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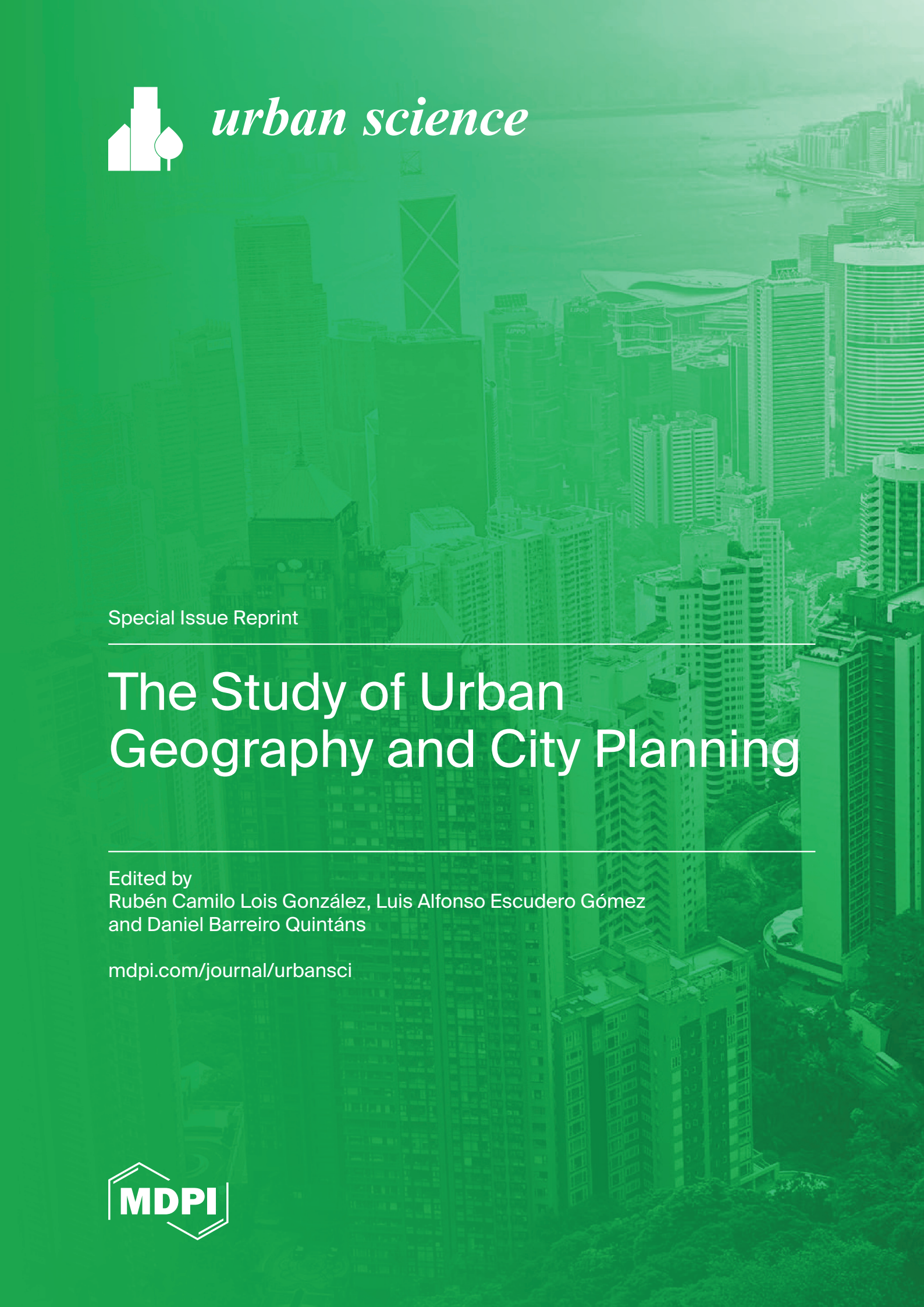

Special Issue Reprint

The Study of Urban Geography and City Planning

Edited by
Rubén Camilo Lois González, Luis Alfonso Escudero Gómez
and Daniel Barreiro Quintáns

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The Study of Urban Geography and City Planning

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Guest Editors

Rubén Camilo Lois González
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Preface

This reprint of *The Study of Urban Geography and City Planning* gathers current contributions that examine how uneven and unfinished urbanization shapes contemporary city regions. Its subject is the interplay between critical urban social geography and city planning, with a scope that spans comparative case studies, systematic reviews, and methodological advances across different national and regional contexts. The aim is to synthesize evidence on equity, resilience, governance, and socio-spatial transformation, and the purpose is to inform planning and policy with analytically rigorous and publicly engaged research.

Our motivation for assembling this reprint is twofold. First, the present conjuncture demands renewed inquiry into the political economy and lived experience of the urban, including retail restructuring, platformization, infrastructure governance, climate risk, and the recomposition of socio-spatial inequalities. Second, we see value in bridging conceptual debates with operational tools that planners, public agencies, and civic actors can apply to real-world problems. This reprint, therefore, advances dialogue between theory and practice, and between macro-level drivers and neighborhood-level outcomes.

This reprint is addressed to scholars of urban studies and geography, to planning practitioners and policy makers, and to students and community stakeholders seeking empirically grounded guidance. By bringing diverse methods into conversation, it encourages transparent standards of evidence and invites collaborative, democratic approaches to the city as an open-ended project.

Rubén Camilo Lois González, Luis Alfonso Escudero Gómez, and Daniel Barreiro Quintáns
Guest Editors

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Editorial

Incomplete Cities: Critical Urban Geography and the Reimagining of City Planning

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1. Introduction: Cities, Uneven Urbanization, and the Contemporary Urban Question

Everything reminded Kiku of the human body diagram that hung in the school science classroom. The physiological systems and organs drawn on that figure were the same as those of this city: the raw materials entering were the food going down the throat; the power plants were the city's lungs; and the offices of government and business, the digestive system that absorbs all available resources. The cables dangling everywhere were the nervous system; the streets were its veins and arteries; and the people, its cells. The port was an open mouth, and the airport runway, the tongue [1].

Cities are widely recognized as centers of social life, carriers of our economies, and custodians of culture, heritage, and tradition [2]. Far from passive containers, they function simultaneously as observatories that register global turbulence and as laboratories in which new socio-spatial arrangements are tested and contested. The twenty-first century is widely heralded as urban: an ever-larger share of humanity will reside in cities, and urban formations occupy pivotal positions in the global economy, environmental change, social inequality, and political transformation [3]. This conjuncture has been forged through the consolidation of postindustrial urbanism—marked by economic deregulation (or, more precisely, re-regulation in favor of firms), the retrenchment and market-like reorganization of public services, the contraction of the social safety net, and the expansion of punitive governance, all justified through the tropes of technical efficiency, fiscal integrity, and individual responsibility [4]. Accordingly, the present is best characterized not merely as an "urban age" but as an era in which city-regions sit at the heart of interlocking economic, ecological, and societal crises that are reshaping our world [5].

Against this backdrop, urban studies has a long pedigree in geography and the social sciences, yet contemporary conditions demand renewed inquiry for at least two reasons. First, in the twenty-first century, the majority of the world's population lives in urban spaces. Second, current urban processes are complex and geographically variegated: while many countries in sub-Saharan Africa continue to experience rapid urbanization, China has largely consolidated a predominantly urban society with the world's largest urban population; across North America, numerous cities are undergoing processes of shrinkage and degrowth; and across Europe, urban dynamics diverge both between and within regions, ranging from gentrification in central districts to continued suburban expansion and sprawl.

2. The Special Issue: Themes, Methods, and Comparative Insights

Responding to these dynamics, the Special Issue "The Study of Urban Geography and City Planning" assembles fourteen contributions that take the pulse of the contemporary urban question across diverse geographies, methods, and policy arenas. Together, these articles map the field along several intersecting axes: programmatic syntheses that chart a shift from segregation to fragmentation in the global literature; inquiries into sustainability, spatial justice, and social cohesion through urban renaturalization; and analyses of urban tourism resilience that leverage digital heritage visibility—as demonstrated by an article in this Special Issue on Bucharest [6]. They are complemented by studies on pedestrian network continuity—an empirical contribution documents that 67.55% of Panama City's network is continuous but that business encroachments and service-station frontages are major sources of fragmentation, with 46.79% of bus stop–crossing distances exceeding 100 m, calling for pedestrian-safety-centered design standards [7]; on the demographic and spatial logics linking populations and football stadiums in Romania [8]; and on regulatory imaginaries that operationalize degrowth principles in zoning [9]. Further threads examine affective bonds and place attachment in urban settings, diagnose retail desertification and the prospect of a "retail-less city" [10], complicate canonical narratives of suburbanization and spatial assimilation, as shown by the Minneapolis–St. Paul case study of Southeast Asian former refugees [11], and review ecological planning tools to reactivate vacant land, foregrounding equity, resilience, and governance as cross-cutting agendas and methodological pluralism as a defining strength. For an up-to-date systematic account of this shift, see the review article included in this Special Issue [12].

In addition, this collection amplifies comparative and policy-relevant insights through a spatial economic analysis of manufacturing agglomerations around Cape Town International Airport that illuminates airport-linked industrial corridors [13]; a study of state-led governance for community gardens in Shenzhen ("We Garden") [14]; a network-analytic identification and weighting of urban-resilience indicators [15]; and an assessment of the non-linear relationships between urban density and per capita municipal spending in the United States [16]—together extending the portfolio toward infrastructure economies, green governance, risk analytics, and urban public finance.

Taken together, the contributions foreground equity, resilience, and governance as cross-cutting agendas while advancing methodological pluralism—from systematic reviews and case-comparative designs to network and visibility analytics—thereby providing a multi-scalar lens on the contradictory trajectories of growth, shrinkage, and socio-spatial recomposition in contemporary city-regions.

Building on this comparative portfolio, it is crucial to recognize that urbanization unfolds unevenly across regions and countries; urbanization is not a homogeneous process [17]. Local political–economic configurations, institutional arrangements, and socio-ecological conditions generate distinctive models of transformation that demand situated analysis [18]. Yet, alongside such specificity, comparative evidence indicates recurring regularities: although every city bears particular historical, biophysical, and contextual traits, many follow common laws of co-evolution, including a measurable homogenization of urban form over time [19]. These tensions have intensified with the advent of neoliberal globalization, which has generalized the capitalist city as the planet's dominant socio-spatial formation [20]. Addressing them requires analytical strategies that connect macrostructural dynamics and micro-level practices, while theorizing and empirically examining the intermediate—meso—contexts (policy regimes, governance arenas, and spatial assemblages) through which they articulate [21].

3. Political Economy, Justice, and Planning for Equitable Urban Futures

Extending this line of argument, capitalism has long operated as a driver of territorial fragmentation and discontinuity: the growth of cities has been propelled to a significant extent by capitalist logics that reorganize space through selective investment, marginalization, and uneven development [22]. A generation of urban scholars—among them Neil Smith, Bob Jessop, Jamie Peck, and Neil Brenner—foregrounded the specifically urban articulation of these dynamics, variously labeled "urban neoliberalism" or "neoliberal urbanism," as a defining condition of the contemporary capitalist city [20]. In this configuration, cities become strategic production platforms for the global economy, while functions of social reproduction are progressively externalized or eroded; urban territories are converted into test beds for entrepreneurial governance and circuits of rent extraction, intensifying the commodification of the city and recoding gentrification as a scalar instrument of global urban strategy [23]. Empirically, a contribution in this Special Issue demonstrates how retail desertification differentially unfolds across urban economy circuits in Barcelona—comparing a global strip (Passeig de Gràcia) with a local commercial strip (Sants–Creu Coberta)—and identifies it as a major driver of economic and landscape change [10]. The cumulative result is a pattern of urbanization marked by socio-ecological unsustainability and destructive tendencies—outcomes that demand a re-centering of critical urban theory and a renewed politics oriented to "cities for people, not for profit" [24]. Concretely, this Special Issue advances that agenda through a review article that examines how degrowth principles can be institutionalized via zoning—using Texas as a case to outline reforms that decouple planning from growth imperatives and reorient ordinances toward equity and ecological protection [9].

Viewed at a planetary scale, territorial and social inequalities are repeatedly denounced by normative agendas centered on the right to the city, urban justice, and sustainability. Yet explaining their production requires an analytical lens that attends not only to circuits of capital, global production networks, and state strategies, but also to social mobilizations and struggles, the concrete textures of everyday life, and embedded social relations—including gender and wage relations and the relation to nature [25]. From this vantage point, struggles of inhabitation—through which residents craft everyday responses to climate change—unfold through and against neoliberal deprivations, illuminating how claims to justice are articulated in lived space and time [3].

Turning to the normative terrain, critical urban theory entails both the critique of ideology and the critique of power, inequality, injustice, and exploitation—within and among cities [26]. From this vantage point, a horizon of more socially just, solidaristic, and democratic cities—set against the extension of privatopia—comes into view, with planning practice oriented to the co-presence of residential and non-residential uses rather than the rigid segregation that accompanied the proliferation of zoning [27]. Likewise, there is no justification for urban policies that privilege the interests of functional elites within neoliberalizing capitalism [28]. As recent critiques insist, the present urban landscape is not the outgrowth of inevitable progress but the cumulative effect of political decisions that prioritized private profit over social needs [29].

Over the subsequent decades, neoliberalization gradually but decisively reweighted urban governance: individuals gained territory over the collective, and markets over states. Privatization, (re)commodification, the deliberate ceding of policy arenas to market processes, deregulation, and decentralization came to dominate national and urban politics, under ideologies that prioritized individual choice and normalized virtually unlimited wealth accumulation; the result was a contraction of social-democratic welfare objectives and the consolidation of more liberal regimes [30]. In this context, the spatial structure of the city does not merely mirror social cleavages; it actively organizes and contributes to income inequality [31].

The proliferation of what Yiftachel terms "gray space"—developments, enclaves, populations, and transactions suspended between the "lightness" of legality/approval/safety and the "darkness" of eviction/destruction/death—creates pseudo-permanent margins that exist partially outside the gaze of state authorities and city plans [32]. As these dynamics sediment, cities exhibit pronounced intra-urban inequalities just as much as we observe inequalities between cities [31].

Given that most of the world's population now resides in cities, contextualizing spatial (in)justice requires anchoring it in the specific conditions of urban life and in the collective struggles to secure more equitable access to the social resources and advantages that the city can provide [33]. Following Fainstein, an equitable distribution—primarily of housing—constitutes the first criterion for assessing whether a city is just, complemented by two secondary criteria: diversity, understood as openness to difference and the accommodation of culturally and economically varied neighborhoods; and democracy, measured by the degree to which community demands are incorporated into government policy [34]. This normative benchmark unsettles the long-standing assumption that growth—defined as the expansion of towns and cities in population, land area, and economic activity—is synonymous with prosperity, a conflation historically entangled with the logics of sprawl [35]. In fiscal terms, evidence from this Special Issue indicates that higher population-weighted density is associated with lower per capita municipal spending across several cost categories in U.S. cities—reinforcing the equity–efficiency case for compact urbanism [16].

From this perspective, the salient question is not whether cities grow, but how—and for whom—they grow: whether investments and planning decisions enlarge the stock of affordable housing, sustain difference, and translate situated claims into distributive and procedural justice. Complementing this lens, a review article in this Special Issue maps the multi-scalar links between place attachment, wellbeing, urban greenery, social participation, migration, gender/age, and walkability, deriving implications for equitable and healthy cities [36].

Operationalizing this normative horizon requires treating cities as complex, open-ended systems whose very incompleteness is a condition of possibility for collective making and remaking [37]. In this light, we consider urban planning a central instrument to contest predatory and socially unjust neoliberal urbanization. Crucially, this orientation is substantiated by a contribution in this Special Issue that examines an urban renaturalization project in Pontevedra (Spain), integrating socio-demographic and spatial-justice factors to relate residents' perceptions and satisfaction to social cohesion and equity—thereby offering empirical guidance for participatory, justice-oriented design [38].

Geography must be applied: we must recognize the limits of plans, yet we must plan—the urban plan matters. At the same time, planning is not neutral; when tethered to place branding and "growth machine" coalitions, spatial planning processes risk reflecting a narrow set of interests rather than community needs, thereby reproducing inequality [39]. As contributions within this Special Issue, a systematic review synthesizes ecological planning tools for revitalizing urban vacant land and recommends stepwise, hybrid approaches that integrate substance- and process-oriented instruments to support equitable, resilient greening [40]; a study analyzes Shenzhen's "We Garden" program as a top–down governance approach that mobilizes nonprofit intermediaries to convert idle public land into green space and institutionalizes public participation for environmentally just urban management [14]; and an ANP-based assessment of urban resilience in Sanandaj (Iran) shows how infrastructural systems, public institutional capacity, and education emerge as influential levers while the most vulnerable zones are identified for

targeted intervention—thus illustrating how indicator frameworks can anchor equitable, resilience-oriented planning [15].

Translating these commitments into practice requires treating cities as complex, open-ended systems whose very incompleteness constitutes a condition of possibility for collective making and remaking [37]. In this light, we consider urban planning a central instrument for contesting predatory and socially unjust neoliberal urbanization.

Advancing this agenda, what is required is a substantive realization of urban sustainability—understood, in a global perspective, as the planning and management of settlements within their social, economic, and environmental contexts so as to secure the wellbeing of current populations without compromising the ability of future generations to experience the same [41]. Moreover, recent interventions insist that the debate must shift from generic sustainability toward *climate urbanism*, explicitly centering mitigation, adaptation, and justice in the face of escalating climate risks—thereby aligning decarbonization with distributive and procedural equity and retooling governance to prioritize vulnerability reduction and collective capacities to act [42].

4. Conclusions and Future Research Directions

Social processes are fluid, whereas territory is too often treated as inert; yet urbanization is, by definition, unfinished. Cities are better understood as ongoing formations—contingent, experimental, and contradictory—rather than completed artifacts, a view consistent with the claim that "the urban" is an incomplete and contingent process [43]. Taking incompletion seriously implies recognizing that the geographies we inhabit remain open to reconfiguration and that urban scholarship is correspondingly provisional and iterative.

In this spirit, understanding the cities we inhabit has never been more urgent. We advocate a sustained dialog between Critical Urban Social Geography and City Science that is empirically rigorous, theoretically reflexive, and publicly engaged. Such a program entails "hopeful geographies" that proactively interrogate and address pressing urban problems—housing conflict and eviction, surveillance and segregation, mental health and homelessness, gentrification and touristification—treating these not as isolated pathologies but as interdependent socio-spatial processes whose trajectories can be redirected through collective action and democratic planning.

Situated within the inescapable context of the Anthropocene, the city must be reframed as part of the solution rather than persist as the problem. Doing so requires strategic optimism and a radical openness to new ideas, methodologies, and coalitions, anchored in a critical spatial perspective that foregrounds justice as both principle and practice [33]. If urbanization is necessarily incomplete, then so too is the horizon of urban possibility; the task ahead is to convert that incompleteness into a capacity for equitable transformation.

Realizing this program demands more open forms of planning—arenas in which citizens, planners, and even visitors co-experiment to co-produce a more liveable city [44]. It must be grounded in broad, transparent democratic consensus that departs from the elitist and closed decision-making too often found in urban development [45]. Following Lefebvre, the urban should be organized for its users—not for speculators, capitalist developers, or the technocratic plans of experts [46]. Recentering human health and wellbeing as the telos of planning [47], we advocate alternative, radically democratic, and sustainable forms of urbanism [48]. This commitment is all the more urgent amid the rise of "anti-woke" agendas in parts of the West—which contest the very vocabulary of justice (where "woke" refers to awareness of, and concern with, racial and related social justice) and risk undermining hard-won advances in inclusion and equity [49].

Looking ahead, we propose a research agenda that bridges macrostructural transformation and everyday urban life through comparative, longitudinal, and experimentally minded designs operating across macro–meso–micro scales. Future work should (i) consolidate a justice-centered climate urbanism by examining mitigation, adaptation, and loss-and-damage through distributional, procedural, and recognitional metrics; (ii) develop post-growth planning tools and evaluation frameworks that move beyond GDP toward capabilities, wellbeing, and ecological thresholds; (iii) interrogate the governance of critical infrastructures—logistics corridors and airports as well as green and social infrastructures—and their uneven effects across neighborhoods and regions; (iv) track the socio-spatial consequences of retail restructuring, platformization, and housing financialization, including displacement, surveillance, and the production of "gray spaces"; and (v) advance co-produced, open-science methods—participatory modeling, civic data observatories, causal and quasi-experimental evaluations, and auditable geospatial/AI analytics—with replication across Global North/South contexts. By aligning Critical Urban Social Geography and City Science around shared standards of rigor, transparency, and public engagement, the community can convert the acknowledged incompleteness of the urban into a generative capacity for equitable transformation, guiding planning institutions toward interventions that are empirically validated, climatically responsible, and democratically governed.

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References

1. Murakami, R. *Los Chicos de las Taquillas*; Álvarez, P., Translator; Escalera: Madrid, Spain, 2010. Original work published 1980.
2. The Aalborg Charter. Available online: https://sustainablecities.eu/the-aalborg-charter/ (accessed on 14 October 2025).
3. Lancione, M.; McFarlane, C. Navigating the Global Urban. In *Global Urbanism: Knowledge, Power and the City*; Lancione, M., McFarlane, C., Eds.; Routledge: New York, NY, USA, 2021; pp. 3–14.
4. Wacquant, L. *Bourdieu in the City*; Polity Press: Cambridge, UK; Medford, MA, USA, 2023.
5. Van Heur, B. Urban vacancy in Europe: A synthetic review and research agenda. *SocArXiv* **2024**. [CrossRef]
6. Lequeux-Dincă, A.; Gheorghilaş, A.; Tudor, E. Empowering Urban Tourism Resilience Through Online Heritage Visibility: Bucharest Case Study. *Urban Sci.* **2025**, *9*, 63. [CrossRef]
7. Quijada-Alarcón, J.; Rodríguez-Rodríguez, R.; Maylin, A.; Adames, M.; Zeballos, J.; Icaza, A.; Harris, A. Assessing Pedestrian Network Continuity: Insights from Panama City's Context. *Urban Sci.* **2025**, *9*, 58. [CrossRef]
8. Herman, G.; Caciora, T.; Herman, M.; Șandra, M.; Bulz, G. Exploration of the Relationship Between the Population and Football Stadiums in Romania. *Urban Sci.* **2025**, *9*, 19. [CrossRef]
9. Yücel, A.; Durán-Díaz, P. Shrinking for Survival: Integrating Degrowth Principles into Texas Zoning Regulations. *Urban Sci.* **2025**, *9*, 6. [CrossRef]
10. Frago, L.; Morcuende, A.; Lloberas, D. Towards a Retailess City? A Comparative Analysis of the Retail Desertification between a Global and a Local Commercial Strips in Barcelona. *Urban Sci.* **2024**, *8*, 126. [CrossRef]
11. Xiong, Y.; Pfeifer, M. Complicating 'Suburbanization' and Spatial Assimilation: The Complex Residential Patterns of Southeast Asian Americans in the Minneapolis-St. Paul Metropolitan Area from 1990 to 2010. *Urban Sci.* **2023**, *7*, 110. [CrossRef]
12. Picó-Gutiérrez, V.; González-Ramírez, F.; Escudero-Gómez, L. From Segregation to Fragmentation: Mapping the Recent Global Literature. *Urban Sci.* **2025**, *9*, 98. [CrossRef]

13. Mokhele, M.; Garatsa, F. Spatial Economic Analysis of Manufacturing Firms Located in the Vicinity of Cape Town International Airport. *Urban Sci.* **2023**, *7*, 35. [CrossRef]
14. Zhang, X.; Pan, D.; Wong, K.; Zhang, Y. A New Top-Down Governance Approach to Community Gardens: A Case Study of the "We Garden" Community Experiment in Shenzhen, China. *Urban Sci.* **2022**, *6*, 41. [CrossRef]
15. Abedini, A.; Aram, F.; Khalili, A.; Mirzaei, E. Recognition and Evaluating the Indicators of Urban Resilient by Using the Network Analysis Process. *Urban Sci.* **2022**, *6*, 31. [CrossRef]
16. Mattson, J. Relationships Between Density and per Capita Municipal Spending in the United States. *Urban Sci.* **2021**, *5*, 69. [CrossRef]
17. Seto, K.C.; Sánchez Rodríguez, R.; Fragkias, M. The new geography of contemporary urbanization and the environment. *Annu. Rev. Environ. Resour.* **2010**, *35*, 167–194. [CrossRef]
18. Low, M.; Barnett, C. After globalisation. *Environ. Plan. D Soc. Space* **2000**, *18*, 53–61. [CrossRef]
19. Lemoine-Rodríguez, R.; Inostroza, L.; Zepp, H. The global homogenization of urban form: An assessment of 194 cities across time. *Landsc. Urban Plan.* **2020**, *204*, 103949. [CrossRef]
20. Rossi, U. *Cities in Global Capitalism*; Polity Press: Cambridge, UK; Medford, MA, USA, 2017.
21. Pinson, G.; Morel, C. (Eds.) *Debating the Neoliberal City*; Routledge: Abingdon, UK, 2016.
22. Apter, D.E. Marginalization, violence and why we need new modernization theories. In *World Social Science Report*; Caillods, F., Ed.; UNESCO Publishing: Paris, France, 2019; pp. 32–37.
23. Smith, N. New globalism, new urbanism: Gentrification as global urban strategy. In *Spaces of Neoliberalism*; Brenner, N., Theodore, N., Eds.; Blackwell: Oxford, UK, 2002; pp. 80–103.
24. Brenner, N.; Marcuse, P.; Mayer, M. Cities for people, not for profit: An introduction. In *Cities for People, Not for Profit: Critical Urban Theory and the Right to the City*; Brenner, N., Marcuse, P., Mayer, M., Eds.; Routledge: New York, NY, USA, 2012; pp. 1–10.
25. Schmid, C. Journeys through planetary urbanization: Decentering perspectives on the urban. *Environ. Plan. D Soc. Space* **2018**, *36*, 591–610. [CrossRef]
26. Brenner, N. What is critical urban theory? In *Cities for People, Not for Profit: Critical Urban Theory and the Right to the City*; Brenner, N., Marcuse, P., Mayer, M., Eds.; Routledge: New York, NY, USA, 2012; pp. 11–23.
27. Silver, C. New urbanism and planning history: Back to the future. In *Culture, Urbanism and Planning*; Monclús, J., Guàrdia, M., Eds.; Routledge: Abingdon, UK; New York, NY, USA, 2006.
28. Krätke, S. The new urban growth ideology of 'creative cities'. In *Cities for People, Not for Profit: Critical Urban Theory and the Right to the City*; Brenner, N., Marcuse, P., Mayer, M., Eds.; Routledge: New York, NY, USA, 2012; pp. 138–149.
29. Davis, C. The Cancelled Future: Neoliberal Capitalism and the Urban Crisis of Imagination. *Antipode* **2025**, *57*, 1872–1891. [CrossRef]
30. Musterd, S. *Advanced Introduction to Urban Segregation*; Edward Elgar: Cheltenham, UK; Northampton, MA, USA, 2023.
31. Harding, A.; Blokland, T. *Urban Theories*; SAGE Publications: London, UK; Thousand Oaks, CA, USA, 2014.
32. Yiftachel, O. Theoretical notes on 'gray cities': The coming of urban apartheid? *Plan. Theory* **2009**, *8*, 88–101. [CrossRef]
33. Soja, E.W. *En Busca de la Justicia Espacial*; Azcárraga, C., Translator; Tirant Humanidades: Valencia, Spain, 2014. Original work published 2010.
34. Fainstein, S.S. *The Just City*; Cornell University Press: Ithaca, NY, USA; London, UK, 2010.
35. Hayden, D. *A Field Guide to Sprawl*; W. W. Norton & Company: New York, NY, USA, 2004.
36. Kamani Fard, A.; Paydar, M. Place Attachment and Related Aspects in the Urban Setting. *Urban Sci.* **2024**, *8*, 135. [CrossRef]
37. Sassen, S. La ciudad según. In *El Atlas de las Metrópolis*; Denis, J.-P., Pourquery, D., Eds.; Fundación Mondiplo: Valencia, Spain, 2014; p. 15.
38. Andrade Suárez, M.; López-Mejuto, U.; García Docampo, M.; Varela-García, F. Sustainability, Spatial Justice and Social Cohesion in City Planning: What Does a Case Study on Urban Renaturalisation Teach Us? *Urban Sci.* **2025**, *9*, 94. [CrossRef]
39. Cleave, E.; Arku, G. Place branding and growth machines: Implications for spatial planning and urban development. *J. Urban Aff.* **2022**, *44*, 949–966. [CrossRef]
40. Mohamad Selamat, I.A.; Maruthaveeran, S.; Mohd Yusof, M.J.; Shahidan, M.F. Planning Tools to Revitalise Urban Vacant Land from Ecological Perspectives: A Systematic Review. *Urban Sci.* **2023**, *7*, 58. [CrossRef]
41. Kaczmarek, S.; Kaczmarek, J. Urban sustainable tourism—Reality or utopia? *Eur. Spat. Res. Policy* **2022**, *29*, 17–39. [CrossRef]
42. Long, J.; Rice, J. From sustainable urbanism to climate urbanism. *Urban Stud.* **2018**, *56*, 992–1008. [CrossRef]
43. Roy, A. What is urban about critical urban theory? *Urban Geogr.* **2016**, *37*, 810–823. [CrossRef]
44. Sennett, R. *Building and Dwelling: Ethics for the City*; Farrar, Straus and Giroux: New York, NY, USA, 2018.
45. Fariña Tojo, J.; Naredo, J.M. (Director) *Libro Blanco de la Sostenibilidad en el Planeamiento Urbanístico Español*; Ministerio de Vivienda, Gobierno de España: Madrid, Spain, 2010.

