

Sustainable Urbanity at the Fringe? Principles of Present-Day Urban Expansions in Germany (2008–2025)

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Abstract

In recent years, Germany has experienced a significant number of large urban expansion schemes. These emerge despite strong policies for more inner-city development and against more land consumption. In this light, this article seeks to better understand these schemes. Of special interest are the sustainability ambitions that appear to be inspired by themes such as re-urbanisation, sustainability, and participation. In this light, we characterise the urban design and development principles underlying these projects. Building on previous studies, we analyse a sample of 69 larger projects, examining locations, spatial structures, social services, transport solutions, and planning processes. Our results illuminate the number, characteristics, and locational dynamics of the urban expansion projects in Germany. Overall, the findings reveal how a specific combination of sustainability-oriented and postmodern development and design principles is realised at the urban periphery. These findings provide a basis for examining the effectiveness of implementing contemporary planning and design principles as well as the procedural dynamics involved.

Keywords

housing; postmodern urban design; sustainable urban development; urban design principles; urban expansion

1. Introduction

This article focuses on the recent “wave” of large urban expansion projects in Germany. At first glance, these new projects at the urban fringe seem to contradict a planning and policy context that prioritises inner-city infill development, walkable and socially mixed 15-minute cities, the reduction of greenhouse gas emissions, and ecosystem preservation. In this sense, we aim to unpack this apparent “paradox” by promoting new insights on the motivations, characteristics, and effects of these schemes. We are interested particularly in better

understanding the specific sustainability ambitions of planned projects, as these are instrumental in making the projects possible in the context of conflicting rationales and goals, and in what difference these new neighbourhoods make at the urban peripheries.

The “wave” mentioned above has evolved against a backdrop of changes in society and planning in view of an increasing housing shortage in conurbations. It could stand for a pivotal moment in German urban development: a strategic reconfiguration of an urban growth logic. While Germany had experienced a reurbanisation trend driven by population growth in many cities in the early 2000s, large cities then sought to avoid outward expansion to conserve natural resources and resistance from neighbouring populations to additional greenfield development. However, since the mid-2010s, Germany’s population growth has accelerated, forcing many municipalities to pursue urban expansion to tackle their housing shortages. While inner-city re-densification projects have highlighted the appeal of reurbanising lifestyles—reflected in relatively dense, compact, functionally mixed, and walkable urban developments (Bundesinstitut für Bau-, Stadt- und Raumforschung [BBSR], 2014)—it remains unclear how these urban “ideals” will affect and be translated to the outskirts. They aim to reconcile the enduring demand for “suburban living concepts” with the need for sustainable, socially inclusive, and functionally diverse communities. This raises a critical question: How are the ideals of urbanity, sustainability, and social inclusion being realised in these suburban contexts?

Our analysis reveals that these contemporary projects are shaped by a convergence of interrelated forces: the legacy of reurbanising lifestyles, the growing imperative of sustainability, and an increasing role for participatory governance. This convergence is not uniform. While larger projects in major metropolitan regions frequently try to integrate high-density, mixed-use frameworks and multi-functional infrastructure, other developments remain anchored in low-density or residential-only models. Furthermore, the normative search for sustainable neighbourhoods on greenfield sites is no longer a contradiction but a redefinition of sustainability. It is no longer about avoiding development, but about shaping it to enhance ecological resilience, social cohesion, and urban vitality. The projects examined demonstrate a clear ambition to transcend mere regulatory compliance, aiming instead to pioneer new urban typologies that are both environmentally responsible and socially vibrant.

To address these dynamics, this study systematically analyses 69 major new construction projects on the peripheries of large German cities. We examine urban design principles—understood as general normative features related to urban form—within the broader context of urban development (encompassing broader characteristics like location, spatial structure, social services, transport, and planning processes) of the latest urban expansion projects. Furthermore, we connect this analysis to the normative search for sustainable neighbourhoods on greenfield sites.

The article proceeds as follows: Section 2 reviews the state of research and practice of current urban development principles, demonstrating a certain interest in sustainable urban development but only a limited focus on the specific conditions of urban expansions. Thereafter, we outline our aims and objectives (Section 3). Next, we introduce a method used to record and evaluate the prevalence of key urban development characteristics, based on the examination of 69 projects (Section 4). In Section 5, we present our findings on current urban planning and design characteristics. We then summarise and discuss the results (Section 6) before presenting the conclusion and outlook (Section 7).

2. State of Research

2.1. *Criticism of Modernist Urban Design and Architecture and the Role of Postmodernism*

Urban development at the end of the 20th century was marked by strong criticism of modern urban architecture and the land consumption of car-oriented single-family housing (Albers, 1997; Bruegmann, 2019; Squires, 2002). Embedded in broader urban transformations and debates on “postmodern urbanism” (Dear, 1986; Ellin, 1999; Hirt, 2009), this period marked a shift to “postmodern” urban design. Its key principles (see Table S1 in the Supplementary Material) include integration with the overall urban structure, pedestrian-friendly transport links, compact and dense development, demarcated public spaces through corridor streets and squares, intensive greening with separation of private and public open spaces and small-scale parcelling, and a partial return to traditional patterns of urban form (Zupan, 2018). There are also calls for functional mix and also for social diversity in neighbourhoods (Aelbrecht & Stevens, 2023; Geyer, 2024; Kuder, 2004; Peer & Psenner, 2024). This shift is embedded in a wider transformation of urban development principles characterised by brownfield redevelopment, inner-city development, and careful urban renewal.

In North America and Europe (for the debate outside these areas, omitted here for reasons of space, see Newman & Kenworthy, 1999), this transformation has given rise to a variety of approaches and debates at the end of the 20th century, from New Urbanism (Knaap & Talen, 2005) to the 15-minute city (Moreno et al., 2021). The respective principles have been applied to the transformation of brownfield sites (BBSR, 2024), occasionally to the conversion of modernist residential neighbourhoods (Edwards & Turrent, 2002), and to some master-planned expansions. Nevertheless, conventional urban growth dominated by single-family homes continues to take place in many smaller European cities and in the USA.

