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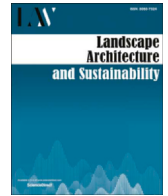
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## Full Length Article

# Designing workspaces: Deriving spatial patterns from comparative analysis of international business districts

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## ABSTRACT

Business districts currently lack the socio-ecologically inclusive standards of workspaces. This study addresses this gap through a comparative design analysis of international precedents, translating best practices into transferable spatial design knowledge for workspace development. The findings demonstrate that the transformation of business districts can be achieved by activating and reconfiguring existing spatial elements to generate ecological, social and spatial value. Five recurring spatial design patterns are identified as key drivers of this transition on the spatial district scale: zone-crossing corridors, mobility-driven green space, active cores, multi-tone environments and spatial enrichment. Together, these patterns foster biodiversity, climate adaptivity, spatial diversity, and improved everyday use. The research shows that these patterns are adaptable and scalable across contexts, offering a practical framework for policymakers and designers to transform monotonous business districts into more liveable and resilient workspaces. While the study primarily draws on Northwestern European cases and non-heavy industrial contexts, it establishes a foundation for further validation through research-by-design approaches and Living Lab setups. By linking spatial analysis with design synthesis, this study advances the methodological framework for evidence-based landscape architecture and contributes to the broader discourse on sustainable and socio-ecologically inclusive urban development.

## 1. Introduction

The need for integrated spatial solutions is highlighted by the exerted pressure on the built environment by urbanisation and population growth. The spatial design disciplines are evolving to support environmental, social and economic growth while enhancing urban quality (Fang, 2022; Abujder Ochoa, et al., 2025). However, certain urban typologies within the built environment, particularly the industrial one (Li and Li, 2024), remain predominantly monotonous. These areas are primarily organised around economic functions such as manufacturing, services, or logistics (Hrelja, 2008), leaving limited space for diverse landscape uses. Although their environmental impacts (e.g. noise, odour, traffic) may vary, their spatial and temporal dynamics are consistently tied to business operations and working hours. Whilst these business districts can range from small sites of a few hectares to expansive areas spanning hundreds of hectares, they house a community of offices and/or industrial businesses. Whilst these areas are undeniably vital to economic productivity, they also have significant potential to contribute to broader social and environmental goals.

In the Netherlands, business districts cover 20% of the total Dutch built environment and remain largely monofunctional and under-utilised. They lack sufficient green space in both quantity and quality, are dominated by fast-moving traffic, and have inadequate public spaces. This makes them vulnerable to climate change hazards and spatial emptiness. Their development is predominantly shaped by economic considerations, overlooking their potential as multi-functional, socio-ecologically inclusive landscapes: workspaces (De Wolf et al., 2025). In the Netherlands, the term workspaces is emerging. However, in scientific literature and international studies, this term is still uncommon. Different terminologies are used to describe the same definition. Van der Beek (1997) uses the term green business districts, *groene bedrijventerreinen*. However, different definitions are also assigned to green business districts or parks. Green business parks can be workspaces, depending on the urban landscape qualities that extend beyond the “green” aspect alone. Green business parks are also known as eco-industrial parks, eco-business parks, environmentally friendly business parks, and low-carbon business parks (Hwang et al., 2017).

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**Table 1**  
Analytical framework for spatial quality of business districts (De Wolf et al., 2025).

Framework	Environmental	Urban	Accessibility
Pathways	A healthy landscape	An inspiring sociosphere	A viable economy
Values	Ecosystems, resources, diversity, integration, renewal, carrying capacity, nutrients, coexistence, undisturbed, calm, healthy, stability, species, environmental types, geomorphology, ecotype, hydrology, habitat, soil	Multipurpose, space, peace, image, attractiveness, quality, safety, beauty, health, uniqueness, contrast, connectedness, encounter, flexibility, agglomeration, symbology, unprogrammedness, senses	Efficiency, externalities, distribution, participation, choice, access, inclusion, ordering, clarity, coherence, structure, construction, occupation
Indicators	Number of trees, canopy coverage, green space, shrubs, water bodies	Heritage, architecture, public space, parks, squares, density, agglomeration, functional mix/composition, size of the districts and buildings	Modes of traffic, slow traffic, rapidness, frequency, parking

However, “eco”, “green”, “sustainable”, and “environmental-friendly” are also increasingly being used and becoming buzzwords, highlighting the importance of qualitative research.

The urban and architectural quality of business districts is considered low (Louw, 2016), and they are generally perceived as ugly, boring, and outdated (Needham and Louw, 2003). Urban design is fundamentally about shaping people’s experiences in the built environment (Sternberg, 2000). Even landscapes that are considered sustainable, focusing on ecological health, social justice, and economic prosperity, can be undesirable places to be in. The appearance of the urban landscape shapes users’ attachment, perceptions, and behaviour. Aesthetics must therefore be understood as a form of performance and quality (Meyer, 2008). Spatial quality is widely regarded as a foundational principle in urban design and planning. Lynch (1960), for example, explains that the quality of urban space is not based solely on form, but on the interaction between physical form and human perception. For designers, Lynch sees paths, edges, districts, nodes, and landmarks as building blocks to shape the identity of the urban landscape. Alexander et al. (1977) argue that by examining high-quality environments people enjoy, a set of design principles can be repeatedly used to shape them. Carmona (2021) notes that much of the contemporary built environment suffers from poor quality, including the car-dominated commercial spaces that lack space for pedestrians. Carmona argues that urban design can address this by shaping better places through the integration of temporal, perceptual, morphological, visual, social and functional dimensions of spatial performance.

