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# Future Commercial and Industrial Areas

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Article

# Post-Fordist Production and Urban Industrial Land Use Patterns

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**Abstract**
Economic restructuring of the 21st century is changing the production methods and location requirements of most industries. Mass production on the outskirts of cities, as was common in 20th century Fordism, is largely being replaced by an economic model characterised by a multitude of networked small and medium-sized production sites as well as logistics facilities. In this article, we want to examine if this also creates the opportunity to combine some of the smaller industrial areas with the city as a whole and to initiate a transformation of these areas in favour of redensification and mixed use. Examining the case of Kassel, Germany, we take a closer look at the transformation processes from Fordism to post-Fordism and the possibilities for a smarter land use. In this largely industrially shaped region, younger companies such as the solar panel producer SMA are using new approaches in terms of urban planning and land use by building their low emission-factories on greyfields in an urban environment rather than on suburban greenfields. In our article, we survey selected industrial areas in Kassel and discuss their recent change as part of a broader development from Fordism to post-Fordism. Firstly, the study contains a theoretical discussion of commercial and industrial land-use patterns in both socio-economic models. Subsequently, an on-site analysis is carried out to determine the extent to which both economic models have influenced the use and shape of industrial areas in Kassel. Based on this analysis, we finally show criteria for how urban planning can help to ensure that this change is combined with an improvement in the spatial and design quality of the industrial areas and is meaningfully integrated into the sustainable development of the city region.

**Keywords**
economic structural change; industrial area; knowledge economy; post-Fordism; productive city; urban manufacturing

**Issue**
This article is part of the issue “Future Commercial and Industrial Areas” edited by Angela Million (TU Berlin, Germany) and Felix Bentlin (TU Berlin, Germany).



## 1. Introduction

One of the key elements of urban planning in the 20th century was the goal of separating residential areas and workplaces as much as possible in order to protect the population from emissions emanating from industry. However, with the change in industrial production methods that has been taking place for some years now, building structures, location preferences, and spatial demands on the surroundings of production and distribution sites are also changing. This process is closely linked to the change from Fordist to post-Fordist production. Instead of large vertically integrated factories, complex networks of diverse smaller production sites are now emerging. The more pronounced small-scale nature of these new factories, an increasing service orientation as well as knowledge-intensive and low-emission production processes make it possible to locate some of these industrial facilities not only outside the city, but also back in the city. This makes a functional, structural, and urban-spatial adaptation of industrial areas possible and can help to adapt the traditional structures to today’s demands for sustainability and urban development quality.

In this article, we want to trace this process by examining in detail the transformation of the commercial and industrial sector in the city of Kassel, Germany, and the changing spatial structures there. The focus is on the questions of how the post-Fordist restructuring is transforming the industrial areas in Kassel, whether this change leads to different spatial requirements, and to what extent this means that some new industrial sites can be built in existing urban small-scale industrial areas. To this end, we first present in the theoretical part what the core elements of the economic models of Fordism and post-Fordism are, what effects this has on the spatial structure of the economy, society and the city, and what adaptation needs of industrial areas result from this in functional and urban planning terms. Building on this, the empirical part examines these aspects in detail using the city of Kassel as a case study. To this end, an overview of the industrial area stock and the previous transformation processes in the production-dominated region of Kassel-Baunatal will be given. Then, the two industrial areas—Waldau and Bettenhausen—are analysed in more detail, especially with regard to urban structures and building adaptations. And finally, in the last section, implications for the further planning of industrial areas in the context of future transformation processes are derived from the theoretical opportunities for change and the findings from the case studies.

## 2. From Fordist to Post-Fordist Production

Fordism and post-Fordism are terms that each describe an economic form characterised by certain modes of production. These economic models have different effects on society, in the sense of its models of work, life, and consumption, as well as on space, in the sense of location decisions, flows of goods, and urban structures. In the next two sections we describe first the impact on society and then the impact on space.

### *2.1. Economic and Social Model*

Fordism is named after car manufacturer Henry Ford, who further developed assembly line work by breaking down the work processes into the smallest units so that even unskilled workers could perform them. In combination with an extreme standardisation of products, this increased productivity and reduced manufacturing costs. As products became cheaper, it was also possible for workers to purchase goods of their own production. In addition, greater importance was attached to the negotiation of wages, so that domestic demand was high. Mass production thus made mass consumption possible, which ultimately led to general social prosperity. Starting in the USA, Fordism spread to Europe, where it had a far-reaching effect after the Second World War. Linked to this development was a tendency towards a standardised model of work and life. Employment relationships usually consisted of long-term contracts and comparatively high wages. One man's work was therefore sufficient to finance the cost of living. The small family, in which the husband was responsible for gainful employment and the wife for running the household and bringing up the children, therefore dominated as the ideal-typical image of the way of life. Fordism finally even made the suburban housing model possible for a broad middle class, which had previously been reserved for the upper classes (Häußermann, 2012).

In the 1970s, Fordism started to lose its significance as an economic and social model. Saturated markets, improved technologies in the area of telecommunications, deregulation of financial markets, and policies that facilitated international investment let to an increased outsourcing of standardised production to low-wage countries (see Figure 1). Closely related to this, the importance of internationally oriented companies and service industries, which finance and organise this global process of spatial distribution of economic activities and are mainly concentrated in the metropolises, increased (Taylor, 2000). Since the new jobs are mainly created either in the highly qualified business services sector or in the low-wage service sector, like cleaning, food preparation, or retail work, the number of jobs increases especially at the upper and lower end of the income scale. This social polarisation is particularly evident in the well-connected centres of the world economy known as global cities (Sassen, 2018).

In cities and regions that are less internationally connected and more characterised by industrial production than financial services, the labour market is also changing as businesses in traditional manufacturing industries in particular closing or downsizing. Here, too, the increasing automation of production and the growth in knowledge-intensive activities has been associated with a shift in the focus of employment from the secondary sector to the tertiary sector since the 1970s (Bosch & Wagner, 2002, p. 483). In the traditional industrial nations, the importance of quality products instead of mass-produced goods grew (Banik-Schweitzer & Blau, 2003). In order to survive in international competition, technologically advanced products and new organisational structures were needed, such as the just-in-time delivery system developed primarily in Japan. The German economy also succeeded in securing a leading role in the world market by specialising in technologically sophisticated products (Häußermann et al., 2008, p. 161).

The hallmark of the post-Fordist service society is an increasing individualisation and diversification of lifestyles (Schimank, 2012). Uniform employment relationships were replaced by atypical employment relationships. An increased share of leisure time also increased demand for cultural, gastronomic, and tourist services (Thuy, 1994, p. 64). Moreover, as women's roles changed, household and personal services, which had previously been performed as part of domestic work, were increasingly provided externally. In the labour

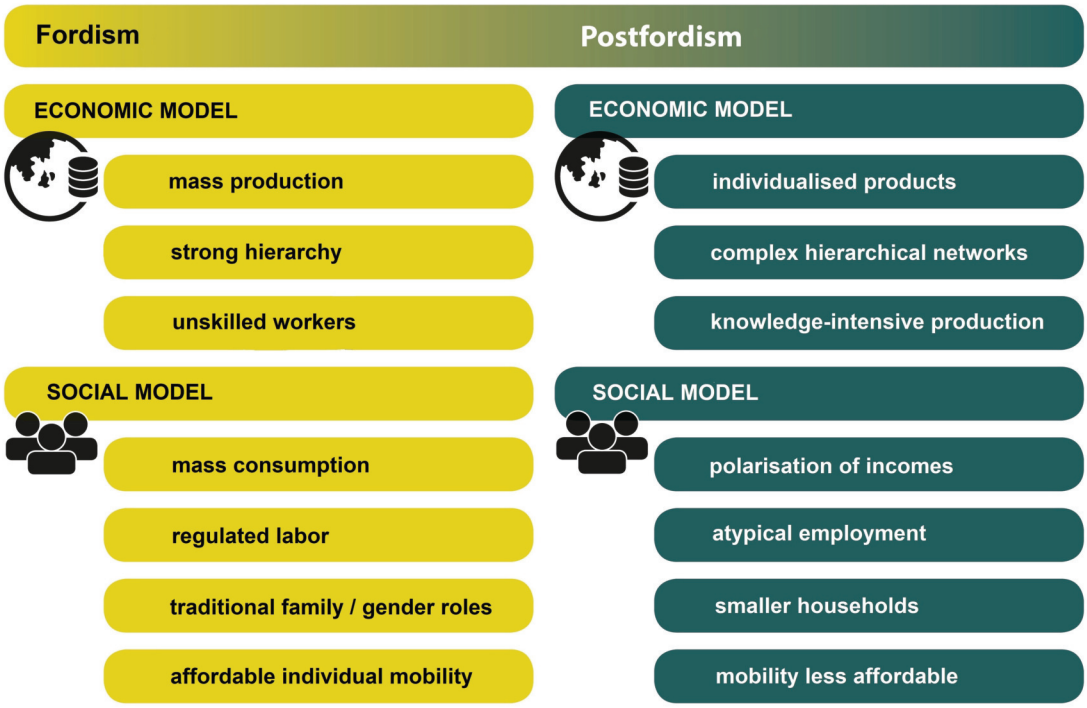


**Figure 1.** Comparison of the economic and social model of Fordism and post-Fordism.

market, women became particularly active in the social, health, and education sectors (Häußermann & Siebel, 1995, p. 186). Parallel to this, family and household forms also changed and the classic nuclear family lost importance—and with it, ultimately, the suburban way of life.

### *2.2. Urban Spatial Organisation and Industrial Area Layout*

The production process of Fordism, which was subdivided into the smallest units, had an effect far beyond industry into the organisation of urban space. The principle of functional subdivision was also applied to urban structures and developed into the guiding principle of modernist urban planning in the 20th century. Urban life was divided in purely functional terms into areas for housing, areas for shopping and leisure centres and areas for work (Häußermann, 2012). The functional separation was intended to ensure healthy living conditions by separating residential areas in need of protection from factories that produced emissions. Industry was also characterised by enormous space requirements. A typical building form was the large industrial complex in low-rise construction. The land required for this was developed especially on the outskirts of the city. The more functional segregation prevailed, the more important mobility became. Together with the functionally structured city, large-scale traffic arteries emerged that linked the individual functional units of the city with each other. Added to this was the growing prosperity based on several decades of full employment. On this basis, mass automobilisation finally succeeded from the 1960s onwards, which promoted suburbanisation and led to the settlement area increasing disproportionately to the population growth.

In the context of post-Fordism, these paradigms changed and with them the planning strategies of cities. In the metropolises and global cities, the real estate industry is driving the creation of new office space and high-quality housing and shaping the transformation of city centres. In smaller cities and those traditionally more dominated by the manufacturing sector, this change is taking place less drastically, as the demand for office space is not quite as large here. However, structural change is also being systematically driven forward. With the abandonment of older industrial sites, freight stations, and harbour zones, larger areas are also becoming available, which are being developed as part of large-scale projects and as new service-oriented neighbourhoods. Particularly in cities and regions that have experienced a strong loss of jobs in the manufacturing sector, efforts are being made to provide new impetus for the economy and urban development in this way (Carter, 2016).

Particular importance is attached to projects areas alongside bodies of water like riverbanks, quay facilities, or the ocean coast, because not only is there often a lot of brownfield land available here, but the development of the waterfront also allows the creation of attractive urban spaces that give the new neighbourhoods a special atmosphere. Furthermore, the implementation of such projects is closely linked to a desire for a positive image for the city and region. With regard to a city's

image, spectacular cultural buildings are being erected as flagship-projects in order to increase tourist attention, cultural attraction, and, indirectly, attractiveness as an investment location. The best-known model for such a strategy is the city of Bilbao, Spain, which, since the opening of the Guggenheim Museum, has succeeded in transforming itself from a shipyard and port city into a tourist destination that attracts international visitors and is also gaining importance as a location for knowledge-intensive "productive services" (Camerin & Mora, 2019).

Projects like this indicate how the demands made on the design of urban space are changing. In the course of post-Fordism, reurbanisation tendencies are becoming visible, which indicate a trend reversal both with regard to the location choices of companies and with regard to the migration behaviour of the population. This trend reversal is due to several factors: The previously common spatial and temporal separation between work, home, and leisure is dissolving in the context of the knowledge society, whereby a mixed-use and urban environment is gaining in importance (Läpple, 2016, p. 24). In the private sphere, the dissolution of the family division of labour means that work and family can be organised more easily within mixed-use structures and short distances between home, workplace, childcare, and service facilities (Brandt et al., 2004, p. 141). In the business sector, the preference of employees for urban locations also leads companies to choose locations within urban structures, where they benefit from the availability of a well-trained workforce (Siedentop, 2008, p. 202).

A major driver of these developments is the process of change in industrial production itself (see Figure 2). A key aspect of post-Fordist restructuring is the disaggregation of the production process into multiple stages. As materials and components have to be moved between multiple manufacturing and assembly sites, this has increased the demand for transportation. From a global perspective, the ecological consequences of this growth in logistics must be assessed critically. However, the local effects are varying and depend on the kind of production. In Germany, many of the new high-tech production sites pollute the environment less than traditional industries were. Technical innovations reduce emissions and make industrial production increasingly compatible with uses requiring protection (Läpple, 2016, pp. 26–27). An increase in services in industry also contributes to a reduction in land requirements, as the service sector has a low land requirement per workplace compared to manufacturing (Rohr-Zänker & Müller, 2014, p. 5). However, it is not only new companies that are characterised by smaller structures: In Germany in particular, the secondary sector is strongly characterised by traditional craft and medium-sized production companies, whose flexibility and adaptability also open up good prospects for them in the context of structural change (Benke, 2021). Overall, this reinforces the trend towards smaller factory structures and thus smaller buildings in industrial areas.

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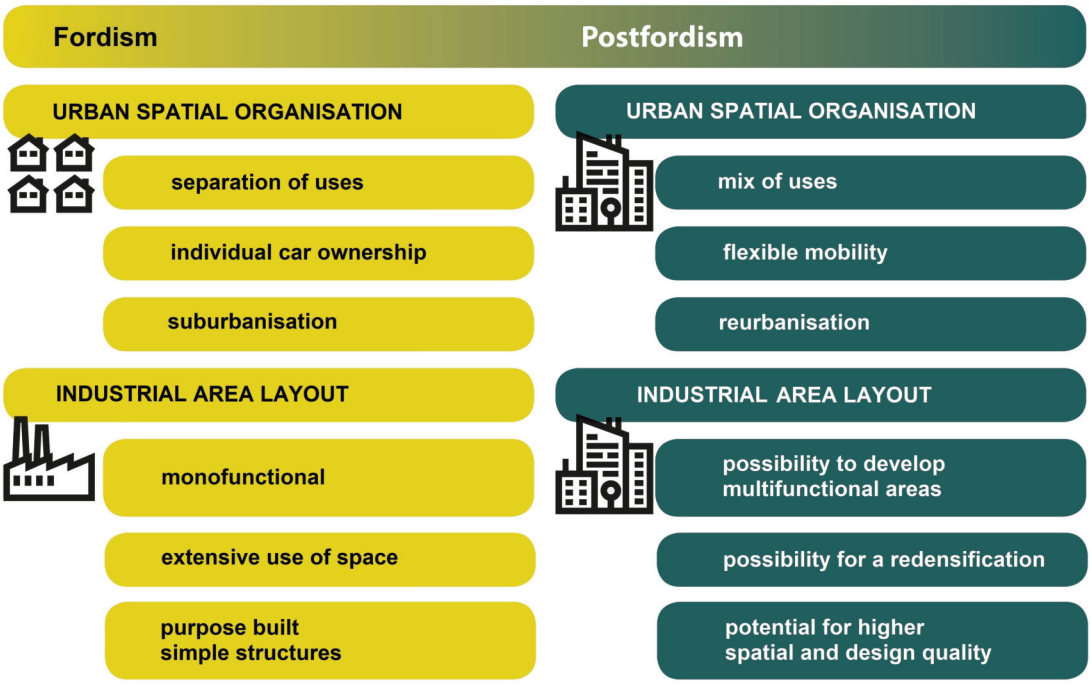


**Figure 2.** Comparison of the urban spatial organisation and industrial area layout in Fordism and post-Fordism.

logistics must be assessed critically. However, the local effects are varying and depend on the kind of production. In Germany, many of the new high-tech production sites pollute the environment less than traditional industries did. Technical innovations reduce emissions and make industrial production increasingly compatible with uses requiring protection (Läpple, 2016, pp. 26–27). An increase in services in industry also contributes to a reduction in land requirements, as the service sector has a low land requirement per workplace compared to manufacturing (Rohr-Zänker & Müller, 2014, p. 5). However, it is not only new companies that are characterised by smaller structures: in Germany in particular, the secondary sector is strongly characterised by traditional craft and medium-sized production companies, whose flexibility and adaptability also open up good prospects for them in the context of structural change (Benke, 2021). Overall, this reinforces the trend towards smaller factory structures and thus smaller buildings in industrial areas.

In addition to the quantity of space and the dimensioning of buildings, the demands on the quality of work locations are also changing in post-Fordism. Further to hard location factors such as land prices and transport connections, soft location factors are gaining in importance. From the perspective of the companies these are primarily the image and business climate of a region, proximity to universities and research institutions, qualification opportunities for skilled workers and the performance of public administration (Hüttenhain & Mayer-Dukart, 2010, pp. 185–186). And since highly qualified workers are sought after on the labour market, companies also attach importance to the design of the place of work as well as the working environment of their business. This includes landscape and urban qualities, leisure, and cultural facilities as well as childcare options (Hüttenhain & Mayer-Dukart, 2010, pp. 185–186).

The importance of such aspects for companies in the field of highly skilled professional services and their demand for inner-city office space has already been studied and discussed (Banik-Schweitzer & Blau, 2003). In addition to this, the following section will examine the extent to which companies in the manufacturing sector, which are located mostly in suburban industrial areas, are also having specific requirements regarding the urban design of their surroundings. For this purpose, we will focus on the situation in Germany, where a large part of the manufacturing industry specialises in technologically sophisticated products and needs highly skilled employees for this.

## 3. Adaptation Needs in Industrial Areas

One of the tasks of today's urban planning is to promote the sustainable development of cities and regions, which includes keeping greenfield development to a minimum, while at the same time possibilities for the transformation process of the economy and its spatial demands have to be created. An important approach is therefore the fact that, in the transition from Fordism to post-Fordism, location requirements have changed and the opportunity to create alternatives to the existing mono-functional industrial areas is increasing. But although post-Fordism largely replaced Fordism on the economic and social level, the functional separation of Fordism still persists in the built environment. As competition for qualified employees rises, the planning task is to adapt the industrially shaped spatial structures to a more knowledge-oriented economy and society. This also offers an opportunity to redesign the built environment of industrial areas.

If we take a closer look at industrial areas in Germany in the following pages, we do not distinguish the two use classes "heavy industrial" and "commercial and light industrial" as defined in German planning law, because large manufacturing facilities can be found in both: In Germany, only the locations of a few exceptionally large high-emission factories are designated as heavy industrial zones in the strictest sense. However, the vast majority of businesses and jobs in the manufacturing sector in Germany are located in commercial and light industrial areas (*gewerbegebiete*), which in German planning law allows nearly all functions of the secondary sector and the tertiary sector including most forms of industrial production as well as trade, crafts, logistics, wholesale, retail, offices, hotels, catering, and to a certain degree even housing for business owners and maintenance personnel. Looking at both types of industrial areas together, we are examining the changes within the secondary sector as well as the general shift from the secondary to the tertiary sector, including options for a redesign of the built environment of industrial areas in general. With the replacement of Fordist structures by post-Fordist structures, instead of functional separation and a simple utilitarian design, mixed-use structures and urban and architectural design qualities can gain in importance.

### *3.1. Functional Aspects*

As a consequence of the functionalist planning idea, the small-scale linking of living and working was largely abandoned. In the course of the 20th century, the proportion of those neighbourhoods in Germany that exhibit functional diversity shrank from around 90% to around 10% (Feldtkeller, 2006, pp. 163–164). These overall planning goals have changed in recent years in favour of the model of the compact and mixed-use European city. However, despite the change in theory, commercial land development continues to take place predominantly under the guideline of avoiding conflict by separating functions (Hüttenhain, 2012, p. 17). For the future, tertiarisation and the transformation of industry will make it possible to bring back into the city the some of the manufacturing and service sectors that have been displaced to urban fringe areas. The options for functionally adapting commercial areas are manifold. Basically, a distinction

must be made between a coarse-grained mix of uses within a commercial area and a fine-grained mix of uses within buildings.

With regard to the coarse-grained mix of uses, the reduced emission load from industry and the reduction of factory sizes make it possible for manufacturing to come into spatial proximity to smaller-scale uses worthy of protection. Above all, the previously very extensive distance space between buildings become obsolete in the context of a coarse-grained mix of uses. Spatially segregated commercial areas can be better integrated into urban structures through the systematic appropriation of the existing underused distance spaces. One way to do this is to develop buffer zones. Many commercial areas have a diverse range of industries, each with different structural typologies and emission potentials, but which are diffusely distributed. Some of these industries, especially more modern production sites, have low emissions and small-scale building structures and therefore are able to create a buffer zone between large-scale working areas and residential uses. In this way, industrial areas can be subdivided into different sub-areas and thus more easily integrated into overall urban structures. The buffer zones serve as structural noise protection and ensure an urban transition from small-scale to large-scale development.

The fine-grained mix of uses within buildings is particularly relevant when it comes to replacing the dominant model of low-rise buildings with multi-storey buildings. As a consequence of limited space resources in agglomeration areas the re-organisation of business in the sense of vertical factories is on the rise. Here, special properties with increased ceiling load-bearing capacity, high rooms, wide corridors, and goods lifts guarantee production on several levels. The option of organising production floor by floor not only enables a mix of different sectors (e.g., shop on the ground floor and production on the floors above), but even a fine-grained mix of living and working (e.g., production on the ground floor and living on the floors above). Inner-city commercial areas in particular have the potential to realise more urbanity in these areas through the fine-grained mix of uses.

### *3.2. Urban Design and Architectural Aspects*

In addition to their mono-functionality, traditional industrial estates are also characterised by land-intensive development. As a result, they not only contribute to increased landscape consumption, but also generate large amounts of commuter traffic due to their car-oriented structure. The recent expansion of the service sector, however, has reduced the land requirements per workplace. In addition, technical innovations in the manufacturing sector have also led to a reduction in land requirements per workplace (Rohr-Zänker & Müller, 2014, p. 5). Although this development is partly thwarted by the growing logistics sector with its large-scale storage and reloading facilities, the transformation processes in favour of the knowledge-intensive economy and new forms of production indicate that the quantitative requirements in industrial estates are changing significantly. This offers the opportunity to rethink commercial areas in terms of urban development and architecture.

Previously underused spaces can be activated by increasing density and adding storeys. The reduction of spatial requirements and new architectural solutions enable the development of compact structures in the sense of vertical factories. Through the conversion of oversized parking lots and underused open space, the hitherto unstructured street spaces can be developed as urban areas with an orientation-providing design. The differentiation of the buildings in terms of storeys makes it possible to create ground floor areas that enliven the street space and promote walking. Public spaces and open spaces can be qualified in terms of design and function in order to meet the growing needs of the knowledge society for its working environment. In place of a large quantity of lawns on hardly used distance areas, fewer but more valuable green spaces with a higher quality of stay can be created. And finally, in industrial areas, factors such as address formation and the need for presentation of individual companies gain in importance, so that architectural quality also becomes more important. Overall, this creates the opportunity to combine the adaptation of commercial locations to the changing needs of businesses with systematic redensification, which also increases the design and amenity quality of these areas.

## 4. Existing Industrial Areas and Their Transformation in the Kassel Region

The city of Kassel serves as an example of the post-Fordist transformation of a city. As part of our study, all commercial locations in the region were first recorded and their commercial and building structure surveyed. This was then analysed according to age, location, and building structure. Based on this survey, two different types of industrial areas can be formed: older areas near the city centre from the first half of the 20th century, which are characterised by a higher building density; and younger commercial areas located on the outskirts of the city or in suburban areas, which are characterised by a lower building density. In this section, examples for both types are presented, including an examination how production facilities have been transformed in the last 20 years, and to what extent this transformation is accompanied by a change in the building structure.

### *4.1. Extent and Form of Industrial Areas in the Kassel Region*

The city of Kassel is located in the geographical centre of Germany, acts as the hub of the North Hesse region, and has an economically balanced development that lies

on average between the boom regions in the southwest of Germany and the structurally weak regions in the northeast. The city of Baunatal directly adjoins the city of Kassel in the south. Baunatal is a medium-sized town founded in 1964 as a result of the settlement of a Volkswagen (VW) AG factory. Both towns together form the region's densely populated area and are still strongly characterised by manufacturing industry.

In the course of the 19th and early 20th centuries, mechanical engineering and vehicle manufacturing emerged as Kassel's core economic fields. During National Socialism, Kassel also established itself as an important armaments' location with the production of tanks, military trucks, and aircraft engines. This led to Kassel becoming one of the main targets of Allied bombing raids during the Second World War, resulting in the destruction of around 80% of the city. The post-war decades in Kassel were characterised by extensive reconstruction. The reconstruction deliberately took place not in the sense of a restoration, but in the sense of modern urban planning models. For this reason, the idea of a city that is greened, car-friendly, and functionally segregated still determines Kassel's architectural image today.

As a result of the post-war building boom, a large number of industrial estates were created in Kassel and its surrounding municipalities, which at the time were laid out in suburban areas in a dispersed manner. As the manufacturing industry remains strongly anchored in and around Kassel to this day, many of the local industrial areas were developed specifically for production purposes. Due to the region's central location within Germany, logistics has also become another field of economic development in recent decades. Major national roads and railway lines converge in the region, so that destinations throughout Germany can be reached from here within a four-hour drive and transport cost advantages can be generated (Regionalmanagement NordHessen, 2016, p. 6). As a hotspot for logistics, specially designed commercial areas for logistics purposes have therefore been developed in the city region since the 1990s.

The stock of industrial areas therefore essentially consists of two groups. Firstly, there are the somewhat older sites from the early industrialisation phase up to the Second World War. Although they were built in peripheral locations at that time, the city has grown since then and numerous residential areas have sprung up in the surrounding area. These industrial estates are relatively small in size and are connected at their edges to the surrounding development. A concentration of these industrial estates can be found in the east of Kassel, the nucleus of the region's industrial development. In these commercial areas close to the city centre, transformation processes have been observed in recent years. The headquarters of SMA, one of Europe's leading manufacturers of photovoltaic systems and inverters, is located here.

On the other hand, there are the sites on the outskirts of Kassel or on the outskirts of neighbouring municipalities that were developed in the post-war period and were developed for production and logistics-oriented uses. These include the VW AG site in Baunatal, which consists of a production plant and a logistics centre. These areas are strongly characterised by large-scale structures and a separation from uses requiring protection, and these characteristics are even more pronounced at the newer, large-scale logistics sites (see Figure 3).

### *4.2. Comparison of the Region's Two Largest Employers: VW and SMA*

The fact that the manufacturing industry is still strongly anchored in the region despite the structural changes in the economy is shown by the two largest employers, both of which belong to the secondary sector: VW AG, which operates one of the largest plants and its most important logistics centre in the region, followed by SMA Solar Technology AG (Wirtschaftsförderung Region Kassel, 2020).

With more than 10,000 employees at the Baunatal factory, VW is the largest employer in the Kassel economic region. In 1957, VW AG set up a production plant on the site of an aircraft engine factory a few kilometres south of the city of Kassel, which was built during the Second World War and had since been little used. In the course of suburbanisation, new residential areas sprang up, particularly in this part of the region, especially around the VW factory. The newly founded town of Baunatal was formed in 1964 from a merger of three former villages. The newly planned centre of this community lies at some distance from the monolithic VW complex with its 1,400 metres length and 570 metres width. In between are large green corridors and traffic facilities as separating elements. Close by, but functionally independent of this production plant, a second facility was built in 1994 on a site a little further to the southeast, the Original Parts Centre's logistics base, which bundles VW AG's European spare parts supply. This facility is almost as large as the production plant and is also a monolith isolated from the city. Both complexes are very purpose-built. The industrial estate is located at the intersection of the A49 and A44 motorways and is thus extremely conveniently situated in terms of transport. Although a tram line running between Kassel and Baunatal also leads to the area, overall, it is very car-oriented in design. The area is mainly used by VW. Next to the gigantic buildings there are almost equally large parking areas for VW AG employees. Only on the edges of the industrial estate have a few other businesses set up shop, either in logistics or in a car-oriented sector, including haulage companies and petrol stations. The edges of the industrial estate are separated from the rest of Baunatal's residential areas by mostly agricultural land.

SMA is one of the second largest employers in the Kassel economic region (Wirtschaftsförderung Region Kassel, 2020). Unlike VW AG, SMA Solar Technology AG

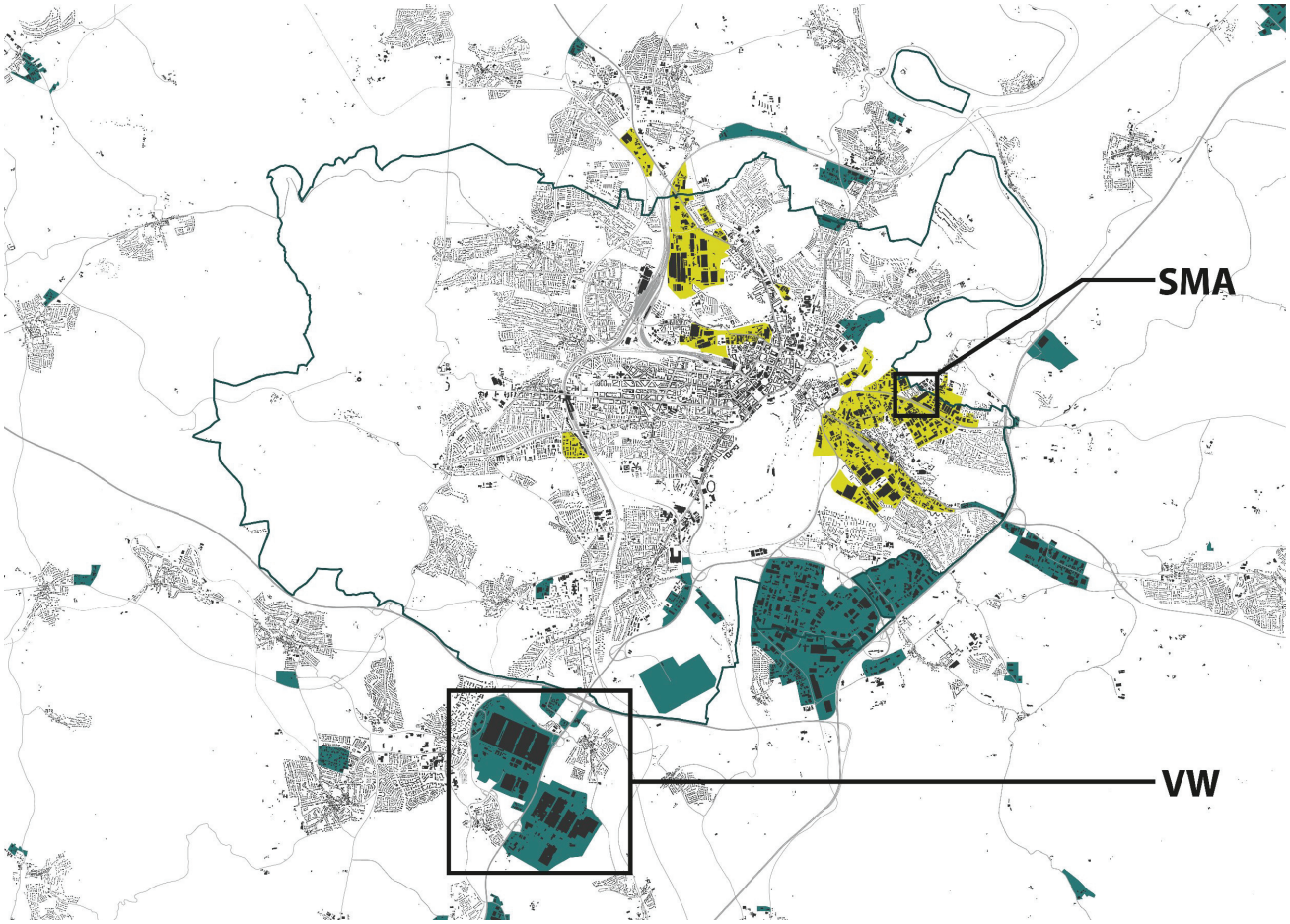


**Figure 3.** Existing older integrated (yellow) und suburban (green) industrial areas in the Kassel region, including the location of VW and SMA factories. Source: Authors' own depiction based on a map by OpenStreetMap Contributors (2020).

does not have such a long tradition in the region. The company was founded in 1981 out of the University of Kassel. Since the turn of the millennium, it has built new facilities in Kassel and the neighbouring municipality of Niestetal. A comparison of the SMA production site with the VW plant in Baunatal clearly shows the upheaval that has taken place in terms of the location requirements of production companies. In this sense, SMA's choice of location as well as the urban and architectural design refers to post-Fordist production conditions and differs considerably from VW's Fordist approach. SMA has settled in an integrated location, on the edge of one of Kassel's oldest industrial areas. Unlike VW, the company does not have a monolithic building structure for all its purposes. Instead, the individual building units are distributed throughout the industrial areas, optimising the use of the scarce land resources in inner-city locations. This has resulted in campus-like areas characterised by comparatively small building layouts, multi-storey buildings, and a high building density. SMA's office and production spaces were designed in a compact architecture to ensure that they blend in with the small-scale residential and commercial buildings in the immediate vicinity. SMA's architectural design also differs from classic production facilities: Instead of a purely functional design, the SMA complex is designed as a representative part of an urban district. With this in mind, SMA has built the Solar Factory 1, which stands out architecturally from the surrounding buildings, on Kassel's busy entrance and exit road, Dresdener Straße. The factory building has two to five storeys and provides views into the building and the production process through extensive glass facades. SMA thus marks a transformation process in Kassel—from separated and space-intensive to integrated and structurally compact production plants. This way, it shows how urban production can have a positive effect on the physical layout and design quality of an industrial area.

## 5. Beginning Transformation, Currently Planned Measures, and Possible Systematic Redevelopment

In the Kassel city region, which is strongly characterised by manufacturing industry, socio-economic structural change is not only expressed in terms of business activity and occupational structures, but also in the built environment. With regard to the function and structural design of industrial areas, the first transformation processes are becoming apparent that open up potential for functional mixing and space savings. The commercial areas are developing away from being a separate place of work

to becoming an integral part of urban structures. Due to their location, these transformation processes are more pronounced in inner-city commercial areas than in suburban commercial areas. In the following, two of these transformation processes are examined in more detail using the example of the Waldau-West industrial estate, in a suburban location, and the Bettenhausen industrial area, in an integrated location.

### *5.1. Waldau-West Industrial Estate*

The Waldau-West industrial estate was developed in the 1970s on the site of a former airfield. The area is located on the outskirts of the city in the south of Kassel. Since the 1990s, the area was enlarged and the older western and the newer eastern parts are today marketed together under the common name "Industriepark Kassel-Waldau" (Stadt Kassel, 2021). The area has very good transport links due to its proximity to the A7, A44, and A49 motorways and a connection to the rail freight network. Currently, more than 200 companies with more than 4,000 employees are located in the area. The companies are mainly from the manufacturing sector. In addition, it is used by wholesale, logistics, and service industry businesses (Stadt Kassel, 2021).

Due to the time of the area's development and the strong influence of manufacturing industry, Fordist urban structures are still evident in the area today, which no longer meet the requirements of modern commercial enterprises. Waldau-West is characterised by large-scale production and storage halls and a simple design of flat buildings. In some parts, the area has two to three-storey office buildings. The building stock has both structural and energy deficits. Accessibility of the area by public transport is limited, so that private automobile transport dominates. On most lots, the flat buildings are surrounded by large open space that is either landscaped as a lawn, used as a car park, or sealed as an open storage area. These underused areas are a large reserve that has not yet been properly used. In addition, the abandonment and relocation of some businesses in recent years has led to properties in the area being vacant or areas falling into disuse (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2016, p. 18).

As a result of these deficits, the city of Kassel took part in a nationwide research programme (ExWoSt) to counteract further negative developments and to develop strategies for the qualification of the area together with the local businesses and the Kassel Region Economic Development Agency. Within the framework of this programme, it was possible to define practical fields of action that are to be worked on in the future in network-like cooperation and with the help of an area management as a central contact point in the area.

#### 5.1.1. Beginning Functional Transformation

The partial vacating of older buildings and spaces has given rise to a number of uses that are untypical of the area (including a bowling alley, go-cart track, tax consultants), which could initiate a structural change in the area (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2016, p. 18). The city of Kassel would like to prevent an unplanned conversion of the area into an office area or mixed area in order to secure this area for commercial and industrial businesses. By drawing up a development plan, the existing industrial area is thus to be secured under planning law and changes of use prevented. For


**Figure 4.** Kassel-Waldau industrial area. Source: Charlotte Reiher.

this purpose, the educational institutions already located in the area—several vocational training schools—are very important. These educational institutions are closely linked to the industrial uses of the area, which results in advantages for businesses in the area. In this context, the educational institutions are also to be preserved and supported by defining their location in the development plan as a "special education area" (Zweckverband Raum Kassel, 2020, pp. 3–4). Through this measure, the city of Kassel secures a sector mix that is limited in scope, but which benefits the resident companies and thus the attractiveness of the location for the manufacturing industry, so that a further relocation of companies, for example to greenfield sites, can be prevented.

#### 5.1.2. Planned Further Transformation

As part of the planning process for the sustainable development of the Waldau-West area, the participation of local businesses also played an important role. During a participation event, a transformation of the area into a green production location was identified as the central vision for the future of the area. With this in mind, green design objectives are to be incorporated into the preparation of the development plan in order to profile it as a green industrial park, also in terms of improved amenity qualities (Stadt Kassel, 2021). Another overarching goal is to improve the attractiveness of the location and thereby retain skilled workers. To this end, the image of the business park is to be upgraded, which also implies measures at the construction level. Brownfield sites are to be brought back into use and operational reserve areas are to be activated. This can lead to a densification of the area (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2016, p. 19). In addition, greater importance is now attached to the protection of resources in the form of energy efficiency, environmental and climate protection, and subsequent uses (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2016, p. 19). Furthermore, the aim is to improve the accessibility of the area through intermodal mobility. In order to counteract the heavy sealing in the area, it is also planned to bundle the parking spaces of various businesses more strongly (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2016, p. 19).

### *5.2. Bettenhausen Industrial Area: Dresdener Straße*

The Bettenhausen district of Kassel represents a nucleus of the industrial development of the city region. Monuments to industrial history have been preserved in the industrial area to this day, including the Messinghof, a former brass works, and the Salzmann & Comp. industrial building, which used to be a textile factory. The importance of the Bettenhausen industrial area as a location for classical production is still evident beyond the industrial monuments. In the 20th century, the industrial area continued to develop in the sense of Fordist production and the associated effects on the urban space. Land-intensive development structures and large-scale building blocks were created, surrounded by extensive transport infrastructure facilities for the benefit of the car-oriented city. Mobility within the area is accordingly characterised by a strong car orientation, although it is in an urban integrated location. The physical appearance of the area is predominantly determined by simple, single-storey hall architecture with adjoining office buildings, so that the area has only a low structural density. The buildings are arbitrarily placed on the plots without orientation towards the street, so that in combination with large-scale traffic areas, hardly any street spaces are formed. The parts that are not built over are mainly used as parking spaces and storage and manoeuvring areas.

Since the 2000s, a functional transformation process can be observed in the Bettenhausen industrial area. On the one hand, this transformation process affects the manufacturing industry itself, and, on the other hand, it affects the functional orientation of the industrial area, in which an increasing number of non-manufacturing businesses have settled. Retailers, restaurants, and a few cultural institutions, including a nightclub, amusement arcades, and a mosque have been added, so that a wide range of uses predominates in the area today. These uses benefit from the proximity to Kassel's sales market on the one hand and the regional accessibility through the proximity to the A7 motorway junction on the other.

Furthermore, the transformation of industrial production itself is evident in the area. Mainly, SMA's combination of headquarters and production facilities in the area shows that modern production can be organised in a way that is compatible with the city and in a small space. Finally, a conversion of an industrial monument no longer needed for commercial purposes, the Salzmann factory, is currently taking place. Together with the city of Kassel, an investor is planning a complete renovation of the building stock in order to eventually convert it in favour of flats, a nursing home, and a hotel.

The functional transformation of the area opens up potential from which both the quality of the commercial area itself and the surrounding urban neighbourhoods can benefit. They offer the possibility of transforming the Fordistic cityscape of the industrial area in favour of small-scale and urban structures. In view of the area's location, its current status as a foreign body between residential areas can also be transformed by integrating it more into the urban fabric. The extensive spectrum of uses that has emerged in the area not only points to a mixture of uses in the sense of a broader mix of industries, but also offers the opportunity of a stronger mixing of commercial and residential uses. The combination of residential and commercial uses is already being practised in individual parts of the area: At the edges of the Bettenhausen area some smaller businesses have been founded on lots that combine a residential building with an adjoining small building for commercial activities, i.e., car repair shops. This creates a good transition,

**Figure 5.** Kassel-Bettenhausen old residential area and new industrial area. Source: Charlotte Reiher.

both functionally and structurally, between residential and small-scale building structures on the one hand and commercial and large-scale development on the other. This development, which is rather accidental and not initiated by planning, could be used more systematically in the course of a further functional transformation to create buffer zones between residential and industrial functions. In this sense, the uses should be staggered in such a way that large-scale and emission-intensive activities take place in the interior of the area, while uses become more small-scale and more compatible with residential areas on the outside.

## 6. Conclusion

As can be seen in the transformation process of the Kassel region, post-Fordist change of production methods and location needs requires a new planning approach to industrial areas and opens up possibilities for a reintegration of manufacturing into the city. This structural change in the economy has not only brought about positive developments with regard to employment structures, because many jobs disappear and even more could disappear in the future, resulting in income and employment polarisation. This makes it all the more important to adapt industrial areas not only to a changed economy, but also to a changed society. The industrial area stock of the post-war decades was built in the wake of a prosperous suburbanising middle class with long-term employment and affordable car mobility. In the meantime, employment relationships and incomes, household types as well as forms of mobility have become highly differentiated, and these differentiations can be seen in the current reurbanisation trends. Since people as well as businesses are more eager to move back into the city, industrial areas do not have to be fully separated anymore but can be transformed into integrated mixed-use urban spaces.

This combination of different functions is possible in two different forms: a coarse-grained mix of uses within an industrial area or a fine-grained mix of uses within buildings. The options depend on the location and characteristics of the respective industrial area. However, as the examples from the Kassel region show, such a transformation seems to be easier to realise in inner-city areas than in areas on the outskirts. In areas near the centre the limited land resources and the historically dense coexistence of residential and commercial areas make it possible to locate production facilities that are open to new solutions in terms of integrated location and building design. In this way, they can generate an impulse with regard to urban planning and architectural quality as well as the quality of stay in public spaces, as was the case in Kassel-Bettenhausen. In contrast, the pressure for densification in areas that are spatially separated from the city is not as high as in integrated locations. In addition, these industrial areas are still home to businesses that depend on spatial separation from emission-sensitive uses. As the example of the Waldau-West industrial estate has shown, deficits in terms of building stock, appearance, and accessibility by public transport have a negative impact on the attractiveness of these industrial estates, leading to derelict sites and vacancies. In cases like this it is important to preserve and protect areas for classic production and at the same time meet the requirements of workers and employees as well as the requirements of new more knowledge-based businesses.

All in all, it becomes clear that a change in the planning approach to industrial areas opens up potential in two respects. Firstly, economic restructuring will keep changing the demand for commercial and industrial buildings, but redensification of existing industrial areas can prevent the use of too many greenfield sites for this purpose. Secondly, overcoming the functional separation of residential and commercial areas enables better networking with the city, improves accessibility for pedestrians and other non-car users, and opens up potentials for higher spatial and design quality. Both elements are important factors of a meaningful integration of industrial areas into the urban fabric and in the long term can contribute to the sustainable development of urban regions.

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**Conflict of Interests**

The authors declare no conflict of interests.

**References**

Banik-Schweitzer, R., & Blau, E. (2003). Urban Form und die 'postfordistische' Stadt—Konzepte, Themen, Fragen [Urban form and the 'post-Fordist' city—Concepts, topics, questions]. In R. Banik-Schweitzer & E. Blau (Eds.), *Städtebau in der postfordistischen Gesellschaft* [Urban development in post-Fordist society] (pp. 7–22). Löcker.

Benke, C. (2021). Urbane Produktion und Handwerk 4.0—Perspektiven der Innenstädte als Zukunftsstandorte für das Handwerk [Urban production and craft 4.0—Perspectives of the inner cities as future locations for the craft]. In T. Krüger, M. Piegeler & G. Spars (Eds.), *Urbane Produktion—Neue Perspektiven des produzierenden Gewerbes in der Stadt?* [Urban production—New perspectives for the manufacturing industry in the city?] (pp. 91–104). Kohlhammer.

Bosch, G., & Wagner, A. (2002). Nachhaltige Dienstleistungspolitik [Sustainable service policy]. In G. Bosch, P. Hennicke, J. Hilbert, K. Kristof, & G. Scherhorn (Eds.), *Die Zukunft von Dienstleistungen. Ihre Auswirkungen auf Arbeit, Umwelt und Lebensqualität* [The future of services. Their effects on work, the environment and quality of life] (pp. 482–512). Campus Verlag.

Brandt, H., Hopmeier, I., & Holzapfel, H. (2004). *EVALO—Eröffnung von Anpassungsfähigkeit für lebendige Orte. Verbundprojekt im Forschungsprogramm 'Bauen und Wohnen im 21. Jahrhundert'* [EVALO—Opening of adaptability for lively places. Joint project in the research program 'Building and living in the 21st Century']. University of Kassel. http://www.uni-kassel.de/fb13/evalo/PDF_Down/EVALO_Endbericht.pdf

Bundesinstitut für Bau-, Stadt- und Raumforschung. (2016). *Nachhaltige Weiterentwicklung von Gewerbegebieten: ExWoSt-Informationen 49/1* [Sustainable development of industrial areas: ExWoSt-Information 49/1]. https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/exwost/49/exwost-49-1.pdf?__blob=publicationFile&v=1

Camerin, F., & Mora, A. Á. (2019). Regenerating Bilbao: From 'productive industries' to 'productive services.' *Territorio*, *89*, 145–154.

Carter, D. K. (2016). Introduction. In D. Carter (Ed.), *Remaking post-industrial cities: Lessons from North America and Europe* (pp. 1–12). Routledge.

Feldtkeller, A. (2006). Die 'Stadt der kurzen Wege'—Ein Mosaik unterschiedlicher Lebensqualitäten [The 'city of short distances'—A mosaic of different qualities of life]. In Heinrich-Böll-Stiftung (Ed.), *Das neue Gesicht der Stadt. Strategien für die urbane Zukunft im 21. Jahrhundert* [The new face of the city. Strategies for the urban future in the 21st century] (pp. 159–174). Heinrich-Böll-Stiftung.

Häußermann, H. (2012). *Die fordistische Stadt* [The Fordist city]. Bundeszentrale für politische Bildung. http://www.bpb.de/politik/grundfragen/deutsche-verhaeltnisse-eine-sozialkunde/138639/die-fordistische-stadt?p=0

Häußermann, H., Läpple, D., & Siebel, W. (2008). *Stadtpolitik* [Urban politics]. Suhrkamp.

Häußermann, H., & Siebel, W. (1995). *Dienstleistungsgesellschaften* [Service societies]. Suhrkamp.

Hüttenhain, B. (2012). *Stadtentwicklung und Wirtschaft. Strategien und Handlungsansätze zur Entwicklung von Gewerbestandorten* [Urban development and economy. Strategies and approaches for the development of commercial locations]. Verlag Dorothea Rohn.

Hüttenhain, B., & Mayer-Dukart, A. (2010). Arbeiten [Work]. In H. Bott, J. Jessen, & F. Pesch (Eds.), *Lehrbausteine Städtebau. Basiswissen für Entwurf und Planung* [Urban planning modules. Basic knowledge for design and planning] (6th ed., pp. 93–100). Städtebau-Institut.

Läpple, D. (2016). Produktion zurück in die Stadt. Ein Plädoyer [Production back to town. A plea]. *Stadt-Bauwelt*, *211*(35), 23–29.

OpenStreetMap Contributors. (2020). *Lageplan & Schwarzplan von Kassel* [Site plan & figure ground plan of Kassel]. SCHWARZPLAN.eu. https://schwarzplan.eu/lageplan-kassel

Regionalmanagement NordHessen. (2016). *Standort Nordhessen. Starke Partner—Starke Region* [North Hesse location. Strong partners—Strong region].

Wirtschaftsförderung Region Kassel. https://www.wfg-kassel.de/solva_docs/EXPO_REAL_Magazin_NH2016_web.pdf

Rohr-Zänker, R., & Müller, W. (2014). *Siedlungsflächenentwicklung* [Settlement area development]. Bertelsmann Stiftung.

Sassen, S. (2018). *Cities in a world economy* (5th ed.). SAGE.

Schimank, U. (2012). *Individualisierung der Lebensführung* [Individualization of lifestyle]. Bundeszentrale für politische Bildung. https://www.bpb.de/politik/grundfragen/deutsche-verhaeltnisse-eine-sozialkunde/137995/individualisierung-der-lebensfuehrung?p=0

Siedentop, S. (2008). Die Rückkehr der Städte? Zur Plausibilität der Reurbanisierungshypothese [The return of the cities? On the plausibility of the reurbanization hypothesis]. *Informationen zur Raumentwicklung*, *3*(4), 193–210.

Stadt Kassel. (2021). *Nachhaltige Weiterentwicklung des Gewerbegebiets Kassel Waldau-West* [Sustainable further development of the Kassel Waldau-West industrial park]. Stadt Kassel, documenta-Stadt. https://www.kassel.de/buerger/bauen_und_wohnen/projekte-und-entwicklung/inhaltsseiten/nachhaltige-entwicklung-kassel-waldau-west.php

Taylor, P. J. (2000). World cities and territorial states under conditions of contemporary globalization. *Political Geography*, *19*(1), 5–32.

Thuy, P. (1994). *Strukturwandel, Qualifikation und Beschäftigung. Eine ökonomische Analyse unter besonderer Berücksichtigung des tertiären Sektors* [Structural change, qualifications and employment. An economic analysis with a special focus on the tertiary sector]. Haupt.

Wirtschaftsförderung Region Kassel. (2020). *Die bedeutendsten Unternehmen und Arbeitgeber der Wirtschaftsregion Kassel* [The most important companies and employers in the Kassel economic region]. https://www.wfg-kassel.de/down/C03DB281-E661-CB5E-6FBE7034F6ECB1E0

Zweckverband Raum Kassel. (2020). *Begründung mit Umweltbericht. Änderung des Flächennutzungsplans des Zweckverbandes Raum Kassel. Änderungsbezeichnung: ZRK-68 'Gewerbe Waldau West'* [Explanatory statement with environmental report. Change to the land use plan of the Kassel area association. Change name: ZRK-68 'Gewerbe Waldau West']. https://www.zrk-kassel.de/media/files/flaechennutzungsplanung/2020-12-17-zrk-68-begruendung.pdf

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Article

# Variable Arrangements Between Residential and Productive Activities: Conceiving Mixed-Use for Urban Development in Brussels

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**Abstract**
Mixing productive economic activities with housing is a hot topic in academic and policy discourses on the redevelopment of large cities today. Mixed-use is proposed to reduce adverse effects of modernist planning such as single-use zoning, traffic congestion, and loss of quality in public space. Moreover, productive city discourses plead for the re-integration of industry and manufacturing in the urban tissue. Often, historical examples of successful mixed-use in urban areas serve as a guiding image, with vertical symbiosis appearing as the holy grail of the live-work mix-discourse. This article examines three recent live-work mix projects developed by a public real estate agency in Brussels. We investigate how different spatial layouts shape the links between productive, residential, and other land uses and how potential conflicts between residents and economic actors are mediated. We develop a theoretical framework based on earlier conceptualisations of mixed-use development to analyse the spatial and functional relationships within the projects. We situate them within the housing and productive city policies in Brussels. From this analysis, we conclude that mixed-use should be understood by considering spatial and functional relationships at various scales and by studying the actual spatial layout of shared spaces, logistics and nuisance mitigation. Mixed-use is highly contextual, depending on the characteristics of the area as well as policy goals. The vertical symbiosis between different land uses is but one example of valid mixed-use strategies along with good neighbourship, overlap, and tolerance. As such, future commercial and industrial areas will occur in various degrees of mixity in our cities.

**Keywords**
Brussels; housing; mixed-use; productive activities; urban development

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## 1. Introduction

In this article, we investigate three mixed-use projects that are currently under construction in Brussels. We selected projects that combine residential uses with productive uses categorised in Brussels’ land use plan as “(light) industrial and material production” (see Table 3; Government of the Brussels Capital Region, 2001). We provide an ex-ante assessment of the functional and design characteristics of these projects against the backdrop of the specific planning context of the Brussels Capital Region and its recent urban development goals.

To do that, we first address the state-of-the-art concerning single-use zoning and the various pleas for mixed-use development, in particular addressing the combination of residential and productive uses, as a specific variety of mixed-use development that is currently

gaining interest against the backdrop of productive city discourses (Cities of Making, 2018, 2020; Ferm & Jones, 2016, 2017).

Secondly, we give a brief characterisation of the (historical) space of live-work mix in Brussels and how this urban fabric was transformed in the wake of modernist urban planning and functional zoning strategies. We then introduce the key urban development goals that explain current spatial policy with regards to housing and productive activities against the backdrop of the specific institutional and governance context of the Brussels Capital Region.

Thirdly, we establish an analytical framework to evaluate the spatial and functional organisation of live-work mix as they occur in the projects under study. This is based on a critical reading of existing planning concepts and conceptualisations for mixed-use planning.

Lastly, we apply the analytical categories to the three selected mixed-use projects and situate them against the specific urban development context and goals in the Brussels Capital Region. This allows us to identify several conditions and design characteristics that warrant successful mixed-use projects in metropolitan contexts confronted with conflicting land-use needs for (affordable) housing and productive activities. This provides nuance to the discourse on what successful mixed-use entails and how it could be assessed.

## 2. Overview of Single-Use Zoning and Motivations for Mixed-Use in Light of Productive City Discourses

The place of economic activities in the city has been at the centre of the conceptualisation of spatial planning since the modernist era. One of the tenets of modernist urban planning was the regulation of conflicting urban activities, resulting in the principle of zoning. It is seen as an instrument to regulate urban "congestion" (Fischler, 1998), with the aim of increasing safety, efficiency, and health (Choay, 1965; Grant, 2002; Mumford, 2000; van Eesteren & van Rossem, 1997; van Es et al., 2014).

The differentiation of uses in different districts of the city emerged in Germany during the late 19th century. The zones defined under these regulations were not single-use but rather comprised various degrees of mixed-use, as continues to be standard practice in Germany under federal legislation (Hirt, 2007; Logan, 1976). In the Frankfurt Ordinance of 1891, some (noxious) industries were banned from the two zones aimed to attract single-family housing, while the factory zone only discouraged residences (Logan, 1976). The remaining three zones all provided a mix of residential, commercial, and industrial uses (Logan, 1976). Single-use zones emerged in the early 20th century in the US, where "especially residential ones are suitable for a singly type of human activity" (Hirt, 2007, p. 437). The 1916 New York City Zoning Ordinance introduced a "hierarchy of uses at whose apex is the single-family detached house" (Perrin, 1977, as cited in Fischler, 1998, p. 178). In the same year, "Berkeley, California gave zoning… the exclusive single-family residential district" and "put industrial districts off-limits for residential development" (Fischler, 1998, p. 174). Hirt (2007, p. 441) draws attention to a further distinction in zoning practices between the US and Europe:

> The US system presumes that the entire city must be pre-emptively divided into relatively large, homogenous areas, each under a specific land use classification. Under the German approach each city block may end up in a different land use category, and this is conducive to a much more fine-grained diversity of uses.

The latter is mainly the case in urban areas, much less so in fringe areas where single-use is also dominant in the German case. Indeed, while early European zoning practices provided for mix, the publication of the results of the fourth International Congress of Modern Architecture (CIAM–Congrès Internationaux d'Architecture Moderne) on the "Functional City" of 1933 (van Es et al., 2014) by Le Corbusier in 1943 as "the Athens Charter" (Gold, 1998) played a great role in making expansive, single-use zoning the dominant land-use planning approach in the post-war years, in Europe and beyond. The Athens Charter proposed the strict separation of dwelling, leisure, work, and transport areas as very vast and detached single-use areas buffered by green spaces (Gold, 1998).

As far as industries are concerned, the development of the industrial park in Great Britain since the 1930s provided a model to organise industrial growth. While early industrial parks such as the Team Valley Trading Estate in Manchester occupied a water-based location, the success of the model became widespread as industrial areas popped up along the emerging highway networks in the US and Europe. In the wake of modernist zoning and the advent of a welfare state economy in the years after World War II, the space of production was largely isolated and removed from the city fabric in (generic) business and industrial parks (Castells & Hall, 1994; Ryckewaert, 2011).

As the crisis of zoning-based urban planning became apparent in a loss of urbanity in single-use urban areas, pleas to reintroduce a mix of urban activities in urban design became more important. These pleas focus on a reconnection between residential, recreational, and commercial uses, the reduction of car use and transit-oriented development, and improvements in public space to develop vibrant, lively, liveable, and sustainable urban areas (Gehl, 2011; Jacobs, 1993; National Academies of Sciences, Engineering, and Medicine, 2004). According to Grant, " 'mixed use' has become a mantra in contemporary planning, its benefits taken for granted" (2002, p. 71). In many cases, historical examples of mixed urban fabrics and building typologies serve as the leitmotiv of such urbanistic endeavours, as is the case of the new urbanism movement

(Grant, 2002; Hebbert, 2003). Cited benefits of mixed-use are the reduction of commuting times, a livelier urban atmosphere, social mix, and more varied temporality of uses throughout the day (Grant, 2002; Hirt, 2007; Jacobs, 1993).

Spatial planning has, however, struggled to regulate mixed-use land-use plans with zoning regulations that rely on fixed numerical proportions between types of activities. Such purely quantitative regulations fail to create planning frameworks that allow co-existence and the mediation of nuisances. In response to this, researchers have sought different conceptualisations of mix that rather focus on different degrees and intensities of mix as a tool to assess the complementarity of activities and the possibilities to cluster them together in space (Hoppenbrouwer & Louw, 2005; Leinfelder & Pisman, 2008). Very often, such conceptualisations occur in a context where the efficient use of scarce land resources pushes for urban densification.

Examples of successful mixed-use projects combining residential uses with commercial, recreational, or services abound. In *Home Work City* (van Gameren et al., 2019), many fine-grained examples of mix are listed and primarily include workshop spaces, hybrids between office and maker spaces, in addition to small scale commercial spaces and home offices. Good examples of a successful mix between residential, industrial, and manufacturing activities are rarer. Moreover, historical patterns of how this live-work mix was realised in the past often serve as a point of reference. These historical conditions included a pressing need for the proximity of productive uses to rapid and high volume means of traffic (waterways and railroads), as well as closeness to consumer and labour markets. This led to vertical production schemes (Rappaport, 2020) as well as a small-scale vertical mix of housing over workspace or shops (Vandyck et al., 2020), and closely-knit horizontal juxtaposition of workers' housing near the factory. The density associated with the vertical factory reoccurs in present-day projects and architectural competitions, where vertical mix at the building or plot level often emerges as a guiding image for mixed-use projects (Borret et al., 2018; IABR—Atelier Brussels Productive Metropolis, 2016; Lane & Rappaport, 2020). From a designer's point of view, the more complex combinations of live-work mix garner great interest in the recent literature (van Gameren et al., 2019).

In recent years, the reintroduction of the spaces of production in cities is on the agenda of both urban scholars and policymakers alike (Cities of Making, 2020; Ferm & Jones, 2016, 2017). In metropolitan urban areas, rising land prices and pressures on the residential market result in "industrial gentrification." Lucrative residential uses tend to push out remaining productive activities from neighbourhoods (Curran, 2007; Yoon & Currid-Halkett, 2015). Various urban governments—such as New York, where the rezoning of industrial land in Brooklyn was curbed and former industrial premises such as the Brooklyn Navy Yard have been preserved as spaces for work, hosting a variety of productive activities—have attempted to combat these tendencies. Cities such as London and Vienna are pursuing productive city policies in recent planning documents (London City Hall, 2021; Rosenberger, 2017).

## 3. The Brussels Spatial, Policy, and Planning Context for Live-Work Mix Projects

Until the mid-20th century, Brussels remained the main industrial heart of Belgium. Industries were mostly concentrated around the canal connecting the city to the seaport of Antwerp in the north, and the industrial coal and steel basin around Charleroi in the south. Other productive hotspots emerged around the numerous Brussels' train stations or in the marshy lands of the tributary valleys of the Senne river (De Boeck et al., 2020). These areas consisted of a tight mix of workshops, small factories and warehouses, and residences, organised primarily in closed building blocks. Productive activities occupied the insides of the building blocks, with housing fronting the street, or organised on the upper floors (Vandyck et al., 2020).

From the 1950s onward, government policy focused on the transformation of Brussels into an administrative capital and host to international company headquarters (De Beule et al., 2017; Ryckewaert, 2011). This went hand in hand with modernist planning principles, resulting in the delocalisation of industries in peripheral industrial parks, the construction of an (urban) highway network, and the demolition of popular neighbourhoods to build office districts. These developments led to fierce anti-modernist sentiments among citizen activist groups and spatial planners from the 1970s onward, impacting how land-use planning was implemented in the Regional Land-Use Plan in 2001 (Government of the Brussels Capital Region, 2001). The 1962 planning law had introduced legally binding land-use plans in Belgium. Due to the process of federalisation, in 1989, the Brussels Capital Region obtained competency on spatial planning policy, alongside the two other federal regions of Belgium, Flanders and Wallonia. In 2001, Brussels adopted a land-use plan that determined land use at the level of the building block. In addition to single-use "industrial" or "harbour" zones, it discerned between "residential" and "typical" housing blocks, as well as "mixed" and "strongly mixed" building blocks (perspective.brussels, 2018). In short, the Brussels land-use plan explicitly recognised the mixed-use nature of the urban tissue, fixing varying proportions between residential, office, and productive uses at the building block level.

Two interrelated socio-spatial issues dominate urban development policy in Brussels with regards to residential and productive land uses. A first issue is the continuing urban flight that followed the "destructive" planning policies of the 1950s. Quantitatively, this negative demographic trend was curbed in the early 2000s.

Demographic projections predicted important population growth, leading to an adaptation of the Regional Land-Use Plan via the Demographic Land-Use Plan in 2013 (perspective.brussels, 2018). Qualitatively, the continuing suburbanisation of families in the higher income groups (De Maesschalck et al., 2015) supported a policy that aimed for the production of subsidised middle-income owner-occupied housing (Dessouroux et al., 2016). Foreign migration fills in the gaps left by these suburbanites, maintaining population growth even if this is weaker than anticipated in the Demographic Land-Use Plan. While Brussels enjoys a fair share of higher-income foreign immigrants as well as youngsters settling in Brussels from other parts of the country after graduation, foreign immigration (documented as well as undocumented) is also marked by groups that occupy a much less favourable socioeconomic position.

This sheds light on a second socio-spatial reality, the existence of a large "crescent" of low-income neighbourhoods in the canal area and around the Brussels city centre. These strongly mixed areas are marked by high proportions of persons without a secondary education degree, high unemployment rates, a young population, and high shares of residents with a migration background. This second socio-spatial reality explains another qualitative housing challenge, the high shortage of affordable low-income rental housing (Dessouroux et al., 2016). In addition, it explains the interest in productive city strategies in Brussels, as providing space for productive activities is seen as a means to maintain short-term skilled jobs within the capital region (Cities of Making, 2018; Orban et al., 2021). Due to industrial gentrification, productive space within the Brussels Capital Region is in continuous decline (De Boeck & Ryckewaert, 2020).

As housing policy and spatial planning are a competency of the regions, the Brussels Capital Region deploys urban development policies that try to tackle these socio-spatial challenges within its own borders even if the functional metropolitan area stretches out far into the bordering regions. The important and conflicting needs for middle- and low-income housing, as well as productive activities, result in fierce competition for these scarce land resources. In 1974, the Brussels Capital Region established a public real estate development agency to support its urban development plans. This agency, citydev.brussels, is the main provider of business space and middle-income housing, and increasingly partners with public and semi-public agencies producing low-income housing. They have a dedicated branch focusing on mixed projects.

A first example of how these policies and challenges impact mixed-use projects can be found in the rezoning of industrial areas into enterprise areas in urban environment under the regulations of the Demographic Land-Use Plan of 2013 (perspective.brussels, 2018). In these areas, the regular conception of mixed-use areas as residential ones where other uses (industrial, office) are "tolerated" is reversed. Early assessments of developments in these areas reveal several problems. First of all, opening them to residential uses engages real estate dynamics that prioritise high-value offices and retail over material production (De Boeck & Ryckewaert, 2020), resulting in industrial gentrification (Yoon & Currid-Halkett, 2015). Second, the involvement of private developers leads to residential development aimed at higher income groups and subsidised housing for middle-income groups. Truly affordable social housing is only included in some of the more recent projects. Third, the planning regulations in most of the projects push for vertical mix projects at the building or plot level. This increases potential conflicts between housing and productive uses (De Boeck & Ryckewaert, 2020). Moreover, this necessitates joint management of the workshop spaces and housing, while it is not clear which actor would be responsible to take up this role (Uyttebrouck et al., 2021).

## 4. Analytical Framework to Study Spatial and Functional Relationships Between Land Uses in Mixed-Use Projects

Hoppenbrouwer and Louw (2005) developed a conceptual framework based on four dimensions, four scales, and three urban texture components to discuss mixed urban developments (Figure 1, Table 1). Starting from Rowley's (1996) definition, they consider the "shared premises" dimension, where two or more activities share the same "point" or premise. This can only happen in one specific area of a building, e.g., a room being used for working and living. Vertical mixed-use, a multi-story building with different activities on different floors, and sequential mixed-use (time dimension) are also considered on a building scale. The horizontal dimension is only discussed from the "block" scale. The urban texture component in the Hoppenbrouwer and Louw scheme (henceforth H–L scheme) of mixed-use contains grain, density, and interweaving, and also mentions the notion of permeability referring to the layout of roads, streets, and paths, and how this offers choices for pedestrians.

Leinfelder and Pisman (2008) propose a different approach, based on the characteristics of functional and spatial relations between activities in research to determine the mixed land-use characteristics of various regions in Flanders (Figure 2). The scheme is also tested in case studies at the "micro-level… of a real project" (Leinfelder & Pisman, 2008, p. 2). In the Leinfelder and Pisman scheme (henceforth L–P scheme), the spatial relationships oscillate between "spreading" and "concentration.'' This resonates with density in the urban texture component of the H–L scheme. The L–P scheme further qualifies the functional relationships among uses, distinguishing between "separating" and "connecting." It considers land uses that are separate but that maintain functional interactions as having a "network" relationship, and simply "separate" if they have no interactions.

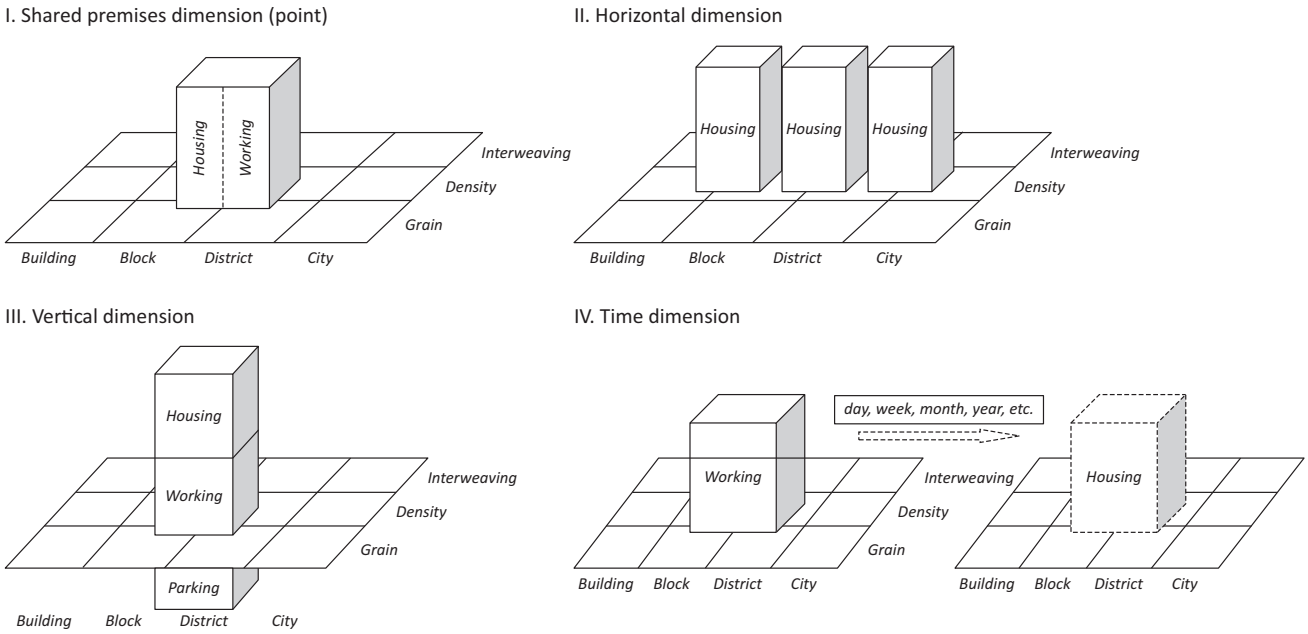


**Figure 1.** Multidimensional typology of mixed-use by Hoppenbrouwer and Louw (2005, p. 973): A conceptual model of mixed land use for four dimensions.

Adjoining land uses with functional interactions are considered "good neighbours," but if they simply co-exist without mutual nuisances, they are in a "tolerance" relationship. Finally, land uses that share space without functional interactions are in a relationship of "overlap," while in the presence of such interactions, they entertain a "symbiotic" relationship. Combined with the time dimension that indicates if the interactions are temporal or permanent, this leads to 12 possible models of mixed land use.