2.2. *The International Debate on Postmodern Change in Urban Design*

The US-American debates on the appropriateness of “New Urbanism” and “smart growth” (Bodenschatz & Schöning, 2004; Dierwechter & Coffey, 2017; Knaap & Talen, 2005) use similar themes to those in Europe in terms of structural and spatial typologies, densities, functional mix, quality of public open spaces, and connections to public transport (Calthorpe, 1993). However, these approaches have been widely criticised in the USA (Ellis, 2002; Gordon & Richardson, 1997; Roost, 2000) and the UK (Carmona & Tiesdell, 2007). In Germany, there are only a few loosely related debates on “postmodern” urban design principles (Siebel, 2004; Wentz, 2000; see Table S1). Some scholars claimed that postmodern principles are better suited to inner-city regeneration and that their promise of more environmentally friendly urban structures has so far only been fulfilled in isolated cases (Zupan, 2017). The practical appropriateness of (controversial) traditionalist principles and their application remain to be thoroughly researched (Kunzmann, 2020; Senatsverwaltung für Stadtentwicklung und Wohnen, 2018).

2.3. *The Impact of the Sustainability Paradigm and Its Integration on Urban Design Principles*

As environmental concerns have occasionally been discussed in urban development since the 1980s, sustainability debates raised issues such as land use efficiency and resource conservation (Edwards & Turrent, 2002; Koch, 2001). Still, urban expansion barely addressed sustainability issues (Calthorpe, 1993;

Potter, 1996). Due to the trend of reurbanisation (Brake & Herfert, 2012; Brombach et al., 2017) and the global financial crisis, which led to a slowdown in suburban development (Siedentop, 2024), sustainability targets were primarily applied to brownfield projects. Consequently, interest in urban design principles for new settlements temporarily waned.

Interest has been revived since the mid-2010s, as shown by new approaches and increased research, especially in suburban areas. In this context, the sustainability paradigm has also influenced debates on urban design by addressing broader issues such as climate and health (Calthorpe, 2011; Camerin & Longato, 2025; Carmona, 2009; Forsyth, 2020; Moreno et al., 2021). Moreover, an integrative approach to sustainable urban development is gradually emerging (Bentley et al., 2024; Kamalipour et al., 2023; Larco, 2016; Loukaitou-Sideris, 2020), with a far-reaching scope (Cozzolino et al., 2020). More flexible urban design principles are being promoted and partly combined with broader sustainability principles (Reicher & Söfker-Rieniets, 2022; Tarbatt & Tarbatt, 2020).

Perhaps the most comprehensive approach to conceptualising sustainable urban design encompasses issues of climate action, with their links to energy and water, ecology and biodiversity, as well as social sustainability and health, at various scales (Larco & Knudson, 2024). Interestingly, this “rich” sustainability approach draws on the principles of postmodern urban design mentioned above and supplements them, including sustainable transport. Principles of postmodern and sustainable urban design converge if traditional formal elements of urban design from the 1990s are disregarded. As those ideas transcend urban form, we argue that it seems appropriate to discuss postmodern urban development principles in this context.

2.4. The Impact and Implementation of Postmodern Urban Development Principles

Attempts to assess the outcomes of “postmodern” approaches so far have been rather fragmented and tend to have a narrow focus (Charmes, 2010; Garde, 2020; Trudeau, 2013; Xu, 2017). In Europe, there is a strong focus on inner-city development approaches (Watt, 2021), while in the USA, “New Urbanism” enjoyed particular attention until the mid-2000s (Bodenschatz & Schönig, 2004). Topics such as the quality and design of public spaces, pedestrian orientation, and transport issues are usually only indirectly related to urban expansion (Abass et al., 2020; Aelbrecht, 2022; Carmona, 2021; Currie, 2020; Ganji & Rishbeth, 2020; Larco et al., 2013; Piatkowski & Marshall, 2014; Podobnik, 2011; Sepe, 2025; Sohn et al., 2012; Stanislav & Chin, 2019; Wiersma & Bertolini, 2024).

The key themes of postmodern and sustainable urban development have mainly been played out in inner-city locations (Berding et al., 2018; Feldtkeller, 2018), where implementation has been easier. Planners and decision-makers tended to neglect the extent to which location factors influence practical feasibility (Altrock, 2022). On the outskirts, a high demand for single-family homes reduces the viability of public transport and other service outlets. Apart from residential facilities, private investors create only a few jobs in the service sector. Systematic links are rarely made between the intentional actions of key players and the resulting suburban morphology, open space and infrastructure provision, and functional, social, and transport structures (Adams et al., 2013; Barnett, 2023; Brandsma et al., 2024; Buckman et al., 2017; Perrin & Grant, 2014; Sorensen & Hess, 2015; Spellerberg & Woll, 2014; White et al., 2024; Yang & O'Neill, 2014).

2.5. The Current Wave of Urban Expansion Projects in Germany

Given the current wave of major new urban expansion projects, the question arises as to what extent these adhere to the normative principles outlined above. Recent analyses of large urban development projects have neither clearly distinguished brownfield and greenfield sites nor focused specifically on the recently planned projects in much detail (Freudenau et al., 2021; Spars & Guhl, 2021; Zupan, 2018). So far, research on large-scale urban expansions mainly focused on individual case studies (Förster & Schmitt, 2021). Few cases (Freudenau et al., 2021) demonstrate the extent to which “postmodern” principles have been consolidating and transforming, especially since the 1990s. Initial findings suggest that sustainability innovations are being incorporated into individual projects (Altrock, 2022) and build on factors like changing lifestyle preferences, among others. Nevertheless, a comprehensive understanding of the origins, protagonists of implementation, areas of application, and detailed characteristics in greenfield areas is still pending.

The debate on urban development principles is expanding to include issues of competitiveness, urban vitality, climate change, and energy transition (Jessen, 2021). Likewise, in addition to the classic formal categories of urban development (Reicher, 2019), social diversity and mixing, a diverse range of housing, different forms of ownership, strategies for land allocation, small-scale parcelling, innovative participation, and procedural structures are promoted (Bertram & Altrock, 2021; Selle, 2013). Likewise, the role of procedural elements in project statements has not been comprehensively researched.

3. Objectives, Questions, and Methods

3.1. Objectives and Guiding Questions

In response to the discussion and the research gaps identified above, this study aims to identify the development and design principles of large contemporary urban expansion projects in Germany. We assume that current large urban expansion projects differ from earlier projects, largely associated with postmodern urban design principles, nurturing innovations addressing the growing sustainability challenges. Inspired by catalogues of “extended” sustainability concepts as discussed above, we focus on their locational, physical, environmental, social, and procedural characteristics, exploring drivers and selected contextual factors. In doing so, we draw on recent literature on the principles of sustainable urban development playing out at the neighbourhood level.