46. Lefebvre, H. *El Derecho a la Ciudad*; Martínez, I.; González-Pueyo, J., Translators; Capitán Swing: Madrid, Spain, 2017. Original work published 1968.
47. Barton, H.; Grant, M.; Guise, R. *Shaping Neighbourhoods for Local Health and Global Sustainability*; Routledge: London, UK, 2010.
48. Brenner, N.; Marcuse, P.; Mayer, M. (Eds.) *Cities for People, Not for Profit: Critical Urban Theory and the Right to the City*; Routledge: New York, NY, USA, 2012.
49. Higgins-Desbiolles, F.; Bianchi, R. Towards understanding and managing the politics of tourism in a crisis-challenged world. *Ann. Tour. Res. Empir. Insights* **2024**, *5*, 100160. [CrossRef]

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Review

Place Attachment and Related Aspects in the Urban Setting

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Abstract: This study reviewed previous studies on place attachment and related factors in the urban setting. Assessments were conducted on over one hundred peer-reviewed journal papers that met the selection criteria. The results were divided into six categories. Place attachment can improve each of the three dimensions of wellbeing. It can also mitigate the negative impacts of environmental stressors on wellbeing. Furthermore, traditional gardens and local landscape characteristics contribute to a stronger place attachment, depending on the degree to which they present local history and culture. Green landscapes can also help immigrants feel more connected to their community and place of origin. Social interaction has also been linked to the development of place attachment, which is stronger in low-income/deprived neighborhoods. Furthermore, higher place attachment promotes civic engagement and social trust. Place attachment also helps older people cope with aging difficulties in their living environments. Finally, there is a mutually beneficial association between place attachment and perceived neighborhood walkability, as well as a relationship between the scale of the place and the level of attachment. The various research gaps recognized by this study could be addressed in future studies to better understand the role of place attachment in creating sustainable urban environments.

Keywords: place attachment; wellbeing; green landscapes; social interaction; walkability

1. Introduction

Place attachment, or people's positive connection to a particular place [1], is an important aspect of the human–environment relationship. It generally refers to the emotional connection or relationship that exists between people and particular locations, and the majority of studies see it as a strong and positive aspect [2]. However, it has a multifaceted, multidisciplinary, multidimensional, and multiparadigmatic nature [3]. Even among trained scholars in environmental and social psychology, as well as psychologists and humanistic geographers, terms like "unclear" [4], "definitional diversity" [5], "slow", "stuck", and "little empirical progress" [3] are used to describe research on place attachment. The most significant challenge for researchers in using the multidimensional concept of place attachment is integrating different viewpoints and approaches [5].

According to Cole et al. [6] and Scannell and Gifford [5] (person–process–place (PPP) model), place attachment includes three main dimensions: (1) a personal/cultural dimension focusing on who is attached and how places become significant through individual experiences and collectively determined meanings; (2) a place dimension that emphasizes what it is to which the person is attached, such as different physical (natural, built) and social (opportunities for interaction) features of the place; and (3) a psychological process dimension that emphasizes how the attachment comprises specific behaviors (like staying close to a place), affective bonds (like pride, love), and cognitions (like knowledge, memories). While the tripartite framework identifies important factors in the attachment process,

the importance of these factors varies depending on the scale and type of the environment. For instance, studies of recreational areas in city neighborhoods include significantly varied characteristics (e.g., [7]). As a result, factors that are important in one kind of context might not be in another. Stated differently, Turton [8] argues that predictors cannot be seen as generally significant to the attachment process. Consequently, it is recommended that place attachment be contextualized rather than considered as a universal phenomenon [8].

According to studies on place attachment's contributing factors, place attachment has been shown to improve subjective, psychological, and social wellbeing [9,10]. Furthermore, green and natural spaces play an important role in strengthening place attachment. Urban parks also have considerable effects on people's wellbeing and quality of life. Exposure to nature increases an individual's cognitive capacity, but only when nature is consistent with a salient identity [11]. According to Liu [12], landscapes that are distinctive and have significant local features help people feel more connected to their place. Local landscapes can help promote an individual's self-identity and dependence [13]. Furthermore, nature usually has better restorative outcomes than built environments [14,15]. The created environment that serves as a setting for human activities is referred to as the "built environment". Studies have shown that stress can be alleviated by (re)connecting people with nature and green spaces (e.g., Stigsdotter, [16]). One proposed mechanism for restorative environments, as conceptualized under Stress Reduction Theory, asserts that contact with restorative environments can help people block out pessimistic thoughts and ruminations, arouse positive appraisals, improve moods, and reduce stress [17,18]. According to Attention Restoration Theory [19,20], environments with four specific psychological characteristics are more likely to attract people's involuntary attention, potentially reducing stress and restoring mental capacity. This theory has primarily focused on the bottom-up, perceptual properties of restorative environments. This mental restoration has been connected to urban green areas and is one of the indicators of both mental health and wellbeing [17].

The social arena is the next component of place that contributes to place attachment [21]. Studies have shown that social settings may affect one's sense of wellbeing and perceived restoration in addition to relationships with nature [22]. Furthermore, given that immigrants and refugees experience a kind of discontinuity between their place of origin and their place of destination, the physical and social features of their new location may contribute to their increased place attachment and improved quality of life there [23]. This may also enhance their wellbeing as well [24]. As a result, the relationships between place attachment and these groups of people require particular attention. Furthermore, a person's place attachment varies according to their individual and/or group characteristics. For example, previous studies have examined the relationship between place attachment and associated characteristics in a variety of age groups, including older adults, adolescents, and children [25].

Finally, perceived neighborhood walkability is one of the environmental factors affecting the formation of a place attachment [15]. Walkability is the extent to which the built environment is friendly to people who walk, which benefits the health of residents and increases the livability of cities [26]. Stronger place attachment may be associated with a positive view of the built environment in one's neighborhood, which in turn makes one more likely to walk and engage in other physical activities [27]. Neighborhood walkability may therefore be another factor associated with place attachment.

Based on the above-described relationships, this study reviews the relationships between place attachment and related factors in the urban setting. The methodology is explained in Section 2, and the findings are presented in Section 3 in six subsections. The findings are summarized and discussed in the next section, and the conclusion section highlights the most important findings in addition to presenting the key research gaps for future studies.

2. Literature Review Methods

We systematically searched English language journals in databases including the Web of Science Core Collection, PubMed, Avery, the Environment Index, Medline, and Academic Search Complete. In addition, only articles from peer-reviewed journals were selected. This study only reviewed articles between 1995 and 2023. According to the introduction, a combination of the keywords including "place attachment", "wellbeing", "green spaces", "social environment", "immigrants", "refugees", "age groups", and "walkability" was used. Then, we excluded papers that did not directly address our main topic (place attachment), such as those that dealt with relevant concepts such as place identity, sense of place, and place dependency. The following exclusion criteria were also applied: the articles had to be written in English, non-peer reviewed, published before 1995, or only discussing theory instead of practical application.

To analyze the selected articles (108 remaining articles), summaries of each article were recorded, including the author, year, study objectives, methodology, sample, location, independent and dependent variables, and a summary of the statistical results regarding the significant and non-significant variables. Particular attention was paid to the validity and reliability of the data collection tools. Respecting the studies that used quantitative methods, regardless of the degree of correlation, attributes with positive and negative values across the selected studies were combined and marked with an asterisk (*). Three main types of associations, including "No association", "Positive significant association", and "Negative significant association", were categorized through different codes. For instance, (+) was used for positive association, and (−) was used for negative association. The moderation effects were excluded from the association calculation. We also disregarded other kinds of data and conclusions that had nothing to do with the relationships between place attachment and its contributing factors. However, the control variables from each article were also extracted because of the potential importance of confounders or additional factors that could have affected the study's results.

The six subsections that organized the Results section were "Place attachment and wellbeing", "Place attachment and urban greenery", "Place attachment and cultural/social aspects", which includes a subsection named "Place attachment and participation", "Place attachment and immigration/refugees", "Place attachments and gender/age", and finally "Place attachment and walkability". These categories were based on the primary factors related to place attachment that were addressed in the Introduction and used as keywords to find the articles.

3. Results

3.1. Place Attachment and Wellbeing

The main idea of wellbeing refers to global life satisfaction [28]. Wellbeing is considered an umbrella concept in positive psychology theories that include two main categories of hedonic and eudaimonic aspects. Hedonic wellbeing mostly refers to feelings like living a good or happy life, and eudaimonic wellbeing is about life purposes and being fulfilled [29]. Place attachment can enhance all three of the dimensions of people's wellbeing, which are generally defined within a place: subjective wellbeing (positive emotions and satisfaction) [28]; psychological wellbeing (growth, environmental mastery, positive relationships with others, and self-acceptance) [30]; and social wellbeing (social coherence, acceptance, actualization, integration, and actualization) [31]. Consequently, people can form significant connections with their surroundings through meaningful sociopsychological activities, and this type of place attachment enhances people's wellbeing [32]. The significant role of place attachment in improving quality of life [33] contributes to better physical and mental health, better social relationships, and more pro-environmental behavior [34].

Place attachment is positively correlated with health not only at the residential level but also at the community level. Having positive feelings (e.g., satisfaction) and expressing a sense of connectedness (e.g., involvement) with physical surroundings are regarded as key indicators of place attachment; however, the degrees of both may vary between

individuals in different contexts [35]. Subjective wellbeing is positively correlated with social justice and community attachment, as demonstrated by Wang et al.'s [35] research. The study by Rajala and Sorice [36] reveals several relationships between US owners' sense of place—acquired through private land ownership—and their wellbeing, since it provides them access to resources, security, and even improved physical health from being outside. This study examined the relationship between community environmental perception and physical wellbeing in addition to hedonic and eudaimonic factors. Berg [37] conducted follow-up interviews with the same respondents about seventeen years after they had moved to rural areas in search of a better life. The purpose of the interviews was to examine the respondents' unique sources of attachment and how it affected their overall health. This study defines place attachment as a sub-dimension of wellbeing that is formed by "Social relations, Materialities, the Past and memories, and Emotions and affects". In addition, different aspects of place attachment and wellbeing do overlap with each other, while there is a direct two-way relationship between place attachment and wellbeing, in which improvement in one significantly enhances the other.

According to a study by Wiles et al. [38] in New Zealand, ones who did not express an affect toward their homes have had worse health outcomes, and this relationship is stronger among Indigenous communities. Similarly, Maricchiolo et al. [39] studied the relationship between different components of place attachment and wellbeing in a local Italian community by applying the "Satisfaction with Life Scale" of Diener et al. [40], "Place Attachment to the Hometown Scale" of Scopelliti and Tiberio [41], and "Local Social Identity Scale" of Paolini et al. [42]. The results of this study showed that both social identity and place identity—as sub-dimensions of place attachment—positively correlate with life satisfaction and wellbeing.

In older adults, place attachment is more influenced by the subjective dimensions of wellbeing than by the objective dimensions [38]. According to Lager et al. [43], place attachment fosters and/or develops a "sense of autonomy, control, confidence, and identity" in older people, which improves their overall wellbeing. A study by Sawada and Toyosato [44] in Japan, which used Pearson's correlation test to measure place attachment and economic status, demonstrates the important role that place attachment plays in lessening the detrimental effects of low economic status on elderly people's wellbeing. Accordingly, to mitigate the effects of low wellbeing, the contribution of place attachment in providing emotional support, self-esteem, and mutual respect is to be noted particularly. Then, social interactions—through different activities in the neighborhood— significantly increase place attachment and positively improve the wellbeing of low-income groups. Moreover, as discovered by Yuan and Wu [45], the relationship between environmental stressors and wellbeing is mediated by place attachment and leisure activities. It demonstrates that a reduction in outdoor activity, which results from a decrease in place attachment, negatively affects the wellbeing of people, particularly older individuals. They used the scale of Lachowycz and Jones [46] to assess outdoor leisure behavior and social interaction in green zones, the scale of Ryan [47] to measure place attachment, the PERMA model scale of Seligman [48] to measure wellbeing, and the scale of Honold et al. [49] to measure environmental stressors [45]. Finally, the place attachment that older adults have to their neighborhoods can provide them with a feeling of security, which enhances their wellbeing [50].

3.2. Place Attachment and Urban Greenery

Ratcliffe and Korpela [51] investigated place attachment in preferred places by examining the features of these locations—selected by the participants—all of which were natural areas in Finland and presented their real-life experiences. The results of this internet-based survey approach showed that a place's capacity for restoration can be enhanced by a person's attachment to it. Cheung and Hui (2018) [52] showed that cultural bonding with greenery heritage makes people more sensitive and responsible about nature—as a collective memory—and promotes environmental awareness in the local community in Hong Kong. This study was based on a quantitative survey measuring the levels of

residents' place attachment, perception of forest heritage, and environmental attitudes. Bazrafshan et al. (2021) [53] investigated the most effective types of urban green spaces that may contribute to enhancing attachment through place dependency. They proposed that because traditional gardens and historic parks have a shared history and memory, they are more important than contemporary parks [53]. Pedestrian accessibility, pedestrian connectivity with surroundings, and satisfaction with children's playgrounds are three key variables that Yang et al. [54] identified through their quantitative survey in Australia using Pearson correlation and later Hierarchical Multiple Regression analysis as contributing factors to place attachment in urban parks. Liu et al. (2021) [13] found that the presence of local landscape features enhances place attachment and the restorative perception of urban green spaces. Put another way, compared to other landscape types, people tend to have a higher sense of place attachment to their native urban parks. Accordingly, the results of the Pearson correlation analysis showed a positive and significant contribution of a "higher level of local landscape characteristics, place dependent, and place identity" to "greater perceived restorativeness" of green spaces [13]. For instance, using local landscape elements in designing urban green spaces increases their restorative capacity and results in stronger place attachment. Ratcliffe and Korpela [51] used a quantitative method to investigate the mediating effect of place attachment in Finland while examining the restorative potential of places and people's memories. They found that place memory—through place identity—contributes to restorative perceptions of a place.

Menatti et al. [55] investigated the role of place attachment and place identification in landscape preference in a different study. They found that people value and prefer local natural landscapes over non-local natural landscapes when it comes to their potential for restorative capacities. Nevertheless, they concluded that place attachment had a more significant effect on restorativeness, and that these studies should also take cultural values into account. According to the studies of Liu et al. (2021) [13], the incorporation of local natural elements into urban landscape design contributes to significantly increasing the sense of place attachment, since familiarity with the environment is the key to maximizing its restorative effects. Applying a quantitative method, the Place Attachment Scale and Perceived Restorativeness Scale were used in this study, carried out in China. Similarly, Kil et al. [56] studied the health outcomes of forest therapy—slow, mindful walking in nature—among people with different levels of place attachment in South Korea. Considering the characteristics of the participants, and measuring place attachment through item factors related to place dependence and place identity, the researchers investigated the preferences of the visitors regarding their recreational experiences as well as the improvements in their wellbeing in this quantitative survey. According to their study, those with a higher sense of place attachment were mostly non-locals with more frequency in visiting and more participation in natural-water and land-based restorative activities.

Supporting the urban landscape, pre-urban greenery zones around the cities are considered an important part of the ecosystem, and positive perception of the local people contributes to the sense of attachment that leads to the preservation of such a heritage [52]. Studying three types of natural, artificial, and artificial-natural features in the landscape and their relationship with emotional attachment in an urban park in China, Zhang [57] measured physiological signals—such as heart rate, eye movements, and skin conductance—by analyzing multimodal data and concluded that natural feature—particularly wild plants compared to designed ones—resulted in higher levels of attachment. However, regarding the artificial features, their contribution to place identification is associated with the degree to which they present local history and culture. Highlighting the contribution of place attachment to place meaning in an Australian natural park, Wynveen et al. [58] explored the potential relationships with a qualitative method and later measured them quantitatively. They concluded that people with different levels of attachment to the place expressed the identity and meaning of the place within distinct forms. Put another way, the importance of a particular set of meanings in a certain place to the users depends on their level of attachment to it. Colley and Craig [59] conducted a similar study and examined place

attachment between original wildscapes and designed or managed landscapes. They found that both types of greenspaces contribute to place attachment in Scotland, and their findings indicate no relationship between people's actual perceptions of place attachment and their childhood memories of particular types of greenspaces. Higher degrees of place attachment are also correlated with "frequency of visits" and "walking distance" from home, according to Colley and Craig [59].

Furthermore, it is emphasized that quantity and quality of greenery have a direct impact on wellbeing. The benefits of being linked to nature have been demonstrated for both physical and psychological health, and it is recognized as a major contributor to the well-being of individuals from diverse sociocultural backgrounds. Thus, wellbeing appeared as another aspect in the studies that examined the relationship between greenspaces and place attachment. For example, place attachment is considered to function as a mediator in the significant relationship between wellbeing and nature connectedness [60]. According to Han et al. [50], place attachment, social capital, and greenness are all strongly correlated with wellbeing. However, this relationship is more significant among older adults due to their higher levels of place attachment. In their empirical study, Basu et al. [60] measured place attachment as a multidimensional concept by applying the Reymond et al. model [61]. They studied the mediating role of place attachment between nature connectedness and wellbeing in Japan. They used two scales: "The Connectedness to Nature Scale (Mayer and Frantz 2004)" [62] for measuring the affective, experiential connection of an individual to nature, and the scale of "Love and Care for Nature [63]" to analyze the intrinsic value of nature and individual sense of responsibility to protect it within a qualitative design [60]. They found that place attachment accounts for 30% of the total effect of nature connectedness on the wellbeing of the studied population [60]. Bazrafshan et al. [64] verified the important role of place attachment in promoting wellbeing and mitigating stress by examining quantifiable physiological emotions. Accordingly, being familiar with the cultural background of the park and having more attachment to it contributes to feeling more relaxed even in the case of non-native visitors.

3.3. Place Attachment and Cultural/Social Aspects

Chishima et al. [65] used surveys and interviews with 1068 respondents to examine how place attachment and participation differed in traditional and modern communities in Japan. They found a significant relationship between individual values and their preferred environmental characteristics. People with traditional values showed higher levels of place attachment to rural areas, whereas those who valued modernization showed higher levels of place attachment in urban areas. According to a study by Azevedo et al. [66] in Portugal, "Self-efficacy, Perceived happiness, and Active citizenship behavior" -as the attributes of quality of life- are significantly correlated with place attachment when taking social factors into account. They suggest that two relevant indicators of place attachment are "social identification" and "satisfaction" with one's current residence. However, this study detects the negative impact of economic dependency on place attachment when a place does not provide stable economic development for the residents.

According to Kamalipour et al. [67], who investigated place attachment and its associated factors in a residential complex in Iran, long-term residents as well as homeowners do experience higher levels of neighborhood attachment, and factors including fear of crime, cultural tensions, and less social cohesion negatively affect place attachment [67]. In the United States, Luo et al. [68] investigated how people perceive place attachment differently in urban and rural settings, both at the neighborhood and city level. They used a quantitative method to measure the factors of belonging, happiness, membership, and pleasure. Accordingly, they found that social ties as well as their distribution play a significant role in developing place attachment. In a quantitative survey, Lu et al. [69] investigated place attachment in China's gated neighborhoods. Their study suggests that a sense of place attachment to one's community is correlated with inhabitants' involvement in social events held there. According to Chang et al. [21], in a study conducted in China,

neighborhood quality—both physical and social—contributes more to place attachment than housing conditions. This research, which uses a quantitative approach, supports the existence of a more complex interaction between social aspects of the environment and place attachment. Accordingly, more social ties in the neighborhood contribute to place dependence, place identity, and the development of place attachment. In a related study, Shamsuddin and Ujang [70] used surveys and interviews in Malaysia to investigate the role that place attachment plays in defining place identity and meaning. Given the significance of shopping streets for people's cultural and economic lives in this region, it becomes apparent that these streets have great meaning for long-term users who have strong attachments to their new location because of personal and shared meanings. According to Shamsuddin and Ujang [70], a person's functional, emotional, and social attachment to a place develops as a result of several factors, such as the duration of engagement, familiarity, and economic dependence on the area. Such a place attachment would be linked to more profound meanings that establish a sense of place.

In addition, Reese et al. [71] conducted an online survey in Germany to evaluate the differences in attachment to their favorite places after imagining the loss of certain physical or social characteristics of those places. They found that there is a significant decrease in the level of place attachment even in this imaginative process. According to this study, social aspects, including community (festivals, social networks, etc.), family and friends, and mentality (welcoming, kind, and open-minded) were all imagined to be lost. The physical features included architectural and urban elements of the place. Accordingly, the loss of social features can affect and reduce the place attachment much more than the loss of the physical features in the same place. Additionally, Pei [72] found that place attachment has a moderating effect on pro-environmental behaviors like recycling household waste, and neighborhood ties are considered a positive motivation for community-level actions toward the environment.

Furthermore, Weijs-Perrée et al. [73] identified satisfaction with social life as an important indicator of wellbeing among neighborhood residents in the Netherlands. In this quantitative path analysis study, the relationship between independent variables (personal and neighborhood characteristics) and dependent variables (place attachment, social network, and social satisfaction) was measured to understand the direct and indirect effects of the above-mentioned variables on overall social satisfaction in the neighborhood. The findings show that while relationships with family and friends might have greater significance than social interactions with neighbors, there is a direct and positive correlation between the two and wellbeing as well as satisfaction.

Added to that, Lomas et al. [74] have emphasized people–place relationships within three themes: "Feelings of control", "Social and community relations", and "Understandings and definitions of place", while examining the consequences of a regeneration project in the UK using an interpretative study. Their study shows that the removal of social spaces—as one of the sources of place attachment—results in mental health reduction and negatively affects wellbeing. According to a statistical investigation, using the neighborhood attachment and perceived environmental quality indices demonstrates how these indices have significantly improved the psychometric qualities of Rome's citizens [75]. In other research, Albers et al. [32] confirm Self Determination Theory as a useful framework to study different aspects of the creation and development of place bonding that significantly contributes to the wellbeing of the community, especially for those who are at risk of mental illnesses. Also, Marcheschi et al. [76] confirmed the contribution of place attachment to health outcomes among people with mental illness using the Human–Environment Interaction Model [77]. According to this study, a combination of place attachment with perceived social and environmental quality positively impacts people's quality of life. The degrees of place attachment may vary from a sense of belonging to a place to a sense of identification with it, and as a multifaceted theme that depends on time, it is defined within human–environment interactions. Furthermore, Hatori et al. [78] implemented quantitative

research to explore place attachment among rural and urban residents in Japan. They found that residents in areas with population decline have lower attachment to the place.

Furthermore, Collins [79] conducted a qualitative study that involved conducting interviews and creating cognitive maps, ending in the coding of various aspects of cultural assets and a corresponding usage frequency. The study identified the public spaces in Los Angeles, California, where forty-three different ethnic residents felt attached. Accordingly, places of everyday life—like supermarkets, restaurants, etc.—are considered as cultural assets by different groups and associated with the sense of attachment that result in social cohesion and collective action. In addition, the manifestation of place identity—cultural events, festivals, etc.—contributes to place attachment among different people. More importantly, in multiethnic urban areas, monolithic interpretation of cultural identity in neighborhoods is to be avoided to attract more economic investment from distinct groups.

Finally, public green areas foster a sense of belonging, satisfaction, and interaction among community members, which in turn contributes to neighborhood attachment. Comstock et al. [80] measured gardening participation among American respondents with a statistical analysis of questions on walkability, social cohesion, place attachment, fear of crime, and incivilities. Consequently, in addition to the length of residency, higher levels of place attachment are associated with higher perceptions of safety and collective efficacy. Additionally, since gardening requires active neighbor interactions, both informally and formally, gardening activities in backyards and neighbor's areas positively correlate with place attachment. Finally, Lo and Jim [81] investigated the relationship between the presence of the natural-cultural element of "stonewall trees" and community attachment in Hong Kong. They found that deep engagement with the local community increased the desire to preserve the walls and associated trees.

Place Attachment and Participation

Given the multifaceted nature of the relationship between place attachment and participation, it is important to examine the influences of citizens' place attachment on their civic engagement in addition to their "participation experience" and "aspiration to participate" [21]. As such, consideration should be given to both the citizens' past involvement and their motivations for potential future involvement. According to Stefaniak et al. [82], learning about the history of the area contributes to a higher sense of attachment to the place and more civic engagement of the residents. This approach helps to increase social trust among people, which results in their wellbeing. The study was implemented in Poland, and they measured the degree of sense of attachment among young adults both before and after learning about local history to analyze its contribution to their engagement in community activities. Approximately 1500 participants took part in this survey; most respondents (89%) stated that, because of their unique social background, they had not engaged in any civic activities or belonged to any civic organization. This quantitative survey used a "social trust scale", "civic engagement scale", and "place attachment scale" to measure the changes in pre- and post-test levels of participation and interest in civic engagement among students. The findings demonstrated that greater place attachment raises social trust and civic involvement. Likewise, the results of the quantitative survey of 1273 respondents in the Chinese city of Guangzhou by Chang et al. [21] confirm that having a higher sense of place attachment would lead to more engagement in neighborhood activities, which directly contributes to quality of life as well as the development of their environment. Using a survey questionnaire, Shaykh-Baygloo [83] investigated the association between place attachment and engagement in a newly constructed town in Iran. She found that a higher sense of attachment positively impacts the degree of civic engagement as well as place loyalty, especially among adult residents compared to teenagers. In the case of recently constructed towns, issues that impact the degree of place attachment among inhabitants include the absence of a local history, culture, and interesting events in addition to inadequate employment opportunities and service provisions [83].

Using information from 1285 respondents in a quantitative survey conducted in China, Pei [72] examined the relationship between participation in pro-environmental behaviors and place-related sociopsychological variables like neighborhood attachment. "Waste recycling intentions" and "neighborhood ties" were the dependent and independent variables in this study. The findings indicate that residents who have closer ties to the community take part in recycling programs at a higher rate than others. In another study, Irani et al. [84] examined the impact of place attachment on civic activities such as social engagement and pro-environmental behavior. The study was based on 240 questionnaires measuring variables of place attachment (place identity, place dependence, emotional attachment, and social attachment) and pro-environmental behaviors (household behavior, information seeking, and transportation). The results show the positive effect of place attachment as well as civic engagement on pro-environmental behaviors. Accordingly, civic participation functions as a mediator in the relationship between place attachment and pro-environmental behaviors. Also, it is found that social attachment is a significant variable regarding place attachment, which motivates people to be engaged in civic activities. Such engagement involves a higher sense of responsibility toward the environment and participating in different social activities to make decisions and solve problems that result in a sense of trust among residents.

3.4. Place Attachment and Immigration/Refugees

Signs of continuity, such as the presence of familiar features in the new environment, are linked to immigrants' growing sense of attachment to it. This process helps create strong bonds with the place and contributes to their integration [32]. Trąbka [23] used a qualitative research design that involved sixty interviews in London and Oslo to examine the dynamic attachment process among Polish migrants in their new environment. It confirms the coexistence of different aspects of place attachment—including place dependence, place discovered, place identity, and place inherited—and concludes that the adaptation to a new setting is considered a gradual process. The complex relationship between place attachment and spatial mobility is an outcome of socioeconomic variables. For instance, when it comes to adjusting to their new environment, highly trained professionals and lower-status migrants differ significantly. Investigating the important places in both the original and residence country for the migrants as well as their reason for migration and their pre- and post-migration life history, Trąbka [23] found that some migrants may not develop all dimensions of place attachment and only have experienced place dependence in their new setting.

When it comes to immigrants, the nature of place attachment and the direction of future related research might change from the existing literature due to the recent high tendencies in several mobilizations in one's life [43]. This is while the nature of the belonging also changes over time [43]. Studying local initiatives among former refugees from Myanmar in New Zealand, Kale [24] suggests that place attachment can offer an alternative approach to health and wellbeing based on the everyday multisensory environments of refugees on feelings of safety and happiness. Accordingly, being familiarized with the environment can build place attachment and reduce stress and anxiety while enhancing feelings of safety, autonomy, and belonging.