The L–P scheme does not include "scale," but they mention the concept as a characteristic of multiple land use and also refer to the density that occurs in the "urban texture" component of the H–L scheme. As the L–P scheme is mainly applied at the regional level, there is no distinction between the horizontal or vertical organisation of land uses. Depending on the scale and spatial organisation, some of the 12 models embedded in the scheme are not illustrations of mixed-use, but rather revert to single-use zoning (Leinfelder & Pisman, 2008). At the level of a district, city, or region, the "tolerance" and "good neighbours" types of adjacent multiple uses can conform to a mixed-use reality, depending on the grain of the respective uses. On the level of a building or a block, adjacent activities organised in the horizontal or vertical dimension of the "tolerance" or "good neighbours" type will always conform to a mixed-use reality. Therefore, it seems useful to combine the "dimensions," "urban texture," and "scale" of the H–L scheme with the L–P scheme as this provides a more complete analytical framework to evaluate the existence and quality of mixed-use on a building block or district scale.

In Table 2, we combine the various dimensions of the H–L and L–P schemes. The table illustrates the various concepts and how they relate to each other. Given its multidimensional nature, we consider the table to list relevant categories that allow assessing mixed-use in projects and spaces at various scales. Not every dimension is relevant for all (combinations of) scales, spatial dimensions, relationships, or urban texture characteristics, as indicated in Table 2 by the grey areas. In addition, the scheme should not be read as normative, discerning between "good" and "bad" types of mixed-use. The types should rather be seen as varying degrees of mixed-use, ranging from single-use ("separation"), low-intensity mix of uses to multiple-use, and

**Table 1.** Multidimensional typology of mixed-use by Hoppenbrouwer and Louw (2005, p. 974): Components of mixed land use; dimensions versus scale and urban texture.

| | Scale | | | | Urban Texture | | |
|---|---|---|---|---|---|---|---|
| Dimensions | Building | Block | District | City | Grain | Density | Interweaving |
| Shared premises dimension | x | | | | | x | |
| Horizontal dimension | | x | x | x | x | x | x |
| Vertical dimension | x | x | | | x | x | x |
| Time dimension | x | x | | | x | x | |

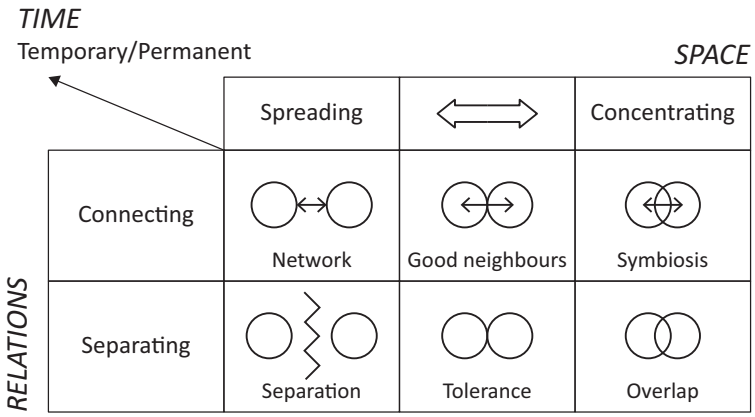


**Figure 2.** Typology of mixed-use as proposed by Leinfelder and Pisman (2008, p. 4).

high-intensity mix of uses ("symbiosis;" Leinfelder & Pisman, 2008). Nonetheless, it seems that the more intense modes of mix-use regularly reoccur in productive city discourses and projects, as indicated before. In particular, vertical symbiosis seems to serve as a guiding image in design competitions.

For the Brussels Metropolitan Region, horizontal mixed-use is the city's reality, as it would be in most cities. Even on a district level, there are only a limited number of districts that do not have some form of horizontal mixed-use. For our research, we will introduce an extra scale, the "project." The examples we study consist of multiple buildings, in some cases spread out over (parts of) multiple blocks or introducing new public streets in existing blocks. We consider the "project" scale as flexible, bridging the fixed spatial scales of building, block, district, and city. Indeed, when an entire city part is planned as a composition of mixed-use neighbourhoods, the "project" level extends between the "district'' and "city" scale, as is the case in the Amsterdam Eastern Docklands (Hoppenbrouwer & Louw, 2005). The Werksviertel in Munich (Werksviertel, n.d.) is an example of a neighbourhood planned as a combination of mixed-use blocks, where the "project level" is situated between the "block" and "district" scale.

## 5. Three Cases of Live-Work Mix in Brussels

From the recent and rapid development of new mixed-use projects in Brussels, we selected three projects that have a similar position in the Brussels Capital Region (Figure 3) and are promoted by citydev.brussels. All selected cases are developed by the "mixed projects" division of citydev.brussels. They all combine residential with "(light) industrial and material productive" uses (Government of the Brussels Capital Region, 2001). According to citydev's definition, spaces for (light) industrial activities are characterised by a rectangular floor space of over 200 m², a limited number of columns and internal walls, a floor to ceiling height of more than 5 m, and a large entrance gate that allows vans to enter the workspace. These light industrial spaces are used by manufacturing companies, construction companies, and storage, wholesale, and urban logistics. They all rely on larger heavy goods vehicles for supplies and delivery; they have an environmental impact (smell, noise) that is present but acceptable for nearby housing and residential areas. In addition to the residential and (light) industrial and material productive uses, various other uses (see Table 3) occur in the projects, in varying degrees. The projects involve public as well as private actors. They

**Table 2.** Analytical scheme of mixed-use, based on Hoppenbrouwer and Louw (2005) and Leinfelder and Pisman (2008).

| **TIME** Temporary/Permanent | | **SCALE** Building | Block Project | | District Project | City(part) Project | | | **URBAN TEXTURE** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **Density** | | | **Grain** |
| **SPATIAL DIMENSION** | **Relationship** | | | | | | | | **Spreading** | **<–>** | **Concentrating** | |
| Shared | Connecting | x | (x) | | | | | | | | Symbiosis | |
| | Separating | x | (x) | | | | | | | | Overlap | |
| Horizontal | Connecting | | x | x | x | x | x | x | Network | Good neighbors | Symbiosis | x |
| | Separating | | x | x | x | x | x | x | Separation | Tolerance | Overlap | x |
| Vertical | Connecting | x | x | x | (x) | | | | (Network) | Good neighbors | Symbiosis | x |
| | Separating | x | x | x | (x) | | | | (Separation) | Tolerance | Overlap | x |

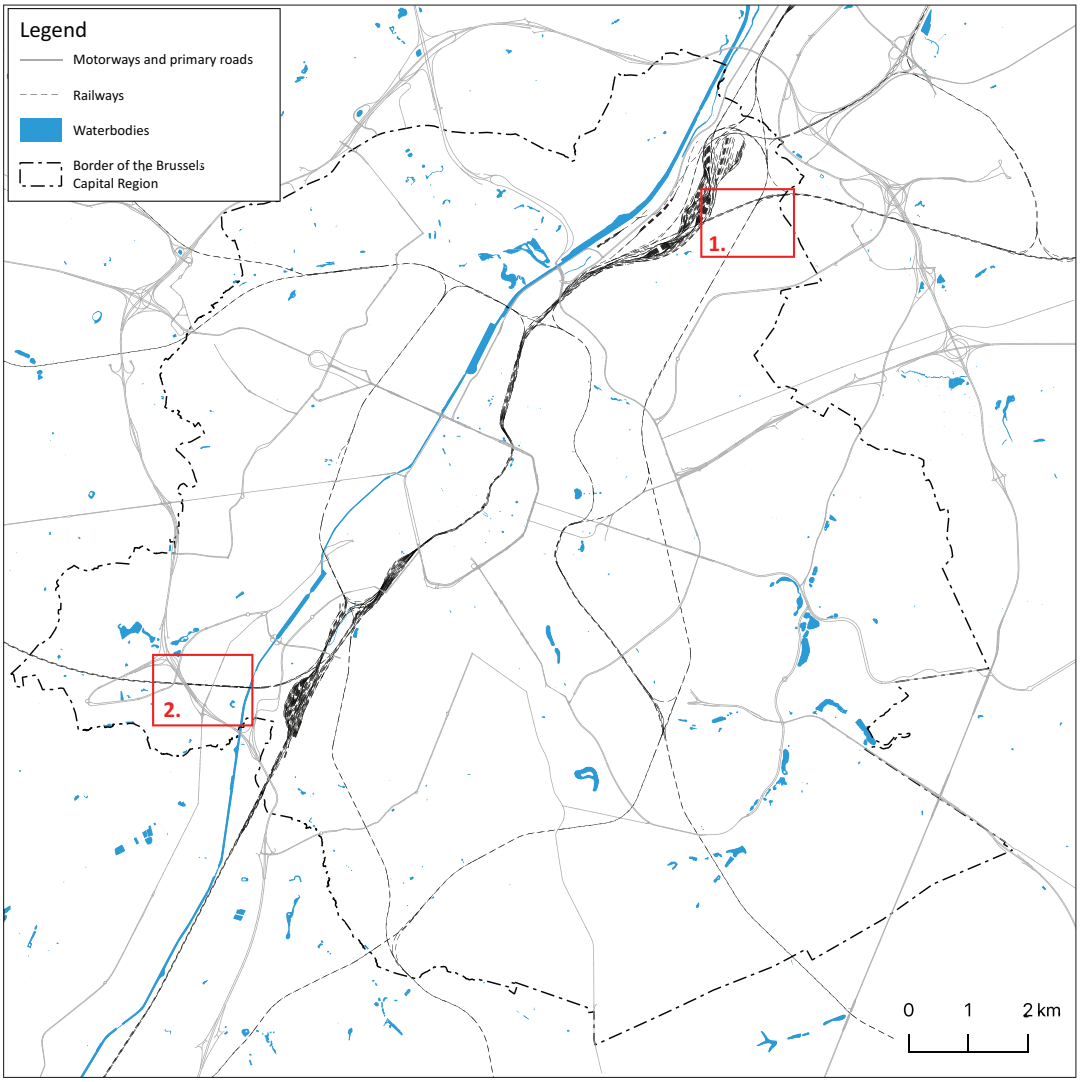


**Figure 3.** Map of the Brussels Capital Region. The NorthCity Haren project is located at no. 1 and the NovaCity and CityCampus projects are located at no. 2. The red rectangles correspond to the excerpts from the land-use map and aerial photographs in Figure 4. Mapped by Michael Ryckewaert. Sources: UrbIS (2020) and OpenStreetMap (2020).

have all obtained planning permission, and construction work has started in 2021. They are all situated at the edge of town, close to good public transport links, and on sites that allow or promote mixed-use. The similarity in the construction phase, timing, and urban location allow comparison on other topics, e.g., type of mixed-use, intensity of uses, visual and environmental relationships. We will analyse the qualitative and quantitative aspects of planned mixed-use developments using publicly available plans and 3D views. Accessibility, logistics arrangements, visual relationships, noise and smell reduction measures, and live-work combinations will be discussed together with the type of mixed-use.

Table 3 lists the basic characteristics of the three selected cases, all of which aim for a mixed-use on the project level and include housing and light industrial activities. As in the Urban Land Institute definition, the developments combine three or more revenue-producing uses (Rabianski et al., 2009; Witherspoon et al., 1976, as cited in Huston & Mateo-Babiano, 2013, p. 4). NorthCity Haren combines private social housing with offices and light industrial units for sale by Futurn and to let by citydev.brussels. The latter two cater to different potential clients and have a different perspective on revenue creation, as citydev.brussels is government-owned and Futurn is a private development company. NovaCity focuses on middle-class subsidised housing, light industrial units with and without showrooms, and retail in the second phase. In CityCampus, ateliers for food-related businesses are combined with student studios for a nearby school, single-family terraced housing, and social housing apartments (Table 3).

## 6. Evaluation of Three Cases of Live-Work Mix Based on the Analytical Framework for Mixed-Use Projects

In the analysis of the three cases, we will first situate them in the H–L "dimensions versus scale" matrix

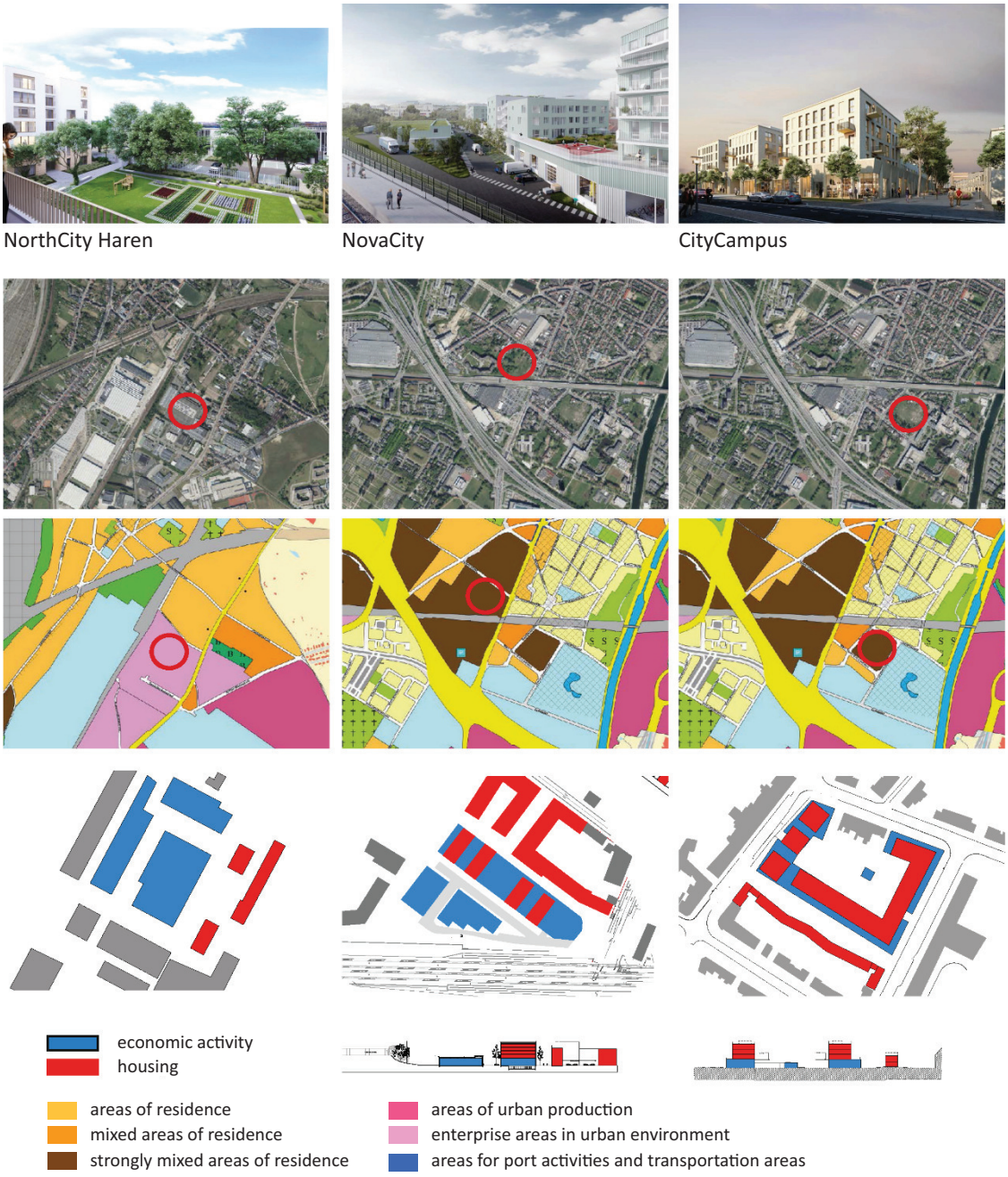


**Figure 4.** Renderings, spatial context, land use, and spatial lay out of three live-work mix projects in the Brussels Capital Region. Sources: Binst Architects and ORG permanent modernity (n.d.); BruGIS Team (n.d.); Pixelab (n.d.); Urban Nation Architects & Associates (n.d.). Spatial lay out drawn by Jan Zaman based on citydev.brussels (2018, 2019) and Futurn (2019).

(Table 5). To analyse the functional aspects of the developments, we focus on a limited set of parameters that allow us to evaluate the potential for functional relationships and strategies to avoid (environmental) nuisances. We include five parameters from the standard environmental impact assessment topic areas of "landscape, visual qualities," "noise and vibrations," "air quality," and "transport" (Glasson et al., 2012): they are visual relationship, noise reduction strategies, smell avoidance strategies, access routes, and loading arrangements (Table 4). The visual relationship parameter, the nature of the access routes, and loading arrangements also allow assessing the nature of the functional relationships and the potential to establish connections between uses needed to situate the projects in the L–P scheme. The sixth and final parameter further assesses the possibilities for connections offered by other types of shared spaces in the projects. The "access," "loading," and "shared space" parameters also allow evaluating the permeability in the urban texture component.

As far as the functional relations of the L–P scheme are concerned, we will evaluate ex-ante the intended and potential functional relations between housing and productive activities based on the development aims and

**Table 3.** Basic characteristics of three live-work mix projects in the Brussels Capital Region.

| Name | NorthCity Haren | NovaCity | CityCampus |
|---|---|---|---|
| Land use zone | Enterprise areas in an urban environment | Strongly mixed areas of residence | Strongly mixed areas of residence |
| District household density | 1,026 hh/km² | 3,474 hh/km² | 3,474 hh/km² |
| District mix (% of non-residential use, 1997) | 48.42% (adjacent district 97.16%) | 34.89% | 34.89% |
| Project: m² (light) industrial and material production | 12,554 m² | 7,519 m² | 5,370 m² |
| Project: m² public services | 212 m² | 0 m² | 138 m² |
| Project: m² offices, immaterial production and other | 1,033 m² | 452 m² | 0 m² |
| Project: m² housing | 9,629 m² | 7,482 m² | 18,615 m² |
| Project: m² green | 0 m² | 2,454 m² | 0 m² |
| Number and average size of economic units | citydev.brussels: 17–266 m² Futurn: 24–250 m² 1,000 m² offices | 17–442 m² | 18–298 m² |
| Ownership economic units | citydev.brussels: rental Futurn: sale | Rental | Rental |
| Type of housing | Privately owned social housing: 123 apartments | 63 lower middle-income apartments | Social housing: 70 units (26 terraced single-family houses, 44 apartments) 293 student housing units |
| Ownership housing | Rental | Sale | Rental |

Sources: BISA.brussels (n.d.); citydev.brussels (2018, 2019); Futurn (2019); perspective.brussels (2018).

the spatial layout of the projects. We add the mixed-use type from the L–P scheme for each scale and each project in brackets to Table 5. Depending on how the projects will actually be used in practice once built, the nature of the relationship might change, indicated by arrows in Table 5. When the outcome is unsure or unlikely, we added a question mark. Both the L–P and the H–L scheme include a temporal dimension to determine if land uses in a particular place can alternate over time or not. Also here, we will assess the intended and potential for such alternation ex-ante, based on a reading of the planning documents of the projects. Finally, in the qualitative discussion of the cases, we will refer to urban texture characteristics such as "grain" and "density" where relevant. Within the four dimensions of mixed-use in the H–L scheme, all developments share premises. As shown in Figure 3, NorthCity Haren has mainly mixed-use in a horizontal dimension, CityCampus a vertical dimension, and NovaCity is combining both horizontal and vertical dimensions.

### *6.1. NorthCity Haren*

NorthCity Haren has no shared premises, horizontal or vertical mix at the building level. At the project level, there is no hard separation between housing and economic functions, creating a situation of "tolerance." At the project level, a horizontal connection is possible in the shared access road so this space is marked by an "overlap" of uses and could be the place where a "good neighbours" relation between housing and industrial use could develop. "Symbiosis" seems unlikely, as the design of this space is not intended to host joint activities between uses. At the building block level, the project introduces housing in a formerly single-use industrial block so there is "tolerance" at the building block level.

At the "district" level, the project is located along a road that separates a "typical housing area" from an "urban enterprise zone," in a part of town that is marked by a relatively low density and heavy infrastructures. Without aiming for a very intense model of mixed-use, the project introduces some density in a fragmented space marked by a mere "tolerance" and "separation" between low-density housing and industry, which occur in relatively coarse-grained patches. We could speak of "overlap" at the district level, but probably not of "symbiosis." As the scale of the project is rather limited, it cannot fundamentally alter the single-use character of this part of the city where, overall, the demarcations between industrial and residential areas remain quite

**Table 4.** Spatial and functional relationships and mitigation of potential nuisances between land uses.

| | NorthCity Haren | NovaCity | CityCampus |
|---|---|---|---|
| Visual relationship | Views from housing and green spaces to industrial sites and offices. | Secondary and side views from the apartments on the industrial street. | View on public space and limited view on yard due to large canopy. |
| Noise reduction strategies | Distance between housing and industrial units. | Special attention to floor separating housing and industry. Balcony increases distance and reflects noise. | Special attention to floor separating housing and industry. Large canopy increases distance and reflects noise. Noisy entrances for goods face the yard. |
| Smell avoidance strategies | Distance between housing and industrial units. | Special attention to floor separating housing and industry. | Special attention to floor separating housing and industry. Large canopy increases distance and might have an impact on smell reduction. Direct vent shafts from the industrial units to the roof to evacuate odours from the ground floor economic activities. |
| Access routes | Access routes between housing and industrial uses separate, but on the same public street. A connection is provided between the shared garden of the housing development and the shared yard. The access route does not create a shortcut between other public streets, so there is no increased permeability. | Access routes between housing and industrial uses separate and on different public streets. As the new access route is open to the public, this increases permeability. | Access routes between pedestrians and heavy goods vehicles are separate. Each economic unit has an entrance on the shared street. As this street is open to the public, this increases permeability. |
| Loading arrangement | Loading and unloading from a shared yard and parking space, away from the housing development. | Loading and unloading from a shared yard and parking space, away from the housing development. | Loading and unloading at the back of the ateliers, in a shared industrial yard. Bike parking and waste management facilities also located in the yard. |
| Shared spaces | A shared garden for the housing development and a shared yard for the economic units, but no space that combines both activities. | A shared garden for the housing development and a shared yard for the economic units, but no space that combines both activities. | The streets surrounding the ateliers are shared between all uses, also open to the public. The inner yard is a shared space between economic activities. Shared student spaces (communal kitchen) face the entrances for heavy goods vehicles with a view of the industrial yard. The roof garden is shared between apartments and student housing. |

clear. It will not fundamentally change the coarse grain of the area.

To conclude, the project introduces affordable housing in a formerly industrial area. It serves as an interface between living and working in this part of the city. It is located near a new train station in the regional express train network. The project mainly stems from the ambitions of the Brussels Capital Region to increase

**Table 5.** Mixed land use according to the H–L scheme (Hoppenbrouwer & Louw, 2005) by dimensions and scale.

| Level | Building | Project | Building-block | District | City |
|---|---|---|---|---|---|
| Shared premise dimension | | NorthCity Haren (Overlap) | | | |
| | | NovaCity (Separate → Overlap?) | | | |
| | CityCampus (Overlap → symbiosis) | CityCampus (Overlap → symbiosis) | | | |
| Horizontal dimension | | NorthCity Haren (Tolerance → Good neighbours) | NorthCity Haren (Tolerance) | NorthCity Haren (Overlap) | NorthCity Haren (Tolerance) |
| | | NovaCity (Overlap → Symbiosis?) | NovaCity (Overlap → Symbiosis?) | NovaCity (Overlap → Symbiosis?) | NovaCity (Overlap → Symbiosis?) |
| | | CityCampus (Overlap → Symbiosis?) | CityCampus (Overlap) | CityCampus (Overlap → symbiosis?) | CityCampus (Overlap → symbiosis?) |
| Vertical dimension | NovaCity (Tolerance → Good neighbours?) | NovaCity (Tolerance → Good neighbours?) | | | |
| | CityCampus (Good neighbours) | CityCampus (Good neighbours) | | | |
| Time dimension | | CityCampus | CityCampus | CityCampus | |

the offer of affordable housing within its borders, while at the same time creating additional productive space. The location of the project is the result of an opportunity that presented itself, rather than a strategic intervention embedded in a larger vision. Nonetheless, within the constraints of the site, and the specificities of the location, the project succeeds in realising some of the goals of mixed-use development. It contributes to increased liveability, multiple-use, and transit-oriented development in this part of town.

### *6.2. NovaCity*

The middle building of the NovaCity project has a vertical mix with housing on top of workshops. Special attention is devoted to the floor of this vertical mix building and protruding balconies create extra distance possibly reducing noise. Both uses are in a situation of "tolerance" and, if residents had a job in the workshops, a more intense relationship of "good neighbours" could develop. At the project level, the uses "overlap" horizontally in the vertical mix building. There is a focus on reducing hindrance of logistics, by organising separate shared spaces and access routes for industrial and residential uses. The only exception is the road between the vertical mix building and the residences, where the workshop might also entertain a relationship with this "residential" access road. This creates some potential for "overlap" in this shared space at the project level.

The project could be a host to a stronger relationship between housing and industry if a campaign would focus on attracting residents of the project, the building block, or the district, to have their business in the project, and as such move toward "symbiosis" at these levels. So far, there are no indications that such initiatives are supported actively. In addition, an integrated ownership structure for the housing and the businesses could improve this, whereas today they are governed by different ownership structures (housing for sale and business space for rent). Some further considerations at the district and city level are discussed after the evaluation of the CityCampus project as both projects are situated in the same district.

### *6.3. CityCampus*

The CityCampus project has a vertical mix building with shared premises, combining business units for food-related activities with student housing for students attending classes in the nearby agri-food school campus

CERIA/COOVI. At the building level, spatial elements are introduced to reduce nuisances, such as a large canopy, noise-reducing floors between the workshops, and student housing and vents. These devices and the "symbiosis" created by joint activities in the shared premises create a "good neighbours" relationship in the vertical sense within the building. At the project level, shared spaces are provided between similar land uses (housing and student housing) as well as between different land uses. The pedestrian interior street provides access to all uses, while the yard, serving mainly logistic purposes for the workshops, is visible from the student housing and kitchen and hosts (shared) bicycle parking. The project clearly wants to provide an "urban parterre" (Psenner & Klodydek, 2017), where the street, ground floor, and courtyard work together as one entity.

Clearly, from a spatial point of view, there is at least (horizontal) "overlap" at the project, building block, and district level. From the organisational set-up, there is a clear aim to reach "symbiosis," at the project and district level. The ambition of the project is that students could have a job or do internships in the food-related spin-off companies in the project and live above. Later on, they might live in the neighbourhood and start a business in the workshops. The schools in the CERIA/COOVI agri-food campus could play a pivotal role in organising and sponsoring these exchanges and functional relationships at the project and district level. The intricate relationships between the student housing, the schools, the workshops, and the shared premises, also hint at alternating uses in time at the project and district level. If indeed these institutions take up the role of accommodating such relationships, true "symbiosis" at the project and district level could emerge.

### *6.4. Advanced Mixed-Use in Response to High Development Pressures for Housing and Productive Space*

As indicated in Figures 3 and 4 and Table 3, the NovaCity and CityCampus projects are located in the same district on the southern edge of the Brussels Capital Region in the municipality of Anderlecht. This district hosts a garden city neighbourhood built in the first half of the 20th century in an area that was marked by small scale agriculture and vegetable farming, also explaining the origins of the agri-food school campus. The area is crossed by a series of infrastructures such as the Brussels-Ghent railway line, the Brussels-Charleroi canal, and the orbital motorway, resulting in spatial fragmentation. Two interrelated developments have marked the area. First of all, the area is developed by the Brussels Capital Region as a mobility hub since the 2010s, with the opening of a new metro-stop, the opening of a new train station, and commuter parking on the motorway exit. Second, in the wake of these infrastructural improvements, vacant land is developed for housing and mixed-use projects such as NovaCity and CityCampus. These developments will alter the composition of the housing stock that is dominated today by single-family homes, as well as the household composition with a share of families with children that is higher than the regional average. When all anticipated projects are realised, the number of inhabitants in the district will increase by one-fifth to a quarter.

In short, as a result of the regional policies, the low density, semi-agricultural, and fragmented edge city district will transform into a very accessible peripheral development node. The NovaCity and CityCampus projects developed by the regional public developer citydev.brussels fit in this policy. The policy and ambition are to provide both productive spaces and affordable housing on the limited land available. This leads to strongly concentrated and very dense mixed-use projects that apply more complex mixed-use configurations (vertical mix, overlap, and symbiosis). Fitting within this regional policy, the projects can alter the overall density and degree of mixed-use of this part of the city. Mixed-use at block and district level of the "good neighbours" or "tolerance" kind is clearly present in the area today. The introduction of additional high-density multi-family housing in an area marked by a relatively high share of single-family housing creates tensions. Residents feel that the area mainly needs green spaces, additional single-family housing, and renovations of existing housing. At the level of this part of the city, it remains to be seen whether the mixed-use projects will result in an increased "overlap" and tensions between productive and residential uses of different kinds, or rather in fruitful "symbiosis," increasing the liveliness and liveability of this part of the Brussels Capital Region.

## 7. Discussion and Conclusion

The integrated application of two conceptual schemes of mixed-use to three live-work mix projects in Brussels shows the need for a multi-level conceptual framework of mixed-use. Whereas the H–L scheme focuses on spatial arrangements and the urban texture of mixity and considers different levels of scale, the L–P scheme considers spatial arrangements and functional relationships between different land uses. In that sense, both schemes complement each other and compensate for their mutual deficiencies. Indeed, in the L–P scheme, some of the models of mixity, such as "tolerance," "separate,'' or "network" apply to single land-use configurations where there is no question of mixed-use, depending on the spatial scale. If "scale" is taken into consideration, it becomes clear that at the project or building block level, these configurations do refer to mixed-use. Conversely, while the H–L scheme distinguishes between shared premises, horizontal or vertical mixity, it does not consider functional relationships between different land uses. Moreover, the L–P scheme further details the density dimension of the urban

texture component, distinguishing between spreading and concentrating land uses. The time dimension discerns between the permanent and temporary nature of mixity, which we assessed based on expected practices of use in the projects under construction. For an ex-post evaluation of mixed-use projects, design and planning strategies, spatial configurations at various levels of scale, urban texture characteristics such as density and grain, functional relationships, as well as the temporal dimension, should be considered.

It appears that the design and conception of mixed-use projects are highly contextual. Vertical mix and a close functional relationship between activities are often presented as a guiding image to break away from functionalist zoning and its adverse effects (Lane & Rappaport, 2020; Rappaport, 2017). As such, there is a risk that reaching "symbiosis" between activities in mixed projects is considered as the holy grail of mixed-use. Aiming for symbiosis could result in mere overlap without the added value of increased liveability, and even in increasing conflicts and tensions between uses, as illustrated in the CityCampus and NovaCity projects at the district and city level. This further illustrates that the analytical framework combining components and types of mixed-use from the H-L and L–P scheme should not be considered as a normative framework.

Indeed, the findings of this analysis of three mixed-use projects suggest that less intense forms of mixity such as "good neighbours," "overlap," and "tolerance" also correspond to valid spatial planning goals in cities that try to combine productive city policies to develop affordable housing within a limited territory, a context of soaring land prices and traffic congestion. The aims to increase density and keep essential economic activities within the city, close to the "consumers" of such essential services and goods, as well as to a labour force in search of short-term skilled jobs, seem to justify the choice for projects that combine activities to various degrees without, however, reaching "symbiosis."

It seems that symbiotic mixity is only to be achieved when specific conditions are met. Notably, the combined programs or activities should have functional and organisational links and some form of governance should be in place to organise shared use in space and time. A government agency such as citydev.brussels could take up this role, but also the introduction of leasehold schemes, where joint ownership of land for mixed projects leads to joint management, could result in better governance of relationships between different land uses (De Boeck & Ryckewaert, 2020). This could also be part of the extended role of the curator, a unit or agency responsible for the integration, management, and networking of productive uses in the city as proposed in productive city strategies (Cities of Making, 2020).

As such, the productive city discourse introduces a new motivation to pursue mixed-use development, beyond the "traditional" goals of combatting the negative aspects of single-use development, such as increasing the liveability and liveliness of urban environments. As our examples show, projects should find a balance between the need to intensify land use to accommodate conflicting and competing land uses (residences and production notably) and these established aims of mixed-use development.

Finally, the various types of mix—good neighbours, tolerance, overlap, symbiosis—come with their own design and spatial strategies. In the case of tolerance and good neighbourship, the careful design of the separation between uses at the building level, project and building block level, as well as in terms of logistic and access flows seem the most essential. In the case of the symbiotic mix, the design effort should focus on clever solutions for shared spaces, situated between different uses. Symbiosis will mainly emerge if these spaces allow for multiple uses (possibly alternating in time) and/or for joint activities between different land uses that strengthen the links between residential and productive uses. Examples could be a shared garden that serves as a space for lunch breaks for workers, professional workshops where inhabitants can do DIY work or lend tools for jobs in and around the house, among many others.

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**Conflict of Interests**

The authors declare no conflict of interests.

**References**

Binst Architects, & ORG permanent modernity. (n.d.). *CityCampus*. citydev.brussels. http://www.citydev.brussels/fr/projets/citycampus

BISA.brussels. (n.d.). *Wijkmonitoring* [Neighborhood monitoring]. https://wijkmonitoring.brussels

Borret, K., Lacasse, G., & Collet, J. (2018). *Brussels productive city.* Bouwmeester Maitre Architecte.

BruGIS Team. (n.d.). *brugiswebapp*. https://gis.urban.brussels/brugis/#

Castells, M., & Hall, P. (1994). Boston's highway 128. High-technology reindustrialization. In M. Castells & P. Hall (Eds.), *Technopoles of the world. The making of twenty-first-century industrial complexes* (pp. 29–39). Routledge.

Choay, F. (1965). *L'urbanisme, utopies et réalités. Une anthologie* [Urbanism, utopias and realities. An anthology]. Seuill.

Cities of Making. (2018). *Cities report*. https://citiesofmaking.com/wp-content/uploads/2018/05/CoM_CityReport-0523-LR.pdf

Cities of Making. (2020). *Foundries of the future. A guide to 21st century cities of making*. TU Delft Open.

citydev.brussels. (2018). *Planning permission application 01/PFD/1697838 (CityCampus project)*. https://openpermits.brussels/fr/_01/PFD/1697838

citydev.brussels. (2019). *Planning permission application 01/PFD/1701869 (NovaCity project)*. https://openpermits.brussels/fr/_01/PFD/1701869

Curran, W. (2007). "From the frying pan to the oven": Gentrification and the experience of industrial displacement in Williamsburg, Brooklyn. *Urban Studies*, *44*(8), 1427–1440. https://doi.org/10.1080/00420980701373438

De Beule, M., Périlleux, B., Silvestre, M., & Wauty, E. (2017). *Brussel geplande geschiedenis. Stedenbouw in de 19e en 20e eeuw* [Brussels planned history. Urban design in the 19th and 20th centuries]. Meert.

De Boeck, S., Degraeve, M., & Vandyck, F. (2020). Maintaining small-scale production space in the city: The case of Brussels construction companies (1965–2016). *Brussels Studies*, *2020*(General collection no. 147). https://doi.org/10.4000/brussels.5023

De Boeck, S., & Ryckewaert, M. (2020). The preservation of productive activities in Brussels: The interplay between zoning and industrial gentrification. *Urban Planning*, *5*(3), 351–363. https://doi.org/10.17645/up.v5i3.3092

De Maesschalck, F., De Rijck, T., & Heylen, V. (2015). Crossing borders: Social-spatial relations between Brussels and Flemish Brabant. *Brussels Studies*, *2015*(General collection no. 84). https://doi.org/10.4000/brussels.1260

Dessouroux, C., Bensliman, R., Bernard, N., De Laet, S., Demonty, F., Marissal, P., & Surkyn, J. (2016). Housing in Brussels: Diagnosis and challenges. *Brussels Studies*, *2016*(Synopsis no. 99). https://doi.org/10.4000/brussels.1353

Ferm, J., & Jones, E. (2016). Mixed-use 'regeneration' of employment land in the post-industrial city: Challenges and realities in London. *European Planning Studies*, *24*(10), 1913–1936. https://doi.org/10.1080/09654313.2016.1209465

Ferm, J., & Jones, E. (2017). Beyond the post-industrial city: Valuing and planning for industry in London. *Urban Studies*, *54*(14), 3380–3398. https://doi.org/10.1177/0042098016668778

Fischler, R. (1998). The metropolitan dimension of early zoning: Revisiting the 1916 New York City ordinance. *Journal of the American Planning Association*, *64*(2), 170–188. https://doi.org/10.1080/01944369808975974

Futurn. (2019). *Planning permission application 04/PFD/671586 (NorthCity Haren project).* openpermits.brussels. https://openpermits.brussels/fr/_04/PFD/671586

Gehl, J. (2011). *Life between buildings: Using public space*. Island Press.

Glasson, J., Therivel, R., & Chadwick, A. (2012). *Introduction to environmental impact assessment* (4th ed.). Routledge.

Gold, J. R. (1998). Creating the charter of Athens: CIAM and the functional city, 1933–43. *The Town Planning Review*, *69*(3), 225–247.

Government of the Brussels Capital Region. (2001). *Plan regional d'affectation du sol* [Regional land use plan].

Grant, J. (2002). Mixed use in theory and practice: Canadian experience with implementing a planning principle. *Journal of the American Planning Association*, *68*(1), 71–84. https://doi.org/10.1080/01944360208977192

Hebbert, M. (2003). New urbanism—The movement in context. *Built Environment*, *29*(3), 193–209. https://doi.org/10.2148/benv.29.3.193.54285

Hirt, S. (2007). The devil is in the definitions. *Journal of the American Planning Association*, *73*(4), 436–450. https://doi.org/10.1080/01944360708978524

Hoppenbrouwer, E., & Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's eastern docklands. *European Planning Studies*, *13*(7), 967–983. https://doi.org/10.1080/09654310500242048

Huston, S., & Mateo-Babiano, I. (2013). *Vertical mixed-use communities: A solution to urban sustainability? Review, audit and developer perspectives July 2013* [Conference paper]. 20th Annual European Real Estate Society Conference, Vienna, Austria.

IABR—Atelier Brussels Productive Metropolis. (2016). *A good city has industry*. BOZAR—Paleis voor Schone Kunsten.

Jacobs, J. (1993). *The death and life of great American cities*. Vintage.

Lane, R. N., & Rappaport, N. (2020). *The design of urban manufacturing*. Routledge.

Leinfelder, H., & Pisman, A. (2008). *A methodological framework for a political approach of mixed land use, tested in the urbanised region of Flanders, Belgium* [Conference paper]. 4th Joint ACSP–AESOP Conference "Bridging the Divide: Celebrating the City," Chicago, IL, USA.

Logan, T. H. (1976). The Americanization of German zoning. *Journal of the American Institute of*

*Planners*, *42*(4), 377–385. https://doi.org/10.1080/01944367608977742

London City Hall. (2021). *The London plan: The spatial development strategy for Greater London*. Greater London Authority. https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf

Mumford, E. (2000). *The CIAM discourse on urbanism, 1928–1960*. MIT Press.

National Academies of Sciences, Engineering, and Medicine. (2004). *Transit-oriented development in the United States: Experiences, challenges, and prospects*. The National Academies Press.

OpenStreetMap. (2020). *Belgium* [Data set]. Geofabrik. https://download.geofabrik.de/europe/belgium.html

Orban, A., Trenado, C. S., & Vanin, F. (2021). Who benefits from productive activities? Analysis of the case of Cureghem. *Brussels Studies*, *2021*(General collection no. 153). https://doi.org/10.4000/brussels.5358

perspective.brussels. (2018). *Plan régional d'affectation du sol. Dispositions relatives à l'affectation du sol: Version coordonnée* [Regional land use plan. Planning prescriptions linked to the coordinated version of land use] https://perspective.brussels/sites/default/files/documents/pras_180104_prescriptions_coordonnees_officieuses.pdf

Pixelab. (n.d.). *NovaCity*. citydev.brussels. http://www.citydev.brussels/fr/projets-logement/novacity-i

Psenner, A., & Klodydek, K. (2017). Researching the morphology of the city's internal micro structure: UPM urban parterre modelling. In *24th ISUF International Conference: Book of Papers* (pp. 1245–1254). Universitat Politècnica de València.

Rabianski, J., Gibler, K., Tidwell, O. A., & III, J. S. C. (2009). Mixed-use development: A call for research. *Journal of Real Estate Literature*, *17*(2), 27.

Rappaport, N. (2017). Hybrid factory | Hybrid city. *Built Environment*, *43*(1), 72–86. https://doi.org/10.2148/benv.63.3.72

Rappaport, N. (2020). *Vertical urban factory*. Actar.

Rosenberger, M. (Ed.). (2017). *Fachkonzept Produktieve Stadt* [Spatial concept productive city]. Stadtentwickelung Wien.

Rowley, A. (1996). Mixed-use development: Ambiguous concept, simplistic analysis and wishful thinking? *Planning Practice & Research*, *11*(1), 85–98. https://doi.org/10.1080/02697459650036477

Ryckewaert, M. (2011). *Building the economic backbone of the Welfare State in Belgium. Infrastructure, planning and architecture 1945–1973*. 010.

Urban Nation Architects & Associates. (n.d.). *NorthCity*. citydev.brussels. http://www.citydev.brussels/fr/projets/northcity

UrbIS. (2020). *UrbIS–ADM* [Data set]. Datastore.brussels. https://datastore.brussels/web/urbis-download

Uyttebrouck, C., Remøy, H., & Teller, J. (2021). The governance of live-work mix: Actors and instruments in Amsterdam and Brussels development projects. *Cities*, *113*, Article 103161. https://doi.org/10.1016/j.cities.2021.103161

van Eesteren, C., & van Rossem, V. (1997). *Het idee van de functionele stad. Een lezing met lichtbeelden van 1928* [The idea of the functional city. A lecture with slides from 1928]. Nai.

van Es, E., Harbusch, G., Maurer, B., Pérez, M., Sommer, K., & Weiss, D. (Eds.). (2014). *Atlas of the functional city: CIAM 4 and comparative urban analysis*. Thoth.

van Gameren, D., Kuitenbrouwer, P., & Schreurs, E. (2019). *Home work city: Living and working in the urban block*. DASH—Delft Architectural Studies on Housing.

Vandyck, F. M., Bertels, I., Wouters, I., & Ryckewaert, M. (2020). Urban industries and the production of space: A typomorphological analysis of the mixed urban fabric around the historical national road Jetsesteenweg in Brussels, Belgium. *Urban Morphology*, *24*(2), 200–215.

Werksviertel. (n.d.). *Werksviertel München*. https://werksviertel.de/?page_id=410&lang=en

Witherspoon, R., Abbett, J. P., Gladstone, R. M., & Institute, U. L. (1976). *Mixed-use developments: New ways of land use*. Urban Land Institute.

Yoon, H., & Currid-Halkett, E. (2015). Industrial gentrification in West Chelsea, New York: Who survived and who did not? Empirical evidence from discrete-time survival analysis. *Urban Studies*, *52*(1), 20–49. https://doi.org/10.1177/0042098014536785

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Article

# Planning Urban Manufacturing, Industrial Building Typologies, and Built Environments: Lessons From Inner London

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**Abstract**
Despite concerns about the loss of industry, industrial land, and buildings in high-value post-industrial cities, there is concurrently a renewed enthusiasm around the potential of "new" urban manufacturing and its contribution to the socio-economic diversity of cities. Yet, little is known about how planning policy can best support the retention and growth of urban manufacturing. To advance this agenda, this article proposes that we need a better understanding of industrial building typologies and resultant urban form. Using concepts developed by Julienne Hanson to analyse residential morphologies undergoing transformation under modernism, we apply these concepts to investigate the industrial, mixed-use contexts in two areas of London with concentrations of urban manufacturing—Hackney Mare Street and Old Kent Road. The research presented examines how both areas have evolved historically to produce distinctive urban tissues and a range of industrial building typologies. The article reveals that, despite territorial similarities in the late 19th century, the mixed land uses and smaller plot sizes of Hackney Mare Street have allowed for a more resilient development pattern, whereas the greater separation of land uses, large plot sizes, and inward-facing development in the Old Kent Road has facilitated its reimagination for large-scale regeneration. We conclude that greater attention needs to be paid to the relationship between urban manufacturing and built urban form if policies that aim to protect or support the revival of manufacturing in cities are to avoid negative unintended consequences.

**Keywords**
built environment; industry; London; manufacturing; morphology; planning

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## 1. Introduction

After decades of deindustrialization and the loss or decentralization of large-scale manufacturing, there has been a revival of interest and enthusiasm for small-scale "new" urban manufacturing in the context of the debate around so-called "post-industrial" cities. This has emerged alongside and parallel to the growth of high-tech "advanced" or "smart" manufacturing facilitated by a wave of new technologies driving what is being referred to as a fourth industrial revolution or industry 4.0 (De Propris & Bailey, 2020). Although some of the small urban-based manufacturing businesses are also benefitting from new digital technologies, Grodach and Martin (2020) situate them in contrast to advanced manufacturers. They characterise them as "low-tech," "high-touch,'' and labour-intensive firms that benefit from an urban location that provides proximity to networks of suppliers, services, and local labour (Grodach et al., 2017), as well as to consumers and markets that are important for niche design-driven firms (Ferm & Jones, 2017).

Despite the enthusiasm for a revival of urban-based manufacturing, the reality in London—the research focus of this article—is that the potential for growth of this sector is threatened by the limited availability of land and buildings to accommodate it. The loss of industrial land has consistently (since 2001) been more than double the target set in London policy, accelerating to three times the target across London in the period of 2011–2015, and almost eight times the target in the central London sub-region (Greater London Authority, 2016). This accelerated loss has been driven by real estate pressures and substantially higher land values for alternative uses, particularly housing, rather than being a direct consequence of deindustrialization (Ferm & Jones, 2015). It has been facilitated by a widely held assumption that, by definition, manufacturing no longer has a function or place in the post-industrial inner city on the basis that it is dirty, noisy, and an inefficient use of land. Such assumptions fail to take account of a "more nuanced understanding of manufacturing geographies" and the fact that new urban manufacturing businesses "are more likely to cluster in the few remaining pockets of industrial land in the central city" (Grodach & Martin, 2020, p. 2). In London, there has been some progressive thinking reflected in the new London Plan (Greater London Authority, 2021b; for further elaboration see Ferm, 2021) which acknowledges the need to increase industrial capacity across the city and promotes greater intensification of industrial uses and some co-location with housing. However, the ambitions of those policies, as first drafted, have been undermined by central government pressure for the London Plan to deliver more housing (see letters from the Secretary of State to the Mayor of London, March and December 2020; Greater London Authority, 2021a). This points to the need for new typologies of mixed-use buildings incorporating industry. However, to date, there has been little research undertaken into the typologies of buildings accommodating manufacturing and the relationship between industrial buildings and the urban fabric that surrounds them. In other words, an understanding of how industrial businesses are embedded in, and relate to, their urban environments. This has resulted in a lack of knowledge regarding the impacts of displacement through redevelopment and the best form of new development to accommodate manufacturing in a mixed-use context.

This article is one output of a wider cross-disciplinary research project bringing together Bartlett colleagues in the School of Planning and Space Syntax Laboratory (School of Architecture) at University College London with a shared interest in the place of manufacturing in the "post-industrial" city. The idea is to combine methods and approaches used by collaborators in other projects, drawing on space syntax concepts and analysis, analysis of planning policy and historic documents, and ethnographic and observational work in two inner London case study areas: Old Kent Road, in the London Borough of Southwark, and Mare Street, in the London Borough of Hackney, part of what has come to be known as the "Maker Mile" (see Figure 1).

Our article draws on Julienne Hanson's conceptualisation of the shifts in the design of post-war social housing in British cities as involving a paradigmatic transformation of urban design ideas driven by architectural modernism (Hanson, 2000). It applies the same principles to an analysis of industrial typologies within mixed-use urban contexts. The next section reviews the literature on the drivers of the location of urban manufacturing, including policy and external economies of agglomeration, arguing that less attention has been paid to the importance of place, urban form, and the built environment in the location of businesses. In order to examine this dimension in more detail, we use Hanson's (2000) original analysis of the changing relationship between buildings and streets in the context of housing design under modernism and seek to apply this to the industrial context. In the following sections, we apply our analysis to two case studies, focusing first on the evolution of urban morphologies in both contexts and second on the variety and distribution of industrial building typologies. The research reveals that, despite demographic and territorial similarities within the late 19th century, the mixed land uses and smaller plot sizes found in Hackney Mare Street have allowed for a more resilient development pattern, whereas the greater separation of land uses, large plot sizes, and more formal, rule-governed environment in the Old Kent Road have facilitated its reimagination for large-scale regeneration. The article concludes that greater attention needs to be paid to the relationships between urban manufacturing activity and built urban form if policies that aim to protect or support the revival of manufacturing in cities are to avoid negative unintended consequences.

## 2. The Geography of Urban Manufacturing and Its Relationship to the Built Environment

Debates in policy and literature on the location of urban manufacturing in the past 40 years or so have drawn attention to the contrasting perspectives of policy-led versus market-led approaches. In the first part of this section, we discuss the related and interconnected drivers of policy and agglomeration economies. However, there is also a strong tradition of literature (e.g., Davis, 2019; Jacobs, 1969; Soja, 2003) that is concerned with the urban morphology of cities and its relationship to the economy. It claims that there is scope for greater attention to be paid to the relationship between urban manufacturing and the material and spatial form of the built urban environment.

Until very recently, the dominant policy approach to industrial land in global cities, including London, has been that of "managed decline" through a gradual reduction in the supply of industrial land that accommodates such businesses, on the basis that we are at the tail end of a long, drawn-out process of deindustrialisation

and restructuring of the economy (Ferm, 2020). Until the publication of the new London Plan (Greater London Authority, 2021), the approach in previous iterations of London plans was to actively manage the decline of surplus industrial land, whereby the 32 London boroughs fell into one of three categories: "managed," "limited," or "restricted" release. Inherent in such policy approaches is a characterisation of any remaining urban manufacturing as a "relic," associated with the industrialisation of the late 19th and early 20th centuries. Their continued existence has been supported, according to such accounts, by land use policies or statutory zoning approaches that effectively subsidise urban manufacturers to continue to operate in an otherwise high-value city where other land uses would out-bid manufacturers for space (Hills & Schleicher, 2010). The new London Plan acknowledges the need to retain industrial capacity across London and has moved towards a policy of intensification on industrial land (Policy E7), introducing a mix of uses including housing, rather than supporting piecemeal loss of strategic sites.

Empirical evidence suggests that exclusionary zoning—which serves to prevent other higher-value land uses from locating in an area zoned for industrial use—has remained popular in US city administrations (Dempwolf, 2010; Leigh & Hoelzel, 2012), and protectionist policies continue to find favour in the new London Plan, albeit with more flexibility than in the past (Ferm, 2021). Arguments in support of industrial zoning are that it helps to diversify the economy and types of jobs available, that it supports the location of small, new firms in central locations at the point when they rely most on the agglomeration benefits of the inner city (Heikkila & Hutton, 1986), and that industrial areas provide more flexible space, allowing firms to expand and contract more readily (Chapple, 2014). On their own, industrial preservation policies were found by Davis and Renski (2020) to be effective in stemming urban industrial land losses in New York, but the lack of linkage with economic development objectives meant that there was little impact on promoting new industrial business registrations or new employment. The more mainstream economic argument (summarised in Heikkila & Hutton, 1986) is that zoning inhibits economic efficiency, and that manipulating business location through policy undermines the external economies and benefits of industrial agglomeration and clustering based on market signals.

Yet the characterisation of manufacturing as a relic in cities that would have disappeared through deindustrialisation had it not been for subsidy through planning policy or zoning ignores much theoretical and empirical evidence, particularly on the location of small manufacturers. Whereas market signals led the large-scale mass manufacturers of the Fordist era to decentralise to the newly urbanised suburbia, "business parks" on peripheral greenfield sites, or much further afield to newly industrialised countries, small-scale manufacturers, and those in the start-up or incubation phase are more dependent on other businesses in the supply or co-production chain. They are more dependent on labour than capital and have always benefitted from the agglomeration economies found in cities (Jacobs, 1969; Scott, 1982). As Curran (2007, p. 1429) described in her analysis of the displacement of industrial businesses in Williamsburg, New York:

> Small urban manufacturers need urban locations for access to customers, suppliers and labour markets. Those businesses that could, left the city long ago; those that remain are the ones that need to be there and have a business advantage because of their urban location.

Unlike the large manufacturers under Fordism, small-scale manufacturers rely on fluid labour markets available in cities and in the production of products that compete on quality over price, there being a benefit to proximity to consumers and access to global markets (Scott, 2006). In contemporary manufacturing, there is a distinction between advanced manufacturers and what Grodach and Martin (2020) call "low-tech, high-touch" manufacturers, the latter being more dependent on the benefits of proximity that cities provide.

More specifically, beyond the importance of a merely urban location, small manufacturing firms are highly place-dependent and tied to specific localities. This local dependence, argue Cox and Mair (1988), results from relationships, trust, and local knowledge built over time, between customers and suppliers in particular places. Small enterprises tend to be more reliant on a local labour force and skills base workers who might not have the capacity to move should the firm be displaced. Unlike large manufacturers who have the capacity to participate in business coalitions to influence local economic development, small manufacturers lack capacity and are more vulnerable. Curran (2010) supports this argument with empirical evidence in Williamsburg, New York, revealing the importance to local manufacturers of place-specific supporting infrastructure and cultural and social networks. In London's East End, Raco and Tunney (2010) also revealed the importance of local linkages for small industrial firms that were affected by redevelopment associated with the 2012 Olympic Games. Many displaced businesses were unable to replicate customer, buyer, and supplier bases elsewhere, bringing attention to the under-acknowledged "peopled nature of SMEs or the relationships of trust and reciprocity that build up between social actors over time" (Raco & Tunney, 2010, p. 2082). This brings attention to the importance of the local urban context for small manufacturers. As Vaughan et al. (2013) reveal in their study of London's suburbs, industrial uses are part of the delicate ecology and balance of uses in town centres, which is central to understanding why they have remained so adaptable over decades.

Despite this growing knowledge about the importance of locale for small urban manufacturers, and place-specific social and economic ties, there is little understanding of how the urban fabric can be shaped to accommodate such an ecology. As Soja (2003, p. 274) argues, although the literature on agglomeration economies draws our attention to the "savings in time and energy that derive from clustering things together rather than spreading them out," there is little theoretical or empirical understanding of how this translates into creativity and innovation, and the relationship to wider spatial, social, and historical processes underpinning urban life. Furthermore, the materiality of the city is often overlooked: As Griffiths (2017, p. 127) identifies, although "the urban dimension is acknowledged as critical to the agglomerative process… the natural focus of economists on the instrumental requirements of industry can serve to prioritize the economic 'city of production' at the expense of the quotidian, lived 'city-as-place.' " This article brings the "city-as-place" into central focus through an examination of the evolution of the urban tissue that accommodates industrial typologies and manufacturing activity.

To date, studies of the morphologies of urban environments that accommodate manufacturing are scarce, but there is increasing interest (for an urban design perspective on urban manufacturing in the US context see Lane & Rappaport, 2020). Wood and Dovey (2015) investigated this issue in relation to creative industries in Australian cities more broadly and found that a mixed morphology linked to a multiplicity of functions was an important factor in creating the "buzz" or "atmosphere" of a creative cluster. Froy and Davis (2017) analysed the relationship between urban form and the location of manufacturing in London's railway arches. They found the arches accommodated a disproportionate amount of manufacturing, which was due to their highly adaptable, flexible, and modular nature suitable for hybrid uses and expanding enterprises, as well as their affordability. Their study points to the potential for an emergent new spatial form: "industrial streets" as opposed to the industrial estates we have seen as the dominant urban form under modernism. The wider impact of a transition from a street-grid urban form that was dominant in the late 19th century to an estate-based one that emerged in the middle of the 20th century has been investigated in the study of housing morphologies by Hanson (2000). Drawing on the space syntax tradition of urban research and analysis, Hanson found that the creation of estate-based social housing morphologies organized around open space rather than streets, inverted the traditional relationship between the building and street. The result was an increased separation of the interior space of estate developments from the life of the urban realm. In social terms, this led to increased segregation of residents of housing estates from the life of the city and reinforced a sense of isolation due to a lack of natural urban encounters, since these estates were generally not entered by people other than those who lived in them. There are parallels here to urban manufacturing, which was also impacted by the transition from a street-based urban form to an estate-based one, with the result that urban manufacturing's residual presence in industrial estates led both to a sense of its alienness in the city and invisibility in policy terms. This study therefore seeks to apply some of Hanson's thinking to industrial morphologies and the relationship between industrial building typologies, their urban form, and the social and economic life that emerges as a result. We do this through a case study-based investigation of two inner London mixed-use urban areas with concentrations of manufacturing activity, but with very different urban morphological characters that have contributed to their distinctive treatment in policy terms. In the section that follows, we provide a rationale for our case study selection, an overview of the two case studies, and a description of the research methodology adopted.

## 3. Case Study Overview and Methodology

Our case study areas were selected through a two-stage process. In the first stage, a London-wide mapping of manufacturing businesses was conducted (see Figure 1) using business count data from the Directory of London Businesses (London Data Store, 2019), mapped by statistical areas at the medium super output area (MSOA) level. This was overlayed on a space syntax analysis of routes with the highest intensity of use, represented on the map as high "choice" values and thicker lines (for further explanation and discussion see Palominos Ortega et al., 2020). The mapping exercise revealed areas with concentrations of manufacturing businesses.

For the purpose of this article, we were interested in further exploring the morphological characteristics of urban mixed-use areas with concentrations of manufacturing, along well-connected routes, rather than in large tracts of more isolated mono-functional industrial land, as can be seen for example along the River Thames in east London. Therefore, in the second stage of the selection process, we identified areas that met these criteria. Next, we were interested in selecting two case studies that had different historical trajectories of development, policy contexts, and contrasting built environments. The two case studies chosen—Hackney Mare Street and Old Kent Road—are both located in inner London, along A-roads leading out of central London north and south of the River Thames, respectively. They are both outside the original Victorian industrial ring mapped in detail by Peter Hall's (1962) account of the industries of London since 1861, but have had concentrations of manufacturing since at least the 1800s, following the construction of the Regents Canal and Surrey Canal respectively, and later the railway (British History Online, n.d.; Southwark Council, 2021). Yet, the two areas have developed over time in different ways and have experienced different development pressures and policy responses, as will be explained.

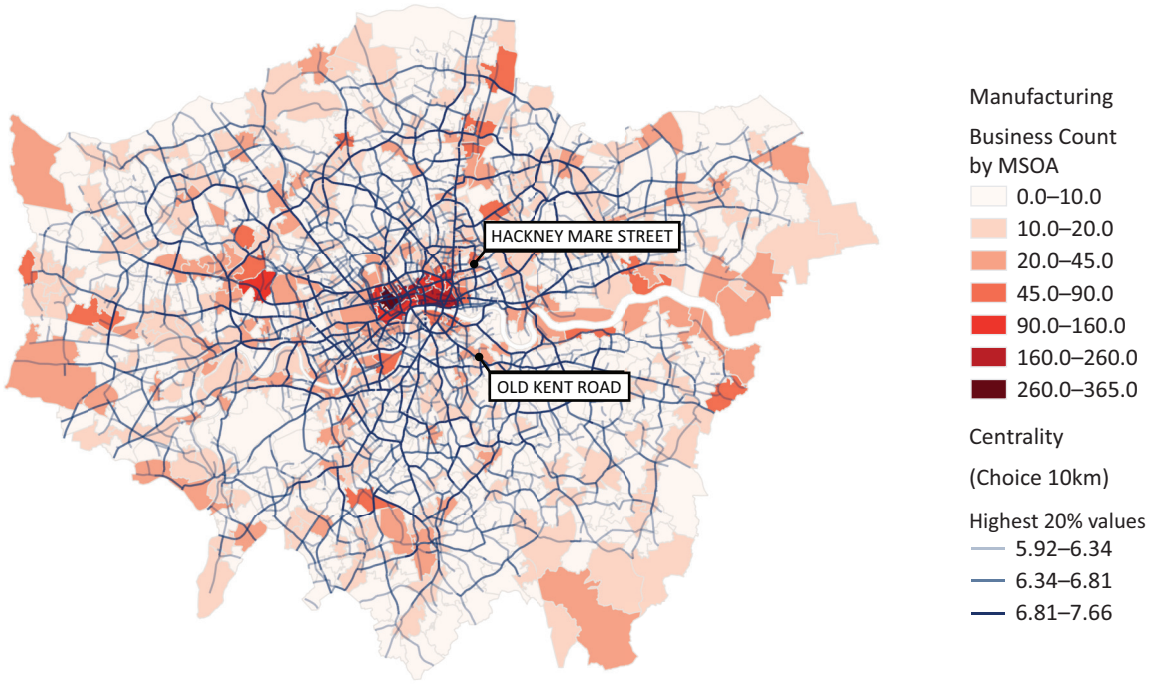



**Figure 1.** Concentrations of manufacturing businesses in London. The map shows the location of the Hackney Mare Street and the Old Kent Road case studies in London used in this article. Sources: Image elaborated by Nicolas Palominos Ortega using business count data from the Directory of London Businesses (London Data Store, 2019), measured by MSOAs; centrality data retrieved from Space Syntax (2020).

Hackney Mare Street is now part of what has been branded the "Maker Mile" and was featured in the European project "Cities of Making" (Domenech et al., 2020) as a hotspot for new urban manufacturers and creative industries. Hackney has been subject to waves of gentrification, with artist "pioneers" later displaced by middle class gentrifiers and with the "frontline" of gentrification extending geographically north-eastwards over the last few decades (Duman, 2012; Hamnett & Williams, 1980). This has resulted in both industrial gentrification and industrial displacement by residential redevelopment, with its manufacturing and artistic heritage used in developers' branding strategies (Ferm, 2016). In contrast, the Old Kent Road has long been dismissed as "nothing"—an undesirable thoroughfare and collection of traditional manufacturing, retail depots, and a very run-down high street (Cargill Thompson, 2018). This, along with its designation as strategic industrial land, meant that, until recently, the Old Kent Road was seen by artists, industrial occupiers, and lower-value service businesses as one of the few districts of inner London that had escaped the pressures of gentrification (Cargill Thompson, 2018) and, as such, was relatively protected from displacement by higher value uses. However, the Old Kent Road's identification as an "opportunity area" in the 2016 London Plan and an area of growth in Southwark's local plan, prompted by the planned extension of the Bakerloo Line, has made the area ripe for large-scale redevelopment and has already prompted the piecemeal submission of planning applications for the residential redevelopment of sites (see https://www.vitalokr.com/threat) long before the arrival of the extended Bakerloo Line (now under threat due to lack of government funding).

This article approaches the different development trajectories of these two manufacturing clusters from an urban-morphological perspective in order to better understand how the range and type of manufacturing building typologies identified are embedded in London's historical built environment. In order to meet these objectives, we used the following methods:

Stage 1: Analysis of historical maps, review of historical sources, and policy documents;

Stage 2: Mapping of manufacturing businesses, drawing on the Directory of London Businesses (London Data Store, 2019);

Stage 3: Site visits and observation, using the STRAVA tracking app which allowed the researchers to geolocate any photographs taken. The purpose of the site visits was to (a) verify the data collected in the desktop mapping exercise; (b) identify and map industrial building typologies and identify the activities/uses therein, using observational methods and taking into consideration criteria such as construction type, building and plot size, mixed versus single use, number of storeys, single vs multiple occupancy, and site boundaries; and (c) observe the relationship between

these typologies and their built environment contexts, exploring accessibility, constitutedness (i.e., street-building interface), urban embeddedness, flexibility of use, and potential for natural urban encounter (see Hanson, 2000);

Stage 4: Semi-structured interviews with business owners or representatives that were selected either during the analysis of the primary data or during the first set of observation-focused visits. Attempts were made to interview businesses in each building typology. The aim of these interviews was to gain insight into the various links between businesses and the built environment related to the location rationale, accessibility, use of space, daily life of employees, and embeddedness. Interviews were transcribed and recorded observations fed into NVivo software for thematic analysis. This analysis used abductive coding whereby codes and themes either emerged from the research itself or were predefined based on theory and the analysis of primary data. The aim of the thematic analysis was to search recurrent underlying themes related to the research framework. As such they covered—in alphabetical order—accessibility, activity, constitutedness, degree of activity, embeddedness, flexibility, formality/informality, morphology, noise, other, parking, possibility for encounter, safety, and vibrancy. Once the interviews and observations were categorised, they were then used to complete a "typology table" constructed at the beginning of the research to qualify the relationship between each type and its immediate urban environment. This was then simplified and produced in Table 1.

## 4. The Urban Morphology of Manufacturing in Hackney Mare Street and Old Kent Road

The first stage of the research involved an historical overview of Hackney Mare Street and Old Kent Road from the late 19th century onward to detect trends and patterns in the location and clustering of industrial activities. This formed the basis for the empirical research into the spatial morphologies of urban manufacturing, including the configuration of buildings, plots, and streets, and their embedding within the local urban environment. Through our investigation of these two cases, we explore how the aggregation of these features results in tighter or looser urban tissues depending on the relationship between buildings, plots, and streets (see Kropf, 2017). We examine the implications this has for understanding and managing industrial building typologies as part of the evolution of the city fabric. We then use the local empirical findings to discuss the wider relations between manufacturing and the city and reflect on the association with modernism and influence of post-war planning.

The Hackney Mare Street area was, in 1880 (Figure 2), already a densely and heavily urbanised landscape. By 1951, it had showed little fundamental change in its urban tissue except for the extension of the railway to the north, which incidentally required demolition of part of the urban fabric. Between 1880 and 1951, the incongruent in-between spaces that appeared in the middle of the new railway and the pre-existing urban tissue were gradually filled with larger buildings that started accommodating non-residential uses. Indeed, by 1951 manufacturers of clothing, furniture, chemicals, glass, etc., appear in proximity to the railway (see Figure 2). Notably, these changes coincide with a heavy period of industrialisation during the inter-war period and, as the following sections will explore, their legacy persists to this day.

The Old Kent Road was, until the late 19th century, composed of a mix of farmland, a dense network of residential streets, an extensive rail network, and a cluster of productive activities—manufacturing and various workspaces (e.g., glass works, fur workshops, breweries)—along the Grand Surrey Canal. As Figure 3 shows, the Canal's arrival in the early 1800s prompted the first wave of industrialisation in the area and acted as a major axis along which further workshops and manufacturing businesses gradually appeared alongside the iconic South Metropolitan Gasworks. These remained, despite the Canal being later covered over (Southwark Council, 2021). By 1952, the entire area was urbanised, and the previous farmland had given way to a dense urban fabric comprising predominantly single row houses along residential streets. Despite the network of railways, the Grand Surrey Canal—by that time covered—remained an organising axis for industry, and its legacy can still be seen in our analysis of the area's contemporary morphology (Figure 4). The Second World War had a devastating impact on the area; the concentration of industry being a target for the bombing raids. The reconstruction of housing and industry that followed resulted in a greater separation of land uses and larger plot sizes. Importantly, Figure 3 also reveals the location of the Bricklayer's Arms station and depot, which was later demolished and developed as a modern industrial estate, warehousing, and distribution area.

With the exception of parks and green communal areas, the urban tissue of both Hackney Mare Street and the Old Kent Road are, today, totally urbanised (Figure 4). However, important distinctions exist in their respective spatial morphologies.

Hackney Mare Street is, today, composed of a mix of densely packed small-scale buildings—predominantly terraced houses—and larger units along major infrastructure axes (see Figure 4). At first glance, the latter seems to fragment the otherwise homogenous residential urban landscape. However, the figure-ground map (Figure 4) and first-person observation (see photographs in Figure 5) indicate that despite this contrast, Hackney Mare Street's urban tissue remains tightly knit and has, to this day, resisted large-scale redevelopment. This could be attributed to the flexibility of the smaller size individual units found around Mare Street—also

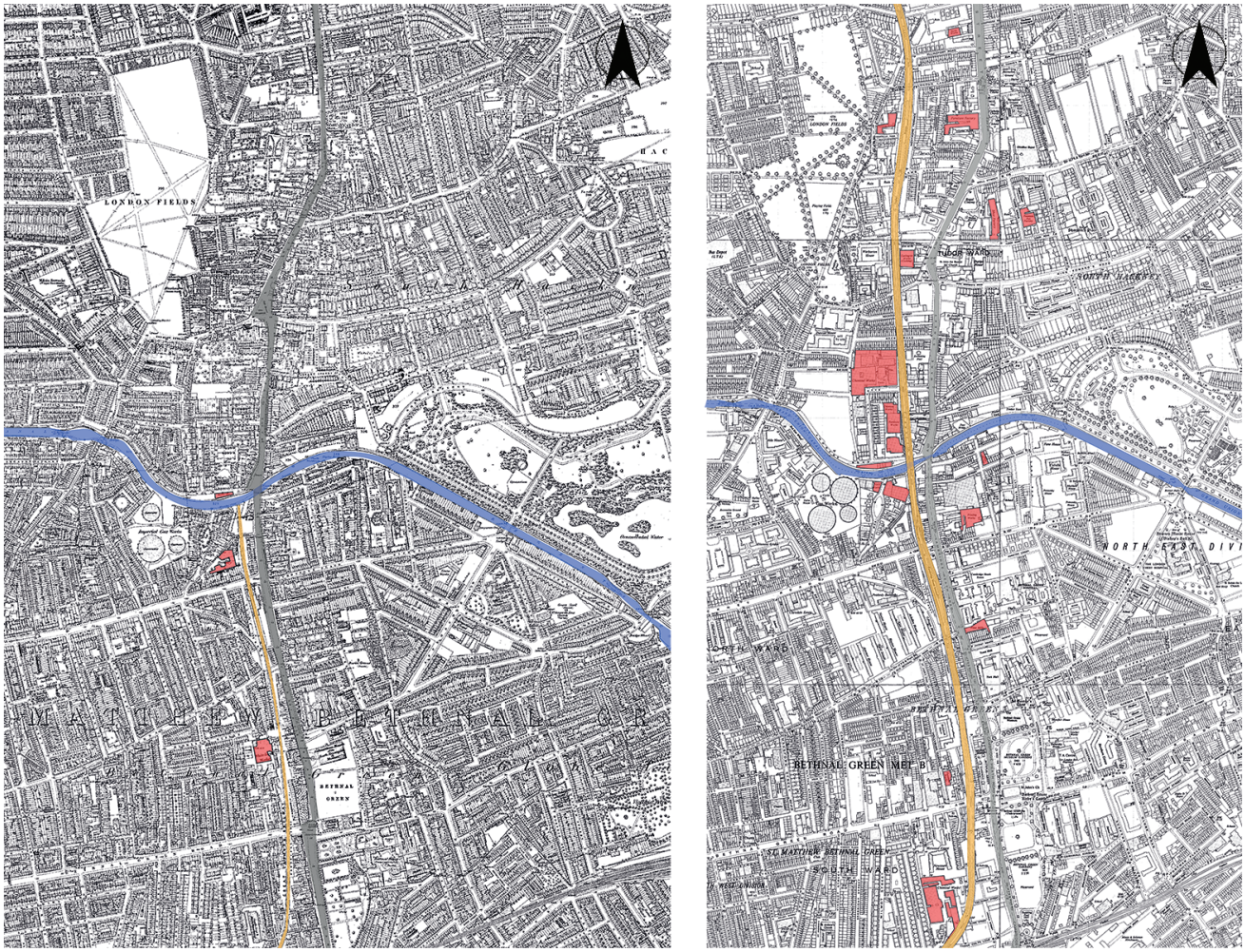



**Figure 2.** Historical maps of Hackney Mare Street: 1880 (left) and 1951 (right). Highlighted in blue is the Regent's Canal; in orange, the railway; in grey, Mare Street; and in red, manufactories, industrial buildings, and workshops. Source: Ordnance Survey (2019). Created 12 July 2019.

evidenced by its ability to accommodate an entirely new railway line in the early 20th century—allowing the area to evolve incrementally.