The following research questions guide the inquiry:

- Where can we find large-scale urban expansion projects in Germany today, and why?
- How can these projects and the underlying key concepts be described?
- How do the projects (and the key concepts) relate to their context, considering variables such as project size, location, and political leadership?
- How do the main concepts compare with previous approaches? What is new?

3.2. Methods

The analysis is based on a systematic, internet-based survey of current urban expansion projects in German cities with more than 100,000 inhabitants (121 cities). The focus was on information on the project characteristics and on ambitions related to innovative sustainability-related plans. Data were retrieved from planning documents and reported decision-making processes, including design competitions, master plans, and accompanying explanatory reports. Project information was compiled from municipal and developer sources and complemented by competition platforms, real estate portals, press releases, and planning office websites. In addition, previous studies (Bertram & Altrock, 2021; Freudenau et al., 2021) were consulted.

In line with the objectives set out above, the projects had to be greenfield developments large enough to allow for the application of varied urban development principles. To this end, we restricted the sample to projects at the urban edge, comprising at least 500 residential units, on land that was at least 80% undeveloped. Moreover, meaningful urban development goals, reflecting concrete planning and design elements, approved by the municipality between 2008 and 2024 were required. The cut-off date of 2008 distinguishes the projects from earlier phases of urban development in Germany. Conurbations showed signs of a renewed housing shortage around 2008, when the international financial crisis changed property markets and when urban growth in the wake of German reunification was mostly complete.

The application of the above criteria led to a sample of 69 projects in 37 cities.

We compiled 100 urban development characteristics in a semi-standardised manner for each project through a structured online data collection form. Quantitative and qualitative methods were combined for analysis and interpretation. Descriptive methods and statistical tests with *p*-values (given the relatively small sample size) were used to identify basic trends in relationships and correlations. The fact that most of the projects are still in the planning stage resulted in varying information densities; the evaluations therefore refer to the data available in each case.

The analysis focuses on six analytical categories. These are relevant in the context of the issues discussed above and could be captured at the neighbourhood level. The results reflect planning objectives, not implementation or long-term impact (see Section 4 below, and also Table S5). The six categories are the following:

- Location: Here, we examine the occurrence and location of the projects at different scales—in Germany, in the respective city-regional context, and for the immediate environment of the planned project—asking, for example, which types of cities attract city expansions.
- Building structure and use: We suspect that there is a conflict between contradictory requirements—new neighbourhoods should create urban density, mixed use, and urban identity, but they must also relate to the suburban surroundings (including scenic landscapes). Therefore, we explore whether plans envisage a compact structure differing from previous “postmodern” principles. We also examine whether mixed-use, rather than purely residential, quarters are planned. Can we find typologies that are even similar to inner-city neighbourhoods?
- Open space, landscape, and nature: We assume that green corridors, public spaces, and landscape references are seen as crucial aspects of sustainability performing social and climatic functions. How

does the location on the urban fringe influence the structure and function of open spaces with respect to environmental sustainability and climate change?

- Social aspects and services: Social inclusion, mix, and diversity are key elements of sustainable urban development and design. Accordingly, we examine the role of planned diversity and social integration. We ask what the planned projects offer for poor, vulnerable, and marginalised populations and what is being done to promote conviviality and social cohesion.
- Mobility: Here we examine planned mobility approaches and especially alternatives to motorised individual transport that are being offered. We examine efforts to reduce parking spaces and to promote sharing solutions, walkability, and bike-friendly infrastructure.
- Planning and governance: This category examines the planning processes including the role of stakeholders. We ask for the relationship of public, private, and civil society actors in the planning, design, and development process and for/urge new forms of participation and co-production.

Finally, our aim was to characterise the aspiration of promoting innovative *sustainable urban development and design* solutions. For this purpose, we have developed a “tentative sustainable urban development ambition index” (TSUDAI) to approximate the cumulated sustainability efforts of new urban expansions. The index builds on a selection of key indicators, which are clustered into six main categories. It can reach a maximum value of around 7:

$$\text{TSUDAI} = \text{IF} + \text{ID} + \text{IM} + \text{IO} + \text{IH} + \text{IP}$$

Functional mix (IF) and residential density (ID) stand for space efficiency; mobility transition (IM) stands for the ideals of the 15-minute city and resource conservation; open space (IO) stands for ecological sustainability and quality of life; and housing (IH) and process quality (IP) stand for equity and social sustainability. Apart from the cardinal density measurement, values are calculated from simple ordinal assessments of subcategories (see Table S2).

4. Results

This section analyses the six categories of urban expansion projects and their sustainability ambition.

4.1. Profile and Location

Our findings indicate that, on a German scale, a total of 146,435 new homes are to be built on approximately 40,000 hectares. Assuming an average household size of 2.0, this corresponds to roughly three new large cities. The planned areas range from 6 to 600 hectares (ø58 hectares), while the number of planned residential units varies from 500 to 11,500 (avg. 2,122). Eleven projects account for half of the total land (2,054 hectares) and residential units (75,600). The total densities of the planned projects range between 11.4 and 123.1 residential units/ha, which is between those of single-family home areas and dense inner-city neighbourhoods (avg. 46.5 residential units/ha). Just over half of the projects were still in the planning stage at the cut-off date. This corresponds to the observation that planning large housing estates today takes up to 2.5 times longer than in the 1990s (BBSR, 2021, p. 70).

4.1.1. Spatial Distribution: Attachment to Booming Regions

Macro-scale analysis reveals that six (mostly large) cities host more than three projects, seven cities have two projects, and 24 cities only one each (see Figures 1 and 2a).



Figure 1. Location and size of recent urban expansion projects.

Geographically, with a few exceptions, the projects are distributed across all of Germany, with clear concentrations in growth centres stretching from Berlin westwards to the Ruhr area and along the Rhine corridor to Munich (Figure 1). The projects with over 5,000 residential units are located in large metropolitan regions except for Freiburg (Dietenbach). Nevertheless, significant projects also occur in smaller cities: Freiburg and Münster (rapidly growing university cities), Wiesbaden, Augsburg, and Kiel (administrative centres), and Wolfsburg (a car-production hub)—each with three major projects (Figure 2a).