Spatial quality should therefore be understood as a combination of many interconnected aspects and practices that together shape how well a space works, looks, and feels. It is important to give the concept an integral and integrative character (Khan et al., 2014). As the landscape has become the integrative and organising framework of our urban environments (Waldheim, 2012; Nijhuis, 2022), qualitative urban landscape design is essential to improve spatial performance in business districts. Regarding business districts, De Wolf et al. (2025) proposed a framework to assess their spatial quality, including pathways, values, and indicators (Table 1). This framework differs from other urban assessment frameworks (e.g., EcoCity Builders, 2022; UN-Habitat, 2020) by grounding the assessment of business districts in landscape architectural composition. Unlike existing tools, it specifically evaluates the socio-ecological spatial quality of workspaces, rather than social, sustainability, or environmental metrics of public space in general. The analytical framework aligns with international approaches that emphasise systemic and multi-layered design thinking. Like Cervero et al., (2002) Transit-Oriented Development review, it considers design components related to connectivity and programmatic integration. Like Ahern’s (2011) resilience-based urban planning and design, it incorporates conditions linked to sustainability and resilience. In line with Steiner’s (2012) ecological landscape planning, it adopts ecological and human values. This alignment highlights the framework’s relevance as a tool for enhancing the spatial quality of business districts.

De Wolf et al. (2025) spatial analysis of the spatial quality in forty business districts highlights the importance of rethinking the urban landscape design of business districts. This is particularly relevant as

cities worldwide continue to develop or retrofit industrial sites into residential districts (Van den Berghe et al., 2023; Danilina et al., 2024; Wu and Han, 2025) in response to global economic pressures and evolving expectations around liveability, sustainability, and inclusivity. This is while in the Netherlands, for instance, the available space and business districts are already under pressure (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025).

Earlier research has identified various spatial, sustainability, and environmental deficiencies of business districts (Schoneboom and Moss, 2024; Lejoux and Charieau, 2021; Le Tellier et al., 2019; Meinsma, 2004). Other studies have examined the design of smaller-scale open space in these areas (Atwa et al., 2019) or derived strategies from worldwide examples (Atwa et al., 2017). Van Dinteren (2007) presents examples such as Chiswick Park in England, which set the trend regarding offering an enjoyable work environment. Almost two decades later, Strelitz (2024) still presents this case as a highly successful business park. Van der Beek (1997) presents examples such as TechnologieZentrumDortmund in Germany, where open green space was part of the development plan and connects to larger green structures within and surrounding the district. Despite extensive scholarship on spatial quality and design in urban environments, research on the spatial quality of business districts often focuses on single-case studies, the small scale, or broad theoretical discussions. Business districts remain an overlooked typology in urban landscape studies. The theoretical foundation for the urban landscape design of workspaces, a rapidly proliferating yet under-synthesised urban typology, is lacking. There is still a limited understanding of which urban landscape design principles recur consistently across different geographic and cultural contexts and how these principles contribute to perceived and experienced spatial quality.

This study addresses the knowledge gap by identifying and comparing recurring design principles across multiple contemporary international business districts. Thereby, it moves beyond isolated case-based insights toward a more generalisable understanding and transferable knowledge, to advance the scholarly field. In doing so, it responds to an urgent need for evidence-based guidance that can inform the design of business districts that are not only economically successful but also socially and spatially meaningful.

Therefore, this paper aims to answer the following research question: Which urban landscape design principles recur across contemporary international business districts, and through what spatial logics do they contribute to improving socio-ecological value?

To address this question, the research: (1) Conceptualises spatial quality in the context of workspaces and identifies the accompanying spatial criteria. (2) Documents and compares best practice design principles in contemporary workspaces via a comparative design analysis on decomposed designs, revealing recurring design elements. (3) Develops a framework that supports better planning and transformation of workspaces elsewhere.

As the field of urban landscape design lacks a coherent set of empirically grounded design patterns for business districts, this research builds a practical framework that planners, designers, and decision-makers can use to guide future (re)development. Alexander et al. (1977) formulated a pattern language as a method for designing qualitative environments based on recurring spatial patterns. Each pattern

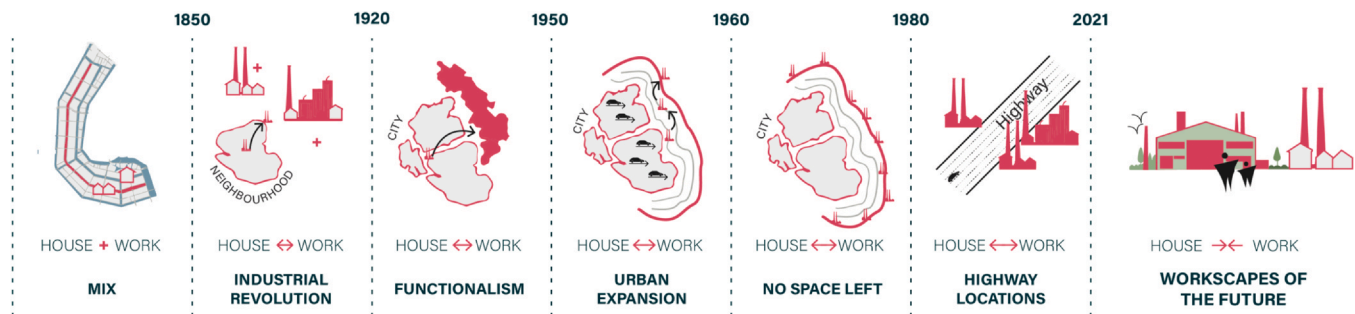


Fig. 1. Historical development of the Dutch urban concept of the business district related to the living environment. Based on Louw et al. (2004).

describes a problem and offers a spatial solution adaptable to human needs and contextual conditions. Through comparative design analysis of decomposed workscales, this study identifies missing principles in urban landscape design that can inform future workscale development. This contributes to a spatial design pattern language to design workscales. This pattern language can serve as a spatially integrative framework for workscale design worldwide, leveraging urban landscape design to address environmental, social, and economic challenges. The patterns presented in this study can be used similarly to Alexander et al.'s (1977), as they always need the creative adaptation of designers to be implementable and generate site-specific workscales. However, these patterns differ from Alexander et al.'s in that they can be understood through the theoretical lens of landscape as a system, structure, and process (Nijhuis and Jauslin, 2015), hence they are more spatial-ecological and system-oriented.