In contrast, the Old Kent Road tells a very different story. In the years following 1952, the area saw three extensive transformations: (a) the closure of the Bricklayers Arms Station and Goods Depot, and replacement with a modern industrial estate; (b) the carving of Burgess Park over a pre-existing dense residential and industrial neighbourhood; and (c) the covering of the Grand Surrey Canal (Figure 4). These key events in the transformation of the Old Kent Road area substantially modified the structure of the area's urban fabric. Through these large-scale urban transformations, the historically dense spatial morphology of the Old Kent Road area with outward-facing residences and buildings evolved and is now characterised by a combination of large open spaces and impermeable inward-facing building types on plots with solid perimeters (fencing, blank walls) preventing easy through movement, resulting in an impermeable urban environment (Figure 6).

## 5. Building Typologies of Urban Manufacturing

Despite the contrasting spatial morphologies of both case studies, the range of industrial building typologies found in both areas are broadly similar. What differs—as will be shown later in this section—is the relative dominance of larger format typologies in the Old Kent Road. In the first part of this section, we document our empirical analysis of the range of industrial building typologies found in both areas and their relationships with their direct urban environments. Eight types of buildings were consistently found across both cases (outlined in Table 1 and shown in Figure 7): small-scale industrial buildings, railway arches, industrial estates, large single-occupancy industrial buildings, multi-storey multi-occupancy buildings, containers in container developments, dedicated fenced buildings, and mixed-use developments. Based on the findings from site visits, observations, and interviews, Table 1 unpacks the most common activities found in each type, their respective architectural and morphological characteristics and related degree of flexibility to accommodate productive activities, and finally,

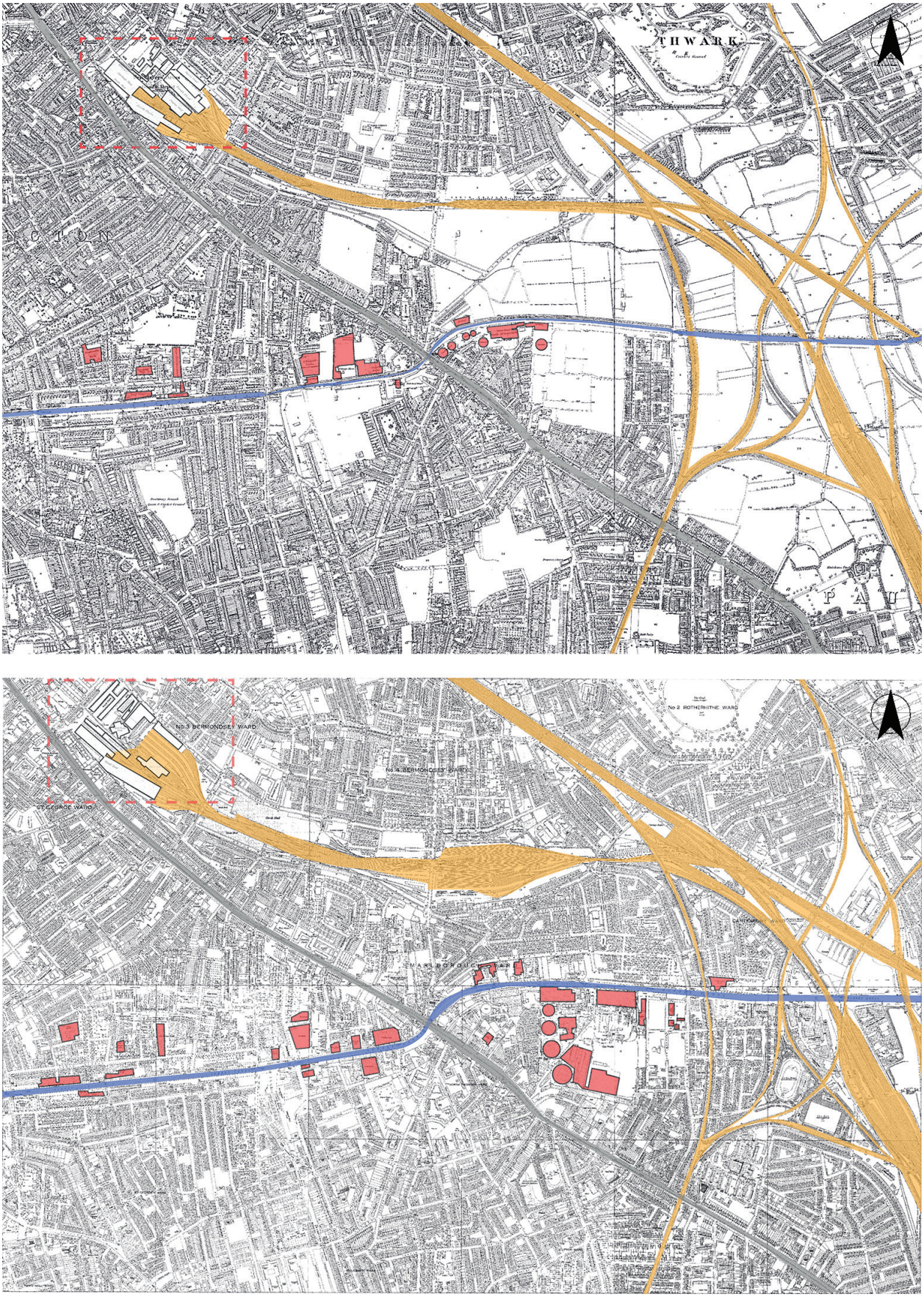



**Figure 3.** Historical maps of Old Kent Road: 1896 (top) and 1952 (bottom). Highlighted in blue is the Grand Surrey Canal; in orange, the railway; in grey, Old Kent Road; in red, manufactories, industrial buildings, and workshops; and, in white, the Bricklayers Arms Station and Depot. Source: Ordnance Survey (2019). Created 12 July 2019.

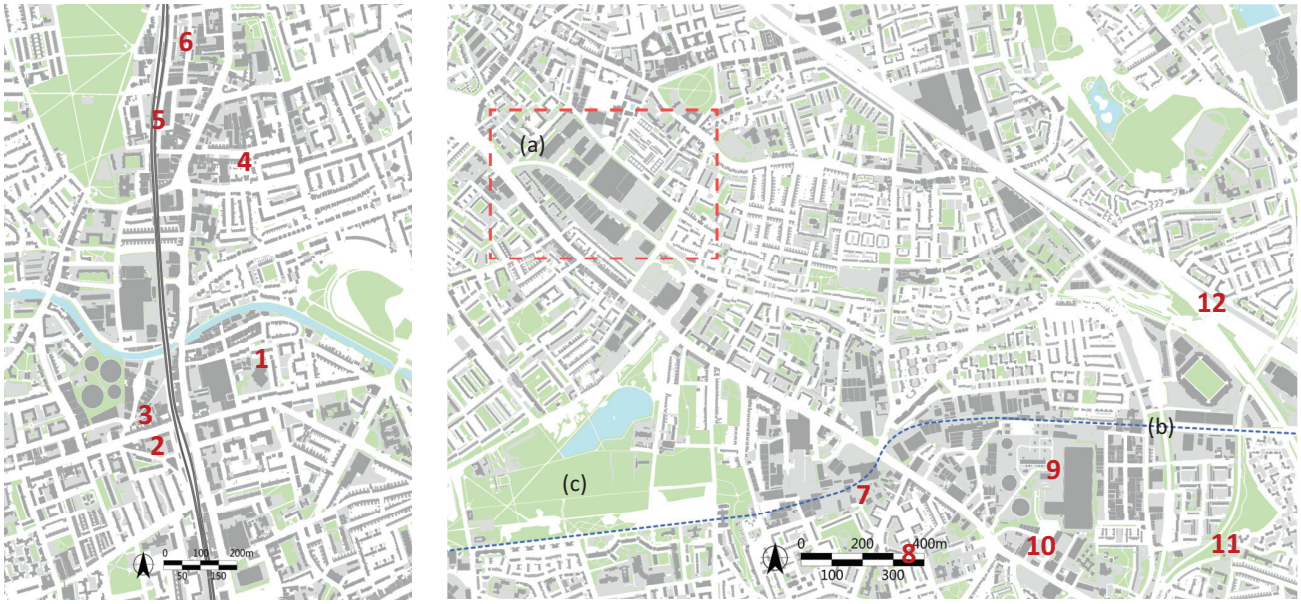



**Figure 4.** Present day figure-ground maps of the Hackney Mare Street (left) and the Old Kent Road (right) case studies. On the Old Kent Road map is noted (a) the site of the Bricklayers Arms Station and Goods Depot; (b) the path of the now covered Grand Surrey Canal; and (c) Burgess Park. Base map source: Ordnance Survey (2019). Created 11 December 2020.

their accessibility and relationship to the street and their immediate urban environment.

Table 1 reveals how small-scale industrial buildings and railway arches are usually dedicated to one specific activity or business primarily due to their small size, but also how the versatile internal configuration of these buildings allows for a very wide range of activities. Depending on the immediate urban environment, these types open either directly onto the street, a private alley, or a front yard which is connected to the main road network resulting in a high degree of constitutedness (see Hanson, 2000). The clustering of small businesses along industrial streets and railway arches was historically very beneficial for businesses as it allowed for the creation of a vibrant local community of manufacturers. Unlike railway viaducts, which by their spatially restricted nature have escaped pressure for residential redevelopment, industrial streets with small-scale industrial buildings (such as Vyner Street in the Hackney case and Hatcham Mews in the Old Kent Road area) have been


**Figure 5.** Present-day photographs of Hackney Mare Street. Source: Photographs taken by the authors during weekday site visits in working hours on 21 June 2019, 20 August 2019, and 5 September 2019.


**Figure 6.** Present-day photographs of Old Kent Road. Source: Photographs taken by the authors during weekday site visits in working hours on 12 July 2019, 20 August 2019, and 9 October 2019.

**Table 1.** Summary of activities, main characteristics, and accessibility of each type of manufacturing building as found in Hackney Mare Street and Old Kent Road.

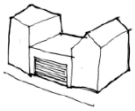
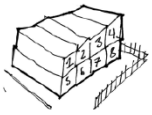
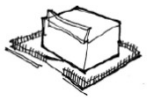
| | Type | Main activities | Characteristics and flexibility | Access and relation to the street |
|---|---|---|---|---|
|  | Small scale industrial building | Small-scale makers (e.g., umbrellas), printers, fashion and interior design studios, video production and car repairs. | Smaller units usually fitted to one specific activity or business. Flexible type that can be fitted to a wide range of manufacturing and light industrial activities. | Direct access from the street through a larger entrance. Direct relation to the street forming an informal type of environment. |
|  | Railway arches | Vehicle repairs, garages, food manufacturing, building related manufacturing, interior design, architecture offices, retail, warehouses, breweries, and other commercial activities. | Standardised open-floor internal space with potential to connect more than one arch. Very flexible type as railway arches can easily accommodate new and diverse uses due to their standardised dimensions. | Access via one large main entrance usually a large door or a roller shutter door. Direct relation to the street forming an informal type of environment. |
|  | Industrial estates | Small-scale manufacturers, larger building related manufacturers, food processing, and various non-manufacturing related activities such as artists, designers, and other services. | Group of buildings that include distinct businesses organised around a central shared open space (i.e., a yard or court). Flexible type that can house a wide range of activities. | Access to the estate through one main gate and then each individual building is accessed via the shared internal courtyard. Distant relation to the street forming a rule-based environment. |

**Table 1.** Summary of activities, main characteristics, and accessibility of each type of manufacturing building as found in Hackney Mare Street and Old Kent Road.

| | Type | Main activities | Characteristics and flexibility | Access and relation to the street |
|---|---|---|---|---|
|  | Large single-occupancy industrial building | Heavy industrial activities (e.g., foundry, metalworks, furniture, joineries) and other non-manufacturing related activities requiring large surface areas (e.g., warehouses, and retail/wholesale). | Large standalone buildings that tend to be fitted to one specific activity that occupies the space on a longer timeframe. Relatively flexible buildings due to the open space type of internal arrangement. | Usually two separate entrances: one for people and one for goods. It is very common for this typology to be surrounded by a large yard used for parking, storage, and manoeuvring. |
|  | Multi-storey multi-occupancy | Retail or light productive activities and makers such as design and architecture studios, artist studios, video and music production, and finishing of textiles. | Large buildings where individual businesses share the same building and floors without being related. Relatively flexible type that can be fitted to a variety of uses that do not require heavy machinery. | Single private entrance on street. Usually very detached from public space. |
|  | Container development | Services, architectural, and design offices, makers, and light manufacturing activities such as wood workshops and 3D printing. | "Up-cycled" shipping containers into workspaces. Very flexible type due to the standardised dimensions, the lack of internal compartmentalisation and the possibility to combine units. | Access via several layers or interfaces. (a) a front gate from the street; (b) a shared open area, and (c) dedicated door to each container. Separated and detached from the street and public space. |
|  | Dedicated fenced building | Exclusive to uses that require large open spaces, such as storage and large suppliers, printing, car dealerships, and rentals. | Large industrial shed surrounded by ample open space and separated from public space with fences or walls. Very flexible type due to high floor-to-ceiling heights and the generic "shed" architecture. | Access via a large multi-purpose private open yard surrounding the main building. Very harsh relation to the street as opaque walls or fences create a rule-dominated environment. |
|  | Mixed-use development | Start-ups, small scale makers, and the creative industry. | Combination of residential units with professional spaces, workshops, and co-working spaces. Inflexible type that is geared towards very specific activities and businesses. | Separate entrances for workshops and residential units. Clear separation between private and public space resulting in a very formal urban environment. |

subject to piecemeal residential and commercial gentrification. Mixed-use industrial/residential buildings, as a new typology, are often integrated into these environments. According to a business owner in Vyner Street, the transformation of the urban landscape from an industrial to an increasingly residential one has eroded the thriving community of workers.

Single-occupancy large industrial buildings are uncommon, given the dominance of smaller manufacturers in these inner London urban environments. Older

**Figure 7.** Photographs of manufacturing building typologies. From top to bottom and left to right: small-scale industrial buildings, railway arches, industrial estates, large single-occupancy industrial, multi-storey multi-occupancy, containers, dedicated fenced building, and mixed-use developments. Source: Photographs taken by the authors during weekday site visits in working hours on 21 June 2019, 12 July 2019, 20 August 2019, 5 September 2019, and 9 October 2019.

buildings, such as the Foundry in Hackney, have a strong relationship to the street, whereas newer large-scale industrial buildings tend to accommodate more vehicular movements and car parking within, and therefore their relationship to the street is more similar to that of industrial estates. These buildings tend to accommodate one specific activity that occupies the space over a longer timeframe and, due to their massive size, they are rarely found in dense urban areas with smaller plot sizes. Industrial estates—more dominant in the Old Kent Road area but found in both cases—are purposedly built with a high floor-to-ceiling ratio and are optimal for heavy industrial activities and other non-manufacturing related activities that require a substantial surface area to operate. Transforming and fitting these buildings to new activities is usually easy given their open space design. However, their industrial character has served to protect these areas from piecemeal redevelopment and gentrification. Industrial estates are usually accessed through one main entrance and normally comprise a large multifunctional yard used for parking, storage, loading, unloading, and manoeuvring. This results in a very low degree of constitutedness as the very large size of these buildings and the relatively few entrances create large impenetrable spaces with a distant relationship to the street, and physical barriers that clearly separate public and private spaces. Although there may be business-to-business relationships established within these industrial estates, their spatial separation from the street and broader environment precludes their contribution to a sense of local community.

Container developments (only found in the Hackney Mare Street case) are small-scale and designed to accommodate start-ups and new businesses requiring small, flexible space. Containers are, by their nature, cheap and flexible—it is common for companies to expand and use more than one container. The businesses occupying space in container developments tend to be car-free and there is no direct vehicular access to the units, with a single entrance to the development from the street normally served by smaller, narrower streets with low traffic. These spatial attributes allow for a rather informal use of space by pedestrians to the extent where, occasionally, public space is also used as an extension of the working area. Although businesses report that they value the sense of community fostered in container developments, they are isolated bubbles in the urban fabric without a direct relation to the street, resulting in an introverted typology where both work and socialising happens within it.

To better understand how each type is embedded in the urban fabric, Table 2 compares the count of each

**Table 2.** Count of manufacturing building typologies found in the Hackney Mare Street and Old Kent Road case studies.

| Key | Type | Scale | Street / estate based typology | Unit count (Hackney) | Typologies as a % of total industrial units surveyed (Hackney) | Unit count (OKR) | Typologies as a % of total industrial units surveyed (OKR) |
|---|---|---|---|---|---|---|---|
| 1 | Small scale industrial building | Small scale | Street | 35 | 13% | 59 | 17% |
| 3 | Railway arches | Small scale | Street | 71 | 26% | 69 | 20% |
| 6 | Industrial estates | Large scale | Estate | 2 | 1% | 148 | 42% |
| 10 | Large single-occupancy industrial | Large scale | Street | 13 | 5% | 33 | 9% |
| 17 | Multi-storey multi-occupancy | Large scale | Street | 9 | 3% | 10 | 3% |
| 4 | Containers* | Small scale activity / large scale | Estate | 132 | 48% | 0 | 0% |
| 5 | Dedicated fenced building | Large scale | Estate | 0 | 0% | 31 | 9% |
| 14 | Mixed use development | Large scale | Street | 11 | 4% | 1 | 0% |
| | TOTAL | | | 273 | 100% | 351 | 100% |

*Containerville: 78 containers. *Gossamer city: 54 current residents.

building type in Hackney Mare Street and the Old Kent Road which are then mapped in Figure 8. Both table and figure confirm a clear dominance of small-scale units in Hackney Mare Street and a predominance of larger building types in the Old Kent Road area.

Larger typologies such as industrial estates, large single-occupancy industrial, multi-storey multi-occupancy, and dedicated fenced buildings are dominant in the Old Kent Road (69%) but very limited in Hackney (9%). These observations confirm the earlier


**Figure 8.** Maps of the Old Kent Road (top) and Hackney Mare Street (bottom) highlighting the geographical distribution of industrial building types, based on site observations. Base map source: Ordnance Survey (2019). Created 11 December 2020.

analysis which revealed the tighter urban morphology of Hackney Mare Street, made of smaller plots, in contrast to a looser one in the Old Kent Road, composed of larger parcels.

The data also shows that small-scale industrial buildings and railway arches comprise relatively equal proportions of the building stock in both cases (averages of 15% and 23% respectively). This is important since small-scale industrial buildings and railway arch typologies were the dominant industrial typologies during the earlier stages of 19th-century industrialisation. The fact that they are enduring to this day indicates that they have been able to sustain the passage of time and adapt to the changes and the needs of manufacturing for decades. Flexibility has been attributed to the modular and standardised architectural features of such industrial premises (see Froy & Davis, 2017; specifically for railway arches see Rosa, 2014) and is one key aspect underpinning their long-term sustainability. As Froy and Davis (2017) highlight, the flexible spatial configuration of railway arches facilitates business expansion and contraction with relative ease, which is paramount for businesses to be successful and remain relevant.

The clustering and mix of industrial activities have also been documented as fundamental for production, exchange, and reproduction (Dovey & Wood, 2014). Wood and Dovey (2015, p. 65) found that the spatial morphologies of creative clusters are not homogeneous but rather comprise a "mix of mixes" of functions and spatial interfaces. This is observed in both Hackney Mare Street and Old Kent Road as industrial building types are surrounded by residential neighbourhoods and often work to fill in the in-between spaces between infrastructure and the rest of the urban fabric generating an uncommonly mixed-use urban landscape. Nevertheless, within this very diverse urban environment and a mix of typologies, a clear clustering of types can be observed. The two maps in Figure 8 highlight how in both cases industrial activity and manufacturing is still clustering around long-standing infrastructure, such as railways and waterbodies, and that within these clusters smaller groupings of building types are found.

In the Old Kent Road area, industrial estates, large single-occupancy buildings, dedicated fenced buildings, and small-industrial buildings tend to be clustered closer to their relative type. The same is apparent in Hackney Mare Street where small-scale industrial buildings remain closely grouped along the Regent's Canal. It is also noteworthy that the only two container developments are located around the same public space. It is unclear whether this is deliberate, but their focus on building strong communities could be a fundamental factor in their location rationale. As for the dedicated fenced building typology, it is for the most part isolated from other industrial buildings as this typology requires a very large amount of open space. It is therefore not surprising that, in the Old Kent Road, this type is almost exclusively found on the former site of the Bricklayers Arms Station and Depot, while it is non-existent in Hackney Mare Street. It is noticeable that in Hackney Mare Street a more localised approach to manufacturing and productive activities has been embraced by promoting smaller units and developments such as container villages which are more appropriate for start-ups and small-scale makers. These retain many of Hanson's (2000) pre-modern morphological attributes of a street-based environment where space is continuous and composed of open and outward-facing building typologies, attributes which have proved to be a source of resilience. In contrast, in the Old Kent Road area, industry and manufacturing are predominantly accommodated in larger inward-facing industrial estates and tend to be characterised by heavier manufacturing and industrial activities.

However, that is not to say that Hackney Mare Street has remained in a "pre-modern" stage. Instead, there is a higher proportion of start-ups and small companies around Hackney Mare Street, which are in transitionary states and are likely to eventually outgrow their first location and relocate, hence, their fit in smaller-scale building typologies. In contrast, although start-ups and small firms are found in the Old Kent Road area, more traditional and longer-established manufacturing activities have been located there, facilitated by larger format industrial buildings with significant yard space to accommodate vehicular servicing, heavy machinery, and tools required for their operation (although the pressure for redevelopment and rapid change in the area at the time of writing means these observations are time sensitive). Therefore, the lack of "newer" building types, such as container developments and mixed-use buildings, in the Old Kent Road area suggests that there is less demand from new manufacturing businesses and start-ups.

The built environments in Hackney Mare Street and the Old Kent Road have evolved differently over time and have resulted in two very different outcomes with certain typologies dominating more in one area than the other. The massive events of urban transformation that altered the Old Kent Road allowed the resulting massive plots to house large buildings whereas the mostly unchanged fabric of Hackney Mare Street allowed it to retain its dense urban character. The smaller plots found around Hackney Mare Street have allowed the urban environment to change and evolve gradually, facilitating gentrification but avoiding large scale redevelopment, whereas the Old Kent Road's looser form and larger individual plots and buildings have led to the opposite: an urban fabric struggling to survive in the face of development pressure without extensive (re)development. This illustrates the urban tissue's varying degrees of flexibility and adaptability to change but also the complexity underpinning spaces of urban manufacturing—which was also highlighted by Lane and Rappaport (2020) in American cities. From an analysis of the changing spatial morphologies of both areas, in the context of their historical development, we hypothesise that the pressures

both areas are currently facing from (re)development are inexorably linked to their current urban form and the way it evolved during the 20th century. We argue that it is therefore key to look beyond the individual building types and consider the urban environments they create cumulatively. Understanding the relation between industrial typologies and their urban-morphological embedding is key to grasping the evolution of urban manufacturing and the urban context of the living city in which it is still found.

## 6. Conclusions

Much has been written about the role of residential buildings and typologies in shaping the city fabric, and this focus on housing is reinforced by planning policy in London, which places an arguably disproportionate emphasis on housing as the dominant land use in the city, with growth targets that eclipse all other land uses and activities. This article brings our attention to industrial building typologies and industrial morphologies as part of the city fabric. It has drawn parallels with the transformation of residential morphologies under architectural modernism and the associated tradition of post-war town planning, which Hanson (2000) conceptualised. In the same way that the demolition of post-war housing estates has been justified on the grounds of poor urban design and integration with the wider city fabric, so areas with a dominance of inward-looking industrial estates—whose segregation from residential areas was once justified on environmental and pollution grounds—have become targets for large scale regeneration and re-imagination.

The two inner London case study areas chosen for this research are experiencing different pressures for redevelopment, which we have argued is directly related to the evolution of the two urban environments since the late 19th century. Whereas the area around Hackney Mare Street has been subject to gentrification and piecemeal redevelopment over time, its urban form is tighter and denser and has remained largely intact, increasingly accommodating businesses in the so-called "new economy." In contrast, the Old Kent Road has been identified as a site for major redevelopment and transformation through a targeted policy-led approach, which has already prompted significant residential-led development activity in the area threatening up to 1,000 businesses (vitalokr.com). This, we have suggested, is closely linked to its relative dominance by larger post-war industrial estates, that emerged in the tradition of architectural modernism and "rational" post-war town planning, and which renders its industrial activity—that has included larger, more traditional manufacturers as well as smaller, new ones—relatively invisible.

As this article shows, inner London districts with concentrations of manufacturing comprise a wide variety and diversity of industrial building typologies, all accommodating different types of activities and sizes of businesses. These include older "traditional" manufacturers and newer "high-tech" firms, which interact in different ways with their immediate urban environments. Some require the formal access and servicing arrangements inherent in industrial estates, others benefit from the less rule-governed nature of "industrial streets," or the networking and business-to-business interaction facilitated by multi-occupancy buildings or containers. The wide variety of industrial typologies and urban environments required to sustain an industrial ecology and support the growth of urban manufacturing in the city is—we suggest—underexplored and inadequately understood. This article is a contribution towards a new framework of industrial typologies for policy purposes. Together with recent work on the design of urban manufacturing (Lane & Rappaport, 2020) and the re-integration of material production into the life of the working city (Davis, 2019), we believe this points to an important emerging research agenda. It is one which fundamentally brings our attention to the importance of place in both determining the location decisions of manufacturers—hitherto less explored in the literature—and their fate once established in their urban environments.

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## Conflict of Interests

The authors declare no conflict of interests.

## References

British History Online. (n.d.). *Home*. https://www.british-history.ac.uk

Cargill Thompson, J. (2018). *"This is not nothing:" Everyday places and identities on London's Old Kent Road* (Unpublished master's thesis). University College London, London, UK.

Chapple, K. (2014). The highest and best use? Urban

industrial land and job creation. *Economic Development Quarterly*, *28*(4), 300–313. https://doi.org/10.1177/0891242413517134

Cox, K. R., & Mair, A. (1988). Locality and community in the politics of local economic development. *Annals of the Association of American Geographers*, *78*(2), 307–325.

Curran, W. (2007). "From the frying pan to the oven:" Gentrification and the experience of industrial displacement in Williamsburg, Brooklyn. *Urban Studies*, *44*(8), 1427–1440.

Curran, W. (2010). In defence of old industrial spaces: Manufacturing, creativity and innovation in Williamsburg, Brooklyn. *International Journal of Urban and Regional Research*, *34*(4), 871–885.

Davis, H. (2019). *Working cities: Architecture, place and production*. Routledge.

Davis, J., & Renski, H. (2020). Do industrial preservation policies protect and promote urban industrial activity? *Journal of the American Planning Association*, *86*(4), 431–442. https://doi.org/10.1080/01944363.2020.1753563

Dempwolf, C. (2010). *An evaluation of recent industrial land use studies: Do theory and history make better practice?* Unpublished manuscript. http://www.academia.edu/319809/An_Evaluation_of_Recent_Industrial_Land_Use_Studies_Do_Theory_and_History_Matter_In_Practice

De Propris, L., & Bailey, D. (2020). *Industry 4.0 and regional transformations*. Routledge. https://doi.org/10.4324/9780429057984

Domenech, T., Froy, F., & Palominos, N. (2020). *Case study report: The Maker Mile in East London*. Cities of Making. https://citiesofmaking.com/case-study-report-the-maker-mile-in-east-london

Dovey, K., & Wood, S. (2014). Public/private urban interfaces: Type, adaptation, assemblage. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, *8*(1), 1–16. https://doi.org/10.1080/17549175.2014.891151

Duman, A. (2012). Dispatches from "the frontline of gentrification." *City*, *16*(6), 672–685. https://doi.org/10.1080/13604813.2012.737507

Ferm, J. (2016). Preventing the displacement of small businesses through commercial gentrification: Are affordable workspace policies the solution? *Planning Practice & Research*, *31*(4), 402–419. https://doi.org/10.1080/02697459.2016.1198546

Ferm, J. (2021). Governing urban development on industrial land in global cities: Lessons from London. In S. Bunce, N. Livingstone, L. March, S. Moore, & A. Walks (Eds.), *Critical dialogues of urban governance, development, and activism: London and Toronto* (pp. 115–129). UCL Press.

Ferm, J., & Jones, E. (2015). *London's industrial land: Cause for concern?* University College London.

Ferm, J., & Jones, E. (2017). Beyond the post-industrial city: Valuing and planning for industry in London. *Urban Studies*, *54*(14), 3380–3398. https://doi.org/10.1177/0042098016668778

Froy, F., & Davis, H. (2017). Pragmatic urbanism: London's railway arches and small-scale enterprise. *European Planning Studies*, *25*(11), 2076–2096.

Greater London Authority. (2016). *London Industrial land supply and economy study 2015*. We Made That. http://www.wemadethat.co.uk/projects/view/london-industrial-land-supply-economy-study

Greater London Authority. (2021a). *Secretary of State's response*. https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/secretary-states-response

Greater London Authority. (2021b). *The London Plan 2021: Spatial development strategy for Greater London*. https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/london-plan-2021

Griffiths, S. (2017). Manufacturing innovation as spatial culture: Sheffield's cutlery industry c.1750-1900. In I. Van Damme, B. Blondé, & A. Miles (Eds.), *Cities and creativity from the renaissance to the present* (pp. 127–153). Routledge.

Grodach, C., & Martin, D. (2020). Zoning in on urban manufacturing: Industry location and change among low-tech, high-touch industries in Melbourne, Australia. *Urban Geography*, *42*(4), 1–23. https://doi.org/10.1080/02723638.2020.1723329

Grodach, C., O'Connor, J., & Gibson, C. (2017). Manufacturing and cultural production: Towards a progressive policy agenda for the cultural economy. *City, Culture and Society*, *10*(1), 17–25. https://doi.org/10.1016/j.ccs.2017.04.003

Hamnett, C., & Williams, P. (1980). Social change in London: A study of gentrification. *The London Journal*, *6*(1), 51–66.

Hall, P. G. (1962). *The industries of London since 1861*. Routledge. https://doi.org/10.4324/9780203716670

Hanson, J. (2000). Urban transformations: A history of design ideas. *Urban Design International*, *5*(2), 97–122.

Heikkila, E., & Hutton, T. A. (1986). Toward an evaluative framework for land use policy in industrial districts of the urban core: A qualitative analysis of the exclusionary zoning approach. *Urban Studies*, *23*(1), 47–60.

Hills, R. M., Jr., & Schleicher, D. (2010). The steep costs of using noncumulative zoning to preserve land for urban manufacturing. *The University of Chicago Law Review*, *77*(249), 249–273.

Jacobs, J. (1969). *The economy of cities*. Random House.

Kropf, K. (2017). *The handbook of urban morphology*. Wiley.

Lane, R. N., & Rappaport, N. (2020). *The design of urban manufacturing*. Routledge.

Leigh, N. G., & Hoelzel, N. (2012). Smart growth's blind side: Sustainable cities need productive urban indus-

trial land. *Journal of the American Planning Association*, *78*(1), 87–103.
London Data Store. (2019). *Directory of London businesses*. http://data.london.gov.uk
Ordnance Survey. (2019). *Digimap Ordnance Survey collection*. https://digimap.edina.ac.uk
Palominos Ortega, N., Griffiths, S., Froy, F., & Ferm, J. (2020, July 21–23). *Visualising manufacturing activity in London* [Conference paper]. Proceedings of the GISRUK 2020 Conference, London, UK. https://discovery.ucl.ac.uk/id/eprint/10105882
Raco, M., & Tunney, E. (2010). Visibilities and invisibilities in urban development: Small business communities and the London Olympics 2012. *Urban Studies*, *47*(10), 2069–2091.
Rosa, B. (2014). *Beneath the arches: Re-appropriating the spaces of infrastructure in Manchester* [Doctoral dissertation, The University of Manchester]. The University of Manchester's Repository. https://www.research.manchester.ac.uk/portal/en/theses/beneath-the-arches-reappropriating-the-spaces-of-infrastructure-in-manchester(333f6f40-4f4f-4689-ab2f-0019fff88ede).html
Scott, A. J. (1982). Locational patterns and dynamics of industrial activity in the modern metropolis. *Urban Studies*, *19*(2), 111–141.
Scott, A. J. (2006). Creative cities: Conceptual issues and policy questions. *Journal of Urban Affairs*, *28*(1), 1–17.
Soja, E. (2003). Writing the city spatially. *City*, *7*(3), 269–280. https://doi.org/10.1080/1360481032000157478
Southwark Council. (2021). *A brief history of Old Kent Road*. https://oldkentroad.org.uk/history
Space Syntax. (2020). *OpenMapping*. https://spacesyntax.com/digital/openmapping
Vaughan, L. S., Dhanani, A., & Griffiths, S. (2013). Beyond the suburban high street cliché: A study of adaptation to change in London's street network, 1880–2013. *Journal of Space Syntax*, *4*(2), 221–241.
Wood, S., & Dovey, K. (2015). Creative multiplicities: Urban morphologies of creative clustering. *Journal of Urban Design*, *20*(1), 52–74.

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Article

# City and Industry: How to Cross Borders? Learning From Innovative Company Site Transformations

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**Abstract**
While working and living coexisted in the historical city, the functions are separated in the Modernist city. Recently, the idea of connected urban districts with short distances and attractive work spaces have received renewed attention from companies and planners alike, as soft site factors, tacit knowledge, and local production are gaining importance. In this article we focus on the development of multi-national company sites and the economic and spatial conditions that encourage them to transform existing sites, improve placemaking, and cross borders. We also have a look at their interactive influence on the neighbourhood. We talked to the real estate managers of BASF, BMW, Bosch, Siemens, and Trumpf about site development strategies and approaches for connecting and mixing functions, and therefore crossing borders and, where it is necessary, separating. The professional discourse on "productive cities" and "urban manufacturing" is concerned with reintegrating production into the city. Reurbanisation is especially instrumental in overcoming a major guiding principle or dogma of the Modernist city: the separation of functions. Nevertheless, reurbanisation results in price rises and increases the competition for land. Therefore, planning has to pay attention to industrial areas, as well as housing or the inner-city. An important thesis of the article is that multi-national companies are pioneers in transforming their priority sites to suit future development. For cities, it is an upcoming communal task to ensure that all existing industrial areas develop into "just, green and productive cities," as pointed out in the New Leipzig Charter. To a certain extent, it is possible to adapt the urban planning and design strategies of multi-national companies for existing industrial areas. This is especially true regarding the question of how borders and transition zones between industrial areas of companies and the surrounding neighbourhood can be designed to be spatially and functionally sustainable or how they can be transformed to suit future urban needs. However, urban planning has to balance many concerns and therefore the article concludes with a synopsis of the importance of strategic planning for transforming existing industrial areas.

**Keywords**
company sites; economic development; global players; industrial areas; just city; productive city; strategic planning; transition zones; urban planning and design; urban resilience

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## 1. Introduction

Cities are subject to constant change, depending on geographical conditions, economic development, and political constellations. Economic and urban development have a correlating influence on each other and become visible in the built environment and the urban morphology. After years of separating functions and developing new industrial areas on greenfield sites it is obvious that ecological aspects and brownfield sites play an important role for future development. Companies and cities are facing a comprehensive transformation and digitalisation

process—strengthened by the Covid-19 pandemic—that needs to be designed to keep European cities and companies competitive. The success of the transformation will depend on the global players, as well as the diverse small and medium-sized manufacturing industries, the land owners, and urban politics.

In the New Leipzig Charter of 2020, the EU ministers for Urban Matters emphasise the pursuit of the common good using the transformative power of cities. They confirm three dimensions that contribute to developing resilient cities taking into account ecology, economy and social issues, and secure competitiveness, as well as ensuring prosperity: the just city, the green city, and the productive city (EU, 2020). In the global context, the UN speaks of sustainable development goals and in the financial sector of environment, social, and governance ratings. All these publications reinforce the necessity to transform our cities and point out the challenge to balance different interests to ensure greater justice.

Research projects show the need for a new discourse on "productive cities" if European cities are to stay competitive and ensure prosperity. Therefore, urban manufacturing and local material flows need more attention as important urban functions (e.g., Bathen et al., 2019; Croxford et al., 2020; Hosoya & Schäfer, 2020; Läpple, 2019). Other studies focus more on existing industrial areas as "blind spots" of our discipline that need new spotlighting and strategic urban planning to raise the hidden potentials in these city areas and the interactive influence for the future (e.g., Bundesinstitut für Bau-, Stadt- und Raumforschung, 2020; Eckmann et al., 2020; Förster et al., 2017; Roost et al., 2021; Schmitt et al., 2019). However, the studies pay little attention to multi-national companies (e.g., Volkswagen in Wolfsburg; Bosch, Daimler, and Porsche in Stuttgart; BMW in Munich; BASF in Ludwigshafen; Siemens in Erlangen, Berlin, and Munich) or to developments that take place in these settings. Although these companies can be seen as pioneers for transforming existing sites, new working environments, or material cycles (depending on the site), at the same time, they generate markets that have an impact on the district and far beyond local value creation.

In this article, we explore the activities of such global players in terms of the necessity and forms of interconnecting industrial areas with surrounding neighbourhoods, asking what we could learn from them in transforming industrial sites to suit the needs of the economy, both today and in the future. We focus on the scale of urban design. This might sound trivial, but implementing integrated spatial developments is far from being common practice, and the idea of qualified mixed-use industrial areas is far from new. We can find best-practice-projects since the 1990s, especially the transformation of large-scale areas (e.g., Basel, Dreispitz, Werksviertel Munich, Zurich-West).

In addition to previous research in the Region of Stuttgart and best-practice studies, we talked to the real estate managers of BASF, Bosch, BMW, Siemens, and Trumpf. The aim was firstly to structure and reflect on their approaches of connectivity, i.e., type, degree, and strategy (see Section 3), and secondly to generalise what urban planning and design might learn to promote sustainable and productive business districts in a "just city" (see Section 4).

## 2. Cities and Industry: Historical View

The relationship between cities and industry is in constant flux and there are several interdependencies that form and transform city-districts. Before looking at what is going on today, we will take a brief look at guiding principles, opportunities, and pressures that have created new forms of industrial areas in the last century to show continuities and discontinuities.

### *2.1. Unity of Production, Distribution, and Consumption Under One Roof*

In the medieval city, work was an integral part of urban life and different types of work were reasons to found cities. Work founded and shaped the city (Böhme, 2004, p. 180). Living and working closely linked and form a unity of production, distribution, and consumption under one roof. Businesses were small in scale, family-operated, and showed diverse forms of economic self-organisation. Besides a fine-grained mix of uses, some specialised neighbourhoods emerged (Pesch, 2004, p. 9). Living inside the city walls was associated with the hope of a better life and future which is associated with the phrase "Stadtluft macht frei" (city air makes you free).

In the following years, cities grew steadily as the importance of international trade increased, and a new economic order of concentration of capital and labour through publishers, manufactories, and factories took hold. Division of labour and specialisation were strengthened by new technical tools and machines, and the textile, mining, and steel industries became engines of economic development (Pesch, 2004, p. 11).

### *2.2. Inner-City Mixed Use and Peripheral Areas*

From the 16th to the 19th century, the population grew continuously (e.g., Manchester: from 75,000 inhabitants in 1800 to 700,000 in 1900; Berlin: 172,000 inhabitants in 1800 to 1.9 million in 1900). The demand for goods increased significantly during that period. Industry responded with enhanced productivity levels through mechanisation and rationalisation that allowed a more advanced division of labour and provided a number of benefits in terms of cost, production volumes, and efficiencies, which remain relevant until today (Croxford et al., 2020, p. 36).

During industrialisation in the 19th century, the dynamic urban development showed various characteristics. On the one hand, the invention of the railway as

a means of transport enabled the expansion of cities, and peripheral greenfield sites were developed. On the other hand, urban locations densified, and the urban structure transformed. Instead of small-scale parcelled houses with vertical stacking of functions in one house, residential and commercial buildings within the urban block structure (keyword: backyard industry, challenging mix-use) were built. Despite conflicts, the mix of functions was necessary because the transport system was still underdeveloped, and short distances between working and living areas were evident. At the beginning of the industrial age, commercial sites usually showed high-quality, monumental, multi-storey buildings, which still characterise many cityscapes today.

### *2.3. Separation of Functions*

The increasing importance of the railway as a means of passenger transport and the availability of electricity, oil, and gas at every location gradually made it possible to separate housing and workplaces and to resolve the unacceptable living and working conditions in inner-city locations. The impulse to move outside the city became embedded in the European culture with the ideas of the "garden city" of Ebenezer Howard (in 1898) and the "Cité Industrielle" of Tony Garnier (about 1904). These were followed by the Athens Charter of CIAM (in 1933) with its dogma of separation of functions—living, working, leisure—which were connected by railway and automobile infrastructures. Manufacturing industries no longer fitted into the Modernist vision of city centres. Separation and Fordism became the guiding principles of urban planning in the 20th century (Häussermann et al., 2008, pp. 135–181), and segregation was the major collateral damage.

The idea of separation took full advantage of the central requirements of companies (e.g., increasing demand for space due to production on one level; centralisation of administration; special facilities for logistics; increasing independence of specific location; cost efficiency per location), but also facilitated the administrative handling of urban development.

Technological developments in the energy, transport, and especially telecommunications sectors led to a virtual shortening of distances, despite greater real distances. Widely spread separated urban landscapes emerged, divided into residential, office, shopping, and recreational centres—later described as "the in-between city" ("Zwischenstadt"; Sieverts, 1997). The negative consequences of this development included unattractive, monotonous urban structures that lacked atmosphere, diversity, and quality of experience in the neighbourhood, as well as expansive landscape consumption, high infrastructure costs, and noise and emission pollution from the resulting traffic.

The "economic miracle" in Germany during the 1950s and 1960s, with constantly growing prosperity and labour unions that steadily reduced working hours and achieved many amenities for employees, made the spatial disadvantages fade into the background.

From the 1970s onwards, the professional discourse publicised a stronger connection between uses and the reduction of suburbanisation for several reasons. In practice, however, only minor effects could be reached in the 20th century, although technological progress and environmental restrictions resulted in reduced distances (Pesch, 2004, p. 17).

### *2.4. Urban Focus of the Knowledge Society*

The influence of the information and communication industry, the global division of labour—made possible by increasing automation and digitalisation—and the global limitedness of resources is fundamentally changing the world of work and urban development. A coexistence of centralisation and decentralisation can be observed. While standardised mass production is being relocated to cheaper locations in suburbia or to other parts of the world in order to lower production costs, various other conditions favour the reurbanisation of industry in the 21st century: human capital; tacit knowledge; war of talents; cluster strategies; cooperation with third-party companies and contractors; knowledge transfer to university research institutes; global networking. These are keywords that are addressed in this context (see, e.g., Roost et al., 2021, pp. 15–25). Since the turn of the millennium, we have observed that multi-national companies have invested a lot of time and effort to transform priority sites (often headquarters sites in metropolitan areas) to connect research and prototype development, as well as some parts of consumer-oriented requirements, in order to be viable.

In the EU's 2013 report on re-industrialisation, manufacturing industries are discussed as important drivers for the future (Stadtentwicklung Wien, 2017, p. 23) and, more and more, urban researchers point out the significance of developing "productive cities." One of the pioneers is Dieter Läpple (2020), who has announced that we face a fundamental and overdue structural transformation, prompted by the Covid-19 pandemic. The crisis offers the unique opportunity to transform the economy and he mentions resilience, supply security, and sustainability as paramount guiding principles, opening up new perspectives for the development of a new production logic. The conclusion for urban policymakers is that it is up to them to provide affordable land and intelligent governance structures for shaping productive cities (Läpple, 2020, p. 23).

## 3. Connecting Company Sites: Observations of Field Study

Multi-national companies often have an important impact on the urban context and the financial performance of municipalities, either directly through real estate developments, the influx of employees/

inhabitants, scaling effects on cooperating companies or indirectly through taxes and duties. The spheres of influence vary greatly in size and type. But, headquarters of large multi-national companies often have 10,000 to 40,000 employees, and thus generate decisive markets and influence surrounding areas.

We did a field study exploring the site development of several companies through literature studies and, where possible, on site. Besides this, we talked to the (former) real estate managers of BASF in Ludwigshafen, BMW in Munich, Bosch in Stuttgart, Siemens in Erlangen and Berlin, and Trumpf in Ditzingen. One finding of the interviews is that big players have the power to plan future developments strategically, have resources to deal with different future scenarios ahead of time, and have the capital to implement transformation. Consequently, a closer look at the large companies may give a good view of the current situation, especially how to motivate connectivity and design transition zones.

In this section, we describe and reflect on the types of connectivity between cities and industry that we discovered in the field study. There are already a lot of sites relevant for developing "just, green and productive cities" (EU, 2020, pp. 3–5). Our study, however, focuses on priority sites of companies and the urban design scale. We get back to this aspect in Section 4.

### *3.1. Spatial and Structural Connection*

Structural change in the employment sector and in lifestyle offer starting points to rethink the interaction between company locations and their surroundings. In the last few years, in addition to high-quality, industrial architecture, or new industrial space concepts, the urban dimension continues to gain importance for companies themselves and in competitions awarded (Sgobba, 2012, p. 197). Recently, this fact has been emphasised by different professional activities. For instance, the German Industrial Building Award added the category "Städtebauliche Anlagen" (Urban Context) to its list of awards; the EUROPAN Young Architects´ Award dealt with the theme twice; and the International Building Exhibition, IBA'27 Stuttgart Region has included it into its themes and projects list. One theme of the IBA'27 is the "productive city" and there are competitions going on for several different sites. One new area of development for industry, living, and leisure is a competition in Winnenden (IBA'27-Projekte), asking the participants to show ideas for connecting the so-far separated functions. The innovative next step will be the real estate implementation with different stakeholders.

Looking at the global players, three types of spatial and structural connection can be found (Figure 1).

#### 3.1.1. Connecting Through Architecture

The representation of companies through architecture played an important role in industrial architecture at the beginning of the 20th century, as the prominent example of the AEG Turbine Hall (architect: Peter Behrens) in Berlin shows (Vonseelen, 2012, p. 155). High-quality architecture was and is used to represent the company and create a positive image, especially at visible locations or locations close to the customer. Similarly, in the discourses on urban production, a high value is attached to the façade and its design. It should not only serve to represent the company, but also react to the cityscape and the surrounding neighbourhood (Möllers et al., 2020, p. 22). Due to the intensive contact with external companies and trade visitors, as well as the increased quality expectations of employees, the design of research and development buildings in particular (Sgobba, 2012, p. 211) but also centrally located production buildings (e.g., Wittenstein, Fellbach) became more important. Architecture and high-quality construction often designed by renowned architects play a prominent role for the whole company site (e.g., Trumpf, Ditzingen). Some companies use a unique language of form and

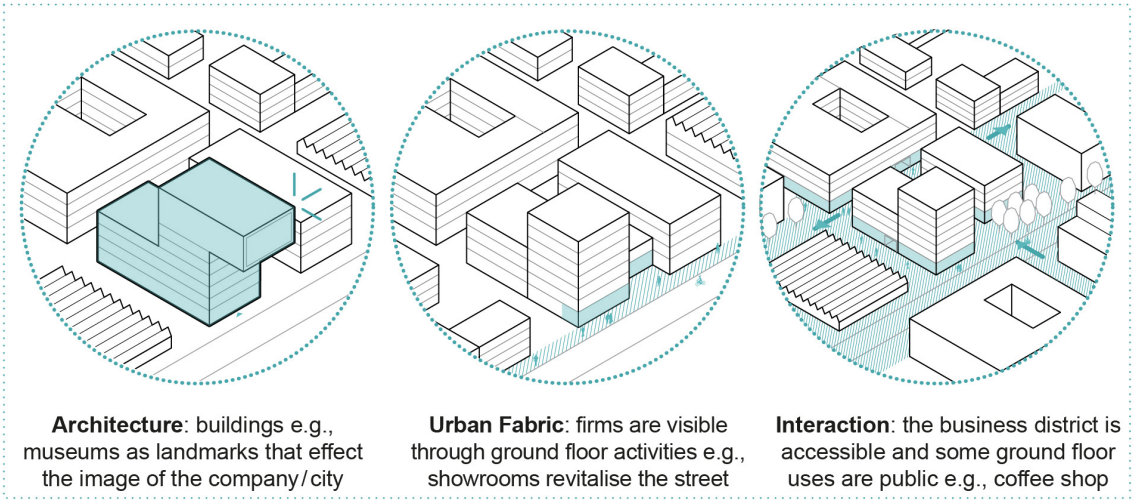


**Figure 1.** Types of spatial and structural connection (marked in green; see descriptions in Subsections 3.1.1—3.1.3).

colour in the sense of corporate architecture and brand architecture (Sgobba, 2012, p. 175). These strategies are used as a communication offer (Daldrop, 2004, p. 61) for the environment, branding, strengthening recognition, and identification. Especially in the automotive industry, corporate architecture plays a major role, as shown by Fiat's former research and development building in Lingotto (in 1923) or BMW's four-cylinder administration building in Munich (in 1973). In some cases, high-quality buildings not only represent the company, but also contribute to the formation of identity with the city. In this way, an interrelationship between society and the company is very carefully established.

#### 3.1.2. Connecting Through Urban Fabric

A new reputation for urban and open space qualities initially develops within closed factory sites. Meeting places become increasingly important as spaces for breaks and dialogue (e.g., Campus Novartis, Basel), especially at research and development locations. In some firms, the company site is zoned into different grades of publicness: more protection-intensive areas (prototypes/innovation in-house), public-friendly zones (exchange zones with external colleagues), and public-intensive zones (visitors). This can create attractive places for employees as well as representing the company when there are visitors from other companies (e.g., FIZ, BMW-Munich).

In addition to the internal zoning, companies are currently reassessing the connectivity to the surroundings and the integration into the urban fabric. Whereas some years ago a perimeter fence represented the boundary to the surroundings and a disruption in the urban fabric, these transition zones become deliberate "points of contact with the public" (Sgobba, 2012, p. 171). Here, the dialogue (adaptation vs. accentuation) with the spatial context forms the basis for structural contact points, such as the BMW administration building in Munich or the Daimler and Porsche museums in Stuttgart. Depending on the size and context of the site, these contact points can also be ground-floor public areas (e.g., showrooms) or attractive open spaces. In addition to the contact points, a spacious entrance to the street serves to make the adjacent public space more attractive and enhances the company's brand position.

#### 3.1.3. Connecting Through Interaction

Another component of connectivity is to make the area accessible and to continue pathways or biking lanes that previously ended at the factory fence. This allows a higher permeability to the neighbourhood and is a further step to shorten distances. The area gets part of the city, instead of being a separate island in the urban structure and blind spot on the mental city map. The study shows two types of interaction. On the one hand, there is large-scale transformation that requires a high level of investment and is of high interest for companies and cities alike. Examples are the Siemens site development plans in Berlin and Erlangen, as well as the finished corporate headquarter in Munich. Another example is the Zalando headquarters in Berlin. Raised and open ground floor zones make it possible to accommodate other uses (e.g., co-working spaces, local suppliers) and improve transition zones. On the other hand, connectivity gets more important in "normal" industrial areas as well. Structural change modifies the land requirements of business sectors and thus leads to transformation—often former production spaces turn into office space. In some cases, land is sold or rented out. Often the tenants hope to achieve synergies with customers and visibility. Thus, opening company sites might have a further positive side-effect as it saves protection costs.

### *3.2. Connecting Through Functions: Everyday Connectivity*

Easily accessible and lively locations that, in addition to the classic workplace, satisfy everyday needs as well as collaborative, independent work, are becoming increasingly important in the "war for talents." Instead of the friction previously feared due to hard industry, the focus is now on the potential of cooperation in the form of synergies and interactions. These can be temporary (events) or long-term and have an impact on different scales (neighbourhood, district, city, regional, supraregional).

As for everyday connectivity, we observed one vital focus in relation to the provision of everyday goods and places for local recreation within walking distance, which is confirmed by research colleagues (Schmitt et al., 2019, p. 37). Companies offer their employees services that promote work-life balance and women's employment close to home, e.g., medical care by doctors or physiotherapists; leisure facilities such as gyms; parcel acceptance points; local supply facilities; or different open spaces for breaks. We describe three different types of everyday connectivity as follows (Figure 2).

#### 3.2.1. Open (Social) Infrastructures for the Public

While the integration of everyday uses and social infrastructures on company sites (Campus-Novartis, Googleplex) has been common since the 1980s, the opening of these uses to the neighbourhood has been observed in recent years. For example, in-house children's facilities, canteens, open spaces (Carlsberg Areal, Copenhagen), or even mobility services are made available to the public. On the one hand it is probably more profitable, but on the other hand companies support municipalities by providing services of general interest and making a contribution to urban development. Therefore, they can assume responsibility in the sense of "corporate social responsibility" or "corporate urban responsibility" (Albers & Hartenstein, 2017).

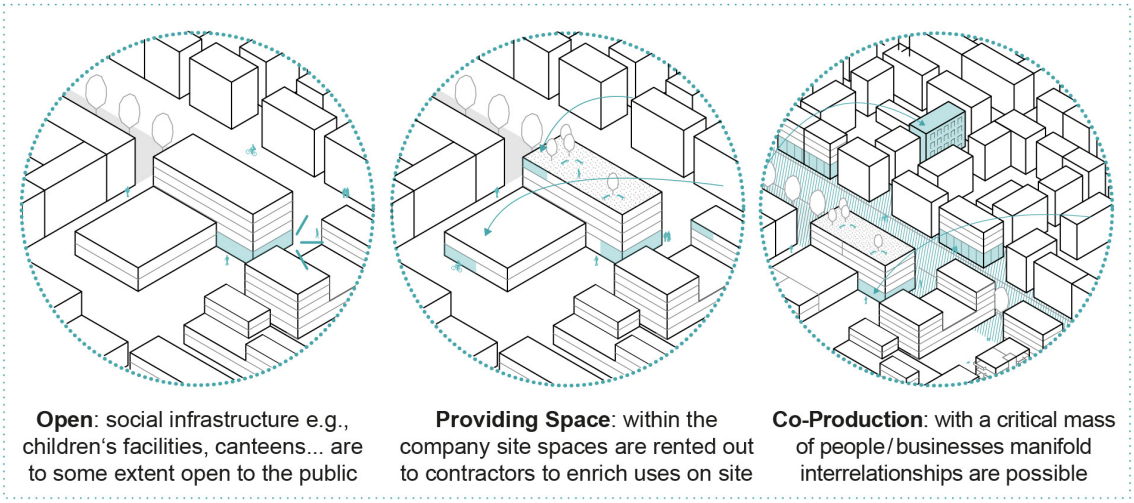


**Figure 2.** Different types of everyday connectivity (marked in green; see descriptions in Subsections 3.2.1—3.2.3).

3.2.2. Providing Space for (Social) Infrastructures

As another way of networking, companies provide space for external operators (coffee shops, therapists, fitness facilities, etc.) that are more-or-less open to the public. In this way, a diverse range of services is offered to the staff and the neighbourhood. Through the joint use of staff and neighbourhood, the necessary critical mass can be reached for some facilities. The uses could include social infrastructure, cultural, and mobility offerings. In smaller urban sites, the shared uses are located at the ground floor level. On larger sites, buildings can be the interface with the surrounding area. In both cases, they serve as intermediaries between company and the city.

3.2.3. Co-Production of (Social) Infrastructures

If a critical mass is created by businesses and neighbourhoods, larger developments might take place. These can be a combination of different uses on the factory site and decentralised uses in the neighbourhood. The distribution of uses on both sides (factory site and neighbourhood) may lead to the necessary exchange and interaction with the surroundings. Furthermore, a cooperative development (participation, surveys) of uses can be observed. In this way, the development of the site is much more about looking at the needs of the neighbourhood and including them into the development. An interest in cooperation is shown and can contribute to social networking. The Ikea site (under construction) at the Vienna Westbahnhof provides a good example, as the inclusion of a vertical park and a public roof garden into the design scheme makes up for the missing open spaces in the neighbourhood.

### *3.3. Connecting Through Functions: Professional Activities*

The transformation to a science-based society and the growing importance of collaborative cooperation are leading to the dissolution of isolated structures. Spaces for collaborative work and spatial proximity to the scientific and urban society gain importance. Companies open available space due to structural change or corporate restructuring (e.g., relocation of traditional production to Eastern Europe/Global South or centralisation of corporate divisions) and thus shape change. Three developments can be observed: transformation, collaboration, and development—depending on the company location, the size of the vacant plots/spaces, the life cycle of the building structures, or the type of industry (Figure 3).

3.3.1. Transformation of Existing Properties: Rental Spaces Expand Professional Connectivity

A strong focus of site development is the transformation of existing properties. Areas that have become obsolete due to restructuring (e.g., relocation abroad, reduced demand of office spaces) are sold or rented to new users. The primary focus is on renting to strategic partners who are part of the value chain or to scientific institutions, founders, and start-ups. At strategically or historically important locations, the companies develop the site themselves. For example, Siemens Real Estate develops "technoparks" in the sense of multiple use. Similar to classic business parks, tenants can take advantage of a wide range of space, services, and infrastructure such as area management. Tenants are thus relieved and can concentrate on their core work, cooperation opportunities, and synergies, which also benefit the developing company (Siemens) in addition to raising rent. The communication and networking of companies are mostly in the foreground of the developments. However, depending on the existing environment, connecting through daily activities is also the goal. Another form of transformation, which is primarily motivated by the growth of mobile working (strengthened by Covid-19 pandemic), is the transformation of central locations into mobile work places (e.g., Bosch-Leonberg, Siemens-CoWorking). On the one hand, these are meant for the company's own

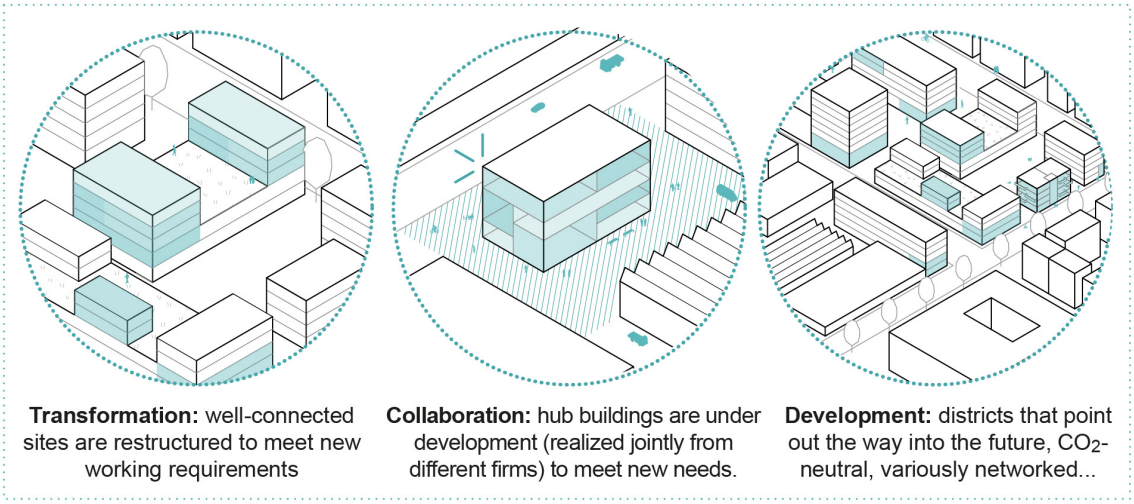


**Figure 3.** Types of connecting professional activities (marked in green; see descriptions in Subsections 3.3.1—3.3.3).

employees, but can also be used by registered users or the general public. Some companies open some areas (often the ground floor spaces) to the public, as the LinkedIn co-working space does.

#### 3.3.2. Collaboration: Companies Develop Locations Together

The network-like, project-related cooperation is reflected in real estate development. In addition to the content-related mergers on individual topics and the promotion of innovation, the first spatially effective mergers of companies can be observed. Different companies are joining forces as artificial intelligence innovation campuses or hubs. They cooperate in developing locations on a new site or on a company's own site.

#### 3.3.3. Development of Future Manufacturing Districts

Another form is a highly investment-intensive transformation that can be observed in traditional locations. For example, Siemens Real Estate in Erlangen is developing an urban district together with scientific institutions and the municipality. A connected district, the Siemens Campus, will gradually emerge until 2030 from a previously isolated factory site to a $CO_2$-neutral district in the sense of innovative, sustainable, and future-oriented urban development. A similar development is going on for Siemensstadt in Berlin, which was built at the end of the 19th century as a company location, including company-owned flats, cultural, and social facilities. This area will change to a mixed, productive, and dense smart city. The cross-linking potential for city and companies to gain synergies are enormous but the city has to keep track of the social interest as well. In addition, such developments can serve as pioneers for further developments, in terms of resource-saving development and the circular economy.

### *3.4. "Experience Factory"*

Besides spatial and functional ways of interconnecting for employees or professional contractors as described before, companies are paying attention to soft site factors named below (Figure 4).

For a long time, company premises were only accessible to employees and the first factory tours were mainly for the employees' relatives and neighbours of the site. While at that time the guided tours were intended to dispel the fear of the industry, which was perceived as critical, as a neighbour and to achieve an understanding and experience of production, the guided tours became more professional and were supplemented by exhibition rooms. The invitees were expanded to include customers and people interested in technology, and a separate market was created. Industrial tourism developed in the early 20th century, especially in food production and automotive factories (Rappaport, 2019, p. 440). Over time, production-related functions increased (Sgobba, 2012, p. 281) and the visibility and emotional participation in the production of an automobile reached its peak in the "Gläserne Manufaktur" ("transparent factory") of Volkswagen in Dresden. Entire worlds of experience were created, especially in the automotive sector, through the enrichment of further functions (museum, park, visitor centre), as is visible, for example, in Wolfsburg (Autostadt Wolfsburg), Munich (BMW Welt), or Herzogenaurach (Adidas World of Sports).

On the one hand, these serve to build image and brand loyalty and, on the other, have an enormous influence on the context. The worlds of experience developed into a tourist magnet, created new markets with the visitors and attracted new uses (hotels, restaurants, etc.) and events. By developing "brand hubs" (comprehensive urban development projects), companies use cities as stages and also make an important contribution to the attractiveness of the city as a business location (Höger, 2007; Hüttenhain, 2012, p. 29). Networking ranges from

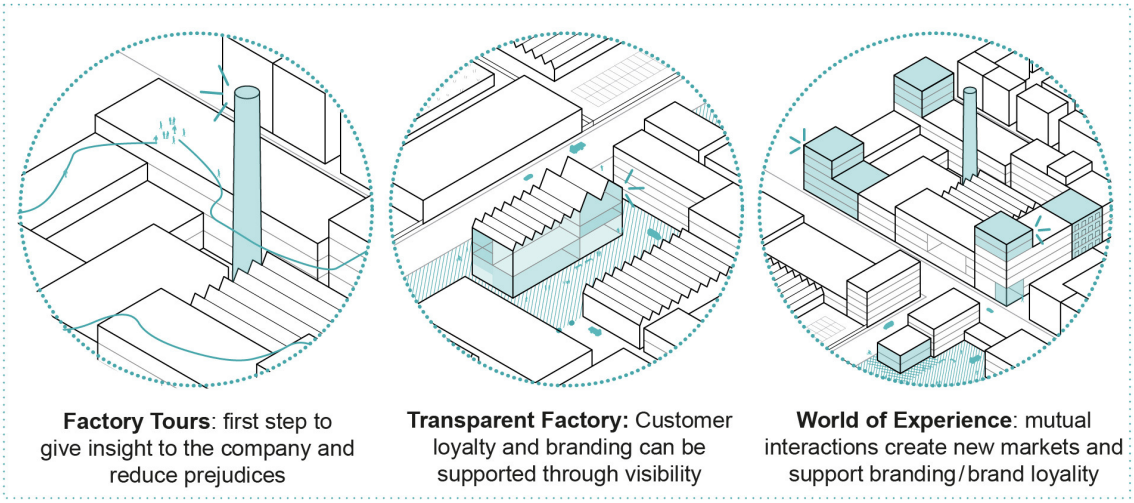


**Figure 4.** "Experience Factory" (potential to connect is marked in green; see description in Subsection 3.4).

small-scale qualification of public spaces and the creation of new jobs and new markets to buildings that shape the cityscape.

In the context of urban production and the increasing demand for fairly- and environmentally-produced products, it is evident that transparency and mutual interactions can become the focus of future developments. In this way, work and the production of goods can heighten the value of work (Rappaport, 2019, p. 439) and contribute to raising awareness and creating acceptance among the population for production and products. An important aspect in this context is that local residents accept disturbances to a certain extent. The development on urban sites is favoured above all by digitalisation and 3D printing in small series and individual production in the sense of urban manufactories. Transparent factories can take place in the urban context in the sense of urban manufactories and urban production (e.g., Manner) or at non-central locations (e.g., Volkswagen). Hopefully, further imitators will follow suit.

## 4. Study Results: Company Sites and Industrial Areas—From NoGo to Go

The previously described observations about spatial and functional connections between companies and surrounding neighbourhoods show that cooperation takes place in different ways. It is obvious that urban planning and design have different influences on site development. Companies are more interested in connectivity at headquarters or at research and development sites than at simple production or logistic sites.

As pointed out before, industrial areas will play an important role, if cities follow the strategic goals of the Leipzig Charter to develop "just, green and productive cities," and cities probably are the incubator for the renewal of industry (Läpple, 2020, p. 23). Therefore, we generalise some aspects that urban planning and design might assess to support vibrant industrial areas. However, we do not consider simple production and logistics locations or small-scale structured industrial areas in the following subsections. Aspects such as the regional economic situation, the size of the city, the ownership structure, the availability of skilled workers, proximity to knowledge institutions, or the state of renovation of the company's real estate are important for future development of companies but they are not part of the following consideration.

Looking at the urban context (Figure 5), three company site locations can be identified that show potential for connectivity (see Subsection 4.1; Figure 6). These are followed up with some considerations on the importance of strategic urban planning (see Subsection 4.2).

### *4.1. Company Sites and Potential for Connectivity*

#### 4.1.1. Isolated Site: Internal Qualification

Isolated sites are characterised by a peripheral location without a direct urban context. The locations were mainly developed during the heyday of motorised individual transport and are therefore mostly located on major roads. Accordingly, the public transport connection is subordinate.

The potential of connectivity in these locations is the transformation on-premise. Qualification can take place in the form of improvement of various modes of mobility, representative architecture, (re)densification, enrichment of use, and urban quality. Functional connection through social infrastructures can only be realised if a critical mass of employees is reached. Considerable potential for connectivity is offered by ground-floor uses, e.g., as parcel shops or small service providers, which at the same time favour an upgrading and frequenting of the open space. Further potential lies in networking improvement (of the working world). Restructuring or redensification offers the possibility of providing space to

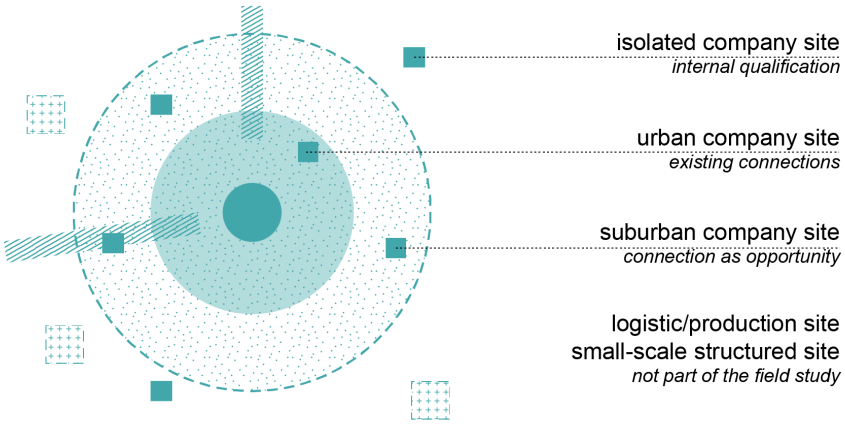


**Figure 5.** Company sites: From NoGo to Go. Source: Own drawing based on Roost et al. (2021, p. 37).

new tenants to create synergies (partnerships and cooperation with both academia and competing firms, or with companies that add value or offer a perfect complement). The only spatial interfaces with the surroundings are the street and the buildings along the street that could be created as landmarks.

#### 4.1.2. Urban Site: Existing Connections

Urban sites are characterised by density and often a mix-use context. A lot of these sites have already been changed (e.g., densified, opened, qualified) some years previously. They benefit from social and cultural infrastructure, good public transport connections, and offer many points for connectivity. Due to a long-standing proximity of company and neighbourhood, a social network with the factory site might already exist and might be extended for alternating interconnections, e.g., temporary use or events can serve to increase visibility and identification. A spatial opening of previously fenced historic factory sites and the right of passage through the site could be another option for connectivity. Some of the areas still have potential for restructuring and vertical redensification to enrich uses, as a study called "Urban Sandwich" by the city of Stuttgart shows (Landeshauptstadt Stuttgart, 2020). Accordingly, missing uses or public spaces in the area can be realised by companies, and connectivity with the neighbourhood can be created. Functional connectivity can take place on a small scale through public ground floor zones or rooftop uses as well as on a large scale through a world of experience or the addition of further building blocks such as museums, hotels, educational institutions, or visitor centres. Challenges in urban sites include high land prices and logistics. However, new concepts for urban logistic can already be explored (Industrie- und Handelskammer Region Stuttgart, 2020).

Looking at urban sites it is obvious that they offer great potential for less land-intensive uses such as urban production, research and development, or innovation clusters.