It is also noteworthy that some economically strong cities that have extensive conversion areas and regions with stagnating or declining development remain significantly under-represented.

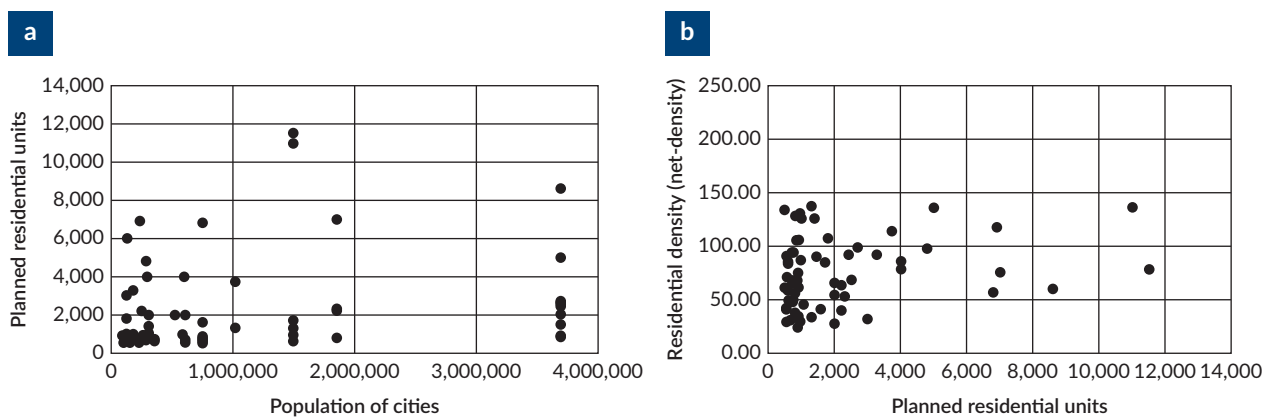


Figure 2. Scatterplots illustrating planned residential units by city population (a), and residential density by planned residential units (b).

4.1.2. Urban Environment and Previous Use: Controlled Expansion With Distinct Identity

The neighbourhoods are planned within heterogeneous environments. The majority (56/69) round up existing settlement edges (“growing the city”), sometimes using green buffer zones to separate them from neighbouring settlements and deliberately limiting road connections. This can be interpreted as a planning strategy to avoid protest but also to promote a distinct identity.

Building structures often blend with their surroundings through graduated zoning or visual references, mediating between the latter and the ideal of compact settlement expansion. “Solitary” extensions (4) or “filling in” of loosely built-up settlement edges (3) are the exception.

Most projects (53) are built on open, undeveloped, intensively used agricultural land, and in some cases on former sewage fields (3). In many places, these areas had been designated as residential building land for decades. A few are being built on undeveloped or sparsely developed military sites, industrial sites, horticultural businesses, allotment gardens, cemeteries, etc. In their immediate vicinity are single-family housing areas (62), agricultural land (55), nature and forest (21), large housing estates (17), commercial areas (15), and other uses (15). For details about the urban environment and previous use, see Tables S3a–c. For further details on the following subsections, see Tables S3d–l.

4.2. Building Structure and Use

4.2.1. Building Structures: Open Perimeter Blocks as Representation of Community

A characteristic feature is the prevalence of blocks with multiple openings (56 out of 67 cases). These promote a distinct spatial order (enclosed street spaces, green courtyards) with improved climatic and functional properties (ventilation, lighting, thoroughfares). At the same time, they allow a high degree of flexibility for arranging different building types and uses. In contrast to the more formalised “New Urbanist” perimeter block development of many 1990s housing estates, open blocks can be seen as a representation of community combining openness and diversity with unity and shared values. Open blocks are composed of individual forms. They offer many opportunities to arrange urban density, mix building types, and integrate

open spaces. Additional structures observed in the studied neighbourhoods include terraced and row housing (46), detached buildings (36), and isolated closed blocks (16).

Beyond the basic urban structures, specific building typologies characterise the new neighbourhoods. Multi-storey residential buildings dominate (34 of 66 cases). A wide variety of other building types such as terraced houses (61), terraced/row houses (47), city villas (23), and high-rise buildings (17) are used flexibly in different configurations (Figures 3a–f).

Although most current plans feature open blocks and multi-storey buildings (Figures 3a–f), divergent concepts also appear (Figures 3g–i). Some cases display blocks and open spaces as dissolved structures (Figures 3h and 3j). Others work with detached houses (Figure 3i).