Kale [24] highlighted the importance of place attachment in the destination setting for refugees in reducing the negative impacts of sense of loss, grief, and disorientation that could affect their wellbeing. This study was based on an analysis of the interviews as well as the paintings drawn by the respondents—female former refugees from Myanmar in New Zealand—representing the places to which they feel attached. According to this study, "connecting to the land and putting down roots" as a form of environmental therapy promotes meaningful relationships with places and enhances place attachment. Furthermore, gardening and planting foster a sense of ownership and place attachment by showing care and responsibility [24].

In another study, Szaboova et al. [85] examined how the subjective wellbeing of migrants in their destination is shaped by core aspects of social and environmental risks and insecurity, place attachment, and aspirations using 2641 immigrants in Ghana, India, and Bangladesh through a quantitative survey. As they state, the subjective wellbeing of international migrants is highly correlated with their deep social integration in the community. They found that, on average, an increase of one standard deviation in the place attachment scale is associated with a 20 percentage point higher probability of reporting being very happy at the destination as one of the indicators of subjective wellbeing. They concluded that despite some general risks—including discrimination, fear of crime, and housing insecurity—that low-skilled immigrants may experience in their new place, the feeling of belonging to the new place is considered a determining factor that is more important than subjective wellbeing for mobile people. In this regard, achieving certain goals related to the migration purpose may contribute to reducing the effects of the possible negative risks. These factors are considered when regarding the aspirations associated with creating and developing an attachment to the new place.

According to a study by Bazrafshan et al. [53], place dependency—the capacity of an urban environment to provide an environment that gives more than basic amenities—is linked to a higher sense of attachment and may even result in place identity, particularly for bicultural immigrants. As a result, this study emphasizes the function of memory as a place attachment catalyst that reduces the consequences of disruption by associating certain similar current urban landscape characteristics with those of the place of origin. In addition, Rishbeth and Powell [86] have highlighted the role of green landscapes in providing a sense of place attachment among migrants by connecting with the memories of their different life stages. The study also demonstrates that the creation of a sense of place attachment among immigrants is facilitated by a sense of continuity as well as the "personal fit" that occurs in the open spaces through various family activities.

Furthermore, studying the association between place attachment and wellbeing, Bazrafshan et al. [64] investigated the relationship between familiarity with landscape features and the physiological reactions of immigrants in Switzerland through an audio-visual simulation. Additionally, the reactions of both immigrants and local respondents toward native and non-native garden environments were analyzed using a comparative method. The result of this study showed that place attachment to urban parks significantly increases the capacity for stress reduction and improves recreational quality for visitors. In addition, using multicultural landscape features enables immigrants to create more efficient bonds with them and accelerates the attachment process. In this regard, respondents showed a more relaxed reaction to the landscape of their own—origin—culture compared to an unfamiliar environment.

Peters et al. [87] used interviews, a qualitative method, to study how natural environments affect immigrants' place attachment in four countries. Seventy research participants' interpretations of place, the natural environment, and their social interactions within it were analyzed using a symbolic interaction technique. The study highlights three main concepts concerning place attachment in natural environments for immigrants. These concepts are "History", referring to their connections to and memories of favorite places in the origin country, "Place", referring to their evaluation of the natural environments, and "People", which refers to their social interactions in such places. The results of this study support the dynamic process of place attachment with natural settings that occurs gradually and is influenced by several factors in immigrants' lives, such as employment, family, income, and housing. Considered a cross-national study, this research shows that immigrants gradually develop a sense of attachment to their new place of residence and create emotional bonds with their surrounding natural environments through holding memorable events—birthdays or graduation celebrations of their children—as well as establishing social interactions with the host community.

Furthermore, Glorius et al. [88] used a mixed-method study (which included surveys and questionnaires) on place attachment for refugees and the value of social interaction with

German citizens to demonstrate that various social events and gatherings help newcomers integrate more successfully. Additionally, it has been demonstrated that the positive effects of social integration on refugees' wellbeing and place attachment will ultimately benefit and strengthen the community as a whole. In another study, Lager et al. (2012) [43] found that cohousing is regarded as a successful experience that results in the wellbeing of older immigrants by extending the environment and developing a sense of attachment in the Netherlands. It also explores the association of social networks and ethnic identity among such groups and their wellbeing in cohousing residences. The photo-voice approach was used in this study, where participants took pictures of objects or situations that represented their feeling of place and wellbeing. They could also subsequently clarify their perceptions in the interviews. Accordingly, cohousing was regarded as a living style that resulted in feeling attached to a place by such people while maintaining their independence and cultural identity. Stated differently, older migrants would be able to feel culturally grounded and attached by having social support from like-minded people, contributing directly to their wellbeing [43].

Liu et al. [89] investigated the degree of sense of attachment among immigrants, considering their feelings in different neighborhoods in a city in China. Accordingly, the findings show that the reason for the low sense of belonging to certain neighborhoods is related to the capacity of the environment for social integration. Stated differently, "living in uncertainty, not being involved in the formal urban economy, and poor neighborhood environment" result in a lower sense of attachment to their neighborhoods. This is a mixed-method study that includes questionnaires, interviews, and site visits to measure the city-level sense of belonging, which is mainly based on the economic relations and social networks beyond their neighborhood in an environment with a high immigrant population. The results of this study indicate that, in addition to the living environment, quality of housing has a direct impact on the sense of belonging for immigrants from various socioeconomic backgrounds. Age also demonstrates a substantial association with sense of belonging, with middle-aged groups presenting higher attachment compared to the elderly, regardless of gender and marital status. Furthermore, there is an obvious difference between immigrants from rural and urban areas, with those from urban areas showing a notably greater sense of attachment.

A study by Wu et al. [90] found that immigrants' tendencies to engage in civic activities and build social capital in their areas in China are positively impacted by place attachment, and they are less motivated to engage in these kinds of activities since they feel less attached to the neighborhood than natives do. This concern relates to their plans, both present and future, to participate in and spend time in local activities. It should be highlighted that the strength of the correlation between place attachment and civic engagement varies among countries, which is why these correlations are quite context-dependent [90]. Finally, Glorius et al. [88] investigated the critical function of the number of interactions between natives and immigrants as an indicator in Germany's rural areas. They examined expectations, perceptions, and experiences of immigrants in small rural neighborhoods to measure their effects on the degree of place attachment. They found that the process of forming ties with the new location and the immigrants' wellbeing are positively impacted by the host community's openness and welcome, even if it is only shown by a small portion of the local population. This issue especially is highlighted in communities with fewer numbers of immigrants—to develop their internal connections—and consequently, the main source of their social support is native people.

3.5. Place Attachments and Gender/Age

Lewicka [91] examined the factors that contribute to place attachment in three major Polish cities. According to their findings, while education, gender, and family size were not associated with the degree of place attachment, other predictors, including residence duration, age, and ownership status, did play a role in that. A quantitative approach has been used by Casakin et al. [92] to investigate place attachment at the neighborhood

level. They found that despite the contribution of one's satisfaction with place attachment in the neighborhood, it is not related to personal dimensions, including gender, religion, and length of residency. However, according to Kamalipour et al. [67], women showed higher levels of place attachment to their environment. In another study, it was found that gender matters, since female residents felt more attached to their homes, whereas male residents are typically less socially conscious and more economically dependent [66]. Furthermore, a range of age groups—particularly teenagers and older adults—were the subject of numerous studies on place attachment. Shabak et al. [25] investigated the perception of an accessible natural environment, using a visual method based on storytelling so the respondents could express their feelings about bonding with the place. They found a strong correlation between the degree of place attachment and the availability of natural features in the gated communities. Children, however, have different preferences for natural environments than adults; instead, they seek areas that enable them to play freely and creatively. Alcindor et al. [93] examined age variations in place attachment in Portugal and discovered that older generations had more ties to the historic location than did teenagers. In Italy, Bartolo et al. [94] investigated the benefits of place attachment on the pro-environmental behaviors of teenagers and the mediating role it plays in those activities. Similarly, Pretty et al. [95] investigated the sense of place among adults and adolescents in Australia, considering the age of residents in their attitudes and behaviors toward their small town and rural environment. Their study demonstrates that adults' feelings of place-based belonging encompass both behavioral and emotional commitment, but teenagers' senses of place-based belonging are mostly based on their perceptions of the facilities and opportunities available to them. Concerning children, Shabak et al. [25] investigated the contribution of natural features and facilities to developing a sense of attachment among children in the residential common open spaces in high-rise buildings. They found that cultural elements, in addition to natural features, contribute to the formation and development of children's sense of identity. Additionally, promoting pro-environmental behavior is considered a tool to increase both place attachment and wellbeing among adolescents [94].

Furthermore, place attachment is an important predictor of the social wellbeing of older adults. It is to be considered not only at the residential level but also at the neighborhood scale [96]. This qualitative study in Spain confirms that there are strong relations between home and neighborhood attachment, and in the case of older adults, this linkage is highlighted due to their perception of social contacts as well as place dependence. Accordingly, aging in a familiar environment results in a feeling of belonging and security that is considered a source of support for older adults. In this regard, it is suggested that participating in a neighborhood's cultural and religious events is associated with improving a sense of place attachment. Wiles et al. [38] highlighted the importance of community attachment for older adults. Their study showed that there is a strong relationship between place attachment and the health conditions of the elderly in New Zealand. Similarly, Yuan and Wu [45] investigated the association between middle-aged and older individuals' wellbeing and place attachment, as well as leisure outdoor activities, in China's urban green zones. Their research showed a direct relationship between environmental stressors and place attachment. Accordingly, older adults are not interested in outdoor activities in green areas with higher environmental stressors where they feel less attached. In addition, a study by Sun et al. [97] in Hong Kong showed that place attachment contributes to improving the capacity of older adults to cope with aging challenges in their living environment.

Wiles et al. [98] investigated how older persons in New Zealand felt about their physical and social environments, including their homes and neighborhoods, and discovered a correlation between these perceptions and their overall wellbeing. Furthermore, Han et al. [99] verified that older persons' wellbeing is positively impacted by a green environment. The results of this study also show that older adults with greater levels of actual wellbeing perceive behavioral and environmental characteristics in the green spaces around them more accurately, which improves their overall wellbeing. Additionally, Shenk et al.'s [100] qualitative study explored elderly female residents' sense of place attachment.

They linked gender expectations to the approaches toward the place through the concepts of continuity, identity, and lifetime memories of the place.

Finally, research on the place attachment of immigrants and refugees has also focused on elderly persons. Palladino [101] argued that older adults experience different processes of adaptation when migrating and making bonds with new places. Their opinions and attitudes about their location of residency may differ greatly, depending on their motives for migrating. The interviews with twenty-seven older Italian immigrants to the UK provided the basis for this study. It demonstrates how social ties are important for a person to identify with their new location and lessen the negative effects for migrants of being away from their homeland. Redefining one's identity is positively correlated with growing up and aging in a place, and the wellbeing of the older migrants is a direct effect of social support for fostering place identity. Additionally, using a qualitative research methodology, Sieng and Szabó [102] explored the degrees of two dimensions of place dependence and place identity among ten older adult migrants in New Zealand. The findings indicate that while all the older migrants may experience place dependency in their new home country, only a small percentage have been able to establish a sense of place identity. The narrative method they used suggested that language, cultural attitudes, and values might have a direct impact on the development of place attachment in both positive and negative ways for the migrants.

3.6. Place Attachment and Walkability

Neighborhood attachment can make walking a positive source of good feelings and change perceptions of the environment [103]. Walking, according to Chan and Li [103], fosters a stronger feeling of place attachment and closer contact with the environment, both of which increase life satisfaction. According to their mixed-method study of survey questionnaires and interviews conducted in China, attachment to the neighborhood has a positive significant effect on the rate of walking among the residents and is associated with creating memory and knowledge of their neighborhood. This study was designed to measure walking satisfaction, life satisfaction, built environment variables, neighborhood attachment, neighborhood characteristics, and sociodemographic variables. It also included interviews designed to determine the relationships between walking, inhabitants' place attachment, and overall quality of life.

Koohsari et al. [27] studied the mediating role of perceived neighborhood walkability in the relationship between place attachment and neighborhood physical activity in Canada. In this study, 1500 respondents completed questionnaires that measured perceived walkability, place attachment, and level of physical activity in their neighborhoods. The results of this study demonstrate a strong correlation between the amount of time spent walking for recreation in the neighborhood and place attachment. In addition, they found that perceived neighborhood walkability is a mediator between place attachment and walking for transport. This study also emphasizes how important place attachment is in encouraging residents to keep up with their physical activities in the neighborhood.

Van Den Berg et al. [15] aimed to provide insights into the relation between neighborhood walkability and place attachment and the mediating role of (satisfaction with) social interaction. They used 251 residents of different neighborhoods across the Netherlands and two structural equation models to analyze the data. They found that perceived neighborhood walkability is a stronger predictor of place attachment than objective walkability, and perceived walkability has both a positive direct effect on place attachment and an indirect effect, via neighborhood-based social interaction. In another study, Li et al. [104] looked at the relationships between five predictors of perceived qualities of urban design—walkability, accessibility, space quality, urban function, and management—and two place-related dependent factors, place attachment and place satisfaction, in the context of China. They found that walkability and space quality were revealed as the most influential factors associated with place attachment, and place satisfaction and accessibility were indirectly associated with place attachment through the mediation of walkability.

The association between accessibility, as one of the main environmental-associated factors with walkability, and place attachment was also examined by Zhang et al. [105] in the main urban area of Jiamusi City, China. They investigated the effect of accessibility on place attachment in metropolitan public open spaces using surveys and structural equation modeling. They found that accessibility has a positive effect on place attachment, and place satisfaction plays a mediating role.

According to research by Chan and Li [103], there is a complex relationship between residents' satisfaction with walking and their perception of their neighborhood and place attachment. Their study analyzed the various purposes of walking in the neighborhood, such as going shopping, going to school or work, or walking for leisure. Accordingly, different purposes of walking have different degrees of relationship with place attachment in the neighborhood. Arnberger et al. [106] also investigated the level of place attachment among various users of green spaces, including walkers and dog walkers/owners. Also, they investigated different types of settings with distinct levels of development to find their degree of contribution to the place attachment of the users in Austria and the United States. Applying regression analysis, they have found that "motivations, satisfaction, and visit frequency" are predictors of place attachment. They also found that less developed settings result in higher place dependence and place identity among visitors.

4. Discussion

Place attachment can enhance each of the three distinct dimensions of people's wellbeing—subjective [28], psychological [30], and social [31]—that are typically defined within a location. According to Tartaglia [34], place attachment promotes improved physical and mental health. Subjective wellbeing and community attachment are directly correlated, with increases in one significantly enhancing the other ([35–37]). This relationship is stronger among indigenous communities [38]. Sub-dimensions of place attachment, social identity, and place identity positively relate to wellbeing and life satisfaction, and perceptional aspects of wellbeing have a greater impact on place attachment among elderly people compared to objective aspects [38]. According to Han et al. [50], place attachment plays the most significant contribution to the wellbeing of residents compared to other intermediates, namely neighborhood social cohesion and neighborhood social capital. Place attachment contributes to the wellbeing of the elderly through creating and/or developing a "sense of autonomy, control, confidence, and identity" [43]. According to Sawada and Toyosato [44], place attachment plays a critical role in mitigating the negative impacts of low economic status on wellbeing among older adults. This is due to place attachment's role in fostering neighborhood social interactions and offering emotional support, respect for one another, and self-esteem [44]. Furthermore, the relationship between environmental stressors and wellbeing is mediated by place attachment [45].

In addition, the presence of local landscape features, historic parks, and traditional gardens strengthens the perception of green spaces' restorative qualities because of people's familiarity with the area and their shared history and memories. This process also strengthens their attachment to the place. Moreover, compared to developed plants, wild plants produce higher degrees of attachment [57]. Furthermore, certain studies have emphasized the significance of cultural values in the correlation between landscape elements and place attachment. Specifically, the impact of landscape elements on place attachment is dependent on their level of presentation of local history and culture [55,57]. Additionally, wellbeing appeared as another aspect in the studies that examined the relationship between greenspaces and place attachment, since it is highly related to greenness [58,64]. For example, Basu et al. [60] demonstrated place attachment's mediation function between wellbeing and connection to nature. The process by which greenery helps to lower stress and improve mental wellbeing is explained by Stress Reduction Theory and Attention Restoration Theory [18–20].

Moreover, social interaction is associated with developing place attachment [21]. People build functional, emotional, and social attachments because of familiarity with different

environmental aspects and shared information [70]. Social networks with friends [71] and ties with one's family and friends [73] are also positively associated with place attachment. A lesser sense of belonging to a place and population decline are also associated with less place attachment [78]. Social activities and social contacts play a more important role in enhancing place attachment, especially in low-income/deprived neighborhoods, due to the lower quality of the environment [107,108]. Furthermore, public green spaces have been shown to improve place attachment through social aspects like a sense of belonging and interaction among community members [80,81]. Apart from social elements, it has been demonstrated that certain cultural elements, like commonplace locations like grocery stores and dining establishments, may improve a feeling of attachment [79]. Additionally, higher place attachment raises social trust and civic engagement [21,82,83], both of which directly raise quality of life [2]. Such engagement involves a higher sense of responsibility toward the environment and participating in different social activities to make decisions and solve problems. Therefore, improving place attachment helps to increase a variety of pro-environmental variables, including intent to recycle waste [72,84].

Furthermore, plenty of research has been carried out on the attachment to one's new home among immigrants and refugees. Trąbka [23] asserts that immigrants' adjustment to a new environment is considered as a progressive process involving several dimensions of place attachment, such as place dependency, place discovery, place identity, and place inherited. In terms of the process of adapting to the new environment, there are also significant differences among immigrants based on socioeconomic factors, such as highly skilled professionals and migrants with lesser status [23]. Immigrants' growing sense of attachment to their homeland is linked to signs of continuity, such as the presence of familiar elements in the scene [32]. Refugees who plant and garden show empathy and responsibility, which fosters a sense of belonging and attachment to their new home [24]. According to Risbeth and Powell [79], green spaces in public open spaces have a strong association with immigrants' sense of place attachment by connecting with the memories of their different life stages and enhancing the sense of continuity among immigrants [79]. Particularly for bicultural immigrants, the green urban landscape is linked to a stronger sense of attachment [53]. Furthermore, place attachment can provide an alternative approach to improving the wellbeing of immigrants and refugees [24,85], and becoming familiar with the environment can foster place attachment and lessen stress among refugees [24]. The availability of recreational areas enhances refugees' wellbeing and place attachment [24]. Immigrants' sense of attachment and ability to cope with stress are greatly enhanced by the presence of green places, particularly those that are part of their native landscape [64]. Additionally, Peters et al. [87] demonstrate that social interaction with the host community and the organization of memorable events foster the emotional ties that immigrants form with the natural landscapes around them. Comparably, increased place attachment for immigrants and refugees [43,88,89] as well as the wellbeing of older immigrants [43] are facilitated by cohousing, increased social contact with residents, increased environmental capacity for social integration, and the openness and acceptance of the host community [43]. Finally, immigrants' motivations to engage in civic activities and create social capital in their communities are improved by place attachment [82].

Additionally, female residents showed a stronger sense of attachment to their place of residence compared to male residents while considering the socio-demographic characteristics associated with place attachment [66,67], and depending on the age group, the attributes of the related elements with place attachment change. As an example, older generations have stronger ties to historic sites than adolescents [93]. Open spaces that allow children to play creatively are the main characteristics of natural environments for children so that their place attachment increases, an issue that is not observed in adults [25]. Pretty et al. [95] found that although adolescents primarily rely on their perceptions of the opportunities and amenities of their place of residence, adults' sense of belonging to the neighborhood involves both emotional and behavioral commitment. Children's sense of

identity is created and developed in part by the presence of cultural aspects, according to Shabak et al. [25].

Studies on place attachment have primarily focused on older persons among the age ranges. Compared to older populations, middle-aged groups show higher levels of attachment [89]. According to Lebrusán and Gomez [96], older persons who live in familiar environments experience a greater sense of place attachment and a sense of belonging and security. Participating in cultural and religious events in the community is linked to older persons having a stronger feeling of place attachment [44]. Older adults are not interested in outdoor activities in green areas with higher environmental stressors where they feel less attached [45]. Place attachment also helps older adults cope with aging challenges in their living environment [90], and the concepts of continuity, identity, and lifetime memories of the place play a role in enhancing the place attachment of older female residents [100]. Finally, studies regarding the sense of attachment among immigrants and refugees have also focused on older adults. Language, cultural attitudes, and values may have an impact on how well elderly immigrants develop place attachment [102]. Social aspects and identification with place are considered as determining factors in improving the place attachment of elderly immigrants [101].

Additionally, there is a positive correlation between walking frequency and place attachment, because walking fosters closer relationships with the environment and is associated with the creation of memories and knowledge of one's neighborhood, both of which may increase one's sense of place attachment. Attachment to specific places, such as residential neighborhoods, has been shown to encourage people to adopt and maintain physical activity routines [27,103]. According to Koohsari et al. [27], there is a substantial correlation between the amount of time spent walking for enjoyment in the neighborhood and place attachment. This is supported by Li et al. (2020) [104], who found that walkability and space quality were revealed as the most influential factors associated with place attachment. Koohsari et al. [27] also found that place attachment and walking for transportation is mediated by perceived neighborhood walkability [27]. According to Van Den Berg et al. [15], subjective walkability rather than actual walkability is a better indicator of place attachment. They also found that perceived walkability has an indirect effect on place attachment via neighborhood-based social interaction [15]. Finally, Arnberger et al. [106] found that among various users of green areas, such as walkers and dog walkers/owners, motivations, satisfaction, and visit frequency are predictors of place attachment.

Concerning the relationship between walkability and place attachment, much research has not been carried out on how walkability-related built environment features can strengthen place attachment. For example, it was discovered that place attachment and accessibility are related. Accessibility is a primarily built environmental factor connected with walkability [104]. This is supported by Zhang et al. [105], who found that accessibility has a positive effect on place attachment, while place satisfaction plays a mediating role. In addition, it has also been shown that crime-related factors contribute to a lower sense of place attachment in low-income/deprived neighborhoods [107,108]. The built environment factors that are linked to walkability also include certain qualities of urban design and aesthetic and design-related aspects of path context [109–114]. These factors are particularly significant for place attachment because they can contribute to creating more enjoyable walking experiences [115], which pedestrians may use as a basis for their place attachment in their neighborhoods [104]. The presence of parks and green spaces, the existence of natural features, the amounts of greenery, the types of building facades and their maintenance, the presence of landmarks, the degree of enclosure, the transparent façade, building height, and articulation in building design are some examples of these aesthetic and design-related aspects of path context [116–122] Furthermore, according to Ewing and Handy (2009) [123] and Paydar et al. (2023b) [124], legibility, complexity, mystery, coherence, imageability, enclosure, and human scale are examples of urban design qualities linked to walkability

and the everyday walking experience of pedestrians. These aspects of urban design might further promote a sense of place attachment.

Finally, Lewicka (2010) [91] noted that most studies on place attachment are conducted at the middle-scale level and concentrate on people's relationships with their neighborhood; smaller and bigger scales, which can be defined as cities and housing units, are less investigated. Furthermore, there is an association between the degree of place attachment and the place's scale [91]. The size of a city can have a significant impact on how people perceive and interact with their place; in particular, large and small cities tend to have higher levels of place attachment than medium-sized cities, according to Casakin et al. [125], who investigated the relationship between the place dimension and the level of attachment among Israeli residents.

5. Conclusions

This study reviewed place attachment and related variables using the following six categories: "place attachment and wellbeing", "place attachment and urban greenery", "place attachment and social and cultural factors", "place attachment and immigrants/refugees", "place attachment and gender/age", and "place attachment and walkability".

All three of the subjective, psychological, and social dimensions of wellbeing can be enhanced by place attachment, and there is a higher correlation between place attachment and subjective wellbeing among indigenous communities. In addition, place attachment contributes to the wellbeing of the elderly by creating and/or developing a sense of autonomy, control, confidence, and identity. This association works to improve social interactions, mutual respect, and emotional support to lessen the detrimental impact that low economic status has on older people's wellbeing. This applies particularly to city planners trying to lessen the negative impacts of economic distress on the standard of living in lower-income neighborhoods. Place attachment can also lessen the detrimental effects of environmental stressors on wellbeing. Aspects of one's surroundings that increase psychological or emotional stress are referred to as environmental stressors. Extreme temperatures, crowded spaces, loud noises, and criminal activity are a few examples of environmental stresses. Therefore, improving place attachment in communities with high concentrations of environmental stressors may help mitigate the detrimental impacts of those stresses on wellbeing.

In addition, the presence of local landscape features, historic parks, and traditional gardens all strengthen a person's sense of place attachment, and the effect of landscape features on place attachment varies according to how much they represent the history and culture of the area. This could be further investigated by future studies. Furthermore, green spaces have been linked to improved mental wellbeing following Stress Reduction Theory and Attention Restoration Theory. It was also found that place attachment plays a mediator function between nature connectedness and wellbeing.

Social interaction is also linked to the development of place attachment, and this relationship is stronger in low-income/deprived neighborhoods due to the lower quality of the environment. As a result, in poor neighborhoods, social context is crucial for improving place attachment. Urban policymakers could use this to raise the level of place attachment among inhabitants by concentrating more on various social features in such neighborhoods. Furthermore, public greenspaces have been shown to contribute to place attachment through social factors such as interaction among community members. Increased place attachment also improves social trust and civic engagement, both of which have a direct positive impact on quality of life. Such engagement involves a higher sense of responsibility toward the environment and participating in different social activities to make decisions and solve problems.

When it comes to immigrants and refugees, signs of continuity—that is, incorporating familiar features into a setting—are linked to an increasing sense of attachment among the immigrants in their new environment. Green landscapes play a significant role in helping immigrants and refugees connect with their memories of their various life stages

and enhance their sense of continuity, particularly among bicultural immigrants. Green landscapes connected with the origin culture of immigrants are crucial in strengthening their sense of continuity and place attachment. Natural landscapes also help immigrants strengthen their emotional ties and sense of place attachment by providing opportunities for social engagement with the host community. Furthermore, place attachment positively influences older immigrants' tendencies to engage in civic activities in their communities, and language, cultural attitudes, and values may have an impact on the development of place attachment in these individuals. Future studies in regions with a high concentration of immigrants and refugees may focus more on the types of landscape features, cultural attitudes and values, and social factors that connect to the immigrants' home cultures and increase the likelihood of social integration between the immigrants and the host communities, all of which ultimately help to strengthen the immigrants' sense of place attachment.

Additionally, the process by which place attachment develops varies according to age group: adults' sense of place attachment involves both behavioral and emotional commitment, whereas adolescents' sense of place attachment is primarily based on their impressions of the amenities and opportunities provided by their place of residence. Involving older people in the neighborhood's cultural and religious events is linked to increasing their sense of place attachment, which in turn helps them cope better with the challenges of aging in their living environment. Urban policymakers may help to strengthen the sense of place attachment among older persons residing in communities with higher rates of aging by recognizing and enhancing these cultural activities.

Furthermore, the duration of time spent walking and the perception of the neighborhood's walkability are positively correlated with each other. Place attachment is indirectly influenced by perceived walkability through social interactions inside the neighborhood. Place attachment relates to accessibility, one of the primary built environmental factors associated with walkability. However, the role of other built environmental factors related to perceived walkability, especially the aesthetic and design-related aspects of path context and certain urban design qualities in enhancing place attachment, has been rarely investigated. Further studies could investigate the potential effects of these aesthetic and design-related aspects of path context and urban design qualities on place attachment. Finally, studies have shown that place attachment is higher in large and small cities relative to medium-sized cities, indicating a link between place attachment and the scale of the place. The contribution of the scale of the place to the sense of place attachment could also be stressed by future studies.