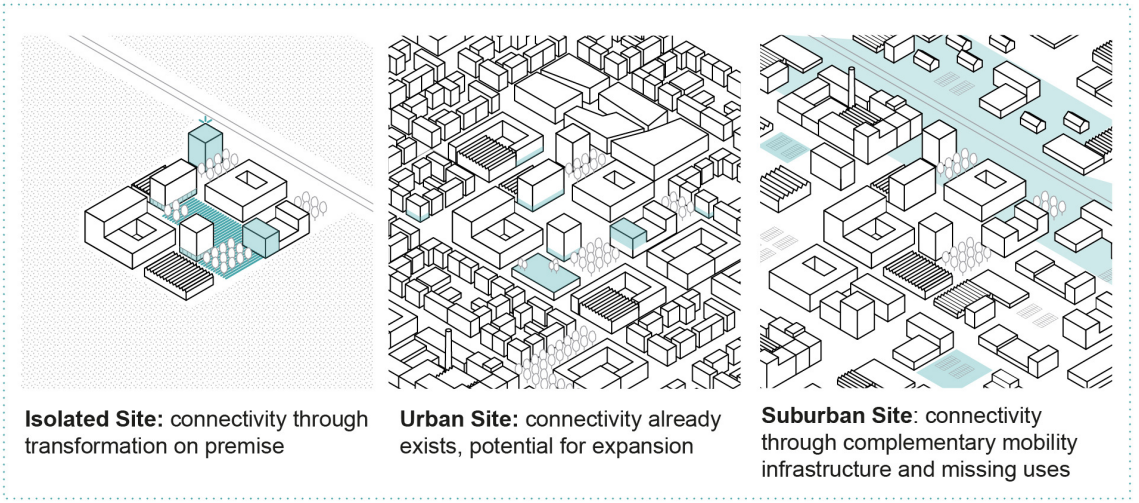


**Figure 6.** Company sites and potential for connectivity (marked in green; see descriptions in Subsections 4.1.1–4.1.3).

4.1.3. Suburban Site: Connection as Opportunity

Another widespread type of site with high potential and necessity for transformation is the "Zwischenstadt" (in-between city). According to Sieverts (1997), characterised by a dispersed and separated development of residential neighbourhoods and industrial areas, in some cases with spacious undeveloped transition zones. Mostly these areas are accessible by car, but often a favourable location would be suitable to improve public transport and therefore lower traffic problems. Due to the lower land prices in the surrounding area, there are single-storey commercial halls, ground-level parking areas, and large undeveloped areas that offer potential for redensification and connectivity. When both sides (company and neighbourhood) create a critical mass, new uses become profitable and both sides benefit. Uses could serve the living environment (fitness studio, e-charging stations) or the working environment (co-working, start-up centres). The improvement of environmentally friendly mobility (mobility hubs, public transport, car and bike sharing) and the reorganisation of ground-level parking areas enable the development of new space potentials. Another option to reach connectivity would be to build on the transition zone areas in such a way that the new buildings complement the existing uses and mediate between the different building blocks in case there are scale jumps. Adequate uses might be education institutions or mix-use areas for local supply. By organising them in commercial courtyards, costs can be lowered, uses and resources can be bundled, and synergies can be created (built examples include Munich, Hamburg). Another option is to share resources in the sense of a zero-emission park. In addition to functional connections, the continuation and spatial qualification of pathways and public spaces can be another option to improve connectivity and location quality.

As described, the suburban site shows great potential of transformation to better integrate industrial areas spatially and functionally through complementary mobility infrastructure or missing uses that might suit the existing working and/or living district. One challenge in this context, however, will be to counteract possible gentrification. The instruments for this are available and well-known, but they also have to be put into use.

*4.2. Dimensions of Strategic Urban Planning*

Evidently, urban planning and design as set out in the Leipzig Charter need strategic planning in interdisciplinary teams of the municipality, including stakeholders, in order to balance the various interests of global and local businesses and urban society on site in a co-productive design process. Demand-related planning, land-use planning, and sectoral thinking will no longer be sufficient. Instead, it is necessary to precisely know the requirements of the different industrial areas and the dynamic/potential of change and moderate transformation processes, and take an active role to set development impulses (Eckmann et al., 2020, p. 49; Hüttenhain, 2012, pp. 216–223).

Possible scales and ways of strategic urban planning that support connectivity are described below (Figure 7).

4.2.1. Sharing Spaces and Services

The study shows that bigger companies are highly interconnected on site. If possible, they have already established greywater use and treatment, use waste heat for other processes, or try to establish material cycles.

In the urban context, sharing of resources (e.g., services, energy, mobility) gains more and more attraction, but there is still a lot of room to improve. Sharing of resources in the form of cooperation, associations, contribution payments, and cooperatives offer the possibility to take care of issues such as reserve areas or the qualification of locations (quality of stay, enrichment with uses, improvement of mobility, etc.). On the other

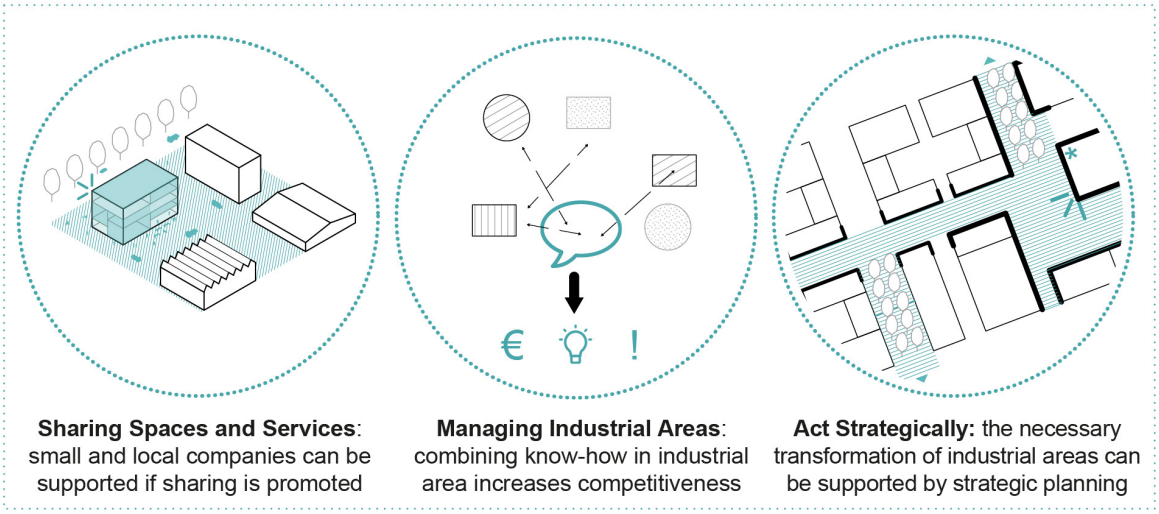


**Figure 7.** Scales of strategic urban planning (marked in green; see descriptions in Subsections 4.2.1–4.2.3).

hand, building associations such as commercial courtyards offer new opportunities for companies. For example, certain areas can be shared, expansion areas can be rented jointly or, in the case of municipal commercial courtyards, areas can be rented or given on a leasehold basis, thus ensuring the municipality's long-term ability to act. Similar to the social land use, financially weaker companies or unprofitable uses can still be enabled to use certain locations in this way.

#### 4.2.2. Managing Industrial Areas

Headquarters of global companies often combine production, offices, and retail on the same site. The internal planning department choreographs the spatial development and transformation of the existing site. Castling of plots and spaces, redensifying, or unsealing depend on the respective needs.

In existing industrial areas within the city, it is often difficult to know the requirements and perspectives of all the local companies and sometimes they differ. Furthermore, individual companies lack the resources (financial, spatial) or ideas to transform an area. However, usually individual companies would welcome the enhancement of the industrial area to be attractive for employees and associates.

To accompany transformation processes, local companies can therefore come together to form an association, cooperative, or location initiative to implement individual measures (greening, parking solutions, etc.) or to develop a marketing or a transformation strategy together with the municipality.

In addition to the association of individual companies, "business park" management can also be implemented by the municipality itself, or by an external office to ensure future viability of existing industrial areas, or to remain true to the principle of inner development before outer development. Studies show that it is useful to have a curator (team) to mediate between different local firms, administration departments, or to initiate network events (see, e.g., Bundesinstitut für Bau-, Stadt- und Raumforschung, 2020, pp. 40–45).

#### 4.2.3. Act Strategically!

Companies with real estate departments in general act strategically and this enables them to successively transform existing industrial sites into attractive urban sites with qualities that employees appreciate and with spaces designed in a way that takes into account, for example, accessibility or noise and challenges are spatially resolved. But companies pay attention mainly to priority sites.

In existing industrial areas most of the individual firms (including the global players) are not yet thinking about the district and ways of transforming. Usually, smaller firms lack resources and/or know-how and therefore it turns out that municipalities have to initiate strategic planning and collect data about the firms and their development goals or vacancies. In this context, it is necessary to work in interdisciplinary teams of different city departments to come up with goals and interventions that support future development and ensure competitiveness. It will be advantageous if strategic planning views industrial areas as laboratories of urban development and therefore experiments with new forms of sustainable and energy-efficient construction, climate adaptation strategies, new forms of mobility, and new financing models. Depending on the site location and economic pressures it should be examined whether urban development funding could be applied to industrial areas. This might help counteract upgrading processes and save non-profitable uses that are important for social coherence, as Dieter Läpple emphasises, perpetually (see, e.g., Läpple, 2020, p. 17). The Wuppertal Institute argues, similarly, that two recent studies point out the necessity to act with more resilience (Schneidewind et al., 2020; Wuppertal Institut, 2020). Positive approaches to co-productive urban development can be experienced first-hand (completed projects such as Werksviertel Munich or Basel-Dreispitz, and conceptual phases, such as IBA'27, Stuttgart Region).

## 5. Conclusions

Multi-national companies have a decisive influence on urban development and some of them show innovative ways of connecting industrial areas with neighbourhoods that can be an inspiration for urban planning representatives (see Section 3). But reasons for and strategies of connectivity are complex, as spatial ideas and the impact of transformation processes vary. Therefore, multi-national companies force connectivity with great effort—possibly through concentration and consolidation of business sectors—on headquarter and/or priority locations (especially for urban sites (see Subsection 4.1.2) and isolated sites (see Subsection 4.1.1), while other locations are abandoned for various reasons.

As industrial areas add up to about 20 percent of the settlement area, they obviously have great relevance for future urban development. The hidden reserve of industrial areas—not only for company sites, but in general terms—needs more attention if urban planning wants to make its contribution to "just, green and productive cities," as pointed out in the Leipzig Charter (EU, 2020). Obviously, municipality and the planning department have a special responsibility to give spatial expression to the transformative power of cities and this includes industrial sites. In particular, the widespread suburban sites (see Subsection 4.1.3), small-scale structured industrial areas, or peripheral logistics locations play an important role in developing productive cities. But only some planners and cities are aware of this, at the time of writing.

One step to achieve this goal would be to overcome thinking in terms of separation of functions

(black and white/ego-perspective). Instead, it is vital to think more about interdependencies and interconnecting spaces (shades of grey/common perspective), even if this requires greater effort and creating awareness of mutual dependencies. The full impact of the Covid-19 pandemic is unknown yet, but several scientists (e.g., Horx, 2020; Läpple, 2020; Schneidewind et al., 2020) see greater willingness and the necessity of what one might call the approach of "as well as" or of concomitant interventions. In the context of industrial sites, this means to think "global and local" or "urban and suburban" or "city-friendly and dirty/noisy industrial areas" to name just a few pairs of opposites that need to be suitably recombined or zoned rather than separated. This does not mean that all industrial areas should be transformed to meet different requirements. Rather, a precise analysis of local pressures and circumstances may help reach more productivity and mix-uses and therefore develop new building types for denser industrial areas. See, for example, the study "Urban Sandwich" (Landeshauptstadt Stuttgart, 2020) or developing industrial courtyards (Reiß-Schmidt, 2010, pp. 49–51). In other areas it may be, on the contrary, necessary to prevent undesirable side effects of upgrading (e.g., displacement). As the instruments of urban development funding are already well known, it should be examined how to create awareness for these themes and apply them to industrial areas.

It will be advantageous to focus on strategic urban planning that balances the various interests of local and global businesses and urban society in a co-productive design process. As described above, demand-related planning, land use planning, sectoral thinking, or finished pictures of future development will no longer be sufficient for urban planning processes in existing industrial areas. In this regard, multi-national companies make a strong case. Instead, it is necessary to moderate transformation processes and in some cases take an active role to set development impulses. The basis for this will be to precisely document existing site qualities, know the requirements of local companies, and develop a locally coordinated understanding for a desirable common urban future. In this context, industrial areas must be seen as laboratories of urban development, trying new forms of sustainable and energy-efficient processes or working in interdisciplinary cooperation. At the same time, it is necessary to have a climate that promotes innovation, focussing not only on technical or functional aspects (new mobility concepts, broadband expansion, and other infrastructure) but also struggling for the appropriate space and atmosphere. Depending on the site and its priority, transformation processes could be comprehensive, reaching vitally connected areas or it could simply mean to re-zone street spaces and add some green spaces to reduce overheating. Every step towards "more city" in industrial areas is an earning to a "just, green and productive" future of our cities. This requires more courage for, and joy in experimenting for all stakeholders.

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**Conflict of Interests**

The authors declare no conflict of interests.

**References**

Albers, H.-H., & Hartenstein, F. (Eds.). (2017). *CSR und Stadtentwicklung. Unternehmen als Partner für eine nachhaltige Stadtentwicklung* [CSR and urban development. Businesses as partners for sustainable urban development]. Springer. https://doi.org/10.1007/978-3-662-50313-3

Bathen, A., Bunse, J., Gärtner, S., Meyer, K., Lindner, A., Schambelon, S., Schonlau, M., & Westhoff, S. (2019). *Handbuch Urbane Produktion. Potenziale, Wege, Maßnahmen* [Handbook urban production. Potentials, pathways, recommendations]. Urbane-Produktion.Ruhr. https://urbaneproduktion.ruhr/wp-content/uploads/2019/12/Handbuch-Urbane-Produktion_2019_Web.pdf

Böhme, H. (2004). Stadt und Arbeit—Integration und Ausgrenzung. Überlegungen aus historischer Sicht [City and work—integration and separation. Historical considerations]. In I. Flagge & F. Pesch (Eds.), *Stadt und Wirtschaft* [City and economy] (pp. 180–192). Das Beispiel.

Bundesinstitut für Bau-, Stadt- und Raumforschung. (Ed.). (2020). *Nachhaltige Weiterentwicklung von Gewerbegebieten* [Sustainable development of working areas]. Bundesamt für Bauwesen und Raumordnung. https://nbn-resolving.org/urn:nbn:de:101:1-202006031027586272122 6

Croxford, B., Domenech, T., Hausleitner, B., Hill, A. V., Meyer, H., Orban, A., Muñoz Sanz, V., Vanin, F., & Warden, J. (2020). *Foundries of the future: A guide for 21st century cities of making*. TU Delft Open. https://books.bk.tudelft.nl/press/catalog/book/ISBN_9789463662475

Daldrop, N. (2004). Corporate Identity und Architektur—mehr als nur Fassade [Corporate identity and architecture—More than facade]. In N. Daldrop (Ed.), *Kompendium Corporate Identity und Corporate Design* [Compendium corporate identity and corporate design] (pp. 58–65). av-edition.

Eckmann, B., Holthey, L., Krüger, T., & Spars, G. (2020). Perspektiven für Gewerbe und Produktion in der Stadt [Perspectives for industry and manufacturing in

the city]. *RaumPlanung*, *209*(06), 44–49.

EU. (2020). *The New Leipzig Charter. The transformative power of cities for the common good*. https://eurocities.eu/wp-content/uploads/2020/12/New-leipzig-charter_2020.pdf

Förster, A., Wenzel, S., & Thierstein, A. (2017). *Gewerbe & Stadt. Gemeinsam Zukunft gestalten* [Working & city. Co-designing future]. Studio Stadt Region and Technische Universität München. https://mediatum.ub.tum.de/doc/1398132/1398132.pdf

Häussermann, H., Läpple, D., & Siebel, W. (2008). *Stadtpolitik* [Urban policy]. Suhrkamp.

Höger, K. (2007). Brandhubs: Markenzeichen im Stadtraum [Brandhubs: Brands in urban spaces]. *Informationen zur Raumentwicklung (IzR)*, *2007*(12), 705–718. http://www.kerstinhoeger.com/HOEGER/publications/0712_Brandhubs_IrZ-Bonn.pdf

Horx, M. (2020). Die Städte von morgen—6 Thesen für die urbane Post-Corona-Welt [The cities of tomorrow—6 theses for the urban post-corona world]. *Informationen zur Raumentwicklung (IzR)*, *2020*(4), 118–125.

Hosoya, H., & Schäfer, M. (2020). *Industrie.Stadt. Urbane Industrie im digitalen Zeitalter* [The industrious city: Urban industry in the digital age]. Lars Müller Verlag.

Hüttenhain, B. (2012). *Stadtentwicklung und Wirtschaft: Strategien und Handlungsansätze zur Entwicklung von Gewerbestandorten* [Strategies and instruction for the development of business locations]. Dorothea Rohn.

Industrie und Handelskammer Region Stuttgart. (Ed.). (2020). *City-Logistik neu gedacht. Impulse für das Stuttgarter Rosensteinviertel* [City logistics rethought. Impulse for Stuttgart's Rosenstein district]. https://www.stuttgart.ihk24.de/blueprint/servlet/resource/blob/4877820/0df009e26df44c518419c023bc65a68d/rosensteinstudie-pdf-final-data.pdf

Landeshauptstadt Stuttgart. (Ed.). (2020). *Urban Sandwich—Steigerung der Flächeneffizienz durch Stapelung gewerblicher Nutzungen* [Urban Sandwich—Increasing space efficiency by stacking commercial uses]. https://www.stuttgart.de/medien/ibs/Abschlussbericht_Urban_Sandwich_2020.pdf

Läpple, D. (2019). Neue Arbeitswelten—eine Einführung [New working worlds—An introduction]. *Informationen zur Raumentwicklung (IzR)*, *2019*(6), 4–19.

Läpple, D. (2020). On the significance of the productive city in the pandemic era. Lessons from the Corona pandemic. In Europan Deutschland (Ed.), *Europan 15, Produktive Städte 2* [Europan 15, Productive cities 2] (pp. 15–25). Jovis.

Möllers, C., Schmitt, G., & Klanten, C. (2020). Produktion in die Stadtstruktur einfügen [Integrate production into the urban structure]. *RaumPlanung*, *209*(06), 21–27.

Pesch, F. (2004). Urbanität und Wirtschaft—Die Stadt und das Städtische im Spiegel der wirtschaftlichen Entwicklung [Urbanity and economy—City and the urban in the mirror of the economic development]. In I. Flagge & F. Pesch (Eds.), *Stadt und Wirtschaft* [City and economy] (pp. 8–26). Das Beispiel.

Rappaport, N. (2019). *Vertical urban factory* (2nd ed.). Actar Publishers.

Reiß-Schmidt, S. (2010). Gewerbe und Handwerk in der Stadt—Beispiel München [Trade and crafts in the city—The example of Munich]. In Deutscher Industrie—und Handelskammertag (Ed.), *Experimentierfeld Stadt. Handel, Handwerk und Gewerbe im 21. Jahrhundert* [Experimenting in the city. Trade, crafts and commerce in the 21st century] (pp. 49–51). DIHK Berlin.

Roost, F., Baur, C., Bentlin, F., Höfler, J., Hüttenhain, B., Jeckel, E., Kübler, A., Millon, A., & Werrer, S. (2021). *Vom Gewerbegebiet zum produktiven Stadtquartier: Dienstleistungs—und Industriestandorte als Labore und Impulsgeber für nachhaltige Stadtentwicklung* [Turning business parks to productive urban quarters: Commercial and industrial areas as laboratories and impulses for sustainable urban development]. Bundesinstitut für Bau-, Stadt- und Raumforschung.

Schmitt, G., Klanten, C., & Shapiro, J. (2019). *Produktion stadtverträglich integrieren. Ein Forschungsbericht im Rahmen des Verbundprojektes MIA—Made in Aachen* [Integrating production compatible with the city. A research report within the framework of the joint project MIA—Made in Aachen]. RWTH Aachen University. https://doi.org/10.18154/RWTH-2020-02261

Schneidewind, U., Baedeker, C., Bierwirth, A., Caplan, A., & Haake, H. (2020). Näher, öffentlicher, agiler: Bausteine einer resilienten Post-Corona-Stadt [Closer, more public, more agile: How to build a resilient post-Corona city]. *GAIA*, *29*(2), 134–136. https://doi.org/10.14512/gaia.29.2.15

Sgobba, A. (2012). *Architektur, Stadt und Automobilindustrie: Entwicklungstendenzen und Paradigmenwechsel im Informationszeitalter* [City and automotive industry: Development trends and paradigm shifts in the information age]. Dorothea Rohn.

Sieverts, T. (1997). *Zwischenstadt: Zwischen Ort und Welt, Raum und Zeit, Stadt und Land* [In-between city: Between place and world, space and time, city and countryside]. Vieweg.

Stadtentwicklung Wien. (Ed.). (2017). *STEP 2025—Fachkonzept Produktive Stadt* [STEP 2025—Strategic urban planning productive city]. https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008500a.pdf

Vonseelen, T. (2012). *Von Erdbeeren und Wolkenkratzern: Corporate Architecture—Begründung, Geschichte und Ausprägung einer architektonischen Imagestrategie* [Of strawberries and skyscrapers: Corporate architecture—Justification, history and development of an architectural image strategy]. Athena.

Wuppertal Institut. (2020). *Wirtschaftsförderung 4.0. Rahmenarbeitsbericht* [Economic development 4.0. Framework work report].

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Article

# Surpassing the Line: Urban-Oriented Strategies in the Development of Business Complexes in Poland

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**Abstract**
Development trends regarding the business-related urban complexes seem to evolve from the "big-box" towards the more "multi-use" types of structures. Within it, the special role is reserved for places, which—due to economic, political, and geographical reasons—have not been previously considered as major business hubs. Only recently, places like cities in Central and Eastern Europe have become attractive locations for business complexes. These could offer centrally located and attractive locations for new structures, which resulted in the development of the new type of commercial centers—in the form of multi-use districts, walkable, and complemented by other uses. Therefore, to some extent, these cities "surpassed the development line" of the commercial and business complexes, and have become home to something much more advanced. Within the article, the cases from Poland, including Gdańsk, Warsaw, Cracow, and Wrocław, are discussed. Not only is the urban arrangement of selected complexes presented, but the planning and socio-economic, legal, and infrastructural aspects of these developments are also discussed.

**Keywords**
business centers; Cracow; Gdańsk; multi-use projects; Warsaw; Wrocław

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## 1. Introduction

The office clusters—and office-dominated business parks and complexes—became increasingly common across Europe in the second part of the 20th century. This trend emerged as a result of the Western European shift from industrial to service-based economies (Barnett & Parnell, 2018). The other pragmatic issue was that in the city's dense office structure, the centralized infrastructure systems were far more efficient while serving the multiple buildings located close to each other (Gang et al., 2016). As a result, the concept of the central business district (CBD) emerged. In many cases it was associated with the downtown areas; however, the term was sometimes applied to the central cities of the metropolitan area, namely "core" and "urban core." The "core" was conceptualized and outlined by its position on the mental map of the inhabitants. CBD was originally seen as a somewhat distinctive area. As for its original character, the CBD was easily accessible, with a greater concentration of tall buildings than anywhere else in the city, with the largest retail and commercial facilities. CBD was widely known for its congested and overcrowded streets. Land values within these areas were higher than average elsewhere (Murphy, 2017).

The extended set of location criteria match the decision makers' preferences well while selected according to the individual valorization and assessment hierarchy. Thus, the exemplary list of the location variables for evaluating the location of the CBD proposals in 1st, 2nd tier,

and 3rd tier cities can be presented. The authors developed their analysis of these factors (see Table 1).

The concentration of economic activity around the most valuable areas in an undefined metropolitan core resulted in a vertical zoning characteristic of CBD. Throughout the time, the CBD, originally dominated by offices and retail stores, was replaced by the accompanying set of specific functions within the CBD (hotels,

**Table 1.** Variables for evaluating location factors of CBD in 1st, 2nd, and 3rd tier cities.

| Variables | CBD in 1st tier cities (in case of Poland: a capital city) | CBD in 2nd tier cities | CBD in 3rd tier cities |
|---|---|---|---|
| Cost | Construction, taxes, utilities, investment incentives | Construction, taxes, utilities, investment incentives | Construction, taxes, utilities, investment incentives |
| Location | Headquarters, large corporations (finance, real estate and insurance sector [FIRE]), critical mass of similar firms, contractibility distance to other Alpha cities | Large corporations (FIRE/subsidiary), critical mass of similar firms, contractibility distance to the European metro network | Large corporations (subsidiary), critical mass of similar firms, contractibility distance to the capital city |
| | Nice and safe surroundings | Quiet, safe, and nice surroundings | Quiet, safe, and nice surroundings |
| Proximity | City center (core), prestigious location, airport | City center, train, metro, subway station, motorway, airport | City center, airport, train station, by-pass motorway, subway, seaport |
| | Clients, business partners, suppliers | Clients, suppliers, business partners, universities | Clients, suppliers, business partners, universities |
| Access | Public transport | Public transport | Public transport |
| | Complimentary business services, culture, entertainment | Complimentary business services, retail, restaurants | Complimentary business services |
| | Distribution channels and high-quality information network | Distribution channels and high-quality information network | Distribution channels and high-quality information network |
| Car mobility | Car access, parking available for employees/clients | Car access, parking available for employees/clients | Car access, parking available for employees/clients |
| Availability | R&D knowledge | Industry cluster | Industry cluster |
| | Distant markets | Lack of competitors | Office space expansion opportunity |
| | Sport/cultural amenities and medical services, colleges, universities, recreational facilities | Sport/cultural amenities and medical services, colleges, universities, recreational facilities | Sport/cultural amenities and medical services, colleges, universities, recreational facilities |
| Resources | State regulatory environment, the quality of the infrastructure | High-quality infrastructure | High-quality infrastructure |
| | Skilled with knowledge of foreign languages, with market experience | Education level of residents, skilled with knowledge of foreign languages | Education level of residents, skilled with knowledge of foreign languages |
| Brand | Municipal reputation as a good place to work, prestigious location in the capital city | Municipal reputation as a good place to live and work, attractiveness of the area, unique amenities, and venues | Municipal reputation as a high-quality place to live and work, high attractiveness of the area, alternative urban lifestyles and vibrancy, unique amenities, and venues |

Source: Own study based on Karakaya and Canel (1998), Kimelberg and Williams (2013), and Smętkowski et al. (2021).

restaurants, theatres, banks, nightclubs) and resulted in a decline in the use of the "core" blend. This helped to sustain the life of the formerly office-dominated areas (Polese & Chapain, 2000). Therefore, the trend of relocating the CBDs from the archetypal city centers to the most accessible city parts seemed to be the natural consequence in a globalized world. The CBD's (re)location due to accessibility reasons was especially likely to happen in waterfront cities causing even a shift in the meaning of centrality (Murphy, 2017). Nevertheless, all of these trends have been reflected in some kind of standardization of CBD concepts around the world.

Considering the decision-making processes on CBD's (re)location, three general approaches were distinguished globally: the neoclassical, the behavioral, and the institutional (Bagchi-Sen, 2001). The first assumes that the decision is based on cost minimization (Kimelberg, 2014). The second behavioral approach assumes that with a limited amount of information available, the only rational attempt is to balance the economic factors with the others. The institutional approach challenges previous paradigms, recognizing that the intangible social and cultural context which can be found in the spatial dimension is crucial for business success.

The tendency of (re)location of the CBD areas was reinforced with the emergence of the creative sector concept and understanding its role in the successful development. The so-called creative clusters and districts have risen (Carta, 2007; Florida, 2005). Although the theory of the creative class by Florida (2005) was recently criticized, the development of creative districts (as conceptualized by Landry, 2008) as a driver of urban development is continuously being advocated (Culver, 2017), along with understanding that start-up companies have the same (if not greater) importance for economic development as large corporations. This trend is also accompanied by the development of the "slow-life" and "work-life-balance" concepts, which have resulted so far in the re-appreciation of the traditional social networks and types of urban structures (Hatuka et al., 2018).

All these factors have contributed to redesigning the landscape of the business-oriented built environments. This change has also been strengthened by the policy of sustainable urban development calling for a more dense, multi-use type of development, less dependent on cars, and more blended with the traditional urban fabric (e.g., Bott et al., 2019; Haas, 2012; Meijer et al., 2010; Säynäjoki et al., 2014). This is a new approach to city planning in general, and in defining development projects in particular (Burdett & Rode, 2018; Stangel, 2013). Secondly, the developers—feeling the changes in the market, which started to demand more diverse urban environments—decided to reshape their master plans (e.g., Bullivant, 2012; Firley & Grön, 2013; Rudlin & Hemani, 2019), as well as the scope and character of particular projects. As a result, the business parks and office centers are no longer constructed like a big box meant to work alone at the premises. Modern companies wanted their employees to feel at home, so they tried to create an attractive workplace regardless of 1st, 2nd, or 3rd tier city locations. The best-known example of this trend is the Google headquarters in Mountain View, which offers unique architectural solutions, excellent restaurants with free food from around the world, basketball courts, sun loungers, and much more (Ferguson, 2005).

Within this article, the issue of the location of the new type of business centers is discussed, focusing on the tendency to develop these new types of centers without the "big box-looking" structures. This tendency is a characteristic of "emerging markets," like Central Europe in general, and Poland specifically. The analysis of the cases presented in the article can serve as the point of departure for further research on the evolution of the city core areas in Central Europe and elsewhere. The state of the research was blended in the text, and the theoretical background was presented in its introductory parts. On that basis, it was possible to define the case studies to be discussed and, as a result of this elaboration, to draw more general conclusions on the nature of the phenomenon.

## 2. Situation of the Business Centers in the Case of Poland

The evolution of the business-cluster creation described above globally reflects the situation based on highly developed countries (in Western Europe or North America). However, at the end of the 20th century, a new group of markets emerged—including the Central and Eastern European ones—which were previously (due to political reasons) excluded from the processes of globalization and free flow of capital and labor. These countries could offer new opportunities for the location of business headquarters, and local companies (including newly created and dynamically growing ones) appeared to require new office spaces. The special role in this process is reserved for Poland, the largest of the Central European countries, with a dynamically developing economy and decentralized spatial structure (Gelbuda et al., 2008; Luthans et al., 1995).

Since its inception in the 1990s, the Polish real estate market has had an attractive performance record (Colliers International, 2020). Following the perceived "distinct locational advantages" (McCartney, 2012), the first market chosen had been Warsaw—the capital of Poland with the headquarters of both the Polish companies and Polish branches of the international corporations located since the early 1990s. The second market was established in regional centers such as Cracow, Poznań, and Wrocław, forming the set of major business centers in Poland, although in the course of 2020s, the relatively high position of Poznań was overtaken by Gdańsk, which nowadays tends to become the 4th strongest center of business activity in the country (Morawiecki, 2021). Although the office clusters were developed mostly according to the transit-oriented

development schemes, car accessibility continued to be highly important for the workers. It was believed that increasing the density near clustering office buildings has "many tangible economic benefits, which are likely to fuel the economic performance in real estate" (Kołodziejczyk et al., 2021, p. 171). The large clusters of office developments were undertaken regardless of the possibility of a permanent imbalance caused by rapid growth (Brzezicka et al., 2018).

Today, the office space available in Poland is estimated to be 11 million $m^2$ in total. As far as the overall tendency focusing on the qualitative changes is concerned, it is understood that not only as the demand for a higher level of competencies (including hybrid jobs) but also as the potential employees' demand for more attractive work conditions (including the quality of place). Therefore, the case studies had to be selected from the major business centers in tier 1 and tier 2 cities in Poland, based on the comparative study of the modern business services sector in 2020 (ABSL, 2020). The literature review was carried out to establish the theoretical framework as further guidelines for practice-oriented research focusing on the differences in the development of the 1st, 2nd, and 3rd tier of Polish agglomerations and setting the criteria of city selection. The overall methodology aimed to investigate the quality in the indicated key areas in Poland that enable interactions between the office real estate complex and the urban tissue (community and city) focusing on the critical attempt rather than on case study description. The empirical research methods were documentary studies on office real estate complexes and structured studies on the local context with direct observation of public spaces. Finally, the primary research led to the designation of four CBD locations, namely Gdańsk (2nd–3rd tier), Wrocław (2nd tier), Cracow (1st–2nd tier), and Warsaw (1st tier) for conducting the further study. One must note that none of these cities are of exceptional international importance, which applies also to the capital city of Warsaw (Parteka, 2008).

By 2020, there were plans to construct the office clusters of approximately 100 k gross leasable area (GLA), twice as much as in Warsaw by that time (see Table 2). The expected 100 k GLA demand in each (Gdańsk, Wrocław, and Cracow) was twice as high as in the other Polish sub-centers (Poznań, Katowice, Lublin) since 2004 (Morawiecki, 2021). Unexpectedly, due to Covid–19, the trend of the office cluster's expansion to Polish sub-centers reversed at the turn of 2020.

As can be derived from Table 2, the largest office markets in 2020 were located within four major Polish cities: Warsaw, Cracow, Wrocław, and Tricity (including Gdańsk, Sopot, and Gdynia). As a result, these four centers were

**Table 2.** The office market analysis in the capital city (Warsaw) and the selected sub-centers of Gdańsk, Cracow, and Wrocław.

| | Warsaw (CBD and NCL) | Tricity (Gdańsk, Sopot, and Gdynia) | Cracow | Wrocław |
|---|---|---|---|---|
| Number of inhabitants (2020) | 1,702,139 | 751,314 | 755,050 | 634,893 |
| Number of students (2019) | 246,000 | 120,000 | 148,300 | 120,000 |
| Unemployment rate (%) in 2019 and 2021 | 1.4<br>1.9 | 2.3<br>3.2 | 2.3<br>3.2 | 1.7<br>2.5 |
| Medium salary (euro/month) | 1,486 | 1,202 | 1,322 | 1,272 |
| GLA (sqm) 3rd quarter of 2020 | (CBD) 2,387,514<br>(NCL) 3,434,839 | 898,804 | 1,521,429 | 1,235,004 |
| GLA supply (sqm) 3Q2020 | (CBD) 112,987<br>(NCL) 18,488 | 30,360 | 38,160 | 48,941 |
| GLA demand (sqm) 3Q2020 | (CBD) 288,608<br>(NCL) 4,876 | −1,782 | 13,828 | 5,164 |
| Rent (euro/sqm/month) 3Q2020 | (CBD) 17.00<br>(NCL) 12.00 | 14.00 | 13.80 | 13.50 |
| Rent dynamics (2019–2020; %) | (CBD) 7.89<br>(NCL) 7.69 | −3.45 | −2.82 | 0.00 |
| Vacancy rate (%) 3Q2020 | (CBD) 8.42<br>(NCL) 10.43 | 9.42 | 12.41 | 14.29 |

Notes: (1) The CBD is limited by the Vistula, Trasa Łazienkowska, Raszyńska, and Towarowa streets, and the WZ route, according to Polish Office Research Forum (2017); (2) NCL stands for non-central area, according to Polish Office Research Forum, constituting the rest of Warsaw without the CBD; (3) the vacancy rate is a percentage of a building's GLA that is unoccupied by tenants. Source: Own study based on data by Colliers International (2020), Statistics Poland (2021), Polish Office Market (2019), and Morawiecki (2021).

selected for further research. As far as the CBDs construction at the major regional centers in Poland is concerned, the high-density office complexes are built according to the new standards, i.e., not only the "big box" type of structures, but also "multi-use, clustered" types. This was due to several reasons, among which one should mention the availability of distressed and brownfield urban areas, the low density of central parts of the cities, as well as the willingness of local governments to develop high-quality urban environments (Ossowicz, 2019). It was also noticed that the clustered development should result in less energy consumption, less pollution, and, in consequence, higher users' satisfaction, enabling users to enjoy the amenities which accompany office real estate (Tapsuwan et al., 2018). Furthermore, it was also noticed that denser built environments foster social contacts and motivate interactions (Patacchini et al., 2015), which has become an important feature of the work environment for many employees, especially at the end of the 2010s.

## 3. Description of the Key Case Studies

Within each of the above-mentioned cities, the key business complexes were identified based on the analysis of the urban structure of the city as well as on the authors' expertise on development processes occurring within these. On that basis, one exemplary case was picked from each of the cities and researched in detail. Each of the case studies was presented in a unified way, which relates both to the text-based descriptions, presentation on schemes showing both the city-wide and local contexts, as well as images presenting the key features of the sites (i.e., typical interior walkable spaces, green area connections, transportation connections, and with convenient access to other parts of the city.

### *3.1. Warsaw: Targowa Street/Daszyńskiego Roundabout Complex*

Warsaw is the capital city of Poland and its main business hub. Traditionally, the country headquarters of various companies were located within the structure of the city, although after the political and economic transformation of the 1990s, new business hubs emerged (Smętkowski et al., 2019). One of them—also referred to as the Warsaw CBD area—is located within the area of the Daszyńskiego roundabout and along Targowa Street. One must note that this is not the only location of office complexes in Warsaw, as there are numerous complexes spread around the urban structure of the city, and each of these is different.

#### 3.1.1. Urban Setting of the Selected Case Study

The city's CBD is located in close vicinity to the city center, near the central train station, and close to the Okęcie International Airport. Thanks to its location on the edge of the historic urban center, the complex is neighbored by extensive housing districts, both developed after the war-time destruction and newly constructed. The area is also well served by public transportation lines (underground train line, tram, and bus routes) and has a good connection to the commercial centers of the city. The recent and rapid development of the area, which utilized many empty and vacated (due to the restructuring of the industrial estates) plots, resulted in a patchwork-type urban structure. The key features of the location of the discussed case are presented in Figure 1.

#### 3.1.2. Current State of the Area

The landscape of the selected area is characterized by the modern design of the office buildings, in many cases blended with pre–1989 structures which include occasional remnants of the pre-war urban structure. New structures are also infilling the historic urban layout of the area. Since some of the projects located within it occupy larger sites, within their structures one can find green spaces which are usually publicly available. The most notable example is the Plac Europejski square, which is perceived as a privately-owned but high-quality public space. The character of the site's landscape is presented in Figure 2.

#### 3.1.3. Planning and Development Mode

The character of the site was decided in the city's planning documents, the authors of which defined the area as "the site of representative character" (Office of the Capital City of Warsaw, 2018). It was also proposed to densify the area as well as to locate within its borders various commercial and public services. Particular buildings and complexes were developed according to regulations included within both the so-called local plans (City of Warsaw, 2021) as well as in the special-purpose planning permits. Although such a mode of planning for the site is not perceived as the most comprehensive and desired, the site's high level of attractiveness has resulted in the relatively high quality of the urban structure. The above-mentioned diversity in the process of developing the particular projects results in differentiated conditions imposed on particular developers and site owners. This situation is also, in many cases, used extensively by the developers to maximize the floor area and height of the proposed buildings. As a result, the urban structure of the area is very much architectonically and functionally diversified.

#### 3.1.4. Social and Infrastructural Aspects of Project Implementation

Blending new office and commercial complex areas within the existing city structures contributes to the area's attractiveness. The special role in this process is played by large-scale public areas, provided by some of

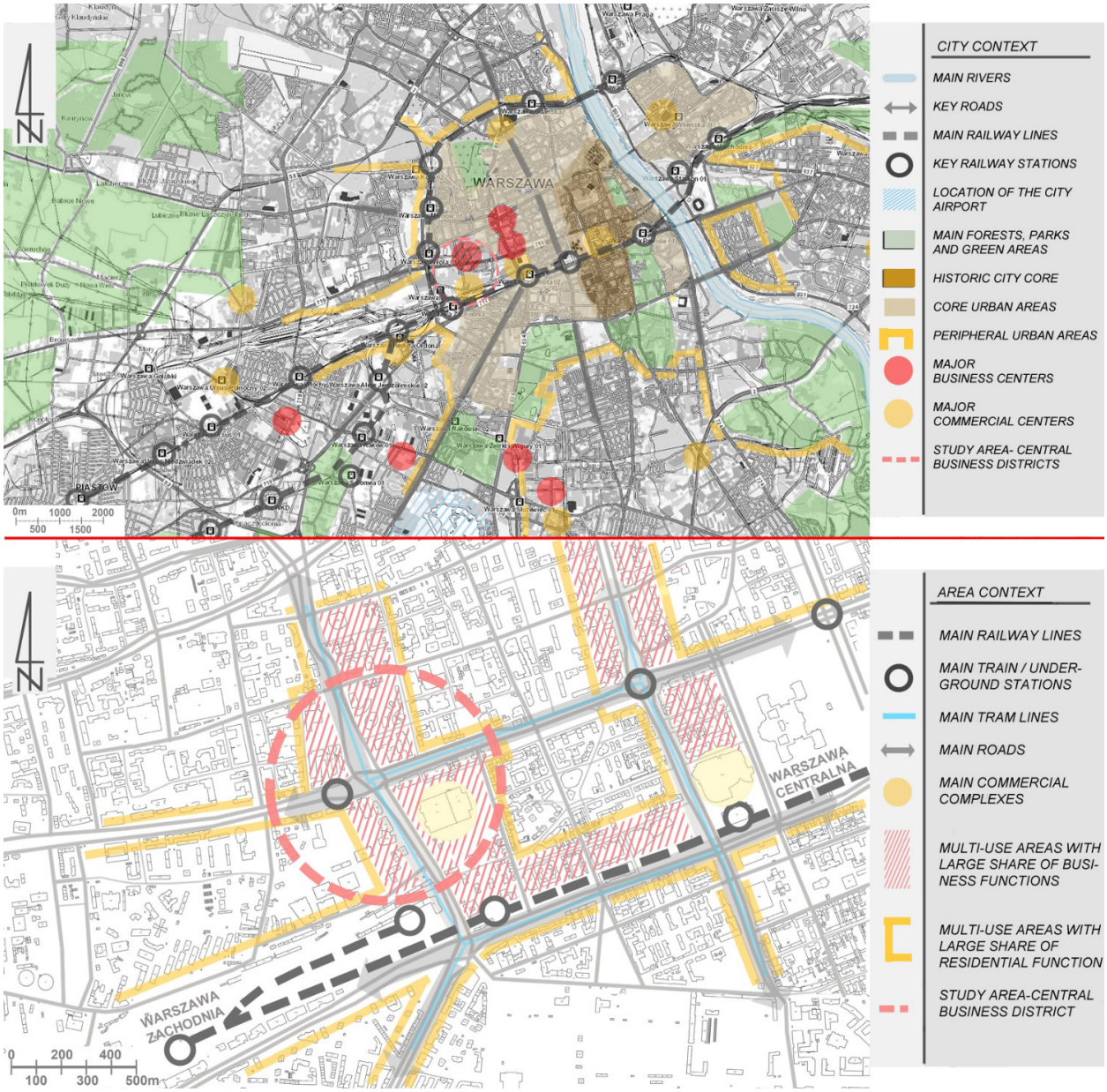


**Figure 1.** The urban setting of the Warsaw case study area.

the site developers. This large-scale area, known as Plac Europejski, was awarded a special prize by the Society of Polish Town Planners for the "best public space in Poland" in 2016. Also, the new housing estates emerged in close vicinity of the area, which contributed to the improvement of the housing offer within the entire city center. These estates took different forms, within which the traditional urban fabric with lots of accompanying commercial uses prevails. These attracted many new inhabitants, making the entire district a proper multi-use type of area, a true urban center of the growing metropolis.

### *3.2. Cracow: Rondo Mogilskie/Rondo Grzegórzeckie*

Cracow is one of the oldest and best-preserved cities in Poland, a UNESCO cultural heritage site, and the second most important business hub in Poland. Many office complexes are scattered around the city. Rondo Mogilskie and Rondo Grzegórzeckie are the places around which the most notable structures were developed. Located in close vicinity of the Old Town, these pretend to become the proper CBD of the city.

#### 3.2.1. Urban Setting of the Selected Case Study

The area is located in the vicinity of the Cracow main train station, which provides excellent connectivity with the airport and other cities both in the region and nationwide. The transportation infrastructure providing access to the area has been inherited from the previous era of planning and includes an extensive road network, which is presented in Figure 3. Also, the pedestrian connections were not given priority over car-related infrastructure. This resulted in the low quality of the urban environment,


**Figure 2.** The current state of the Warsaw case study area.

typical for the modernistic type of structure. Part of this is the tram network and recently added bike pathways system.

#### 3.2.2. Current State of the Area

Currently, the site is being predominantly filled with new office buildings, which are also sporting the commercial infrastructure. These represent modern, though pretty standard architecture (see Figure 4). Nowadays in the vicinity of the two roundabouts, being the core of the road structure for the area, local multi-use centers are emerging, which also serve extensive housing structures located nearby.

#### 3.2.3. Planning and Development Mode

Within the municipal master plan for the city of Cracow, the area in question was marked as the "main central area designated for the New Cracow City Center" (Public Information Bulletin of the City of Kraków, 2014). Most of the complexes and buildings are not built according to the well-defined planning regulations, as most of them are based on individually issued planning permits. This, confronted with the legacy of modernistic transportation planning, does not allow proper coordination of the area development (City of Kraków, 2021). The planning specifics of the area development result in a random location of the new office and public buildings within the area, resulting in great diversity, but, at the same time, little coordination and comprehensiveness.

#### 3.2.4. Social and Infrastructural Aspects of Project Implementation

Development of the new office building complexes seems like an opportunity to break with the modernistic road layout of the district, within which it was located. This also helped in regenerating surrounding housing areas and improving commercial functions within them. Also, creating opportunities to work and live at a close distance contributes to the process of sustaining urban structures and improving the quality of life of the local community. At the same time, distribution of the office program among three major concentrations and locating it within the vicinity of two major commercial complexes as well as within walking distance of the Old Town and main train station complex helped to avoid the mono functionality of the area. Also, the location of these structures within walking distance from the city's main train station as well main lines of public transport (trams) provides excellent opportunities for workers, inhabitants, and visitors to the area to get there without the need of using a private car.

### *3.3. Wrocław: Mikołajów*

Wrocław is a city which, in the last twenty years, has been to some extent reinvented as the major urban center in Poland. Being one of the major German cities before

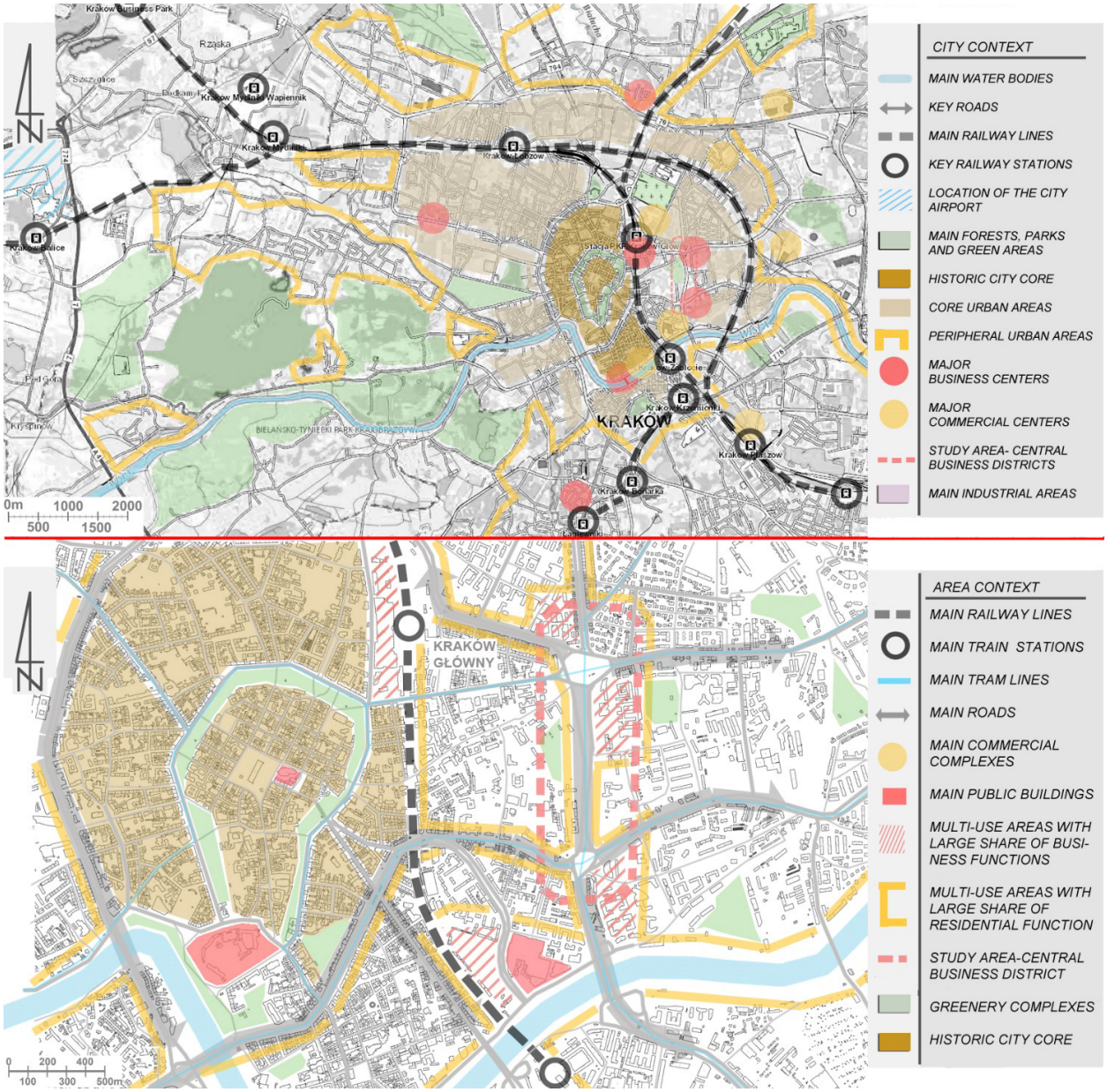


**Figure 3.** The urban setting of the Cracow case study area.

WWII, later on extensively destroyed by bombardments and the siege of the Red Army in 1945, it had struggled through the communist era with the provincial location. Only after the political changes of the 1990s did it go through an in-depth transformation into one of the most important Polish urban and business centers.

### 3.3.1. Urban Setting of the Wrocław Case Study

In the case of Wrocław, the Business Garden Office Park was selected. Located in the western part of the urban center, it is situated in close vicinity of the city's international airport and right next to Mikołajów train station. Also, numerous public transport lines allow smooth communication with the rest of the city. It also neighbors the large housing area as well as the commercial center (see Figure 5). Nearby, one can also find a park that provides recreational opportunities for the office complex employees. However, the Business Garden Office Park, along with other neighboring sites, forms a rather isolated enclave.

### 3.3.2. Current State of the Area

The majority of the office park structure was developed according to a single architectural concept, which resulted in the unified architecture of the buildings that make it up. The aesthetics of the neighboring structures seem to follow the style defined by the design of the main part of the complex. The entire complex corresponds with the scale and form of the Wrocław city architecture, which contributes to the image of the high-quality urban environment of the area (Figure 6).


**Figure 4.** The current state of the Cracow study area.

#### 3.3.3. Planning and Development Mode

The area surrounding the Mikołajów train station—according to the Wrocław Development Plan—has been designated as one of the major concentrations of office and industrial complexes in the city (Wrocław Spatial Information System, 2021a, 2021b). Also, most of the study area has been covered by the development regulations included in the local planning documents, which, in principle, allows proper coordination of the area development (Wrocław Spatial Information System, 2021). According to these regulations, it seems possible to predict the future type of land use of the still developable areas as well as relations and connections between particular parts of the site. Besides, within these documents, the representative function of the main roads and public spaces has been declared, which also becomes a clear indication for the future transformations of these.

#### 3.3.4. Social and Infrastructural Aspects of Project Implementation

Close to the city center, the inclusion of numerous commercial services in the urban program of the complex as well as excellent functional and transportation connections with the surrounding neighborhoods decide the attractiveness of the area. Nevertheless, many improvements still have to be made, mostly concerning the transformation of the main roads and the development of public space systems. One must point out the excellent transit opportunities for the inhabitants and workers from the area: The location of one of the city's main train stations in the center of the complex provides good access to other parts of Wrocław, as well as connections to the rest of the country. Also, the plots surrounding the office complex, although designated for housing, are still empty and await new developments. So, potentially, this entire complex may become an excellent example of a complete multi-use type of neighborhood, but for now, it still lacks many features.

### *3.4. Gdańsk: Olivia Business Centre and Alchemia Complexes*

Gdańsk is one of the most historic cities in Poland, a major harbor, and tourist center. Along with Sopot and Gdynia, it forms the Tricity metropolis, which is the largest business hub in the northern part of the country. At the same time, its rich history—associated with the rise of the Solidarity movement as well as immense development during the Hanseatic times—along with outstanding environmental features (proximity to the sea and major forest complexes) make it a city of the highest living quality in Poland.

#### 3.4.1. Urban Setting of the Selected Case Study

The area selected as a case study is located between the districts of Wrzeszcz and Oliwa, next to the regional train station Gdańsk-Przmorze-Uniwersytet. It has become a

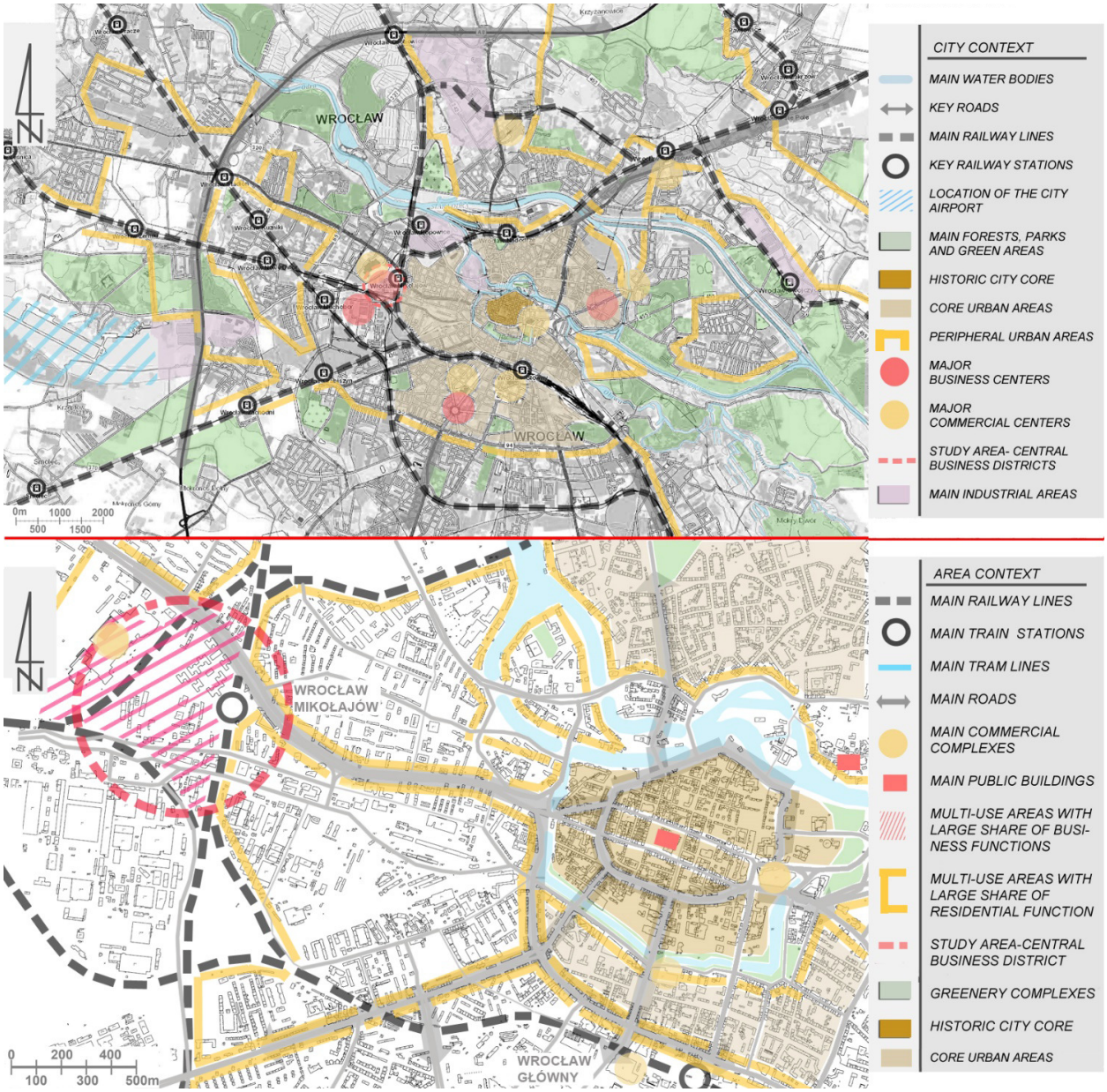


**Figure 5.** The urban setting of the Wrocław case study area.

home for at least three major office complexes—the main campus of the Olivia Business Centre, the Alchemia office complex, and the Skanska office complex. It neighbors with the Gdańsk University campus as well as the well-developed housing districts of Oliwa, Przymorze, and Zaspa. Also, many commercial facilities may be found in nearby areas (Figure 7).

### 3.4.2. Current State of the Area

At present, the office and business developments are concentrated around the three above-mentioned complexes. Each of these can be regarded as a large-scale urban intervention. The program of each of these is truly diverse and includes numerous commercial activities, a sports center, greenhouse-style enclosed public space, and top-notch restaurants and bars located on the top floors of the main office tower of the Olivia Business Centre complex (Figure 8).

### 3.4.3. Planning and Development Mode

According to the municipal development plan, the area in question was designated as one of the major parts of the so-called central commercial strip of the city (Portal of the City of Gdańsk, 2021). This resulted in the concentration of numerous and diverse functions, both within its structures as well as in other neighboring sites. The development potential of the area is additionally increased by the proximity of the Gdańsk University complex. Also, since the entire area has been included in the local planning regulations, all development activities—


**Figure 6.** The current state of the Wrocław study area.

although performed by large-scale developers—to a large extent are coordinated and tend to form a coherent urban structure.

#### 3.4.4. Social and Infrastructural Aspects of Project Implementation

A number of the community and employee-oriented features of the urban program have been conceptualized from the very beginning as a part of the urban program for the area. These included commercial areas and leisure areas (including a large greenhouse area providing resting opportunities during the wintertime), imposing a fine-grain urban structure of the entire complex. The main part of the complex has been accompanied by several housing and other commercial and university-related functions, which brought to the area a truly diverse social image. Also, the excellent connection to the rapid regional train system allowed conceptualizing the site as a multi-use center based on the transit-oriented development scheme. As a result, a high-quality urban environment has been created, although many empty sites within the structure still call for new developments.

## 4. Analysis of the Case Studies Discussed

The critical study was based on the methodology applied to assess the quality of interactions in selected Western European office real estate broadly described in the works dealing with user perceptions of the interaction between the corporate office building and the city (Trakulwattanakit, 2021). The methodology which is applied in this research in the limited form of key variables aims to describe and compare the perception of the office-user, the local community, and the city of the CBD interactions in selected cases of Polish CBDs. After determining the appropriate indicators for variables, a cross-analysis was performed for four office real estate complexes in Poland, discussed in the previous section of this article.

Details on the criteria, variables, and factors are presented in Table 3. Following the assessments, the selected office clusters in the Polish capital and subcenters are ranked on a scale of 1 to 5. Rating the behavioral intentions (B) is based on subjective opinion to recommend CBD: 1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree. Regarding the architecture/urban (A/U) design of CBD complex, features such as materiality, lighting, sound, and serial scenes seen through bodily movement were assessed according to the following scale: 1 – not impressive at all; 2 – not very impressive; 3 – neutral; 4 – impressive; 5 – very impressive. Rating the subjective emotions (E) was based on the following scale: 1 – neutral; 2 – pleasant, 3 – relaxing; 4 – pretty; 5 – exciting.

The research hypothesized that the Polish CBDs in the form of selected office clusters in major city centers are set in the triple context of the office complex premises, the city, and the community interactions

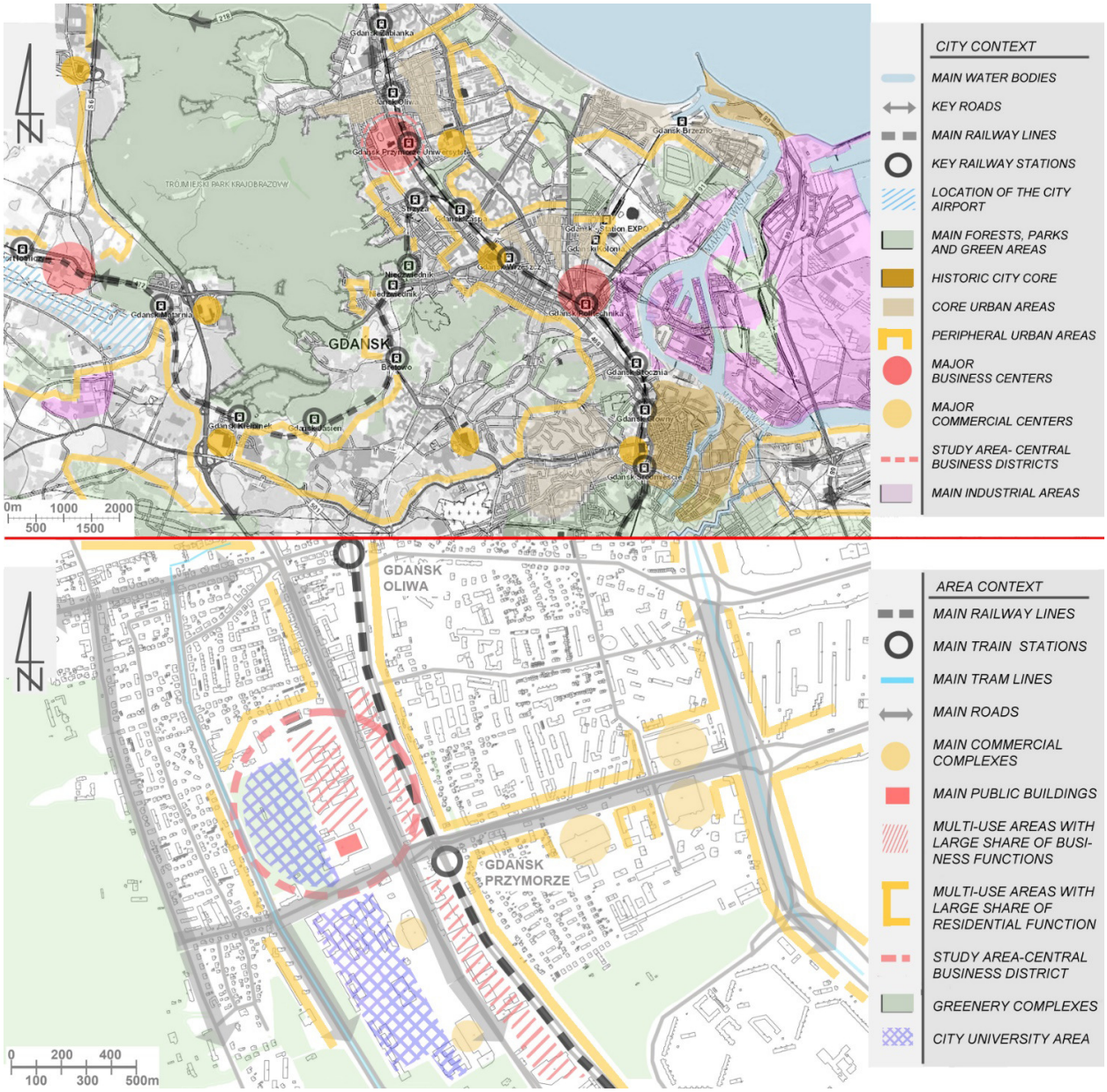


**Figure 7.** The urban setting of the Gdańsk case study area.

(Van de Putte, 2009). The kind of interactions within the triple context can be explored so that the impact degree on the office estate submarkets can be assessed by the designed matrix. The matrix criteria, variables, and factors can follow the survey results which originally "aimed to identify relevant variables that encourage the interaction between the corporate office building and the city from the users' perspectives and the designers' ideas" (Trakulwattanakit, 2021, p. 3). The acquired position values the degree of the interactions within the office cluster, the city, and the community triple context on the regional center's ranking. The total score of a selected sub-center places the estate complex among the others in the office submarket framework (see Table 3).

The ideal office complex should attract skilled and knowledge-intensive service sector workers (Curran, 2010; Leslie & Hunt, 2013) who are (eco sensitively) demanding high tech on a daily basis. Therefore, the mixed-use spaces should be flexible for any combinations of functions, the workplaces open for any changes and ready for any co-creation process. The complex itself ought to be designed in (at least) BREEAM standard to cater to any desires of the privileged and well-educated creative class (Wilson & Keil, 2008). The office development should welcome any interactions at the premises; properly addressing any ideas of co-working and/or emerging start-ups and be easily accessible and safe/secure at the same time.

The city context should improve the overall city position "by framing the municipal management within emerging urban concepts and by implementing visions associated with vigor, innovation, success, and prosperity in the public's imagination" (Hatuka et al., 2018, p. 160). Therefore, the vibrancy of the office development located


**Figure 8.** The current state of the Gdańsk study area.

in the city structure focuses the central attention. The common anticipation is the openness of the office's public places smoothly connected with the city spaces network. Nonetheless, the importance of the development's overall harmony and aesthetic excellence from the city perspective cannot be forgotten.

The context of the community reveals the real orientation towards the needs of the residents of the area. The residents can be either perceived as users who are part of a skilled workforce resource recruiting from the upper and middle class and the consumerist-driven lower class or as the important agents in the neighbourhood development process, i.e., co-creating the public realm. The office development's design form can be motivated by the users' perception and their needs to some extent. The design form may also be devoted to either economic strength, progress, global capital, or on the contrary—strive for sustainable development and resilience by focusing on the ecological, social values, and finally on the user's needs. Therefore, the design forms show the main difficulty of an ideal office complex that should be user-oriented. The above-mentioned development of the triple context, composed of an office environment, the municipality, and the community, is usually based on theoretical insights not only of a corporation and city but also of a design company.

The assessment showed that the main weakness is the lack of interactions with a community within the triple context (office, city, and community). The scores varied from 2.29 (Warsaw) to 3.29 (Gdańsk). The absence of local community involvement activities and the unfriendly streetscape for the local community remain the main challenges for the analyzed locations. Relatively low are the scores (2.88–3.28) concerning the city context. Although Warsaw, the capital, took the lead, pollution stressors (noise and air) and lack of diversity in activities (seasonal/daily/weekly) were pointed out in all cities.

The best office cluster context (scored 4.88) is Gdańsk, well-known not only for the environmentally–friendly development (BREEAM certificate), but also for the flexibility, business-friendly activities (co-working and startup spaces), openness, and flexibility. As far as the total value in assessment is considered, the outcomes varied from 63% in Warsaw to 74% in Gdańsk. The maintained effective rents in Gdańsk and the relatively low vacancy rate (see Table 1) indicated the uniqueness of the Gdańsk office development cluster.

## 5. Discussion

Following the assessment presented above, it is necessary to discuss the specifics of processes shaping the contemporary structures of the cases discussed. Their specifics might serve as the point of reference for processes regarding reshaping the other centrally located large-scale business centers.

First of all, in Polish realities, the formal planning procedures should be complemented by other non-formalized activities. Among these, one should mention master planning exercises developed on behalf of the local business leaders. In the case of Gdańsk, such a document helps in understanding the scope of actions to be

**Table 3.** Assessment of the selected office clusters in Polish sub-centers in the triple context of interactions (matrix).

| Variables | Warsaw | Gdańsk | Cracow | Wrocław |
|---|---|---|---|---|
| Office Context (ranked 1–5) | | | | |
| Easily accessible (A/U) | 5 | 5 | 5 | 4 |
| Workplace and business-friendly activities (A/U) | 3 | 5 | 4 | 3 |
| Safety and security (A/U) | 5 | 5 | 5 | 5 |
| Workplace flexibility for change (A/U) | 3 | 5 | 4 | 5 |
| Operating and maintenance (A/U) | 5 | 5 | 4 | 3 |
| High tech and environmentally friendly solutions (A/U) | 4 | 5 | 3 | 4 |
| Mixed use at ground floor (A/U) | 2 | 5 | 4 | 3 |
| The flexibility of ground floor functions (A/U) | 2 | 4 | 4 | 2 |
| The assessment score (average): | 3.63 | **4.88** | 4.13 | 3.63 |
| City Context (ranked 1–5) | | | | |
| Opened public spaces (A/U) | 4 | 3 | 3 | 2 |
| The vibrancy of the location (E) | 2 | 2 | 5 | 3 |
| Aesthetics excellency (E) | 5 | 4 | 3 | 4 |
| Harmony in colors, materials, forms in the surrounding (A/U) | 4 | 3 | 3 | 4 |
| Sufficient ground floor height (B) | 5 | 5 | 4 | 5 |
| Diverse activities seasonal/daily/weekly (B) | 2 | 2 | 3 | 2 |
| Public space without physical boundaries (A/U) | 3 | 3 | 4 | 3 |
| Limited pollution (noise, air, etc.; E) | 2 | 1 | 1 | 3 |
| The assessment score (average): | **3.38** | 2.88 | 3.25 | 3.25 |
| Community Context (ranked 1–5) | | | | |
| Human scale provided (B) | 2 | 4 | 3 | 4 |
| The scale of the street aimed at liveness in street (A/U) | 2 | 2 | 3 | 1 |
| Lively plaza with attractions, i.e., water (A/U) | 3 | 3 | 2 | 2 |
| Interactions with users aimed sense of belonging (E) | 2 | 3 | 4 | 3 |
| Fluent connection with a transport hub (B) | 5 | 4 | 3 | 4 |
| Intuitive wayfinding at the office park location (E) | 1 | 4 | 1 | 3 |
| Local communities' involvement activities (B) | 1 | 3 | 3 | 2 |
| The assessment score (average): | 2.29 | **3.29** | 2.71 | 2.71 |
| The value (total) | 72 | **85** | 78 | 74 |

Source: Own study based on key variables from Trakulwattanakit (2021), and the concept of rating scales based on Dai and Zheng (2021).

undertaken (Lorens et al., 2021). A lack of similar documents results in larger dispersion of the commercial and office program, which does not contribute towards the creation of the new "downtown-like" area (see the case of Cracow).

Secondly, it pays to undertake cooperation with academic institutions in the process of shaping the new face of the area in question. Confronting ideas generated by both students and senior staff with the business and spatial realities of the office complexes may result in several fresh ideas that can influence the routine of the operations and the development processes undertaken by business leaders (Bach-Głowińska & Krośnicka, 2020).

Thirdly, any important interventions cannot be made without close cooperation with the municipal and other authorities. Only joint planning and implementation efforts may result in well-structured interventions, which deal both with the site infrastructure (i.e., related to transportation) and with the transformation of the area into a truly multi-use type of district (Bach-Głowińska et al., 2020). This should also result in developing pedestrian-oriented structures, well served by the public transit (Istrate et al., 2020; Viderman & Knierbein, 2020). Developed according to the principles of placemaking and public space design, these can serve as the new type of urban center of metropolitan importance (Carmona, 2019). Allowing for better social interactions can contribute to providing socially accepted proximity of functions and social interactions (Gil Solá & Vilhelmson, 2019).