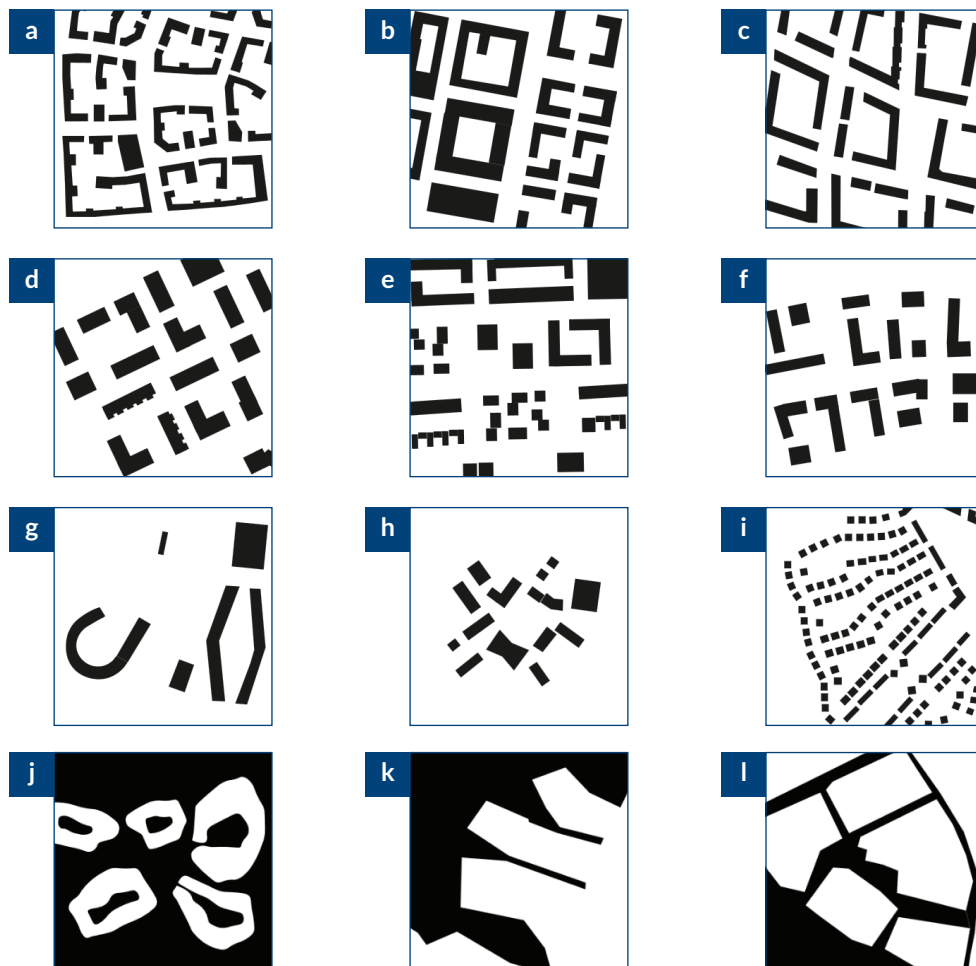


Figure 3. Examples of structural diversity of perforated and agglomerated blocks (a–f), other patterns (g–i), and three examples of intertwined urban and landscape relations (j–l): (a) Munich-Freiham 1. RA (Hild und K/Studio Vulkan, 2018); (b) Hamburg-Oberbillwerder (ADEPT/Karres en Brands, 2021); (c) Hanover-Kronsrode (ASTOC/West 8/SHP, 2017); (d) Saarbrücken-Im Kappenroth (MARS/GREENBOX, 2022); (e) Wolfsburg-Hellwinkel Terrassen (smaq, 2015); (f) Berlin-Buch am Sandhaus (Studio Wessendorf/Grieger Harzer, 2021); (g) Hamburg, Gartenstadt Öjendorf (BeL/URBAN CATALYST/PolinnaHauck/ARGUS/BWS, 2022); (h) Düsseldorf-Kalkumer Schloßallee (Venus/BeL/GREENBOX, 2024); (i) Krefeld-Fischeln Southwest (Christoph Kohl/KK, 2016); (j) Cologne The WoodHood (Karres en Brands/Metabolic/Argus, 2024); (k) Offenbach-Bieber Waldhof West (rheinflügel severin/[f], 2019); (l) Hildesheim-Wasserkamp (mla+, 2023).

4.2.2. Urban Density: Reaching Inner-City Levels

We observe that compact and dense structures, essential to “postmodern” urban development, are implemented in many places. High urban densities are intended to save space, thereby promoting sustainability, yet they can conflict with demands for climate-friendly and green neighbourhoods, as green infrastructure also requires land. The average neighbourhood-related density (or net-density) is 77 residential units/ha (Figure 2b). This corresponds to recent studies on new urban neighbourhoods in Germany (Freudenau et al., 2021, pp. 46–50, with an average density of 93 residential units/ha for projects in large and 51 residential units/ha in small cities, regardless of their location in the city). No statistically significant association was found between residential density and city size ($r = 0.15$, $p = 0.23$, $n = 69$). Even in the largest cities, individual lower density projects are being planned. A weak negative correlation was found between density and gross project area ($r = -0.28$, $p = 0.02$, $n = 69$; Figure 2b), suggesting a slight tendency for larger projects to be developed at lower densities. Although statistically significant, the effect remains limited. One explanation is the prevalence of large open spaces in large projects.

It should be noted that many neighbourhoods are zoned, with densities decreasing from the centre to the periphery. For example, in the Hellwinkel-Terrassen project, densities decrease from 3.6 to 1.2. The corresponding maximum floor area ratios (FAR) in the neighbourhood centre range from 0.4 (Bielefeld-Grünheide) to 7.2 (Munich-Freiham), while the average is 1.9 ($n = 40$). Eight projects achieve a value above 3.0. The peaks are usually due to higher-rise urban development accents, particularly evident in the largest cities. The corresponding minimum values at the edge of the settlement range between 0.3 and 2.75, with an average of 1.0 ($n = 30$).

Larger projects tend to accommodate denser areas, as indicated by a moderate but statistically significant positive correlation between maximum FAR and project size ($r = 0.42$, $p = 0.007$, $n = 40$). This suggests a tendency for larger projects to be associated with higher permitted densities, although the relationship is not deterministic. In contrast, no meaningful correlation was found between city size and maximum density ($r = 0.10$, $p = 0.535$, $n = 40$). This result supports our observation that larger projects tend to be more complex and diverse (see, for example, the next section).

4.2.3. Functional Mix and Defining Uses: Dominance of Serviced Residential Neighbourhoods

Since 2010, almost no purely residential areas have been planned on city outskirts, in contrast to the first decade of the 2000s (Freudenau et al., 2021, p. 54). The degree of mixed-use varies considerably and tends to increase with neighbourhood size. Nevertheless, only about a quarter of cases (17) features a more extensive mix with office and service space, educational or university uses, and, in some cases, manufacturing. In isolated instances, large-scale retail, hotels, trade fairs, clinics, and healthcare facilities also contribute to the mix.

Notably, larger cities tend to attract schemes with a higher degree of functional mix: 30% of projects in cities with more than 500,000 inhabitants envisage more extensive mixed-use concepts, compared with only 20% in smaller cities.

4.3. Open Space: Green and Multifunctional Streets and Places

Open spaces are a defining feature of many projects, encompassing extensive, sometimes dominant open corridors, parks, and other undeveloped areas. The peripheral location requires constant mediation between urban and suburban contexts. In 38 of 65 projects, open space networks are being created that allow the landscape to “flow” into the neighbourhood. The stronger focus on nature and landscape compared to the 1990s is reflected both quantitatively and in the structuring, arrangement, and design of networks and interconnections (Figures 3j–l).

Pedestrian-oriented green corridors are increasingly replacing car-oriented boulevards and streets. Another new feature is the multifunctional use of spaces serving as air corridors, infiltration area, play area, park, and urban gardening, as exemplified by the “Green Loop” in Hamburg-Oberbillwerder, a green lung, biotope, and place for sport, leisure, and relaxation (Figure 4).