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References

1. Manzo, L.C. For better or worse: Exploring multiple dimensions of place meaning. *J. Environ. Psychol.* **2005**, *25*, 67–86. [CrossRef]
2. Manzo, L.C.; Devine-Wright, P. *Place Attachment: Advances in Theory, Methods and Applications*; Routledge: London, UK; New York, NY, USA, 2014.
3. Moulay, A.; Ujang, N.; Maulan, S.; Ismail, S. Understanding the process of parks' attachment: Interrelation between place attachment, behavioral tendencies, and the use of public places. *City Cult. Soc.* **2018**, *14*, 28–36. [CrossRef]
4. Lewicka, M. Place attachment: How far have we come in the last 40 years? *J. Environ. Psychol.* **2011**, *31*, 207–230. [CrossRef]

5. Scannell, L.; Gifford, R. Defining place attachment: A tripartite organizing framework. *J. Environ. Psychol.* **2010**, *30*, 1–10. [CrossRef]
6. Cole, L.B.; Coleman, S.; Scannell, L. Place Attachment in Green Buildings: Making the Connections. *J. Environ. Psychol.* **2021**, *74*, 101558. [CrossRef]
7. Kyle, G.; Graefe, A.; Manning, R.; Bacon, J. Effects of place attachment on users' perceptions of social and environmental conditions in a natural setting. *J. Environ. Psychol.* **2004**, *24*, 213–225. [CrossRef]
8. Turton, C.J. Defining Residential Place Attachment and Exploring Its Contribution to Community and Personal Environmental Actions. Ph.D. Thesis, University of Surrey, Guildford, UK, 2016.
9. Afshar, P.F.; Foroughan, M.; Vedadhir, A.; Tabatabaei, M.G. The Effects of Place Attachment on Social Well-Being in Older Adults. *Educ. Gerontol.* **2016**, *43*, 45–51. [CrossRef]
10. Scannell, L.; Gifford, R. Place Attachment Enhances Psychological Need Satisfaction. *Environ. Behav.* **2016**, *49*, 359–389. [CrossRef]
11. Morton, T.A.; Bles AM, V.D.; Haslam, S.A. Seeing our self-reflected in the world around us: The role of identity in making (natural) environments restorative. *J. Environ. Psychol.* **2017**, *49*, 65–77. [CrossRef]
12. Liu, Q.; Fu, W.; Van den Bosch, C.C.K.; Xiao, Y.; Zhu, Z.; You, D.; Zhu, N.; Huang, Q.; Lan, S. Do Local Landscape Elements Enhance Individuals' Place Attachment to New Environments? A Cross-Regional Comparative Study in China. *Sustainability* **2018**, *10*, 3100. [CrossRef]
13. Liu, Q.; Zhu, Z.; Zhuo, Z.; Huang, S.; Zhang, C.; Shen, X.; Van Den Bosch CC, K.; Huang, Q.; Lan, S. Relationships between residents' ratings of place attachment and the restorative potential of natural and urban park settings. *Urban For. Urban Green.* **2021**, *62*, 127188. [CrossRef]
14. Tyrväinen, L.; Ojala, A.; Korpela, K.; Lanki, T.; Tsunetsugu, Y.; Kagawa, T. The influence of urban green environments on stress relief measures: A field experiment. *J. Environ. Psychol.* **2014**, *38*, 1–9. [CrossRef]
15. van den Berg, P.E.; Liao, B.; Gorissen, S.; van Wesemael, P.J.; Arentze, T.A. The Relationship between Walkability and Place Attachment and the Mediating Role of Neighborhood-Based Social Interaction. *J. Plan. Educ. Res.* **2024**, *44*, 1730–1741. [CrossRef]
16. Stigsdotter, U.K.; Corazon, S.S.; Sidenius, U.; Refshauge, A.D.; Grahn, P. Forest design for mental health promotion—Using perceived sensory dimensions to elicit restorative responses. *Landsc. Urban Plan.* **2017**, *160*, 1–15. [CrossRef]
17. Paydar, M.; Kamani Fard, A. The Hierarchy of Walking Needs and the COVID-19 Pandemic. *Int. J. Environ. Res. Public Health* **2021**, *18*, 7461. [CrossRef]
18. Ulrich, R.; Simons, R.; Losito, B.; Fiorito, E.; Miles, M.; Zelson, M. Stress Recovery During Exposure to Natural and Urban Environments. *J. Environ. Psychol.* **1991**, *11*, 201–230. [CrossRef]
19. Kaplan, R.; Kaplan, S. *The Experience of Nature: A Psychological Perspective*; Cambridge University Press: Cambridge, UK, 1989.
20. Kaplan, R.; Kaplan, S. Well-being, Reasonableness, and the Natural Environment. *Appl. Psychol. Health Well-Being* **2011**, *3*, 304–321. [CrossRef]
21. Chang, J.; Lin, Z.; Vojnovic, I.; Qi, J.; Wu, R.; Xie, D. Social environments still matter: The role of physical and social environments in place attachment in a transitional city, Guangzhou, China. *Landsc. Urban Plan.* **2023**, *232*, 104680. [CrossRef]
22. Bowler, D.E.; Buyung-Ali, L.M.; Knight, T.M.; Pullin, A.S. A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health* **2010**, *10*, 456. [CrossRef]
23. Trąbka, A. From functional bonds to place identity: Place attachment of Polish migrants living in London and Oslo. *J. Environ. Psychol.* **2019**, *62*, 67–73. [CrossRef]
24. Kale, A. Building attachments to places of settlement: A holistic approach to refugee wellbeing in Nelson, Aotearoa New Zealand. *J. Environ. Psychol.* **2019**, *65*, 101315. [CrossRef]
25. Shabak, M.; Norouzi, N.; Abdullah, A.; Khan, T.H. Children's sense of attachment to the residential common open space. *Procedia Soc. Behav. Sci.* **2015**, *201*, 39–48. [CrossRef]
26. Wang, H.; Yang, Y. Neighbourhood walkability: A review and bibliometric analysis. *Cities* **2019**, *93*, 43–61. [CrossRef]
27. Koohsari, M.J.; Yasunaga, A.; Oka, K.; Nakaya, T.; Nagai, Y.; McCormack, G.R. Place attachment and walking behavior: Mediation by perceived neighborhood walkability. *Landsc. Urban Plan.* **2023**, *235*, 104767. [CrossRef]
28. Diener, E.; Suh, E.M.; Lucas, R.E.; Smith, H. Subjective well-being: Three decades of progress. *Psychol. Bull.* **1999**, *125*, 276–302. [CrossRef]
29. Ryan, R.M.; Deci, E.L. On Happiness and Human Potentials: A review of Research on Hedonic and Eudaimonic Well-Being. *Annu. Rev. Psychol.* **2001**, *52*, 141–166. [CrossRef]
30. Ryff, C.D. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *J. Personal. Soc. Psychol.* **1989**, *57*, 1069–1081. [CrossRef]
31. Keyes, C.L.M. Social Well-Being. *Soc. Psychol. Q.* **1998**, *61*, 121. [CrossRef]
32. Albers, T.; Ariccio, S.; Weiss, L.; Dessi, F.; Bonaiuto, M. The Role of Place Attachment in Promoting Refugees' Well-Being and Resettlement: A Literature review. *Int. J. Environ. Res. Public Health* **2021**, *18*, 11021. [CrossRef]
33. Harris, P.; Werner, C.M.; Brown, B.; Ingebritsen, D. Relocation and Privacy Regulation: A Cross-Cultural Analysis. *J. Environ. Psychol.* **1995**, *15*, 311–320. [CrossRef]
34. Tartaglia, S. Different predictors of quality of life in urban environment. *Soc. Indic. Res.* **2012**, *113*, 1045–1053. [CrossRef]

35. Wang, Q.; Liu, X.; Jian, I.Y.; Zhang, E.; Hou, Y.; Siu, K.W.M.; Li, Y. Community resilience in city emergency: Exploring the roles of environmental perception, social justice and community attachment in subjective well-being of vulnerable residents. *Sustain. Cities Soc.* **2023**, *97*, 104745. [CrossRef]
36. Rajala, K.; Sorice, M.G. Sense of place on the range: Landowner place meanings, place attachment, and well-being in the Southern Great Plains. *Rangelands* **2022**, *44*, 353–367. [CrossRef]
37. Berg, N.G. Geographies of wellbeing and place attachment: Revisiting urban–rural migrants. *J. Rural Stud.* **2020**, *78*, 438–446. [CrossRef]
38. Wiles, J.; Rolleston, A.; Pillai, A.; Broad, J.; Teh, R.; Gott, M.; Kerse, N. Attachment to place in advanced age: A study of the LiLACS NZ cohort. *Soc. Sci. Med.* **2017**, *185*, 27–37. [CrossRef]
39. Maricchiolo, F.; Mosca, O.; Paolini, D.; Fornara, F. The mediating role of place attachment dimensions in the relationship between local Social Identity and Well-Being. *Front. Psychol.* **2021**, *12*, 645648. [CrossRef] [PubMed]
40. Diener, E.D.; Emmons, R.A.; Larsen, R.J.; Griffin, S. The satisfaction with life scale. *J. Personal. Assess.* **1985**, *49*, 7175. [CrossRef]
41. Scopelliti, M.; Tiberio, L. Homesickness in university students: The role of multiple place attachment. *Environ. Behavior.* **2010**, *42*, 335–350. [CrossRef]
42. Paolini, D.; Maricchiolo, F.; Pacilli, M.G.; Pagliaro, S. COVID-19 lockdown in Italy: The role of social identification and social and political trust on well-being and distress. *Curr. Psychol.* **2020**, *41*, 5652–5659. [CrossRef]
43. Lager, D.; Van Hoven, B.; Meijering, L. Places that Matter: Place Attachment and Wellbeing of Older Antillean Migrants in the Netherlands. *Eur. Spat. Res. Policy* **2012**, *19*, 81–94. [CrossRef]
44. Sawada, S.; Toyosato, T. The moderating effect of place attachment on the relationship between economic status and well-being among the older adults in Japan. *Geriatr. Nurs.* **2021**, *42*, 721–726. [CrossRef] [PubMed]
45. Yuan, K.S.; Wu, T.J. Environmental stressors and well-being on middle-aged and elderly people: The mediating role of outdoor leisure behaviour and place attachment. *Environ Sci Pollut Res Int.* 2021, *ahead of print*. [CrossRef] [PubMed]
46. Lachowycz, K.; Jones, A.P. Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework. *Landsc. Urb. Plan* **2013**, *118*, 62–69. [CrossRef]
47. Ryan, R.L. Exploring the effects of environmental experience on attachment to urban natural areas. *Environ. Behav.* **2005**, *37*, 3–42. [CrossRef]
48. Seligman, M.E.P. *Flourish: A Visionary New Understanding of Happiness and Well-Being*; Free Press: New York, NY, USA, 2011.
49. Honold, J.; Beyer, R.; Lakes, T.; van der Meer, E. Multiple environmental burdens and neighborhood-related health of city residents. *J. Environ. Psychol.* **2012**, *32*, 305–317. [CrossRef]
50. Scannell, L.; Gifford, R. The experienced psychological benefits of place attachment. *J. Environ. Psychol.* **2017**, *51*, 256–269. [CrossRef]
51. Ratcliffe, E.; Korpela, K. Memory and place attachment as predictors of imagined restorative perceptions of favorite places. *J. Environ. Psychol.* **2016**, *48*, 120–130. [CrossRef]
52. Cheung, L.T.; Hui DL, H. Influence of residents' place attachment on heritage forest conservation awareness in a peri-urban area of Guangzhou, China. *Urban For. Urban Green.* **2018**, *33*, 37–45. [CrossRef]
53. Bazrafshan, M.; Tabrizi, A.M.; Bauer, N.; Kienast, F. Place attachment through interaction with urban parks: A cross-cultural study. *Urban For. Urban Green.* **2021**, *61*, 127103. [CrossRef]
54. Yang, C.; Shi, S.; Runeson, G. Towards sustainable urban communities: Investigating the associations between community parks and place attachment in master-planned estates in Sydney. *Sustain. Cities Soc.* **2023**, *96*, 104659. [CrossRef]
55. Menatti, L.; Subiza-Pérez, M.; Villalpando-Flores, A.E.; Vozmediano, L.; Juan, C.S. Place attachment and identification as predictors of expected landscape restorativeness. *J. Environ. Psychol.* **2019**, *63*, 36–43. [CrossRef]
56. Kil, N.; Stein, T.V.; Holland, S.M.; Kim, J.J.; Kim, J.H.; Petitte, S. The role of place attachment in recreation experience and outcome preferences among forest bathers. *J. Outdoor Recreat. Tour.* **2021**, *35*, 100410. [CrossRef]
57. Zhang, R. Integrating ergonomics data and emotional scale to analyze people's emotional attachment to different landscape features in the Wudaokou Urban Park. *Front. Archit. Res.* **2023**, *12*, 175–187. [CrossRef]
58. Wynveen, C.J.; Kyle, G.T.; Sutton, S.G. Natural area visitors' place meaning, and place attachment ascribed to a marine setting. *J. Environ. Psychol.* **2012**, *32*, 287–296. [CrossRef]
59. Colley, K.; Craig, T. Natural places: Perceptions of wildness and attachment to local greenspace. *J. Environ. Psychol.* **2019**, *61*, 71–78. [CrossRef]
60. Basu, M.; Hashimoto, S.; Dasgupta, R. The mediating role of place attachment between nature connectedness and human well-being: Perspectives from Japan. *Sustain. Sci.* **2019**, *15*, 849–862. [CrossRef]
61. Raymond, C.; Brown, G.; Weber, D. The Measurement of Place Attachment: Personal, Community, and Environmental Connections. *J. Environ. Psychol.* **2010**, *30*, 422–434. [CrossRef]
62. Mayer, F.; Frantz, C. The Connectedness to Nature Scale: A Measure of Individuals' Feeling in Community with Nature. *J. Environ. Psychol.* **2004**, *24*, 503–515. [CrossRef]
63. Perkins, H.E. Measuring love and care for nature. *J. Environ. Psychol.* **2010**, *30*, 455–463. [CrossRef]
64. Bazrafshan, M.; Spielhofer, R.; Hayek, U.W.; Kienast, F.; Grêt-Regamey, A. Greater place attachment to urban parks enhances relaxation: Examining affective and cognitive responses of locals and bi-cultural migrants to virtual park visits. *Landsc. Urban Plan.* **2023**, *232*, 104650. [CrossRef]

65. Chishima, Y.; Minoura, Y.; Uchida, Y.; Fukushima, S.; Takemura, K. Who commits to the community? Person-community fit, place attachment, and participation in local Japanese communities. *J. Environ. Psychol.* **2023**, *86*, 101964. [CrossRef]
66. Azevedo, A.; Custódio, M.J.; Perna, F. "Are you happy here?": The relationship between quality of life and place attachment. *J. Place Manag. Dev.* **2013**, *6*, 102–119. [CrossRef]
67. Kamalipour, H.; Yeganeh, A.J.; Alalhesabi, M. Predictors of Place Attachment in Urban Residential Environments: A Residential Complex case study. *Procedia Soc. Behav. Sci.* **2012**, *35*, 459–467. [CrossRef]
68. Luo, X.I.; Hipp, J.R.; Butts, C.T. Does the spatial distribution of social ties impact neighborhood and city attachment? Differentials among urban/rural contexts. *Soc. Netw.* **2022**, *68*, 374–385. [CrossRef]
69. Lu, T.; Zhang, F.; Wu, F. Place attachment in gated neighborhoods in China: Evidence from Wenzhou. *Geoforum* **2018**, *92*, 144–151. [CrossRef]
70. Shamsuddin, S.; Ujang, N. Making places: The role of attachment in creating the sense of place for traditional streets in Malaysia. *Habitat Int.* **2008**, *32*, 399–409. [CrossRef]
71. Reese, G.; Oettler, L.M.; Katz, L.C. Imagining the loss of social and physical place characteristics reduces place attachment. *J. Environ. Psychol.* **2019**, *65*, 101325. [CrossRef]
72. Pei, Z. Roles of neighborhood ties, community attachment and local identity in residents' household waste recycling intention. *J. Clean. Prod.* **2019**, *241*, 118217. [CrossRef]
73. Weijs-Perrée, M.; Van Den Berg, P.; Arentze, T.T.; Kemperman, A. Social networks, social satisfaction and place attachment in the neighborhood. *Region* **2017**, *4*, 133. [CrossRef]
74. Lomas, M.J.; Ayodeji, E.; Brown, P. Experiences of place attachment and mental wellbeing in the context of urban regeneration. *Health Place* **2021**, *70*, 102604. [CrossRef]
75. Bonaiuto, M.; Fornara, F.; Bonnes, M. Indexes of perceived residential environment quality and neighborhood attachment in urban environments: A confirmation study on the city of Rome. *Landsc. Urban Plan.* **2003**, *65*, 41–52. [CrossRef]
76. Marcheschi, E.; Laike, T.; Brunt, D.; Hansson, L.; Johansson, M. Quality of life and place attachment among people with severe mental illness. *J. Environ. Psychol.* **2015**, *41*, 145–154. [CrossRef]
77. Küller, R. *Environmental Assessment from a Neuropsychological Perspective*; Oxford University: New York, NY, USA, 1991.
78. Hatori, T.; Shirayanagi, H.; Matsumura, N. The mediating role of residential time perspective between regional decline and place attachment. *J. Environ. Psychol.* **2023**, *88*, 102022. [CrossRef]
79. Collins, B. The view from the salad bowl: Community place attachment in multiethnic Los Angeles. *Cities* **2019**, *94*, 256–274. [CrossRef]
80. Comstock, N.; Dickinson, L.M.; Marshall, J.A.; Soobader, M.; Turbin, M.S.; Buchenau, M.; Litt, J. Neighborhood attachment and its correlates: Exploring neighborhood conditions, collective efficacy, and gardening. *J. Environ. Psychol.* **2010**, *30*, 435–442. [CrossRef]
81. Lo, A.; Jim, C.Y. Community attachment and resident attitude toward old masonry walls and associated trees in urban Hong Kong. *Cities* **2015**, *42*, 130–141. [CrossRef]
82. Stefaniak, A.; Bilewicz, M.; Lewicka, M. The merits of teaching local history: Increased place attachment enhances civic engagement and social trust. *J. Environ. Psychol.* **2017**, *51*, 217–225. [CrossRef]
83. Shaykh-Baygloo, R. A multifaceted study of place attachment and its influences on civic involvement and place loyalty in Baharestan new town, Iran. *Cities* **2020**, *96*, 102473. [CrossRef]
84. Irani, M.; Aghdam, S.R.; Ghasemzadeh, B. Investigating the link between place attachment, civic engagement, and pro-environmental behaviors. *Environ. Dev.* **2023**, *47*, 100897. [CrossRef]
85. Szaboova, L.; De Campos, R.S.; Adger, W.N.; Abu, M.; Codjoe SN, A.; Gavonel, M.F.; Das, S.; Siddiqui, T.; Rocky, M.H.; Hazra, S. Urban sustainability and the subjective well-being of migrants: The role of risks, place attachment, and aspirations. *Popul. Space Place* **2021**, *28*, e2505. [CrossRef]
86. Rishbeth, C.; Powell, M. Place attachment and memory: Landscapes of belonging as experienced post migration. *Landsc. Res.* **2013**, *38*, 160–178. [CrossRef]
87. Peters, K.; Stodolska, M.; Horolets, A. The role of natural environments in developing a sense of belonging: A comparative study of immigrants in the U.S., Poland, the Netherlands and Germany. *Urban For. Urban Green.* **2016**, *17*, 63–70. [CrossRef]
88. Glorius, B.; Kordel, S.; Weidinger, T.; Bürer, M.; Schneider, H.; Spenger, D. Is social contact with the resident population a prerequisite of Well-Being and place attachment? The case of refugees in rural regions of Germany. *Front. Sociol.* **2020**, *5*, 578495. [CrossRef]
89. Liu, S.; Zhang, F.; Wu, F. Contrasting migrants' sense of belonging to the city in selected peri-urban neighborhoods in Beijing. *Cities* **2022**, *120*, 103499. [CrossRef]
90. Wu, R.; Li, Z.; Liu, Y.; Huang, X.; Liu, Y. Neighborhood governance in post-reform Urban China: Place attachment impact on civic engagement in Guangzhou. *Land Use Policy* **2019**, *81*, 472–482. [CrossRef]
91. Lewicka, M. What makes neighborhood different from home and city? Effects of place scale on place attachment. *J. Environ. Psychol.* **2010**, *30*, 35–51. [CrossRef]
92. Casakin, H.; Ruiz, C.; Hernández, B. Place Attachment and the Neighborhood: A case study of Israel. *Soc. Indic. Res.* **2021**, *155*, 315–333. [CrossRef]

93. Alcindor, M.; Jackson, D.; Alcindor-Huelva, P. Heritage places and the place attachment of adolescents: The case of the Castelo of Vila Nova de Cerveira (Portugal). *J. Rural Stud.* **2021**, *88*, 410–421. [CrossRef]
94. Bartolo, M.G.; Servidio, R.; Palermiti, A.L.; Nappa, M.R.; Costabile, A. Pro-Environmental Behaviors and Well-Being in Adolescence: The Mediating role of place attachment. *Int. J. Environ. Res. Public Health* **2023**, *20*, 5759. [CrossRef] [PubMed]
95. Pretty, G.; Chipuer, H.M.; Bramston, P. Sense of place amongst adolescents and adults in two rural Australian towns: The discriminating features of place attachment, sense of community and place dependence in relation to place identity. *J. Environ. Psychol.* **2003**, *23*, 273–287. [CrossRef]
96. Lebrusán, I.; Gomez, M. The importance of place attachment in the understanding of ageing in place: "The Stones know me". *Int. J. Environ. Res. Public Health* **2022**, *19*, 17052. [CrossRef]
97. Sun, Y.; Yang, F.; Yung, E.H.; Chao TY, S.; Chan, E.H. Investigating the links between environment and older people's place attachment in densely populated urban areas. *Landsc. Urban Plan.* **2020**, *203*, 103897. [CrossRef]
98. Wiles, J.; Allen, R.; Palmer, A.J.; Hayman, K.; Keeling, S.; Kerse, N. Older people and their social spaces: A study of well-being and attachment to place in Aotearoa New Zealand. *Soc. Sci. Med.* **2009**, *68*, 664–671. [CrossRef]
99. Han, B.; Li, D.; Chang, P.-J. The effect of place attachment and greenway attributes on well-being among older adults in Taiwan. *Urban For. Urban Green.* **2021**, *65*, 127306. [CrossRef]
100. Shenk, D.; Kuwahara, K.; Zablotsky, D. Older women's attachments to their home and possessions. *J. Aging Stud.* **2004**, *18*, 157–169. [CrossRef]
101. Palladino, S. Older migrants reflecting on aging through attachment to and identification with places. *J. Aging Stud.* **2019**, *50*, 100788. [CrossRef]
102. Sieng, V.; Szabó, Á. Exploring the place attachments of older migrants in Aotearoa: A life course history approach. *Adv. Life Course Res.* **2023**, *57*, 100560. [CrossRef] [PubMed]
103. Chan ET, H.; Li, T.E. The effects of neighborhood attachment and built environment on walking and life satisfaction: A case study of Shenzhen. *Cities* **2022**, *130*, 103940. [CrossRef]
104. Li, X.; Jia, T.; Lusk, A.; Larkham, P. Rethinking place-making: Aligning placeness factors with perceived urban design qualities (PUDQs) to improve the built environment in historical districts. *Urban Des. Int.* **2020**, *25*, 338–356. [CrossRef]
105. Zhang, J.; Zhang, Z.; Liang, Y. Exploring the Impact of Accessibility on Place Attachment in Urban Public Open Spaces: A Case Study of Jiamusi City, China. *Buildings* **2024**, *14*, 957. [CrossRef]
106. Arnberger, A.; Budruk, M.; Schneider, I.E.; Stanis, S.A.W. Predicting place attachment among walkers in the urban context: The role of dogs, motivations, satisfaction, past experience and setting development. *Urban For. Urban Green.* **2022**, *70*, 127531. [CrossRef]
107. Adewale, B.A.; Ibem, E.O.; Amole, S.A.; Adeboye, A.B. Place attachment in Nigerian urban slums: Evidence from inner-city Ibadan. *Cities* **2020**, *107*, 102902. [CrossRef]
108. Livingston, M.; Bailey, N.; Kearns, A. Neighborhood attachment in deprived areas: Evidence from the north of England. *J. Hous. Built Environ.* **2010**, *25*, 409–427. [CrossRef]
109. Paydar, M.; Kamani-Fard, A. Perceived legibility in relation to path choice of commuters in central business district. *Urban Des. Int.* **2016**, *21*, 213–235. [CrossRef]
110. Paydar, M.; Kamani Fard, A. The impact of legibility and seating areas on social interaction in the neighbourhood park and plaza. *Archnet-IJAR* **2021**, *15*, 571–588. [CrossRef]
111. Paydar, M.; Kamani Fard, A. The Contribution of Socio-Demographic Factors to Walking Behavior Considering Destination Types; Case Study: Temuco, Chile. *Soc. Sci.* **2021**, *10*, 479. [CrossRef]
112. Paydar, M.; Kamani Fard, A. The Contribution of Mobile Apps to the Improvement of Walking/Cycling Behavior Considering the Impacts of COVID-19 Pandemic. *Sustainability* **2021**, *13*, 10580. [CrossRef]
113. Paydar, M.; Kamani Fard, A. Walking Behavior of Older Adults in Temuco, Chile: The Contribution of the Built Environment and Socio-Demographic Factors. *Int. J. Environ. Res. Public Health* **2022**, *19*, 14625. [CrossRef]
114. Paydar, M.; Rodriguez, G.; Kamani, F.A. Movilidad peatonal en Temuco, Chile: Contribución de densidad y factores sociodemográficos. *Rev. De Urban.* **2022**, *46*, 57–74. [CrossRef]
115. Krogstad, J.; Hjorthol, R.; Tennøy, A. Improving walking conditions for older adults. A three-step method investigation. *Eur. J. Ageing.* **2015**, *12*, 249–260. [CrossRef]
116. Carrapatoso, S.; Cardon, G.; Van Dyck, D.; Carvalho, J.; Gheysen, F. Walking as a mediator of the relationship of social support with vitality and psychological distress in older adults. *J. Aging Phys. Act.* **2018**, *26*, 430–437. [CrossRef]
117. Kamani Fard, A.; Paydar, M.; Gárate Navarrete, V. Urban Park Design and Pedestrian Mobility—Case Study: Temuco, Chile. *Sustainability* **2023**, *15*, 14804. [CrossRef]
118. Paydar, M.; Fard, A.K.; Khaghani, M.M. Walking toward Metro Stations: The Contribution of Distance, Attitudes, and Perceived Built Environment. *Sustainability* **2020**, *12*, 10291. [CrossRef]
119. Paydar, M.; Fard, A.K.; Khaghani, M. Pedestrian Walkways for Health in Shiraz, Iran, the Contribution of Attitudes, and Perceived Environmental Attributes. *Sustainability* **2020**, *12*, 7263. [CrossRef]
120. Paydar, M.; Kamani Fard, A.; Mashlool, F. Cycling network and its related criteria; the case study: Shiraz, Iran. *J. Transp. Health* **2021**, *21*, 101045. [CrossRef]

121. Paydar, M.; Arangua Calzado, J.; Kamani Fard, A. Walking Behavior in Temuco, Chile: The Contribution of Built Environment and Socio-Demographic Factors. *Behav. Sci.* **2022**, *12*, 133. [CrossRef]
122. Paydar, M.; Kamani Fard, A.; Sabri, S. Walking Behavior of Older Adults and Air Pollution: The Contribution of the Built Environment. *Buildings* **2023**, *13*, 3135. [CrossRef]
123. Ewing, R.; Handy, S. Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. *J. Urban Des.* **2009**, *14*, 65–84. [CrossRef]
124. Paydar, M.; Kamani Fard, A.; Gárate Navarrete, V. Design Characteristics, Visual Qualities, and Walking Behavior in an Urban Park Setting. *Land* **2023**, *12*, 1838. [CrossRef]
125. Casakin, H.; Hernández, B.; Ruiz, C. Place attachment and place identity in Israeli cities: The influence of city size. *Cities* **2015**, *42*, 224–230. [CrossRef]

urban science

MDPI

Systematic Review

From Segregation to Fragmentation: Mapping the Recent Global Literature

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Abstract: Urban fragmentation is a phenomenon that characterizes inequalities and their physical reproduction in the geographical space of cities. (1) Background: This polysemic concept is currently on the rise, as cities become increasingly differentiated and disconnected in their internal dynamics. Research on this topic has increased in recent years, paralleling the growing urban complexity influenced by phenomena such as the 2008 crisis and the COVID-19 pandemic. (2) Methods: This study conducts a bibliometric analysis based on a filtered compilation of results extracted from the main indexed bibliographic databases in social sciences for subsequent computer-assisted processing. The objective is to provide a systematic overview of the structure of academic production and to identify its main descriptors. The analysis includes works published in globally indexed media on urban fragmentation, evaluating the progress of recent publications in this area. (3) Results: Findings show a growing and increasingly globalized production, particularly highlighting publications in Latin America, both in case studies and contributions from leading authors and sources with the highest concentration of publications. Thematically, the production leans towards the term fragmentation rather than the classic segregation, focusing on urban spaces and their specificities related to vulnerability and socio-spatial differentiation.

Keywords: urban fragmentation; urban studies; bibliometrics; urban spaces; socio-spatial differentiation; urban processes

1. Introduction

Today's cities are characterized by being a stage for various forms of inequality, which are an expression of the society they contain. These inequalities are clearly manifested in urban spaces where, in addition to the internal contrast of the city, there are elements of differentiation between residents and visitors, all within the framework of cities that are increasingly global yet divided within themselves.