Finally, the site owners and developers should realize the needs of contemporary workers and the directions in reshaping the business complexes emerging from these. Only by understanding what the high-quality work environment means for contemporary workers as well as how this can be delivered may help in maintaining long-term sustainable solutions (Maric et al., 2021; Przywojska et al., 2019; Rześny-Cieplińska & Szmelter-Jarosz, 2021).

## 6. Conclusions

At the end of the first quarter of 2020, over 338,000 people were employed in business services in Poland (5.2%

of employees in the sector enterprises, estimated to be responsible for 3.0–3.5% of Poland's GDP). Foreign capital in the sector of modern business services is of particular importance, preferring the major business centers in tier 1 and tier 2 cities which are located mostly in the southern part of the country. Accordingly, Polish investors open centers in tier 3 and tier 4 cities, due in particular to the interest in the IT sector over the last few years (ABSL, 2020). The Polish office business sector proved to be shock resistant, flexible, and adaptable, which the Covid–19 crisis made evident. Massive transition to remote work accelerated digital transformation without any strong effects on the business continuation. The changes were limited to adapting business strategies and reorganizing work in the major business centers in Poland. Moreover, taking into account the possible growing importance of nearshoring trends in Western Europe, Central and Eastern Europe could be the winner of the crisis.

The analysis of the Polish case studies included in this article may serve as the basis for shaping the initial conclusions regarding the future directions for the transformation of office and business complexes, especially the ones located within the city's central areas.

The first is associated with the need to understand the potential of central locations and the consequences associated with dealing with past planning and development-related decisions, i.e., transport networks and infrastructure. Also, the vicinity of these complexes is the result of past development processes and, in many cases, needs deep transformation. In recent years, municipalities have started to understand the potential associated with the transformation, but no serious actions have been planned yet.

Secondly, the developers and operators of the business complexes understand the need of transforming these structures and introducing the multi-use type of structures though, in many cases, their actions are limited only to the borders of their properties. Therefore, in case of the absence of any cooperation platform, their ideas and requests are not seen or heard, which does not spur any comprehensively shaped processes of change.

Finally, the future of these business complexes is associated with the new philosophy of work, revolving around the term "work and create." This comes from the business incubators and start-up clusters, often associated with creative districts and clusters, which should become an important point of reference for reshaping the traditional office campuses.

## Conflict of Interests

The authors declare no conflict of interests.

## References


ABSL. (2020). *Sektor nowoczesnych usług biznesowych w Polsce* [Modern business services sector in Poland]. https://absl.pl/storage/app/uploads/public/5ee/887/8d5/5ee8878d59858995982318.pdf

Bach-Głowińska, J., & Krośnicka, K. (2020). *Otoczenie Olivia business centre* [Vicinity of the Olivia business centre]. Politechnika Gdańska.

Bach-Głowińska, J., Krośnicka, K., & Małuj, J. (2020). *Węzeł multimodalny Gdańsk–Oliwa* [Multimodal knot Gdańsk–Olivia]. Politechnika Gdańska.

Bagchi-Sen, S. (2001). The dynamics of industrial location: The factory, the firm and the production system. *Economic Geography*, *77*(1), 77–79.

Barnett, C., & Parnell, S. (2018). Spatial rationalities and the challenges for planners in the New Urban Agenda for Sustainable Development. In G. Bhan, S. Srinivas, & V. Watson (Eds.), *The Routledge companion to planning in the Global South* (pp. 25–36). Routledge.

Bott, H., Grassl, G., & Anders, S. (2019). *Sustainable urban planning*. Detail.

Brzezicka, J., Wiśniewski, R., & Figurska, M. (2018). Disequilibrium in the real estate market: Evidence from Poland. *Land Use Policy*, *78*, 515–531.

Bullivant, L. (2012). *Masterplanning futures*. Routledge.

Burdett, R., & Rode, P. (Eds.). (2018). *Shaping cities in an urban age*. Phaidon Press.

Carmona, M. (2019). Principles for public space design, planning to do better. *URBAN DESIGN International*, *24*(1), 47–59. https://doi.org/10.1057/s41289-018-0070-3

Carta, M. (2007). *Creative city. Dynamics, innovations, actions*. List.

City of Kraków. (2021). *Kraków local plan*. https://www.bip.krakow.pl/?id=48

City of Warsaw. (2021). *Warsaw local plans*. http://mapa.um.warszawa.pl/mapaApp1/mapa?service=plany_zagospodarowania

Colliers International. (2020). *Polska market insights. Annual report 2020*.

Culver, G. (2017). Mobility and the making of the neoliberal "creative city": The streetcar as a creative city project? *Journal of Transport Geography*, *58*, 22–30.

Curran, J. (2010). *Media and society*. Bloomsbury Publishing.

Dai, T., & Zheng, X. (2021). Understanding how multisensory spatial experience influences atmosphere, affective city image and behavioural intention. *Environmental Impact Assessment Review*, *89*, Article 106595.

Ferguson, C. H. (2005). What's next for Google. *Technology Review*, *108*(1), 38–46.

Firley, E., & Grön, K. (2013). *The urban masterplanning handbook*. Wiley.

Florida, R. L. (2005). *Cities and the creative class*. Psychology Press.

Gang, W., Wang, S., Xiao, F., & Gao, D. C. (2016). District cooling systems: Technology integration, system optimization, challenges and opportunities for applications. *Renewable and Sustainable Energy Reviews*, *53*, 253–264.

Gelbuda, M., Meyer, K. E., & Delios, A. (2008). International business and institutional development in Central and Eastern Europe. *Journal of International Management*, *14*(1), 1–11. https://doi.org/10.1016/J.INTMAN.2007.05.011

Gil Solá, A., & Vilhelmson, B. (2019). Negotiating proximity in sustainable urban planning: A Swedish case. *Sustainability*, *11*(1), Article 31. https://doi.org/10.3390/su11010031

Haas, T. (2012). *Sustainable urbanism and beyond: Rethinking cities for the future*. Rizzoli.

Hatuka, T., Rosen-Zvi, I., Birnhack, M., Toch, E., & Zur, H. (2018). The political premises of contemporary urban concepts: The global city, the sustainable city, the resilient city, the creative city, and the smart city. *Planning Theory & Practice*, *19*(2), 160–179.

Istrate, A.-L., Bosák, V., Nováček, A., & Slach, O. (2020). How attractive for walking are the main streets of a shrinking city? *Sustainability*, *12*(15), Article 6060. https://doi.org/10.3390/su12156060

Karakaya, F., & Canel, C. (1998). Underlying dimensions of business location decisions. *Industrial Management & Data Systems*, *98*(7), 321–329. https://doi.org/10.1108/02635579810205395

Kimelberg, S. M. (2014). Labor needs, crime, and the business location decision: A qualitative account. *Community Development*, *45*(1), 45–59.

Kimelberg, S. M., & Williams, E. (2013). Evaluating the importance of business location factors: The influence of facility type. *Growth and Change*, *44*(1), 92–117.

Kołodziejczyk, B., Osiichuk, D., & Mielcarz, P. (2021). The more, the emptier: The consequences of growing concentration in urban office space in Poland. *Eastern European Economics*, *59*(2), 171–197. https://doi.org/10.1080/00128775.2020.1870408

Landry, C. (2008). *The creative city: A toolkit for urban innovators* (2nd ed.). Earthscan.

Leslie, D., & Hunt, M. (2013). Securing the neoliberal city: Discourses of creativity and priority neighborhoods in Toronto, Canada. *Urban Geography*, *34*(8), 1171–1192.

Lorens, P., Obracht-Prondzyńska, H., & Breś, J. (2021). *Nowa Oliwa masterplan* [New Oliwa masterplan]. Politechnika Gdańska.

Luthans, F., Patrick, R. R., & Luthans, B. C. (1995). Doing business in Central and Eastern Europe: Political, economic, and cultural diversity. *Business Horizons*, *38*(5), 9–16. https://doi.org/10.1016/0007-6813(95)90031-4

Maric, J., Aleksandra, D., Antonic, B., Furundzic, D., & Parezanin, V. (2021). The effects of open space on reducing workplace stress: Case study of business park in the post-socialist urban setting. *Sustainability*, *13*(1), Article 336. https://doi.org/10.3390/su13010336

McCartney, J. (2012). Short and long-run rent adjustment in the Dublin office market. *Journal of Property Research*, *29*(3), 201–226.

Meijer, M., Dubbeling, M., & Marelis, A. (Eds.). (2010). *Sustainable urban design*. Blauwdruk.

Morawiecki, M. (2021). *Rynek nieruchomości biurowych: Początek trudnych czasów?* [Office real estate market: Beginning of tough times?]. Department of Economic Analysis of the PKO Bank of Poland. https://www.pkobp.pl/media_files/e11cef77-493e-4d6b-b046-ef96e197e4fe.pdf

Murphy, R. E. (2017). *The central business district: A study in urban geography*. Routledge.

Office of the Capital City of Warsaw. (2018). *Spatial policy of the capital city of Warsaw*. http://www.architektura.um.warszawa.pl/studium

Ossowicz, T. (2019). *Urbanistyka operacyjna. Zarys Teorii* [Operational city planning. The outline of a theory]. Oficyna Wydawnicza Politechniki Wrocławskiej.

Parteka, T. (2008). *Europejskie wyzwania spójności przestrzeni* [European challenges of space cohesion]. Wydawnictwo Politechniki Gdańskiej.

Patacchini, E., Picard, P. M., & Zenou, Y. (2015). *Urban social structure, social capital and spatial proximity* (CEPR Discussion Paper No. DP10501). Centre for Economic Policy Research.

Polese, M., & Chapain, C. (2000). *Are central business districts (CBDs) really declining? An analysis for U.S. and Canadian urban areas*. University of Quebec.

Polish Office Market. (2019). *Raport. Powierzchnie biurowe w Polsce 2019* [Report: Office spaces in Poland 2019]. AXI IMMO. https://www.axiimmo.com/raporty-i-publikacje/raport-powierzchnie-biurowe-w-polsce-2019

Polish Office Research Forum. (2017). *Office 2017, Guide New Warsaw office zones*. Colliers International. http://bpcc.org.pl/uploads/ckeditor/attachments/12464/Raport_Guide_New_Warsaw_Office_Zones.pdf

Portal of the City of Gdańsk. (2021). *Gdańsk development plan*. https://www.gdansk.pl/studium/obowiazujace-studium-suikzp,a,113625

Przywojska, J., Podgórniak-Krzykacz, A., & Wiktorowicz, J. (2019). Perceptions of priority policy areas and interventions for urban sustainability in Polish municipalities: Can Polish cities become smart, inclusive and green? *Sustainability*, *11*(14), 3962. https://doi.org/10.3390/su11143962

Public Information Bulletin of the City of Kraków. (2014). *Krakow development strategy*. https://www.bip.krakow.pl/?id=48

Rudlin, D., & Hemani, S. (2019). *Climax city*: *Masterplanning and the complexity of urban growth*. Routledge.

Rześny-Cieplińska, J., & Szmelter-Jarosz, A. (2021). Stakeholders' analysis of environmental sustainability in urban logistics: A case study of Tricity, Poland. *Energies*, *14*(5), Article 1274. https://doi.org/10.3390/en14051274

Säynäjoki, E.-S., Inkeri, V., Heinonen, J., & Junnila, S. (2014). How central business district developments facilitate environmental sustainability: A multiple

case study in Finland. *Cities*, *41*, 101–113. https://doi.org/10.1016/j.cities.2014.05.010

Smętkowski, M., Celińska-Janowicz, D., & Wojnar, K. (2019). Nowe przestrzenie gospodarcze metropolii—Od postmetropolii do metropolii mozaikowej? [New economic spaces of metropolises—From post-metropolises to mosaic metropolises?]. *Studia Regionalne i Lokalne*, *4*(78), 28–53.

Smętkowski, M., Celińska-Janowicz, D., & Wojnar, K. (2021). Location patterns of advanced producer service firms in Warsaw: A tale of agglomeration in the era of creativity. *Cities*, *108*, Article 102937.

Stangel, M. (2013). *Kształtowanie współczesnych obszarów miejskich w kontekście zrównoważonego rozwoju* [Shaping contemporary urban areas in the context of sustainable development]. Wydawnictwo Politechniki Śląskiej.

Statistics Poland. (2021). *Registered unemployed persons and unemployment rate. As at the end of January 2021*. https://stat.gov.pl/en/topics/labour-market/registered-unemployment/registered-unemployed-persons-and-unemployment-rate-as-at-the-end-of-january-2021,1,102.html

Tapsuwan, S., Mathot, C., Walker, I., & Barnett, G. (2018). Preferences for sustainable, livable and resilient neighbourhoods and homes: A case of Canberra, Australia. *Sustainable Cities and Society*, *37*, 133–145.

Trakulwattanakit, P. (2021). *Corporations and cities: Designer's intentions and user perceptions of the interaction between corporate office building and the city* [Master's thesis, Delft University of Technology]. TU Delft Repository. https://repository.tudelft.nl/islandora/object/uuid:d35f038b-2ac2-4297-9c4c-6bc1c8ce40a4?collection=education

Van de Putte, H. J. M. (2009). Corporations and cities. *Real Estate Magazine*, *12*(63), 40–45.

Viderman, T., & Knierbein, S. (2020). Affective urbanism: Towards inclusive design praxis. *URBAN DESIGN International*, *25*, 53–62. https://doi.org/10.1057/s41289-019-00105-6

Wilson, D., & Keil, R. (2008). The real creative class. *Social & Cultural Geography*, *9*(8), 841–847.

Wrocław Spatial Information System. (2021a). *Studium uwarunkowań I kierunków zagospodarowania przestrzennego Wrocławia* [Study of the conditions and directions of spatial development]. https://gis.um.wroc.pl/imap/?gpmap=Studium2018&locale=en

Wrocław Spatial Information System. (2021b). *Plany miejscowe* [Local spatial development plans]. https://gis.um.wroc.pl/imap/?gpmap=gp7&locale=en

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Article

# The New Distribution: Spatio-Temporal Analysis of Large Distribution Warehouse Premises in England and Wales

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**Abstract**
This research addresses the deficit of empirical investigation of changes in industrial and warehouse property markets in the UK. It uses business rates (rating list) data for England and Wales to reveal changes in the quantum and distribution of premises over the last decade. Spatio-temporal analysis using geographical information systems identifies where new industrial and warehouse premises have been developed and examines spatial changes in the distribution of premises between the two sectors. The research focuses on the development of new large distribution warehouses (LDWs) to investigate whether there is a new pattern of warehouse premises located in close proximity to junctions on the national highway network. Findings confirm the emergence of a dynamic distribution warehouse property market where "super sheds" have been developed in areas with high levels of multi-modal connectivity. The comprehensive spatio-temporal analysis of all industrial and warehouse premises in England and Wales reconfigures the previously recognised Midlands "Golden Triangle" of distribution warehouses to a "Golden Pointer" and reveals the emergence of a rival "Northern Dumbbell" of distribution warehouse premises in the North of England. Further analysis using isochrones confirms that 85% of the population of Great Britain is situated within four hours average heavy goods vehicle drive time of these two concentrations of super sheds and over 60% of all LDWs floorspace is within 30 minutes' drive of intermodal rail freight interchanges.

**Keywords**
distribution warehouses; drive time; England; GIS; industrial; logistics; motorways; multi-modal; spatio-temporal; Wales

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## 1. Introduction and Context

In recent decades there have been structural changes in the nature of commerce and work, relating to how society creates, buys, and consumes goods. In part, this is due to significant growth in online retailing and e-commerce but also a widespread change in the nature of work, where society is less reliant on manufacturing industry, with more onus on information and consumer services. These changes have consequences for the physical built environment. On the one hand, traditional bricks and mortar shops and large-scale manufacturing buildings face uncertain futures; on the other hand, new ways of working and consuming have fuelled demand for new types of buildings, for example large distribution warehouses (LDWs), located in close proximity to nodes of multi-modal connectivity. These buildings have been constructed in response to the aforementioned demand

from distribution and logistics firms, much of which has been built in close proximity to junctions on national highway networks.

In turn, these changes in the built environment and land use have implications for those studying and working in the fields of urban (spatial) and economic planning. The changing nature of property markets requires recalibration of international planning and development perspectives, that need to identify, safeguard, and release land for LDWs situated in locations that benefit from high inter-modal connectivity. More broadly, the research will be of interest and relevance to a variety of market participants in manufacturing, distribution, and logistics sectors; industrial and warehouse tenants and owner occupiers; commercial and industrial sector landlords and investors; industrial and warehousing real estate agents and developers; inter-modal freight operators; and central and local government civil servants responsible for transport, spatial planning, and economic development.

Despite having been one of the most dynamic property market sectors of the last decade, distribution warehouse premises have received far less attention from researchers and market analysts than, for example, residential or commercial property market sectors, reminiscent of the Cinderella status previously afforded to their antecedents, industrial sheds. Although often existing in relatively peripheral locations, these buildings play a pivotal role in servicing urban and rural economies, via the distribution of vital goods, helping underpin society and the wider economy. Whilst distribution warehouses employ approximately half the full time equivalent employees of similarly sized industrial premises—according to Drivers Jonas Deloitte (2010), the employment density of large scale, high-bay warehouses is approximately half that of general and light industrial premises, at 80 $m^2$ per full time employee (FTE) compared with 36 $m^2$/FTE for B2 General Industrial and 47 $m^2$/FTE for B1 Light Industrial uses—they are crucial components in the complex spatial ecology of the manufacturing and distribution of consumer goods, via increasingly sophisticated logistics networks, to satisfy ever demanding consumers, retailers, and suppliers. It is also worth noting that the growth in demand for LDWs in the UK has been accelerated by post-Brexit onshoring, driven by concerns about the resilience of global supply chains and the need for healthcare providers to store millions of items of personal protective equipment and other vital medical supplies to tackle the Covid-19 global pandemic.

It is this gap in knowledge that this article seeks to address through the lens of the industrial and distribution sector in England and Wales. The ambition of the research is to investigate, at a national scale, whether there has been a shift from established industrial and warehouse market locations, towards new patterns of location and land use, influenced by demand for premises from new and emerging sectors of the national economy. Whilst the research focuses on England and Wales (in part due to the availability of reliable spatial data; see Section 3.1), the trends observed are similar to those being experienced by other countries with mature industrial property markets and growing warehouse and distribution sectors that serve, not only advanced manufacturing "just in time" production methods, but also the modern consumer requirements of "next day delivery" fulfilment, driven by the relentless growth in online shopping and e-commerce.

In order to examine this gap in knowledge, the article utilises a novel methodology founded upon national property taxation registers that are used to:

a) Map the location of industrial and warehouse premises in the England, between 2010 and 2020;
b) Record changes in the quantum and distribution of floorspace;
c) Reveal the areas where new industrial and warehouse development has been concentrated;
d) Shed light on some of the underlying drivers of some of the reported trends.

This is achieved by a bespoke geographical information systems (GIS) model that applies isochrone analysis. While the primary focus of this article is on England, it is important to note that the underlying data sets deployed in this study also cover Wales, while the travel distances include southern Scotland. The remainder of the article situates the research in wider literature, before setting out a novel and replicable methodology in detail, presenting and discussing the highly original results and findings, and offering final conclusions and contemplation of the significance of the research.

## 2. Review of Literature

Whilst commercial and industrial property location theories based on transport and factor costs, established by the likes of Alonso (1964), Isard (1956), Losch (1954), and Weber (1929) explain patterns of commercial and industrial activity that have prevailed in developed countries throughout the twentieth century, such theories may no longer explain twenty-first century commercial and industrial property market development trends. Traditionally, industrial facilities and premises were located close to sources of raw materials and power. The creation of employment opportunities then attracted workers and transport infrastructure was created to convey manufactured goods (Ball, 1984). Due to technological and socio-economic changes, these relationships have gradually been breaking down.

New economic geographers, such as Krugman (1991), have argued that transport costs, along with economies of scale, market size, and competition influence the location of industry. However, as Holl (2004) observes, transport infrastructure improvements can change the relative importance of concentrating (market size and agglomeration economies) and dispersing forces (factor

costs and competition). Consequently, better transport connections can make areas of lower economic activity more attractive for firm location as they gain better access to markets in the core areas (Holl, 2004). Modern manufacturing is more footloose, with proximity to raw materials replaced by connectivity with distribution and logistics networks to serve just-in-time manufacturing processes in a move toward more distributed production networks (Matt et al., 2015).

Such trends have led to changes in planning policy: for example, The Town and Country (Use Classes) (Amendment) (England) Regulations 2020 (UK Government, 2020), which revoked the B1 Business Use Class (including light industrial) and created a new Commercial, Business and Service Class E, which places light industrial manufacturing within the commercial sector, whilst retaining B2 General Industrial and B8 Storage and Distribution as separate use classes. However, many local plans (the documents which, in the UK planning system, establish suitable locations for different types of new development) do not make a distinction between land allocated for B2 and B8 uses.

The relationship between spatial variables and the distribution of commercial and industrial property has been investigated in a variety of different countries and contexts. Seo et al. (2018) investigated commercial property values in relation to light rail and highway infrastructure in the US, considering both their negative and positive effects; Kadokawa (2018) investigated the relationship between manufacturing locations and the distance to highway interchanges in Japan; and Debrezion et al. (2010) investigated the relationship between commercial property value and proximity to railway stations in the Netherlands. Other researchers have considered the inter-relationship between a number of different variables. For example, Schoenmaker and Van der Vlist (2015) examined the relationship between commercial and residential real estate markets in the Netherlands, and Droj and Droj (2015) used locational analysis software to evaluate commercial real estate properties in Romania, resorting to GIS to map factors such as physical conditions, pollution, infrastructure, social conditions, and legal or planning constraints. Z. Yang et al. (2020) investigated the inter-relationship between new railway infrastructure, and the development of international logistics.

Particularly with reference to the research by Kadokawa (2018) and Debrezion et al. (2010), it is relevant to note that the importance of different modes of transport has changed over time. In the early nineteenth century, watercourses—natural and artificial—were the most important conduit for raw materials and goods. As the century progressed, railways became more important, and, in the twentieth century, the development of national highway networks as well as the increasing availability of motorised vehicles brought about modal shift towards road transport—not just for goods and raw materials, but also for employees and customers. Whilst the canal and river network in the UK are now less relied upon for transportation of bulk materials, rail freight still plays an important role not least because it produces 65% less $CO_2$ than road freight (Laing & Mofid, 2020).

Modal shift is particularly apparent in the warehousing and distribution sector, where changes in consumer preference from "bricks and mortar" to online retailing has not only had consequences for the retail sector and the performance and functionality of central business districts and out of town shopping centres, but also for complementary sectors such as distribution and logistics. Even before the Covid-19 pandemic, online retailing or e-commerce amounted to 19.1% of the total UK retail market in 2019 (Kotak & Vezyridis, 2020). The Covid-19 pandemic of 2020–2021 has accelerated the trend, with online retail sales in the UK peaking at 31% of all sales in June 2020 (Dalgleish, 2021) leading to a crisis in "bricks and mortar" retail property, up to 40% of which may now be surplus to requirements (Greenhalgh, 2020).

Growth in online shopping increases demand for distribution warehouse premises, evidenced by property markets for large distribution warehousing registering strong demand and growth in the decade following the 2008–2013 recession. Whilst most new LDWs in the UK have been developed along the M1 motorway corridor (Jackson & Rae, 2020), the North-West of England experienced large increase in take-up and development and the North-East and Yorkshire recorded its strongest ever performance, with a 170% increase above the long-term average, particularly large warehouses of over 100,000 sq. ft (9,290 $m^2$) and "super-sheds" of over 500,000 sq. ft (46,451 $m^2$; Mofid & Asher, 2020). Access to major highways is becoming more, rather than less, important as growth of online retailing shifts the mechanism of supply towards warehouses from which goods are delivered directly to customers rather than via retailers (Kadokawa, 2018).

At the same time, technological development, and the take-up of new technologies, has permitted changes in the way warehouses operate. Picking and transporting goods within a warehouse, scanning, inventory, and documentation can all be automated. This has implications for the buildings themselves. According to Jackson et al. (2019), the specification of new LDWs typically includes 15–21 m bay heights, although 22–30 m bays—facilitating automated and robotic stock handling and picking at heights that forklift trucks cannot reach—are becoming more common. The new taller breed of distribution warehouses is more voluminous, allowing insertion of space-saving mezzanine floors, and accommodate greater quantity of stock, operate around the clock 24/7, consume large amounts of electricity and, despite automation, still require a large nominal workforce (Jackson et al., 2019).

This raises the question as to whether factors influencing the optimal location of warehouse and distribution premises are the same as they were. Over the past three decades, a common pattern for logistics

has been for goods to arrive at ports in the south of England, and then to be transported to warehouses in the "Golden Triangle"—an area lying in between Birmingham, Northampton, and Nottingham, from which it is estimated 90% of the UK's population can be reached in four hours journey time (Lupton, 2018). The goods are then transported by road to retailers and suppliers elsewhere in the country. Demand has remained strong over recent years, with 39% of all new warehouse leases in the UK having been taken within the Golden Triangle (Laing & Mofid, 2020). However, due to high rents and property prices in the Golden Triangle, distribution and logistics operators have begun to look further afield for cheaper alternatives (Lupton, 2018). Laing and Mofid (2020) think it illogical and environmentally inefficient for goods bound for the north of the country to be shipped to the south coast, then transported by road to a central location, and then moved on by road to their final destination, when they could be shipped to the north of England . More sophisticated and intelligent logistics systems could allow a shipment of goods to be split at its origin into a northern and a southern shipment rather than arriving in Dover, Felixstowe, Southampton, or London Gateway and then being distributed via warehousing in the Golden Triangle.

This research seeks to exploit the availability of comprehensive national non-domestic (business) rating list data for England and Wales, to investigate what patterns of change can be observed in the size, distribution, number, and location of industrial and warehouse properties in England, between 2010 and 2020, and their relationship to the national highways network and major population centres.

## 3. Methodology

The methodology has been designed to address the previously identified gap in existing research, namely the lack of a comprehensive national level mapping and analysis of changes that have occurred to the quantum and distribution of industrial and warehouse premises in England and Wales over the last decade. The study exploits the capacity of GIS software to measure distances efficiently and accurately between premises and other geographical features, in this case LDWs, industrial premises and major junctions in the national highway network. This was pursued in order to validate the existence of a large cluster of LDWs in the Midlands, known as the Golden Triangle, and reveal whether other concentrations have emerged elsewhere in England and Wales, particularly in respect of "super sheds." The methodology deploys isochrone analysis of distance by average journey time for road freight in order to reveal the population of Great Britain within range of single heavy goods vehicle (HGV) journeys. Finally, the spatial analysis overlays the national rail freight network and strategic interchanges to reveal the proximity of inter-modal facilities with identified concentrations of LDWs.

### *3.1. The Dataset*

In the UK, all non-residential property is taxed on the basis of its "rateable value," which is benchmarked and revalued by the Valuation Office Agency (VOA), on behalf of the Government, every five to seven years (Ministry of Housing, Communities and Local Government, 2020). Due to the predominantly privately-owned, complex, and fragmented tenure of commercial real estate in the UK, rateable values are calculated for hereditaments, which represent smaller units of property, rather than whole buildings. A hereditament is defined as:

> A piece of real, inheritable and taxable property on which (business) rates can be charged. A hereditament generally corresponds to an extent of floor space suitable for a single occupant and might comprise a piece of land, a number of separate buildings, a single complete building, one or more floors within a building, or part of one floor. (Myers & Wyatt, 2004, p. 288)

Properties in the VOA list are classified by bulk classes: industry, retail, office, and "other." The last category covers a range of different land uses, such as advertising rights, public houses, police stations and schools. Of those hereditaments where floorspace data are published, 60% of the total floorspace is industrial, 13% offices, 16% retail, and 11% "other". It is worth noting that, because different sectors generate hereditaments of different sizes, the relative shares by number of hereditaments is more evenly distributed across the bulk classes: 28% industrial, 22% offices, 27% retail, and 22% "other."

The bulk classes are classified into 369 special category (SCAT) codes which represent more specific land uses. The VOA states that within the industry sector, there are 20 SCAT codes, but admits that the relationship between sector and SCAT is not an exact science (VOA, 2020). In 2020, there were 49 SCAT codes within which at least some of the records were classed as "industry.'' However, for the purposes of this research, data for the following industrial, storage, and warehousing SCAT codes were used:

- 096 Factories, Workshops, and Warehouses;
- 151 Large Distribution Warehouses (LDWs);
- 153 Large Industrials over 20,000m$^2$.

These represent three of the four largest categories of industrial property, by floorspace, in the UK. The fourth category, land used for storage, is excluded because it consists of land rather than buildings which is not immediately relevant to the study of industrial and warehouse premises. The 20,000 m$^2$ threshold for large industrial premises is consistent with the custom and practice of UK industrial agents to use 200,000 sq. ft (imperial measurement) as the threshold between regular and large

industrial and warehouse premises in their market analyses. The dataset was analysed in four different ways, as illustrated in Figure 1. Firstly, the total floorspace, average floorspace, and number of units in each of the three categories were calculated.

Secondly, the records were geocoded by matching against an existing geocoded dataset of postcodes, and the straight-line distance between each unit and the nearest motorway junction (MJ) was calculated using the "join attributes by nearest" function in QGIS. The average distance from industrial unit to MJs, for each category of industrial property, in 2010 and 2020, could then be calculated. This also permitted calculation of the total floorspace and number of industrial units proximal to each MJ.

Thirdly, subsets of the 2010 and 2020 datasets were compared by matching Unique Address Reference Numbers (UARN) pertaining to each record. UARNs are allocated to hereditaments by the VOA and cease to exist when a property is redeveloped or another major change has taken place. Therefore, by matching datasets by UARN, it is possible to establish which units were present in both 2010 and 2020, which ones fell out of use, and which ones were newly constructed. It is also possible to track change-of-use by comparing the use class in 2010 with the use class in 2020.

Fourthly, isochrone analysis was carried out on MJs (using Open Roads Dataset—see Figure 1) and rail freight interchanges. Isochrone analysis has been well established as a tool for investigating accessibility and modelling the impact of a range of developments in relation to transport networks (see Fayman et al., 1995; O'Sullivan et al., 2000; L. Yang et al., 2020). 60-minute isochrones were calculated using the ORS Tools plugin for QGIS. Four-hour isochrones were calculated using the Network Analyst function on ArcMap, using Ordnance Survey OpenRoads data to create a model road network. An assumption was made that HGVs would travel at a maximum of 60 miles per hour (96 km per hour) on motorways and dual carriageways and 50 miles per hour (80 km per hour) on single carriageways. This takes account, firstly, the Department for Transport average speed statistics on the Strategic Road Network from 2015 to 2020 (Department for Transport, 2021); and, secondly,

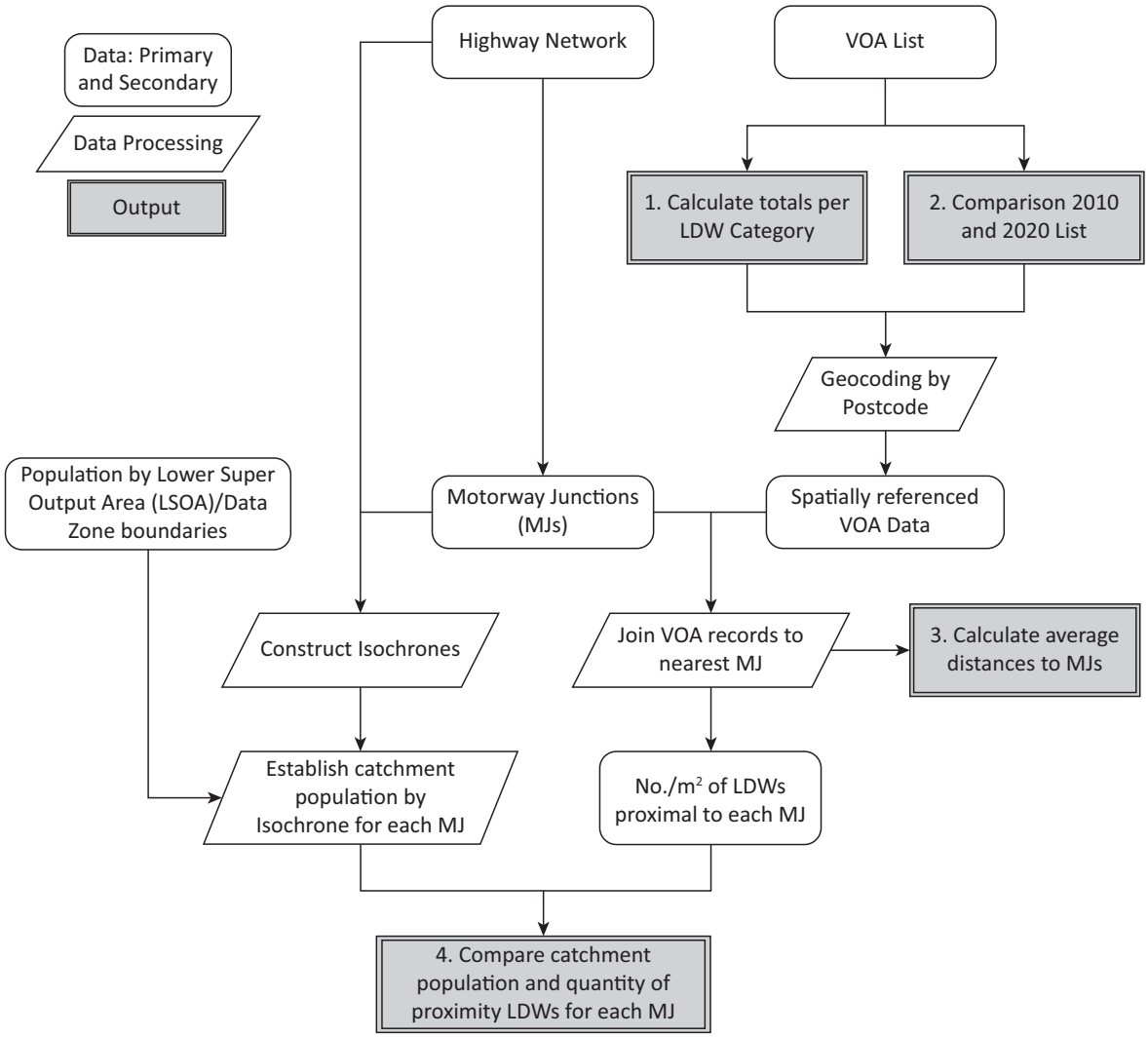


**Figure 1.** Research method and analysis flowchart.

of UK speed limits for HGVs. These assumptions are, of course, open to question, since speeds vary considerably with time of day, weather and road conditions, and location. However, they provide us with a starting point for an approximate analysis of the effective catchment areas of each junction.

The resulting isodistance polygons were compared with a population map of the Great Britain, constructed by combining Scottish data zones and their estimated population for 2019 (National Records of Scotland, 2019; Scottish Government, 2011) with Lower Super Output Areas for England and Wales and their estimated population for 2019 (Office for National Statistics, 2016; Park, 2020). It was then possible to compare the population (as a proxy for the number of consumers that need to be supplied by distribution networks) within a four-hour isochrone of each MJ with the amount of LDWs floorspace proximal to it, and to establish whether any sort of relationship existed between the two. Thus, LDWs can be grouped by proximity to MJs, on the basis of which MJ is nearest permitting mapping of both the number of LDWs and the quantum of LDWs floorspace proximal to each MJ in 2010 and 2020.

## 4. Results and Findings

### *4.1. Change in Industrial Property Size and Distribution Between 2010 and 2020*

#### 4.1.1. Change in Floorspace and Number

Between 2010 and 2020, the total floorspace ($m^2$) of large industrials and factories, warehouses, and workshops in England and Wales decreased by 11.9% and 1.4% respectively. Factories and warehouses actually increased in number, but large industrials declined by 17.3%. The total quantities of LDWs, however, increased by 21.9% by number and a significant 36.1% by area (Table 1).

#### 4.1.2. Change in Average Size

LDWs have increased in size, as they have increased in number. The situation with other types of industrial property is a little less straightforward. On average, smaller industrial premises have increased in number but declined in size, so the total floorspace is almost the same. Large industrial properties, however, have increased in size but decreased in number. An alternative way of looking at the situation might be to say that, *on average*, industrial premises have tended to decline in size and that this is the cause of a modest decline in overall industrial floorspace between 2010 and 2020 (see Table 2).

#### 4.1.3. Distance to MJs

Results confirm that proximity to motorways is more significant for LDWs than for other industrial uses. The average distance between a distribution warehouse and the nearest MJ is approximately half the comparable distance for a large industrial unit or a smaller industrial property. Analysing 2010 and 2020 records reveals that markets are polarising, with distance to MJs increasing for smaller industrial properties and decreasing for LDW and industrial units (Table 3).

### *4.2. LDWs: Comparison Between New, Existing, and Defunct Units*

The majority of industrial properties of all kinds were present both in 2010 and 2020. A comparison between units that ceased to exist, and those which persist, can help understand processes that are taking place. Underlying changes in stock, as a response to occupier demand, register as changes in the average size of a category of property. For example, an increase in average size could be due a combination of lost units being smaller, new units being larger or persisting units growing in size,

**Table 1.** Change in floorspace ($m^2$) and number of units by category, 2010–2020.

| | SCAT Description | | |
|---|---|---|---|
| Dataset | Factories, Workshops, and Warehouses | LDWs | Large Industrials (Over 20,000 $m^2$) |
| Aggregate in $m^2$, 2010 | 237,433.187 | 27,440.932 | 36,885.484 |
| Aggregate in $m^2$, 2020 | 234,046.777 | 37,338.878 | 32,492.964 |
| Change in $m^2$, 2010–2020 | −3,386.409 | 9,897.945 | −4,392.520 |
| Change in %, 2010–2020 | −1.4 | 36.1 | −11.9 |
| Number of units, 2010 | 337,582 | 1,113 | 1,099 |
| Number of units, 2020 | 365,859 | 1,357 | 909 |
| Change in number, 2010–2020 | 28,277 | 244 | −190 |
| Change in %, 2010–2020 | 8.4 | 21.9 | −17.3 |

**Table 2.** Change in average size of industrial premises ($m^2$) by category, 2010–2020.

| | SCAT Description | | |
|---|---|---|---|
| Dataset | Factories, Workshops, and Warehouses | LDWs | Large Industrials (Over 20,000 $m^2$) |
| Average in $m^2$, 2010 | 703 | 24,655 | 33,563 |
| Average in $m^2$, 2020 | 640 | 27,516 | 35,746 |
| Change in $m^2$, 2010–2020 | −64 | 2,861 | 2,183 |
| Change in %, 2010–2020 | −9 | 11.6 | 6.5 |

**Table 3.** Distance (m) to MJ by category, 2010–2020.

| | SCAT Description | | |
|---|---|---|---|
| Dataset | Factories, Workshops, and Warehouses | LDWs | Large Industrials (Over 20,000 $m^2$) |
| Average distance in km, 2010 | 14.982 | 6.697 | 12.600 |
| Average distance in km, 2020 | 15.272 | 6.385 | 12.178 |
| Average change in m, 2010–2020 | 290 | −312 | −422 |
| Change in %, 2010–2020 | 1.9 | −4.7 | −3.3 |

or a combination of two or three of these. The average size of LDWs increased because the average size of lost units was lower than average, the size of new units greater than average, and because persistent units increased slightly in size over the period. Similarly, lost units were slightly further away from MJs than the average for 2010, and new units were closer than the average for 2020.

Perhaps the most significant observation is that there were many more new units than persistent or lost ones, a key finding being that units which contribute the most to the characteristics of the sector are those constructed in the last ten years. Despite increased bay heights, average building footprints have also continued to increase, as have yard depths and car parking, thus requiring more land (Jackson et al., 2019). Of the 20 largest "super sheds" built in 2020, all were over 100,000 $m^2$; of these, 14 belonged to individual retail companies that also have a physical retail presence (of which four belonged to Next); three belonged to Amazon; and three belonged to logistics companies (see Figure 2). Most very large warehouses are bespoke, typically procured and constructed under design and build contracts (Jackson et al., 2019), and are suitable only for the purpose for which they were originally constructed (see Table 4).

Having established that the number and floorspace of LDWs in England and Wales has increased in the past ten years, the next section considers where this increase has taken place, and why.

### *4.3. Relationship Between LDWs Location and Access to Customers*

LDWs locate in close proximity to MJs; on average, they are less than 7 km away from MJs, well below the average distance to MJs of the other industrial categories covered by this study. Their distance to MJs is declining over time, as newer units tend to be built slightly closer to MJs

**Table 4.** Characteristics of new, lost, and persisting LDWs, 2010–2020.

| | All units, 2010 | Lost units | All units, 2020 | New units | Persistent units, 2010 | Persistent units, 2020 |
|---|---|---|---|---|---|---|
| Number of units | 1,113 | 451 | 1,357 | 695 | 662 | 662 |
| Aggregate in $m^2$ | 27,440,932.00 | 10,303,661.00 | 37,338,878.00 | 20,013,185.00 | 17,137,271.00 | 17,325,692.00 |
| Average in $m^2$ | 24,654.90 | 22,846.30 | 27,515.80 | 28,795.90 | 25,887.10 | 26,171.70 |
| Average distance (m) to MJ | 6,697 | 6,824 | 6,381.20 | 6,170.50 | 6,610.60 | 6,602.40 |


**Figure 2.** Location of the 20 largest LDWs, 2020.

than older ones. LDWs in the Golden Triangle are in high demand, as evidenced by occupier (demand) side indicators such as high rental and capital values. This is due to their coveted locational position within the national motorway network, as well as proximity to the international rail freight network (Daventry International Rail Freight Terminal is located at the heart of the Golden Triangle; Lupton, 2018). This raises the question as to whether there are locations within our study area that are competing with, or have the potential to challenge, those in the Golden Triangle. Some initial observations are possible.

Firstly, the Golden Triangle, as it is commonly defined (see RCS Logistics, 2020), is not a very precise representation of the location of LDWs in the UK, which is a compelling reason to pursue a contemporary, comprehensive, and accurate spatial analysis of the sector. There is an area of the Midlands which is a popular location for LDWs but according to our analysis, it extends further south-east along the M1 corridor towards London and extends across the conurbation of Birmingham and Wolverhampton. We have tentatively outlined this area in Figure 3, naming it the "Golden Pointer."

Secondly, there is a large area in the north of England, covering Leeds, Sheffield, Doncaster, Liverpool, and Manchester, that has a concentration of LDWs floorspace. Again, we have tentatively outlined it in Figure 3, under the name "Northern Dumbbell." Growth

is also seen along the M1 and A1, at Peterborough, and around London and Bristol.

Thirdly, MJs that had a large amount of proximal LDWs floorspace in 2010 tended to have an even larger amount of LDWs floorspace in 2020, whereas the majority of MJs (385 out of 668 in 2020 or 58%) had no proximal LDWs at all. Significantly, by 2020, the majority of all LDWs floorspace in England and Wales were located either in the Golden Pointer or the Northern Dumbbell (22.5% and 30.3% respectively). Between 2010 and 2020, LDWs floorspace overall grew by 36.07%; but growth was unevenly distributed, with the Golden Pointer growing by 44.8% and the Northern Dumbbell by 44.1% whilst the remainder of England and Wales recorded growth of only 27.7%.

Certain MJs underwent intensive development between 2010 and 2020. Five junctions, indicated in Figure 3, saw a ten-fold increase in proximal LDWs floorspace (> 1000%): three in the Northern Dumbbell (J3 of the M606, J28 of the M6, and J8 on the M62), one near London (J11 of the M4), and only one in the Golden Pointer (J24A of the M1). Since the popularity of the Golden Pointer is due to its proximity to the majority of the UK's population, we can hypothesise that the popularity of junctions with a large amount of proximal LDWs floorspace is also linked to their proximity to centres of population.

Analysis appears to show that Northern Dumbbell locations are beginning to compete, in terms of market rent and status, with the Golden Pointer, providing either

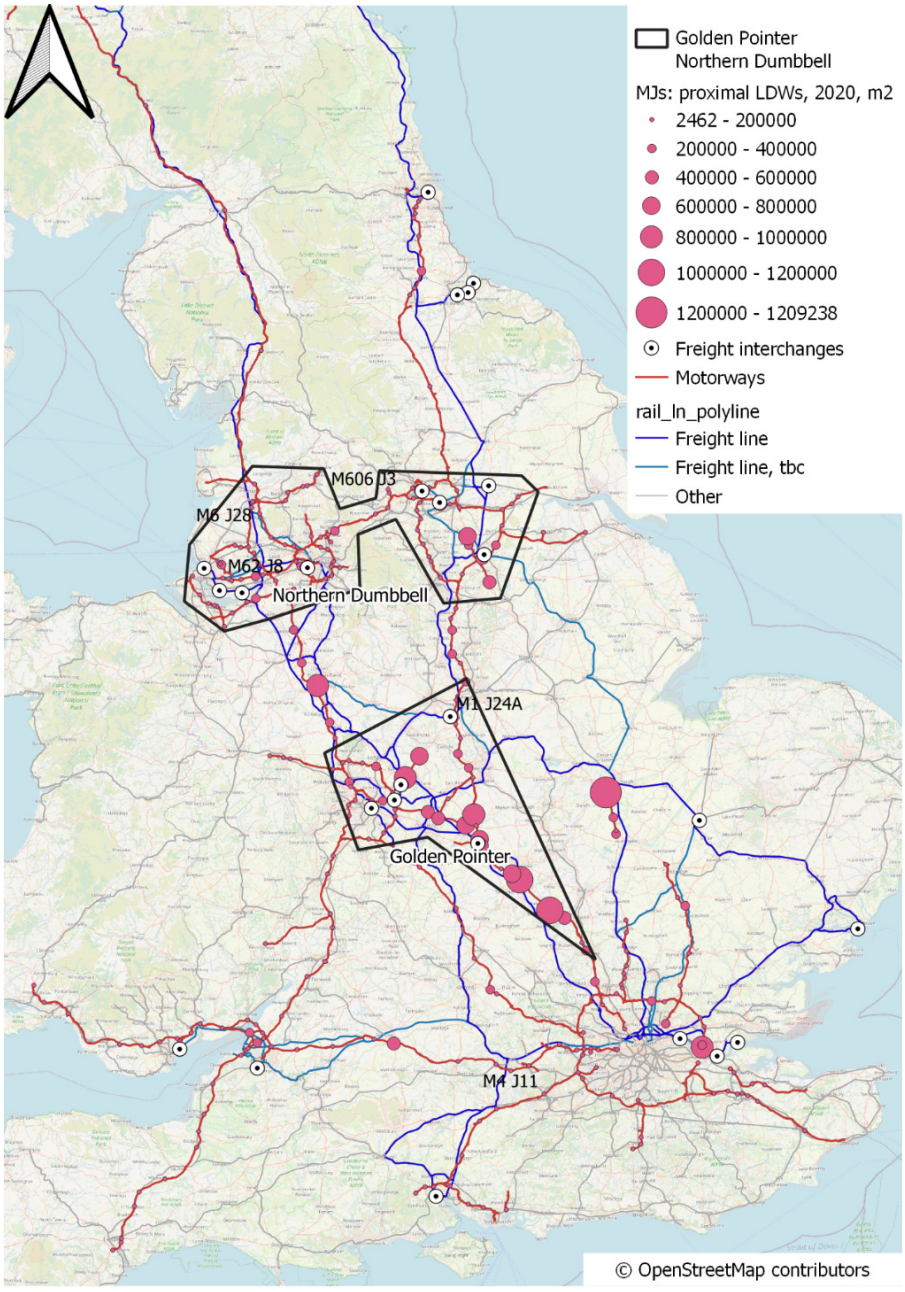


**Figure 3.** LDW floorspace ($m^2$) proximal to MJs, 2020.

an alternative or complementary location from which the majority of the country's population can be reached within four-hour haulage drive time. This is consistent with Laing and Mofid's (2020) observation that distributors are beginning to select two bases within the UK, one in the Midlands and one in the North of England. This can be demonstrated by comparing the isochrone polygon for Junction 38 of the A1—the junction in the Northern Dumbbell with the largest amount of proximal LDWs floorspace—and the corresponding isochrone polygon for Junction 20 of the M1, the most popular junction in the Golden Pointer. The former extends northwards to reach the major centres of Glasgow and Edinburgh, and south to cover London, Bristol, and their hinterlands. In comparison, junctions in the Golden Pointer are within reach of a slightly different subset of the Great Britain, extending to cover almost all of Wales and the South Coast, but not including Edinburgh and Glasgow (see Figure 4).

While junctions within the Golden Triangle (or Pointer) still form a reliable and consistent way of accessing over 85% of the population, the most popular junctions elsewhere in the country—defined here as the junctions with the largest number of proximal LDWs—are able to reach a comparable proportion of the population. Junctions to the south and east of the Golden Pointer, and those to the north of the Northern Dumbbell, tend to have lower catchment populations (i.e., lower numbers

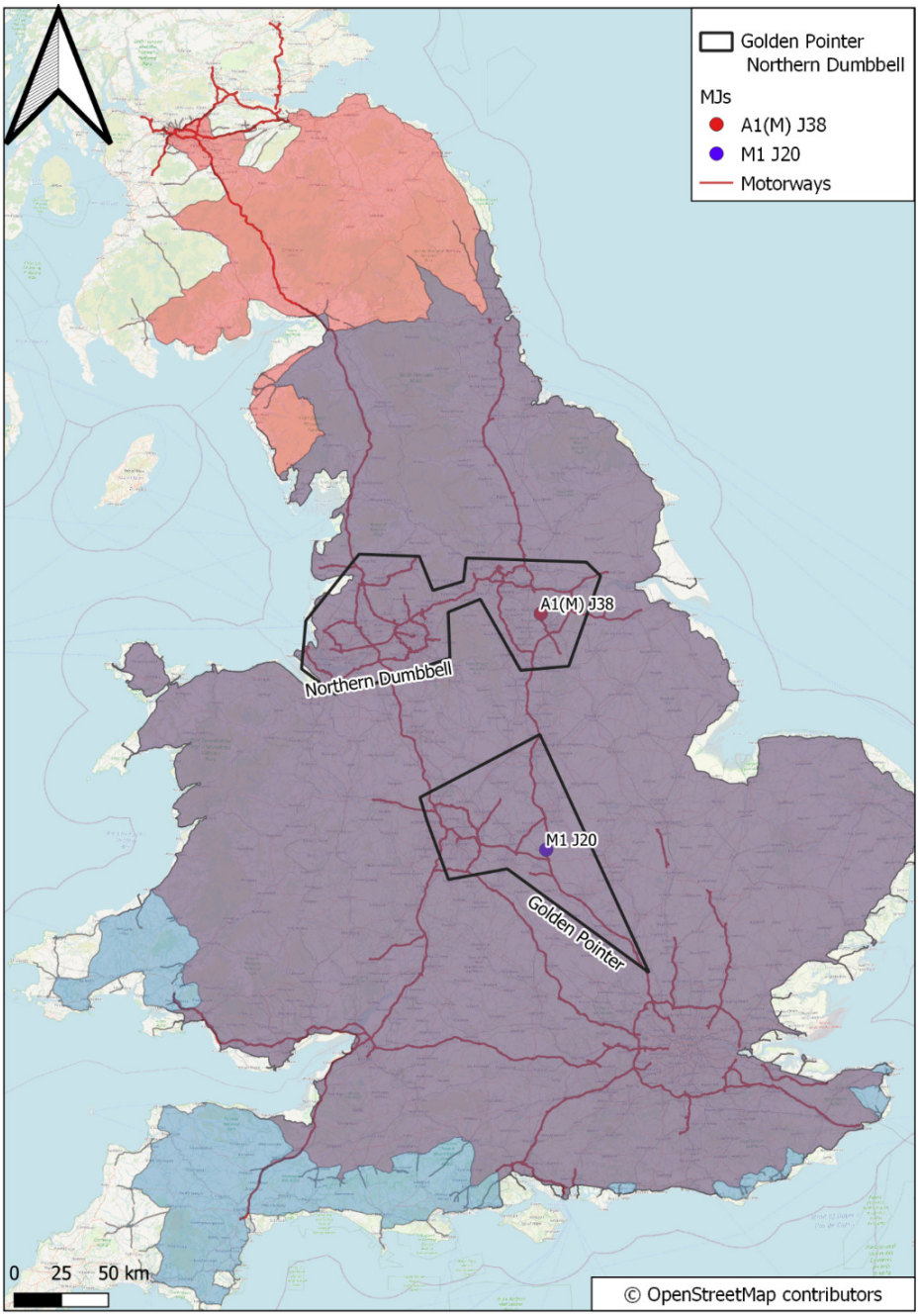


**Figure 4.** Four-hour isochrones for junction 38 of the A1 and junction 20 of the M1.

of people within their four-hour isochrones). This is not the case for the two corridors (M1 and M6) between the Golden Pointer and Northern Dumbbell, which have some of the highest catchment populations in the country (see Figure 5).

Three other factors may be relevant to the location of LDWs. The first is the cost of premises. Broadly speaking, LDWs premises are more expensive the closer they are to Greater London and the M25 in the south-east of England, where land and property prices are higher than locations further north and west (Statista, 2021).

The second is whether premises exist, or can be found, close to MJs. The area in between the Golden Triangle and the Northern Dumbbell contains some of the MJs with the largest catchment populations. However, because this area does not contain many motorways—due to the Pennine Hills at its centre—LDWs here are limited to the corridors of the M6, M1, and A1. Elsewhere, there are some MJs with little or no proximal LDWs space, despite being in an area with many LDWs and high catchment populations; these may be locations where there are few suitable sites.

A third factor may be the distance to the rail freight network, or rather, to rail freight interchanges, of which there are 25 in England and Wales and another five in Scotland (NetworkRail, 2020). Mapping of strategic

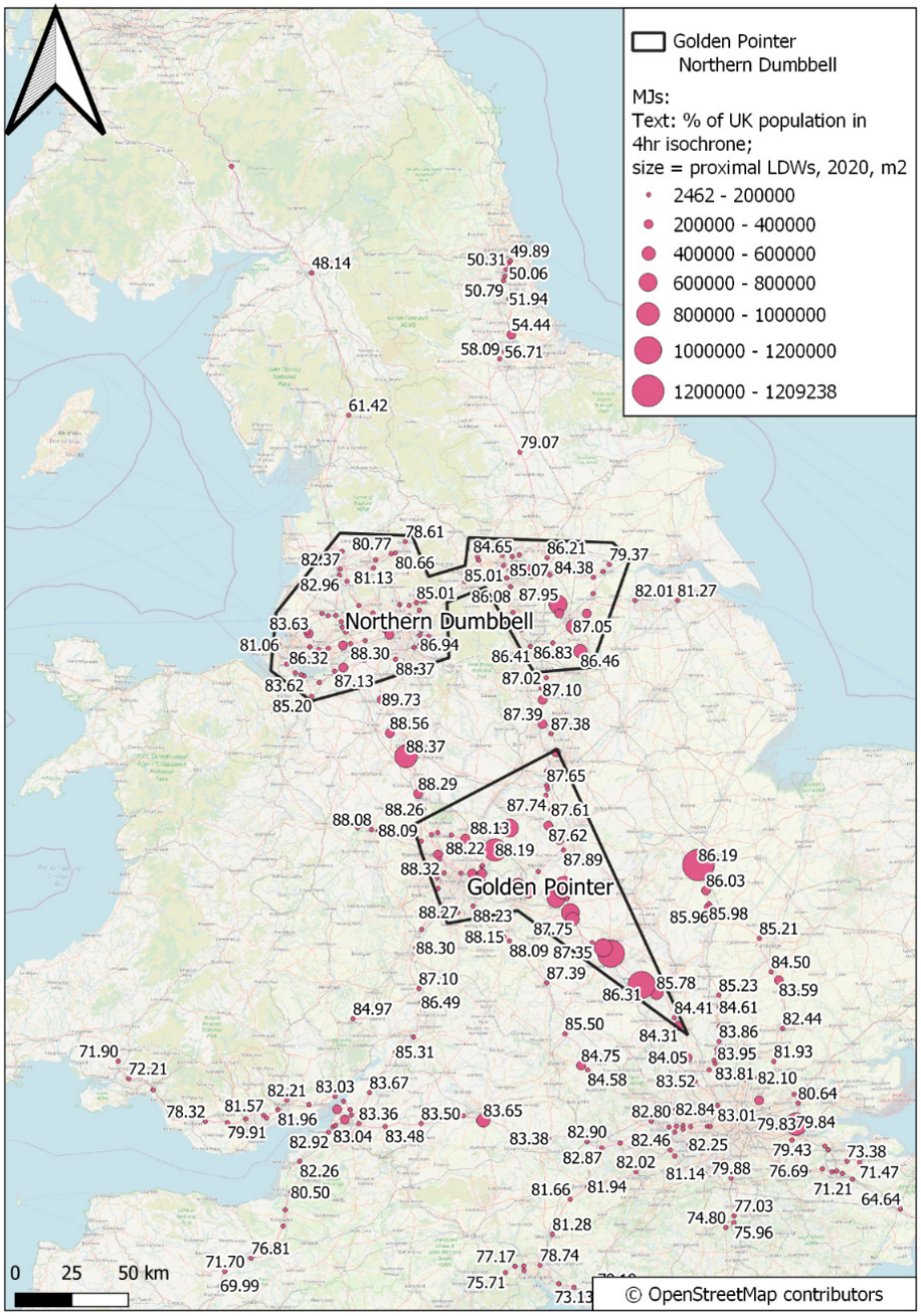


**Figure 5.** Junctions with proximal LDW development (2020) and isochrone population as a percentage of total UK population, 2020.

rail-freight interchanges confirms that the three largest clusters of interchanges sit within the Golden Pointer and either side of the Northern Dumbbell, as shown in Figure 6. The fact that 61.7% of *all* LDWs floorspace in England and Wales is within a 30-minute drive of a rail freight interchange would suggest that this is no coincidence (see AECOM, 2010; Intermodality, 2009).

## 5. Discussion and Conclusions

The research addresses a deficit of empirical study in relation to the increased quantity and concentration of LDWs in England and Wales between 2010 and 2020. In doing so, the article reveals the significance of proximity to population centres, MJs, and strategic rail freight hubs as determinants of location. The research explored the divergence between LDWs and other types of industrial premises and reveals the emergence of a new cluster of distribution warehouses that we have named the "Northern Dumbbell" to rival the already well recognized "Golden Triangle" in the Midlands. Identification, geo-location, and quantification of the existence of this new cluster of distribution warehouses is an original and significant finding of the research, contributing to a better understanding of recent dynamic activity in the distribution warehouse sector in the UK. The findings should be of interest and relevance to policy makers and market participants alike. Having created and

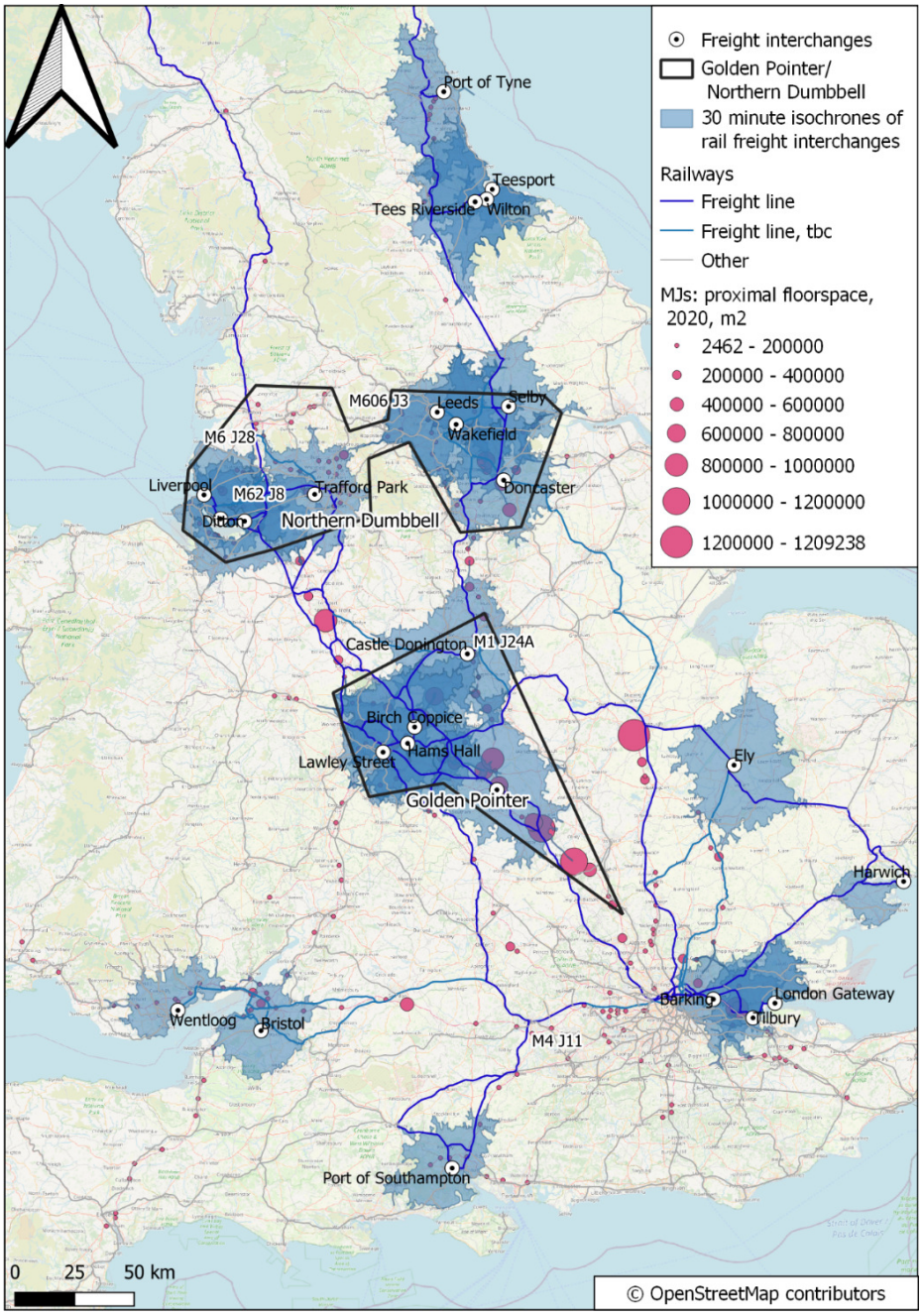


**Figure 6.** 2020 LDWs with 30-minute isochrones of rail freight interchanges.

tested an effective method for analysing and representing changes that have occurred in the quantum and distribution of new industrial and distribution warehousing in England and Wales, there is now the opportunity to conduct comparative studies in other countries with mature industrial markets to identify whether similar sectoral trends can be identified. The method permits the measurement of proximity of premises to junctions in national highway networks and calculation of the population within reach of LDWs calculated with reference to average HGV speed and maximum single journey drive time. The GIS can also integrate national transport infrastructure such as rail freight networks and strategic inter-modal and multi-modal interchanges, such as rail freight interchanges, airports, and deep-water container port facilities.

According to our research, covering England and Wales, over the last decade there has been a decline in industrial floorspace, as defined by the VOA ("Factories, Workshops, and Warehouses" and "Large Industrials") whilst there has been significant increase in LDWs. Total LDWs floorspace has increased by 36% between 2010 and 2020, coinciding with strong growth in online retailing (see Dalgleish, 2021) which has driven demand for more and bigger warehouses to support distribution and fulfillment activity in the UK. Concomitantly, spatio-temporal analysis has revealed that new LDWs are being built closer to highway junctions, with average distances between LDWs and the nearest MJ decreasing over the last decade.

The "Golden Triangle," an area in the Midlands between Birmingham, Northampton, and Nottingham, was already recognized as the UK's primary cluster of LDWs due, in part, to 90% of the UK's population being within four hours travel time, and the area being accessible to strategic ports in the southeast of England. According to our research, between 2010 and 2020, LDW floorspace in the Golden Triangle grew by 44.8%. However, the Golden Triangle's boundaries did not correspond entirely to the pattern of LDW growth in the Midlands. A revised "Golden Pointer" has been identified and tentatively suggested as a more accurate representation of the Midland cluster, including more of the Birmingham/Wolverhampton conurbation and units along the M1 towards London. Growth was also observed around MJs further north, and around Peterborough. Our research also revealed a new rival and previously un-recorded concentration of LDW premises that we have named the "Northern Dumbbell," covering Leeds, Sheffield, Doncaster, Liverpool, and Manchester. Between 2010 and 2020, LDW floorspace in the Northern Dumbbell increased by 44.1%. By 2020, the majority of all LDW floorspace in England and Wales was found either within the Golden Pointer or Northern Dumbbell. According to our isochrone calculations, the proportion of the population of Great Britain that can be reached from the Northern Dumbbell is almost as great as that within reach from the Golden Triangle. Significantly, whilst the Golden Pointer is within four hours journey time of almost all of England and Wales, it is not within reach of Scotland's central belt between Edinburgh and Glasgow; whilst the Northern Dumbbell cannot reach the south-west of England and Wales, it is within four hours drive time of the Scottish Central Belt. It appears that distribution and logistics operators are seeking better value premises in locations outside of the "traditional" Golden Triangle, simultaneously moving towards a two-centre distribution model, one serving northern England and the Scottish central belt and the other covering the midlands and southern England. The emerging Northern Dumbbell also appears to be exploiting the strength of the rail freight network in the north of England. An opportunity for further study is to use kernel density analysis or similar techniques to analyse these locations more rigorously to verify that the "Northern Dumbbell" is a discrete location for distribution and logistics operators, but also whether it rivals or complements the "Golden Pointer" in the Midlands as the prime location for distribution warehousing in the UK.

These findings, into the changing nature of industrial property markets, occurring in response to structural changes in international modes of work, should form a sound basis and early staging post for planners, and associated professionals, in the international community as they consider competing demands on land in strategic locations in relation to national highway and transport networks and nodes. As hinted at in the early part of this article, due to the sheer size of these buildings and the area of land required to accommodate not only the footprint of the building but also ancillary external infrastructure, spatial and land-use planners and transport strategists may need to review their approaches to the allocation, zoning, and designation of land for warehouse and storage use in proximity to existing transport infrastructure and multi-modal interchanges.

There is a need for further research into the mapping and modelling of alternative calculations of drive times and distances, alongside exploration of other ways of capturing the variable ratio of population reached by distance travelled (or time spent travelling) and consideration of the interaction between other variables that may make sites and premises more or less attractive to occupiers.

Another issue for further consideration is the role of A roads—the second most important group of roads in the UK, after motorways. In some locations, they perform the same function as motorways and are counted as part of the Strategic Road Network. Currently there is no standard subset of strategic junctions on A roads that have a similar function to MJs, thus they were excluded from the study; however, if this challenge could be overcome then they could be included within the analysis.

As we have discussed, the rental value of LDW premises varies across Great Britain, with the highest rents and land prices around the M25 London orbital motorway, pushing both developers and occupiers of

"space hungry" distribution warehouses away from expensive locations towards more affordable ones. Reassuringly, the underpinning logic of commercial and industrial property location theories of Alonso (1964), Isard (1956), Losch (1954), and Weber (1929), that there is a trade-off between cost, availability, and location, appears to still be pertinent in today's highly connected consumption driven economy.

Finally, the spatio-temporal method and analysis presented in this article offers potential to further explore the changing relationships between increasingly dynamic commercial and industrial sectors, and the response of real estate markets to changing occupier demands and fixed national transport infrastructure. For example, a contemporary issue in the post-Brexit UK is that of freeports (locations that are outside their geographical country for tax purposes, within which little or no taxes or tariffs are paid). The UK Government invited bids for freeport status from across the UK with the expectation of seven being designated in England and one each in Wales, Scotland, and Northern Ireland, with successful applicants benefitting from a wide package of tax reliefs, simplified customs procedures, streamlined planning processes to boost redevelopment, and government support to promote regeneration and innovation (HM Treasury, 2020; HM Treasury & Ministry of Housing, Communities and Local Government, 2021). In the latest Budget (HM Treasury, 2021), Chancellor Rishi Sunak confirmed approval of eight freeports in England, with further announcements of freeport designation in Wales, Scotland, and Northern Ireland anticipated. There is an urgent need to examine their potential to function as holding bays, or distribution centres, facilitating smoother flow of "tariff free" goods between the UK (including Northern Ireland) and both mainland Europe and the Republic of Ireland, with tariffs only paid when the goods are moved elsewhere (Laing & Mofid, 2020). The method presented in this article offers an analytical tool with which to evaluate and monitor how industrial and warehouse markets respond to the designation of incentivised locations.

## Conflict of Interests

The authors declare no conflict of interests.

## References


AECOM. (2010). *Strategic distribution site: Assessment study for the three cities sub-area of East Midlands. Final report*. https://www.nwleics.gov.uk/files/documents/strategic_distribution_site_assessment_east_midlands_study_final_report_may_2010/Strategic%20Distribution%20Site%20Assessment%20East%20Midlands%20Study%20Final%20Report%20-%20May%202010.pdf

Alonso, W. (1964). *Location and land-use. Toward a general theory of land rent.* Harvard University Press.

Ball, M. (1984). The spaced out urban economy. In D. Massey (Ed.), *Geography matters* (pp. 68–84). Open University Press.