New urban districts use a wide repertoire of open space types, forming an interwoven open space structure; green corridors (48) are employed to enhance landscape integration. Semi-public block-related communal areas (47) remain common, as are meeting places such as central (46) and decentralised squares (35) and some village green-style street spaces (9). Lakes (9) are also incorporated. Private garden areas are also common (39). Overall, planning communal open spaces is seen as central to strengthening social cohesion and ensuring quality and diversity of use.

As with 1990s’ projects, open spaces are grounded in postmodern concepts. Furthermore, quality of life and a wide range of recreational facilities are intrinsically linked to ecological functions (fresh air, circular economy, water retention, infiltration) and frequently impact project concepts (sponge city, animal-assisted design, etc.).

4.4. Social Aspects and Services: New Levels of Social Housing and Social Infrastructure

The projects examined demonstrate ambitions for innovation in social aspects. Social housing is not a new instrument. Nevertheless, following large-scale privatisation and a decline in occupancy rights, many cities have re-emphasised affordable housing provision as a core task, often exceeding respective legal requirements. Of the 54 sufficiently concrete projects, 27 provide for subsidised housing, 10 of which even have an above-average subsidy rate of more than 30%, which underlines the relevance in new neighbourhoods. Among special types of housing, senior citizens’ housing dominates (26), followed by “mixtures of different types of housing” (18), “other innovative housing projects” (18), “multi-generational housing” (16), and student housing (14).

There is also a wide range of social infrastructure. The projects (65) provide for legally binding nursery schools, plan food retail outlets (42), and schools (38; especially in large neighbourhoods). This is complemented by facilities for children and teenagers (22), senior citizens and health infrastructure (18), and religious facilities (7).

Of particular note are more far-reaching contributions, which are supported by civil society promoting social cohesion. However, these are more difficult to grasp due to the projects’ planning status and inconsistent terminology. These include neighbourhood meeting places (31/36), services for surrounding neighbourhoods (12), and rare but significant services such as “urban agriculture” and “workshops” (8).

Programmes like co-working, multifunctional rooms, and pop-up stores were observed occasionally, demonstrating considerable variety. Notably, the term “special social infrastructure” was often associated with the term “central” (21), for example to enrich neighbourhood centres.

New neighbourhood projects are increasingly integrating special forms of housing and a variety of “alternative” facilities. Their breadth reflects current trends such as individualisation, diversification, and ageing, combined with the demand for different lifestyles and household types with specific needs. The high proportion of cooperatives and building groups (see Section 4.6) corresponds to this observation.

4.5. Mobility: Streets to the People

Mobility has undergone considerable change since the 1990s, e.g., in terms of cycling, the 15-minute city, parking, and e-mobility. Car parking seems to be moving towards bundled, neighbourhood-based solutions. The most common (40/65) are neighbourhood garages. These are complemented by conventional underground garages (34), street-side parking (33), and parking on private plots (22), and sometimes collective parking in open spaces (4).



Figure 4. Integrating infrastructure and public spaces in the “Green Loop” (Hamburg-Oberbillwerder)—an attempt to promote “sustainable” solutions: (a) social and functional mix; (b) mobility; (c) open space; and (d) ecology. Sources: (a) and (b) by ADEPT/Karres en Brands/IBA Hamburg, (c) and (d) by Atelier Loidl/IBA Hamburg.

Today's neighbourhood garages are often planned as multifunctional "mobility hubs." They serve as car parks and offer additional services such as shared facilities, neighbourhood cafés, and delivery points. They can also be used as co-working spaces and hubs for the circular economy (see Figure 4, for example).

These new "centres" are sometimes linked to public spaces, with the aim of vitalising them and staging the routes to residential areas.

Even more important than parking solutions are integrated multimodal mobility options, linking attractive public transport with good cycling and pedestrian infrastructure. Public transport is usually already available (buses in 53 and rail in 30 cases). Many projects are planning intermodal "sharing hubs" (44) and mobility stations (34). For non-motorised private transport, measures to promote bicycle use (36), integration with existing cycling networks (28), and attractive footpaths (25) are planned.

4.6. Planning and Governance

4.6.1. Planning Processes: Informal Tools Managing Complexity and Citizen Engagement

An ambitious diversity of planning and governance instruments characterises the projects studied. In many cases, multi-stage urban planning competitions guide complex planning processes (19/59). Informal framework plans mediate between various interests and represent a central link to subsequent formal land-use planning.

The more prominent projects show that plans must be continually adjusted to diverging interests and framework conditions. Competitions allow designers (and people) to feed ideas into the debate. Moreover, development rights and subcontracts tend to be awarded using concept-based procurement—prioritising ideas over cost efficiency. Citizen engagement is also central: In addition to standard information sessions (59/63), multi-stage dialogue-oriented procedures, planning workshops (59), digital participation procedures (22), or other formats are employed to promote identification and shared ownership. For more details about planning and governance see Tables S4a–d.

4.6.2. Project Sponsors and Stakeholders: The Public Sector Steers, With Selected Partners

Municipal control forms the backbone of complex projects, yet often a diverse group of partners is involved. The leading role of the public can be attributed to the high demands on coordination, public welfare orientation, and long-term land availability. Other stakeholders playing a minor but vital role are large housing companies (37/59), ahead of construction companies (36), project developers (34), and private individuals (30). Building associations and cooperatives (40) underscore the importance of incorporating alternative housing and living models. The diverse parties involved point to a heterogeneous project culture, and to diverse target groups and implementation models.

4.7. Agglomerated Sustainability Ambition TSUDAI: A Diverse Field, but Larger Projects More Aspiring?

The analysis of the six criteria related to an agglomerated sustainability ambition index (TSUDAI, see Section 3.2, and Table S2) shows a broad distribution of both ambitious and "simpler" projects across the

entire spectrum of cities and project sizes. Sustainable urban design, being a relational concept based on integrated dimensions, manifests itself very differently at the local level, which leads to a mean TSUDAI of 2.7. We see that sustainability approaches are obviously being pursued selectively, but in many places and in various fields. A considerable variance and dispersion between the projects exist: Six achieve a TSUDAI of over 5 (Figures 5a–d).

The results were correlated with planned residential units, project size, and structural conditions such as city size, population development, and political context ($n = 67$). The planned number of residential units showed a strong and statistically highly significant positive correlation with the TSUDAI ($r = 0.52$, $p < 0.001$; Figure 5a). The planning of larger neighbourhoods, often in the hands of the local authority, allows sustainability dimensions to be addressed in parallel through different procedural steps. Moreover, high levels of public attention can facilitate housing subsidies and thematic grants promoting innovation.