This paper advances the field by systematically deriving transferable design patterns that connect landscape systems thinking with business district redevelopment. By doing so, the paper promotes socio-ecologically inclusive approaches to landscape change. Regarding the planning and policy of business districts, these patterns can serve as practical principles to guide decisions on how to plan, transform, or manage them.

## 2. Theoretical basis

### 2.1. Historical context

The design of business districts and their relationship to the living environment have evolved over time, influenced by key historical events. As Louw et al. (2004) describe, historically, businesses were embedded within residential areas. The Industrial Revolution introduced large-scale factory complexes and displaced businesses from neighbourhoods. Initially, proximity remained essential, with employers providing housing adjacent to factories, as motorised transport was not yet available. However, increasing environmental nuisances in the early twentieth century prompted a functional separation. The advent of Functionalism in the 1920s institutionalised this segregation, while the rise of the automobile in the 1950s further amplified spatial distancing. From the mid-20th century onward, business districts emerged at the urban periphery, initially as industrial districts. Economic restructuring in the 1970s shifted their focus toward services, commerce, and logistics, giving rise to the contemporary Dutch business district. By the 1980s, highway locations arose in response to urban land scarcity. The prevailing model remains monofunctional, characterised by industrial buildings and extensive parking areas, an urban typology that is over a century old. Regulatory frameworks prohibiting nuisance industries within urban cores have reinforced this pattern. Recent trends, however, signal a shift in paradigm. Businesses increasingly pose fewer environmental conflicts, and concepts such as “workscales” advocate for mixed-use environments. Dutch national initiatives, including the Workscales of the Future programme (Werklandschappen van de Toekomst, 2022), aim to reconfigure Dutch business districts. Their spatial quality remains a critical challenge.

There are various types of business districts, ranging from seaport districts, with a higher concentration of industry, to mere economic zones. As Stec Groep (2023) notes, no comprehensive sustainability policy governs these areas, and municipal strategies prioritise cost minimisation and land yield over spatial quality (Louw, 2016). Consequently, business districts lack the regulatory and qualitative standards applied to residential development, perpetuating their functional and aesthetic limitations. This historical development is depicted in Fig. 1.

The historical distancing of business districts from residential areas, driven by industrialisation, zoning, and later highway-based mobility, illustrates how infrastructural and technological systems have long structured urban form. The persistence of monofunctional, peripheral business districts reflects urban landscape design thinking dominated by infrastructural logics. The recent aim to develop mixed-use, socio-ecological inclusive workscales aligns with Nijhuis and Jauslin's (2015) call to transform these landscapes from separating mechanisms into integrated, multifunctional urban landscape infrastructure systems. By doing so, the districts can facilitate functional, social, and ecological relationships.

### 2.2. Designing for the core values

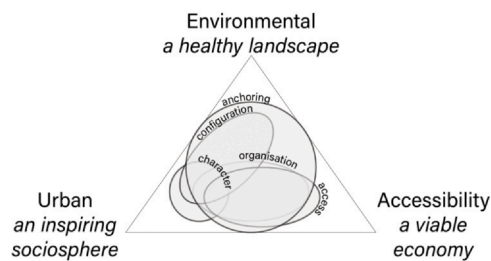
Business districts are man-made landscapes that can be interpreted as landscape architectural compositions. As Steenbergen et al. (2008) present, these composed landscapes can also be decomposed into structural elements to understand their spatial logic. While the spatial quality of business districts can be assessed through the established analytical framework, a design decomposition provides an understanding of how the landscape's spatial experience is organised. To effectively design to improve business districts, it is essential to identify these spatial patterns by decomposing exemplary workscales.

#### 2.2.1. Business districts in their context

Business districts often create urban discontinuity due to their characterising buildings and infrastructure. The anchoring of a business district in the surrounding landscape links to the three fundamental pathways in the transition of business districts into workscales. Environmentally, Bennett (2004) describes the ecological network, which includes cores: large parks, natural elements, stepping stones: small parks or green-blue elements, and linear corridors: avenues, roadsides, banks, and waterways. Snep et al. (2009) suggest enhancing biodiversity in business districts by creating eco-corridors, stepping stones, or dynamic habitats within the district. By doing this through open green space, business districts can be embedded in the network rather than functioning as barriers. Economically, the position of the business districts towards their partners, clients, and employees is important. Spatially, these networks are integrated into the urban ecological network. Business districts well integrated into this network, with prominent lines and locations, enable orientation for both humans and non-humans.

#### 2.2.2. Design of the business district

The district's design and its fit within the region are crucial to accessibility. Every species has its specific requirements regarding its



**Fig. 2.** Illustration linking the five spatial criteria (anchoring, access, organisation, configuration and character) to the analytical framework for spatial quality of business districts.

habitat and habitat size (Jansen, n.d.). The urban landscape design of a business district creates a configuration of urban habitat. Regarding these habitats, size, connectivity, and proximity are important, following the theory of island biogeography by MacArthur and Wilson (1967), which was further elaborated upon by Diamond (1975). To create a healthy landscape in business districts, a range of habitats is required, particularly in response to the built form of businesses. In business districts, most of the surface is currently sealed. As de Vries et al. (2020) note, the availability of open and accessible green spaces, such as urban parks and gardens, is likely to decrease as urban areas become denser. While ensuring universal access to safe, inclusive, and accessible green and public spaces remains a key objective within the United Nations' Sustainable Development Goals (United Nations, 2015). The spatial analysis of Dutch business districts by De Wolf et al. (2025) reveals that these locations are underrepresented in Dutch business districts. Despite their economic role, the specific functions and amenities, their distribution, and connectivity within the district must form a functional coherence. The character of a business district is defined by the integration of the above, along with the architecture and urban landscape design. The design and spatial coherence between public and private spaces enable a more multifaceted approach. Jacobs (1961) already advocated creating eyes on the streets to enhance safety and social cohesion, as isolated, poorly designed spaces discourage engagement and visibility. Gehl (2010) advocates people-oriented cities and human-scale urbanism to create more pedestrian-friendly, well-integrated spaces.