Dalgleish, R. (2021). *Internet sales as a percentage of total retail sales (ratio) (%)*. Office for National Statistics. https://www.ons.gov.uk/businessindustryandtrade/retailindustry/timeseries/j4mc/drsi

Debrezion, G., Pels, E., & Rietveld, P. (2010). The impact of rail transport on real estate prices. *Urban Studies*, *48*(5), 997–1015. https://doi.org/10.1177/0042098010371395

Department for Transport. (2021). *Average speed, delay and reliability of travel times (CGN)*. https://www.gov.uk/government/statistical-data-sets/average-speed-delay-and-reliability-of-travel-times-cgn

Drivers Jonas Deloitte. (2010). *Employment densities guide* (2nd ed.). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/378203/employ-den.pdf

Droj, L., & Droj, G. (2015). Usage of location analysis software in the evaluation of commercial real estate properties. *Procedia Economics and Finance*, *32*, 826–832. https://doi.org/10.1016/s2212-5671(15)01525-7

Fayman, S., Metge, P., Spiekermann, K., Wegener, M., Flowerdew, T., & Williams, I. (1995). The regional impact of the channel tunnel: Qualitative and quantitative analysis. *European Planning Studies*, *3*(3), 333–356. https://doi.org/10.1080/09654319508720310

Greenhalgh, P. (2020, October 22). Up to 40% of UK retail space is not needed—Here's what can be done with it. *The Conversation*. https://theconversation.com/up-to-40-of-uk-retail-space-is-not-needed-heres-what-can-be-done-with-it-148556

HM Treasury. (2020). *Freeports bidding process opens for applications*. https://www.gov.uk/government/news/freeports-bidding-process-opens-for-applications

HM Treasury. (2021). *Budget 2021: Protecting the jobs and livelihoods of the British people*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966868/BUDGET_2021_-_web.pdf

HM Treasury, & Ministry of Housing, Communities and Local Government. (2021). *Freeports bidding prospectus*. https://www.gov.uk/government/publications/freeports-bidding-prospectus

Holl, A. (2004). Manufacturing location and impacts of road transport infrastructure: Empirical evidence from Spain. *Regional Science and Urban Economics*, *34*(3), 341–363. https://doi.org/10.1016/S0166-0462(03)00059-0

Intermodality. (2009). *Rail freight interchange facilities for South Holland District: Summary report*. http://www.southeastlincslocalplan.org/wp-content/uploads/2012/02/Rail-freight-interchange-facilities-for-South-Holland-District-Summary-

Report-November-2009.pdf
Isard, W. (1956). *Location and space-economy: A general theory relating to industrial location, market areas, land use, trade and urban structure*. MIT Press.
Jackson, A., & Rae, R. (2020). *Big box bulletin: Half-yearly update of distribution activity. H1 2020*. Avison Young. https://www.avisonyoung.co.uk/big-box-bulletin-h1-2020
Jackson, A., Rae, R., & Tebbits, G. (2019). *The rising warehouse: Man and machine*. Avison Young. https://www.avisonyoung.co.uk/documents/38901/59345308/The+rising+warehouse+-+man+and+machine.pdf
Kadokawa, K. (2018). Highway access and the critical distance to an industrial location: A survival analysis. *GeoJournal*, *84*(1), 31–54. https://doi.org/10.1007/s10708-018-9846-7
Kotak, H., & Vezyridis, T. (2020). *UK logistics viewpoint: Mild symptoms for industrial property*. CBRE. https://www.cbre.co.uk/research-and-reports/UK-Logistics-ViewPoint-Mild-Symptoms-for-Industrial-Property
Krugman, P. (1991). History and industry location: The case of the manufacturing belt. *The American Economic Review*, *81*(2), 80–83.
Laing, W., & Mofid, K. (2020). *Traditional logistics versus 21st-century demands*. Savills. https://www.savills.co.uk/research_articles/229130/307719-0/traditional-logistics-vs-21st-century-demands
Losch, A. (1954). *The economics of location*. Yale University Press.
Lupton, K. (2018). *Is the 'Golden Triangle' still the centre of UK logistics?* Bis Henderson Space. https://www.bis-hendersonspace.com/is-the-golden-triangle-still-the-centre-of-uk-logistics
Matt, D. T., Rauch, E., & Dallasega, P. (2015). Trends towards distributed manufacturing systems and modern forms for their design. *Procedia CIRP*, *33*, 185–190. https://doi.org/10.1016/j.procir.2015.06.034
Ministry of Housing, Communities and Local Government. (2020). *Business rates revaluation postponed*. https://www.gov.uk/government/news/business-rates-revaluation-postponed
Mofid, K., & Asher, T. (2020). *The logistics market in Yorkshire and the North East*. Savills. https://www.savills.co.uk/research_articles/229130/302066-0
Myers, D., & Wyatt, P. (2004). Rethinking urban capacity: Identifying and appraising vacant buildings. *Building Research & Information*, *32*(4), 285–292. https://doi.org/10.1080/0961321042000221061
National Records of Scotland. (2019). *Mid-2019 small area population estimates for 2011 data zones*. https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/2011-based-special-area-population-estimates/small-area-population-estimates/mid-2019
NetworkRail. (2020). *Rail freight*. https://www.networkrail.co.uk/industry-and-commercial/rail-freight
O'Sullivan, D., Morrison, A., & Shearer, J. (2000). Using desktop GIS for the investigation of accessibility by public transport: An isochrone approach. *International Journal of Geographical Information Science*, *14*(1), 85–104. https://doi.org/10.1080/136588100240976
Office for National Statistics. (2016). *Lower layer super output area (LSOA) boundaries*. https://data.gov.uk/dataset/fa883558-22fb-4a1a-8529-cffdee47d500/lower-layer-super-output-area-lsoa-boundaries
Park, N. (2020). *Lower layer super output area population estimates (National statistics)* [Data set]. Office for National Statistics. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/lowersuperoutputareamidyearpopulationestimatesnationalstatistics
RCS Logistics. (2020, January 29). The Golden Triangle of logistics. https://www.rcslogistics.co.uk/blog-and-news/golden-triangle/2935
Schoenmaker, D. A. J., & Van der Vlist, A. J. (2015). On real estate development activity: The relationship between commercial and residential real estate markets. *Letters in Spatial and Resource Sciences*, *8*(3), 219–232. https://doi.org/10.1007/s12076-015-0144-4
Scottish Government. (2011). *Data zone boundaries*. https://spatialdata.gov.scot/geonetwork/srv/eng/catalog.search#/metadata/7d3e8709-98fa-4d71-867c-d5c8293823f2
Seo, K., Salon, D., Kuby, M., & Golub, A. (2018). Hedonic modeling of commercial property values: Distance decay from the links and nodes of rail and highway infrastructure. *Transportation*, *46*(3), 859–882. https://doi.org/10.1007/s11116-018-9861-z
Statista. (2021). *Annual primary rent costs for warehouses in the occupier logistics market for select cites of the United Kingdom (UK) from the 4th quarter 2014 to the 4th quarter 2020*. https://www.statista.com/statistics/527827/warehouse-primary-rent-cost-logistics-market-united-kingdom-uk
UK Government. (2020). *The town and country (use classes) (amendment) (England) regulations 2020* (SI 2020/757). https://www.legislation.gov.uk/uksi/2020/757/contents/made
Valuation Office Agency. (2020). *Non-domestic rating: Stock of properties including business floorspace. Background Information*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820492/Background_Information.pdf
Weber, A. (1929). *Theory of the location of industries*. The University of Chicago Press.
Yang, L., Chu, X., Gou, Z., Yang, H., Lu, Y., & Huang, W. (2020). Accessibility and proximity effects of bus

rapid transit on housing prices: Heterogeneity across price quantiles and space. *Journal of Transport Geography*, *88*, Article 102850. https://doi.org/10.1016/j.jtrangeo.2020.102850

Yang, Z., Sun, Y., & Lee, P. T.-W. (2020). Impact of the development of the China–Europe Railway Express—A case on the Chongqing international logistics center. *Transportation Research Part A: Policy and Practice*, *136*, 244–261. https://doi.org/10.1016/j.tra.2020.03.022

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Article

# Berlin's Manifold Strategies Towards Commercial and Industrial Spaces: The Different Cases of *Zukunftsorte*

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**Abstract**
Despite being the third largest industrial agglomeration in the world before World War II, Berlin was faced with an economic void after the partition and reunification of the city with many abandoned and alienated commercial and industrial spaces in a compact urban fabric. What has happened with this commercial and industrial heritage over the last 30 years? The main rationale behind this article is to show how Berlin planned and developed some of these spaces through the Zukunftsorte strategy by preserving its historical sites and modernizing its commercial and industrial base. As part of this undertaking, the article combines insights from urban planning and regional innovation studies. Methodologically, a two-step approach is applied: First, the article conducts an analysis of fundamental planning frameworks and technology/innovation policy trajectories with regard to commercial and industrial spaces; second, a multiple-case study analysis of selected *Zukunftsorte* (Adlershof, Marzahn, Schöneberg, Siemensstadt) is carried out to test whether and to what extent those spaces are supported by planning frameworks and exhibit components of what we coined territorial ecosystem models. The data compiled stems from 15 years of work engaging in various planning and policy steering committees, individual or joint research projects, personal interviews with relevant stakeholders, and regular field observations. The findings suggest that Berlin's strategies towards commercial and industrial spaces need to integrate highly contextual approaches since size, progress, operation, means, and timelines of *Zukunftsorte* vary substantially. Whereas Adlershof is a well-functioning network of business, academia, planners, and policymakers with preliminary attempts to embed those stakeholders in residential neighborhoods and the European Energy Forum in Schöneberg—which can be described as a miniature living lab of Adlershof—the other investigated *Zukunftsorte* do not yet deserve to carry this name.

**Keywords**
Berlin; commercial and industrial planning; technology and innovation policies; territorial ecosystem models; territorial innovation models; Zukunftsorte strategy

**Issue**
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## 1. Introduction

Urban commercial and industrial spaces undergo transformations in manifold ways: as abandoned brownfields, residential neighborhoods, shopping centers, revitalized old industrial sites, urban areas for events and spectacles, milieus for creativity and innovation, or modern living labs (Kitzmann & Suwala, 2018). Once the third largest industrial agglomeration in the world, Berlin looks back on a long history of such spaces. The city's unique past of being devastated by the World War II, partitioned during the Cold War, deprived of suburbanization processes

until 1990, and hollowed out shortly thereafter left behind many empty commercial and industrial spaces inside a compact urban fabric (Ellger, 1992; Kulke, 2003). Against this background, the purpose of this article is to shed light on how Berlin planned and developed some of these spaces using the Zukunftsorte strategy to preserve its historical sites and modernize its commercial and industrial base. As part of this undertaking, we combine insights from urban planning and regional innovation studies. This distinctive theoretical perspective makes it possible to analyze not only planning frameworks to preserve and develop such areas, but also technology and innovation initiatives to revitalize and modernize them. In doing so, we are able to broaden the view for both subdisciplines and contribute to debates on interdepartmental and integrative planning, as well as territorial innovation platforms and ecosystems. Methodologically, we apply a two-step approach: First, we analyze the planning frameworks and innovation/technology initiatives with regard to commercial and industrial spaces to demonstrate that the Zukunftsorte strategy encompasses policies from both fields; second, using case studies with selected *Zukunftsorte*, we test whether and how those localities align with modern planning paradigms and the other building blocks of territorial ecosystem models (TEM) mentioned above. The data compiled stems from 15 years of work engaging in various planning and policy steering committees, individual and joint research projects, personal interviews with relevant stakeholders, and regular field observations from excursions and walks for international and domestic expert and student groups to all *Zukunftsorte* locations discussed in the article. The article is structured as follows: Section 2 introduces theoretical discourses around commercial and industrial spaces from an urban planning and regional innovation studies perspective, as well as the empirical origins of the Zukunftsorte strategy by reconstructing pertinent planning and policy framework trajectories since 1990 in Berlin; Section 3 examines four examples of *Zukunftsorte* (Adlershof, CleanTech Marzahn [CTM], European Energy Forum [EUREF] Campus Berlin, Siemensstadt 2.0) to assess whether and to what extent modern planning imperatives and other theoretical building blocks of TEM have already been implemented; Section 4 summarizes the main results and pinpoints the value added for ongoing theoretical and empirical discourses.

## 2. Theoretical Accounts and Berlin's Trajectories Toward the Zukunftsorte Strategy

The article applies a twofold perspective on Berlin's strategies towards new commercial and industrial spaces based on urban planning and regional innovation studies. For this purpose, we briefly outline theoretical accounts from both perspectives (2.1), show development trajectories of pertinent planning frameworks and policy initiatives since 1990 (2.2), and amalgamate and pinpoint these theories, frameworks, and initiatives based on the Zukunftsorte strategy in Berlin (2.3).

### *2.1. From Triple-Helix-Driven Commercial and Industrial Spaces to Integrated Regional Ecosystems*

Let us start with some introductory remarks about urban planning and urban governance related to commercial and industrial spaces in Germany and their idiosyncrasies in Berlin. Germany is a federal state with governmental and planning tasks split up between the federal government (*Bund*), states (*Länder*), and municipalities (*Kommunen*). Berlin is both a state and a municipality (called *Bezirke* in this case). In line with the principle of subsidiary, the right of municipal self-administration is constitutionally guaranteed as long as realms of extraordinary urban interest for the entire city are not concerned (e.g., *Flächennutzungsplanung*, i.e., preparatory land-use planning [LUP], or *Stadtentwicklungspläne*, i.e., urban development plans [UDP]). This right comprises compulsory (e.g., *Bauleitplanung*, i.e., communal land-use planning [CLUP]) and voluntary self-government tasks (e.g., communal business development). Apart from the legal responsibilities at different governmental levels, a differentiation can be made based on formal (e.g., LUP) and informal governance and planning tools (e.g., UDP). This repertoire of tasks and tools is legally underlined by pertinent sections of the Federal Land Utilization Ordinance (*BauNVO*, Sections 8–9; Federal Ministry of Justice and Consumer Protection, 2021, pp. 7–8) and specified by sectoral UDPs (UDP Economy) with regard to industrial and commercial spaces. For a long time, the main rationales behind these formal planning frameworks were to preserve existing and develop new spaces either by maintaining a certain commercial and industrial base (e.g., reutilizing brownfields, developing, and operating commercial yards) or by modernizing and renewing this commercial and industrial base (e.g., establishing technology and business incubators, start-up infrastructure). The modernization of the commercial and industrial base and the respective areas were also accompanied by a wave of technology and innovation policies based on so-called territorial innovation models (TIM; e.g., clusters, innovative milieus, new industrial spaces) in the 1980s and 1990s (Moulaert & Sekia, 2003, pp. 291–294). The main idea behind TIM was to co-locate companies from related industries along economic value chains (business) and stakeholders from academia and government (altogether triple helix) on these commercial and industrial premises in spatial proximity. At the same time, the purpose was to connect them in order to generate an endemic and implicit innovation and knowledge base for the (inter)national competitiveness of these territorial entities (Brinkhoff et al., 2012, pp. 122–123).

The increasingly blurred boundaries between the above-mentioned stakeholders of the triple helix, the participation of civic society and the environmental

concerns (fourth and fifth helix) call for novel, holistic, and more flexible planning frameworks, and technology/innovation policies (Brinkhoff & Kitzmann, 2014, pp. 268–275; König et al., 2020, pp. 9–10). With regard to planning frameworks, both an established section of the Federal Land Utilization Ordinance on specially designated areas (*Sondergebiete*; see BauNVO, Section 11 in Federal Ministry of Justice and Consumer Protection, 2021, p. 9) and a new building law category designated as urban areas (*Urbanes Gebiet*; see BauNVO, Section 6a in Federal Ministry of Justice and Consumer Protection, 2021, p. 6) within this framework allow for a greater multiplicity of uses (Brandt et al., 2017, pp. 45–46). In specially designated areas, custom industrial, academic, or residential utilizations patterns can be determined (see Section 3.1). Urban areas are intended to create mixed-use zones with short distances between residence, work, education, culture, and leisure. With regard to technology/innovation policies, a second wave of initiatives, which we coin as TEM, can be observed. TEM can be understood as integrated regional ecosystems (also called regional platforms or open regions) fueled by various types of innovation (e.g., social, cultural) transforming TIMs into innovative, viable, and vibrant urban areas as a result of the participation of civic society and environmental concerns (fourth and fifth helix) legally secured by binding planning laws and guiding planning frameworks (Schmidt et al., 2018, pp. 190–193; Suwala & Micek, 2018, pp. 354–355). This in turn requires integrated and interdepartmental planning measures and efforts for economic land (*Wirtschaftsflächenkonzepte*) well beyond the narrow borders of commercial and industrial logics, or more generally as places for work (*Orte der Arbeit*; Wagner-Endres et al., 2018, pp. 24–25). Here, knowledge as the dominating production factor alters locational requirements and disrupts production logics with great potentials driven by technological advancement or re-urbanization of production (e.g., floor space efficiency, multifunctional buildings, and vertical production), but these developments also have to cope with manifold new problems (e.g., scarce areas, land-use conflicts, displacement of low-yield uses; see Henckel et al., 1986; Wagner-Endres et al., 2018).

Given this combined theoretical framework of an extended understanding of TIM underlined by planning frameworks and resulting in TEM, we will consider Berlin's *Zukunftsorte* as a blueprint for the future development of commercial and industrial areas—or, in short, as promising places to live and work—and test whether selected locations already fulfill theoretical prerequisites. While doing so, we will focus on the four helices of academia (university), business (enterprises), government (policies), and civic society (housing) and also consider how these locations are supported by planning frameworks (a largely neglected dimension of the government helix; see Section 3). Before investigating this, we will provide additional background information on Berlin's planning and policy frameworks for commercial and industrial spaces since 1990 in general and in conjunction with the Zukunftsorte strategy in particular.

### *2.2. Trajectories Toward Zukunftsorte*

Despite its legacy as the world's third largest industrial agglomeration (mainly electrical industry, heavy machinery, clothing industry) and its renowned name of *Elektropolis* before the World War II, two caesuras in the second half of the 20th century (World War II, 1939–1945, and the division of Berlin, 1949, 1961–1989) erased this industrial legacy and forced Berlin to start anew (Bähr, 2001; Kulke, 2003). In 1990, Berlin was economically hollowed out as most headquarters of leading enterprises have been relocated to West-Germany and only low-tech highly subsided industrial enterprises remained in the west part of the city (securing employment and strategic provision). In the east part of the city, state-owned industrial combines (*Volkseigene Kombinate*) were not competitive and lost their markets due to the dissolution of the Council for Mutual Economic Assistance (*Rat für gegenseitige Wirtschaftshilfe*; Der Regierende Bürgermeister von Berlin, 2000; Kulke & Suwala, 2015). In addition, Berlin still exhibited the urban characteristics of a Fordist city—high density of land use, compact urban fabric with a mixture of various functions (housing, industrial, commercial)—and had to find new ways to revitalize its commercial and industrial spaces (mostly dormant or abandoned brownfields; Ellger, 1992, pp. 42–43). What has happened since then? Figure 1 shows the most important planning frameworks and innovation/technology policy initiatives in Berlin from the last three decades and illustrates two main trajectories around and toward the Zukunftsorte strategy. We use these trajectories for a thorough analysis of whether those documents align with theoretical models and planning imperatives outlined above (see Section 2.1). It is important to mention that the enforcement and implementation of those frameworks and initiatives depend on the overall political power constellation, social movements, and economic or fiscal situation within the city. Since we stem from the fields of economic geography and regional economics, we predominantly draw connections to economic circumstances where applicable. There are selected events from before 1990 that also need to be outlined in order to understand the whole story. With the exception of the 1994 preparatory LUP, all other city-wide planning frameworks, and in particular pertinent UDPs and technology/innovation policies, have a guiding but not a binding character. The preparatory LUP results in binding CLUPs flanked by voluntary local business development policies at a municipal level (see Section 3).

From a retrospective standpoint, pertinent planning frameworks dealing with commercial and industrial areas string together like pearls on a necklace; grounded on experiences made within the UDP Commerce

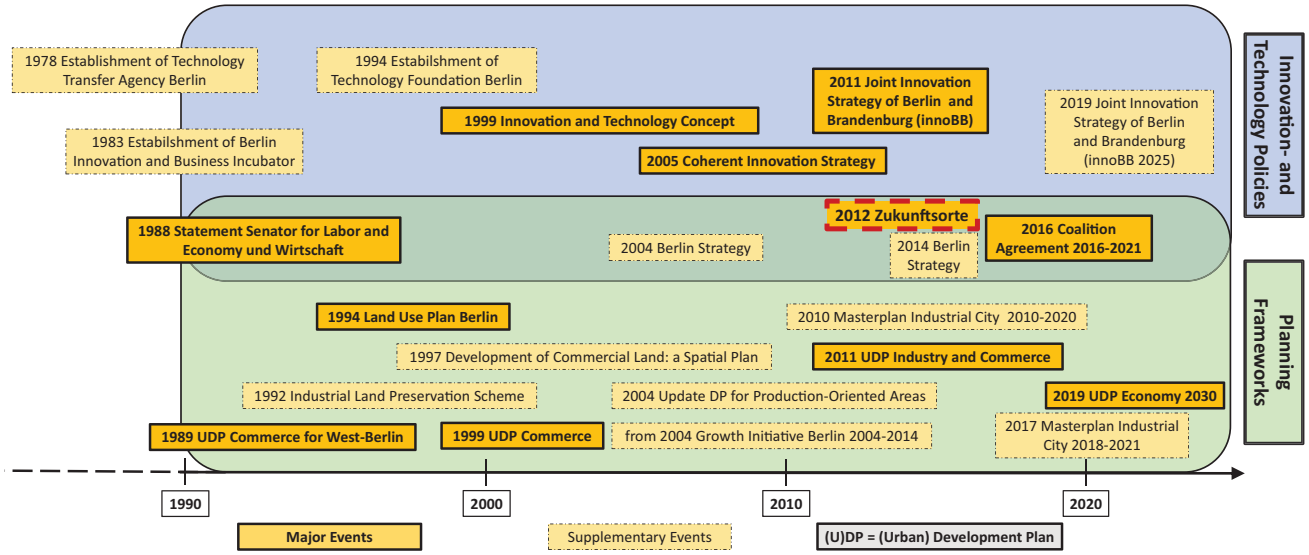


**Figure 1.** Planning frameworks and technology/innovation policy initiatives for commercial and industrial spaces in Berlin.

(*Gewerbe*) for West Berlin in 1989 and reliability in planning derived from the legally binding preparatory LUP in 1994, the Berlin administration developed revised plans (UDP Commerce in 1999, UDP Industry and Commerce in 2011, UDP Economy in 2019) roughly every ten years with updates in between. Two aspects become clear based solely on the designation and the scope of the plans. First, the separation between commerce and industry that prevailed until 2010 has been suspended, conceived jointly and now even merged under the heading "economy." For this to take place, former collateral schemes dealing with particular tasks and sectors of industry and/or commerce (e.g., industrial land preservation scheme [*Industrieflächensicherungskonzept*], development concept for production-oriented areas [*Entwicklungskonzept für den produktionsgeprägten Bereich*]) were subsumed. The "economic" UDPs were embedded in manifold further documents evidencing a broader and integrated understanding of planning and a more transparent development and participation process. They are directly referred upon in the 2004 and 2014 Berlin Strategy (updated in subsequent years) and coordinated with other UDPs (transport, mobility, retail, housing); moreover, they are also taken into account within the Industrial City Master Plan and its successors, compiled and approved by multiple stakeholders (administration, business, society; e.g., Senate Administration for Urban Development, 2004, pp. 47–48, 2011, pp. 6, 13; Senate Administration for Urban Development and Housing, 2020a, pp. 12–13, 24–25). Second, both the depiction and development of the diverse spatial and technological landscapes (*Räumliche Entwicklungsmodelle*) for Berlin's commercial and industrial spaces went far beyond the mere description of those spaces in the planning frameworks. Targeted fields of action and measures (e.g., acceleration of building permit procedures, customized land parceling, operating management structures for location marketing) were formulated. They qualified and profiled entire urban areas, selected locations, and unique plots through spatial and industrial priorities. At the same time, districts were called upon to define context-specific concepts for economic areas (*Wirtschaftsflächenkonzepte*; Senate Administration for Economy and Businesses, 1999; Senate Administration for Urban Development, 2011, pp. 13–14; Senate Administration for Urban Development and Housing, 2020a, pp. 12, 52).

The trajectory of innovation/technology policies was by far not so straightforward. Although West Berlin was among the pioneers in setting up a technology transfer agency (*Technologievermittlungsagentur*) in 1978 and the first innovation and business incubator in Germany (*Berliner Innovations- und Gründerzentrum*) in 1983, technology-oriented policies were financially overshadowed by the Berlin Subsidy Act (*Berlinförderungsgesetz*). Whereas only 46 million Deutsche Marks were allocated to West Berlin's technology/innovation policies (e.g., start-up advice, technology transfer and information) in 1987, nine billion Deutsche Marks were disbursed in the same year to externally controlled and low-tech workbenches (e.g., the food industry), which could only maintain their production due to these subventions (Hofmann, 1991, pp. 91–92). Despite short-term catch-up consumption and a prestige-based and superficial boom in the construction industry until the mid-1990s, Berlin's technology and innovation policies represented a loosely moderated, but mostly unfocused and disoriented round table implementing emergency policies (*Feuerwehrpolitik*) as most commercial and industrial areas were affected by decline and/or plant closures followed by a lost decade (1995–2005) of poor economic dynamics (Kulke, 2008, pp. 196–197; Scheuplein, 1999, p. 48). Two events led to a breakthrough. First, an organizational consolidation, where

the technology transfer agency merged with the 1994-established Technology Foundation (*Technologiestiftung Innovationszentrum Berlin,* later *TSB Technologiestiftung Berlin*, and today *Technologiestiftung Berlin*) in 1999, culminating in a promotion agency for innovation in natural sciences and engineering providing most services in a one-stop shop (later merged with the Business Location Center). Second, a conceptual consolidation broke away from stand-alone technology und incubation centers (e.g., *Innovationspark Wuhlheide, Gründerzentrum am Borsigturm*) or programs (e.g., *Technologieprogramm FIT Berlin* 2001 in 1993) to focus on the profiling of technology, innovation, and competence fields (*Kompetenzfeldstrategie*) accentuating industrial sectors such as healthcare, energy engineering, transportation/mobility/logistics, information/communication/media/culture, creative industries, and optics and photonics (Krätke & Borst, 2000, pp. 71–82). Those efforts gave rise to an innovation and technology concept (*Innovations- und Technologiekonzept*) by the end of the 1990s and paved the way toward the Coherent Innovation Strategy of Berlin (*Kohärente Innovationsstrategie*) in 2005. This in turn gave way to the Joint Innovation Strategy of Berlin and Brandenburg (*innoBB*) in 2011 (updated in 2019, *innoBB 2025*) in which competence fields were overhauled to create genuine clusters with pertinent cluster master plans (Senate Administration for Economy and Technology, 1993; Senate Administration for Urban Development and Environmental Protection, 1993; Senate Administration for Urban Development, Environmental Protection and Technology, 1999; Senate of Berlin, 2006; Senate of Berlin & Government of Brandenburg, 2011, 2019). In summary, systematic steps were taken to identify technological fields, assess their innovation potential, explore competencies (by means of outstanding research capacities, flagship projects, acquisition of large-scale third-party funding, competitive product launches, international networks), and turn them into viable clusters (the various innovation strategies mentioned above). Simultaneously, a broader and more open understanding of innovation (e.g., social innovation) combined with trans-sectoral themes (*Querschnittsthemen*; e.g., clean technologies) attempted to refine (cross-)clusters to create regional platforms or TEM (Senate of Berlin, 2006; Senate of Berlin & Government of Brandenburg, 2011, p. 14, 2019, pp. 8, 25).

### *2.3. The Zukunftsorte Strategy*

The Berliner Zukunftsorte strategy emphasizes 11 future-oriented locations (see Figure 2) embedded in distinct neighborhoods (*Transformationsräume*) that are capable to act as:

> Laboratories for future visions and pivotal places for networking and participation… where living, working, science and culture are to come together, and explorative approaches are to be tested how urban and social structures can be preserved or further developed within changing framework conditions. (Senate of Berlin, 2016, p. 7)

The nucleus of the strategy accentuates locations (a) with a spatial concentration of business and science, where (b) an effectively lived exchange and cooperation takes place characterized by (c) sectoral profiling that (d) promotes the innovation and competitiveness of the regional economy (Koglin, 2012, p. 9). Today, according to estimates, *Zukunftsorte* are home to 42 scientific institutions (including four universities), 2,200 companies, and 62,000 workplaces and provide learning venues for 96,000 students ("Zukunft Berlin—Ideen aus der Metropole. Folge 1," 2020; "Zukunft Berlin—Ideen aus der Metropole. Folge 2," 2020).

The general idea and underlying assumption of *Zukunftsorte* can be traced back to Berlin's former Senator for Economy and Labor, Elmar Pieroth, who outlined rationales and strategies for commercial and industrial spaces based on "cooperation between the economy, science, and the government" (Senator for Economy and Labor, 1988, p. 87, authors' translation) as early as 1988. These demands were framed under the heading of technology policy (*Technologiepolitik*), considered fundamental requirements to establish innovative small and medium-sized industries in high-tech sectors by bringing together economy and science and regularly repeating these encounters (Hofmann, 1993, pp. 171–175; see also Senate Administration for Economy and Technology, 1994). These imperatives acted as guidelines for both planning frameworks and technology/innovation policies when reconstructing the sites of Berlin-Adlershof (see Section 3.1) and Berlin-Buch in former East Berlin (Senate Administration for Economy and Businesses, 1999; Senate Administration for Urban Development, 2011, pp. 17, 51, 59; Senate Administration for Urban Development and Housing, 2020a, pp. 46–47, 103). Later, the concept was applied to further locations all over Berlin with a strong presence of science and research (*Standorte mit Wissenschaft und Forschung als prägenden Standortfaktor*): Adlershof (A), Buch (B), Charlottenburg (C), Dahlem (D), and Mitte (M) with larger campuses of Berlin's major universities (Lange et al., 2011, p. 9).

The 2012 main manifesto of the Zukunftsorte strategy (Koglin, 2012) ascribed only Adlershof and Buch substantial qualities of *Zukunftsorte* with potential for the remaining (A-D,M) locations and five further sites to be developed (EUREF Schöneberg, CTM, Schöneweide, and the two former airports Tempelhof and Tegel), joined by Siemensstadt in 2019 after a major decision by the conglomerate to restructure and revive its site. It was obviously a political decision to not fully acknowledge other locations (e.g., Motzener Straße) with favorable prerequisites (Koglin, 2012, pp. 10–11).

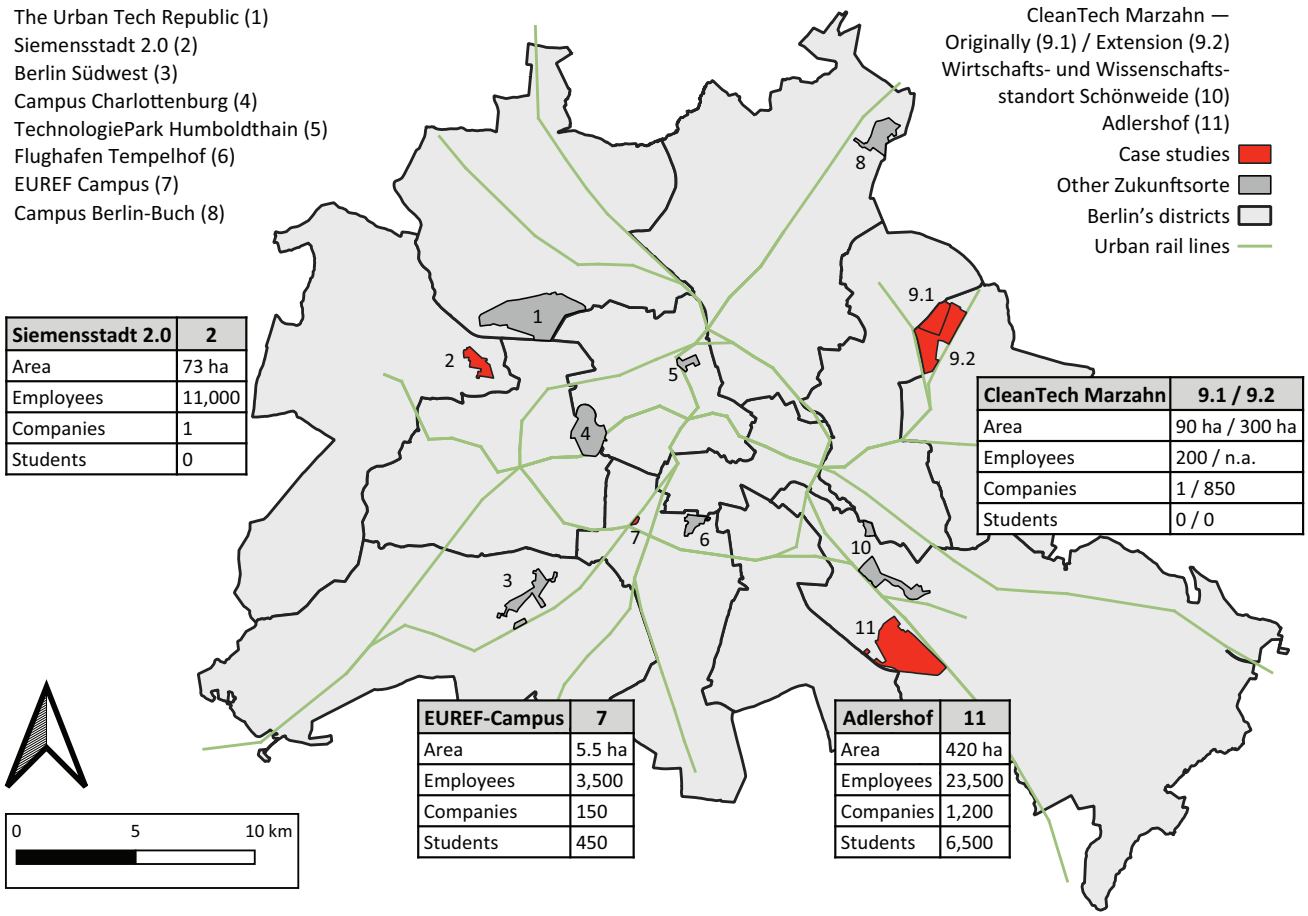


**Figure 2.** Berlin's Zukunftsorte.

Apart from that, the Zukunftsorte strategy could only unfold its potential since it drew lines to existing innovation/technology initiatives (e.g., *innoBB* in 2011; Koglin, 2012, p. 8). Ultimately, a consortium of multiple stakeholder (politics, science, business, society) was leveraged by its issuers, to enter both impending blanket policy agreements (Berlin Strategy 2014, Coalition Agreement 2016–2021; Senate Administration for Urban Development and Environment, 2015, pp. 48; Senate Chancellery, 2016, pp. 52, 84) and specific planning frameworks (UDP Economy 2019; Senate Administration for Economy, Energy and Businesses, 2018a, p. 20; Senate Administration for Urban Development and Housing, 2020a, pp. 25–26). Today, *Zukunftsorte* can be considered a bridge between pertinent planning frameworks for commercial and industrial spaces and innovation/technology initiatives, embedded in general political and strategic documents. They align with the sector and cluster priorities outlined above (or vice versa) and are therefore capable of channeling substantial business promotion funds from European, national, and municipal sources ("Zukunft Berlin—Ideen aus der Metropole. Folge 3,'' 2020).

## 3. Selected *Zukunftsorte* Case Studies

This section examines four examples of *Zukunftsorte* (Adlershof, CTM, EUREF, and Siemensstadt 2.0) at the municipal level to determine whether and to what extent modern planning imperatives and other theoretical TEM building blocks have already been implemented (Section 3.5). A multi-case study approach (Ebneyamini & Moghadam, 2018) was applied to allow for greater generalization with regard to emergent theory, simultaneously expounding the variety of Berlin's *Zukunftsorte* in terms of the historical backgrounds, actors involved, operating modes, and levels of development. The four cases presented were chosen along the following dimensions. First, we opted for two sites in former East and two sites in former West Berlin. Second, we chose sites where the underlying conditions varied substantially. Adlershof was developed based on a century-long research tradition, Siemensstadt is part of a long-standing industrial production, EUREF evolved around an iconic landmark, and CTM was attractive due to its largely undeveloped industrial site capable of hosting hazardous incident plants (*Störfallbetriebe*). Third, we selected sites where the main operating entities (*Betreibergesellschaften*) encompass various legal forms and sector affiliations from the district administration itself (CTM) and publicly driven, municipally owned companies (Adlershof) to private-sector high-tech conglomerates (Siemensstadt 2.0) and real-estate development companies (EUREF). Fourth, we picked sites in various stages of their lifecycle; from a more or less undeveloped parcel (CTM) to one of

the biggest sciences and technology parks operating in Europe (Adlershof).

### *3.1. The Adlershof* Zukunftsort

The general idea behind *Zukunftsorte* in Berlin was strongly influenced by experiences made during the (re-)development of today's Adlershof Technology Park, located in the south-east of Berlin (Area 11 in Figure 2). Within three decades after reunification, Adlershof was transformed into one of the largest technology parks in Europe with roughly 23,500 employees and 6,500 university students working and studying at 1,200 enterprises, six university institutes, and eight non-university think tanks (WISTA Management, 2020a). Adlershof started as the cradle of Germany's aviation research and production in 1909 and became its most important location before World War II. Thereafter, it was merely transformed into a research site, hosting GDR's Academy of Sciences specialized in natural sciences (e.g., physics and chemistry). German reunification marked another turning point: The Academy of Sciences was significantly downsized from 5,000 to 1,500 employees and integrated into a newly established, nationally financed, (non-)university research network (Leibnitz, Helmholtz, etc.; Kulke, 2008, pp. 197–199; Suwala & Dannenberg, 2009, p. 133). At the beginning of the 1990s, the 420-hectare area was mainly characterized by empty spaces, abandoned buildings, and outdated infrastructure (Suwala & Kulke, 2015, pp. 157–158). In 1992, Berlin's administration adopted a master plan and dubbed Adlershof the "city of science and economy." Three pillars earmarked this master plan. First, a Berlin-owned but privately organized development and operation company (*Entwicklungsgesellschaft Adlershof mbH*, today *WISTA Management GmbH*) was commissioned to exploit, develop, and promote the area entirely. Second, many natural science institutes from a major Berlin university were relocated from the city center to Adlershof to complement and strengthen the above-mentioned (non-)university research network. Third, a comprehensive system of technology/innovation-promoting measures was assembled based on university spin-offs, business plan development, business incubators, and segmented technology centers (e.g., for photonics, environmental technologies) to promote tangible and non-tangible infrastructure. Even housing facilities were initially part of the plans (Kulke, 2008, pp. 197–206; Suwala & Dannenberg, 2009, pp. 106–109).

In 1990, the site was characterized by mixed ownership (63% by the German Federal Government, 19% by the city of Berlin, which transferred the land to the operating company WISTA Management, and 8% by a community association), mostly in public hands. This fact combined with the early uniform designation of the site as an urban development area (*urbanes Entwicklungsgebiet*) based on the Federal Land Utilization Ordinance on specially designated areas (*Sondergebiete*; BauNVO, Section 11 in Federal Ministry of Justice and Consumer Protection, 2021, pp. 8–9) provided reliability for planning; most activities executed on site (e.g., urban development, property marketing, technology promotion, foundation support, facility management) have been executed by a "one-stop agency" for three decades. Although Adlershof fortunes were also influenced by Berlin's lost decade (1995–2005), in particular, housing developments were built with a 15-year delay, the idea of bringing together and connecting business, science, and policymakers and even planners was implemented consistently. Renowned institutions (e.g., HU, Leibnitz, and Helmholtz institutes) are located on site and feature an advanced architectural and technology infrastructure (e.g., the electron accelerator, BESSY II; Dannenberg & Suwala, 2009, pp. 130–132; Suwala & Kulke, 2015, pp. 158–162). However, spatial proximity alone does not constitute a well operating *Zukunftsort*. Considerable and orchestrated efforts (e.g., technology transfer office activities, industry and regional networks, mutual research projects, matchmaking events) were necessary to enhance knowledge flows between the stakeholders and create desired networks and innovations (Brinkhoff et al., 2012, 2015). These processes have been backed by profiled technology centers (e.g., biotechnology, photonics, new materials, and microsystems) thematically in line with operational programs for national and European funds (e.g., *OP Berlin EFRE*) and striking urban design components (e.g., central agora with the campus zone). Over the past decade, the initial idea of a residential area (beyond the triple helix) was achieved with the construction of 3,000 units for rental housing, condominiums and student apartments, retail and gastronomy, and social infrastructure to form a sustainable and livable neighborhood. These developments propelled an increasing number of employees and students to live on site (Kitzmann & Kulke, 2021, pp. 44–46; Kulke & Kitzmann, 2012, pp. 12–15, 2020, pp. 17–20).

### *3.2. The CleanTech Marzahn* Zukunftsort

The CTM—with its heart, the CleanTech Business Park (CBP), in Berlin-Marzahn (Area 9.1 in Figure 2)—is arguably the least-developed *Zukunftsort* of the cases presented here. The 90-hectare site on the north-eastern fringe of Berlin is currently a largely undeveloped brownfield that was partly used as a sewage treatment plant until 1990 and afterwards only sparsely used for leisure activities. Ideas to redevelop the site were based on the interest of surrounding companies (solar industry) in space to expand more than a decade ago. Urged by Berlin's planning authorities, the local district administration evaluated options and started to comprehensively demolish, decontaminate, and develop the site predominately as an industrial area in 2009 (District Administration of Marzahn-Hellersdorf, 2019). This transformation was backed by Berlin's economic development authorities and allotted financial resources

through national (the joint Federal/Länder Task for the Improvement of Regional Economic Structures, GRW) and European funds (EFRD; Senate Administration for Economy, Energy and Businesses, 2021). The district discarded initial ideas for a photovoltaics business park and renamed the core site CBP, which was merely a buzzword at the time but general and promising enough to align with European and national funding schemes and to attract production-oriented companies in renewable, green, and sustainable sectors. The unique selling point of the CBP is the opportunity to host hazardous incident plants (*Störfallbetriebe*) that cannot settle in ordinary industrial areas (District Administration of Marzahn-Hellersdorf, 2019; Senate Administration for Economy, Energy and Businesses, 2021). Unlike the other *Zukunftsorte*, CTM constitutes the largest connected open-space industrial plot within the city. An ambivalent advantage is that the core plot (CBP) is currently owned by the city of Berlin and its water management company and is managed by the local district administration (District Administration of Marzahn-Hellersdorf, 2017; Senate Administration for Urban Development and Housing, 2020b). Despite the united and public ownership, only one company (a producer of energy-efficient industrial storage media) has settled on the ground (Senate Administration for Economy, Energy and Businesses, 2018b). Reasons for the difficult settlement process are manifold: (a) high commercial demand that does not align with the profile of the CBP (e.g., data and logistic centers); (b) a lack of commercial interest in Berlin's land policy (the city is not selling the land but rather issues building right agreements, or *Erbbaurecht*); (c) protracted negotiations with the city of Berlin (interested companies turn to other sites, often owned by private developers); and (d) expectations are high and monitoring is precise since the site was publicly subsidized (e.g., long-term employment with mandatory social security contributions, or *sozialversicherungspflichtige Beschäftigung*) is desired.

The perpetuated industry-related planning of authorities and frameworks (in particular, development concept for the manufacturing-based economy) did a great job securing an industrial spot that can even host hazardous incident plants, but the settlement itself remains difficult. The main ingredients (triple helix) of a *Zukunftsort* are missing. Despite some well-established and promising local and mid-sized companies with in-house internships and vocational training activities (e.g., Hasse & Wrede GmbH, Flexim GmbH), there are no universities or non-university research institutions on site (Area 9.2 in Figure 2). It comes as no surprise that a former business incubator (2016–2019) offering co-working and workshop space to cleantech-oriented startups (Senate Administration for Economy, Energy and Businesses, 2021) had to close down. The development of the site was initially left to the district administration but will be taken over by the municipally owned WISTA (which also runs Adlershof) in mid-2021. As a preparatory measure, CBP (90 hectares, Area 9.1 in Figure 2) was expanded to CTM (300 hectares, Areas 9.1 and 9.2 in Figure 2) including neighboring commercial premises (Gewerbepark Georg Knorr, Econopark Wolfener Straße) and established and thriving companies mentioned above (WISTA Management, 2020b). It remains to be seen whether and when any beneficial impacts will emerge. The potential is there as the CTM *Zukunftsort* is even part of Berlin's largest connected industrial area (1,200 hectares; Senate Administration for Economy, Energy and Businesses, 2021; Senate Administration for Urban Development and Housing, 2020a, pp. 51–54). Although neither CBP nor CTM contain residential space, they border directly on the city's two largest former Socialist large-scale housing developments (Marzahn with 60,000 housing units and Hohenschönhausen with 40,000). In the near future, more than 2,000 additional residential units will be established by city-owned housing companies, housing associations, and private developers in these neighborhoods (own calculations). Future planning efforts—currently spearheaded by the city's planning and economic development office—have two objectives. One involves a new business incubator and, in the long run, even a university campus. The other entails a new strategy for smaller plots (even less than one hectare) to meet changing demands.

### *3.3. The EUREF Campus Berlin* Zukunftsort

EUREF covers an area of only 5.5 hectares and is located on the south-western edge of Berlin's inner city, within a triangle of houses and railway tracks (Area 7 in Figure 2). The site has a long history as an industrial area with an urban gas production and supply depot. In 1871, the British Imperial Continental Gas Association—the market leader in municipal gas supply of its time—erected the first gas-fired power plant as coal could be delivered easily here by rail. This plant was replaced in 1910 by a novel 78-meter-high gasometer—the third biggest in Europe as measured by the capacity to store gas—with a characteristic steel structure that gives the site its distinctive image to this day. The plant was shut down in 1946, but the gasometer remained in operation by the municipally owned gas provider GASAG as a gas storage facility until 1995 when it was dismantled (GASAG, 2021). In Berlin's lost decade (1995–2005), the underdeveloped area—still equipped with historic buildings (e.g., low-pressure gas tank, retort house, boiler house with water tower, etc.)—was used only by small businesses to store, park, and service motor vehicles. In 2007, an architect known for restoration—and heritage-related restoration in the city purchased the site with a vision (District Administration of Tempelhof-Schöneberg, 2012). This vision was grounded in developing a concept for a European energy forum consisting of offices, teaching and research facilities, and spaces for the location of European power generating businesses complemented by event venues, accommodation and boarding houses,

and catering services. By means of a carbon-neutral energy supply, a smart energy grid, energy-efficient buildings, an experimental platform for electromobility, and numerous research projects, the campus strives to prove that the energy transition (*Energiewende)* is feasible and financially viable. EUREF already achieved the German government's $CO_2$ emissions reduction goal for the year 2050 in 2014. Currently, 3,500 people are employed there at more than 150 companies, institutions, and start-ups in the fields of energy, mobility, and sustainability (EUREF, 2021).

The new owner, his vision, and the resulting private investment interest triggered the district to regulate the fortunes in the area by means of a binding CLUP (*Bebauungsplan*). The required framework conditions were provided to revitalize the old industrial site for new use endowed with national funding (GRW). According to the city's LUP, the site is dedicated for mixed-land use (*gemischte Baufläche*) open to manifold types of industrial and commercial valorization and therefore offers developer a high degree of freedom (District Administration of Tempelhof-Schöneberg, 2012). Since most of the properties are owned by EUREF AG (private stock cooperation), this private-sector developer of low-energy and environmentally optimized immovables can be considered the operation company and main orchestrator on site. Over the years, EUREF AG has been able to convince both reputable companies (e.g., Deutsche Bahn, Cisco, Schneider Electric, GASAG) and established research institutions (e.g., Technische Universität Berlin, Mercator Research Institute on Global Commons and Climate Change GmbH) to set up shop on site. These institutions work on mutual projects (e.g., Inno Z, 2008–2019, a partnership between two non-university think tanks and Deutsche Bahn), which are often also promoted by flagship projects of German Federal Ministries (e.g., Mobility2Grid). The Mobility2Grid project brings together partners from (non-)university think tanks and the private sector. All these initiatives attempt to simulate a futuristic urban vision by means of a living lab (*Reallabor*) and aim to jointly contemplate the use of renewable energies with emerging trends in urban mobility (EUREF, 2021). Further initiatives encompass co-working spaces, incubators, labs (e.g., Infralab Berlin), and accelerators (e.g., the Climate-KIC Green Garage). The Infralab project is a joint innovation laboratory run by municipal services and infrastructure providers (e.g., the BVG for mobility; the BWB for water; BSR for city cleaning; GASAG for gas works; the Vattenfall Wärme Berlin for heating; Stromnetz Berlin for power; and Veolia for waste disposal), where start-ups and bright minds are given the opportunity to put forth new ideas (Merkel & Suwala, 2021).

### *3.4. The Siemensstadt 2.0* Zukunftsort

The most recently labeled *Zukunftsort*, Siemensstadt, looks back on the longest industrial history of the four case studies presented here (Area 2 in Figure 2). It was both the central location of the renowned electrical company of Siemens during the interwar period, which was the biggest of its kind in the world (Bähr, 2001, pp. 25–27), and a significant pillar for Berlin Electropolis as Europe's center for the emerging electrical industry (Schultze, 1927, pp. 519–521). Siemens started its venture—in a district that would officially be named Siemensstadt in 1914—as a greenfield development in 1897 with a cable-manufacturing plant (established in 1899). The spacious site and the foresighted planning allowed for the constant expansion of both production (e.g., iron foundry in 1908, power station in 1912, telephone exchange in 1913, research laboratory in 1920) and housing facilities (e.g., company-owned accommodation, or *Werkswohnungsbau*) starting in 1904. Later, the modern *Ringsiedlung Siemensstadt* settlement—now a UNESCO world-heritage site—was erected, featuring 1,370 housing units, a combined heat and power plant, laundry facilities, shops, and even a school (Klünner, 1978, pp. 71–86). In a nutshell, Siemens developed an entire district with a mix of industrial production, housing, administrative and social functions, parks, and infrastructure. By the end of the 1930s, the 212-hectare site was home to 13,000 residents and 65,000 employees (Imsirovic, 2020, p. 16). After World War II, Siemens followed a decentralization strategy, relocating its hub to southern Germany (Munich and Erlangen). Left as the "second" headquarters, the administration buildings in Siemensstadt were repurposed into production space, and the central administration building was used again for its original purpose only starting in 1976 (Siemens AG, 2021). Although Siemens' current production volume in Siemensstadt is nowhere near historical figures, the 11,000 employees on site make it the company's largest production site worldwide. Hence, it comes as no surprise that Siemens will invest 600 million euros to transform a selected 73-hectare industrial site into Siemensstadt 2.0 by 2030, representing the company's largest ever investment in a single project (Siemens AG, 2021). Ninety-seven percent of the area is owned by Siemens, 2% by the city and 1% by private stakeholders, forming a unified property basis to complete such a mega project (Senate Administration for Urban Development and Housing, 2020c, p. 9).

Compared to the preceding case studies, Siemensstadt 2.0 is the only *Zukunftsort* that will primarily be created by a single company. In 2018, Siemens and the city of Berlin signed a memorandum of understanding for the creation of this future-oriented neighborhood that combines working, housing, and research following the principle of an "industrial smart city" (Imsirovic, 2020, pp. 16–18; Kögl, 2020, pp. 73–74). The planning and development process encompasses a joint venture between Siemens and a total of 70 employees from various city administration units in manifold working groups, demonstrating Berlin's commitment to the project. Research and teaching activities have mainly been

organized internally to date; with regard to teaching, the on-site Siemens Professional Education is one of the largest German in-house education facilities and offers dual vocational education and training (Siemens AG, 2013). Missing universities and external connections between production, research, and knowledge transfer are substituted by novel initiatives (e.g., the launch of the Werner-von-Siemens Centre for Industry and Science, with joint professorships with Technische Universität Berlin, an agreement between this university, the city of Berlin, and two non-university research institutions; Kögl, 2020, p. 74; Werner-von-Siemens Centre for Industry and Science e.V., 2021). The main areas of research and production will be electrical mobility, IT and automatization, artificial intelligence, new materials, and additive manufacturing (Werner-von-Siemens Centre for Industry and Science e.V., 2021). Siemensstadt 2.0 is planned as a mixed-use neighborhood following the idea of a compact city with short distances (*Stadt der kurzen Wege*). Around 38 hectares will be redeveloped for the following purposes: (a) a 5.4-hectare plot for housing complemented by green spaces and a kindergarten; (b) a 1.4-hectare plot for office use; (c) a 24-hectare core for housing, commercial use, and leisure, including 3.8 hectares of green spaces; and (d) 7 hectares for offices, commercial use, and research. A total of 2,750 housing units are planned by 2030 (Senate Administration for Urban Development and Housing, 2020c, pp. 11–64). In order to realize these plans, changes to Berlin's LUP will be necessary and were initiated in 2019; for example, an area formerly meant solely for industry (BauNVO, Section 9; Federal Ministry of Justice and Consumer Protection, 2021, p. 8) will be opened for housing and social infrastructure (*gemischte Baufläche*). The first repurposing tasks have passed the stage of early public participation and must be approved by the development concept for the manufacturing-based economy (Senate Administration for Urban Development and Housing, 2020b, p. 134, 2020c, pp. 25–28).

### *3.5. Comparative Assessment*

Table 1 summarizes the main results from the case studies and allows for an overall assessment of how the distinctive *Zukunftsorte* were facilitated by planning frameworks and technology/innovation initiatives and to what extent they already share components of TEM necessary to transform commercial and industrial areas into innovative, viable, and vibrant urban areas of the future. Adlershof is a textbook example and role model for the overall idea behind *Zukunftsorte* today. Early on, in 1992, separate statutory provisions, a master plan, and a vision were enacted to create a "city of science and economy" with designated areas for business, science, and housing providing a holistic concept. The statutory provisions secured the area as a specially designated area (*Sondergebiet*; BauNVO, Section 11 in Federal Ministry of Justice and Consumer Protection, 2021, pp. 8–9), while the master plan indicated a strong political will. The master plan was managed, propelled forward, and implemented over the course of the last 30 years by the city-owned operating company (WISTA Management GmbH) and its planning subsidiary (WISTA Plan GmbH, formerly Adlershof Projekt GmbH) with a great impact on municipal planning and the citywide political agenda. The results are high-capacity networks between world-leading high-tech SMEs, various (non-)university institutions, and policy/planning stakeholders. The site constitutes a well working TIM. This venture, however, required a local research tradition and strong local entrepreneurial will after reunification. It started with unified ownership based on a long-term strategy and profited from farsighted planning and management to channel funds and attract investors. It will be interesting to see in the future whether current residential efforts and the development of utility infrastructure (gastronomy, retail, etc.) will be able to transform the area into a viable urban area (TEM). CTM possesses the city's largest connected open-space industrial plot able to host hazardous incident plants that is well secured by planning regulations (*Industriegebiet*; BauNVO, Section 9 in Federal Ministry of Justice and Consumer Protection, 2021, p. 8). Apart from this, the main elements of *Zukunftsorte* are missing and/or not connected with each other. An inflexible location development and marketing strategy coupled with a lack of research institutions, isolated adjacent commercial and industrial properties, and surrounding residential areas pose major challenges. Even though the territory was extended beyond the initial plot, a long and coherent journey will be needed not only to locate fundamental TIM components (e.g., research institutions), but also to create synergies between them. EUREF is an inspiring locational forge of creativity bolstered by binding planning regulations (CLUP) as a mixed-land use area with high degrees of freedom (*gemischte Baufläche*). Due to its very limited size, however, EUREF feels more like a cleverly managed and extended show room with multiple convention centers, event locations, and top cuisine rather than a fully envisioned *Zukunftsort* despite being a steppingstone for some start-ups. Taking the surrounding area into account, the site still gives the impression of a "work island," since its location on suburban railway lines hinders adequate integration into the urban fabric, which is largely disconnected from the site. Apart from boarding houses for temporary visitors, no housing is planned. All in all, EUREF superficially unites all the components of TIM and partly of TEM, however, it is merely a miniature version of a *Zukunftsort* that evokes an exhibition and trade fair venue. The Siemensstadt 2.0 idea is relatively new, and the assessment of it is highly speculative. Its greatest advantage—planning and development under one roof—could make it highly dependent on the industrial conglomerate, although the planning process to date has been very transparent. The entire area, and in particular the 38-hectare core

**Table 1.** Characteristics of the case studies.

| Criteria | Adlershof | CleanTech Marzahn | EUREF Campus Berlin | Siemensstadt 2.0 |
|---|---|---|---|---|
| Components of TEM | | | | |
| Regulations/planning (neglected part of politics) | Separate master plan and vision as a City of Science and Economy with designated areas for business, science, and housing; in-house planning subsidiary—majority of (in)formal planning frameworks | The city's largest connected open-space industrial plot with the city able to host hazardous incident plants (development concept for production-oriented areas, UDP Economy 2030) | Binding CLUP plan as mixed-land use area with high degrees of freedom | Company-owned property secured as commercial, industrial, and residential site by partly changing zoning into mixed areas (changes in LUP, development concept for production-oriented areas, UDP Economy 2030) |
| Business | High-tech SMEs and hidden champions | A few traditional and modern SMEs and crafts for local supply | Living lab/showroom for renowned companies | Stand-alone world-leading conglomerate |
| Science | Top-tier university with pertinent faculty on site | Not on site | Flagship project of Federal Ministries, pilot study programs | Mostly in-house R&D, first linkages to Berlin's science landscape |
| Politics | City-owned operating company with great impact on the political agenda | Inflexible location development and marketing strategy | Operating company with a well-elaborated real-estate exploitation strategy | Decisions of conglomerate have political clout |
| Housing | Various newly constructed residential units with varying degrees of connection (e.g., student apartments, single-family housing) | Lack of integration into adjacent former Socialist large-scale neighborhoods | Only boarding houses for temporary visitors, lack of integration into surrounding neighborhoods | Historical company housing, designated areas for new residential development |
| Assessment | Textbook example of *Zukunftsort* (established networks between business, science) with new residential efforts | Industrial plot with great potential but many missing links | Extended showroom for business and science with event and convention spaces | Infant stage of transforming a traditional industrial space into a modern working and living environment |

being redeveloped, commemorates the master plan of Adlershof and the vision of a futuristic urban quarter where initial changes in the LUP from industrial toward mixed-use areas (*gemischte Baufläche*) have been initiated. It will be interesting to see in the future whether these mostly closed corporate premises can be transformed into an open campus with a thriving research community, start-ups, and residential areas connected beyond the reach of the conglomerates. Planning efforts are already underway.

## 4. Conclusions

By combining an urban planning and regional innovation studies perspective, we were able to shed light on the link that is often missing between both disciplines:

the lack of innovation in planning (Ibert, 2003) and the largely neglected anchoring of planning in TIM (Cooke, 2011). Additionally, our main intention was to add the civic society (housing, fourth helix) and planning frameworks (regulations, a distinctive part of the third helix) in order to extend conventional TIM to TEM. For this reason, we explicitly selected the liminal strategy of Berliner Zukunftsorte, which is applicable to both planning frameworks and technology/innovation policies. The Zukunftsorte strategy attempts to develop former commercial and industrial brownfields by preserving their historic sites and modernizing their commercial and industrial base. Based on the ideas behind TIM or the triple helix that innovation flourishes with co-located and interconnected stakeholders—including companies from related industries along value chains (business), academic entities, and governmental institutions—we postulate that these areas should additionally be embedded in residential neighborhoods and supported by appropriate planning frameworks in order to facilitate the development of viable urban areas capable of offering spaces for living, working, education, culture, and leisure within close proximity (TEM). What sounds simple in theory is difficult to implement in reality because this requires mixed-use areas. Results have shown that neither planning and innovation policies in Berlin in general nor planning and innovation initiatives in distinctive Berlin *Zukunftsorte* in particular, are straightforward, and, ultimately, they depend on persistent trajectories of the past, political power relations, the economic situation, and context-specific site characteristics. With regard to planning, various planning regulations (e.g., LUP and CLUP in combination with industrial zones, *Industriegebiet*, or specially dedicated areas, *Sondergebiet*; see BauNVO, Sections 9 and 11 respectively, in Federal Ministry of Justice and Consumer Protection, 2021, pp. 8–9) backed by informal planning documents for commercial and industrial spaces (development concept for production-oriented areas, "economic" UDPs) led to the desired objectives. Interestingly, the newly introduced building law category "urban area" (*Urbanes Gebiet*; BauNVO, Section 6a in Federal Ministry of Justice and Consumer Protection, 2021, pp. 6–7) has not been used in Berlin so far, mainly because of two alternatives that both also allow for mixed-use areas: An idiosyncratic equivalent is the mixed-use area (*gemischte Baufläche*) and a way around it is the specially dedicated area (*urbanes Entwicklungsgebiet*). With regard to technology/innovation policies, most *Zukunftsorte* are in different stages of the life cycle and are in need of customized tools. Adlershof is a well-functioning network of business, academia, and policymakers with preliminary attempts to embed those stakeholders in residential neighborhoods—therefore, it is partly on its way to becoming a TEM. Where EUREF is miniature version of Adlershof or a living lab of *Zukunftsorte* (without housing), the other selected *Zukunftsorte* do not yet deserve this name as basic TIM/TEM components are still missing. Therefore, Berlin will have to undertake manifold strategies toward its (new) commercial and industrial spaces in the future (Gornig & Werwatz, 2018). Our results showed the value added and idea by incorporating planning frameworks and housing efforts into TIM is imaginable well beyond the context of Berlin. To understand TEM comprehensively, the study should be extended to the fifth helix (the environment) in the future.

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**Conflict of Interests**

The authors declare no conflict of interests.

**References**

Bähr, J. (2001). *Industrie im geteilten Berlin (1945–1990): Die elektrotechnische Industrie und der Maschinenbau im Ost-West-Vergleich—Branchenentwicklung, Technologien und Handlungsstrukturen* [Industry in divided Berlin (1945–1990): The electrotechnical industry and engineering in east-west comparison—Sector development, technologies and agency structures]. De Gruyter.

Brandt, M., Butzin, A., Gärtner, S., Meyer, K., Hennings, G., Siebert, S., & Ziegler-Hennings, C. (2017). *Produktion zurück ins Quartier? Neue Arbeitsorte in der gemischten Stadt* [Manufacturing back with the neighborhood? New workplaces in the assorted city]. Institute for Work and Technology.

Brinkhoff, S., & Kitzmann, R. (2014). Urban dreams and economic realities—Areas of innovation between the demands of the knowledge society and the requirements of innovative industries. In *31st IASP world conference* (pp. 263–279). International Association of Science Parks and Areas of Innovation.

Brinkhoff, S., Suwala, L., & Kulke, E. (2012). What do you offer? Interlinkages of universities and high-technology companies in science and technology parks in Berlin and Seville. In R. Capello, A. Olechnicka, & G. Gorzelak (Eds.), *Universities, cities and regions. Loci for knowledge and innovation creation* (pp. 121–146). Routledge. https://doi.org/10.4324/9780203097144-15

Brinkhoff, S., Suwala, L., & Kulke, E. (2015). Managing innovation in 'localities of learning' in Berlin and Seville. In G. Micek (Ed.), *Understanding innovation in emerging economic spaces* (pp. 11–31). Ashgate. https://doi.org/10.4324/9781315549163-9

Cooke, P. (2011). Transition regions: Regional–national eco-innovation systems and strategies. *Progress in Planning*, *76*(3), 105–146. https://doi.org/10.1016/j.progress.2011.08.002

Dannenberg, P., & Suwala, L. (2009). Der Wirtschafts- und Wissenschaftsstandort Berlin-Adlershof: Herausbildung eines politisch induzierten innovativen Milieus? [The business and science location Berlin-Adlershof: Emergence of a politically induced innovative milieu?], In P. Dannenberg, H. Köhler, T. Lang, J. Utz, B. Zakirova, & T. Zimmermann (Eds.), *Innovationen im Raum – Raum für Innovationen* [Innovations in space – Space for innovations] (pp. 128-141). ARL.

Der Regierende Bürgermeister von Berlin. (2000). *Die BerlinStudie—Strategien für die Stadt* [The Berlin study—Strategies for the city]. Regioverlag.

District Administration of Marzahn-Hellersdorf. (2017). *CleanTech Business Park—Generating the future*.

District Administration of Marzahn-Hellersdorf. (2019). *Exposé—Industrial space in the CleanTech Business Park Berlin Marzahn*.

District Administration of Tempelhof-Schöneberg. (2012). *Development plan XI-231b explanatory memorandum*.

Ebneyamini, S., & Moghadam, M. R. S. (2018). Toward developing a framework for conducting case study research. *International Journal of Qualitative Methods*, *17*(1), 1–11. https://doi.org/10.1177/1609406918817954

Ellger, C. (1992). Berlin: Legacies of division and problems of unification. *Geographical Journal*, *158*(1), 40–46. https://doi.org/10.2307/3060015

European Energy Forum. (2021). *EUREF campus Berlin*. https://euref.de

Federal Ministry of Justice and Consumer Protection. (2021). *Verordnung über die bauliche Nutzung der Grundstücke (Baunutzungsverordnung – BauNVO)* [Ordinance on the building utilization of premises (Federal Land Utilization Ordinance – FLUO).

GASAG. (2021). *Geschichte der GASAG* [GASAG history map]. https://gasaghistorymap.azurewebsites.net

Gornig, M., & Werwatz, A. (2018). Anzeichen für eine Reurbanisierung der Industrie [Signs of a reurbanisation of the industry]. *Wochenbericht*, *85*(47), 1006–1011.

Henckel, D., Grabow, B., Knopf, C., Nopper, E., Rauch, N., & Regitz, W. (1986). *Produktionstechnologien und Raumentwicklung* [Production technologies and spatial development]. Kohlhammer-Deutscher Gemeindeverlag.

Hofmann, J. (1991). Innovationsförderung in Berlin und Baden-Württemberg: Zum regionalen Eigenleben technologiepolitischer Konzepte [Innovation promotion in Berlin and Baden-Wuerttemberg: Regional independence of technology political concepts]. In U. Jürgens & W. Krumbein (Eds.), *Industriepolitische Strategien: Bundesländer im Vergleich* [Strategies of industrial policies: German Federal states in comparison] (pp. 74–97). Edition Sigma.

Hofmann, J. (1993). *Implizite Theorien in der Politik: Interpretationsprobleme regionaler Technologiepolitik* [Implicit theories in politics: Problems of interpretation of regional technology policy]. Westdeutscher.

Ibert, O. (2003). *Innovationsorientierte Planung. Verfahren und Strategien zur Organisation von Innovation* [Innovation-oriented planning. Processes and strategies for the organization of innovation]. Leske + Budrich.

Imsirovic, T. (2020). Höhenflug in Spandau [Soaring in Spandau]. *Bauwelt*, *7*, 16–19.

Kitzmann, R., & Kulke, E. (2021). Der Technologiepark Berlin-Adlershof—Auf dem Weg zum multifunktionalen Stadtquartier!? [The technology park Berlin-Adlershof—Towards a multifunctional urban neighborhood!?]. *Geographische Rundschau*, *73*(6), 44–49.

Kitzmann, R., & Suwala, L. (2018). Oberschöneweide oder Oberschweineöde? Ein Berliner Altindustriestandort im Zeichen der Revitalisierung [Oberschöneweide or Oberschweineöde? An old industrial area in Berlin characterized by revitalization]. *Geographische Rundschau*, *70*(11), 42–48.

Klünner, H. W. (1978). *Spandau und Siemensstadt so wie sie waren* [Spandau and Siemensstadt as they were]. Droste.

Kögl, S. (2020). Vom Industriestandort zum lebendigen Teil der Stadt—Siemensstadt 2.0 als "Smart District" in Berlin. [From an industrial site to a vivid part of the city—Siemensstadt 2.0 as "smart district" in Berlin]. *Forum Wohnen und Stadtentwicklung*, *2*, 73–76.

Koglin, G. (2012). *Berliner Zukunftsorte—Wo aus Wissen Arbeit wird* [Berlin's Zukunftsorte—Where knowledge becomes labor]. Technologiestiftung Berlin.

König, J., Suwala, L., & Delargy, C. (2020). Helix models of innovation and sustainable development goals. In W. Leal Filho, A. M. Azul, L. Brandli, A. Lange Salvia, & T. Wall (Eds.), *Industry, innovation and infrastructure. Encyclopedia of the UN sustainable development goals* (pp. 1–15). Springer. http://dx.doi.org/10.1007/978-3-319-71059-4_91-1

Krätke, S., & Borst, R. (2000). *Berlin: Metropole zwischen Boom und Krise* [Berlin: Metropolis between boom and crisis]. Leske + Budrich.

Kulke, E. (2003). Berlin—German capital and global city? *Die Erde*, *134*(3), 219–233.

Kulke, E. (2008). The technology park Berlin-Adlershof as an example of spatial proximity in regional economic policy. *Zeitschrift für Wirtschaftsgeographie*, *52*(4), 193–208. https://doi.org/10.1515/zfw.2008.0015

Kulke, E., & Kitzmann, R. (2012). *Der Standort Adlershof aus Sicht der Beschäftigten—Ergebnisse einer repräsentativen Erhebung unter Studierenden und Beschäftigten in Berlin Adlershof, Stadt für Wissenschaft, Wirtschaft und Medien* [The site Adlershof from the perspective of the employees—Results of a representative survey among students and employ-

ees in Berlin-Adlershof, city of science, economy and media] (Arbeitsberichte Geographisches Institut No. 171). Humboldt University of Berlin.

Kulke, E., & Kitzmann, R. (2020). *Vom monofunktionalen Arbeitsort zum multifunktionalen Stadtquartier? Bewertung und Wahrnehmung des Technologieparks Berlin-Adlershof durch Studierende und Beschäftigte* [From a monofunctional work site to a multifunctional urban neighborhood] (Arbeitsberichte Geographisches Institut No. 199). Humboldt University of Berlin.

Kulke, E., & Suwala, L. (2015). Wirtschaftsgeographie Berlins—Entwicklungspfade und vernetzte Raumkonfiguration [Economic geography of Berlin—Development trajectories and interconnected spatial configutations]. In M. Makki & R. Kleßen (Eds.), *Exkursionen Deutscher Kongress für Geographie 2015* [Excursion guide for the German Congress on Geography 2015] (pp. 44–54). Humboldt University of Berlin.

Lange, D., Piesbergen, M., Rohn, K., Schmitz, H. R., & Suwala, L. (2011). *Nachhaltige Vitalisierung des kreativen Quartiers um den Campus Berlin-Charlottenburg* [Sustainable vitalization of the creative neighborhood around the Campus Berlin-Charlottenburg]. Adlershof Projekt GmbH.

Merkel, J., & Suwala, L. (2021). Intermediaries, work and creativity in innovative and creative sectors: The case of Berlin. In B. J. Hracs, T. Brydges, T. Haisch, A. Hauge, J. Jansson, & J. Sjöholm (Eds.), *Culture, creativity and economy: Collaborative practices, value creation and spaces of creativity* (pp. 56–69). Routledge.

Moulaert, F., & Sekia, F. (2003). Territorial innovation models: A critical survey. *Regional Studies*, *37*(3), 289–302. https://doi.org/10.1080/0034340032000065442

Scheuplein, C. (1999). Friedrich List und die "neue Mitte." Sozialdemokratische Technologiepolitik in der Metropole Berlin [Friedrich List and the "new center." Social democratic technology politics in the metropolis of Berlin]. *UTOPIE kreativ*, *108*, 46–56.

Schmidt, S., Müller, F. C., Ibert, O., & Brinks, V. (2018). Open region: Creating and exploiting opportunities for innovation at the regional scale. *European Urban and Regional Studies*, *25*(2), 187–205. https://doi.org/10.1177/0969776417705942

Schultze, E. H. (1927). Die Siemens-Werke in Berlin-Siemensstadt [The Siemens plant in Berlin-Siemensstadt]. In Schiffbautechnische Gesellschaft zu Berlin (Ed.), *Jahrbuch der Schiffbautechnischen Gesellschaft* [Yearbook of the Naval Engeneering Society] (Vol. 28, pp. 519–551). Springer.