In this context, urban fragmentation emerges as a phenomenon observed in many cities around the world. This process is framed within an analytical category that studies the city and its processes, adapting its approach to the current situation. This term is polysemic and has received contributions over the last few decades from different academic currents, with its theoretical corpus still being unclear and overlapping with other concepts [1].

The burst of the housing bubble in 2008 triggered a severe economic recession that negatively impacted family wealth. The urban economy and real estate market stagnated,

resulting in difficulties in paying mortgages and rents, which increased foreclosures and legal actions for non-payment.

This period of dispossession, notable until 2015, occurred without significant measures to mitigate it. Policies focused on restricting public deficit and rescuing financial institutions. Economic recovery was centered on economic internationalization, causing labor precarization to increase competitiveness in exports and tourism. Policies were implemented to attract international investors, such as tax benefits and fewer bureaucratic barriers [2].

Although production recovered after the crisis, the macroeconomy improved at the expense of widespread wage devaluation, increased job precariousness, and rising urban poverty. The growth in housing prices and rents far exceeded the increase in per capita income, with this problem worsening with the recent COVID-19 crisis [3].

This development set the stage for the emergence and intensification of urban fragmentation processes, marked by the advancement of global neoliberalism and its effects on cities [4]. This process is related to globalization and manifests in both tangible and intangible ways, with aspects such as the physical and social compartmentalization of built space, the political and governance fragmentation of cities, and the diversification in the social structures that develop within the city [5]. These conditions, increasingly widespread around the globe, have led to a growing number of analyses of fragmentation cases, both conceptually and in case studies.

The reproduction of uneven development and capitalist social relations has led to social inequality that has become embedded in space [6]. The neoliberal turn initiated in the last two decades of the last century resulted in higher levels of social and socio-spatial inequality [7].

Today, the growing social polarization is the result of the weakening of the welfare state, the progressive precarization of work in today's world, and the advance of neoliberal ideology [8]. The Great Recession, triggered by the economic crisis of 2008, has further exacerbated economic inequalities and segregation within urban areas [9,10].

In recent years, a new pattern of segregation with urban fragmentation is emerging that explains the structure of the contemporary city, based on the multiplication of separate pieces with limited permeability on a small scale and structuring around large-scale nodes [11]. The existence of internal borders, the deployment of private security devices, and various forms of urban fragmentation, such as the absence of shared spaces, make it difficult or impossible for the more affluent and the poorer populations to interact [12]. In these areas, stigmatized neighborhoods known as 'no-go areas' are created that are left out of the city's relational dynamics [13].

Given this scenario of increasing inequality, identifying contributions from disciplines that contribute to urban fragmentation, both conceptually and in application, is key to uncovering the progress of research [14] and the configuration of scientific production. This analysis is the main purpose of research of this article, which is achieved by detecting reference articles, key authors, or results towards which the bulk of academic publications are directed.

The hypothesis is that urban fragmentation and the inequalities it entails are becoming an increasingly recurrent phenomenon in cities and are being studied with an increasingly global scope. Its growth and impact on society have sparked significant academic interest. The studies that have been conducted have been modifying their parameters and sketching certain paths towards the near future, which this review attempts to discern.

Building on the previous hypothesis, the aim of the following review is to describe and analyze, through a bibliometric study, the scientific production on urban fragmentation in recent years, identifying articles from scientific databases and conducting a systematic investigation of them. Given that the first mentioned crisis marks the beginning of this long

process of increasing territorial imbalance in the city, 2008 has been chosen as the initial year for compiling literature on urban fragmentation, due to its global reach and the impact it has had on this subject from then until the present, 2023, the final year of the search.

This paper is divided into the following different sections that structure its content: an initial introduction that presents and contextualizes the topic, in addition to the objectives and purpose of the work; a theoretical part that presents the classic theories on socioeconomic differentiation of the city, as well as the themes of segregation and urban fragmentation; a third section on sources and methodology used; the main part of the document where the results of the study are shown and the information obtained is detailed; and finally, a conclusion section, where the results of the research are interpreted, a discussion on forthcoming advances in the topic is provided, and the work is concluded.

2. Theoretical Background

2.1. Social Inequality in the City

Urban fragmentation is a concept considered polysemic and lacking a developed theoretical framework [1], thriving in disciplines such as geography in the analysis of the urban phenomenon in a context of informational capitalism post pandemic. It is understood to be linked to the term urban segregation, and there are two predominant conceptual definitions: urban fragmentation as a result of the break with the preceding form and structure of the city, through non-integrated renewal processes that provoke changes in the social division of space [15], or a new pattern of segregation with urban fragmentation, accentuated with physically impermeable boundaries that divide social groups [11].

This dual interpretation of a concept that gains validity in geographic analysis focuses on physical elements as promoters of social processes of social division. From urban sociology, from the origin of the discipline, and explicitly or inherently, multiple contributions to the concept of fragmentation linked to the urban phenomenon have been made, which must be recognized in its update as a category of analysis.

The concept of fragmentation is at the root of sociological reflection on the urban phenomenon, explicitly so, in a way that interprets social processes of fragmentation as not strictly physical but linked to spatial phenomena.

Walter Benjamin addressed in his Arcades Project [16], a study on the origins of bourgeois culture and modernity based on the analysis of the arcades in Paris transformed by Haussmann in the second half of the 19th century, a pedagogy of fragments developed through allegory, which allowed their resignification [17]. For Benjamin, this represented the reinvention of human experience in an increasingly fragmented urban life. Previously, Simmel [18] had already addressed fragmentary issues and their link to space for the analysis of modernity. According to him, the object of sociology should be the forms of interaction, constituted by the fortuitous fragments of social reality, with its fragmentary images being key to the totality of social reality [19].

The notion of fragmentation in Simmel is linked to a proposal for a theory of space, where the margin is placed at the center of sociological analysis, since the boundary is not a spatial fact with sociological effects but a sociological fact with a spatial form. The joint analysis of the fragmentary in Simmel and Benjamin, related to the city and modernity, led to subsequent developments until it became relevant again [20].

Thus, Simmel is at the origin of the human ecology of the Chicago School. His vision of a city in constant transformation, composed of heterogeneous and interdependent groups and individuals, oriented towards disorganization, whose only recourse was found in distancing, closely resembles Simmel's metropolitan society, in which he attempts to clarify the nature of the city from its parts, norms, and margins [21].

Reflection on fragmentation is inherent in Durkheim's social morphology, which underscores the need for individuals to connect morally to achieve dynamic density, and where some correspondence with the Chicago proposal is noted, mediated by Halbwachs [22]. Fragmentation is also inherent in the establishment of the social environment as a psychosocial structure in Bronfenbrenner's ecological theory [23], and his allegorical Russian nesting dolls of serialized structures (microsystem, mesosystem, exosystem, macrosystem) [24]. The proposal for a science of social context, econometrics [25], seeks to rehabilitate the ecological model of Chicago in the 21st century, as Wacquant [13] points out.

Current researchers who address urban fragmentation are also clearly influenced by the critical approach of Lefebvre [26–28]. McFarlane [17], for example, bases his entire three-dimensional proposal for interpretation on it: attention to cases, to each material fragment; the transformation generated by material fragments on other fragments; and the relationship of material fragments with the whole, with the totality, of the urban process. Indeed, the French sociologist, for whom spatial fragments as products of capitalist urbanization are in tension with the possibility of becoming generative spaces of challenges or transformations of other fragmentation processes, has generated a line of work in the Anglo-Saxon academic literature dedicated to fragmentation [29–32].

Chétry [33], from a geographical perspective, acknowledges that the issue of fragmentation originates from the works of American sociology on the globalization of economic structures and their impact on the configuration of the world's major metropolises, the dual and polarized city proposed by Sassen [34] and Mollenkopf and Castells [35].

Wacquant's [13] challenge of reconstructing urban theory and research around the Bourdieusian trialectic of symbolic space, social space, and physical space, with *habitus* as the conceptual core of the process that leads from structure to social practice, and vice versa, includes the fragmentary analysis of the urban, given the relative autonomy and therefore inertia of each of the three spaces. Fragmentation is explicit in that this trialectic addresses territorial stigmatization as a paradigmatic expression of symbolic power in the city and class fragmentation, ethnic division, and the penalization of the neoliberal state. The fragmentation of wage labor is equally explicit in this work, crystallized in the precariat, and constitutive of the advanced marginality of the dual metropolis, which centers Wacquant's own analysis [36–38].

Research based on the neighborhood effect, as a generator of an enclosure and a social and spatial withdrawal of inhabitants incompatible with an integration process, is theorized with extensive literature [39–41], as noted in Geography by Cary and Fol [42]. Fragmentation is inherent to the three types of effects defined by Manski [43,44]: endogenous, correlated, and exogenous.

Fragmentation as a concept has been present in urban sociology from its inception and involves a conversation and overlap of analytical proposals that range from Simmel to Benjamin; from the human ecology of the Chicago School to Durkheim's social morphology; from Lefebvre's critical approach to Bourdieu's trialectics and the neighborhood effect. In this analytical continuum on fragmentation from urban sociology, explicitly or inherently, we note the articulation of two essential questions: what do we fragment and how do we fragment? The problematization of fragmentation from urban sociology provides a solid foundation for the current reconceptualization of urban fragmentation as a category of analysis in geography.

2.2. Urban Segregation and Fragmentation

As Musterd [7] points out regarding urban segregation, an appropriate and clear conceptualization is required. The line dividing the concepts of segregation and frag-

mentation may seem thin, and some authors refuse to make a choice, using both terms interchangeably [45]. However, they are two different concepts.

The notion of segregation was born in an early phase, at least with the Chicago School from the 1920s, and fragmentation emerged about a quarter of a century ago [42]. In 1988, Massey and Denton [46] published a key article to measure residential segregation where, although the authors and technological advancements have allowed for improved indicators, the methodological foundations of their analysis are definitively established. With Bourdieu's trialectic theory of space (the symbolic, social, and physical spaces), Wacquant [13] has unraveled over decades the variations of urban segregation and analyzed all its possibilities and characteristics. His work, along with other key authors like Musterd [7,47], could be understood as the epistemological culmination of this theoretical concept. For this reason, Carrel et al. [45] suggest abandoning the old concept, segregation, and asking about the new one, fragmentation. The more recent term of fragmentation is interesting because it corresponds well with the heterogeneity of today's cities [8]. It allows a fresh look at the socio-spatial divisions of urban space [33].

Nevertheless, fragmentation is a complex phenomenon, as diverse causes can produce similar effects across different contexts. Thus, in Northern countries, emphasis is often placed on the influence of economic transformations on spatial organization. On the one hand, the shift to a post-Fordist economy—more flexible, less industrial, and characterized by smaller production units—produces significant spatial effects, notably by enhancing companies' ability to relocate. Furthermore, cities have implemented policies to become more appealing to businesses and their top executives, drawing on the leeway they gained through decentralization. [42].

Urban segregation describes the uneven distribution of different social groups within a city [7,48,49]. Urban fragmentation goes beyond segregation and relates social separation to spatial separation [50]. Thus, urban fragmentation would be a process of closing off territories that are spatially delimited and inhabited by socially homogeneous populations. While segregation refers more to a separation in the interdependence of geographic areas and their inhabitants, fragmentation refers, in its spatial dimension, to a situation of splintering—or even dispersion—of the urban fabric, marked by the absence of continuity and physical contiguity between different urban zones and a scant articulation among them. In its social dimension, it refers to a tendency of these different fragments to withdraw into themselves socially, culturally, politically, and/or identity-wise [51].

Fragmentation implies social fracture and secession, a barrier. Thus, the notion of fragmentation emphasizes the discontinuities of urban fabric. It refers to the idea of a loss of the organic unity of the city, in favor of small, juxtaposed units, but not necessarily interconnected [42]. The fragmented city is, therefore, a mix of disconnected and poorly articulated uses [8].

There is no linear or mechanical relationship between segregation and fragmentation. Fragmentation is a much less common notion than segregation [42]. It is a complex phenomenon, with a variety of causes that produce similar effects in different contexts. Navez-Bouchanine [49] subdivides fragmentation into four dimensions: (1) social, (2) urban form, (3) socio-spatial, and (4) administrative and political aspects of the urban territory. She describes it as a splintering, as an urban mosaic, and as fractal urban growth, multiplying the cuts and internal boundaries.

In conclusion, fragmentation compromises the very idea of the city as unity in diversity, while segregation does not eliminate the perception of the city as a geographically coherent entity and does not question the whole [52]. In fragmentation, the city has lost its organic unity, whereas segregation organized the division of a city conceived as a whole. Urban segregation trends continue to rise in large cities while simultaneously spreading to small-

and medium-sized ones [48]. The neoliberal city model reinforces this trajectory unless the necessary political measures are adopted to foster greater spatial justice.

3. Materials and Methods

To achieve the set goals, bibliometric research has been conducted, which is a computer-assisted systematic review of existing scientific production in a specific field or subject [53]. This systematic review was carried out in accordance with the guidelines established in The PRISMA 2020 statement paper, thereby ensuring a rigorous methodological process that enhances the transparency, reproducibility, and reliability of the review. In this case, it concerns urban fragmentation, extracting productions from the two most important bibliographic databases in the social sciences: Scopus and Web of Science. From the latter, the three main indices containing the most relevant productions have been selected: Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), and the Emerging Sources Citation Index (ESCI), all included in the WOS Core Collection.

This review aims to identify the main trends in scientific production, the structure of production, and the most notable specificities thereof. The search was organized using the following search operator: TITLE-ABS-KEY ("urban fragmentation"), so as to identify occurrences of urban fragmentation in title, abstract, or keywords in all the languages covered by the search engine. This operation was repeated identically in both search engines, thus obtaining the first raw sample of information in two ".bib" format files.

To standardize the formats resulting from each database, RStudio software 4.3.2. was used, which allowed for the extraction of a single file to work on in ".xlsx" format, accepted in the analysis software used subsequently.

Once the initial search was formulated, with 395 records obtained, duplicate results were removed, reducing the amount to 185 across both databases, eliminating up to 210 results. Subsequently, the results were filtered by publication date. Publications covering the period from 2008, the start of the Great Recession and the time when the phenomenon of urban fragmentation began to multiply, up to the present (end of 2023) were selected. After this step, the total number of publications was reduced by 33, leaving 152 records.

The last step before analysis involves filtering the results by theme. When searching for scientific productions on urban fragmentation, publications related to habitat fragmentation or urban ecology may be erroneously obtained, and thus themes such as biodiversity, pollution, engineering, or environmental studies included. Therefore, the results were filtered by theme, eliminating 19 more. The database configured for analysis ended up with 133 scientific publications finally.

When conducting this study, it is necessary to consider the limitations that may arise from using these search engines [54], which sometimes may not capture all the complexity and depth of scientific production in a specific field, whether due to the formulation of search operators or the coverage of the databases in the journals they host, to name a few examples. This can lead to the omission of some documents related to the subject that fall outside the scope of these bibliographic repositories due to the indexing of journals or the nature of the works not collected, such as conference journals or some book chapters. Nonetheless, the sample is considered to be sufficiently significant.

The software used for the empirical analysis of this work is Biblioshiny, an application of the Bibliometrix package for Rstudio that allows for descriptive analysis of bibliographic databases [55], with the goal of interpreting a specific scientific production in the best possible way. Thus, by importing the previously filtered bibliographic base in ".xlsx" format, with comma separation, the bibliometric analysis was able to be conducted.

In the following diagram (see Figure 1), the phases of the process are summarized, from the initial insertion of the search operator in both databases to the final sample, illustrating each step in alignment with the bibliometric research method and the principles set out in The PRISMA 2020 statement.

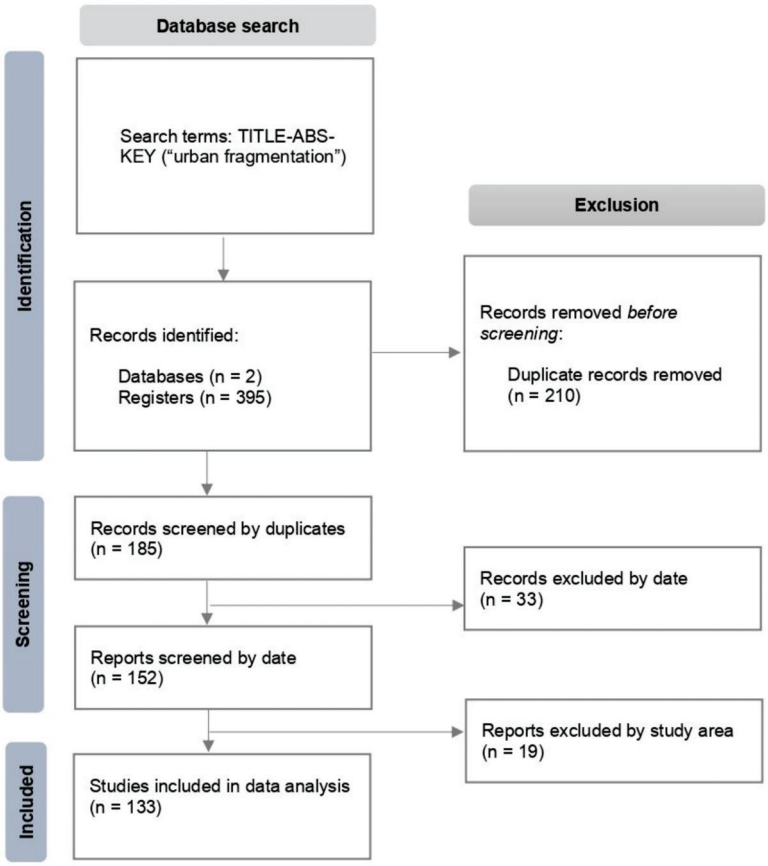

Figure 1. PRISMA flow diagram of the systematic review.

4. Results

After the search and screening process, 133 results from 78 sources were obtained, corresponding to the most relevant indexed scientific production on urban fragmentation from 2008 to the present (end of 2023) (Figure 2), authored by 232 different writers.

Broadly speaking, it can be observed that global production has remained steady and even increased since 2008, the year the global financial crisis erupted and urban inequality increased, a main driver of case studies on fragmentation. After a peak in the year the bubble burst, scientific production increased to reach its maximum in 2023 with about twenty indexed works, with the second highest value being in 2021 with 14. This fact points to fragmentation as a growing topic of debate gaining importance given the current context in cities around the world, increasingly recurring in global literature.

The production in this period is spread across four different continents, including Africa, Europe, Asia, and both North and South America. This points to a global diffusion of fragmentation issues and their study, as a term present in global science and relevant case studies distributed around the planet.

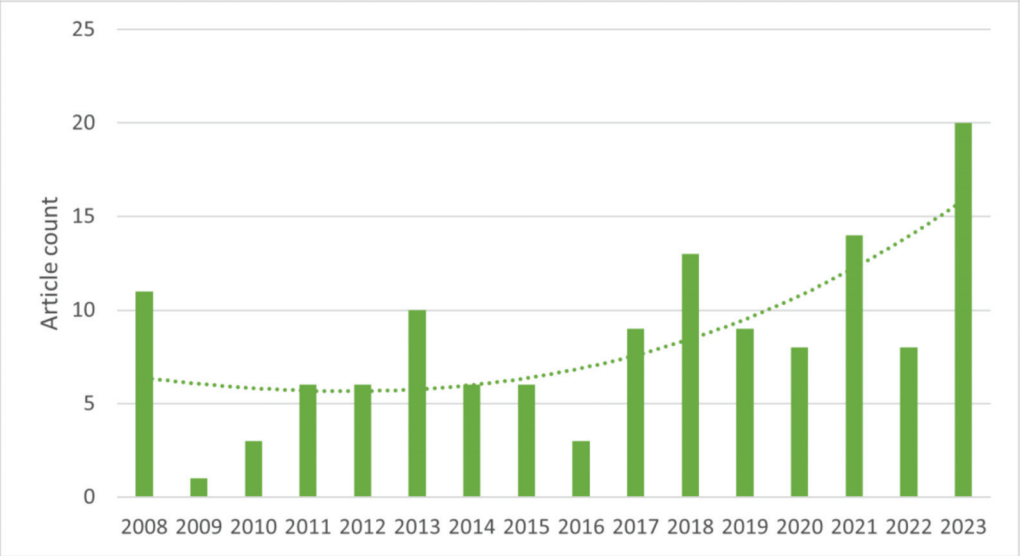

Figure 2. Evolution of annual scientific production on urban fragmentation (2008–2023).

4.1. Themes

In terms of themes, the keywords and approaches taken show the multidisciplinary nature of the concept, but always centered on urban specificity and its processes. The following analysis includes the words included in the title, abstract, and keywords section of the extracted scientific production.

Thus, by extracting the most common words in titles, abstracts, and keywords, fragmentation stands out as the common thread of most research, which orbits around urban processes and their governance: planning, development, expansion, or delimitation of these areas. Additionally, terms that refer to new spatial patterns of fragmentation, such as gated communities, are reflected (Table 1).

Table 1. Most common keywords.

Keywords	Count
Fragmentation	19
Urban area	13
Urban development	11
Urban planning	11
Urbanization	10
Urban sprawl	8
Cities	7
Metropolitan area	7
Gated community	7
Social segregation	7

More broadly, in the word cloud shown below with a wider conceptual range (Figure 3), other aspects stand out in the scientific production on urban fragmentation, such as the analysis of cities and metropolitan areas, the emergence of classical views such as social exclusion or segregation, and secondary themes such as infrastructure, housing, public space, urban morphology, population, or mobility.

The word cloud (Figure 3) also highlights some of the most frequent study locations, showing where the urban fragmentation hotspots analyzed by scientific studies are: Argentina, Brazil, Chile, China, the United States, and Mexico are some of the prominent countries derived from the analyzed articles.

If the keywords are analyzed from an evolutionary perspective, fragmentation appears increasingly frequently in the extracted bibliography, being the term with the greatest rise from 2008 to 2023, considering the growing importance of this phenomenon and its analysis. The concept of fragmentation stands out above others that focus on the urban sphere, such as planning, development, or urban sprawl, in addition to the classic term segregation, which falls outside the keywords with the greatest evolution, represented in Figure 4.

Figure 3. Word cloud with the most repeated concepts in the search.

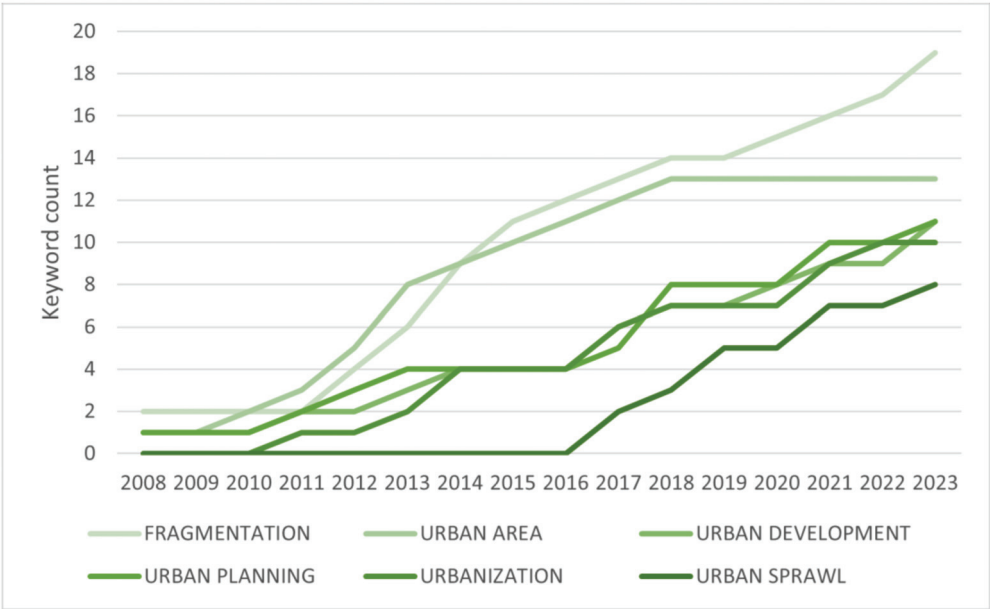

Figure 4. Evolution of the most repeated keywords in the search.

4.2. Affiliations and Origins

In the field of countries with the highest scientific contribution to urban fragmentation, there is a notable dominance of Latin and Western regions. In relation to this, another noteworthy aspect of the selected bibliography is the language of production of its articles. Considering the prominent standardization of English as the main language in most high-impact journals, the Latin and Southern European regions acquire significant weight,

accounting for the production hub that this region represents. Of the total 133 results in the selected sample, there are 75 in English, 44 in Spanish, 8 in French, 4 in Portuguese, and 2 in Italian.

However, it is important to highlight the emerging growth of studies on urban fragmentation in Chinese academia. These studies are gaining relevance both in national scientific production and among Chinese authors writing from other countries or in journals that are growing within China itself. These analyses address inequalities in both the West and China, as the cities of this Asian country are also affected by urban neoliberalism, a global phenomenon.

In terms of the publication mediums that have most extensively covered this topic, the journal *EURE* (*Revista Latinoamericana de Estudios Urbano Regionales*) stands out significantly above the rest. This journal, based at the Pontificia Universidad Católica de Chile, features up to 24 of the 133 articles included in the study, far exceeding the second most productive medium on urban fragmentation, the journal Urban Studies (of Anglo-Saxon scope) from Sage Journals with five registered publications.

These results position *EURE* as the epicenter of production on urban fragmentation, highlighting the relationship between fragmentation and its focus of study as a regional theme, with a special impact in Latin America and a multitude of cases manifesting in its cities and metropolitan areas, with new spatial patterns of segregation such as gated communities or condominiums.

In line with the aforementioned, studying the production according to the nationality of the authors' affiliations, the dominance of Spanish-speaking countries continues (Table 2). In fact, synergies have been generated between the different countries and institutions that have published on this topic in the last fifteen years. Mexico, Spain, and Chile stand out, and among the countries with the most producing authors are also Argentina, Brazil, Colombia, and Peru.

Table 2. Countries' scientific production in analyzed period.

Country	Count
Mexico	36
Spain	28
Chile	23
USA	20
France	18
Argentina	17
Brazil	12
Colombia	11
China	6
Peru	6

Finally, other countries show an upward trend in the study of fragmentation, due to the presence of case studies and the formation of new publication centers, in places such as China, the United States, and France. The Chinese case has already been mentioned. The United States accounts for 20 articles during the studied period, demonstrating the interest in urban fragmentation and the expansion of the phenomenon in North American cities. France also has a certain tradition and references authors in urban fragmentation. In fact, some paved the way for their theories to be later applied in spaces around the world [50].

Regarding specific affiliations (Table 3), the University of Colima, located in Mexico, stands out with eight indexed contributions in the databases. Similarly, the other universities with the highest production are also in Latin America, with the next two being Chilean,

the fourth also Mexican, and the seventh Argentine. They are accompanied by universities from countries that, as noted, excel in the analysis of this topic, such as China, the United States, and Spain.

Table 3. Most productive affiliations.

Country	Count
Universidad de Colima	8
Pontificia Universidad Católica de Chile	6
Universidad de Chile	5
Universidad de Guadalajara	5
Idaho State University	4
Boise State University	4
Universidad de Buenos Aires	4
Universidad de Guanajuato	4
Universidad Politécnica de Madrid	3
City University of Hong Kong	3

4.3. Notable Authors and Documents

The authorship of the collected works is very diverse, as most authors have a low number of published studies. The observed scientific production does not have a clear structure, as there are no notable co-citation patterns. The authors of the most cited and notable literature indexed in these databases do not cite each other, suggesting a dispersion among the scientific community working on topics related to urban fragmentation.

The most relevant author in the results is Daniel Kozak, affiliated with the University of Buenos Aires and the National Scientific and Technical Research Council (CONICET) in Argentina. This researcher, specialized in urban fragmentation, has published various works ranging from theoretical reflections to case studies, focused on Argentina and its cities, with an eye on large developments, global neoliberalism, or urban sprawl, among others.

Secondly, with three published articles, are Rodrigo Hidalgo and Martín Lemma. These authors are also affiliated with countries in Latin America, specifically Chile and Argentina, confirming the previous trend of this part of the world as a hotspot in the analysis of urban fragmentation.

In the obtained database, the most-cited work corresponds to Walid Oueslati, Seraphim Alvanides, and Guy Garrod [56], with affiliations in France and the UK. It was published in 2015 in the first quartile Scopus journal *Urban Studies* and has a total of 221 citations from its publication to the date of the analysis. The article, following the thematic trend of the selected works, is a large-scale study on urban sprawl in Europe and its determinants in recent decades, providing an overview of the growth of large cities based on economic data and geographic variables. From these data and generated indices, the analyzed changes reveal increasing levels of urban fragmentation in the European cities studied, covering 237, including all major metropolitan areas in Western Europe.