In Fig. 2, the five spatial criteria, anchoring, access, organisation, configuration and character, are linked to the analytical framework for spatial quality of business districts.

### 3. Materials and methods

This study identifies spatial design patterns that facilitate the transition of the business districts into workspaces via a comparative design analysis. The comparative logic is based on identifying recurring spatial design patterns across the decomposed design of diverse cases, using common criteria, and then validating them through cross-case synthesis and pattern matching. The cases are international examples of workspaces. The findings synthesise the current best practice into concrete design patterns that foster more inclusive and resilient urban landscapes.

The selection of representative cases follows the four criteria: (1) Already executed projects, with up-to-date Google Maps and Street View images of the executed project available. (2) After excluding zero values and the lowest percentile, the smallest Dutch business district covers approximately 10,100 m<sup>2</sup> (Pleio, n.d); therefore, workspaces with a minimum size of 10,100 m<sup>2</sup> are selected. (3) The project encompasses an urban landscape plan that extends beyond architectural elements alone. (4) The project covers a business district with multiple business terrains.

In this study, the cases were selected through a two-step process combining a literature review and an analysis of architectural archives.

Firstly, key precedent projects were identified through literature based on their relevance to workscape development. To complement this literature-based selection, a set of contemporary cases was systematically analysed using the architectural archive website ArchDaily.

Van der Beek (1997) presents several examples of Green Business Parks in Germany, England, and France. Van der Beek states that sustainable design and high environmental quality are most important to the high-end businesses. The working population's generation is now shifting from the Baby Boomers to Generation Z, a generation that generally prefers a flexible workplace that supports work-life balance and emphasises ethical values. These ethical values often comprise sustainability ambitions (Bulut and Maraba, 2021). Therefore, the design and quality of the business district is expected to be applicable to a wider range of business segments. Van Dinteren (2007) presents Chiswick Park Enjoy Work! and Philips Campus Eindhoven as examples that fit these changing requirements regarding the work environment. Also, Atwa et al. (2017) present several examples of sustainable business districts worldwide.

As a practice-based design research, contemporary business districts from international contexts are also identified through architectural archives. Relevant project information was collected and studied from the architectural archive website ArchDaily.com, using the keywords "office park", "industrial park", "eco-industrial park", "eco-business park", "environmentally friendly business park", "low-carbon business park", "workspace", "business district", "business park", "industrial estate" separately got 1366 cases in total. This specific searching and filtering process was conducted on 23 July 2025.

From this initial dataset, cases were screened for relevance, including compliance with the criteria. The cases were then evaluated on spatial quality using indicators for business districts. This spatial analysis follows the framework by De Wolf et al. (2025), meaning the business districts are analysed via publicly accessible data on environmental qualities, urban characteristics, and accessibility. Only cases that demonstrated relevant spatial characteristics that deviated positively from the spatial analysis of conventional business districts were selected for further analysis. In this way, the final selection is not based on saturation of the full dataset, but on their assessed spatial quality and relevance to the research objectives. The purpose of the selection of international workspaces is not to present all examples of workspaces worldwide, but to synthesise the best practices in designing workspaces. As there is very little prior theory on designing workspaces, this is considered robust (Eisenhardt, 2021) for this study, without overextending.

After determining the spatial quality of these business districts, this research analyses the designs of the international workspaces by using drawing as a research technique. Per composition, similar components or aspects are grouped within a drawing, decomposing the designs. To allow easy comparability, the same drawing principle is applied to each case, as in Designing Parks by Baljon (1992). These analytical drawings are abstractions that reveal the concept behind the design of the business district. Lastly, a comparative design analysis of these design decompositions yields spatial design patterns for sustainable, socio-ecologically inclusive workspaces.

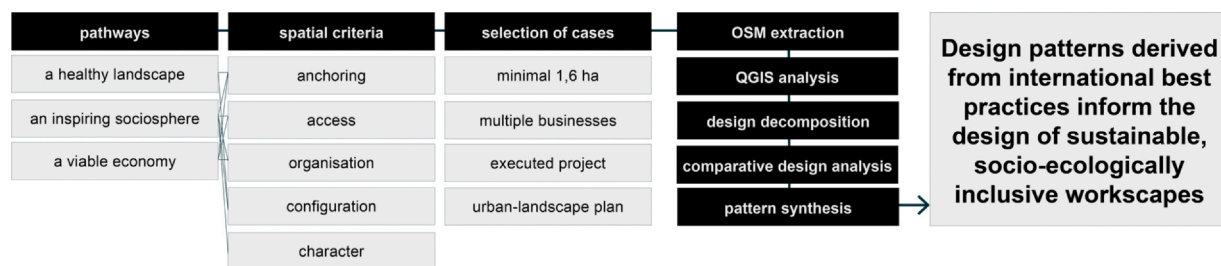
#### 3.1. Cases

Table 2 presents the eight cases selected from the literature or architectural archives that met the selection criteria. For each case, the corresponding links to Google Street View Images and Maps are listed in Appendix A.

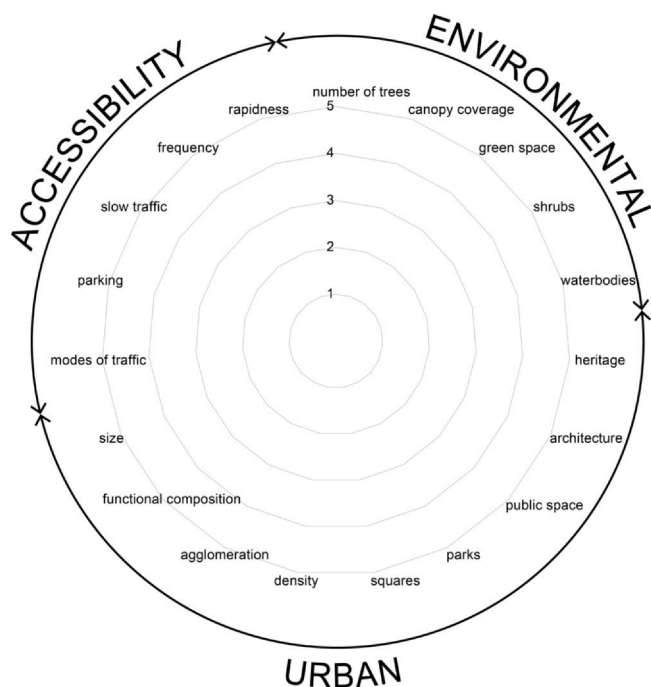
This study focuses on the spatial patterns of contemporary international business districts. However, the institutional and regulatory frameworks for business district development and urban planning differ across these countries. In the Netherlands, plans are developed and driven by municipalities (Louw, 2016). This is similar to the German case, which was developed to attract certain businesses to the region and to generate long-term jobs (Wentland, 2021). In the French case, a