A modest but statistically significant positive correlation is observed between TSUDAI and electoral support for parties focused on social justice and environmental issues (Greens, Left; $r = 0.31$, $p = 0.012$; Figure 5b). By contrast, no statistically significant correlation was found with the local proportion of conservative, business-friendly parties ($r = -0.04$, $p = 0.743$).

No statistically significant correlations were detected between TSUDAI and city size ($r = 0.15$, $p = 0.23$; Figure 5c), or long-term population development over the past quarter of a century ($r = 0.06$, $p = 0.604$;

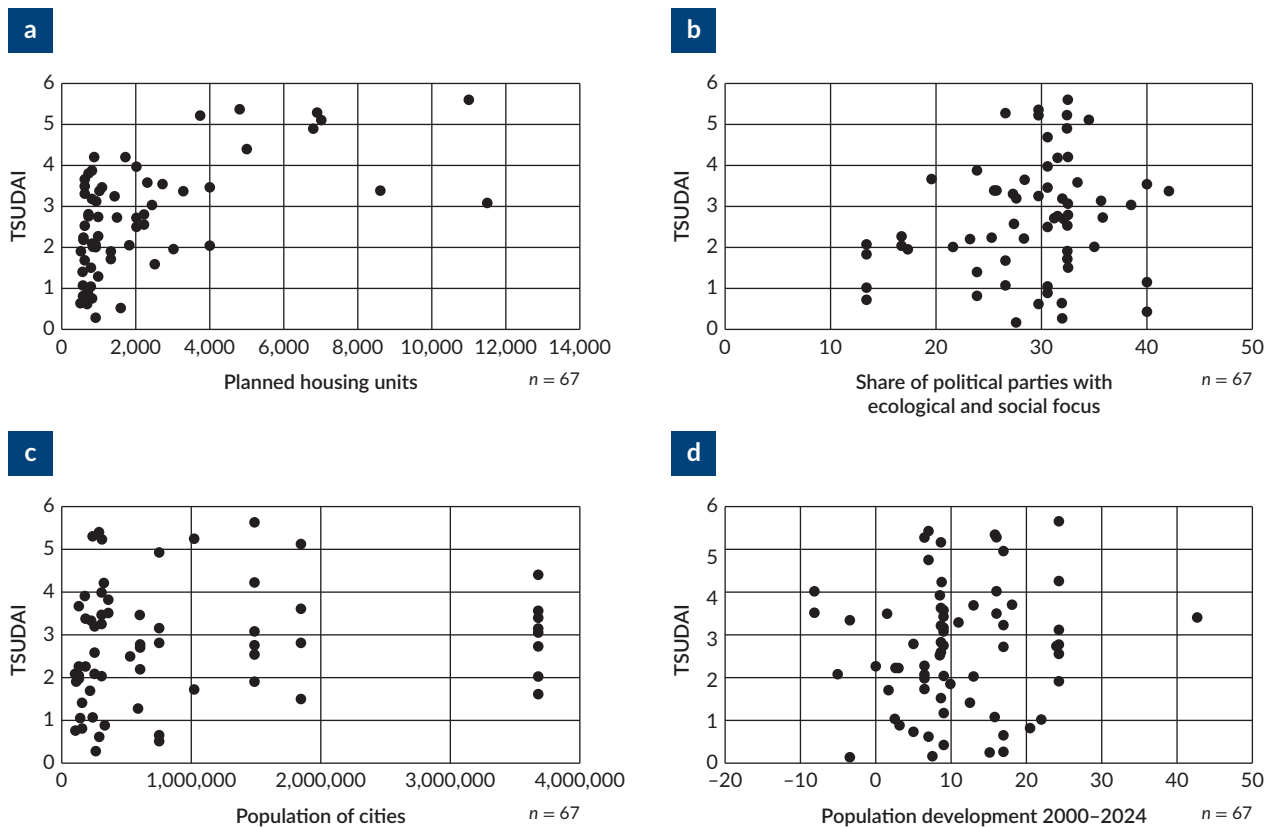


Figure 5. Project features and TSUDAI: The results were correlated with planned housing units (a), the political context (b), the host city population (c), and the population development from 2000 to 2024 (d).

Figure 5d). So, larger cities don't seem more committed to sustainability, and housing pressures in fast-growing cities don't seem to make much difference. A modest positive and statistically significant correlation was observed between TSUDAI and project size ($r = 0.32, p = 0.008$). This finding is in line with the results reported above (correlation with planned residential units) and in Section 2.2.2, which revealed a positive association between higher densities and project size. These results strengthen our observation that larger projects tend to be not only more complex and diverse but also enriched by more sustainability ambitions.

5. Discussion

This section tackles the initial research questions (Section 3) by providing a review of our six analytical categories and the agglomerated sustainability ambitions (see Table S5).

5.1. Location

Large urban expansion projects concentrate in booming metropolitan regions and particular medium-sized cities. Most projects emerge on agricultural land on the city outskirts previously marked for urban development. They are usually found in diverse environments, striking a careful balance between integration and separation while presenting a strong identity of their own. The projects pay attention to the surrounding fabric, for example through pedestrian links, buffer parks, or gradual zoning at the edges. Location is thus shaped both by structural demand (growth dynamics) and planning strategies, including considerations of identity formation and public acceptance.

5.2. Building Structure and Use

The results largely confirm the call for increased compactness and hybridity (Reicher & Söfker-Rieniets, 2022; Tarbatt & Tarbatt, 2020). Block-like structures, defined street spaces, and at least medium building densities are commonplace. These structures are broken up, loosened, and, in some cases, accentuated by modernist features (high-rise buildings, rows). Increased compactness and a net density matching values of inner-city neighbourhoods are no longer necessarily achieved through uniform, closed building typologies, but rather through spatial arrangements of varying degrees of density. Even so, typologies such as loosely composed open blocks dominate and configure public spaces. Although the neighbourhoods show greater diversity of uses than earlier suburban developments, larger concentrations of workplaces remain rare. Functional diversity is achieved through innovative social facilities, combinations of housing types, and a resurgence of flexible ground floors.