Senate Administration for Economy and Businesses. (1999). *Stadtentwicklungsplan Gewerbe. Gewerbestandort Berlin* [Urban development plan on commerce. Berlin as commercial location].

Senate Administration for Economy and Technology. (1993). *Konzept zur Sicherung von Gewerbe- und Industrieflächen in wichtigen Bereichen Berlins* [Concept on protecting commercial and industrial spaces in important areas of Berlin].

Senate Administration for Economy and Technology. (1994). *Transfer Berlin – Kooperationen zwischen Wissenschaft und Wirtschaft* [Transfer Berlin—Cooperation between science and business].

Senate Administration for Economy, Energy and Businesses. (2018a). *Masterplan Industriestadt Berlin 2018–2021* [Master plan industrial city Berlin 2018–2021].

Senate Administration for Economy, Energy and Businesses. (2018b). *Erste Ansiedlung im Zukunftsort CleanTech Business Park Berlin-Marzahn* [First Settlement in the CTP Berlin Marzahn].

Senate Administration for Economy, Energy and Businesses. (2021). *CleanTech Marzahn*.

Senate Administration for Urban Development and Environment. (2015). *BerlinStrategy—Urban development concept 2030*.

Senate Administration for Urban Development and Environmental Protection. (1993). *Konzept zur Industrieflächensicherung* [Concept for industrial area protection].

Senate Administration for Urban Development and Housing. (2020a). *Stadtentwicklungsplan Wirtschaft 2030—Entwicklungspotenziale für Gewerbe und Industrie* [Urban development plan for economy 2030—Development potentials for commerce and industry].

Senate Administration for Urban Development and Housing. (2020b). *Flächennutzungsplan Berlin—Stand September 2020* [Land use plan Berlin—Effective September 2020].

Senate Administration for Urban Development and Housing. (2020c). *Erläuterung zum Bebauungskonzept für den Bebauungsplan 5–123 (Siemensstadt 2.0)* [Explanations on the building concept for the development plan 5–123 (Siemensstadt 2.0)].

Senate Administration for Urban Development, Environmental Protection and Technology. (1999). *Innovations- und Technologiekonzept* [Innovation and technology concept].

Senate Administration for Urban Development. (2004). *Stadtentwicklungskonzept—Berlin 2020. Statusbericht und perspektivische Handlungsansätze* [Urban development concept—Berlin 2020. Status report and perspectival action approaches].

Senate Administration for Urban Development. (2011). *Stadtentwicklungsplan Industrie und Gewerbe—Entwicklungskonzept für den produktionsgeprägten Bereich* [Urban development plan for industry and commerce—Development concept for production-oriented areas].

Senate Chancellery. (2016). *Koalitionsvereinbarung zwischen Sozialdemokratische Partei Deutschlands (SPD) Landesverband Berlin und DIE LINKE Landesverband Berlin und BÜNDNIS 90/ Die Grünen Landesverband*

*Berlin für die Legislaturperiode 2016–2021* [Coalition agreement between the Social Democratic Party of Germany (SPD) Landesverband Berlin and DIE LINKE Landesverband Berlin and BÜNDNIS 90/Die Grünen Landesverband Berlin for the legislative period 2016–2021].

Senate of Berlin, & Government of Brandenburg. (2011). *Gemeinsame Innovationsstrategie der Länder Berlin und Brandenburg (innoBB)* [Joint innovation strategy of the federal states of Berlin and Brandenburg (innoBB)].

Senate of Berlin, & Government of Brandenburg. (2019). *innoBB 2025—Gemeinsame Innovationsstrategie der Länder Berlin und Brandenburg* [innoBB 2025—Joint innovation strategy of the federal states of Berlin and Brandenburg].

Senate of Berlin. (2006). *Innovations-, Forschungs—und Technologieleistungen des Landes Berlin* (Landes-Innovationsbericht; Drucksache Nr. 15/5534) [Innovation, research and technology performance in Berlin (Federal state innovation report; Printed matter No. 15/5534)].

Senate of Berlin. (2016). *Digitalisierung* (Drucksache Nr. 17/2600) [Digitalization (Printed matter No. 17/2600)].

Senator for Economy and Labor. (1988). *18. Bericht über die Lage der Berliner Wirtschaft* [18th report on Berlin's economic situation].

Siemens AG. (2013). Siemens Professional Education—Laufbahnmodelle IT [Siemens professional education—Career models in IT; PowerPoint Presentation]. https://docplayer.org/5999841-Siemens-professional-education-laufbahnmodelle-it.html

Siemens AG. (2021). *Die neue Siemensstadt.* [The novel Siemensstadt Siemens]. https://www.siemensstadt.siemens.com/de

Suwala, L., & Dannenberg, P. (2009). Cluster- und Innovationspolitik maßgeschneidert. Das Beispiel Adlershof in Berlin [Cluster and innovation policy customized. The case of Adlershof in Berlin]. *Standort*, *33*(4), 104–112. https://doi.org/10.1007/s00548-009-0122-4

Suwala, L., & Kulke, E. (2015). Der Technologiepark Berlin-Adlershof—Von der Wiege der deutschen Luftfahrt bis zur gegenwärtigen Stadt für Wissenschaft, Wirtschaft und Medien [The technology park Berlin-Adlershof—From the cradle of German aviation to the current city of science, economy and media]. In M. Makki & R. Kleßen (Eds.), *Exkursionsführer zum Deutschen Kongress für Geografie 2015 in Berlin: Herausforderungen von Mensch-Umwelt-Beziehungen im 21. Jahrhundert* [Excursion guide for the German Congress on Geography 2015 in Berlin: Challenges of human-environmental relations in the 21st century] (pp. 156–165). Humboldt University of Berlin.

Suwala, L., & Micek, G. (2018). Beyond clusters? Field configuration and regional platforming: The Aviation Valley initiative in the Polish Podkarpackie region. *Cambridge Journal of Regions, Economy and Society*, *11*(2), 353–372. https://doi.org/10.1093/cjres/rsy010

Wagner-Endres, S., Wolf, U., & Zwicker-Schwarm, D. (2018). *Neue Konzepte für Wirtschaftsflächen. Herausforderungen und Trends am Beispiel des Stadtentwicklungsplanes Wirtschaft in Berlin* [New concepts for economic areas. Challenges and trends using the case of the urban development plan for economy in Berlin] (Vol. 4). German Institute of Urban Affairs.

Werner-von-Siemens Centre for Industry and Science e.V. (2021). *Industrie- und Wissenschaftscampus* [Industry and knowledge campus]. https://wvsc.berlin

WISTA Management. (2020a). *Jahresbericht 2019* [Annual report 2019].

WISTA Management. (2020b). *WISTA erhält Mandat vom Senat für schnelle Entwicklung landeseigener Flächenpotenziale* [WISTA receives mandate from Senate for faster development of land potentials]. https://www.wista.de/aktuelles/news/wista-erhaelt-mandat-vom-senat-fuer-schnelle-entwicklung-landeseigener-flaechenpotenziale

*Zukunft Berlin—Ideen aus der Metropole. Folge 1: Berlin als Vorreiter für Innovationen* [Future Berlin—Ideas from the metropolis. Episode 1: Berlin as pioneer for innovation]. (2020, September 5). Zukunftsorte Berlin. https://zukunftsorte.berlin/downloads

*Zukunft Berlin—Ideen aus der Metropole. Folge 2. Kooperation aus Wirtschaft und Wissenschaft* [Future Berlin—Ideas from the metropolis. Episode 2: Cooperation from economy and science]. (2020, September 12). Zukunftsorte Berlin. https://zukunftsorte.berlin/downloads

*Zukunft Berlin—Ideen aus der Metropole. Folge 3: Zukunftsjobs und das Werben um Talente* [Future Berlin—Ideas from the metropolis. Episode 3: Future jobs and the recruitment of talents]. (2020, September 19). Zukunftsorte Berlin. https://zukunftsorte.berlin/downloads

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Article

# Behavioural Aspects of Office Space Structures in the City: The Case of Warsaw's Business Districts

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**Abstract**
Agglomeration and urbanisation externalities accelerate the concentration of commercial activities in the urban space and the creation of business districts. As a result, besides the usual central business district (CBD), large cities also have more recent, peripheral, and specialised secondary business districts (SBDs). There is little substantial research on the formation of SBDs in rapidly globalising, semi-peripheral locations, especially in post-socialist metropolises of Central and Eastern Europe. This includes Warsaw, Poland, which is being transformed into an emerging global metropolis. The article aims to determine the differences between the CBD and the SBD in Warsaw in terms of their attractiveness to companies and employees and the spatial behaviours of employees, especially in terms of transport and shopping. The research hypotheses indicate the differences between the two districts in terms of the type of agglomeration economies, transport accessibility, and components of the competitive advantage, as well as the characteristics of companies in those districts. The data are from a survey conducted in 2017–2018 among companies and their employees in both business districts, and they are analysed using basic statistical techniques and discriminatory analysis. The results confirmed there are significant differences between the two Warsaw business areas, mainly in terms of their transport accessibility and urbanisation externalities. In terms of transport, there is a greater role for public transport and rail in the CBD and for motorway and airport proximity in the SBD. Urbanisation externalities are significantly diminished by the traffic congestion in the SBD. The study also revealed that the development of commercial areas in Warsaw—a post-socialist city with a neoliberal model of spatial planning—follows only in some aspects the spatial patterns of business areas in other Western European metropolises.

**Keywords**
central business district; location factor; secondary business district; spatial behaviour; Warsaw

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## 1. Introduction

The new development paradigm of the information economy increases the role of information and communication technologies (ICT), creativity, and innovation as key factors of the competitiveness of an enterprise. Despite the decrease in transport costs, the importance of space—understood not so much as a specific area or region, but as various forms of proximity and relationships—increases in the processes of economic development. Metropolisation, as a territorial dimension of the information economy, creates a global network of large cities that act as nodes for the flow of goods, people, capital, information, and ideas (Castells, 1998). Metropolises offer agglomeration economies favourable for creating new knowledge, innovative technologies (Hardt & Negri, 2000), and creative solutions (Florida, 2005; Wojnar, 2016).

Control and management functions of the global information economy are often concentrated in urban

centres and metropolitan regions (Castells, 1998), where spatial structure is characterised by the deconcentration of economic activity (Criekingen et al., 2007; Hall & Pain, 2006). Such deconcentration and decentralisation may take the form of a chaotic sprawl (Lang, 2003) or a "concentrated dispersion" (Filion, 2000). The result is a polycentric metropolitan structure. In this process, new economic spaces are created, such as business districts outside the city centre or clusters of technologically advanced and creative industries. The emergence of new types of economic areas may eventually weaken the traditional city centre and create polycentric metropolitan structures in which traditional central business districts (CBDs) still play an important role but are accompanied by the secondary business districts (SBDs), also in the form of edge cities (Garreau, 1991) or other urban or suburban structures (Bole, 2010; Hall, 1999; Ratcliffe et al., 2009).

The new development paradigm of the fourth industrial revolution is related to decentralised and adaptive management of the manufacturing process (Hermann et al., 2016). In the knowledge-based economy (Rutten & Boekema, 2012), the dichotomy between the product and the service blurs (Kotler, 1994), while innovation is increasingly related to advanced business services (Doloroux & Shearmur, 2013). These types of economic activities become concentrated especially in central and secondary business areas that become increasingly important topics of contemporary urban development research (Glaeser, 2011). CBDs and SBDs develop and operate in different ways (Spencer, 2015). City centres are usually more multifunctional and offer better access to a range of cultural services and institutions. As a result, they often experience gentrification. SBDs, in turn, usually result from suburbanisation, are based more on individual transport, and are characterised by a clear separation of places of work and residence.

The general aim of the article is to determine the differences between CBDs and SBDs in terms of their attractiveness for companies and employees, as well as spatial behaviours of the latter, especially in terms of transport and shopping. The selected case study in Warsaw, Poland, allows such an analysis in the specific context of a post-socialist city (e.g., Stanilov, 2009) that has recently been transformed into an emerging global metropolis (Gorzelak & Smętkowski, 2012; Korcelli-Olejniczak, 2007; Taylor et al., 2010). Section 2 provides a review of the literature relevant to the aim of this article and is followed by Section 3, which is the presentation of both Warsaw's business districts. Section 4 contains basic information about the research methodology and data, while Section 5 presents the results of the analysis. The article closes with a discussion and conclusion, which includes recommendations for spatial development policy and planning.

## 2. Literature Review

The dynamic development of ICT fosters the polycentricity of contemporary urban regions (Hall & Pain, 2006). Decreasing communication costs allow large advanced producer services companies to locate routine functions outside the city centre. This may lead to a decrease of that area's role and importance (Fujita & Thisse, 2002). The process may create two labour markets: the primary one concentrates front-office functions in the CBD, and the secondary one performs back-office functions in the SBD. The distribution of jobs in those business areas determines commuting patterns and transport network load. The spatial structure and characteristics of the office real estate market are crucial for the city's external connections and its position in the global network of metropolises. The location of business areas also affects the scale and type of agglomeration economies they offer. All these factors result in the significant importance of the location and characteristics of business districts for urban spatial and development planning and policy (Smętkowski et al., 2019, 2020). In this context, European edge cities differ from those in the USA because of the greater involvement of the public sector in their development. That is, they are more planned than spontaneous. European edge cites are also not fully independent of the traditional city core; they are often nearer to the existing CBD (Bontje & Burdack, 2005).

Agglomeration effects in the form of urbanisation economies (Jacobs, 1961, 1969) offered by the CBD result from access to infrastructure and business and public institutions, proximity to other companies (including clients, suppliers, and collaborators), and the possibility of face-to-face contact (Hall & Pain, 2006). These facilitate information flow and tacit knowledge exchange (Polanyi, 1958). Access to other advanced services and a highly qualified workforce (Martinelli & Moulaert, 1993) is accompanied by greater control and management functions in the form of headquarters (Śleszyński, 2004, 2007). While routine functions (at the metropolitan or global scale) are deconcentrated (including offshoring), the most advanced and strategic services still require central locations (Halbert, 2007). Relations with clients during the strategic phases of negotiations and adjusting services usually take place in the CBD, while contacts during implementation phase may be less frequent and remote. Thus, they are more appropriate for the SBD (Fujita & Ogawa, 1982). Location preferences of companies may therefore vary depending on their specialisation (Soja, 2000).

Location factors and structural characteristics of the SBD differ from the traditional CBD (Buisson et al., 2001; Capelle-Blancard & Tadjeddine, 2010; Criekingen et al., 2007), although they are usually driven by the same forces (Giuliano et al., 2012). Based on the results of prior research, we might expect that a CBD is characterised by the greater presence of headquarters and companies preferring face-to-face business contacts, while the presence of more routine services and companies using ICT for business contacts is typical for an SBD. The CBD specifically offers greater diversity and density of activities and functions providing the companies with positive effects

of urbanisation economies. The SBD is expected to exploit the role of location economies related to the proximity of same sector companies (location economies also known as Marshall–Arrow–Romer externalities; Arrow, 1962; Marshall, 1920; Romer, 1986). The main components of the location attractiveness of the CBD are prestige, transport accessibility for clients, and access to public transport and rail. For the SBD, location attractiveness is based more on the cost of office space, accessibility for employees, and proximity to the airport and/or motorway (Buisson et al., 2001; Capelle-Blancard & Tadjeddine, 2010; Criekingen et al., 2007; Giuliano et al., 2012).

Table 1 presents the summary of differences between business districts, including agglomeration economies, transport accessibility, and components of competitive advantage and company characteristics. These differences are the basis for the research hypothesises for Warsaw as a specific case of a post-socialist city. Central and Eastern European (CEE) metropolises provide interesting examples of location patterns that resulting from a combination of post-socialist heritage and the neoliberal model of spatial planning (Tsenkova & Nedović-Budić, 2006). However, there has been no comprehensive research on this topic to the best of our knowledge.

There are several reasons to expect that Warsaw might differ from other Western European metropolises in terms of its CBD and SBD. The first premise (H1) is related to the weakness of the city centre resulting from the heritage of the socialist model of urban development, which did not consider bid rent and offered poor quality public spaces (Węcławowicz, 1996). As a result, companies might not find the prestige of inner-city locations sufficient, and the potential benefits of face-to-face interaction might be seen as limited. The second reason (H2) is related to development that depends on foreign capital (Büdenbender & Aalbers, 2019). Foreign investors tend to have specific preferences, like proximity to an international airport. As companies may choose both types of locations simultaneously, the type of external accessibility might not be a differentiating factor in the overall evaluation of locations. This could also result in locating both the back-office and the Polish and macro-regional headquarters of CEE market in the SBD. Taking this into account, we do not expect major differences between the two areas in terms of the importance of transport accessibility for customers and employees. The third premise (H3) is related to the neo-liberal spatial planning environment (Smętkowski et al., 2020). It manifests itself as a significant concentration of office space in the Warsaw SBD (25%) while other major Western SBDs, like La Défense in Paris, do not exceed 10% of overall city office space. This massive concentration might hypothetically contribute to the occurrence of urbanisation economies in the SBD as well. The last hypothetical difference (H4) comes from the unique features of post-socialist cities, the greater significance of private cars for commuting. Because of inner and outer urban sprawl and a decline in the role of public transport, the car is identified with greater reliability and social prestige (Komornicki, 2011). Therefore, the car might be the dominant mode of transport regardless of the type of business district.

## 3. Business Districts in Warsaw

The post-socialist heritage of the Warsaw metropolis is an important point of reference for its contemporary transformations, including the formation and dynamics of the spatial structure and development of business districts. The most important changes in post-socialist cities are the commercialisation of the city centre; deconcentration of shopping, entertainment, and office facilities (Sýkora, 2009); revitalization of post-industrial areas; and commercial and residential suburbanisation. Neoliberal and ineffective spatial planning often leads to the creation of poorly connected monofunctional areas, including SBDs (Smętkowski et al., 2020; Sýkora & Bouzarovski, 2012). Warsaw is not only the capital and the largest city in Poland: it is also an important regional metropolis that plays a significant role in the CEE office market, exhibits all processes mentioned above, and suffers from all their negative consequences.

Warsaw is becoming increasingly important as a global advanced producer services node, quickly advancing from a gamma-class city (Beaverstock et al., 1999) to an alpha-class world city (Taylor & Derudder, 2016). Despite its strong regional position, the city, similar to other post-socialist metropolises, is still clearly inferior to the core European metropolises (ESPON FOCI,

**Table 1.** Key differences between CBD and SBD location/attractiveness factors based on the literature review.

| Differentiating factors | CBD | SBD |
|---|---|---|
| Competitive advantage | Prestige | Price |
| Functional specialisation | Control | Routine services |
| Main form of business contacts | Face-to-face contacts | ICT |
| Agglomeration economies | Urbanisation economies | Location economies |
| Intraurban accessibility | Transport accessibility for clients | Transport accessibility for employees |
| Main mode of intraurban transport | Public transport | Car |
| Main type of external accessibility | Rail | Motorway, airport |

2010). Both the size and the internationalisation of the largest corporations in CEE are much smaller than those in highly developed countries (Gorzelak & Smętkowski, 2012; Raźniak et al., 2018). Despite the increasing importance of the command-and-control functions in CEE capital cities (Dorocki et al., 2019), significant dominance of subsidiaries rather than headquarters of large international companies and increasing market penetration by global corporations (CB Richard Ellis, 2011; Taylor, 2001) are accompanied by much less advanced knowledge-economy functions. Thus, modern innovation districts and technology parks are rather scarce (Benko, 1993; Dyker & Radosevic, 1999; Komninos, 2008).

The distribution of office space in Warsaw is characterised by a very clear bipolar pattern (Smętkowski & Celińska-Janowicz, 2014). The CBD has developed dynamically, especially in the 1990s (Śleszyński, 2004), while the SBD began to develop in the first decade of the 21st century in the post-industrial areas of Sluzewiec district about six kilometres from the city centre (Smętkowski, 2009).

The total office space in Warsaw increased from 0.4 million $m^2$ in the mid-1990s to over 5.3 million $m^2$ in 2016. Of this, 1.8 million $m^2$ was in the CBD, and 1.1 million $m^2$ in the SBD (Smętkowski et al., 2019). The spatial structure is thus clearly bipolar. Warsaw's CBD covers about 6.35 $km^2$ and is located mainly in the central districts of Srodmiescie and Wola (Figure 1). The core of the SBD covers 3.36 $km^2$ and is in the western part of the Mokotów district (the largest Warsaw district, mostly residential) in the southern part of the city, near the airport and the motorway ring road. Our delimitation of the two areas was based on the cartographic distribution of modern office space in Warsaw taking into account approximately 500 office buildings or their complexes.

The development of the Warsaw SBD area was not planned by local authorities. This is different from cities such as Paris (La Défense), London (Canary Wharf), Amsterdam (Zuidas), and Copenhagen (Ørestad). An extensive volume of office space, comparable to the CBD, emerged because of market forces and the decisions of developers who preferred very cheap and readily available land rather than more expensive CBD plots, which often had undefined legal and ownership status. Spatial planning in this context was a facilitating factor since, during the SBD's most dynamic development

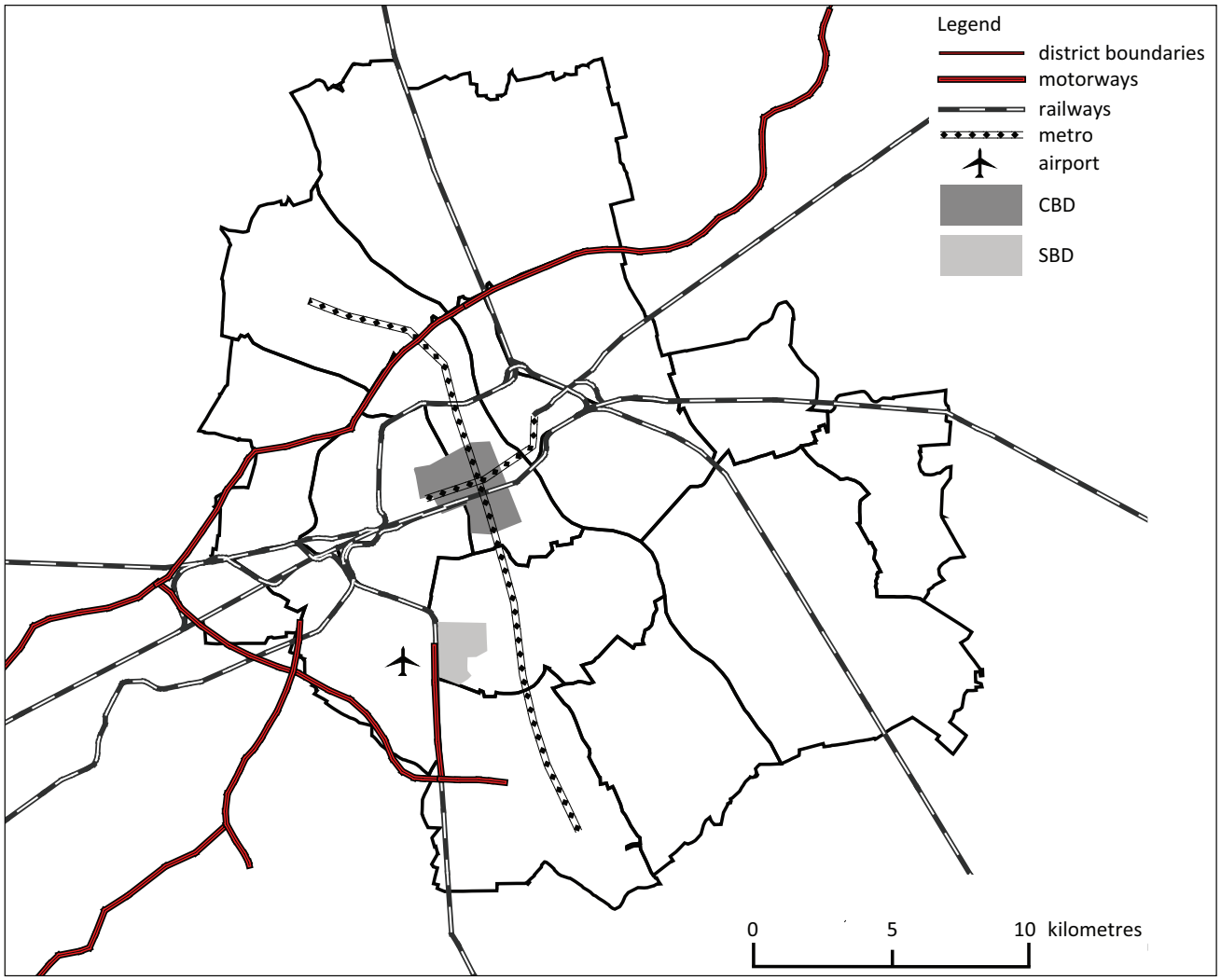


**Figure 1.** Location of the CBD and SBD in Warsaw.

(2004–2013), no local spatial plans were in force for the area, leaving significant freedom for developers (Smętkowski et al., 2020). There is a large modern shopping centre in each business district: Złote Tarasy in the CBD and Galeria Mokotów in the SBD. Both are similar in size (ca. 65,000 $m^2$ gross leasable area) and tenant mix, but Galeria Mokotów is seven years older and has been expanded three times since its opening in 2000.

## 4. Data and Methods

The empirical material for the quantitative analysis of spatial behaviours and preferences of companies and employees in two Warsaw business districts came from surveys conducted in 2017–2018 (both questionnaires are available on request; the key questions are presented in Tables 1 and 2 in the Supplementary File).

The company survey was conducted online based on the InfoCredit database of over 40,000 economic entities. The survey had two rounds. In the first round, the survey was sent to all companies. In the second round, companies were selected to create a stratified sample, i.e., to ensure a balanced geographical and branch structures. Of the 338 completed surveys, 99 came from companies in the CBD, and 62 from SBD. Of these companies, 76% in each area were established before 2010. They employed almost 27,000 employees in Poland and 6,854 in Warsaw offices (4,268 at companies in the CBD, and 2,586 at companies in the SBD). In both areas, 48% of companies could be classified as micro-enterprises (excluding sole traders), hiring fewer than 10 employees. In the CBD, the average office size was 583 $m^2$, but 44.4% of companies had office space of 100 $m^2$ or less. In the SBD, the average was 492 $m^2$, and 35.5% had office space of 100 $m^2$ or less.

Among the enterprises, the highest shares were of advanced business services, both "traditional" (law, accounting, consulting; 38% in the CBD, 29% in the SBD) and "creative" (IT, advertising, architecture; 24% in the CBD, 40% in the SBD). They also belonged to the finance, insurance, and real estate sectors (17% in the CBD, 13% in the SBD). Compared to the structure of the general population in these business areas, the sample was overrepresented by larger companies and companies that have been in business longer, and a significant overrepresentation of companies provided advanced business services. This reflects the specificity of office tenants that, even if they represented traditional sectors of the economy, were usually head offices, mostly in manufacturing, trade, or logistics companies. Furthermore, it should be emphasised that the sample reflected very well the specialisation of the two business areas; they had location quotients very close to those in the general population.

The employee survey was conducted in a direct form. At 10 locations in each business district, people who were leaving office buildings during lunch breaks or after work were approached at random and asked to complete the survey. The return rate was similar in both areas: 99 responders from SBD and 97 from CBD. Of the responders, 58% in the CBD and 67% in the SBD were male; 68% in CBD and 54% in SBD were 30 years old or less; and 70% in the CBD and 66% in SBD worked in their current workplace for less than two years.

The results of both surveys were analysed using several statistical methods. A frequency analysis was used to determine the most common features of the companies and employees' behaviours and preferences. To identify differences between the two districts, a few other methods were adopted, depending on the character of the variables (dichotomous, ordinal, continuous): Chi-square test, Mann–Whitney test, and t-test of independence. Advanced linear discriminatory analysis (McLachlan, 2004) was used to identify the key factors that differentiated the CBD from the SBD. The data used in the discriminant analysis met assumptions specified for this method (Tabachnick & Fidell, 2019).

## 5. Results

### *5.1. Companies*

Based on the responses from the companies' managers, it was possible to identify the attractiveness of both business areas for local companies. The t-test showed that the attractiveness factors of the CBD were its central location, greater public transport (especially subway) and rail accessibility, the location's prestige, and rich culture and entertainment available (see Table 1 in the Supplementary File). For the SBD, the most significant advantage was proximity to the airport and the highway ring road. The attractiveness of CBDs was also shaped by greater access to shops and restaurants, while that of SBDs was shaped by the availability of parking for clients and employees and opportunities for expansion (possibility to rent more office space in the same area or to move to a larger office in the vicinity). In terms of company characteristics, the only factor that significantly differentiated the two areas was the higher frequency of ICT contacts with clients at CBD companies. Both business areas were assessed as similarly attractive in terms of the cost of office space and proximity to suppliers, clients, and same-sector companies.

To determine the differences between the two business districts in more detail, a discriminant analysis was adopted. The model that best defined differentiated the two areas had a relatively strong discriminant power (Wilks' lambda 0.419). The functions of the model enabled correct classifications based on the firms' characteristics and the responders' opinions for 91% of companies in the CBD and 85% in the SBD. This confirms there were significant differences between the CBD and the SBD in terms of location preference.

The results from the discriminant analysis model showed that the main location advantage of the SBD was proximity of the ring road and the airport. This

was attractive to large corporations that often perform control functions at headquarters. This indicated what was important to foreign investors for restructuring and development of this business area (Büdenbender & Aalbers, 2019). Foreign companies valued access to a skilled workforce who also lived in suburban areas in the southwest part of the metropolitan area and good external accessibility because of the international airport nearby. On the other hand, the CBD was seen as more attractive in terms of proximity to the railway station. This shows, first, the importance of accessibility for employees across the metropolitan area and, second, the role of contacts within the national company structures. The locations were chosen by large corporations that might have had a complex organisational structure in Poland with production facilities outside the Warsaw metropolitan area, while their management and commercial functions operated in the city (Smętkowski et al., 2019).

The differences between the areas were also related to agglomeration economies. The SBD was distinguished by the proximity of suppliers. This may have been because of the higher density of economic actors in this economic area, while the central area was more extensive. This pattern corresponds with a higher frequency of ICT use in contacts with clients in the CBD. Also, access to cultural and entertainment facilities was considered a more important location factor in this district. In this case, however, the factor might have been perceived by the responders as a determinant of the city centre rather than a factor significant for their businesses (similarly as public transport accessibility). This is also shown by a study of the location preferences of "professional" and "creative" advanced business services, neither of which found this component to be important (Smętkowski et al., 2019).

It is worth noticing that the variables that did not differentiate the companies' choice of location were the company's age, office size, and cost of office space. Thus, the research did not support the incubation function, although this could be because of sample selection (excluding sole traders). On the other hand, the lower rental prices, on average, in the SBD (€15 per $m^2$ compared to €22 per $m^2$ in CBD) seem to have compensated for weaker transport accessibility and lower availability of urban services. Therefore, the companies' assessment of the cost attractiveness of both districts was similar. It was quite surprising that the importance of face-to-face contacts with customers did not differentiate the areas. This might reflect a change in the model of those contacts because of the technological revolution. As the research showed, despite the higher prestige attached to CBDs, that advantage over SBDs was quite small. This was a result of the weakness of the post-war reconstruction of the city centre, and it also reflected the assessment of the aesthetic value of the central city expressed by employees, presented in the next section.

### *5.2. Employees*

The three main aspects in the questionnaire given to employees were modes of transport in daily commuting, use of local retail and service facilities including a local shopping centre, and opinions about the workplace neighbourhood (see Table 2 in the Supplementary File).

Because of poorer transport accessibility, time travel to work was higher for SBD employees. For almost 20% of them, it was between one and one and half hours, while more than half of the responders from the CBD declared the time was less than 30 minutes. The share of those who travelled between 60 and 90 minutes was significantly higher for employees in the SBD. Employees at both areas commuted from various city districts and the suburban zone. There was a stronger preference for the SBD in the southern districts (34.4% compared to 26.7%) and a higher share of the suburban zone in the case of CBDs (12.2% compared to 7.6%).

When asked about the most important mode of transport in their daily commuting, most responders in both areas indicated some sort of public transport, usually bus and subway, but there were more in the CBD. In the SBD, the most popular mode was a car (27.7%); this was in third place for employees in the CBD (14.9%), after bus and subway. Statistically, there was a significant difference in employees' preference for rail; it was much more popular among employees in the CBD.

In both business areas, employees visited local shopping centres with a similar frequency, and in both cases almost one fourth said they do not visit the local shopping centre at all. More popular were service and retail outlets close to their workplace but outside the shopping centre. Almost 23% of responders in the SBD declared that they do not visit such outlets, while in CBD the share was only 5%. On the other hand, every third respondent from the CBD visited local shopping and service outlets at least once a day, while in the SBD it was only one in ten. In both areas, the most popular time to visit a local shopping centre during workdays was on the way home from work. In the CBD, such behaviour was cited by 31% of responders while in the SBD it was 57%. In addition, the shopping centre in the city centre was also frequently visited on the weekends (33%) and in employees' free time during the workday (19%). In terms of visiting local shops outside the shopping centre, the most popular were visits on the way home from work. However, workers from the SBD also made such visits during working hours. Those in the CBD made such visit on their way from home to work. Similar to the case of the local shopping centres, visits in free time during working days were significantly more popular among responders working in the CBD (14%) than in SBD (4%).

Shopping visits in the local centre were longer in the SBD: 69% of the responders said they spent between 15 and 60 minutes in the shopping centre. In the CBD, the analogous value was only 44%, and 24% said that their average visit took less than 15 minutes (compared to only

8.1% from those in the SBD). There were no statistically significant differences between the two districts in terms of time spent shopping in stores nearby the workplace outside the shopping centre.

The stores in the local shopping centres visited most often by employees in both areas were fashion shops (clothes, shoes, accessories) visited by 47% of all responders. Shopping centre hypermarkets and restaurants were much more popular among employees in the SBD. This disproportion can be explained by the rich and diverse service and retail offers outside the local shopping centre in the city centre and a significantly smaller number of alternative shopping locations outside the shopping centre in SBD. This was confirmed by the differences between the two business areas in terms of the frequency of visits to service and retail outlets outside the shopping centre. In all retail categories, employees of the CBD visited such stores more often than responders from the SBD. In almost all types of stores, the differences between the two areas were statistically significant (the exceptions were fitness clubs, restaurants, fast-food restaurants, and other food and beverages units).

The greater service and retail offerings outside the shopping centre in the CBD was the reason for the more frequent visits to stores outside the shopping centre than inside. The exceptions were fashion and electronic equipment stores and cinema. Those in the city centre shopping site were visited much more often than those outside the shopping centre since the latter were rather scarce. In the SBD, the situation was much more diversified. While the cinema, fast-food restaurants, bookstores, fashion stores, and electronic equipment shops were visited more often in the local shopping centre, outlets like grocery stores, pharmacies, newsstands, restaurants, fitness clubs, banks, and ATMs were visited significantly more often outside the shopping centre. It is also worth noting that for the SBD, the analysis did not reveal a division between employees who visited the local shopping centre and those who prefer stores outside the shopping centre. Instead, the division was between those who shopped near their workplace (67.7%) and those who did not (14.6%), regardless of the stores' location. In the CBD, the situation was slightly different: 77.4% of responders shopped in the local shopping centre and the stores outside the shopping centre, while 17% shopped only outside the shopping centre.

Despite high popularity as a shopping destination, in both business areas the local shopping centre was not perceived as an appropriate or convenient place for business meetings (including working meetings with co-workers). However, the shopping centre in SBD was significantly more popular in this respect than the shopping centre in CBD. In both areas, restaurants and cafes near the workplace were much more popular.

The quality of workplace surroundings was assessed more highly by employees from the CBD. Out of nine criteria, in only one (availability of green areas) was the SBD assessed higher than the CBD. The largest differences were in the organisation of transport; the availability of restaurants, cafes, shops, service units and public services; and public realm supporting and encouraging leisure and social interactions. However, since half of the CBD responders lived within 30 minutes travel time of their workplace, it is possible that they used the city centre retail and service often regardless of where they work. This factor may increase the share of positive assessments of the CBD. The city centre also gained more positive assessments from employees in terms of safety, although police statistics reveal that central districts have the highest number of reported crimes. On the other hand, poor transport arrangements in SBD might have decreased perceived levels of safety because of numerous unregulated interactions between pedestrians and vehicles.

The discriminant analysis of the questionnaire results enabled building a model with a strong discriminant power (Wilks' lambda 0.737, $p < 0.000$). That indicates an even greater differentiation between the areas in terms of the spatial behaviours and preferences of employees than of the companies. The model allowed the proper assignment of responders to one of the business areas for 70.6% of employees from the SBD and for 88.2% for the CBD.

The model indicates that the key differences between the two areas resulted from their diverse transport accessibility and different levels and types of agglomeration economies, which translated into different roles for the local shopping centres (see Table 2). Employees of companies in the CBD benefitted from better organisation of transport in the city centre. Thus, they spent less time on commuting, used rail more often, and assessed the area as better organised in terms of transport. They also visited electronic equipment stores outside the shopping centre significantly more often and the local shopping centre on weekends, and they organised business meetings in cafes and restaurants outside the shopping centre. On the other hand, the frequency of visits to grocery stores in the local shopping centre was significantly higher among SBD employees.

## 6. Discussion

The results of the analysis reveal a complex picture of the business districts in Warsaw. In terms of the differences between the CBD and the SBD, the city resembles metropolises in highly developed countries only partially. In addition, some of the research hypothesis based on the review of literature about the post-socialist metropolis could not be fully confirmed.

In terms of the assumed impact of the weak city centre (H1)—its insufficient prestige and limited potential for creating benefits from face-to-face interactions—the research revealed that the prestige advantage of the CBD was statistically significant but relatively poor. This was especially the case in the context of negative associations with the SBD because of traffic congestion.

**Table 2.** Classification functions of the discriminatory model.

| Classification function | CBD | SBD |
|---|---|---|
| *Transport accessibility* | | |
| Commuting time | 3.351 | 3.744 |
| Rail | −1.974 | −3.843 |
| Workplace surroundings well organised in terms of transport | 2.803 | 1.875 |
| *Agglomeration economy* | | |
| Shopping outside the shopping centre on weekends | 1.503 | 1.267 |
| Shopping in a grocery store in the shopping centre | 1.089 | 2.647 |
| Shopping in electronic equipment stores outside the shopping centre | 0.842 | −0.538 |
| Business meetings outside the shopping centre | 2.213 | 1.608 |
| Constant | −13.313 | −10.207 |
| Model summary | Wilks' lambda = 0.73694; F (7,188) = 9,5872, p < 0.000 | |

The analysis did not reveal any greater presence of headquarters or companies preferring face-to-face contacts in the CBD. This was indeed a result of the weakness of the post-war reconstruction of the city centre, and it was also reflected, among others, in the assessment of the aesthetic value of the central city area expressed by employees. Therefore, we consider the first hypothesis *confirmed to a large extent*.

The research *partially confirmed* the second hypothesis (H2) regarding the impact of the dominance of the foreign capital companies on the development process and structure of business districts in Warsaw. The analysis did not reveal any greater presence of control functions in the CBD or the prevalence of more routine services in the SBD. The importance of the availability of parking for employees and clients was similar in both areas, and—contrary to expectations—it was even more important for companies in the SBD. However, the accessibility of diverse types of transport indicates very clear differences in the relations of companies in both business areas. In the CBD, the role of national contacts, based on rail accessibility, plays a greater role, while in the SBD, more significant are international relations, based on air transport. Proximity to the airport proved to be especially attractive for the SBD location of the headquarters of international companies and also for the CEE region.

The third hypothesis (H3), regarding the lack of differences between business districts in terms of urbanisation and localisation type of agglomeration, is also *only partially confirmed*. On the one hand, specific preconditions of urbanisation economies in the SBD could be considered confirmed, since in both business areas certain urbanisation economies were visible based on the opinions of the enterprises. On the other hand, urbanisation economies took different forms in the two districts. The CBD offered greater diversity and density in terms of services, retail, culture, and entertainment availability as well as vivid public spaces facilitating leisure and informal social interactions, while the SBD had greater proximity to suppliers and a local shopping centre.

The last hypothesis (H4), underlining the similar significance of private cars in commuting, *has not been confirmed*. The CBD had a substantial advantage in terms of public transport and rail accessibility, while the SBD was more accessible by car because of the greater availability of parking for employees and proximity to the highway ring road. The superiority of the CBD in terms of transport accessibility was mainly caused by the unplanned and poorly organised spatial structure of the SBD, characterised mainly by significant negative agglomeration externalities in the form of traffic congestion, which had critical effects on both private cars and public transport. Despite the traffic and because of poorer public transport service, employees from the SBD commute by car more often than those from the CBD. Thus, the availability of parking becomes a significant attractiveness factor. The popularity of the car is increased by proximity to the highway ring road, which allows commuters to bypass the congestion. However, this applies only to employees who live in districts served by the highway, i.e., about 15% of the SBD responders. As a result of access to diverse forms of transport, the two areas operate with different ranges of labour markets defined by the daily commuting. It is metropolitan in the case of the CBD, and sectorial focused on the southern part of the city and the southern suburban zone in the case of SBDs (JLL, 2016). This transport specificity of the SBD is quite uncommon for business districts in Europe, since such areas are usually planned and designed in line with transit-oriented development (TOD; Calthorpe, 1993). Another example of such unusual organisation of transport in the SBD is Dublin (Smętkowski et al., 2020). As a result, both cities (Warsaw and Dublin) face similar traffic congestion and significant commuting time. It is of course not surprising that disobeying the TOD rules reduces the accessibility of transport and increases the costs for companies and

employees. As a result, and despite living and working in the same city, they spend up to three hours every day commuting. Lack of effective spatial planning and neoliberal market-driven development of the whole reveals negative agglomeration externalities (Büdenbender & Aalbers, 2019).

Several other factors did not differentiate the two areas: proximity to clients, competitors, and same sector companies; the sources of the location attractiveness; and company characteristics such as age, office space size, and orientation on business-to-business clients. There were no significant differences in terms of the cost of office space. This does not mean that the prices in both areas were at the same level. In the CBD, they were significantly higher. It does mean that, in both districts, the prices were commensurate with the business conditions offered to companies. In the city centre, higher prices for office space were an acceptable cost for greater transport accessibility, while less expensive office space in the SBD was partial compensation for worse traffic conditions. Furthermore, the role of "soft" location attractiveness was similarly low in both areas, especially for companies. This probably results from the fact that employers focused on providing an adequate working environment in the form of office space rather than broader workplace surrounding (Smętkowski et al., 2019).

## 7. Conclusions and Recommendations

The two business districts in Warsaw manifest both similarities and differences, although the latter are more numerous. The similarities and trade-offs for location attractiveness (cost of office space, soft location factors, proximity to clients and competitors, and basic company characteristics) suggest that there is no hierarchical relation between the CBD and SBD and the latter is a functional extension of the city centre rather than a competing business area. The most significant differences between the two Warsaw business areas were their perceived attractiveness, company characteristics and employees' behaviours and opinions with respect to space. The two main domains of the differences are summarised as transport accessibility and agglomeration economies (see Table 3).

While the central business area was quite accessible by rail and public transport, the SBD was struggling with serious traffic congestion. Its employees were to a large extent dependent on car transport while external accessibility was provided mainly by the nearby ring road and airport. In terms of agglomeration economies, a diversified city centre provided a rich offer of services for both businesses and employees. For employees, it also offered access to many retail and catering opportunities, as well as vivid public spaces that enabled social interactions and leisure. In the SBD, such infrastructure was significantly less available. This was only partially compensated by the local shopping centre.

The analysis of the two business districts in Warsaw revealed that the development of business areas in a post-socialist city with a neoliberal model of spatial planning only partially follows the development of spatial patterns and characteristics of business areas in Western European metropolises. The main similarities between the models in the literature and the Warsaw case were access to transport and the attractiveness of the city centre based on the urbanisation of economies. In other aspects, the Western European model was not confirmed in the reality of the post-socialist metropolis. In addition, only part of the hypothesis that the differences between the CBD and the SBD were because this is a post-socialist metropolis was confirmed, specifically, those related to prestige and car accessibility for customers and employees of both areas and urbanisation economies in the SBD.

The Warsaw case shows many negative consequences of ineffective and highly liberal spatial planning policies in an emerging metropolis exposed to globalisation and market forces. Apart from the general recommendation to direct and guide the development of business areas by consistent and properly equipped spatial planning policy, we also developed some specific rec-

**Table 3.** The main differences between the two business areas in Warsaw.

| | CBD | SBD |
|---|---|---|
| *Transport accessibility* | | |
| Internal (relations within the metropolitan area) | Public transport | Parking for employees, highway ring road |
| External (relations with other cities) | Rail | Airport, highway ring road |
| *Agglomeration economies* | | |
| Business | Urban services availability | Proximity to suppliers |
| Public realm | Wide offer of retail, services, catering<br>Public space that enables social interaction and leisure | Shopping centre |

ommendations for urban planning policy and practice aimed at providing more sustainable and coordinated urban development. In planning the creation and/or the development of secondary SBDs, adopting the approach of TOD is recommended to avoid car traffic congestion which may create significant financial and time travel costs, mostly for the offices' employees.

The study shows that rich retail and service offers and high-quality public space might not be the most important factors of a business district's attractiveness to companies and employees. However, deficiencies in these areas might significantly diminish such attractiveness. It is thus important to promote mixed-use development with appropriate volume and distribution of quality public spaces in SBDs (Booth et al., 2002). This may create an attractive working environment not only for employers but also for employees who would not be forced to use shopping centres as the most accessible—or even the only—substitute for public space (Karrholm, 2016).

The study also proved the significant and increasing role of air transport in business relations. Cities that are important locations for regional headquarters or for subsidiaries of international companies especially could benefit from well-planned business districts and creating favourable conditions for service companies close to airports (Freestone & Baker, 2011) in areas that usually exclude residential development.

It is still difficult to indicate the most appropriate or beneficial spatial structure of the urban commercial space. Although the concentrated, cluster type of urban business district may create significant traffic congestion, especially when they are not properly planned, it also brings considerable agglomeration economies. Despite the development of ICT tools, face-to-face contact and proximity to clients or suppliers still play a significant role in increasing the attractiveness of a business areas' location. It is also worth noting that the Covid-19 pandemic may change this picture by increasing the importance of remote work and ICT-based contacts with clients.

Although this research provides many valuable conclusions, it also has some limitations that should be considered. The results refer to Warsaw, so they can only be extrapolated to other post-socialist metropolises to a limited extent. A post-socialist heritage is not the only factor that determines the trajectory of the development of a city's business areas. The role of spatial planning policy, as well as such factors as the shape of the transport network and the location of airports (which in Warsaw is located relatively close to the city centre) cannot be omitted. We are also aware that we present a static picture of a phenomenon that is very dynamic in nature and that, since 2018, the situation in both business areas (including their relative attractiveness) might have changed. In addition, both survey samples were not representative. Thus, their results cannot be treated as a universal illustration of the behaviours and opinions of the companies and their employees in the two business areas of Warsaw. The size and differentiation of the employee sample did not allow for the control of variables that might have had some impact on the responders' opinions, e.g., age, place of residence, or job position.

The analysis of the two business districts revealed a broad area of possible future research, of which the most obvious are studies that compare the results for Warsaw with similar analysis conducted in other CEE countries. Especially valuable might be comparisons with other post-socialist capital cities and countries in terms of their approaches to spatial planning. It would also be worth comparing the opinions of managers and employees in the same company about the office's location attractiveness. Interesting results may also come from a more detailed analysis of companies (and their employees) that have recently changed their location. They might have more in-depth insights about the attractiveness of available office locations. A promising expansion of our research would be to add a dynamic aspect, i.e., to analyse changes in the characteristics and attractiveness of the two business areas over time. Finally, as already mentioned, (post-)pandemic reality may bring a significant change in terms of the role of specific location factors, such as transport accessibility or proximity to the airport, clients, and suppliers.

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**Conflict of Interests**

The authors declare no conflict of interests.

**Supplementary Material**

Supplementary material for this article is available online in the format provided by the authors (unedited).

**References**

Arrow, K. J. (1962). The economic implications of learning by doing. *The Review of Economic Studies*, *29*(3), 155–173.

Beaverstock, J. V., Taylor, P. J., & Smith, R. G. (1999). The long arm of the law: London's law firms in a globalising world economy. *Environment and Planning A*, *31*(10), 1857–1876.

Benko, B. (1993). *Geografia technopolii* [Geography of technopoles]. Wydawnictwo Naukowe PWN.

Bole, D. (2010). Secondary business districts in Ljubljana. Analysis of conditions and assessment of planned development. *Urbani Izziv*, *21*(1), 78–93.

Bontje, M., & Burdack, J. (2005). Edge cities, European-

style: Examples from Paris and the Randstad. *Cities*, *22*(4), 317–330.
Booth, G., Leonard, B., & Pawlukiewicz, M. (2002). *Ten principles for reinventing suburban business districts*. Urban Land Institute.
Büdenbender, M., & Aalbers, M. B. (2019). How subordinate financialization shapes urban development: The rise and fall of Warsaw's Służewiec business district. *International Journal of Urban and Regional Research*, *43*(4), 666–684.
Buisson, M. A., Mignot, D., & Aguilera-Belanger, A. (2001). Métropolisation et polarités intra-urbaines. Le cas de Lyon [Metropolisation and intra-urban polarities. The case of Lyon]. *Revue d'Economie Régionale et Urbaine*, *2*, 271–296.
Calthorpe, P. (1993). *The next American metropolis: Ecology, community, and the American dream*. Princeton Architectural Press.
Capelle-Blancard, G., & Tadjeddine, Y. (2010). *The urban location of financial activities* (Working Paper). University Paris 1 Panthéon-Sorbonne.
Castells, M. (1998). *The information age: Economy, society and culture—The rise of network society*. Blackwell.
CB Richard Ellis. (2011). *Business footprints: Global office locations 2011*.
Criekingen, M., Bachmann, M., Guisset, C., & Lennert, M. (2007). Towards polycentric cities. An investigation into the restructuring of intra-metropolitan spatial configurations in Europe. *Belgeo*, *1*, 31–50.
Doloroux, D., & Shearmur, R. G. (2013). Innovation strategies: Are knowledge-intensive business services just another source of information? *Industry and Innovation*, *20*(8), 719–738.
Dorocki, S., Raźniak, P., & Winiarczyk-Raźniak, A. (2019). Changes in the command and control potential of European cities in 2006–2016. *Geographia Polonica*, *92*(3), 275–288.
Dyker, D. A., & Radosevic, S. (Eds.). (1999). *Innovation and structural change in post-socialist countries: A quantitative approach*. Springer.
ESPON. (2010). *FOCI: Future orientation for cities*. https://www.espon.eu/sites/default/files/attachments/FOCI_draft_final_report_Scientific Report.pdf
Filion, P. (2000). Balancing concentration and dispersion? Public policy and urban structure in Toronto. *Environment and Planning C*, *18*(2), 163–189.
Florida, R. (2005). *Cities and creative class*. Routledge.
Freestone, R., & Baker, D. (2011). Spatial planning models of airport-driven urban development. *Journal of Planning Literature*, *26*(3), 263–269.
Fujita, M., & Ogawa, H. (1982). Multiple equilibria and structural transition of non-monocentric urban configurations. *Regional Science and Urban Economics*, *12*(2), 161–196.
Fujita, M., & Thisse, J. F. (2002). *Economics of agglomeration: Cities, industrial location, and globalization*. Cambridge University Press.
Garreau, J. (1991). *Edge city: Life on the new frontier*. Random House.
Giuliano, G., Redfearn, C., Agarwal, A., & He, S. (2012). Network accessibility and employment centres. *Urban Studies*, *49*(1), 77–95.
Glaeser, E. L. (2011). *Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier, and happier*. Palgrave Macmillan.
Gorzelak, G., & Smętkowski, M. (2012). Warsaw as a metropolis—Successes and missed opportunities. *Regional Science Policy & Practice*, *4*(1), 25–45.
Halbert, L. (2007). From sectors to functions: Producer services, metropolisation and agglomeration forces in the Ile-de-France region. *Belgeo*, *1*, 73–94.
Hall, P. (1999). The future of cities. Computers. *Environment and Urban Systems*, *23*, 173–185.
Hall, P., & Pain, K. (Eds.). (2006). *The polycentric metropolis: Learning from mega-city regions in Europe*. Earthscan.
Hardt, M., & Negri, A. (2000). *Empire.* Harvard University Press.
Hermann, M., Pentek, T., & Otto, B. (2016). Design principles for industry 4.0 scenarios. In *Proceedings of the 2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 3928–3937). IEEE Computer Society.
Jacobs, J. (1961). *The death and life of great American cities*. Random House.
Jacobs, J. (1969). *The life of cities*. Random House.
JLL. (2016). *Służewiec 2.0. Perspektywy rozwoju największej dzielnicy biurowej w Polsce* [Sluzewiec 2.0. Development perspectives of the largest office district in Poland].
Karrholm, M. (2016). *Retailising space: Architecture, retail and the territorialisation of public space*. Routledge.
Komninos, N. (2008). *Intelligent cities and globalisation of innovation networks*. Routledge.
Komornicki, T. (2011). *Przemiany mobilności codziennej Polaków na tle rozwoju motoryzacji* [Changes in the daily mobility of Poles in relation to the development of the automotive industry]. IGiPZ PAN.
Korcelli-Olejniczak, E. (2007). Berlin and Warsaw: In search of a new role in the European urban system. *Journal of Housing and the Built Environment*, *22*(1), 51–68.
Kotler, P. (1994). *Marketing management. Analysis, planning, implementation, and control* (8th ed.). Prentice-Hall.
Lang, R. (2003). *Edgeless cities: Exploring the elusive metropolis*. Brookings Institution Press.
Marshall, A. (1920). *Principles of economics*. Palgrave Macmillan.
Martinelli, F., & Moulaert, F. (1993). The location of advanced producer services firms: Theory and illustrations. *Geographische Zeitschrift*, *81*, 1–17.
McLachlan, G. J. (2004). *Discriminant analysis and statis-*

*tical pattern recognition*. Wiley.
Polanyi, M. (1958). *Personal knowledge: Towards a post-critical philosophy*. University of Chicago Press.
Ratcliffe, J., Stubbs, M., & Keeping, M. (2009). *Urban planning and real estate development* (3rd ed.). Routledge.
Raźniak, P., Dorocki, S., & Winiarczyk-Raźniak, A. (2018). Central European cities as command and control centers in a time of economic crisis. *Acta Geographica Slovenica*, *58*, 101–110.
Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002–1037.
Rutten, R., & Boekema, F. (2012). From learning region to learning in a socio-spatial context. *Regional Studies*, *46*(8), 981–992.
Śleszyński, P. (2004). *Kształtowanie się zachodniej części centrum Warszawy* [Formation of the western part of the Warsaw city centre]. IGiPZ PAN.
Śleszyński, P. (2007). *Gospodarcze funkcje kontrolne w przestrzeni Polski* [Economic control functions in the space of Poland]. IGiPZ PAN.
Smętkowski, M. (2009). Nowe relacje między metropolią a regionem: od terytorialnej do sieciowej organizacji przestrzeni [New relations between the metropolis and its region: From territorial to network organization of space]. In B. Jałowiecki (Ed.), *Czy metropolia jest miastem?* [Is the metropolis a city?] (pp. 26–49). Wydawnictwo Naukowe Scholar.
Smętkowski, M., & Celińska-Janowicz, D. (2014). Dwubiegunowość przestrzeni biurowej w Warszawie—Porównanie Centralnego i Mokotówskiego Obszaru Biznesu [Bipolarity of office space in Warsaw—Comparison of the central and Mokotów business areas]. In A. Wolaniuk (Ed.), *Centra i peryferie w okresie transformacji ustrojowej* [Centres and peripheries in the period of systemic transformation] (pp. 205–216). Wydawnictwo Uniwersytetu Łódzkiego.
Smętkowski, M., Celinska-Janowicz, D., & Wojnar, K. (2019). *Nowe przestrzenie gospodarcze metropolii. Struktura, funkcje i powiązania obszarów biznesu w Warszawie* [New economic spaces of the metropolis. Structure, functions, and connections of business areas in Warsaw]. Wydawnictwo Naukowe Scholar.
Smętkowski, M., Moore-Cherry, N., & Celińska-Janowicz, D. (2020). Spatial transformation, public policy and metropolitan governance: Secondary business districts in Dublin and Warsaw. *European Planning Studies*, *29*(7), 1331–1352. https://doi.org/10.1080/09654313.2020.1856346
Soja, E. W. (2000). *Postmetropolis—Critical studies of cities and regions*. Blackwell.
Spencer, G. M. (2015). Knowledge neighbourhoods: Urban form and evolutionary economic geography. *Regional Studies*, *49*(5), 883–898.
Stanilov, K. (Ed.). (2009). *The post-socialist city: Urban form and space transformations in central and eastern Europe after socialism*. Springer.
Sýkora, L. (2009). Post-socialist cities. In R. Kitchin & N. Thrift (Eds.), *International encyclopedia of human geography* (8th ed., pp. 387–395). Elsevier.
Sýkora, L., & Bouzarovski, S. (2012). Multiple transformations: Conceptualising the post-communist urban transition. *Urban Studies*, *49*(1), 41–58.
Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.
Taylor, P. J. (2001). Specification of the world city network. *Geographical Analysis*, *33*(2), 181–194.
Taylor, P. J., & Derudder, B. (2016). *World city network* (2nd ed.). Routledge.
Taylor, P. J., Derudder, B., Hoyler, M., Pain, K., & Witlox, F. (2010). *European cities in globalization*. In P. J. Taylor, P. Ni, B. Derudder, M. Hoyler, J. Huang, & F. Witlox (Eds.), *Global urban analysis. A survey of cities in globalization* (pp. 114–136). Earthscan.
Tsenkova, S., & Nedović-Budić, Z. (Eds.). (2006). *The urban mosaic of post-socialist Europe: Space, institutions and policy*. Physica-Verlag.
Węcławowicz, G. (1996). *Contemporary Poland. Space and society*. UCL Press.
Wojnar, K. (2016). *Polska klasa kreatywna* [Polish creative class]. Narodowe Centrum Kultury.

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Article

# Industrial Infrastructure: Translocal Planning for Global Production in Ethiopia and Argentina

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**Abstract**
Current development and re-development of industrial areas cannot be adequately understood without taking into account the organisational structures and logistics of commodity production on a planetary scale. Global production networks contribute not only to the reconfiguration of urban spatial and economic structures in many places, but they also give rise to novel transnational actor constellations, thus reconfiguring planning processes. This article explores such constellations and their urban outcomes by investigating two current cases of industrial development linked with multilateral transport-infrastructure provisioning in Ethiopia and Argentina. In both cases, international partners are involved, in particular with stakeholders based in China playing significant roles. In Mekelle, Ethiopia, we focus on the establishment of a commodity hub through the implementation of new industry parks for global garment production and road and rail connections to international seaports. In the Rosario metropolitan area in Argentina, major cargo rail and port facilities are under development to expand the country's most important ports for soybean export. By mapping the physical architectures of the industrial and infrastructure complexes and their urban contexts and tracing the translocal actor constellations involved in infrastructure provisioning and operation, we analyse the spatial impacts of the projects as well as the related implications for planning governance. The article contributes to emergent scholarship and theorisations of urban infrastructure and global production networks, as well as policy mobility and the transnational constitution of planning knowledge and practices.

**Keywords**
Argentina; China; Ethiopia; global production networks; infrastructure-led development; transnational urban spaces

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## 1. Introduction

The belief that integration in global production networks and seamless flows of goods is a prerequisite of successful development and poverty alleviation in the Global South still guides powerful international institutions, such as the World Bank, and national policy agendas. The continuing influence of this paradigm is reflected in the many large-scale infrastructure projects in the Global South related to manufacturing and resource extraction aimed at integrating urban regions in globalised production systems and promoted by a global "growth coalition" comprised of development banks, governments, multilateral institutions, transnational corporations, and consultancies (Schindler & Kanai, 2019). These include new powerful actors such as state-owned enterprises and banks from China, as well as numerous firms from other Asian countries, as major drivers of a new "South–South'' cooperation in planning, engineering, and manufacturing (Anand et al., 2018). China's Belt and Road Initiative can be regarded as largest among a variety of multilateral and bilateral initiatives

of infrastructure-led development (Liu et al., 2020). In Ethiopia, for example, building physical infrastructures for global garment manufacturing, such as industrial parks and related logistics facilities to attract global fashion brands and their transnational suppliers, became a key national development priority in the last 10 years (Ethiopia National Planning Commission, 2016; United Nations Development Programme Ethiopia, 2017). However, implementation has only been made possible through foreign capital and construction firms, mainly from China (Jalles d'Orey & Prizzon, 2017; World Bank, 2017), which has complemented national investments. In Argentina, the upgrading and expansion of transport infrastructures for global soy production and distribution is implemented by state agencies in close cooperation with firms and financing from China (Ministerio de Transporte, 2017a).

Partnerships between national governments and Chinese companies to develop critical infrastructure projects have triggered controversial debates in policy and research. They often fall under the umbrella of the Belt and Road Initiative, an agenda that has been described as deliberately fuzzy with regard to its official goals, geographical scope, and means of implementation (Narins & Agnew, 2020). Researchers have questioned the long-term economic effects and sustainability of infrastructure-led development in general (Schindler & Kanai, 2019), or problematised the lack of involvement of local municipal planning in implementing such projects (e.g., Beyer et al., in press; Goodfellow & Huang, 2021; Kanai & Schindler, 2019). Some of these authors have pointed towards the way such infrastructural constellations enable the exploitation of spatial differences within global production networks and, thus, contribute to uneven development (Arboleda, 2016; Kanai & Schindler, 2019). Although their extensive impacts on urbanisation dynamics are undisputed, a comprehensive and critical urban assessment of translocal infrastructure initiatives is largely missing, particularly in relation to global production networks. In fact, unravelling the conflicts and fault lines at the interface of infrastructure provision and urban development is particularly relevant given the multiple sustainability challenges in "industrialising" countries, augmented by the Covid-19-related crisis, and the size of the financial commitment already made by national and local governments in relation to transnational infrastructure investments. To answer the questions raised, more solidly grounded case studies are needed to "demystify" (Liu et al., 2020) infrastructure development with Chinese involvement and exploring its varying contours and impacts. Such case studies ought to shed light on the local and spatial development impacts of transnational infrastructure provisioning and to untangle multilateral negotiation processes between the involved actors, such as local government agencies, local communities, development agencies, and a variety of Chinese state-owned enterprises (Goodfellow & Huang, 2021; Liu et al., 2020).

Addressing this gap, this article takes a closer look at the interrelations between industrial infrastructure provisioning and global networks of production and explores their repercussions in terms of urban development and planning governance. Two case studies of industrial areas in Mekelle, Ethiopia, and Rosario, Argentina, will be discussed as crystallisation points of wider transnational networks of production, logistics, and on-going infrastructure development. The article considers manufacturing and processing facilities as integral components of infrastructural arrangements facilitating global commodity circulation. Our analysis is guided by an understanding of infrastructures as "socio-technical apparatuses and material artifacts that structure, enable, and govern circulation" (Burchardt & Höhne, 2015, p. 3). Such a holistic view on the provisioning of industrial infrastructures links physical-material aspects to questions of planning, construction, operation, and maintenance (Leigh Star, 1999). Our findings build on the combination of the spatial analysis of emerging industry and infrastructure complexes in specific urban contexts and a transnational and comparative perspective on their provisioning, i.e., the ways they are planned, constructed, and negotiated through novel transnational actor constellations, including local actors and stakeholders from global production networks. Our approach integrates recent scholarship and theorisations around urban infrastructure, global production networks, as well as the transnational constitution and circulation of planning knowledge and practices.

## 2. Transnational Research Perspectives on Infrastructure Provisioning

Interdisciplinary debates on infrastructures and commodity flows in cities have gained considerable momentum in recent years (for a more extensive review of the literature see Beyer et al., 2020). Scholars of architecture and planning, as well as urban geography, have developed relational perspectives on how urban fabric is produced and organised through infrastructures, and how infrastructural networks spatialise socio-economic power relations (e.g., Graham & Marvin, 2001; McFarlane & Rutherford, 2008). Easterling (2014) and others have begun to show how infrastructure provisioning contributes to the emergence of new spatial and political configurations, for example the physical enclaves of special economic zones or segregated corridors, producing landscapes of "splintering urbanism" (Enns, 2018; Graham & Marvin, 2001; Kanai & Schindler, 2019). For their part, architectural scholars have developed innovative methods for analysis and visual representation of logistical infrastructure systems, their physical form, and urban impact (Hein, 2018; LeCavalier, 2016; Lyster, 2016). Yet, following Lin (2019), we contend that particularly the interrelations between transnational production relations and urban infrastructures remain understudied. Here, the global production

networks' heuristic approach, rooted in economic geography, offers particularly suitable entry points. It allows for an identification of the transnational actor constellations orchestrated by global "lead firms" within the industry and include actors on various scales of governance. Global production networks' scholarship and related approaches have generated instructive empirical analyses of global economic networks, including fundamental studies on the clothing and soy industries (Bair & Gereffi, 2001; for specific treatments of our case study regions see Dobelmann, 2012; Staritz et al., 2016). Furthermore, the approach draws attention to how network integration can foster regional development (Coe & Yeung, 2015; Henderson et al., 2002) and how it contributes to uneven geographies (Werner, 2016). The notion of "strategic coupling" is particularly helpful to conceptualise the nexus between the provisioning of infrastructures and the integration of a place in global production relations. It allows us to grasp how a match between a region's assets and the strategic needs of global lead firms is created in order to plug a region into global production networks. Jacobs and Lagendijk (2014, p. 51) understand "[t]he provision and deployment of key infrastructure…[as] one of the primary vehicles through which to facilitate the insertion of a place into a global production network and, thus, to accomplish strategic coupling." Also, recent research has stressed the centrality of infrastructures for coupling and de-coupling processes (Gao et al., 2017; Scholvin et al., 2019) and demonstrated the impacts the provision of infrastructure at one place can have on other network nodes (Breul et al., 2019).

At the same time, various strands of urban and geographical research have demonstrated the transnational interrelatedness of urban development. Urban research debates on the mobility and transnational constitution of planning knowledge and practices (Grubbauer, 2015; Parnreiter, 2015), as well as urban policies (McCann & Ward, 2012; Peck & Theodore, 2010), provide useful concepts and methodologies by which to explore the transnational processes and actors involved in the planning and provisioning of (urban) infrastructure (Harris, 2013; Kanai & Schindler, 2019; Rode et al., 2020; Wiig & Silver, 2019). Investigating the development of industrial and infrastructural urban spaces through the respective transnational flows and relations also speaks to discussions on "worlding" urban research (Roy, 2009). The concept of "worlding" brings to the fore the importance of contextualising urban development through widening the focus to the various translocal networks of knowledge, capital, commodities, and labour that cities are embedded in. However, scholars such as Söderström (2014) criticise such concepts as too abstract to capture "how connections and flows depend on and create material places" (pp. 171–172). Drawing on Söderstrom, we contend that focussing on the relational constitution of the particular built forms that enable transnational connections can contribute to closing this gap and direct long overdue attention to the globally interconnected nature of infrastructures for commodity production and circulation.

## 3. A Relational, Multi-Scalar Approach to Interrogate the Provisioning of Infrastructures for Global Production Systems

Our approach combines multi-scalar spatial analysis of emerging industry and infrastructure complexes in their specific urban settings with a relational, translocal perspective on their provisioning by translocal actor constellations, including stakeholders from global production networks and government authorities in charge of economic and spatial planning on different scales, as illustrated in Figure 1.

Spatial analysis encompasses three major analytical scales:

1. Buildings and their immediate surroundings, capturing the footprint and specific characteristics of built forms that facilitate the processing and movement of commodities;
2. Urban region or larger urban contexts of the industry-infrastructure complexes defined as "commodity hubs" (Giraudo, 2015), encompassing relevant urban planning schemes, spatial impacts on surroundings such as land use changes, land consumption, and environmental, social, and economic costs and benefits;
3. Translocal flows and infrastructure networks: On a larger scale, the commodity hubs are contextualized within national and transnational infrastructural networks such as commodity transportation and logistics.

Complementing the spatial analysis, we identify key actors involved in the design, implementation, and operation of the respective industrial infrastructure in three major fields: infrastructure provision, spatial planning, and global production. Tracing entanglements and overlaps between these fields allows us to capture the translocal constellations of actors involved in industrial infrastructure provisioning, to identify protagonists of "strategic coupling" with global production networks, and, most importantly, to chart power asymmetries and scalar mismatches posing specific challenges to urban planning.

The article draws on ongoing research, including fieldwork conducted between 2017 and 2019 in Ethiopia (Addis Ababa and Mekelle) and Argentina (Buenos Aires and Rosario), with the goal to trace how the processes, multi-scalar constellations, and negotiations of infrastructure provisioning correlate with physical urban transformations. Our findings are based on the triangulation of different qualitative methods of gathering empirical data, drawing on a pool of methods as suggested by McCann and Ward (2012) for tracing the diffusion of urban policies

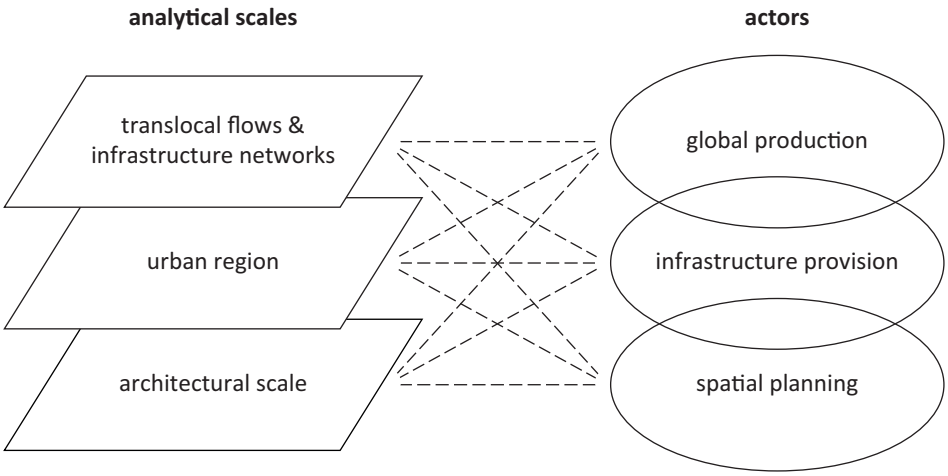


**Figure 1.** Analytical framework.

through interviews, maps, documents, and media analysis, as well as non-participant observation.