**Table 2**  
Overview of selected cases as exemplary workspaces.

No.	Case name	Country	Selection Rationale	Reference
1	TechnologieZentrumDortmund	Germany	A technology park including wide front gardens at every plot, which link to public green space, and even larger green structures within and outside the business district	Van der Beek (1997)
2	Cambridge Science Park	England	A science park along the motorway with a parklike core	Van der Beek (1997)
3	Sophia-Antipolis	France	A technology park, wherein only one third has been developed for businesses, housing and recreation, whilst two thirds of the landscape remain untouched green space	Van der Beek (1997)
4	Chiswick Park Enjoy Work!	England	A corporate campus, designed to make people enjoy their work environment. It includes a wide range of amenities. Accessible by car and public transport through an outer ring. The core remains a green and blue pedestrian-only space with public square	Van Dinteren (2007)
5	Philips Campus Eindhoven	The Netherlands	A technology campus, designed for interaction	Van Dinteren (2007)
6	Greenpark Reading	England	A business park which creates a wildlife landscape preserving biodiversity. The park is connected to public transport and uses bicycles for internal transportation	Atwa et al. (2017)
7	Ecofactorij	The Netherlands	A business district that focuses on sustainable use of energy and water, and uses bicycles for internal transportation	Atwa et al. (2017)
8	Vanke Cloud City (Shenzhen) Design Community	China	An urban park, bus terminal, commercial and office space within three building blocks. The top layers of the blocks are connected through a pedestrian pathway and functions as an urban park	ArchDaily (2019)



**Fig. 3.** Workflow diagram clarifying the research data flow.



**Fig. 4.** Radar chart of spatial quality in business districts (De Wolf et al., 2025).

key public policy limited built development to one-third of the park's surface (Grandclement and Grondeau, 2022), thereby giving rise to the industry-in-park spatial concept. In China, the Shenzhen government introduced measures for Shenzhen Sponge City in response to water-

related challenges posed by extremely rapid urban growth (Zhang, 2025a). The UK cases are typically less influenced by the national government (Van der Beek, 1997). Also, private parties are more involved and districts like Cambridge Science Park enjoy hands-on management at an early stage (Gower and Harris, 1994). Though the cases differ in the urban and institutional context, the recurring spatial patterns can still be considered.

### 3.2. Data processing

The cases are in several different countries. Each country has its own method for collecting spatial data on the sites. To ensure comparability across all business districts, a consistent dataset was used by extracting spatial information from OpenStreetMap (OSM) (OpenStreetMap, n.d.). For each site, a defined spatial boundary was selected within OSM, and the corresponding dataset was downloaded and imported into QGIS version 3.34.1. Within QGIS, the data are systematically cleaned and categorised to enable cross-case comparison. The analysis focused on key spatial components, including the configuration and design of infrastructure networks, building ensembles, functional programmes, land use, natural elements and public amenities. To complement the spatial dataset, public transport information was collected from local transport providers through digital sources, ensuring that accessibility conditions could be consistently assessed across cases. In addition, with Illustrator V.30.4., together with printed versions of the decomposed maps at a consistent scale and with tracing paper, enabled a direct and systematic comparison of spatial configuration across cases. This analogue overlay technique facilitated the assessment of differences and similarities among business districts with respect to the defined spatial criteria.

This study employs an interpretative approach to spatial design analysis by integrating OSM data with visual sources such as Google Maps and Street