The other most-cited documents correspond to a case study and a theoretical discussion, reaching 132 and 120 citations, respectively. The first is a study on land use and socio-spatial segregation in gated communities and private urbanizations, using the term segregation ambivalently with fragmentation in this case. It was developed in the city of Beijing and published in 2013 in the journal *Urban Geography* by Donggen Wang, Fei Li, and Yanwei Chai [57]. The work serves as a reference to indicate that not only does residential segregation imply socio-spatial differentiation, but it also affects how people spend their time and how they use urban space.

Finally, the third article with the greatest global impact in terms of citations is a theoretical reflection published in 2008 on planning and zoning policies and their effects on development, health, or environmental justice. It is authored by Sacoby Wilson, Malo Hutson, and Mahasin Mujahid [58] in the journal *Environmental Justice*. Their article is important support to many subsequent critical studies on urban governance and planning, concluding with a guide of recommendations to improve the quality of life in fragmented neighborhoods.

5. Discussion and Future Lines of Research

The findings presented demonstrate that urban fragmentation has a significant theoretical background, although it often suffers from conceptual ambiguity and a lack of precise boundaries. This background has expanded in recent years, especially after the pandemic [59], with a growing number of studies focusing on the conceptual disruption of the city as an integrated entity as it was previously understood [45]. These disruptions encompass social, physical, symbolic, and economic fractures.

Most of the analyzed studies approach fragmentation primarily as a physical phenomenon, examining it at the urban scale. Prominent examples include new spatial patterns such as *condominios*, gated communities, and urban sprawl. Most of this research is conducted in Latin America, authored by regional scholars who focus on case studies of major cities and urban areas in the region. These areas exhibit a high prevalence of such patterns, fueling case studies characterized by substantial diversity and stark inequalities. Nevertheless, contemporary cities are increasingly complex spaces influenced by a multitude of variables, some of which remain underexplored in discussions of urban fragmentation.

The inherent complexity of urban spaces has left certain dimensions of fragmentation insufficiently addressed in the existing literature. This concept's multidimensionality extends beyond its physical aspects, encompassing economic, symbolic, and political dimensions, among others. Moreover, fragmentation operates with a distinct multiscalar character, as the urban issues extend well beyond administrative boundaries. Drawing on the analyzed studies and the research gaps identified within them, this article proposes several avenues for advancing the study of urban fragmentation.

One promising avenue for future study is fragmentation associated with the politics of space; a subject explored in its early stages by authors such as McFarlane [60]. This perspective focuses on the fragment itself, examining its specific power dynamics and the decisions that have shaped its development, often aligning with research on inequalities and urban poverty. Some other works focus on examining urban fragmentation in relation to spatial policies, pivoting on the dynamics and characteristics of the fragments themselves [61,62], opening the way to new studies more qualitatively oriented.

Furthermore, in an increasingly globalized world that transcends urban scales [63], it is essential to adopt a more diverse, multi-scalar approach to analyzing fragmentation. This includes not only metropolitan areas but also delving into more detailed studies of districts, neighborhoods, and even smaller territorial units. These levels are often where the most pronounced differences in urban dynamics and relational processes can be observed [64].

Finally, within the context of global capitalist restructuring, with dominant global economic activities homogenizing urban dynamics [65], tourism has emerged as a key driver in shaping urban spaces and a significant driver of fragmentation. Over recent decades, tourism has reshaped urban morphology, transformed societies, redefined economic specializations, and connected distant parts of the world, while intensifying internal fragmentation [66]. Thus, the relationship between the increasingly prominent tourism sector and urban fragmentation represents a critical avenue for future research.

An additional aspect that warrants attention in fragmentation research, beyond the thematic scope, is the limited application of qualitative methodologies. To date, quantitative techniques and spatial analysis have largely dominated this field, highlighting an opportunity for a methodological shift. Such a change could incorporate more detailed scale analyses and explore new dimensions of fragmentation through qualitative approaches.

Another widespread bias observed in most published studies is the tendency to analyze fragmentation phenomena affecting low-income populations, socially vulnerable groups, or communities subjected to ethnic or racial discrimination. On the other hand, studies that examine wealthier groups, business and political leaders, professional executives, and elite immigrants—whose behaviors also contribute to urban fragmentation—are considered only marginally [67].

In summary, future research directions in the study of urban fragmentation could be expanded to include three key areas, among others: (1) examining urban fragmentation in relation to spatial policies, with a particular focus on the dynamics and characteristics of the fragments themselves; (2) exploring urban fragmentation beyond the citywide scale, emphasizing finer-grained levels such as neighborhoods, districts, and even smaller units; and (3) investigating tourism as a driver of fragmentation, given its cross-cutting impact on the transformation of cities globally.

The main limitation of the review stems from the type of works included in the indexed databases used, both of which are focused on journal articles with less presence or direct absence of other publications such as books, book chapters, conference papers, etc. Nonetheless, the validity of these databases is well established, and the sample is significant.

6. Conclusions

This paper analyzes the current scientific production on urban fragmentation through a selection of indexed bibliographies. Starting from a scenario of lacking systematic review of the existing publications in urban studies, this document addresses that need with an analysis and a state of the art that contributes to the development of a burgeoning concept. Therefore, this article fills this gap in the current literature in urban studies, contributing to a greater understanding of urban issues and the structure of the most important scientific contributions, employing an innovative methodology compared to prior reviews in the field of urban studies.

Urban fragmentation represents the physical manifestation of a latent inequality scenario that has persisted for many decades in cities around the world. These cities are no longer cohesive spaces, as segregation once asserted, but rather composed of many disconnected parts, especially in relational, social, and economic aspects, which relate their characteristics to their spatial distribution, leaving a task to local urbanists and city planners. This process has been studied by various authors in recent decades, highlighting the complexity of the phenomenon, the discontinuity of the urban fabric it entails, and the different dimensions it encompasses, ranging from socio-spatial to the governance of space.

Following the search conducted, the phenomenon of fragmentation is configured as a process of growing scientific interest, with an increasingly global reach. Since 2008, when the global financial crisis erupted and urban inequality increased, scientific production has remained constant and even on an upward trend, being situated in more places around the planet.

The thematic approaches are very diverse, with varied production among case studies, theoretical reflections, and conceptual analyses. The most recurrent are those that focus on urban space and its specific processes, concentrating on its physical changes: development, diffusion, planning, and new forms of fragmentation, such as condominiums, gated com-

munities, and private urbanizations. The growing interest in the concept of fragmentation stands out in contrast to the stagnation of classic segregation.

Latin America, represented especially by Chile, Mexico, and Argentina, stands out as one of the main areas of study, both in the authors analyzing these processes and in the journals publishing on them. This occurs in two ways: with its cities as a center of analysis, given their urban inequalities and new forms of urban fragmentation, and on the other hand, through its scientific journals, which have become important spaces for scientific publication related to fragmentation both in Latin America and other regions of the world.

Given the importance and relevance of the urban fragmentation process in today's world, which leads, as has been demonstrated, to a growing academic literary production, future research will be necessary with updates to the literature review conducted here.

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References

1. González-Pérez, J.M.; Parreño-Castellano, J.M.; Sánchez-Aguilera, D. Fragmentación urbana. Marco conceptual para el análisis de la desigualdad en España. In *Geografía: Cambios, Retos y Adaptación. XXVIII Congreso de la Asociación Española de Geografía*, 1st ed.; Arnáez, J., Ruiz-Flaño, P., Pascual-Bellido, N.E., Noemí Lana-Renault, N., Jorge Lorenzo-Lacruz, J., Díez Angulo, A., Martín-Hernández, N., Lasanta, T., Estela Nadal Romero, E., Eds.; Asociación Española de Geografía: Madrid, Spain, 2023; pp. 811–820. [CrossRef]
2. Abellán, J. Vivienda, los Fondos de Inversión y la Reestructuración del Capitalismo Español. 19 November 2015. Contested Cities. Available online: http://contested-cities.net/CCmadrid/la-vivienda-los-fondos-de-inversion-y-la-reestructuracion-del-capitalismo-espanol/ (accessed on 19 November 2024).
3. Alves, P.; San Juan, L. El Impacto de la Crisis Sanitaria del COVID-19 Sobre El Mercado de la Vivienda en España. Boletín Económico. 1–15 February 2021. Available online: https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/InformesBoletinesRevistas/ArticulosAnaliticos/21/T2/Fich/be2102-art16.pdf (accessed on 10 October 2024).
4. Janoschka, M. El nuevo modelo de la ciudad latinoamericana: Fragmentación y privatización. *Eure* **2002**, *28*, 11–20. [CrossRef]
5. Escolano-Utrilla, S.; López-Escolano, C.; Pueyo-Campos, Á. Urbanismo neoliberal y fragmentación urbana: El caso de Zaragoza (España) en los primeros quince años del siglo XXI. *Eure* **2018**, *44*, 183–210. [CrossRef]
6. Smith, N. *Uneven Development: Nature, Capital and Production of Space*; Blackwell: London, UK, 1984.
7. Musterd, S. *Advanced Introduction to Urban Segregation*; Edward Elgar: Cheltenham, UK, 2023.
8. Vasconcelos, P.A. Processus et formes socio-spatiaux des villes: Une contribution au débat. In *Ségrégation et Fragmentation Dans Les Métropoles: Perspectives Internationales*; Carrel, M., Cary, P., Wachsberger, J., Eds.; Presses Universitaires du Septentrion: Lille, France, 2013; pp. 37–62. [CrossRef]
9. Andersson, R.; Hedman, L. Economic decline and residential segregation: A Swedish study with focus on Malmö. *Urban Geogr.* **2016**, *37*, 748–768. [CrossRef]
10. Zwiers, M.; Bolt, G.; Van Ham, M.; Van Kempen, R. The global financial crisis and neighborhood decline. *Urban Geogr.* **2016**, *37*, 664–684. [CrossRef]
11. Burgess, R. Segregación y fragmentación urbana: Algunos comentarios. *Rev. Iberoam. Urban.* **2018**, *14*, 79–86.

12. Svampa, M. Fragmentación espacial y procesos de integración social "hacia arriba". Socialización, Sociabilidad y Ciudadanía. *Espiral Estud. Sobre Estado Soc.* **2004**, *11*, 55–84. [CrossRef]
13. Wacquant, L. *Bourdieu in the City*; Polity Press: Cambridge, UK, 2023.
14. Xi, J.; Liu, X.; Wang, J.; Zhou, C. A systematic review of COVID-19 geographical research: Machine learning and bibliometric approach. *Ann. Am. Assoc. Geogr.* **2023**, *113*, 581–598. [CrossRef]
15. Burgess, R. Violencia y la Ciudad Fragmentada. In *Mujeres en la Ciudad. De Violencia y Derechos, Falú, A., Ediciones SUR*; Red Mujer y Hábitat de América Latina: Córdoba, Argentina, 2009; pp. 99–126.
16. Benjamin, W. *The Arcades Project*, 5th ed.; Harvard University Press: Cambridge, MA, USA, 2003.
17. McFarlane, C. Fragment urbanism: Politics at the margins of the city. *Environ. Plan. Dev. Soc. Space* **2018**, *36*, 1007–1025. [CrossRef]
18. Simmel, G. *Soziologische Aesthetik*, 1st ed.; Die Zukunft: New York, NY, USA, 1986; pp. 204–216.
19. Frisby, D. *Fragmentos de la Modernidad*, 2nd ed.; Visor: Madrid, Spain, 1995.
20. Mele, V. *City and Modernity in Georg Simmel and Walter Benjamin: Fragments of Metropolis*; Palgrave McMillan: New York, NY, USA, 2023. [CrossRef]
21. De la Peña, G. *Simmel y la Escuela de Chicago en Torno a los Espacios Públicos en la Ciudad*; Quaderns-e de l'Institut Català d'Antropologia: Barcelona, Spain, 2003; Volume 1.
22. Martínez, E.; López, A. El desarrollo de la morfología social y la interpretación de las grandes ciudades. *Geo Crítica. Scr. Nova. Rev. Electrónica Geogr. Cienc. Soc.* **2002**, *6*. Available online: https://revistes.ub.edu/index.php/ScriptaNova/article/view/445 (accessed on 8 December 2024).
23. Bronfenbrenner, U. *La Ecología del Desarrollo Humano*; Paidós: Barcelona, Spain, 1971.
24. Pérez-Fernández, F. El medio social como estructura psicológica: Reflexiones del modelo ecológico de Bronfenbrenner. *EduPsykhé: Rev. Psicol. Psicopedag.* **2004**, *3*, 161–177. [CrossRef]
25. Sampson, R.J. Urban sustainability in an age of enduring inequalities: Advancing theory and ecometrics for the 21st-century city. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 8957–8962. [CrossRef]
26. Lefebvre, H. *El Derecho a la Ciudad*, 3rd ed.; Ediciones Península: Barcelona, Spain, 1975.
27. Lefebvre, H. *The Production of Space*, 4th ed.; Blackwell: London, UK, 1991.
28. Lefebvre, H. *Les Illusions de la Modernité*, 1st ed.; Le Monde Diplomatique: Paris, France, 1989.
29. Buckley, M.; Strauss, K. With, against and beyond Lefebvre: Planetary urbanization and epistemic plurality. *Environ. Plan. D Soc. Space* **2016**, *34*, 617–636. [CrossRef]
30. Merrifield, A. *The New Urban Question*; Pluto Press: London, UK, 2014. [CrossRef]
31. Pinder, D. Reconstituting the Possible: Lefebvre, Utopia and the Urban Question. *Int. J. Urban Reg. Res.* **2015**, *39*, 28–45. [CrossRef]
32. Stanek, L. *Henri Lefebvre on Space: Architecture, Urban Research, and the Production of Theory*; University of Minnesota Press: Minneapolis, MN, USA, 2013.
33. Chétry, M. La fragmentation: Un nouveau regard sur la ville brésilienne? In *Ségrégation et Fragmentation dans les Métropoles: Perspectives Internationales*; Carrel, M., Cary, P., Wachsberger, J., Eds.; Presses Universitaires du Septentrion: Lille, France, 2013; pp. 121–126. [CrossRef]
34. Sassen, S. *The Global City: New York, Londres, Tokyo*; Princeton University Press: Oxford, UK, 1991.
35. Mollenkopf, J.; Castells, M. (Eds.) *Dual City: Restructuring New York*; The Russel Foundation: New York, NY, USA, 1992.
36. Wacquant, L. Territorial Stigmatization in the Age of Advanced Marginality. *Thesis Elev.* **2007**, *91*, 66–77. [CrossRef]
37. Wacquant, L. *Urban Outcasts: A Comparative Sociology of Advanced Marginality*; Polity: Cambridge, UK, 2008.
38. Wacquant, L. Urban Desolation and Symbolic Denigration in the Hyperghetto. *Soc. Psychol. Q.* **2010**, *20*, 1–5. [CrossRef]
39. Ellen, E.; Turner, M.A. Does Neighborhood Matter? Assessing Recent Evidence. *Hous. Policy Debate* **1997**, *8*, 833–866. [CrossRef]
40. Goering, J. *Choosing a Better Life? Evaluating the Moving to Opportunity Social Experiment*, 3rd ed.; The Urban Institute Press: Washington, DC, USA, 2003.
41. Rose, D.; Seguin, A.M. Les débats sur les effets de quartier: Que nous apprennent les approches centrées surles réseaux sociaux et le capital social? In *Le Quartier: Enjeux Scientifiques, Actions Politiques et Pratiques Sociales*, 1st ed.; Authier, J.Y., Bacqué, M.H., Guérin-Pace, F., Eds.; Éditions La Découverte: Paris, France, 2007; pp. 217–228.
42. Cary, P.; Fol, S. Introduction. Les métropoles soumises à des transformations socio-spatiales. In *Ségrégation et Fragmentation dans les Métropoles: Perspectives Internationales*; Carrel, M., Cary, P., Wachsberger, J., Eds.; Presses Universitaires du Septentrion: Lille, France, 2013; pp. 352–361. Available online: https://books.openedition.org/septentrion/7800 (accessed on 16 March 2025).
43. Manski, C.F. Identification of endogenous social effects: The reflection problem. *Rev. Econ. Stud.* **1993**, *60*, 531–542. [CrossRef]
44. Manski, C.F. Economic analysis of social interactions. *J. Econ. Perspect.* **2000**, *14*, 115–136. [CrossRef]

45. Carrel, M. Conclusion: Ségrégation et fragmentation, de quoi et au nom de qui parle-t-on? In *Ségrégation et Fragmentation dans les Métropoles: Perspectives Internationales*; Carrel, M., Cary, P., Wachsberger, J., Eds.; Presses Universitaires du Septentrion: Lille, France, 2013; pp. 345–352. Available online: https://books.openedition.org/septentrion/7839 (accessed on 16 March 2025).
46. Musterd, S. *Handbook of Urban Segregation*; Edward Elgar: Cheltenham, UK, 2020. [CrossRef]
47. Massey, D.S.; Denton, N.A. The dimensions of residential segregation. *Soc. Forces* **1988**, *67*, 315. [CrossRef]
48. Huntington, D. Revisiting the impact of urban shrinkage on residential segregation in European cities. *Vienna Yearb. Popul. Res.* **2023**, *21*, 1–28. [CrossRef]
49. Préteceille, E. La ségrégation sociale a-t-elle augmenté? La métropole parisienne entre polarisation et mixité. *Sociétés Contemp.* **2006**, *62*, 69–93.
50. Navez-Bouchanine, F. *La Fragmentation en Question. des Villes Entre Fragmentation Spatiale et Fragmentation Sociale'*; L'Harmattan: Paris, France, 2002.
51. Wachsberger, J.M. Portée et limites des indicateurs statistiques de fragmentation et de segregation. In *Ségrégation et Fragmentation dans les Métropoles: Perspectives Internationales*; Carrel, M., Cary, P., Wachsberger, J., Eds.; Presses Universitaires du Septentrion: Lille, France, 2013; pp. 79–96. Available online: https://books.openedition.org/septentrion/7807 (accessed on 16 March 2025).
52. Navez-Bouchanine, F. Des villes entre fragmentation spatiale et fragmentation sociale: Une approche critique de la notion de fragmentation. In *Vocabulaire de la Ville. Notions et Références*, 1st ed.; Dorier-Apprill, E., Ed.; Édition du Temps: Paris, France, 2001; pp. 109–118.
53. Qu, H.; Nordin, N.A.; Tsong, T.B.; Feng, X. A Bibliometrics and Visual Analysis of Global Publications for Cognitive Map (1970–2022). *Inst. Electron. Electron. Eng.* **2023**, *11*, 52824–52839. [CrossRef]
54. Haustein, S.; Larivière, V. The use of bibliometrics for assessing research: Possibilities, limitations and adverse effects. In *Incentives and Performance: Governance of Research Organizations*; Welpe, I.M., Wollersheim, J., Ringelhan, S., Osterloch, M., Eds.; Springer International Publishing: New York, NY, USA, 2014; pp. 121–139. [CrossRef]
55. Aria, M.; Cuccurullo, C. Bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Infometrics* **2017**, *11*, 959–975. [CrossRef]
56. Oueslati, W.; Alvanides, S.; Garrod, G. Determinants of urban sprawl in European cities. *Urban Stud.* **2015**, *52*, 1594–1614. [CrossRef]
57. Wang, D.; Li, F.; Chan, Y. Activity Spaces and Sociospatial Segregation in Beijing. *Urban Geogr.* **2013**, *33*, 256–277. [CrossRef]
58. Wilson, S.; Hutson, M.; Mujahid, M. How planning and zoning contribute to inequitable development, neighborhood health, and environmental injustice. *Environ. Justice* **2008**, *1*, 211–216. [CrossRef]
59. Horrach, B.; Vilá-Vázquez, J.I.; Jiménez-Barrado, V. Apuntes sobre la construcción conceptual latinoamericana de la fragmentación urbana. Un enfoque hacia el vector turístico. *Rev. De Geogr. Norte Gd.* **2024**, *90*, 1–23.
60. McFarlane, C. *Fragments of the City: Making and Remaking Urban Worlds*, 1st ed.; University of California Press: Oakland, CA, USA, 2021.
61. Zhou, L.; Gong, Y.; López-Carr, D.; Huang, C. A critical role of the capital green belt in constraining urban sprawl and its fragmentation measurement. *Land Use Policy* **2024**, *141*, 107148. [CrossRef]
62. Morales, E.R. Planned Socio-Spatial Fragmentation: The Normalisation of Gated Communities in Two Mexican Metropolises. *Urban Plan.* **2024**, *9*, 6879. [CrossRef]
63. Kozak, D. Fragmentación Urbana y Neoliberalismo Global. In *Ciudades Compactas, Dispersas, Fragmentadas*, 1st ed.; Pradilla Cobos, E., Ed.; Universidad Autónoma Metropolitana Xochimilco y Miguel Angel Porrúa Editor: Xochimilco, Mexico, 2011; pp. 13–62.
64. Marengo, M.C.; Elorza, A.L. Segregación residencial socioeconómica y programas habitacionales públicos: El caso del programa "Mi casa, Mi vida" en la ciudad de Córdoba. *Rev. Iberoam. Urban.* **2018**, *14*, 43–58.
65. Pérez-Peñuelas, B.O. Problemática en la delimitación de fragmentación urbana por compartir procesos con otros impactos urbanos. *Rev. Ciudad. Estados Política* **2021**, *8*, 143–160. [CrossRef]
66. Bridge, G.; Watson, S. *A Companion to the City*; Blackwell: London, UK, 2000.
67. Baldán, H.; Torrado, J.M.; Susino, J. Beyond Gated Communities: A Typology of Residential Compounds in Granada. *Land* **2024**, *13*, 1116. [CrossRef]

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Review

Shrinking for Survival: Integrating Degrowth Principles into Texas Zoning Regulations

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Abstract: The degrowth movement is gradually gaining recognition within North American urban planning, but its influence and application remain limited. Most degrowth-oriented initiatives have remained at a small scale, mostly pertaining to communities and neighbourhoods. This study explores whether it is possible to incorporate degrowth principles into larger planning institutions and policies. The paper reviews existing studies on zoning policies and the degrowth movement, employing a qualitative research approach, and utilising secondary data analysis through document and critical discourse analysis. Through this exploration, this study aims to contribute to upscaling and institutionalising degrowth principles and to provide a clear outlook on the movement and its characteristics. Drawing on 32 key sources on zoning and degrowth, alongside two policy documents and a case study of Texas, this study applies coding, content analysis, and GIS mapping to explore the intersections of zoning regulations and degrowth principles in urban planning. The six key principles found to be essential to the degrowth movement—decoupling economics, fostering stronger communities, self-sufficiency, equity, political autonomy/collaboration, and ecological/environmental protection—were analysed in the context of the Texas municipal code for zoning to see whether current zoning ordinances follow the degrowth ideology. The findings reveal that while aspects of degrowth, such as affordable housing initiatives and environmental sensitivity, are present in Texas' zoning regulations, these remain minimal and often constrained by the overarching focus on economic profitability. To integrate degrowth principles more effectively, significant reforms are required, including disengaging zoning ideologies from economic growth, fostering autonomy and self-sufficiency, and reimagining zoning practices to prioritise equity, ecology, and collective resource management.

Keywords: zoning; evolution; degrowth; sub-branch; principles

1. Introduction

Since its first application in 1880, the USA has heavily depended on zoning as its main land use control method [1]. This practice consists of categorising plots of land based on specific criteria. These criteria can change according to the type of zoning (from now on referred to as zoning sub-branches) or according to state regulations. Traditional zoning regulations, also known as Euclidean zoning, have driven American urban development, despite their drawbacks and the formation of alternative zoning sub-branches.

Another concept that has been gaining traction in American urban planning practices is degrowth. Although it is not a direct spatial intervention, the ideology of degrowth

has become increasingly significant for our daily needs and circumstances, emphasising resource conservation and abandoning the economics-driven planning perspective. Degrowth has only been applied at a neighbourhood level so far in the United States. To truly shift our planning processes and to encourage more sustainable practices and equitable resource distribution, economics-oriented city planning approaches have to be tackled institutionally. This paper aims to contribute to the upscaling and institutionalisation of degrowth. By combining the concepts of degrowth and zoning, the main contributions will be to clarify what the degrowth movement entails, and how it can be integrated into urban planning policy.

This paper takes zoning as an example of integrating degrowth principles into a major spatial planning tool used in the US, specifically focusing on Texas. Given that Texas is a state with flexible zoning regulations, degrowth principles can theoretically be easily applied in urban planning, allowing for interpretation of whether it is possible to integrate degrowth into broader contexts with flexible zoning regulations and assess its actual application. Hence, this paper will aim to answer two questions:

- To what extent are current zoning regulations aligned with degrowth principles?
- How can degrowth principles be better integrated into urban planning institutions and land use control methods, such as zoning?

By answering these questions, this paper will uncover whether degrowth principles can be applied in larger urban planning institutions at the city scale.

The principal findings show that although zoning currently resembles some aspects of degrowth, it mainly prioritises function and growth. By bringing together this frequently utilised land use control method and degrowth, our policies can actively pursue greater sustainability and downscaling to condense our built environments.

This study begins with a literature review to contextualise and create a better understanding of each planning tool, followed by the Section 3 to explain the use of secondary data to conduct research, and the selection of Texas as a case study to understand the real-life application of zoning and potentially degrowth. Afterwards, results will illustrate the level of overlap between current zoning regulations and degrowth principles in the State of Texas. The discussion will focus on the possibilities of aligning the foundations of degrowth with zoning practices. This is followed by a conclusion exploring what changes are required to fuse these two concepts in urban planning policies in the United States while answering the previously stated research questions.

2. Literature Review

This literature review is separated into two sub-sections. First, zoning is explored in terms of its purpose and the development and practical differences of sub-branches. This helps to build an understanding of the historical precedent attached to zoning and to show how common this planning tool truly is in American urban planning practices. The second sub-section will examine the degrowth movement, what it entails, and what its main goals are. By unpacking these two planning concepts, a more concrete understanding of both tools can be created, as well as a clearer path for research to see where and how these concepts may overlap.

2.1. Zoning

Since the late 1800s, zoning has been a major tool used across the United States to control land use [1]. By controlling the intensity and the types of developments that occur, Euclidean zoning helps allocate costs effectively across cities [2]. While its original aim was to avoid market failure and provide social welfare for communities, traditional

zoning quickly faced criticism [3]. Its prioritization of economics and its highly political nature have been cited as contributing to segregation and environmental injustice. This is underscored by the fact that when zoning was initially created, one of the two types invented was racial zoning, where minority groups were targeted and neglected [4,5].

Most of the initial developments in zoning ordinances were dependent on the urban elite and significant political figures. Their influence on institutionalised planning practices was based on their economic power and ownership of property [4]. An example of this is when height restrictions were upheld in 1909 in Baltimore, leading to urban sprawl for the sake of development [6,7]. The lower height requirements caused amenities to spread across the land to accommodate building, which subsequently led to the sale of more land and units. The sprawl caused by this has reinforced segregation and classism due to car dependence that could only be afforded by certain income groups [8,9]. The combination of urban sprawl and increased car use leads to environmental degradation due to high carbon emissions. Furthermore, the zoning of certain land use types can cause spillovers into other zones, affecting both the environment and public health [2,10]. This is further emphasised by researchers through the concept of 'environmental racism', claiming that poor and minority communities tend to inhabit zones prone to spillovers [11].

Lastly, for decades it has been argued that one of the major disadvantages of Euclidean zoning is its contribution to rising housing and land prices. This has been repeatedly argued by scholars to reinforce the discriminatory outcomes of zoning [2,4,8]. This argument is supported by evidence that restrictions on housing supply and development due to zoning ordinances increase demand and therefore drive up prices.

These practices, which placed more weight on economic growth and separation, continued well into the 1950s [9,12]. However, the criticism of zoning practices led to the creation of new types of zoning. In the 1970s, two sub-branches of zoning were introduced to urban planning discourse: inclusionary zoning and performance zoning [4,13,14]. More participatory approval processes for project developments were implemented, and affordable housing schemes were made more accessible and available through 'Priced Dwelling Units' as part of inclusionary zoning [9]. Inclusionary zoning mostly aims to include racial minorities and lower-income groups in targeted planning initiatives [8,13]. In accordance with the participatory aspect of inclusionary zoning, performance zoning can help reflect the character of a community more accurately through predetermined standards based on local conditions [10,15]. Additionally, performance zoning ordinances can be written in a way that encourages development and incentivises certain practices, meaning they can prioritise aspects such as environmentalism [15].

Another zoning sub-branch that emerged was incentive zoning. This sub-branch allows developers and planning institutions to negotiate floor-to-area ratios, enabling the construction of higher-density developments in exchange for social service provision (such as landscaping and public space, among others) [16]. Incentive zoning aims to address issues of sprawl and standardisation created by Euclidean zoning practices, promoting diversity in the urban fabric and shaping how our built environments look and function. However, this approach can arguably enhance market-based land use planning through the commodification of land [17,18] By shifting the responsibility of providing public amenities to private developers, governmental institutions risk the construction of unattractive and underutilised public spaces that only meet minimal standards [19].