The analytical maps were prepared on the basis of existing maps and satellite images, as well as planning and design documents such as master plans, land-use plans and building plans, policy documents, and reports, all validated through on-site observations documented with photographs and drawings. At all locations, semi-structured expert interviews (Gläser & Laudel, 2010) were conducted with representatives of urban and transportation planning bodies on various scales: infrastructure providers and operators, companies involved in global commodity production and circulation, domestic and international development agencies, as well as other academic researchers. In total, we conducted 46 interviews (36 in or related to Ethiopia, 10 in Argentina). These were complemented by non-participant observation at trade fairs and conferences promoting industrial development, as well as evaluation of policy documents issued by state institutions, international organisations and NGOs, industry reports, technical reports, and planning and legal documents.

## 4. New Clothing Industry Parks in Mekelle: The Making of a Commodity Hub in Ethiopia

Mekelle city, the capital of the Tigray Regional State in northern Ethiopia, is an instructive case to study how transnational actors and stakeholders in globalised commodity production become significant players in negotiating and physically shaping urban space. At the same time, infrastructure provisioning for manufacturing and global circulation of commodities has become a primary goal of government agencies, leading to new spatial interventions. In the case of Mekelle, the potentially short life and fragility of globalised production arrangements also come to the fore—particularly in light of the violent conflicts between Ethiopia's federal government and the Tigray Regional State that have flared up since autumn 2020. The outcome of these conflicts is highly uncertain at the time of writing and will be critical for the full implementation and future use of infrastructure already in place and in the making.

### *4.1. Spatial Impacts of Industry Zone Construction*

With a population of approximately 500,000 within its current municipal boundaries, but about 1.5 million people living in a 50 km radius, Mekelle is an important secondary city in Ethiopia and a regional centre for administration, industry, business, and education. The city has been steadily growing over the past decades due to migration from rural areas and municipal boundaries were successively expanded (Mekelle University, 2014; Negese et al., 2017; Teka, 2020). In late 2018, when our field visits were conducted, there were four large monofunctional export-oriented industry zones under construction on greenfield sites on the periphery of the city (see Figure 2), all specialising in garment making and with the goal to employ more than 10,000 workers each. Apart from the state-run flagship project, the Mekelle Industry Park (MIP), three large clothing production complexes were being developed by private investors from India, the United Arab Emirates, Bangladesh, and Italy. In addition to its own integrated jeans factory, one of these complexes was set to become a 170 ha, privately run industry park for other companies. Each of the projects was facilitated through significant involvement of various stakeholders at the national scale, such as the Ethiopian Investment Commission, the Development Bank of Ethiopia, and the Industrial Parks Development Corporation (IPDC), as well as transnational actors in the garment industry (global brands and their supplier networks) and in the fields of development cooperation, consultancy, and construction engineering (see Figure 2). As the map shows, the sites are situated in urban fringe areas which are divided, in very broad swathes, into zones for industrial, logistics, or uniform state-led residential developments (plus higher education campuses). Current planning seeks to connect the industrial

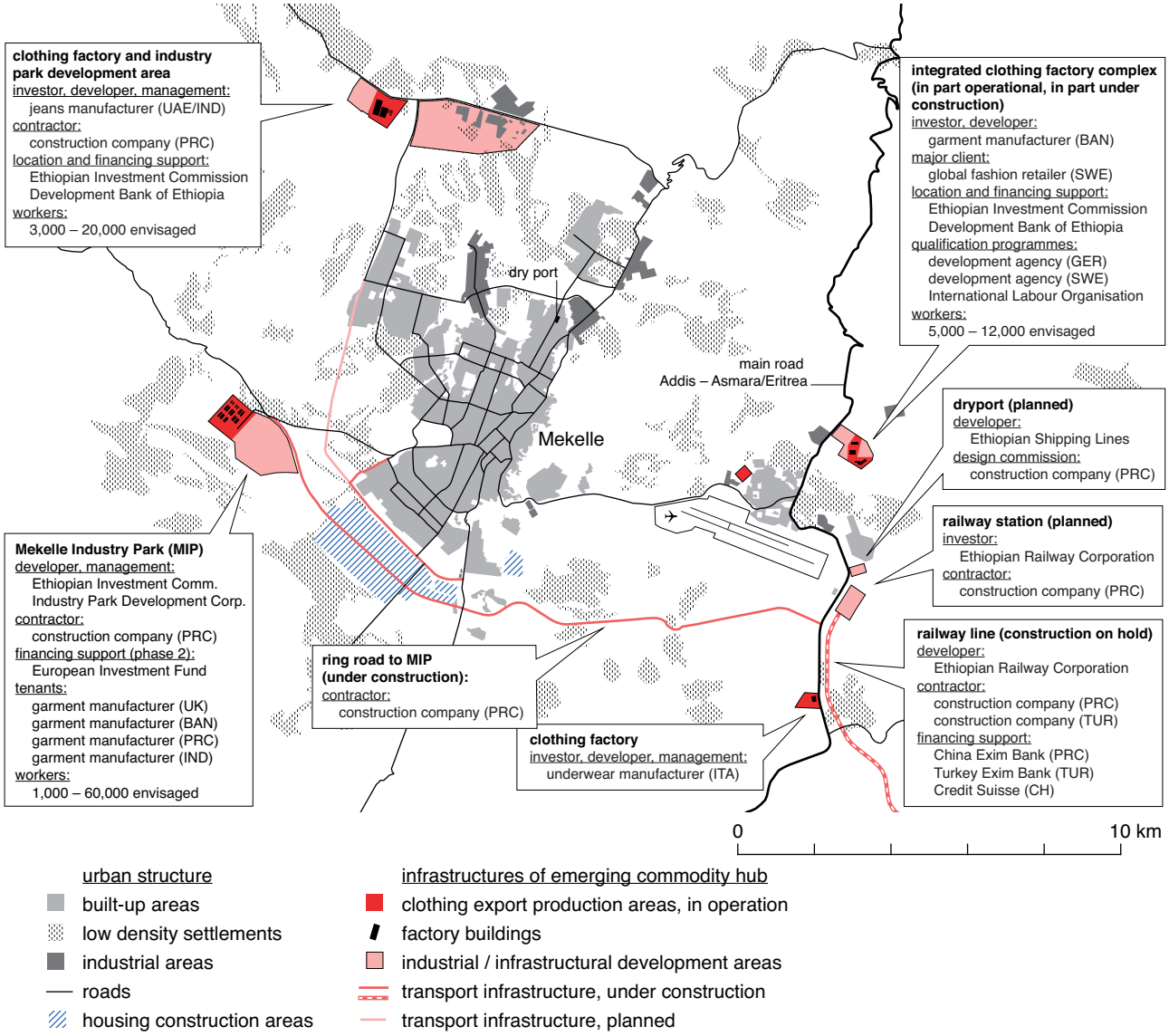


**Figure 2.** Industry and infrastructure projects for export production in Mekelle and involved actors (2018). Sources: Authors based on Google Maps, OpenStreetMap, IPDC (2015), and authors' interviews.

development sites—which had only recently been incorporated into the administrative territory of the city—to the main overland transport arteries by the construction of four-lane roads circumventing the city.

For example, at MIP on the south-western fringe of the city, the regional government designated an area of 1,000 ha for textile and garment production. In the first development phase, it covers an area of 75 ha and encompassed the following building works: 15 turn-key sheds of two sizes; offices for customs, tax issues, etc.; and road and engineering networks, including a wastewater treatment plant (see Figures 3 and 4). The Ethiopian government financed the construction, executed on a design-and-build contract by the Chinese Communications Construction Company (CCCC) within nine months after winning the tender. The monotonous spatial layout of the industry park contrasts sharply with the peri-urban context of agriculture and village structures. By 2018, the park, managed jointly by the Ethiopian Investment Commission and the IPDC, had been inaugurated, and sewing companies from China, India, Bangladesh, and the UK were among the first tenants. An additional area of 163 ha was announced as ready for the second construction phase, to be financed through a $500-million contract with the European Investment Bank. At the time of writing, however, operations in the park had been temporarily suspended due to the military conflicts of late 2020.

The immediate spatial impacts resulting from export-oriented industrial infrastructure development in Mekelle are significant. Not only do the large industrial sites and dual carriageways reconfigure the arid landscape of seasonal pastureland dramatically, dissecting intricate settlement patterns of small farmsteads in traditional stone masonry, they also divide the emerging residential estates south-west of the city

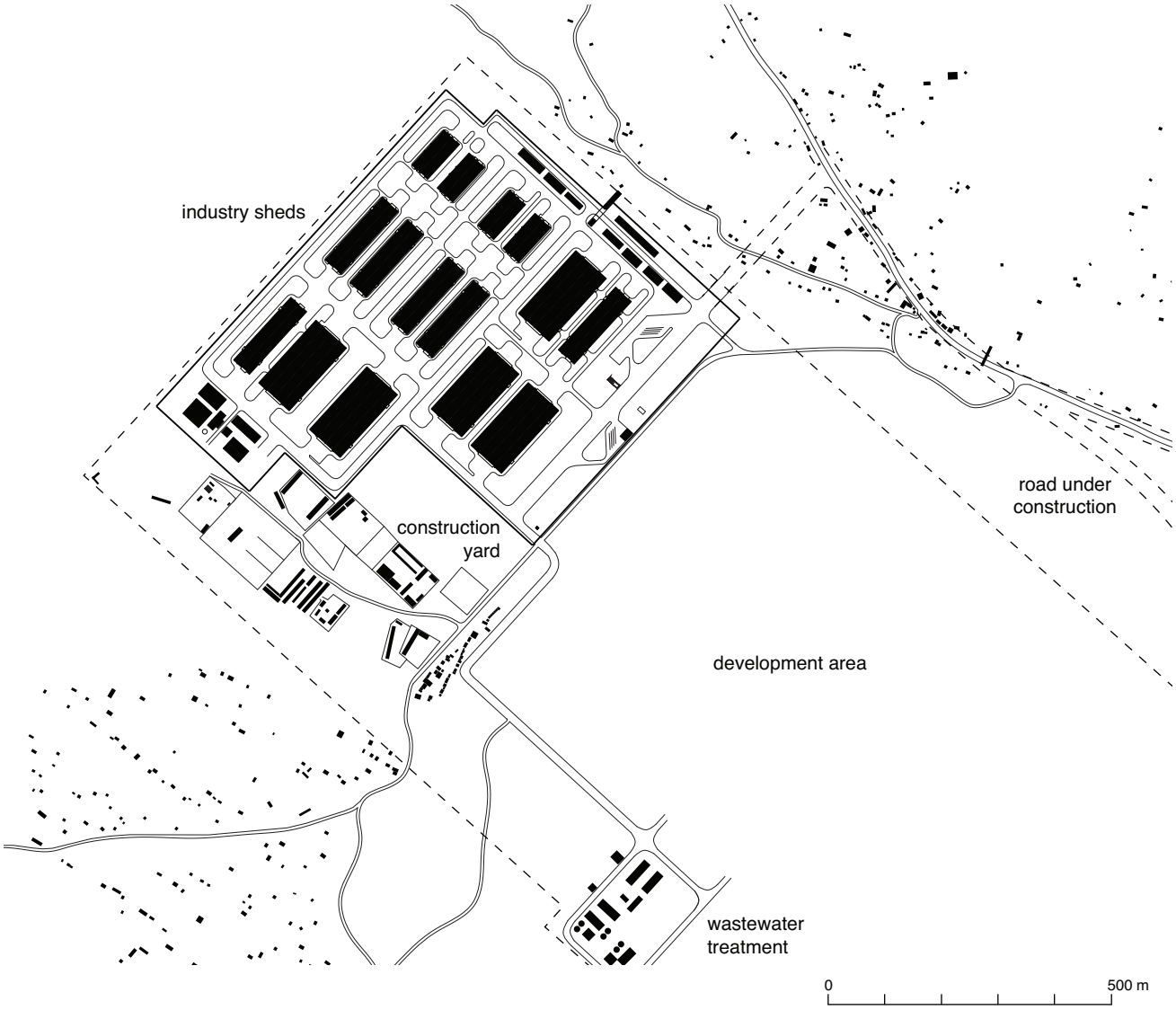


**Figure 3.** MIP, first construction phase (2018). Sources: Authors based on Google Maps, OpenStreetMap, IPDC (2015), and authors' interviews.

with an impermeable road corridor (on the Addis Ring Road development, also designed and implemented by the CCCC and fraught with similar problems, see Delz, 2015). Industry is also prone to consume immense electrical power and increase water scarcity, which is already at critical levels in the region. The huge monofunctional development areas and the fine-grain of existing and future urban texture appear as scalar mismatches posing issues concerning the planning governance constellations.

### *4.2. Urban Planning Challenges Linked to Industrial Infrastructure Development*

The industrial-infrastructural complexes pose multiple governance challenges linked to mediating interests of stakeholders operating at very different scales. These stakeholders include local farmers and workers from rural areas, municipal planners, regional as well as federal state institutions, transnational corporations and their suppliers, and globally active Chinese state-owned engineering companies. Last but not least, a range of foreign and international organisations are acting as development and/or investment consultants and capital providers. Power asymmetries between these stakeholders were already evident in the land allocation for industrial sites circa 2013. The location for the state-developed industry park, as well as for the private foreign-investment projects, was selected by Ethiopian Federal and Tigray Regional State's investment agencies, who went on to transfer publicly owned land from small tenant farmers (who received a very modest compensation) to foreign investors (who pay little or no rents on the land as an incentive). Government institutions operating at the national level actively promoted "strategic coupling" with global production networks by incentivisation, for example tax breaks and Development Bank of Ethiopia credits covering over 50% of initial investments

**Figure 4.** MIP and bypass under construction (2018).

by foreign companies, or through infrastructure provisioning. Meanwhile, locations could be allocated without engaging with the complexity of local realities and concerns. According to our interviews with textile company representatives, they were already exploring peripheral locations or beginning to develop their factories in 2013, but a 2014 land use analysis commissioned by Mekelle City Government in preparation for a revision of the city's structural plan made no mention of these large-scale projects (Mekelle University, 2014). In interviews, local planners conceded that the large industrial developments were only retroactively integrated into local urban planning schemes and it was not until as late as 2016 that a structural plan proposal was elaborated as a basis for the development of the Mekelle urban region taking into account the emerging large industry areas within the city's expanding administrative boundaries (Mekelle University, 2016).

Connecting the industrial enclaves to networked transport and supply infrastructures has been realised incrementally, involving spatial planning and infrastructure provision actors operating at different scales. This also concerns the urban and rural fabric of social reproduction required to keep transnational commodity production running: At the time of our field work, the question of how to provide housing for tens of thousands of workers was still a matter of deliberation. Garment manufacturing workers would clearly not be able to afford the new condominium housing under construction close by (Delz, 2018), but how to finance schemes to develop more affordable housing was still unresolved, according to the MIP's management. In the meantime, some of the manufacturing companies renting sheds in the park had asked for permission to erect dormitories on adjacent land (for similar issues in other Ethiopian industry parks see Beyer & Hagemann, in press). Apart from such factory-owned dorms planned with up to eight bunk-beds per room, the only viable housing option for workers was to rely on their personal or family networks, partly in rural, partly in informal settlements (Mezzadri, 2019).

Another key challenge is connectivity at different scales. National-level planning privileges infrastructural corridors for translocal commodity flows, ignoring more local mobility needs in urban and rural territories. According to a senior planner in Ethiopia's Federal Ministry of Transport, overland transport infrastructure was laid out in such broad strokes, even with regard to

industrial development sites, that critical details such as feeder roads or cargo rail branches were addressed with a time lag. At the time of our visit to Mekelle, major transport infrastructure, including an 18-km bypass, was under construction in order to improve the connection of the export industry to the ports of Djibouti and Eritrea, with the CCCC as the main contractor for designing, engineering, and building (see Figure 2). The company's commissions included the design for a new dry port for customs processing near the airport and the future rail terminus (Kang'ereha, 2017; PwC et al., 2017). Here, a multi-modal hub was envisioned for transferring containers from the road to an electric railway line southward. The CCCC was also contracted to implement a 200-km section of this railway line, as well as the entire Mekelle terminus station, co-financed by the Chinese state. Consequently, the engineering of most transport and industrial infrastructure for the commodity hub emerging in Mekelle relied on the design and construction expertise of one formidable global player in infrastructure provisioning, based in China. Although neither the rail terminus nor the multi-modal dry port project had proceeded beyond site allocation at the time of writing, they can be considered as significant factors in the strategic coupling with global production and important vectors of current and future urbanisation. Images of trains and the future countrywide rail network often feature in information materials for investors in MIP and other Ethiopian industry parks, and company representatives stated that the railway project contributed to their location choice in Mekelle. After painstaking land procurement processes, however, the building of the railway link was temporarily suspended in 2019 due to lack of funds. As the peace process with Eritrea raised hopes of shipping goods through Massawa port 400 km away, Mekelle's evolving commodity hub might ultimately connect to a different infrastructural link. But at the time of writing, the violent conflicts in the region have brought industry operations to a halt, jeopardising civilian life and future development.

### *4.3. Industry Park and Infrastructure Provisioning: National Policy Frameworks and Bilateral and Multilateral Cooperation*

The making of a commodity hub in Mekelle is part of an ambitious national industrial and infrastructure development policy (see Figure 5). The MIP is not a singular case, but part of a national programme launched in the 2010s to build more than a dozen similar state-run industry parks across the country in order to facilitate integration into global production networks, specifically targeting the textile and garment industry (IPDC, 2015). International experiences in industrial-zone development are an important reference for the Ethiopian government, and most parks were designed and built by Chinese state-owned enterprises (United Nations Development Programme China & International Poverty Reduction Center in China, 2015; Weldesilassie et al., 2017; Zhang et al., 2018). At the parks, turn-key sheds, or land, water, and energy are available at very competitive prices, complemented by services such as advanced waste management, customs clearance, or administrative support for foreign businesses, including assistance with worker recruitment.

The national infrastructure development vision includes the construction of an impressive system of transport connections linking the various export-processing zones with transcontinental networks. Bilateral and multilateral partnerships are key to its financing and construction. Measures include the improvement of the overland road network, dry port facilities for international freight logistics (United Nations Development Programme Ethiopia, 2017) and a national electric railway network branching out from the railway connection between Addis Ababa and the port of Djibouti, which was re-established in 2018 in bilateral cooperation with China. The railway is an ambitious flagship project of state-led infrastructural development and Ethio-Chinese partnership, but transport planners question its actual exigency for the prioritised textile sector, as well as its high cost at a time when many rural areas still lack basic road access (authors' interviews in the autumn of 2018). As "renewable" power sources for manufacturing, Ethiopia's major rivers are being dammed by international engineering firms. In the field of infrastructure provisioning, China—also the biggest source of foreign direct investment in Ethiopia—has become the country's most important partner in financing as well as in designing and building the physical structures (Delz, 2015, 2016; Eom et al., 2018; Jalles d'Orey & Prizzon, 2017; Nicolas, 2017; Ziso, 2017), but many other international stakeholders are competing on this promising market terrain.

### *4.4. Industrial Infrastructure as Arena of Collaboration for New Transnational Actor Constellations: Global Production Networks and Global Development Cooperation*

As large export production enclaves are built up on the fringes of Ethiopian cities such as Mekelle and linked to privileged transport corridors, transnational involvement in infrastructure provisioning plays out in the formation of global production networks. The new industry parks have mostly attracted basic sewing operations by South-East Asian suppliers of ready-made garments to global fashion brands or retailers in Europe and North America. Producing in Ethiopia allows these firms to profit from preferential trade agreements, low wages, and other costs, as well as government incentives. Company managers and external observers stated that major European and US clothing retailers and brands actively encouraged their suppliers to move to Mekelle, and Ethiopia generally. The untarnished reputation of the country's new industry parks matched

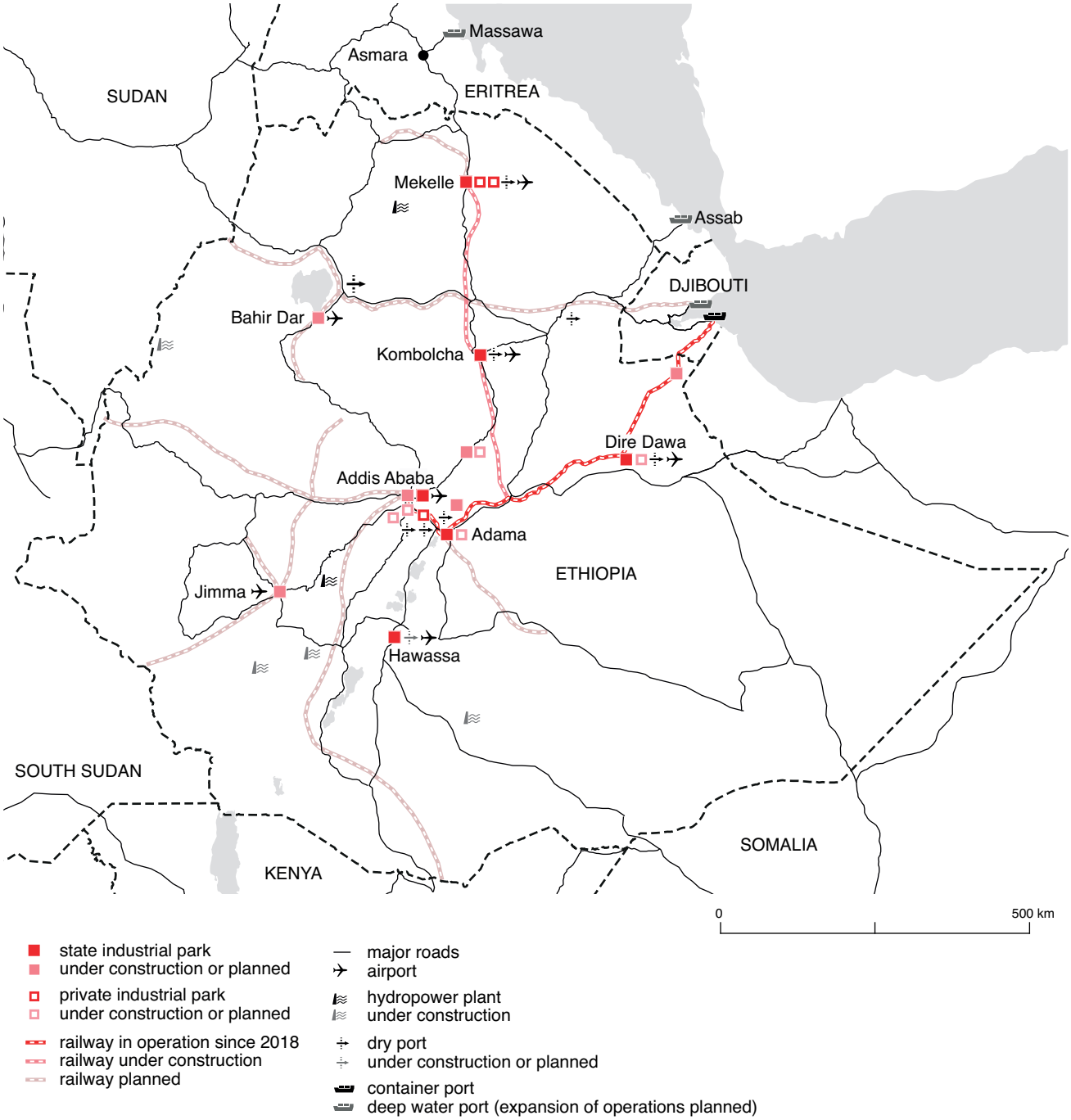


**Figure 5.** Industrial park and infrastructure development in Ethiopia (2018). Sources: Authors based on Google Maps, OpenStreetMap, Map Library, Ethiopian Investment Commission (2017), IPDC (2015), Embassy of Ethiopia in Brussels (2016), and authors' interviews.

the buyers' corporate social responsibility strategies in seeking cheap yet humane and safe working conditions. Further incentives were provided by qualification and vocational education programmes from European development agencies like Swedfund or Germany's Ministry for Development Cooperation (Federal Ministry for Economic Cooperation and Development, 2017; Swedfund, 2016). The parks operate not only as a field of collaboration between Ethiopian government institutions, transnational construction companies, and garment firms, but are also supported by national and international development agencies and banks in numerous ways. This includes the mobilisation of planning knowledge and international experience in industry zone development, for example, conferences and training sessions to promote "sustainable industry areas" organised by Germany's development cooperation agency GIZ. Most of the international engagements are framed as catalysts of environmentally sustainable development and good governance practices, creating great numbers of

jobs with the potential to reduce poverty and migration, but equally profitable opportunities for investment, garment sourcing, as well as the export of machinery, technology, and know-how from the agencies' home countries. However, observers point towards the significant risks and uncertainties of banking on the notoriously footloose clothing industry by offering export-oriented industrial enclaves with hardly any sustainable linkages to the domestic economy (Nicolas, 2017; Staritz et al., 2016; Weldesilassie et al., 2017; for a slightly more optimistic outlook see Altenburg et al., 2020). Beyond offering very low-wage jobs, the value captured in Ethiopia may therefore remain very low (Whitfield et al., 2020) and is subject to the extreme volatility of the global clothing industry. At the same time, the physical infrastructures catering to global production networks are bound to have questionable impacts on local urban development, which seems to be a secondary concern to stakeholders pursuing agendas of national and global scope but pose urgent tasks for more inclusive urban planning.

## 5. The Grain Ports of Gran Rosario: A Global Centre of the Soy Industry in Argentina

The metropolitan region of Gran Rosario is one of the world's largest hubs for the shipping and processing of grains (Giraudo, 2015) and an illustrative example for the power of this industry and its protagonists to shape the transformation processes of entire urban regions.

### *5.1. Spatial Impacts of Soybean Shipping and Processing*

With approximately 1.3 million inhabitants, Gran Rosario is the third largest metropolitan region in Argentina. The city of Rosario, located on the banks of the Paraná River, has been a centre of grain trading, transport, and processing since the 1930s (Raposo, 2009). Today, the metropolitan region is home to more than 20 deep-water ports, most of them specialised in the shipment of grains and by-products in the metropolitan area which stretches over 60 km along the bank of the river. In recent decades soybeans and by-products became Argentina's major export commodities, accounting for more than 25% of the national exports, with Gran Rosario evolving to become the key node for soybean processing and shipping overseas. In addition to the expanding port, the railway lines, silos, and mills are now defining features of the region, linking the agricultural areas of the Argentinean Pampa with global markets (Galimberti, 2015). Today, the most important market for Argentina's grains is China, which received 96% of the country's soybean exports in 2018 (Calzada & Ramseyer, 2019).

One of the most notable large-scale transformations can be observed within the municipal borders of the small town of Timbúes at the northern fringe of the metropolitan area (see Figure 6). The peri-urban area is dominated by huge integrated port and processing facilities, including soy crushing plants, grain dryers, and a bio-diesel refinery covering areas up to 200 ha and built on former agricultural land. The construction of the complexes was partly financed through specialised infrastructure investment funds or loans from different regional and global development banks (International Finance Corporation, 2009; Origlia, 2019; Ralev, 2013). The five national and multinational companies that are present in this area (see Figure 6 for details) accounted for 43% of Argentina's exports of grains and by-products in 2018 (Calzada & Ramseyer, 2019). One of the major actors is the China Oil and Foodstuffs Corporation, a Chinese state-owned food processing and trading company which became an important player in Argentina's agroindustry through the acquisition of two large competitors. China Oil and Foodstuffs Corporation operates its biggest processing and port complex in Timbúes (see Figure 7) and is planning to expand its operations.

### *5.2. Urban Planning Challenges Linked to the Soybean Processing and Shipping Infrastructures*

The vast port facilities in the north of the Gran Rosario region are highly securitised enclaves that have few links to surrounding suburban and peri-urban areas. Nevertheless, they assert a tremendous impact on their surrounding environment, posing serious challenges for sustainable local development. The ports' externalities include heavy emissions such as grain dust (see Figure 8) and massive traffic congestion. The latter partly results from inadequate road infrastructure serving the high-capacity ports, the exorbitantly high number of trucks entering the ports during harvest seasons, and insufficient parking areas for trucks in the ports ("Colapso logístico," 2021). Port expansions have also fuelled land use conflicts (Schweitzer, 2017). These have resulted, among other things, in the displacement of activities that sustain the livelihoods of the local population, such as small-scale river-bank fisheries (Roldán & Godoy, 2020).

In addition, these large-scale transformations on the fringe of the metropolitan area, which have occurred with the involvement of the highest bodies of the national government, pose challenges in terms of integrated planning in the urban region: While only some of the municipalities gain revenues from the transport infrastructures and processing facilities, they heavily impact the greater region's economic development, environmental conditions, and traffic flows. Nevertheless, the local authorities of Timbúes, who have to directly deal with the interests of the powerful grain trading companies, do not have to align their land use plans with the planning of the other municipalities in the metropolitan region. Moreover, Timbúes does not participate in the voluntary association for metropolitan planning coordination ECOM. Instead, the municipalities that host ports in the province of Santa Fé, including Timbúes, created their own advocacy group to represent their particular interests vis-à-vis the provincial and national governments.

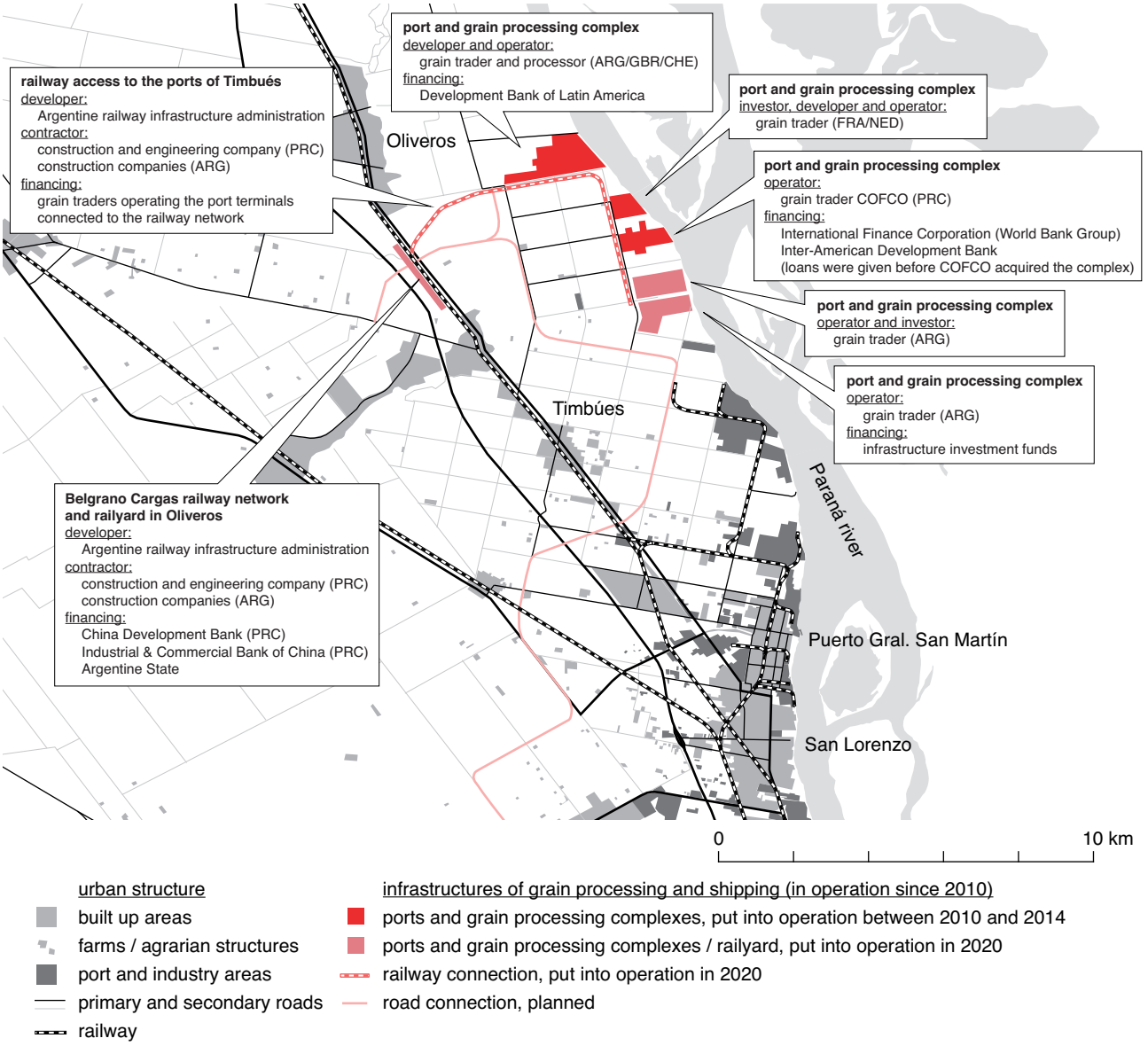


**Figure 6.** Infrastructure projects for soybean export and their actors around Timbúes, northern Gran Rosario. Sources: Authors based on Google Maps, OpenStreetMap, Calzada et al. (2017), International Finance Corporation (2009), Origlia (2019), Ralev (2013), and Vialidad Nacional (n.d.).

In order to mitigate the conflicts and risks caused by traffic at the peak times of the harvest seasons, the national state, in cooperation with provincial bodies and the municipalities, initiated actions to regulate heavy traffic. These include checkpoints operated by the traffic police, temporary road closures, and the assignment of specific routes to lorries. Another initiative led by the province's transport ministry brings together various provincial bodies, municipalities, and representatives of the transport industry to improve the coordination of traffic flows to the ports, inter alia through providing real-time information through messenger apps ("Colapso logístico," 2021). To increase the infrastructural capacities and to keep heavy traffic off the local road networks, a new motorway, projected as a public–private partnership, is intended to serve the grain ports in the north of Gran Rosario (Calzada et al., 2017; see Figure 6).

The infrastructures that enable transnational commodity flows to markets overseas and couple Argentina's rural areas with global production networks create frictions and put strain on suburban communities in Gran Rosario, resulting in specific patterns of spatial inequality. Due to the current mismatch of the infrastructures' locations and their spatial impacts, these problematic constellations cannot be resolved on the level of single municipalities but demand coordination on higher scales, as for instance happens in the case of cross-sectoral and multi-scalar initiatives by government bodies to prevent the collapse of the local road network at harvest times.

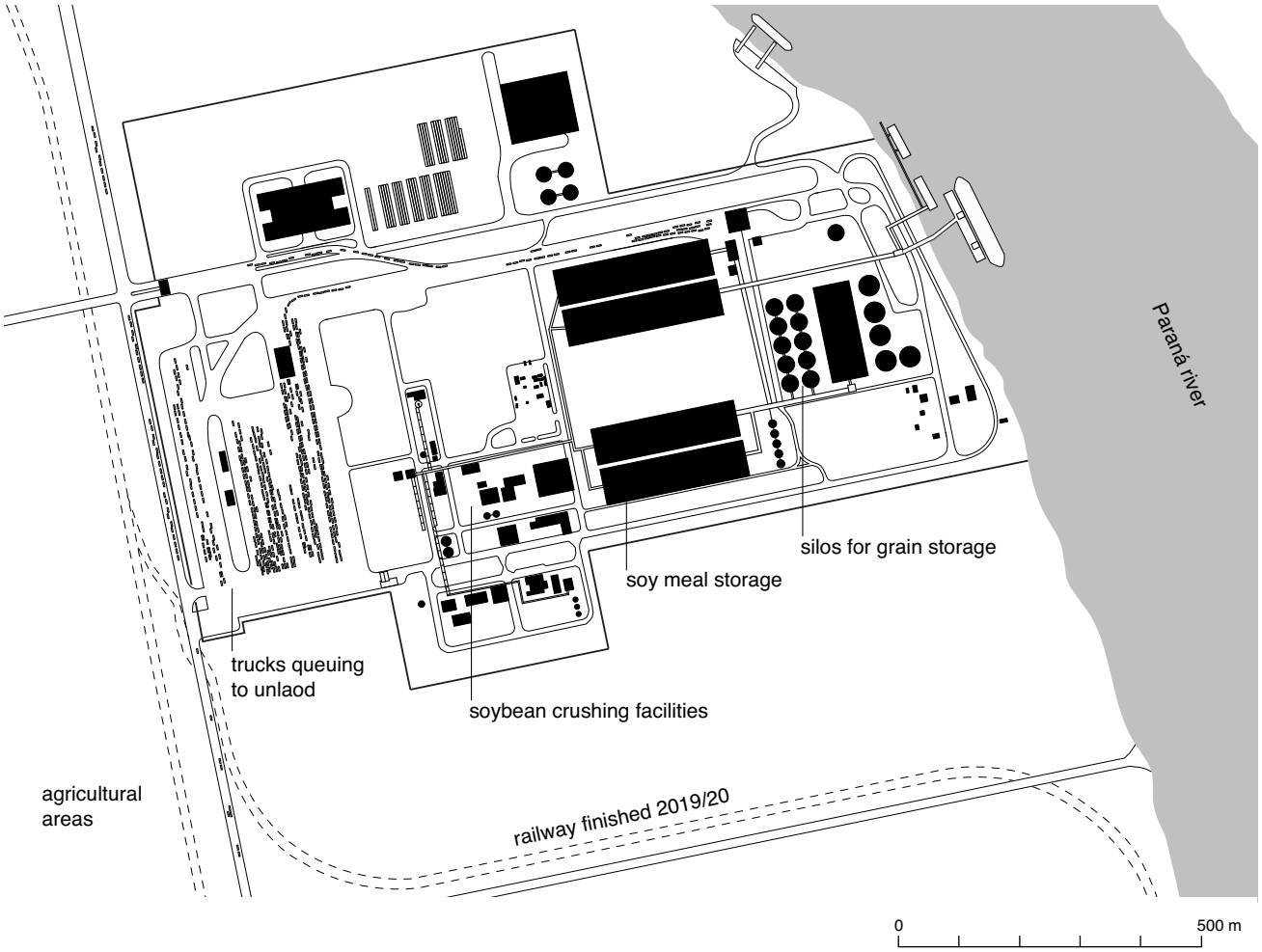


**Figure 7.** Soybean processing facility and China Oil and Foodstuffs Corporation harbour in Timbúes (2021). Sources: Authors based on Google Maps and OpenStreetMap.

### *5.3. Bilateral Cooperation and the Globalised Agroindustry as Drivers of Infrastructure Development*

Currently, soybeans are mostly transported by lorry in Argentina (Gómez Lende & Velázquez, 2018), hastened by the fact that the railway network has been fragmented and partly decaying since the late 20th century, in the context of the country's neoliberal restructuring. Despite this, the ports around Timbúes are an endpoint of one of Argentina's major current transportation infrastructure projects, namely the renovation of the main corridors of the Belgrano Cargas railway network.

In Timbúes and the neighbouring municipality of Oliveros, new rail tracks to the port terminals and a new rail yard have been constructed as part of the project, co-financed by the companies operating the ports and processing facilities (see Figure 6). Transport infrastructure development in Argentina strongly reflects the needs of the country's extractive industries, in particular the agroindustry: Many of the country's main road and railway corridors, as well as the infrastructures for inland navigation, connect regions of intense agricultural activities to seaports that enable access to overseas markets. The renovation of the Belgrano Cargas network allows for better integration of territories in Argentina's north (see Figure 9), which still hold great potential for the expansion of soybean cultivation, into global agro-industrial production networks (Gómez Lende & Velázquez, 2018) by increasing railway capacity and dramatically reducing travel time. In addition, the major grain traders have become important actors in the freight transport market as they operate port terminals, railway lines, and lorry fleets. Most of the companies whose terminals in Timbúes are being connected to the Belgrano Cargas network are already customers of Trenes Argentinos Carga, the state-owned freight railway company operating the network. In the past ten years grains and by-products accounted for up to 80% of the Belgrano Cargas railway's transported volumes. Therefore, it can be assumed that these companies generate a considerable share of the cargo transported as well as the future demand for planned services. The five companies are all members of the Rosario Board of Trade, a local business organisation that represents the interests of the agricultural and port


**Figure 8.** Entrance of a port in northern Gran Rosario, covered in grain dust (2018).

industries, among others. It is seen as an influential voice of the respective sectors in local, provincial, and national politics (authors' interviews, 2018).

The railway renovation project is directed by Argentina's federal transport ministry and coordinated by a state-owned railway infrastructure company. Planning decisions are taken by national-level authorities and only need to be approved by the municipalities directly affected. The project is financed by the Argentinean state and a $4-billion loan from two Chinese banks (China Development Bank Corporation and the Industrial and Commercial Bank of China Limited), linked to a contract with the China Machinery and Engineering Corporation (Ministerio de Transporte, 2017a). The contract with China Machinery and Engineering Corporation includes the purchase of rolling stock and construction materials from China, as well as respective technical services and staff training. The construction work, on the other hand, is the responsibility of Argentinean companies. By late 2019, 900 km of the targeted 1,845 km of the Belgrano Cargas network had been renovated. The expansion of the network is currently under consideration, as mentioned by the Argentine ambassador to China in an interview in early 2021 (Dinatale, 2021). The Belgrano Cargas project is embedded in the multilateral South American infrastructure planning initiative IIRSA-COSIPLAN and is also part of greater infrastructure initiatives with Chinese involvement in Argentina, which include loans for passenger and further cargo railway projects as well as for energy infrastructures (The Dialogue, n.d.).

On the scale of the urban region, the renovation and local expansion of the Belgrano Cargas network might contribute to tackling the dominance of road-borne commodity transport and the related problems it causes in the respective municipalities. For the grain traders, the project can also be seen as a solution to the bottleneck situation that the urban spaces represent within their logistical networks. The renovation of the railway network and the expansion of the ports in Gran Rosario also strengthen and consolidate the region as a central node within the global production network of the soybean industry. These infrastructures also fix large amounts of capital in space and thus contribute to the persistence of the extractivist model of economic development focused on the export of soybeans and by-products, creating in turn critical relations of dependency on the global market for this specific commodity (Gómez Lende &

Velázquez, 2018). The boom of the soybean industry has deeply transformed Argentina's landscape and the country's social structure in recent decades. On the one hand, many actors involved in the sector benefited when the soybean industry was thriving, the respective state revenues allowed for redistributive measures and

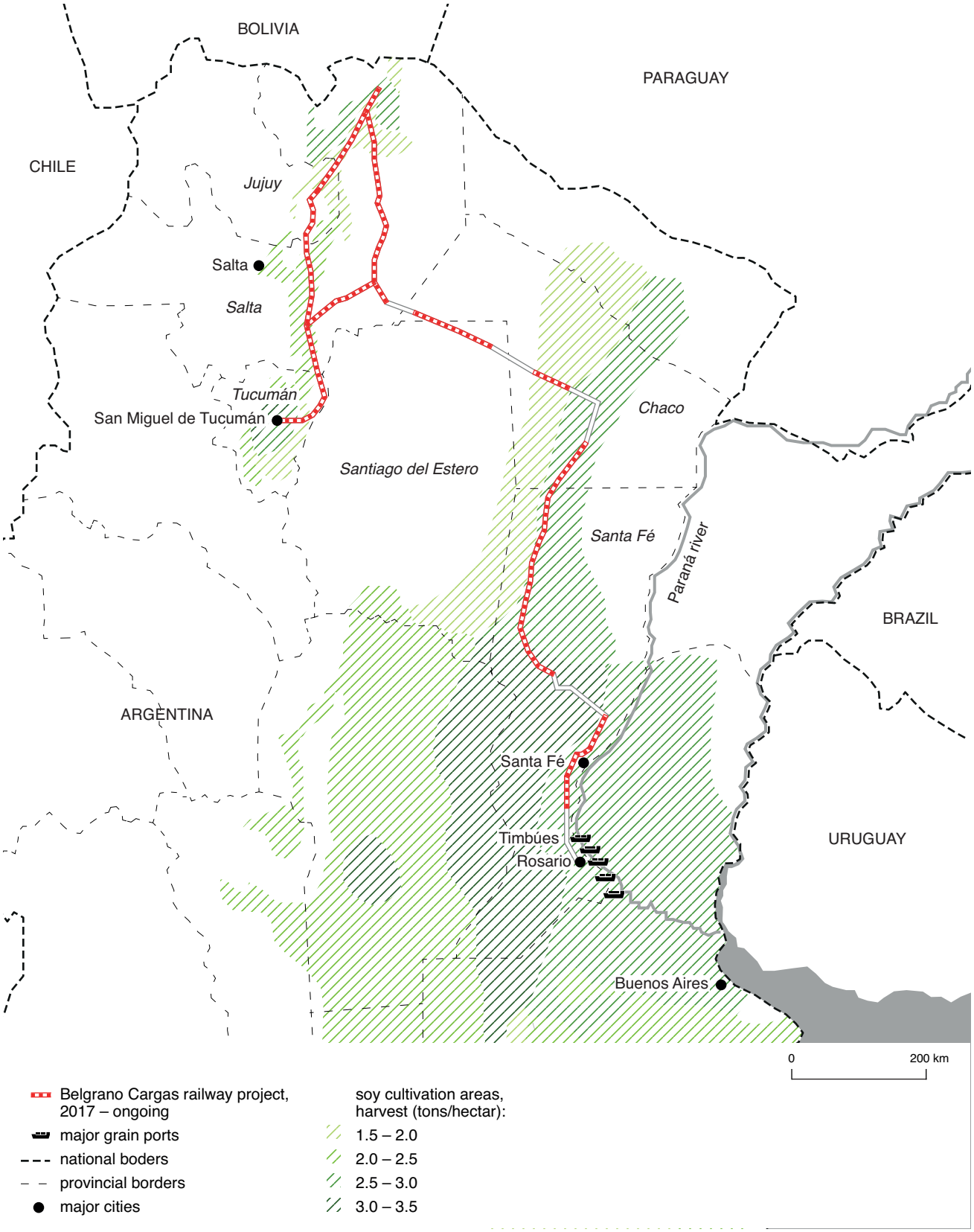


**Figure 9.** The Belgrano Cargas railway renovation project. Sources: Authors based on Google Maps, OpenStreetMap, Global Yield Gap Atlas (n.d.), and Ministerio de Transporte (2017b).

a considerable processing industry was developed in the soybean sector (Dobelmann, 2012; Sly, 2017). On the other hand, large parts of the value generated are being captured by very few, mostly transnationally active companies, amongst them the large traders. Furthermore, the development of the soybean industry has been accompanied by an enforcement of existing, and the creation of new, patterns of inequality (e.g., Dobelmann, 2012; Gras, 2013). This has occurred particularly through the spatial expansion of the industrialised cultivation of soybeans and environmental degradation linked to the intensive deployment of pesticides and monocultural modes of farming (Gómez Lende, 2017). Improving the connectivity to the northern provinces through the renovation of the Belgrano Cargas network, and thereby integrating new territories into the global production networks of the soybean industry, will very likely contribute to this development, as the considerable increase in the transportation of grains originating from the provinces Salta and Chaco in 2020 (Ministerio de Transporte, 2021) indicates. These are also the same provinces where massive deforestation can be observed (Patel, 2020). Other results of the transformations of rural Argentina through the soybean sector are, inter alia, the exclusion of former peasants from participating in agricultural activities and rural–urban flows of migration (Viale, 2017), the latter also greatly affecting Gran Rosario.

The case study of Timbúes has shown that the development of the peri-urban landscape of the soybean industry is being decisively shaped by translocal relations which encompass the global soybean production networks and the bilateral railway infrastructure project. Both actor constellations are tightly entangled, and in both—besides the significant role of Argentina's national government—Chinese companies have become central figures.

## 6. Conclusion

In this article we employed a multi-scalar and relational research approach in order to add crucial dimensions to the understanding of industrial site development in a globalised world. We argue that mobilising methodological tools from related disciplines, such as economic geography, can add essential new perspectives and, thus, make the case for a more comprehensive methodological approach to planning studies. As a result, entanglements between spatial planning, global production networks and infrastructure provisioning on the scales of built forms, urban regions, and translocal infrastructure networks are revealable.

More concretely, the cases discussed in this article showed the following:

- Firstly, we have shown how planning of infrastructures and the transformation of local built environments in Mekelle, Ethiopia, and Rosario, Argentina involve a transnational stakeholder network and new actor constellations. Both cases illustrate the deep entanglement of local industrial site development and the provisioning of large physical infrastructures and global production networks, supporting the claim that "urban development is increasingly shaped by transnational and translocal relations" (Söderström, 2014, p. 171). Indeed, both cases point towards a significant shift in planning power towards actors in global production networks supported by national governments, especially in the initial planning and implementation phases. In both cases, local planners were left to make do with the new realities, retrospectively stitching together new industrial complexes and existing cities and retroactively planning for access roads or housing, as if an afterthought. In addition, municipalities often lack the necessary capacities to mitigate the effects of such infrastructure projects as they are poorly mandated and resourced vis-à-vis the national government.
- Secondly, by tracing the transnational actor constellations of industry and infrastructure development beyond the local and national scales of planning, we were able to demonstrate how global production networks can be instrumental in the spatial dynamics transforming specific places into commodity hubs. Local industrial Chinese stakeholder and state interests are involved in these networks to a different degree and with different aims: Enhancing connectivity in Rosario promises a stabilisation of China's import demands for agricultural staples and qualifies the region's function as the soybean industry's major hub. In contrast, industrial and infrastructural development in Ethiopia offers opportunities for the relocation of production capacities in the low-wage textile industry to a preferential trade area. In both cases, however, the infrastructure projects foster the import of industry supplies and construction technology from China. Moreover, transnational enterprises are deeply involved in financing, ownership, operation, and construction of the infrastructures under study. They emerge as potent actors able to channel the global flows of commodities and value generation enabled by these structures. In both case studies, large construction engineering companies and banks from China are key players, orchestrating a large network of Chinese companies from the infrastructure, transportation, and construction sectors involved in the projects. In these networks the engineering companies and banks act as intermediaries for loans and coordinate the supply of construction materials and technology, as well as the provisioning of the expertise from China. These relations materialise in the provided infrastructures, and thereby in the resulting built environments constituting transnational urban spaces.

This phenomenon warrants a closer study of how urban spaces are produced in asymmetrical interaction between transnational, national, and municipal actors—each with potentially diverse and conflicting agendas—and the local residents, not least because it is the livelihoods of local residents that stand to be most heavily impacted by such transformations as could be observed in Mekelle and Gran Rosario.

- Thirdly, the spatial analysis of both cases has confirmed the massive physical implications of infrastructure provisioning for global production in both urban regions. The large-scale interventions under study constitute not only important vectors of spatial transformation and likely future urbanisation. In both cases, uneven urban textures have emerged which evoke the inequities and risks described by Graham and Marvin (2001) as "splintering urbanism": Investments and infrastructure provisioning concentrate in highly connected enclaves catering to globalised production and linked to transnational networks, while existing settlements and their inhabitants face negative externalities, such as increased water scarcity, pollution, and unresolved housing needs. Providing the necessary infrastructure, i.e., with regard to transportation and housing, that meets the needs of both the global production networks and the respective workers and local residents seems to be a major challenge for local authorities. Thus, the provisioning of large-scale infrastructures for global production can complicate efforts of planning for sustainable local development.

What consequences might these findings have for more sustainable planning approaches? Both cases have shown that powerful transnational actor constellations, the primacy of industrial development, and the leading role of planning authorities at the national level result in the bypassing of local authorities and the neglect of integrated urban development strategies, creating major challenges for planning at an urban and regional scale. Local authorities appear poorly mandated, resourced, and capacitated to negotiate and steer developments towards more favourable outcomes. Both cases also reveal specific vulnerabilities and governance failures which, together, map out a broad field for potential action: In Rosario, the lack of effective cooperation between municipalities leaves the region exposed to destructive competition and deal-makings with negative consequences; in Mekelle, local authorities are left at the receiving end of planning for industrialisation and infrastructure development in which primarily national and global actors are engaged.

Our article clearly shows that the transnational setups described can have major implications for the governance of infrastructure provisioning, implications which need to be understood and considered in strategic planning approaches for the future development of such industry locations and in efforts to mitigate the corresponding negative effects on local contexts.

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**Conflict of Interests**

The authors declare no conflict of interests.

**References**

Altenburg, T., Chen, X., Lütkenhorst, W., Staritz, C., & Whitfield, L. (2020). *Exporting out of China or out of Africa? Automation versus relocation in the global clothing industry* (Discussion Paper No. 1/2020). Deutsches Institut für Entwicklungspolitik. http://hdl.handle.net/10419/213279

Anand, N., Gupta, A., & Appel, H. (Eds.). (2018). *The promise of infrastructure*. Duke University Press.

Arboleda, M. (2016). Spaces of extraction, metropolitan explosions: Planetary urbanization and the commodity boom in Latin America. *International Journal of Urban and Regional Research*, *40*(1), 96–112.

Bair, J., & Gereffi, G. (2001). Local clusters in global chains: The causes and consequences of export dynamism in Torreon's blue jeans industry. *World Development*, *29*(11), 1885–1903.

Beyer, E., & Hagemann, A. (in press). Transnational urban spaces. Production locations of the global clothing industry in Ethiopia. In L. Moretto, A. Fisher, & G. Faldi (Eds.), *African cities through local eyes. Experiments in place-based planning and design*. Springer.

Beyer, E., Elsner, L.-A., & Hagemann, A. (in press). Infrastructures for global production in Ethiopia and Argentina. Commodity chains and urban spatial transformation. In I. Castillo Ulloa, C. Haid, A. Million, & N. Baur (Eds.), *Spatial transformations. Kaleidoscopic perspectives on the refiguration of spaces*. Routledge.

Beyer, E., Hagemann, A., & Misselwitz, P. (2020). Commodity flows and urban spaces. An introduc-

tion. *Articulo—Journal of Urban Research*, *2020*(21). https://doi.org/10.4000/articulo.4522

Breul, M., Revilla Diez, J., & Sambodo, M. T. (2019). Filtering strategic coupling: Territorial intermediaries in oil and gas global production networks in Southeast Asia. *Journal of Economic Geography*, *19*(4), 829–851.

Burchardt, M., & Höhne, S. (2015). The infrastructures of diversity: Materiality and culture in urban space. *New Diversities*, *17*(2), 1–13.

Calzada, J., & Ramseyer, F. (2019, March 1). *¿Quiénes fueron los principales exportadores argentinos de granos y subproductos y a dónde fue la mercadería en 2018?* [Who were the main Argentine exporters of grains and by-products and where did the goods go in 2018?]. Bolsa de Comercio de Rosario. http://www.bcr.com.ar/es/mercados/investigacion-y-desarrollo/informativo-semanal/noticias-informativo-semanal/quienes-fueron

Calzada, J., Ferrer, N., & Calivari, J. I. (2017, December 1). *Participación público privada y ejecución de obras viales* [Public-private partnerships and the implementation of road works]. Bolsa de Comercio de Rosario. http://www.bcr.com.ar/es/mercados/investigacion-y-desarrollo/informativo-semanal/noticias-informativo-semanal/participacion

Coe, N., & Yeung, H. W.-C. (2015). *Global production networks: Theorizing economic development in an interconnected world*. Oxford University Press.

Colapso logístico: El lado B de la cosecha [Logistical collapse: The downside of the harvest]. (2021, May 7). *AGROCLAVE*. https://www.agroclave.com.ar/colapso-logistico-el-lado-b-la-cosecha-n2659080.html

Delz, S. (2015). *Development cooperation at all costs: How global actors and concepts influence urban and rural transformation. Case studies from Ethiopia*. ETH Zurich.

Delz, S. (2016). Who built this? China, China, China! Expanding the Chinese economy through mutual benefit and infrastructure construction. In M. Angélil & D. Hebel (Eds.), *Cities of change—Addis Ababa. Transformation strategies for urban territories in the 21st century* (pp. 198–205). Birkhäuser.

Delz, S. (2018). Low-cost at a high price–financial, spatial and social inclusion challenged by individual home-ownership and standardized housing blocks. *TRIALOG*, *3*(130/131), 20–26.

Dinatale, M. (2021, May 23). Sabino Vaca Narvaja: "China demostró que será un aliado clave para nuestra recuperación" [Sabino Vaca Narvaja: "China has shown that it will be a key ally in our recovery"]. *El Cronista*. https://www.cronista.com/economia-politica/no-publicar-china-demostro-que-es-un-aliado-clave-para-la-recuperacion-de-la-argentina

Dobelmann, A. (2012). Neue Strukturen der Abhängigkeit: Das globale Produktionsnetzwerk der Gensojaproduktion in Argentinien [New structures of dependency: The global production network of GM soy production in Argentina]. *PERIPHERIE*, *32*(128), 475–499.

Easterling, K. (2014). *Extrastatecraft: The power of infrastructure space*. Verso.

Embassy of Ethiopia in Brussels. (2016). Industrial park development in Ethiopia. *The Ethiopian Messenger*, *2016*(2), 15–19.

Enns, C. (2018). Mobilizing research on Africa's development corridors. *Geoforum*, *88*, 105–108.

Eom, J., Brautigam, D., & Benabdallah, L. (2018). *The path ahead: The 7th forum on China-Africa cooperation* (Briefing Paper 01/2018). China Africa Research Initiative.

Ethiopia National Planning Commission. (2016). *Ethiopia Growth and Transformation Plan II (GTP II).* Federal Democratic Republic of Ethiopia.

Ethiopian Investment Commission. (2017). *An investment guide to Ethiopia* (EIC Ref. No. 03/2017).

Federal Ministry for Economic Cooperation and Development. (2017, April 4). *Development Minister Müller launches TVET centre for the textile sector in Ethiopia* [Press release]. http://www.bmz.de/20170404-1en

Galimberti, C. I. (2015). *La reinvención del Río. Procesos de transformación de la ribera de la región metropolitana de Rosario, Argentina* [The reinvention of the river. The transformation of the riversides of the metropolitan region of Rosario, Argentina]. UNR Editora.

Gao, B., Dunford, M., Norcliffe, G., & Liu, Z. (2017). Capturing gains by relocating global production networks: The rise of Chongqing's notebook computer industry, 2008–2014. *Eurasian Geography and Economics*, *58*(2), 231–257.

Giraudo, M. E. (2015). Commodity hubs: Production of space and new geographies of capital. *Alternautas*, *2*(1), 79–87.

Gläser, J., & Laudel, G. (2010). *Experteninterviews und qualitative Inhaltsanalyse als Instrumente rekonstruierender Untersuchungen* [Expert interviews and qualitative content analysis as tools for reconstructive studies] (4th ed.). Springer.

Global Yield Gap Atlas. (n.d.). *Argentina. Description of cropping systems, climate, and soils*. https://www.yieldgap.org/argentina

Gómez Lende, S. (2017). Usos del territorio, acumulación por desposesión y derecho a la salud en la Argentina contemporánea: El caso de la soja transgénica [Land use, accumulation by dispossession, and the right to health in contemporary Argentina: The case of transgenic soybeans]. *GEOgraphia*, *19*(39), 3–15.

Gómez Lende, S., & Velázquez, G. (2018). Soybean agribusiness in Argentina (1990–2015): Socio–economic, territorial, environmental, and political implications. In G. Egilmez (Ed.), *Agricultural value chains* (pp. 117–136). InTech.

Goodfellow, T., & Huang, Z. (2021). Contingent infrastructure and the dilution of 'Chineseness': Reframing roads and rail in Kampala and Addis Ababa. *Envi-*

*ronment and Planning A: Economy and Space*, *53*(4), 655–674.

Graham, S., & Marvin, S. (2001). *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. Routledge.

Gras, C. (2013). *Agronegocios en el Cono Sur: Actores sociales, desigualdades y entrelazamientos transregionales* [Agribusiness in the Southern Cone: Social actors, inequalities, and transregional entanglements] (Working Paper No. 50). desiguALdades.net. https://www.desigualdades.net/Resources/Working_Paper/50-WP-Gras-Online-revised.pdf?1380020114

Grubbauer, M. (2015). Circulating knowledge, marketization and norm-making: International developers and construction firms in Eastern Europe since 2000. *Global Networks*, *15*(3), 288–306.

Harris, A. (2013). Concrete geographies: Assembling global Mumbai through transport infrastructure. *City*, *17*(3), 343–360.

Hein, C. (2018). Oil spaces: The global petroleumscape in the Rotterdam/The Hague area. *Journal of Urban History*, *44*(5), 887–929.

Henderson, J., Dicken, P., Hess, M., Coe, N., & Yeung, H. W.-C. (2002). Global production networks and the analysis of economic development. *Review of International Political Economy*, *9*(3), 436–464.

Industrial Parks Development Corporation. (2015). *Industrial Parks Development Corporation* [Brochure].

International Finance Corporation. (2009, July 16). *IFC respalda expansión de infraestructura de procesamiento de soja en un puerto en Argentina* [IFC backs expansion of soybean processing infrastructure at port in Argentina] [Press release]. https://pressroom.ifc.org/all/pages/PressDetail.aspx?ID=23896

Jacobs, W., & Lagendijk, A. (2014). Strategic coupling as capacity: How seaports connect to global flows of containerized transport. *Global Networks*, *14*(1), 44–62. https://doi.org/10.1111/glob.12035

Jalles d'Orey, M. A., & Prizzon, A. (2017). *An 'age of choice' for infrastructure financing? Evidence from Ethiopia*. Overseas Development Institute.

Kanai, J. M., & Schindler, S. (2019). Peri-urban promises of connectivity: Linking project-led polycentrism to the infrastructure scramble. *Environment and Planning A: Economy and Space*, *51*(2), 302–322.

Kang'ereha, D. (2017). *Ethiopia's US $100m dry port design concluded*. Construction Review Online. https://constructionreviewonline.com/2017/11/ethiopias-us-100m-dry-port-design-concluded

LeCavalier, J. (2016). *The rule of logistics: Walmart and the architecture of fulfilment*. University of Minnesota Press.

Leigh Star, S. (1999). The ethnography of infrastructure. *American Behavioral Scientist*, *43*(3), 377–391.

Lin, W. (2019). Infrastructure's expenditures: Changi airport, food cargo and capital's technosphere. *International Journal of Urban and Regional Research*, *43*(1), 76–93.

Liu, Z., Schindler, S., & Liu, W. (2020). Demystifying Chinese overseas investment in infrastructure: Port development, the Belt and Road Initiative and regional development. *Journal of Transport Geography*, *87*, Article 102812. https://doi.org/10.1016/j.jtrangeo.2020.102812

Lyster, C. (2016). *Learning from logistics: How networks change our cities*. Birkhäuser.

McCann, E., & Ward, K. (2012). Assembling urbanism: Following policies and 'studying through' the sites and situations of policy making. *Environment and Planning A: Economy and Space*, *44*(1), 42–51.

McFarlane, C., & Rutherford, J. (2008). Political infrastructures: Governing and experiencing the fabric of the city. *International Journal of Urban and Regional Research*, *32*(1), 363–374.

Mekelle University. (2014). *Revision of structure plan of Mekelle City. Spatial analysis (land use analysis)*. Unpublished document.

Mekelle University. (2016). *Mekelle city structure plan revision. Final framework plan report/proposal*. Unpublished document.

Mezzadri, A. (2019). On the value of social reproduction. *Radical Philosophy*, *2*(4), 33–41.

Ministerio de Transporte. (2017a). *El Gobierno Nacional amplió USD 1600 M el crédito para recuperar el FFCC Belgrano Cargas* [The national government extends the loan for the renovation of the FFCC Belgrano Cargas by 1.6 billion USD]. Argentina.gob.ar. https://www.argentina.gob.ar/noticias/el-gobierno-nacional-amplio-usd-1600-m-el-credito-para-recuperar-el-ffcc-belgrano-cargas

Ministerio de Transporte. (2017b). *Renovaron más de 200 km de vías del Belgrano Cargas* [More than 200 km of the Belgrano Cargas tracks have been renovated]. Argentina.gob.ar. https://www.argentina.gob.ar/noticias/renovaron-mas-de-200-km-de-vias-del-belgrano-cargas

Ministerio de Transporte. (2021). *Trenes Argentinos Cargas transportó un 15% más durante el 2020* [Trenes Argentinos Carga increased their volume of transported goods by 15% in 2020]. Argentina.gob.ar. https://www.argentina.gob.ar/noticias/trenes-argentinos-cargas-transporto-un-15-mas-durante-el-2020

Narins, T. P., & Agnew, J. (2020). Missing from the map: Chinese exceptionalism, sovereignty regimes and the Belt Road Initiative. *Geopolitics*, *25*(4), 809–837.

Negese, D. S., Guchale, E. N., Aregawi, H. G., Hirbaye, K. B., & Gebremeskel, S. A. (2017). *City profile Mekelle* (Report prepared for the Social Inclusion and Energy Management for Informal Urban Settlements Project). Mekelle University. https://mdl.donau-uni.ac.at/ses/pluginfile.php/314/mod_page/content/4/City%20Profile%20Mekelle.pdf

Nicolas, F. (2017). *Chinese investors in Ethiopia:*

*The perfect match?* Ifri and OCP Policy Center. https://www.ifri.org/sites/default/files/atoms/files/nicolas_chinese_investors_ethiopia_2017.pdf

Origlia, G. (2019, December 11). Con US$7,5 millones. AGD completó el financiamiento para el puerto de Timbúes [With 7.5 million USD AGD completed financing for the port of Timbúes]. *La Nación*. https://www.lanacion.com.ar/economia/campo/con-us75-millones-agd-completo-financiamiento-puerto-nid2314847

Parnreiter, C. (2015). Strategic planning, the real estate economy, and the production of new spaces of centrality. The case of Mexico City. *Erdkunde*, *69*(1), 21–31.

Patel, K. (2020). Deforestation in Argentina's Gran Chaco. *NASA Earth Observatory*. https://earthobservatory.nasa.gov/images/146731/deforestation-in-argentinas-gran-chaco

Peck, J., & Theodore, N. (2010). Mobilizing policy: Models, methods, and mutations. *Geoforum*, *41*, 169–174.

PwC, IPE Global Triple Line, & Ethiopian Development Research Institute. (2017). *Green climate compatible urban industrial development in Ethiopia. Strategy and projects for the Kombolcha-Mekele industrial corridor* (Final report). https://cdkn.org/wp-content/uploads/2018/02/Final-Reporting-Climate-Compatible-Urban-Industrial-project-development-and-Investment-Plan.pdf

Ralev, R. (2013). *Renova to launch Timbues port grain terminal*. Renewables Now. https://renewablesnow.com/news/renova-to-launch-timbues-port-grain-terminal-367947

Raposo, I. (2009). Reestructuración ferroviaria en Argentina y cambios en el territorio. Una verificación en la Región Metropolitana Rosario [Railway restructuring in Argentina and territorial changes. The case of the Rosario Metropolitan Region]. *Revista Transporte y Territorio*, *1*, 25–56.

Rode, P., Terrefe, B., & da Cruz, N. F. (2020). Cities and the governance of transport interfaces: Ethiopia's new rail systems. *Transport Policy*, *91*, 76–94.

Roldán, D., & Godoy, S. (2020). Conflictos territoriales y culturales en la renovación del frente costero, Rosario (Argentina) [Territorial and cultural conflicts in the renewal of the waterfront, Rosario (Argentina)]. *EURE—Revista de Estudios Urbano Regionales*, *46*(138), 95–116.

Roy, A. (2009). The 21st-century metropolis: New geographies of theory. *Regional Studies*, *43*(6), 819–830.

Schindler, S., & Kanai, J. M. (2019). Getting the territory right: Infrastructure-led development and the re-emergence of spatial planning strategies. *Regional Studies*, *55*(1), 40–51.

Scholvin, S., Breul, M., & Revilla Diez, J. (2019). Revisiting gateway cities: Connecting hubs in global networks to their hinterlands. *Urban Geography*, *40*(9), 1291–1309.

Schweitzer, M. (2017). San Lorenzo y Puerto General San Martín. Territorios atravesados por dinámicas globales [San Lorenzo and Puerto General San Martín. Territories crossed by global dynamics]. *América Latina Hoy*, *75*, 101–124.

Sly, M. J. H. (2017). The Argentine portion of the soybean commodity chain. *Palgrave Communications*, *3*(1), Article 17095. https://doi.org/10.1057/palcomms.2017.95

Söderström, O. (2014). *Cities in relations. Trajectories of urban development in Hanoi and Ouagadougou*. Wiley.

Staritz, C., Plank, L., & Morris, M. (2016). *Global value chains, industrial policy, and sustainable development—Ethiopia's apparel export sector*. International Centre for Trade and Sustainable Development.

Swedfund. (2016, May 26). *Swedfund, H&M and DBL Group create 4,000 jobs in Ethiopia* [Press release]. http://swedfund-com.mynewsdesk.com/pressreleases/swedfund-h-m-and-dbl-group-create-4-000-jobs-in-ethiopia-1419599

Teka, D. (2020). *Mekelle City: Secondary cities project*. Office of the Geographer and Global Issues (GGI) in the Bureau of Intelligence and Research. https://storymaps.arcgis.com/stories/31dcbc444368466dae174ecee1f4393d

The Dialogue. (n.d.). *China-Latin America finance database* [Data set]. https://www.thedialogue.org/map_list

United Nations Development Programme China, & International Poverty Reduction Center in China. (2015). *If Africa builds nests, will the birds come? Comparative study on special economic zones in Africa and China* (Working Paper 06.2015).

United Nations Development Programme Ethiopia. (2017). *National logistics strategy*.

Viale, E. (2017). El extractivismo urbano [Urban extractivism]. In A. M. Vásquez Duplat (Ed.), *Extractivismo urbano* [Urban extractivism] (pp. 15–20). El Colectivo.

Vialidad Nacional. (n.d.). *Circunvalación transito pesado y accesos a puertos* [Heavy traffic bypasses and port accesses]. Unpublished document.

Weldesilassie, A. B., Gebreeyesus, M., Abebe, G., & Aseffa, B. (2017). *Study on industrial park development: Issues, practices and lessons for Ethiopia* (Research Report No. 29). Ethiopian Development Research Institute.

Werner, M. (2016). Global production networks and uneven development: Exploring geographies of devaluation, disinvestment, and exclusion. *Geography Compass*, *10*(11), 457–469.

Whitfield, L., Staritz, C., & Morris, M. (2020). Global value chains, industrial policy and economic upgrading in Ethiopia's apparel sector. *Development and Change*, *51*(4), 1018–1043.

Wiig, A., & Silver, J. (2019). Turbulent presents, pre-

carious futures: Urbanization and the deployment of global infrastructure. *Regional Studies*, *53*(6), 912–923.

World Bank. (2017). *Ethiopia trade logistics project. Combined project information documents/integrated safeguard data sheet. Appraisal stage* (Report No. PIDISDSA19897).

Zhang, X., Tezera, D., Zou, C., Wang, Z., Zhao, J., & Gebremenfas, E. A. (2018). *Industrial park development in Ethiopia. Case study report* (Research and Statistics Working Paper, No. 21/2018). UNIDO Department of Policy.

Ziso, E. (2017). *A post state-centric analysis of China-Africa relations: Internationalisation of Chinese capital and state-society relations in Ethiopia*. Springer.

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