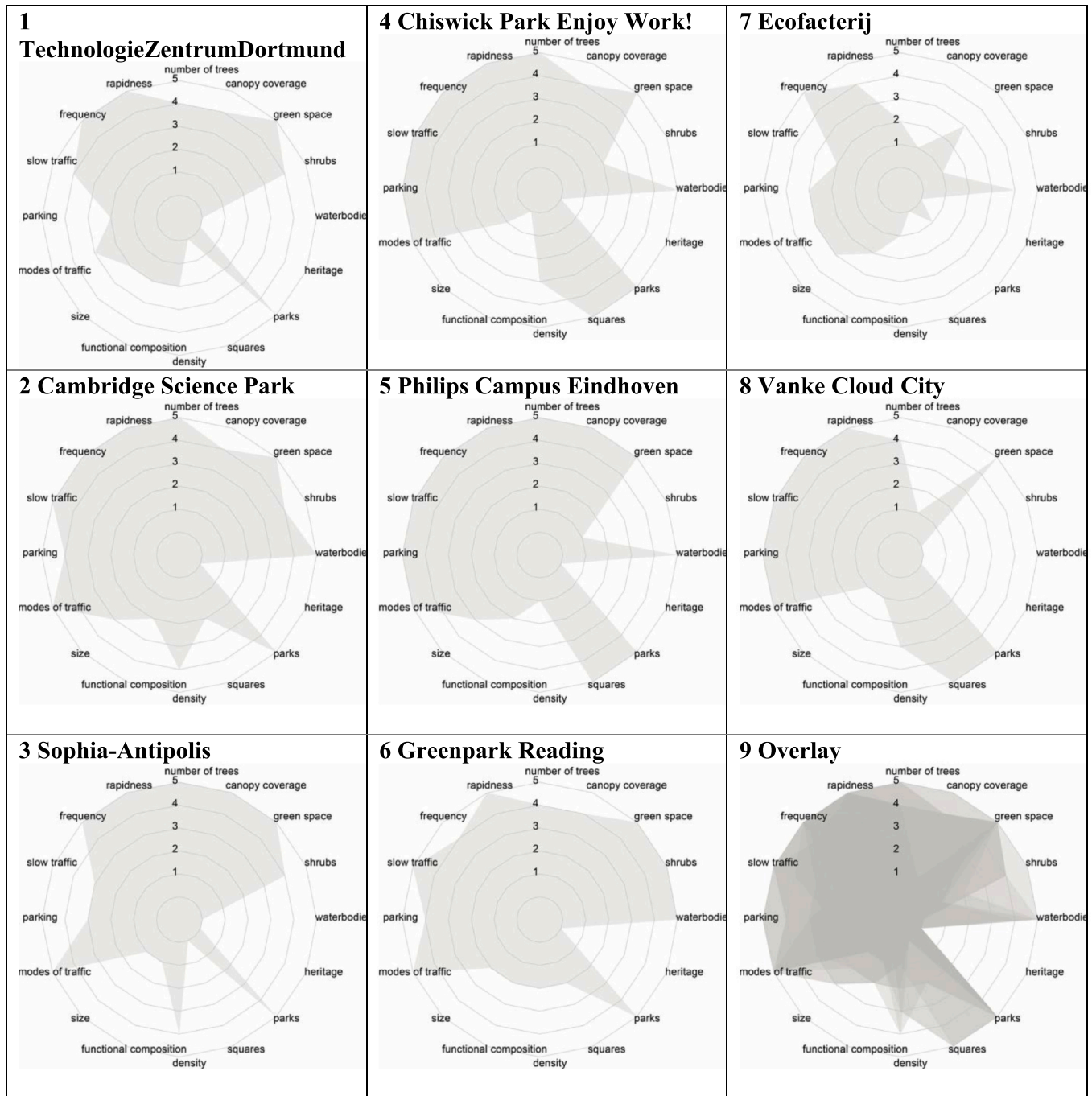


Fig. 5. Radar charts showing the spatial quality of the eight selected business districts and their overlapping radar chart.

View. Given the limited accuracy of volunteered geographic information (such as OSM), these sources are compared to enhance spatial understanding. This process aligns with the interpretative strategies outlined by Deming and Swaffield (2011), particularly in terms of visual interpretation and abductive reasoning. Visual interpretation involves analysing spatial representations to uncover patterns, relationships, and meanings within the landscape. By comparing multiple visual sources, a form of visual triangulation is applied to validate and enrich the spatial reading. In cases where data inconsistencies arise, abductive reasoning is employed to bridge gaps through interpretive inference, enabling a more nuanced, context-sensitive understanding of the urban environment.

In Fig. 3, the workflow is schematically illustrated. After defining the criteria critical to workspaces, several international cases are selected. Through (1) OSM extraction, (2) QGIS analysis, (3) design decomposition, (4) comparative design analysis, and (5) pattern synthesis,

design patterns are derived to inform the design of sustainable, socio-ecologically inclusive workspaces.

#### 4. Results

##### 4.1. State-of-the-art in spatial quality of workspaces

The original radar chart by De Wolf et al. (2025) (Fig. 4), presents indicators from their analytical framework (Table 1) and enables a comprehensive assessment of the spatial quality of a business district in a single diagram. In this study, this assessment method is used to verify the spatial quality of the eight selected cases. The outcomes of this are presented in Fig. 5.

Almost all the cases score very well on the accessibility and environmental characteristics. Additionally, public parks and squares are

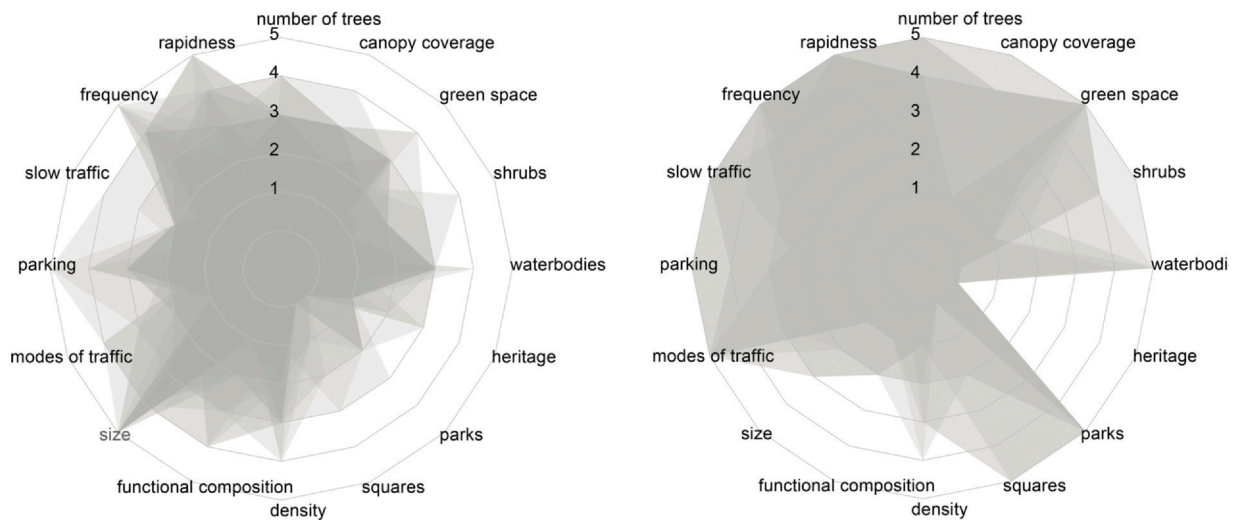


Fig. 6. Overlapping radar chart of 40 Dutch cases from analysis De Wolf et al. (2025) (left), and overlapping radar chart of eight examples (right).