Lastly, to tackle the lack of environmental protection in Euclidean zoning, form-based zoning codes were created. By integrating buildings into urban contexts, rather than assigning zones to land use types, planners have more control over the environmental impact of buildings and can maintain sustainability and environmental stability [9,10].

While zoning was initially employed due to its economic and discriminatory tendencies, it has since transformed to tackle these issues while also incorporating sustainability and equity into its approach. The evolution of this practice has also partly reflected the divide in opinions between those who defend strict regulations (Pigouvian) and those who defend public choice (Coasian) [20]. However, it is important to note that much of the discourse and research on zoning applications and sub-branches relies on older sources. This highlights the need for more up-to-date research on zoning to truly understand how the practice has evolved and whether there is space for more change. Through these changes, certain principles of degrowth can also be identified and potentially incorporated into zoning regulations to address the weaknesses of zoning (segregation, environmental degradation, and political inequity, among others highlighted in this section).

2.2. Degrowth

Evidently, traditional zoning practices reinforce certain economic cycles that only benefit property owners [21]. As Euclidean zoning helped to stabilise the real estate market and commodify housing, this is exactly what it has been criticised for, as such priorities neglect the need for community participation and social welfare provision in favour of profitable construction patterns for homeowners and property owners [21]. Alongside the criticism regarding the prioritisation of commodification and profit, traditional zoning is criticised for advancing urban sprawl, which is an undesired outcome, especially within the degrowth movement. This is because urban sprawl is perceived to be environmentally harmful and causes issues such as biodiversity loss [22]. To address these criticisms, modern zoning practices have begun to reflect certain principles of the degrowth movement. To fully understand the relationship between the reinforced cycles caused by Euclidean zoning and degrowth, we need to further explore what degrowth entails.

The degrowth movement has been defined in multiple ways. For instance, Savini (2021) claims that degrowth is "a collective and deliberative process aimed at the equitable downscaling of the overall capacity to produce and consume and of the role of markets and commercial exchanges as a central organizing principle of human lives" [21]. Other definitions proposed by Khmara et al. and Xue emphasise the importance of ensuring equity, well-being, and high quality of life while reducing ecological degradation and downscaling production to provide more sustainable livelihoods in both the short and long term [17,18,22]. Already, the importance of maintaining environmental integrity and relegating economic growth is heavily incorporated into the movement. Essentially, one of the key ideologies behind degrowth is to reduce competition and de-commodify aspects of urban life [21]. This is the opposite of the reality of zoning, which commodifies aspects such as housing and neglects land and resource conservation—both of which have been criticised.

A crucial aspect of degrowth is shifting the focus of urban planning from consumption- and valuation-based perspectives to those that are more focused on community-building [23,24]. This can be achieved through broadening socio-environmental responsibilities through our policies as well as our production and consumption trends, while also building relationships and emphasising the importance of networking to empower each other and make collective decisions [23–25]. More specifically, a key principle of degrowth that works towards this goal is reducing our consumption rates, rather than simply trying not to consume or produce more [24–26]. This can also help in reducing our carbon footprints and adopting more sustainable lifestyles [17]. This not only promotes ecologically sustainable practices, but it can also help create closely knit communities through initiatives such as community gardening [17]. These aspects also tie in with the principle of providing resources and

urban space in an equitable manner. The degrowth movement pays special attention to reducing hierarchies in urban planning by putting citizens and their participation first, to allow for more choice in the planning process (similar to the Coasian approach mentioned earlier) [17]. This also encourages the development of community initiatives and collective societies that live and share together [17]. These are aspects that are not considered in zoning regulations, as they mostly focus on single-family housing. By combining degrowth perspectives and zoning regulations, and therefore including a variety of housing, zoning can expand the built environment in a more inclusive and equitable manner.

However, as seen in the examples stated above, degrowth principles have not yet been formally introduced and integrated into urban planning policies. Currently, degrowth practices are based on community initiatives and small-scale neighbourhood projects. There is a lack of institutional integration, which limits the impact and spread of the movement, and this needs to be tackled [17]. This requires a more contextual planning approach, which may seem familiar from the development of form-based codes discussed earlier, to ensure ecological and cultural conditions are taken into account when spatial interventions are planned [21]. To do this, however, the movement needs to change its narrative from criticising economic growth to emphasising the human and ecological costs it brings, setting more achievable expectations in today's economic climate [26]. Decreasing the value of economic gain and instead promoting environmental stability and equity are crucial steps that have driven the movement; however, there are other possibilities to integrate the degrowth ideology into planning institutions. For instance, housing must be utilised better, both in terms of existing structures and by making homeownership more accessible to less economically advantaged groups of citizens [22]. Furthermore, the movement has to start setting clear foundations and definitions for its key pillars, goals, and applications to standardise its practice so it can be translated into public policies. This is an aspect of degrowth that remains understudied in current discourse. Scholars such as Kaika et al. also criticise the movement for paying little attention to upscaling and institutionalising its practices [27]. These aspects also need to gain more traction in the current discourse, which this paper is aiming to enhance.

By translating the key aspects of degrowth, urban planning institutions, and more specifically, the implementation of zoning regulations, can be improved to be more considerate of our urban environment, our resources, and how the built environment shapes interaction. The emphasis on ecological protection and equity, in particular, can help improve zoning to address its points of critique, while institutionalising and upscaling the degrowth movement.

3. Materials and Methods

The research conducted for this paper was based on qualitative secondary data sources, which were subjected to document and critical discourse analysis. During the document and critical discourse analysis, the content of each source was examined to uncover patterns of discussions surrounding degrowth and zoning. Common themes and linkages were identified, such as the influence of economics, politics, and community input. These patterns were crucial for the coding process and created a comprehensive outlook on how the interdependence between these themes shapes regulations, and consequently, our built environments. These secondary sources ranged from existing open-source research papers and books to public policy documents. This study consulted twelve sources on degrowth, and twenty sources on zoning (thirty-two sources in total) out of the ninety-four sources found using search engines such as Google Scholar. The research used in this paper ranges in topics from different types of zoning to the degrowth movement. While

the search was kept as broad as possible, the thirty-two documents selected specifically focused on urban economics and spatial planning interventions, in relation to zoning and degrowth. From an original pool of 112 documents, twenty were directly related to urban economics, demonstrating the extent to which economics is prioritised in urban planning, compared to fifty documents referring to degrowth and fifty-nine to zoning. Other topics common in degrowth discourse that were noticed during the collection of sources ranged from the origins of the concept to the housing and transportation sectors, and how they can implement more degrowth-minded practices. These research papers were used as a foundation for the literature review, to conduct a secondary data analysis of zoning and degrowth discourse. This foundation was built through coding and content analysis, to determine the main principles of degrowth, as will be further explained in Section 3.1. Furthermore, this foundation provided common terms and indicators associated with degrowth. This helped ensure internal validity, as this process ensured a standardised method of identifying degrowth practices, providing more insight into what was measured and how.

Alongside the selection of discourse, an important aspect of this research and the selection of secondary data sources was the process of finding and selecting which policy documents and policy briefs to use for the analysis. Through this process, two policy documents relevant to the United States and the case study of Texas were discovered. First, the Standard Zoning Enabling Act of 1926, which was the first public policy document to be used in the United States as a baseline for all states to follow when drafting zoning regulations, was selected to understand initial zoning regulations and to compare with more recent zoning regulations to assess how zoning ordinances have developed, and whether or not newer sub-branches were integrated over time. The second document, the Texas Municipal Code for Zoning, was selected as a more recent zoning ordinance applicable to the specific case study—and as a basis for comparison of multi-level policy. This document summarises which zoning regulations are standard in the state, and their purpose. As a case study, Texas is relevant as an anomaly to most other states in terms of how zoning is applied, as it is one of the least regulated states, due to the lack of a state-wide mandate for zoning regulation implementation [28]. The differing levels of implementation between cities, or even counties, in Texas may result in a rich variety of zoning landscapes that could facilitate the study of the different degrowth patterns either enabled or hindered by existing regulations which may or may not have been implemented.

In addition to the two policy papers found, a comprehensive list was made to identify all counties in Texas which zone, by accumulating all zoning codes of each county through a thorough online search. While these county-based codes were not used for analysis, this list was used to create a visual representation to understand how many counties in Texas engage in zoning practices. This map (found in Section 3.3) was created based on a list of states that implement zoning, and visualised using Graphic Information Systems (GIS). The map created is a modification of an existing polygon layer (a layer used to visualise the boundaries and shapes of areas on a map) found online [29], to only show the counties which enforce zoning regulations.

Lastly, two degrowth initiatives were found globally as points of comparison. These two initiatives (sustainable building bricks in Egypt and the Nieuwe Meent development in the Netherlands) are meant to provide examples of how degrowth can be incorporated into urban planning at the neighbourhood level. Each initiative highlights a different aspect of degrowth, such as fostering stronger communities, autonomy, and ecological protection. These initiatives will be used as comparison points to Texas, to see how degrowth practices can be improved in Texas, and what possible initiatives can be incorporated into Texan

urban planning (See Section 4.3). Not only will this show possibilities for more degrowth-minded practices in Texan planning culture, but it will also provide external validity, as these comparisons will explore whether or not degrowth initiatives are applicable in different contexts.

In the following sub-sections, the coding process, operationalisation and selection of degrowth principles, and case study selection are outlined in more detail.

3.1. Coding Process

All data and sources collected for this research were subjected to a coding process using the qualitative analysis software, Atlas.TI, version 25.0.1. The coding process consisted of labelling terms and phrases in each source to categorise indicators and crucial pieces of information related to zoning and degrowth. This process is divided into two separate sections. First, the degrowth literature was coded (see Figures 1 and 2 for code trees) to identify the key principles of the movement. Secondly, the summary of the Texas policy paper was coded to find overlap between different zoning sub-branches and degrowth principles.

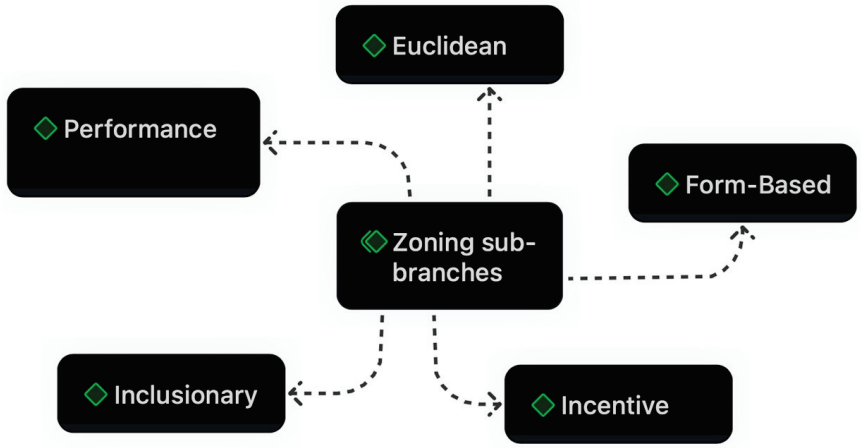

Figure 1. Zoning sub-branch code tree.

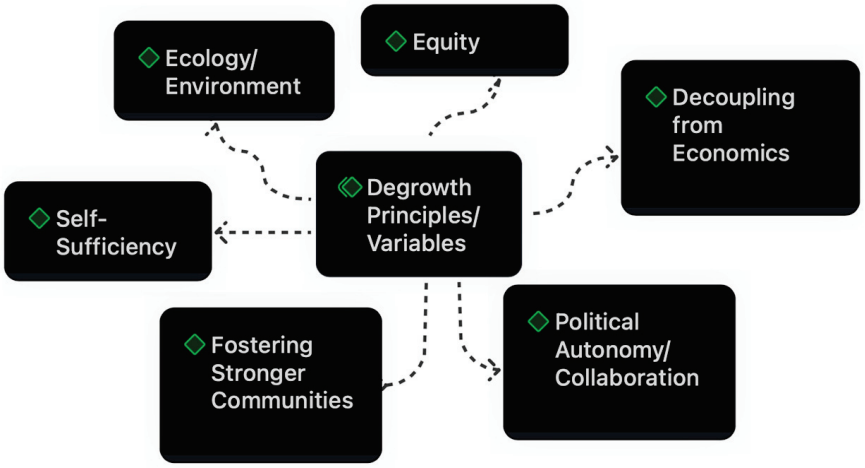

Figure 2. Degrowth principles code tree.

During the collection of the literature, an initial list of degrowth principles was identified. When each source was coded, it became clear that the initial list of principles had to be expanded to accommodate newly found trends in the literature. Therefore, during the coding process, new indicators were added, as explained in Section 3.2. Afterwards,

all codes were revisited to avoid repetitions and miscoding. This led to the creation of the principles identified in Table 1 in a semi-inductive manner, by combining the initial list of indicators with new ones that emerged from the analysis process (see Figure 2).

Table 1. Operationalisation table.

Concept	Principles	Indicators	Explanation
Degrowth	Decoupling Economics	Decommodification	Deprioritising material and financial growth
	Fostering Stronger Communities	Conviviality, Cohabitation, Culture, Interaction	Providing community spaces for networking and solidarity
	Self-Sufficiency	Low-impact Livelihood, Downsizing	Reducing consumption and production patterns to avoid excess
	Equity	Cooperation, Collective Action, Equal Distribution	Democratically allocating resources in a socially just manner, to maintain well-being
	Political Autonomy/Collaboration	Decision-making, Participation, Organising and Regulating	Empowering residents and smaller entities to have influence over regulations and their living environments
	Ecological/Environmental Protection	Lowering Emissions, Renewable Energy Sources, Resource Conservation, Biodiversity	Encouraging sustainable practices to reduce waste, emissions, and consumption patterns, while preserving our environment

The second part of the coding process involved coding the summary of the Texas policy document. Although the same dimensions were used as for the coding of the literature, an additional code tree was used to identify zoning sub-branches (see Figure 1). By using both code trees, overlap between zoning sub-branches and degrowth principles was found, which will be expanded upon in Section 3.2. Furthermore, motives and generic ideologies behind zoning regulations were coded in relation to degrowth, to assess how much of the degrowth movement is reflected in active zoning ordinances, and how much of it remains conceptual.

3.2. Operationalisation

Based on patterns found during the coding process, a list of principles guiding the degrowth movement was identified. As discovered in the literature review, the degrowth ideology heavily depends on equity, environmental protection, and reducing the importance of economic growth in urban areas. These three aspects of degrowth are most discussed across the literature. Across these three aspects, six principles have been identified to encompass the ideology of degrowth, which are explained in Table 1.

The equity principle refers to the equal distribution of resources, while empowering all citizens. More specifically, the equity pillar details the importance of rights and equality, to provide equal opportunities for everyone. There is a strong emphasis on justice and providing social welfare [17]. This is closely related to another principle, which was identified as fostering stronger communities. This principle was separated from equity to highlight the concepts of cohabitation, conviviality, and networking, which are strongly dependent on degrowth initiatives [22].

The environmental protection principle, mostly referred to as ecological value in degrowth literature, encompasses everything ranging from climate change adaptation to reducing our ecological footprints through more sustainable and less consumption-heavy practices. Most importantly, this principle aims to conserve both our natural environment and our resources, through less consumption and production, and by efficiently using what is already available [17]. This notion also ties in with the fourth principle of degrowth, which is decoupling economic growth from urban planning. This means that an active effort must be made to reduce the importance of economic growth when planning our urban environments, as well as to downscale our lifestyles [21,24–26,30]. The act of downscaling also corresponds with the concept of self-sufficiency, identified as the fifth principle of the movement. Alongside reducing our consumption patterns, self-sufficiency also attempts to produce only what is necessary within smaller communities [25]. This can also be achieved through physical downscaling, which requires proximity between facilities, eliminating the need for transportation services [22]. This can also help protect our environment and reduce emissions.

Lastly, the political dimension mostly refers to the goal of diminishing hierarchy in urban planning, to provide opportunities for collaboration between planning institutions and communities. Furthermore, there is a strong emphasis on deliberative democracy in the degrowth movement, to allow for greater empowerment and participation, as well as a level of autonomy for communities to self-organise and self-regulate [21].

Evidently, most principles of degrowth are interlinked and work together to shift our attitudes from an economics-based planning approach to one which prioritises social welfare and the environment. Each of these crucial principles identified as the main dimensions of degrowth was considered when evaluating zoning regulations in Texas. The operationalisation of degrowth principles not only provides better grounds for analysis but also creates a comprehensive overview of the movement and its components, which have yet to be defined concretely in common discourse, as noted in Section 2.2. While the explanation of each principle remains broad in this article, the operationalisation table can serve as a starting point to address this research gap.

3.3. Case Study

Texas is known to be one of the only states that does not enforce zoning regulations across the state [28]. In fact, while Houston, the second largest city covering almost 1740 km^2 of land, does not implement zoning [31], Dallas has been implementing zoning since 1910 [32]. This is due to the fact that, historically, residents across the state of Texas have rejected the notion of zoning [9]. This variation in the implementation of zoning by county or city can be seen in Figure 3.

The variation in implementing zoning regulations across the state is an interesting feature to study; more specifically, the difference between current zoning regulations and those proposed by the 1926 publication of the Standardised Zoning Enabling Act [2]. These changes can clarify whether there is a possibility of integrating ideologies such as degrowth into planning institutions, and how this can be achieved.

To truly see the varying extents of zoning ordinances adopted in each city in Texas, the zoning policies of each county would need to be analysed individually. However, this is beyond the scope of this paper; therefore, a summary of the Texas zoning regulations was used instead [33]. The municipal code itself was not relevant to this study as it is strictly procedural and only addressed appeal processes and levels of jurisdiction. The summary used was more insightful in terms of the content of zoning regulations.

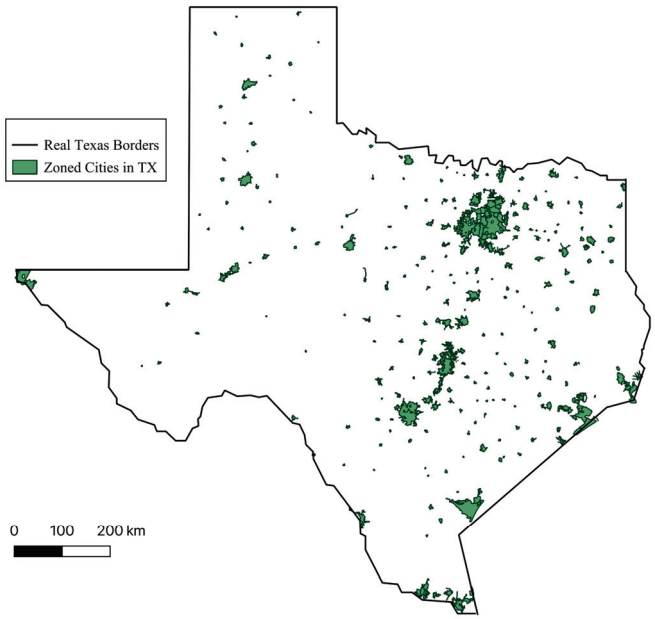

Figure 3. Map showing cities in Texas that implement zoning [29].

4. Results

This section presents the findings from the coding process, to understand whether degrowth principles are present in the overarching zoning regulations issued by the state of Texas. Although the Texas municipal code is only meant for generic guiding purposes, giving individual municipalities the right to remove, edit, or add clauses, it provides insight into common practices across the state and a comprehensive overview of which clauses align with degrowth principles. To identify which principles align, the results showing which degrowth principles and zoning sub-branches overlap will first be presented. Next, more general findings will be outlined to see how degrowth principles have infiltrated the policy brief without a direct link to zoning. Lastly, the integration of degrowth in Texas will be compared to other degrowth initiatives implemented internationally.

4.1. Sub-Branches Used to Push Degrowth

Although all sub-branches of zoning are present to some extent in the Texas municipal code, there is little overlap between the various zoning sub-branches and degrowth principles. The overlap observed has been identified in Table 2. For instance, performance zoning was used to bring attention to environmental protection by aiming to 'lessen congestion in the streets' and 'provide adequate light and air' in the comprehensive plan of Texas [33]. A comprehensive plan identifies a strategy to achieve a city's goals and ambitions to grow [33]. Zoning is one of the main tools to implement a comprehensive plan, essentially aiming to reach the goals stated within it. By extension, zoning in Texas aims to protect the environment through adequate light and reduced congestion. Another example is the combination of inclusionary zoning with the equity principle of degrowth, which is apparent in the clause stating that through urban planning, a 'range of housing opportunities and choices' should be created [33]. This not only aligns with degrowth, as there is a focus on widening the target group of development projects by setting prerequisites to consider different incomes and co-habitation possibilities, but it is also part of the 'smart growth' initiative [33]. This initiative is spread across the United States, and Texas has integrated it into its policies, alongside other states. The smart growth initiative also calls for strengthening and directing development towards existing communities, which

hints at the fostering stronger communities principle of degrowth, as well as alluding to the idea of utilising what exists rather than expanding [33].

Table 2. Overlap between degrowth principles and zoning sub-branches in the Texas policy paper.

Degrowth Principle	Performance	Incentive	Inclusionary	Euclidean	Form-Based
Decoupling Economics	-	-	-	-	-
Fostering Stronger Communities	-	Yes	-	-	-
Self-sufficiency	-	-	-	-	-
Equity	-	-	Yes	-	-
Political Autonomy/ Collaboration	-	-	-	-	-
Ecological/ Environmental Protection	Yes	-	-	-	-

4.2. General Findings

Through the coding process, it became clear that many initiatives, such as the smart growth movement, as well as various types of zoning and tools (such as planned unit developments, which provide flexibility to deviate from standard zoning regulations), have addressed various aspects of what degrowth has brought together into one movement. The idea of building on what we have rather than expanding and consuming more, for instance, has recurred both in smart growth and degrowth. This can also be seen in other parts of the policy brief summarising the Texas Municipal code, which aims to avoid urban sprawl and ensure close-knit communities both socially and physically. This was present in one of the smart growth clauses within the Texas municipal zoning policy brief, calling for 'a range of housing opportunities and choices', aiming at more varied and affordable housing options, but also in clauses stating the importance of fostering a strong sense of space and attractive communities, hinting at more inclusive zoning practices and stronger social cohesion. This is reinforced by the presence of multiple sub-branches in this dimension, suggesting that modern regulations consider urban areas as complex and cohesive systems with many facets, rather than collections of buildings and parcels which have to be profitable and spatially uniform.

The call for more varied housing options aligns deeply with degrowth ideology, as it tackles issues of equity, sprawl, and co-habitation simultaneously. The general idea behind these initiatives highlights the importance of issues such as a lack of affordable housing, private transportation dependence, and the role residents play in shaping their physical environment. Many regulations have been set through zoning to ensure these three issues are tackled. For instance, in the Texas municipal zoning regulations, it is stated that land use has to be mixed, and public transportation facilities and financing schemes have to be included, closely aligned with form-based zoning codes. Alongside avoiding sprawl, these clauses align with degrowth, as they direct development to be more compact and sustainable through shorter distances as well as more resource-efficient practices to reduce carbon emissions. And while the Texas zoning regulations encourage the development of public transportation, this may need to be adjusted to fit degrowth principles more closely. The Texas municipal code states that future transportation needs must be forecast, and financing for more transportation facilities should be planned, aiming to discourage private vehicle use [33]. While this is a more sustainable and resource-efficient method, it is not enough to be associated with degrowth. Rather, to truly integrate degrowth, the use of

motorised vehicles in any capacity should be discouraged, in favour of closer proximity between facilities and amenities.

Nevertheless, while most, if not all, principles of degrowth specified in Table 1 are present to some extent in the zoning policies of Texas, there are two essential components missing from seamlessly connecting the concepts of zoning and degrowth: intention and deprioritising economics. The degrowth movement has emphasised time and again that the intention to achieve its principles is what sets it apart from other initiatives. One of its main intentions is to remove the influence of economic growth on our cities and their development. This is a major point missing from the Texas municipal code, as there is no specification as to how this would be tackled, or how the economy would be decoupled from the built environment. Instead, there are certain clauses, such as the creation and enhancement of economic value clause in the smart growth concept, which prioritise the cost-effectiveness of urban planning and development projects, essentially suggesting the opposite of economic decoupling [33].

While there is clearly a motive to be more considerate of our environment and foster stronger communities, the motive for degrowth clearly lacking in the municipal zoning code. Although the main idea behind degrowth is present, there is no clarity as to whether or not these clauses and goals are meant to support the degrowth movement. The lack of direct reference means these clauses cannot be considered to truly be part of the degrowth movement. It is important, therefore, to change zoning ordinances to demonstrate the intent to integrate degrowth principles.

In addition to the lack of change in the economic perspective of zoning, we observed that the Texas municipal zoning codes were inherently similar to those proposed by the 1922 Standard Zoning Enabling Act (SZEA) [34]. For instance, while political autonomy is an important aspect of degrowth, by dismantling the hierarchical structure of zoning affairs, there is no active attempt towards it. This is not to be confused with the town hall meetings and appeal processes available for residents to participate in, and voice their opinions regarding zoning affairs, as this is not a step towards political autonomy. While there is a degree of participation, this has been possible since the formal introduction of zoning in the early 1900s, whereas gaining political autonomy would require decision-making power and self-organised communities which are not reliant on state-wide regulations. Furthermore, the municipal code explicitly quotes sections one and three (Grant of Power and Purpose in View, respectively) of the Standard Zoning Enabling Act, which shows the lack of change in zoning regulations, especially regarding alignment with the degrowth movement. For instance, Section 2 of the SZEA, concerning districts, and Section 7, regarding the Board of Adjustment, have been copied into the Texas municipal code word for word. The lack of change in this regard, and dependence on old-school zoning ideologies, suggests a lack of intention or even motivation to combine zoning with degrowth.

4.3. International Degrowth Initiatives

To gain an understanding of how degrowth initiatives impact neighbourhoods, and through which methods Texas can apply it to its own urban development trajectory, it is important to look at initiatives started internationally. This section will explore two degrowth initiatives, one from Egypt and one from The Netherlands. These practices will provide a new perspective on what degrowth initiatives can look like, and how even the smallest changes can become part of the movement.

4.3.1. Bastoob, Egypt

Due to the growing efforts by the government to encourage citizens in Egypt to move away from Cairo, there has been an increase in housing demand and construction in other regions of the country. Bastoob, a local business in Egypt, recognised the need for safe, affordable, and quick construction of housing, to be able to meet the demand, while providing adequate housing. As a solution, Bastoob has innovated an interlocking construction block [35]. These blocks eliminate cement in construction, due to their interlocking quality, and are thermally insulating [35]. They have taken various principles from the degrowth movement such as ecological protection and equity. The technology behind the bricks allows for them to be salvaged and reused, if and when a house made of them is dismantled, and the elimination of cement significantly reduces the carbon footprint of the construction process [35]. Furthermore, the insulation characteristic of this block allows for less energy consumption as the brick itself can keep the house warm on its own. Furthermore, these bricks make safe housing more accessible to the people of Egypt, providing equity in terms of affordability and security. By encouraging practices or innovations such as these bricks, policymakers can provision multiple aspects of degrowth at once, with small actions and changes. Texas can take the innovation of Bastoob as either a tool or inspiration for more local innovation, as well as implement the usage of modern building technologies to reduce the strain put on our environment when constructing new infrastructure, and to simultaneously provide more secure housing.

4.3.2. Nieuwe Meent, Netherlands

The Nieuwe Meent development project, started in 2018, is a cooperative housing development in Amsterdam seeking to detach from the competitive economic-minded housing market of Amsterdam by highlighting community sharing and cohabitation [34]. This development has adopted the ecological and community-building principles of the degrowth movement through the establishment of three key pillars: collective living groups, shared facilities, and caretaking [34]. The community fosters self-sufficient practices through agricultural and ecological education [34]. Furthermore, this development provides autonomy to its residents, as collectivism in this case also extends to decision-making power and participation [34]. This independent community has created a neighbourhood in which degrowth principles are nurtured and affirmed to provide affordable, resourceful, and autonomous housing in the neighbourhood. The steps taken in this community to provide autonomy and social interaction can be taken as a stepping stone for policies or actions to be taken in Texas, to integrate degrowth into urban planning and development. As seen in Section 4.2, Texas has already put effort into developing affordable housing. By taking the Nieuwe Meent as an example, these policies can be developed further to be considerate of housing other than single-family units, which fosters stronger communities and sharing practices.