5.3. Open Spaces

The location at the urban edge, climate adaptation needs, and environmental standards explain a rising significance of open spaces and green landscape corridors. Landscape and topography are widely used as elements of local integration and structuring elements rearticulating the urban edge. Different from the "postmodern" 1990s' projects, green is the dominant colour of the designs, and green spaces are omnipresent. Water management, energy concepts, habitats, leisure, mobility, and social interaction are integrated into so-called "multi-coded spaces." The green street emerges as a new urban typology, still awaiting full appreciation. Pedestrian-oriented green corridors increasingly replace car-oriented street

spaces, reflecting changing urban design priorities, echoing calls in the literature (Aelbrecht, 2022; Carmona, 2021; Larco et al., 2013; Sohn et al., 2012).

5.4. Social Aspects and Services

Many plans embrace principles of social inclusion, diversity, and co-production. They demonstrate ambitions for affordable and inclusive housing through measures such as flexible building structures, diversity of providers, binding subsidy quotas, and occupancy restrictions. New housing options and corresponding infrastructure go beyond standards to address trends such as ageing, individualisation, and social diversity. Numerous projects are setting standards by including diverse, often civil society-run facilities—from edible gardens and workshops to community centres—to promote social cohesion. However, these attempts merely represent limited approaches to achieving equity and health as called for in the literature (Larco & Knudson, 2024).

5.5. Mobility

Guided by principles such as “city of short distances,” and the 15-minute-city, the transition from car-dominated to pedestrian spaces has become a defining characteristic of contemporary urban expansion projects (Larco, 2016). Mobility hubs emerge as integrative new types of service buildings, contributing significantly to the realisation of visions of sustainable mobility, representing a radical departure from modernist car-centric structures (Carmona, 2021; Sepe, 2025). Likewise, the transition from car-dominated streetscapes to pedestrian-oriented green corridors, a defining characteristic of postmodern neighbourhoods, is now signalling a broader shift towards more walkable, environmentally-responsive urban forms.

5.6. Planning Processes and Actors

Urban expansion is increasingly characterised by many institutional actors and formal and informal procedures and intricate governance arrangements. However, there is a growing role of small-scale urban producers such as building groups and cooperatives, as the “icing on the cake.” This is a significant difference to both large publicly-controlled modernist projects or the private sector-centred “postmodern” schemes from the 1990s. Planning processes experience increasing complexity, as a wide range of issues and competing interests—including sustainability goals, public acceptance, mobility, environmental protection, and land-use conflicts—are negotiated. This leads to new informal instruments, transdisciplinary cooperation arrangements, and new forms of citizen engagement. Whether the new projects will be truly co-produced remains to be seen.

5.7. Sustainability Ambition

In our exploration of the sustainability ambition (TSUDAI), we observe a broad and diverse distribution, indicating that sustainability approaches are being pursued in many places and in various categories. Most clearly, the level of sustainability ambition seems to increase with the number of planned units. The presence of governments that focus on social and environmental goals also appears influential. The impact of the planned units on ambition levels can be explained by the scale and complexity of these projects and the attention these receive, including protests and needs for justification. City population, project area, and long-term population dynamics do not appear to impact sustainability ambitions.

6. Conclusion and Outlook: Towards Convergence of Postmodern and Sustainable Urban Design Principles?

Our results clearly show that the current phase of urban expansion in major German cities constitutes more than a continuation of postmodern principles prominent in the 1990s. Previous approaches are merged with typological, process, and sustainability-oriented innovations. Urban planning and design combine elements from the “catalogue” of older periods (modernist architectural language, postmodern organisation of space) with recent innovations (multi-coded areas, mobility-hubs) for increasingly complex and ambitious ends: housing production, urbanity, ecosystem preservation, mobility, social integration, acceptance, and identification.

The outcomes follow a distinct design approach resulting in a seamless whole with a distinct urban “grammar”: Open perimeter-blocks dominate most of the urban fabric; green dominates the open spaces; projects are intertwined with green landscape corridors as structural backbones and connectors; streets are for pedestrians; parking is organised in mobility hubs; social housing takes a significant share; the public sector steers the process. Additionally, alternative elements are sometimes added, such as building rows, towers, townhouses, alternative apartment types and layouts, non-residential uses, neighbourhood bureaus, community farms, private electric buses, spontaneous transdisciplinary coordination groups, etc. This complementary blending promotes a controlled, organised level of mix and diversity different from earlier periods. Not least, the careful localisation and integration into the local context, graded buffers, transition zones, and consideration of landscape and topographical features are important components of the language of new urban expansions.

Overall, new urban expansion projects in Germany adopt an integrative approach to sustainable urban development. The ambition of this approach varies significantly, as does its manifestation in social, technical, energy, and transport systems. Spatial and morphological implications are evident in the heterogeneity of districts and diverse green open spaces. Climate protection and adaptation, along with their links to energy, water, ecology, biodiversity, social sustainability, and health, are addressed at various scales. A wide range of elements relating to sustainable transport is also included. The flexible combinations are far from random, and their distinctive grammar is distinct from previous phases and project types such as infill and conversion projects.

In this context, design principles function less as coherent programmes and more as discursive frameworks structuring complex decision-making processes. The sustainability paradigm in particular acts as a catalyst, shifting the focus from purely morphological issues to technical, energy, and infrastructural systems and producing new combinations of density, mobility, and open space. The transformation of urban development principles is thus less a linear paradigm shift than a selective, project-related recombination of elements of postmodernism and the sustainability agenda—enriched by features already used in modernism. The special location conditions on the outskirts do, however, resist a comprehensive implementation of these principles and shape change in a particular way. The outskirts are thus important arenas where current shifts in principles are materialising in concrete terms in space and in planning processes.

A more precise understanding of these shifts will require further in-depth research, especially when it comes to the specific connection between sustainability ambitions and urban planning principles. Due to the early

planning stage of many of the projects, this article could only document preliminary results. Against this background, the future implementation of the numerous planned urban expansion projects should be carefully monitored. Questions regarding local variations, the feasibility of high sustainability standards, their adaptability, and acceptance will play a role, as will the extent to which many innovative approaches that have not yet been tested can prove their worth in practice.

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Conflict of Interests

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The AI-based language model (DeepL) was used exclusively for translation purposes, in compliance with data protection regulations. Cross-checks were always performed, and adjustments were made as necessary; none of the generated content was used without being reviewed first.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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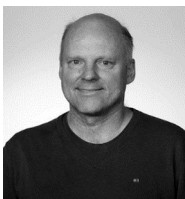
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