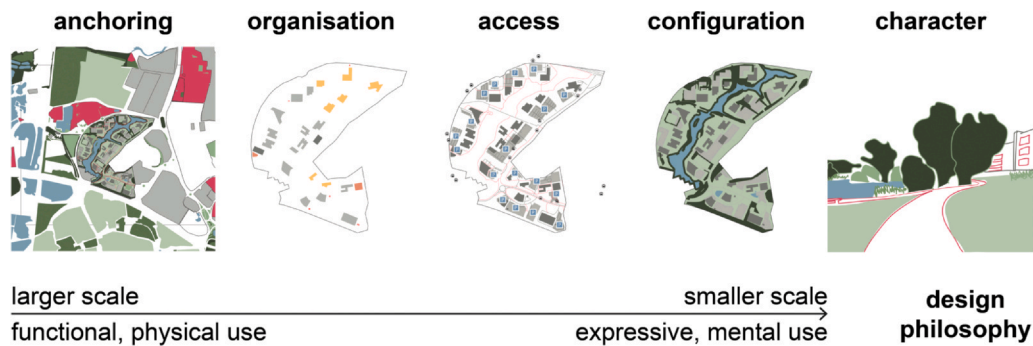


Fig. 7. Drawing method for the spatial design patterns, ranging in scale and use, Green Park Reading's design decomposition.

often found in these cases. Due to the lack of a common source of data on agglomerations, property boundaries, and building construction years, these indicators were removed from the original chart.

De Wolf et al. (2025) analysed 40 Dutch business districts. The left diagram in Fig. 6 shows that these districts lack quality in indicators such as parks, squares, and slow traffic. The overlapping radar charts of the international examples of business districts analysed in this study (Fig. 6, right diagram) score significantly higher on environmental and accessibility indicators, such as the presence of trees, waterbodies, slow traffic infrastructure, and frequent public transport, as well as well-organised, car-oriented infrastructure. Moreover, the examples include public parks and squares in the district, which are rare in the Dutch districts. However, these eight examples are generally smaller and exhibit less functional diversity, with no heritage objects.

#### 4.2. Design decomposition of exemplary workspaces

For each case, the business district's design is decomposed. For easy comparison, this uses the same drawing method and scale as per the design criteria. The design principles range from more functional, physical use to more expressive, mental use. This is exemplified in Fig. 7 below for the case of Green Park Reading.

Table 3 shows the design decompositions of the eight cases and reveals their similarities and synergies. The decomposition is presented in Appendix B at an enlarged scale.

#### 4.3. Design patterns to facilitate workspace development

A comparative design analysis of eight exemplary workspaces highlights a different approach to anchoring, access, organisation,

configuration, and character, compared to the design of the mono-tonous business districts.

The spatial integration of the compared workspaces within the urban fabric reveals a recurring pattern of continuity with natural elements, other industrial/commercial zones and residential areas. In most cases, traffic flows are segregated, resulting in distinct routes for fast and slow traffic, as well as multimodal streets. In Cambridge Science Park, GreenPark Reading, Chiswick Park, and Philips Campus Eindhoven, the core of the district is designed as an urban-park-like environment. These green-blue pedestrian-only zones are clearly separated from the outer ring, which accommodates fast-moving infrastructure, thereby enhancing accessibility for all modes of traffic. These pedestrian-only zones are always linked to a green environment, whether it is in the park-like core of the aforementioned cases, the green corridors within the grid structure of TechnologieZentrumDortmund, or the green roofscape of Cloud City.

The districts Chiswick Park, GreenPark Reading, and Philips Campus Eindhoven feature prominent water bodies at their cores, enclosed and intersected by pedestrian pathways. Architectural uniformity in Chiswick Park is offset by a varied landscape that introduces diverse atmospheres. Several examples employ elevation changes within the landscape. The urban habitat configuration demonstrates significant ecological and spatial diversity, typically incorporating water bodies, grasslands, and forested elements. Together with varying layers of vegetation and openness, these variations create dynamic visual experiences and spatial complexity, thereby enhancing the overall spatial quality (Zhang, 2025b).

The organisational structure of these business districts typically involves clustering functions, such as industrial, office, services and facilities or amenities. Offices and services are commonly situated

**Table 3**  
Design decomposition of the five criteria for the eight selected business districts.

Design decompositions	1 TechnologieZentrumDortmund	2 Cambridge Science Park	3 Sophia-Antipolis	4 Chiswick Park	5 Philips Campus Eindhoven	6 Greenpark Reading	7 Ecofactorij	8 Vanke Cloud City	Synergy	Similarities
Anchoring									<p>Scale: district</p> <p>Pattern 1: Zone-crossing Corridors</p>	<p>Whilst business districts often function as a barrier in the urban ecological network, these workspaces provide clear axis to transition different land-use types for both humans and non-humans by linking to their surroundings</p>
Access									<p>Scale: district</p> <p>Pattern 2: Mobility-driven Green Space</p>	<p>The business districts lack sufficient open, public, green spaces. These workspaces add these spaces to the landscape by separating the traffic flows. Either through an outer ring, the use of underground and built parking or parking areas in courtyards, they allow safe and comfortable slow and fast traffic</p>
Organisation									<p>Scale: district</p> <p>Pattern 3: Active core</p>	<p>Business districts are monofunctional, they lack amenities, facilities, and functions. These workspaces all present a parklike core, level or corridor, with urban amenities and street furniture. Functions are clustered and industry is positioned along the main road, creating most eyes on the inner-district's slow-traffic infrastructure</p>
Configuration									<p>Scale: district</p> <p>Pattern 4: Multitone environment</p>	<p>The business districts are too monotonous as stony habitats. These workspaces present urban parklike cores, levels or corridors with a diversity of urban habitats, linking to and/or continuing the surrounding environments</p>
Character									<p>Scale: district</p> <p>Pattern 5: Spatial Enrichment</p>	<p>The monotonous business districts generate uninspiring atmospheres. These workspaces show that with diverse waterbodies and vegetation, in density, layering, and openness, more spatial complexity can be generated in this urban typology as well</p>

adjacent to green cores, whilst industrial functions are located near the main road. Three distinct spatial configurations for district accessibility have been identified: (1) Ring configuration: A surrounding ring of public transport stops and parking facilities enables the development of green pedestrian zones at the district's core. (2)

Subterranean configuration: Underground and built parking supports a diverse and accessible ground level or roofscape. (3) Courtyard configuration: Parking areas located within courtyards are complemented by green pedestrian zones embedded in a grid-like structure.

Table 4

Concluding spatial design patterns to design workspaces, based on the comparative design analysis of the eight selected cases.

Design patterns	Problem	Solution	Schematic diagram
<b>D1 Zone-crossing</b> <b>Corridors: Anchoring to the urban ecological network</b>	Business districts often interrupt ecological and urban continuity	Workspaces re-establish these links while structuring movement, for humans and non-humans, together with flows and development potential. This supports cross-program synergies (e.g. between housing, businesses and landscape), and stimulates businesses' visibility and employees' commuting	
<b>D2 Mobility-driven Green Space: Accessibility of open, public and green spaces</b>	Business districts lack sufficient open, public, green spaces. They are characterised by industrial buildings and extensive parking areas. There seems to be a paradox between access and spatial quality	Reorganising mobility allows a continuous, high-quality urban landscape. It enhances employee and visitors' experience and attractiveness of firms	
<b>D3 Active Core: Coherence of urban and environmental amenities</b>	Business districts are monofunctional, and they lack amenities, facilities, and functions	Develop a concentrated core where amenities, services and workspaces are co-located to produce continuous activity, visibility and social density. This enhances liveliness, knowledge exchange and productivity, generates "eyes on the street"	
<b>D4 Multitone Environment: Configuration of multiple urban habitats</b>	Business districts are too monotonous, stony habitats that generate water nuisance, heat stress and little ecological value	A diversity of habitats is embedded within the district to regulate microclimate, while connecting to regional ecological systems. This supports long-term asset value and climate-proofing of real estate and enables coexistence	
<b>D5 Spatial Enrichment: Generation of diverse atmospheres</b>	Monotonous business districts generate uninspiring atmospheres	Through variation in vegetation, water, enclosure, openness, the district generates a sequence of atmospheres that enhance user experience and place identity. This creates high-valued environments that support talent attraction, branding and different working modes	

## 5. Discussion

This study extends and connects the widely discussed concept of spatial quality in urban landscape design (Lynch, 1960; Alexander et al., 1977; Sternberg, 2000; Meyer, 2008; Khan et al., 2014; Carmona, 2021) to the specific typology of business districts. While earlier research focused on the smaller-scale design features (Atwa et al., 2019), on spatial, sustainability, and environmental deficiencies (Lejoux and Charieau, 2021; Le Tellier et al., 2019; Meinsma, 2004), or sustainable strategies (Atwa et al., 2017) of business districts, this paper advances the field of urban landscape design by systematically generating empirically grounded knowledge that connects landscape systems thinking with business district (re-)development. The study is consistent with previous studies' outcomes and shows that these objectives are realised in practice through the proposed design patterns.

The research focused on the current best practice in the design of workspaces. Nonetheless, exploring alternative design approaches and research-by-design can reveal opportunities for further innovation and the advancement of the urban concept of workspaces. Moreover, the practical effectiveness of the design patterns has not been tested. Empirical validation is necessary to evaluate their performance in real-

world settings. A suitable approach for evaluating spatial design patterns is the Living Lab methodology, which enables innovation via iterative testing in a real-world environment with active stakeholder involvement (Dell'Era and Landoni, 2014).

Although historical elements were absent in the OSM data for the studied cases, it remains unclear whether this reflects a genuine absence of these features in the urban landscape or a limitation of the data source. This highlights a key challenge in using volunteered geographic information, such as OSM, where data completeness can vary significantly by region and contributor engagement. As historical elements are indicators in this study, their absence, whether real or due to data gaps, introduces ambiguity into the interpretation of the results. Future research could benefit from triangulating OSM data. However, no common worldwide dataset for this was found in this study. In the functional composition of the analysed districts, heavy industry is not dominant. This may not be representative of all business districts. However, their urban landscape design can still set a spatial example for those locations and inform future developments. Most of the analysed workspaces are in Northwest Europe. Whilst this is representative of the Dutch cases, analysing locations with greater geographical diversity could yield greater insight into the international design of workspaces.

## 6. Conclusion

Business districts do not meet the standards of socio-ecologically inclusive workspaces of the future. Through a comparative design analysis of several international examples of workspaces, this study synthesises current best practices into tangible design patterns. These spatial patterns promote inclusive and resilient urban environments, as illustrated in Table 4.

This research contributes to the evolving discourse on sustainable, socio-ecologically inclusive, urban development and spatial design. The findings show that elements in business districts' compositions can be activated and further developed to bring architectural life to the man-made landscape. The design patterns are transferable yet adaptable across contexts. The identified spatial design patterns offer potential for transforming conventional business districts into more liveable workspaces. While this study provides valuable insights into the design of workspaces, certain limitations should be considered when interpreting the findings. The cases include the cultural specificity of Northwest Europe and functional compositions in which industry is not dominant, which may influence applicability. Further research into international workspaces with more geographical diversity could enrich the study's findings. Validation of applied spatial patterns on business districts via the Living Lab methodology and research-by-design can further inform future workspace development.

This study extends and connects the widely discussed concept of spatial quality in urban landscape design to the typology of business districts. By bridging spatial analysis and design synthesis, this study advances the methodological toolbox for evidence-based landscape design research.

## CRedit authorship contribution statement

**Rosa de Wolf:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Steffen Nijhuis:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Peter Boelhouwer:** Writing – review & editing, Supervision, Methodology. **Nico Tillie:** Writing – review & editing, Supervision, Project administration, Funding acquisition.

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## Declaration of competing interest

Given his role as Associate Editor, Prof. Steffen Nijhuis had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to another journal editor. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.las.2026.100056>.

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