5. Discussion

Although there are direct quotes and phrases used in the current Texas municipal zoning code from the SZEA, it has also adopted various new sub-branches which have reduced the dominance of Euclidean zoning. Essentially, the foundations of zoning are already changing to become more considerate of other aspects of urban environments than economic growth. Although not all sub-branches considered in Table 1 have a direct correlation to degrowth principles through zoning clauses in the municipal code, all have been adopted in some capacity. The shift in nature of these regulations, from Euclidean to sub-branches such as performance and inclusionary zoning, already provides some

insight regarding the changing perspective of planners. There is clearly an attempt at deprioritising Euclidean zoning and its consequences by focusing on more equitable and non-economical measurement practices. While this is a step in the right direction, there is no direct relationship formed with degrowth as it stands.

By definition, all sub-branches created in recent years are aimed at amending zoning practices to be more ecological and inclusive (which is, in fact, a zoning sub-branch on its own). As a matter of fact, across the literature, inclusionary zoning has been established to aim at providing affordable housing to enhance racial and social integration. This can be seen as a base on which the equity principle of degrowth is formed. However, what sets degrowth apart from this sub-branch is its broader approach to social inclusion and integration, addressing systemic inequalities and fostering diverse communities. The equity principle of degrowth also emphasises the importance of communal spaces and resource sharing, aspects that are often missing from current zoning regulations [17]. By integrating degrowth principles with inclusionary zoning, developments can focus on both affordability and providing a variety of housing forms to appeal to a larger population. Similarly, incentive zoning aims to encourage more community-building opportunities through its exception- and bonus-based mechanisms [13]. Not only does this diversify the urban fabric, it also institutionalises degrowth, through the inclusion of collaborative living and flexible ownership schemes. This would shift the focus of zoning from traditional single-family units to more accessible and versatile housing options. This can also help with controlling our resource consumption, as the solution would lie within already existing structures, rather than expanding the boundaries of our cities to build more and newer structures, avoiding sprawl. Furthermore, more participation should be encouraged in the planning process. This trend has been growing in recent years; however, it is crucial to limit hierarchy in planning processes at an institutional level [17]. This can help address more pressing needs expressed by the public and empower citizens to become a stronger community with more equitable practices and shared habits. By including practices as such in our planning policies, we can ensure the inclusion of all three pillars of degrowth: equity, ecological integrity, and lower consumption [26].

Form-based codes also allow for more diversity in the urban fabric through their encouragement of mixed land-use planning. The mixture of land use can help avoid sprawl by limiting the distance between amenities, essentially allowing for a more compact city model, while also consuming fewer resources such as land or fuel. Lastly, performance zoning can be used as a foundation to integrate degrowth principles into zoning practices seamlessly, as it is meant to provide a framework to regulate standards more efficiently. Although it does not impact the built environment as directly as other zoning sub-branches, it provides motivation to be more considerate of the consumption of various resources and serves as a tool for accountability when assessing aspects such as carbon emissions, waste handling, and more. If the foundations of each sub-branch are expanded upon and used efficiently, degrowth principles can align and even elevate the mission and vision of these sub-branches to create a more environmentally sensitive and equitable zoning concept.

It is important to note, however, that while these sub-branches are already present in the Texas municipal code, there is still a lack of collaboration with the degrowth movement, undermining the potential of what can be achieved when the two are combined. This also limits how much degrowth can truly be institutionalised, as there is no regulation advanced enough to accommodate space for degrowth principles. This is especially true because most of the current zoning regulations are still highly dependent on Euclidean and old-school zoning ideologies. The commodification of land, and the cost-effective perspective on which Euclidean zoning is built, remain highly influential in the current zoning code

of Texas, suggesting that although other principles of degrowth have the possibility to integrate, the main goal, which is to deprioritise economic growth, is still at the root of planning and zoning approaches. If the degrowth movement uses innovative building technologies such as the bricks made by Bastoob (See Section 4.3.1), or the cooperative approach seen in the Nieuwe Meent development (See Section 4.3.2), the movement can try to find common ground with urban economics, as these practices are clear examples of urban degrowth, which also happen to reduce construction and maintenance costs. However, to truly integrate degrowth principles and build upon the sub-branches present in the Texas municipal code, the concept of zoning must be reimagined to highlight ideologies similar to that of degrowth, rather than economic growth.

6. Conclusions

As can be derived from this research, zoning regulations in Texas are rather flexible, providing opportunities to integrate degrowth principles and ideologies. A small overlap between zoning sub-branches and degrowth principles in current Texan zoning regulations (such as the overlap between equity and inclusionary zoning, or performance zoning and ecological protection) suggests there is potential for more development within these local regulations to institutionalise degrowth ideology through the framework of zoning regulations. Nevertheless, the small facets of degrowth that have been identified in the state's current zoning legislation (specifically resolutions such as affordable housing, community-building initiatives, and sensitivity towards the natural environment) are overshadowed by the lack of change in fundamental ideologies such as profitability. Zoning regulations in Texas illustrate the pressing need to reimagine urban planning frameworks to align with degrowth principles at larger scales and more directly, challenging deeply entrenched economic paradigms that prioritise commodification over resourcefulness. The influence of economic growth over urban planning policy has blocked the path for intentionally implementing degrowth-minded initiatives and policies. This begs the questions posed by this study: "To what extent are current zoning regulations aligned with degrowth principles?" and "How can degrowth principles be better integrated into urban planning institutions and land use control methods, such as zoning?". To answer the first question, it is important to note that although certain Texan zoning policies simultaneously address the concerns of degrowth, there is potential for more conscientious action to be taken. The second research question requires a more complex understanding of the changes that need to be made. Even though, theoretically, there is a possibility of amending zoning to integrate degrowth ideologies in a more institutional and tangible manner, fundamental changes have to be made to the practice of zoning. To truly reap the benefits of zoning sub-branches and their predisposition to be more inclusive of degrowth ideology, the influence of urban economics on urban planning regulation must be re-examined.

The major building blocks of zoning, which are profitability and economic growth, must be deprioritised to truly integrate the essence of degrowth. This may require some restructuring of urban economics, which is beyond the scope of this paper. Instead, smaller steps can be taken to shift priorities in urban planning from economics to ecology and self-sufficiency. By promoting other principles and aspects of degrowth, indirect pressure on economic growth can be applied. For instance, understanding land as a resource to protect and cultivate, rather than a tradeable asset in our planning approaches, would result in less land being occupied during development processes, and land would be used more effectively. To achieve this, urban planning institutions have to shift focus from city-scale economic growth and introduce more legislation focused on resource conservation. This could involve policies that prioritise the repurposing of abandoned

amenities and buildings over further construction. By encouraging a mindset of using what is readily available, rather than producing new facilities, degrowth can be integrated more structurally into zoning ordinances. This can also be used as a method to decouple zoning from economic growth by advancing development strategies that discourage the construction of new buildings, limiting potential profit accumulation while also treating the land that has already been developed as the scarce resource it is. Repurposing old structures and avoiding new construction and consumption could detach monetary value from land.

In the case of Texas zoning policies specifically, there are a couple of possibilities to adapt existing policies to be more degrowth-minded. Firstly, current zoning techniques in Texas do not include form-based zoning. By incorporating form-based zoning, Texas can prioritise social-ecological values. This would require more flexibility in terms of mixing land use in urban areas. Not only will this further emphasise the efficient use of already occupied land, but the mixture of amenities can also help reduce distances. Furthermore, the flexibility provided through form-based codes can help counter critiques of zoning standardisation. The reduction of distances is also a major tool Texan municipalities can use to transform their zoning regulations. Currently, Texan zoning regulations call for the expansion of public transport accessibility. However, to truly integrate degrowth, it is important to reduce all kinds of motor vehicle usage. While the use of public transportation is more sustainable than private vehicles, there is no attempt at containing urban sprawl, a key concern for the degrowth movement. The mixture of land use through zoning tools such as form-based codes can allow for the shrinking of cities, shifting the focus from managing urban sprawl through accessible transport to containing sprawl. Another aspect through which zoning regulations in Texas can be adapted to include more degrowth principles concerns the level of autonomy that is delegated. Currently, the state of Texas has given local municipalities and counties power over which state codes are adopted by their local regulations, which ones are amended, and which ones are declined. While autonomy is a major aspect of degrowth, this level of autonomy is not a new addition to the state's zoning regulations. In fact, it reflects the 1926 SZEA model. This level of autonomy has to be expanded to fit modern planning approaches and the degrowth movement, extending autonomy and decision-making power to residents. To extend autonomy to residents, as suggested by the degrowth movement, Texas should aim to make appeal processes and public hearings of zoning reforms more accessible. Although these hearings are already open to the public, the announcements of these hearings are rather limited, making it hard to keep track of them. By publicising them appropriately and arranging hearings in accessible formats, more autonomy can be granted to residents, and participation can be more direct and effective. Lastly, Texan zoning codes can be amended to be more considerate of construction processes. Current zoning regulations in Texas allow interference with aspects such as density, building height, and the size of buildings. By adding control over, or simply encouraging innovative building technologies, urban development can take a more resourceful and sustainable approach. This not only integrates the ecological protection emphasised by degrowth, but it also allows for resource conservation and the reduction of consumption or production of new materials. These innovative forms of construction can include urban mining practices, where older resources and parts of demolished infrastructure can be reused in the construction of new structures.

Nevertheless, the implementation of these changes requires major changes in perspective. To institutionalise degrowth through zoning regulations, it is important for the degrowth movement to gain legitimacy. Currently, degrowth is a rather small-scale initiative, only observed in neighbourhood initiatives. It is important for the movement

to broaden its reach and upscale its practices while also gaining more momentum. This requires allyship with different movements that have similar goals and lobbying for the movement to be perceived with an image of unity and perseverance. However, it is also important for the movement to change its narrative from anti-economic growth to an image that balances urban economics with its goals of conserving our environment and providing equity and autonomy. This is important not only to gain support from other movements but also from the public. By its nature, degrowth calls for practices that limit our consumption. This means that there may be luxuries or habits the public needs to give up, which can be a major cause of friction. The fact that degrowth requires changes in lifestyles may not be appreciated by most; therefore, the movement has to tackle this in phases, rather than immediately calling for institutions to be decoupled from economics or for consumption and production rates to be reduced significantly. This can also cause potential political friction that the movement needs to overcome. As seen in this study, urban planning methods and institutions are heavily influenced by political figures and economic interests. If the degrowth movement wants to infiltrate planning institutions, it may need to compromise on certain goals to find a middle ground with political figures.

Reimagining zoning will require major changes but can allow for a more seamless integration of degrowth. Through these changes, and the addition of aspects such as ecology and autonomy, urban environments can meet the needs of our societies, as well as the environment, more efficiently. Exploring ways in which degrowth can be coupled with institutional planning tools, such as zoning, is one of the main contributions of this article. While the degrowth movement is growing, it has yet to break the barrier to institutionalised urban planning. By upscaling degrowth practices and finding potential outlets, such as zoning, to enlarge the operation of degrowth, this barrier can be overcome more easily. The second contribution of this paper is to provide a clear outlook on what the movement entails. Although more attention has been directed to the movement, there is no consistency in degrowth discourse as to what the main indicators and key principles are, and how they should be defined. This paper aimed to clarify the content of the movement and provide a foundation to build upon as we gain more insight into the intricacies of degrowth. To gain a better understanding of the degrowth movement, and whether its integration into zoning regulation, or other institutionalised planning tools, is feasible, further research can focus on whether other methods of land use planning can be created to be more considerate of factors such as equity, ecology, and political autonomy. Other avenues of future research could include a change in case studies, to explore the applicability of degrowth in the zoning regulations of different states in the US with varying levels of regulation, or to explore potential aspects of urban economics that can be adapted to be more accepting of degrowth principles to shift perspectives in urban planning from financial profit to equitable resource distribution.

Although this article has attempted to explore the degrowth movement in as much detail as possible, it has two major limitations that can be potential grounds for further research. Firstly, the explanations and exploration of the fundamental principles of degrowth remain rather vague. While this paper has combined all characteristics and aspects of degrowth into one paper, these aspects have only scratched the surface of a complex and intricate ideology. It is important to develop these explanations and principles further, to avoid confusion and better define the movement. Secondly, the points of comparison used (Egypt and The Netherlands) may not be considered the most appropriate. Although these case studies are concrete examples of the degrowth movement and how its principles can be used in urban developments, these case studies remain at the neighbourhood level

and have not influenced local policy. It is important to highlight cases where degrowth initiatives have influenced policy or upscaled the movement overall.

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References

1. Pollard, W.L. Outline of the Law of Zoning in the United States. *ANNALS Am. Acad. Political Soc. Sci.* **1931**, *155*, 15–33. [CrossRef]
2. Serkin, C. A Case for Zoning. *Notre Dame L. Rev.* **2020**, *96*, 749–798.
3. Lens, M.C. Zoning, Land Use, and the Reproduction of Urban Inequality. *Annu. Rev. Sociol.* **2022**, *48*, 421–439. [CrossRef] [PubMed]
4. Whittemore, A.H. Exclusionary Zoning: Origins, Open Suburbs, and Contemporary Debates. *J. Am. Plan. Assoc.* **2021**, *87*, 167–180. [CrossRef]
5. Shertzer, A.; Twinam, T.; Walsh, R.P. Zoning and Segregation in Urban Economic History. *Reg. Sci. Urban Econ.* **2022**, *94*, 103652. [CrossRef]
6. Connor, S.M. Performance Zoning: Successor to Euclidian Zoning? *Land Use L. Zoning Dig.* **1981**, *33*, 7–10. [CrossRef]
7. Talen, E. Zoning For and Against Sprawl: The Case for Form-Based Codes. *J. Urban Des.* **2013**, *18*, 175–200. [CrossRef]
8. Aoki, K. Race, space, and place: The relation between architectural modernism, post-modernism, urban planning, and gentrification. *Fordham Urb. L. J.* **1993**, *20*, 699–829.
9. Fischel, W.A. *Zoning Rules!: The Economics of Land Use Regulation*; Lincoln Institute of Land Policy: Cambridge, MA, USA, 2015; ISBN 978-1-55844-288-7.
10. Ghorbanian, M. The Evolution of Urban Zoning from Conventional to Form Based Codes; Introducing Non-Euclidean Zoning Techniqueschniques. *IJAUP* **2020**, *30*, 107–118. [CrossRef]
11. Fischel, W.A. Zoning and land use regulation. *Encycl. Law Econ.* **1999**, *2*, 403–442.
12. Hirt, S. Form Follows Function? How America Zones. *Plan. Pract. Res.* **2013**, *28*, 204–230. [CrossRef]
13. Ellickson, C. The irony of "inclusionary" zoning. *S. Cal. L. Rev.* **1981**, *54*, 1167–1216.
14. Marwedel, J. Opting for Performance: An Alternative to Conventional Zoning for Land Use Regulation. *J. Plan. Lit.* **1998**, *13*, 12. [CrossRef]
15. Stockham, J.R. *Performance Zoning as an Alternative to Euclidean Zoning*; Oregon State University: Corvallis, OR, USA, 1974; pp. 1–54. Available online: https://ir.library.oregonstate.edu/concern/graduate_projects/mp48sd59n (accessed on 15 February 2024).
16. Homsy, G.C.; Kang, K.E. Zoning Incentives: Exploring a Market-Based Land Use Planning Tool. *J. Am. Plan. Assoc.* **2023**, *89*, 61–71. [CrossRef]
17. Hermans, M.; De Kraker, J.; Scholl, C. The Shrinking City as a Testing Ground for Urban Degrowth Practices. *UP* **2024**, *9*, 8008. [CrossRef]
18. Xue, J. Urban Planning and Degrowth: A Missing Dialogue. *Local Environ.* **2022**, *27*, 404–422. [CrossRef]
19. Kiefer, M.J. Privatizing creation of the public realm: The fruits of New York City's incentive zoning ordinance. *B. C. ENVTL. AFF. L. Rev.* **2001**, *28*, 637–649.
20. Qian, Z. Without Zoning: Urban Development and Land Use Controls in Houston. *Cities* **2010**, *27*, 31–41. [CrossRef]
21. Savini, F. Towards an Urban Degrowth: Habitability, Finity and Polycentric Autonomism. *Env. Plan A* **2021**, *53*, 1076–1095. [CrossRef]
22. Khmara, Y.; Kronenberg, J. Urban Degrowth Economics: Making Cities Better Places for Living, Working, and Playing. *Local Environ.* **2023**, *28*, 304–321. [CrossRef]
23. Savini, F. Maintaining Autonomy: Urban Degrowth and the Commoning of Housing. *Urban Stud.* **2023**, *60*, 1231–1248. [CrossRef]
24. Xue, J.; Kębłowski, W. Spatialising Degrowth, Degrowing Urban Planning. *Local Environ.* **2022**, *27*, 397–403. [CrossRef]
25. Hickel, J. The Anti-Colonial Politics of Degrowth. *Political Geogr.* **2021**, *88*, 102404. [CrossRef]

26. de Juan Ayuso, I.; Giralt, C.; García, A. *Towards Urban Degrowth? Urban Planning as a Common Thread of Contradictory Dynamics in Cities*; Springer International Publishing: Cham, Switzerland, 2023; pp. 215–228; ISBN 978-3-031-36016-9.
27. Kaika, M.; Varvarousis, A.; Demaria, F.; March, H. Urbanizing Degrowth: Five Steps towards a Radical Spatial Degrowth Agenda for Planning in the Face of Climate Emergency. *Urban Stud.* **2023**, *60*, 1191–1211. [CrossRef]
28. Gyourko, J.; Saiz, A.; Summers, A. A New Measure of the Local Regulatory Environment for Housing Markets: The Wharton Residential Land Use Regulatory Index. *Urban Stud.* **2008**, *45*, 693–729. [CrossRef]
29. Texas City Limits 2016. Scale: 200 km and 100 mi. Available online: https://koordinates.com/layer/15204-texas-city-limits/ (accessed on 31 August 2018).
30. De Castro Mazarro, A.; George Kaliaden, R.; Wende, W.; Egermann, M. Beyond Urban Ecomodernism: How Can Degrowth-Aligned Spatial Practices Enhance Urban Sustainability Transformations. *Urban Stud.* **2023**, *60*, 1304–1315. [CrossRef]
31. Demographics. Available online: https://www.houstontx.gov/planning/Demographics/ (accessed on 6 July 2024).
32. Talen, E. Zoning and Diversity in Historical Perspective. *J. Plan. Hist.* **2012**, *11*, 330–347. [CrossRef]
33. Dahlstrom, W. Chapter 4: Zoning Regulations in Texas. In *A Guide to Urban Planning in Texas Communities*; American Planning Association: Chicago, IL, USA, 2013; pp. 137–158.
34. Savini, F.; Bossuyt, D. Housing Commons as a Degrowth Planning Practice: Learning from Amsterdam's de Nieuwe Meent. In *Post-Growth Planning*; Routledge: London, UK, 2022; ISBN 978-1-003-16098-4.
35. Ibrahim, S.E.; Sarkis, J. Technological Innovations and Degrowth Opportunities From Urban Egypt: Initiating the Discourse. *Front. Sustain. Cities* **2020**, *2*, 2492866. [CrossRef]

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Article

Assessing Pedestrian Network Continuity: Insights from Panama City's Context

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Abstract: This study evaluates pedestrian continuity in Panama City, analyzing disruptions and the spatial relationship between crossings and transit stations. Using GIS and field validation, pedestrian networks were assessed based on their continuity, defined by well-maintained sidewalks and marked crossings, and discontinuities, caused by absent sidewalks, commercial infrastructure, service stations, and unmarked crossings. Two urban zones with contrasting layouts were analyzed: Zone A, characterized by a regular grid structure, and Zone B, marked by irregular planning. Results indicate that 67.55% of the study network maintains pedestrian continuity. Additionally, 46.79% of the measured distances between bus stops and formal pedestrian crossings exceed 100 m. The average length of continuous paths is 73.37 m in Zone A and 45.60 m in Zone B. Encroachments by businesses are the primary cause of fragmentation, and the study reflects an important impact of car-oriented urban infrastructures on discontinuities, such as service stations. These stations cause average disruptions of 34.69 m per station in Zone B and 27.56 m in Zone A. The research highlights the need for urban planning strategies to ensure pedestrian continuity, particularly in fragmented urban grids, and underscores the importance of an in-depth consideration of continuity in pedestrian network characterization studies.

Keywords: pedestrian continuity; urban infrastructure; Panama City; public transport connectivity; GIS; pedestrian network; spatial analysis; service station impact; urban mobility

1. Introduction

The rapid global expansion of cities imposes substantial demands on existing infrastructure, particularly regarding mobility and transportation. As urban populations grow, urban planning strategies must shift towards an organization that fosters sustainable mobility to promote social inclusion [1,2].

Constant traffic congestion in major cities, driven by excessive private vehicle use, places significant strain on transportation networks. Such congestion worsens traffic problems, reduces the efficiency of the mobility system, lowers residents' quality of life, and has negative environmental impacts [1,2]. In response, urban planning strategies should

align interventions with the goal of mitigating the effects of congestion and pollutant emissions resulting from the high volume of daily commutes.

Walking is a fundamental and widely utilized mode of transportation worldwide. Beyond enabling movement, it reduces reliance on motorized transport systems, fostering a more sustainable approach to mobility [3]. It offers pedestrians a sensory engagement shaped by interactions with infrastructure and the surrounding environment [4]. Research on pedestrian mobility examines walking not only as a means of connecting origins and destinations but also as an activity influenced by environmental conditions [5]. This perspective highlights how route characteristics shape the pedestrian experience, addressing both connectivity and spatial interactions throughout the journey [6].

Pedestrian routes should ensure continuity, connectivity, and accessibility through environments that allow uninterrupted movement. Sidewalks, as key components of pedestrian infrastructure, delineate spaces for pedestrians and facilitate mobility, particularly for individuals with reduced mobility, improving their walking experience. Nevertheless, numerous areas lack continuity, complicating the efficient use of public transportation networks. Pedestrian connectivity to public transport depends not only on the presence of continuous sidewalks but also on the availability of pedestrian crossings, which are often informal and lack proper signage [7].

Pedestrian-involved accidents occur most frequently in situations where pedestrians cross the road, particularly at locations such as crosswalks. Pedestrians have the legal right to cross any street, whether at intersection crosswalks or designated mid-block crossings; however, both locations pose potential risks. Studies on pedestrian perception of footbridges have highlighted challenges related to distance and convenience compared to other crossing options, such as crosswalks [8].

In cities with high mobility demands, well-integrated sidewalk networks connect urban spaces [9,10] and facilitate interactions between socioeconomic activities [11]. These networks serve as connectors, reducing physical and social barriers, particularly in cities with significant contrasts in urban development [12,13]. In the case of Panama City, its rapid urban growth, driven by foreign investment and real estate expansion, aligns with its territorial and economic development, heavily influenced by its strategic location and the Panama Canal. Panama City presents a variety of scenarios regarding urban planning and the distribution of urban facilities, especially concerning pedestrian walkability [14]. This growth has created a marked contrast between developed areas and inner-city neighborhoods with disorganized and low-quality urban infrastructure [15]. Despite Panama's remarkable economic growth over the past century, this development has not translated into adequate street planning and design [16].

This study aims to assess pedestrian continuity in Panama City by analyzing the urban infrastructure in the context of the main pedestrian network and the spatial coverage of urban elements that influence it. Ensuring pedestrian continuity also requires uninterrupted routes to public transport. The objective is to examine the condition of pedestrian continuity and to identify whether significant variations exist based on the configuration of the urban layout. This approach enables the quantification of the proportion of discontinuity attributable to urban functions such as service stations and to describe the spatial distribution of both disruptive elements and those that enhance continuity.

Through this analytical approach, insights are provided for urban planners and authorities to develop policies and projects that foster more continuous pedestrian mobility in rapidly growing urban areas, such as Panama City. While some pedestrian network studies take continuity into account, others tend to overlook it. This work addresses this gap by offering an examination of pedestrian continuity from two urban topology perspectives,

emphasizing its role in assessing sidewalk quality and exploring the various types of interruptions that impact it.

Literature Review

Pedestrian continuity refers to the ability of pedestrian networks to provide unbroken, interconnected routes, enabling safe and efficient travel in urban environments [17]. This continuity enhances pedestrian connectivity, which, as indicated in previous studies, refers to the topology of the pedestrian network that facilitates movement from one point to another [9,18,19]. Continuity also contributes to pedestrian accessibility, which means access to essential urban functions [20,21].

Studies on accessibility emphasize the importance of designing sidewalk networks that seamlessly link key destinations, such as residential areas, recreational and commercial zones, and public transportation spaces. Research highlights that well-integrated and continuous pedestrian networks are essential for enabling uninterrupted movement and promoting pedestrian volume [22,23]. This planning and management effort involves identifying and addressing discontinuities in the pedestrian network to ensure that the population has uninterrupted and connected routes. Measuring pedestrian continuity provides essential information for urban planners and policymakers [17].

Topics such as pedestrian accessibility and connectivity have been studied both at the urban scale, encompassing entire cities, and at the neighborhood level. Generally, within these investigations, the characteristics of pedestrian networks are measured through constructed indicators, such as those shown by [24], to assess these concepts on a measurable scale. Previous research highlights that a well-connected sidewalk infrastructure, functioning as an interconnected system, enhances pedestrian volume; however, it also recognizes that the presence of infrastructure is a factor that impacts this pedestrian demand [23]. This study by [23] also recognizes that one of the limitations of their proposed model is that variables associated with the quality of the infrastructure, such as continuity, were not included.

Beyond the previously discussed research, other studies focus on the macro-level measurement of indicators related to pedestrian connectivity and accessibility, aiming to analyze the efficiency of pedestrian networks as systems of connections and spatial distributions in a comprehensive and detailed manner [24–27]. Conversely, assessing the quality of the pedestrian network often reveals obstacles that disrupt sidewalk continuity, resulting in routes that are unsuitable for pedestrians [17]. An assessment of existing sidewalks reveals that they can be obstructed by businesses that partially or completely encroach on the sidewalk space, or even in instances where sidewalks are converted into parking spaces and occupied by street vendors [3,28]. It also shows clear urban fragmentation that occurs in various locations, with abrupt changes from the presence of a sidewalk to its absence along a pedestrian route [3].

Other studies have considered continuity as one of the criteria used to describe pedestrian networks through the following indicators: “network directness” [9] and “seamless sidewalk continuity” [11]. Measuring continuity has taken various approaches; it has been measured through a bicycle route aimed at achieving a direct connection, with the requirement that the route continue through urban areas, parks, and parking areas [29]. Although this characterization of continuity could be applied to sidewalk areas, its application is impractical in many urban contexts, especially at macro levels of continuity measurement, due to the large extension of the networks [9].

Approaches that have been used most effectively in large-scale continuity studies have included the use of Google Street View (GSV) and Geographic Information Systems (GIS) to characterize continuity through dichotomous measurements by sidewalk segments detailing whether continuity existed or not [11]. This methodology provides broader results in terms of study coverage, yet it does not address the categorization of the interruptions identified.

Another approach to measuring continuity utilized GIS tools to generate what were termed "graph indicators," and two of them were used to characterize pedestrian continuity: "average edge length" and "average length per vertex" [9]. Although this study did not explore the categorization of pedestrian continuity types either, its approach allows for the generation of linear entities that model the linear extension of the sidewalk and segregate the sections according to the existence or lack of pedestrian continuity, allowing its adaptability to be oriented towards a study focused on describing pedestrian continuity in a more extensive way.

Panama has limited documented research on pedestrian networks, and existing studies indicate that sidewalk quality is very poor, often obstructed, and, in many areas, even non-existent [30]. As shown by [30], in Panama's metropolitan urban area, 73.75% of pedestrian path spaces are unfavorable for mobility, reflecting significant deficiencies in comprehensive urban planning and posing a challenge in terms of measuring indicators associated with pedestrian network systems, given the local state of pedestrian continuity.

2. Materials and Methods

GIS-based data collection methods allow for detailed characterizations of variables related to the built environment, making them key tools in pedestrian network studies [31]. This study employs virtual audits alongside physical audits for the construction of the pedestrian network and the identification of urban elements of interest [32]. The research follows the methodological framework outlined below:

(i) The research divides the study area of Panama City into two zones.
(ii) The data collection process involves the construction of the pedestrian network, the classification of continuity and discontinuity types, and the mapping of urban elements. This collected information was stored and mapped in GIS.
(iii) The process includes a physical audit to validate the elements used in the construction and classification of the network, as well as the location of urban elements.
(iv) Pedestrian continuity and the spatial distribution of urban elements are analyzed using GIS geoprocessing tools and statistical techniques.

2.1. Study Area

The study focuses on a representative sample of Panama City (Figure 1), covering an area of 26.25 km^2 with a population of approximately 209,305 inhabitants. To address the diversity of urban contexts, the study area was divided into two zones based on contrasting urban typologies (Figure 2): Zone A, representing a dense historic commercial area with a regular grid layout, and Zone B, characterized by fragmented land uses and an irregular street network. This division enables a comprehensive analysis of pedestrian mobility patterns across varied urban scenarios. The outcomes may be significantly impacted by disparities between zones due to variability in urban grid layout, as well as diverse land uses [33].

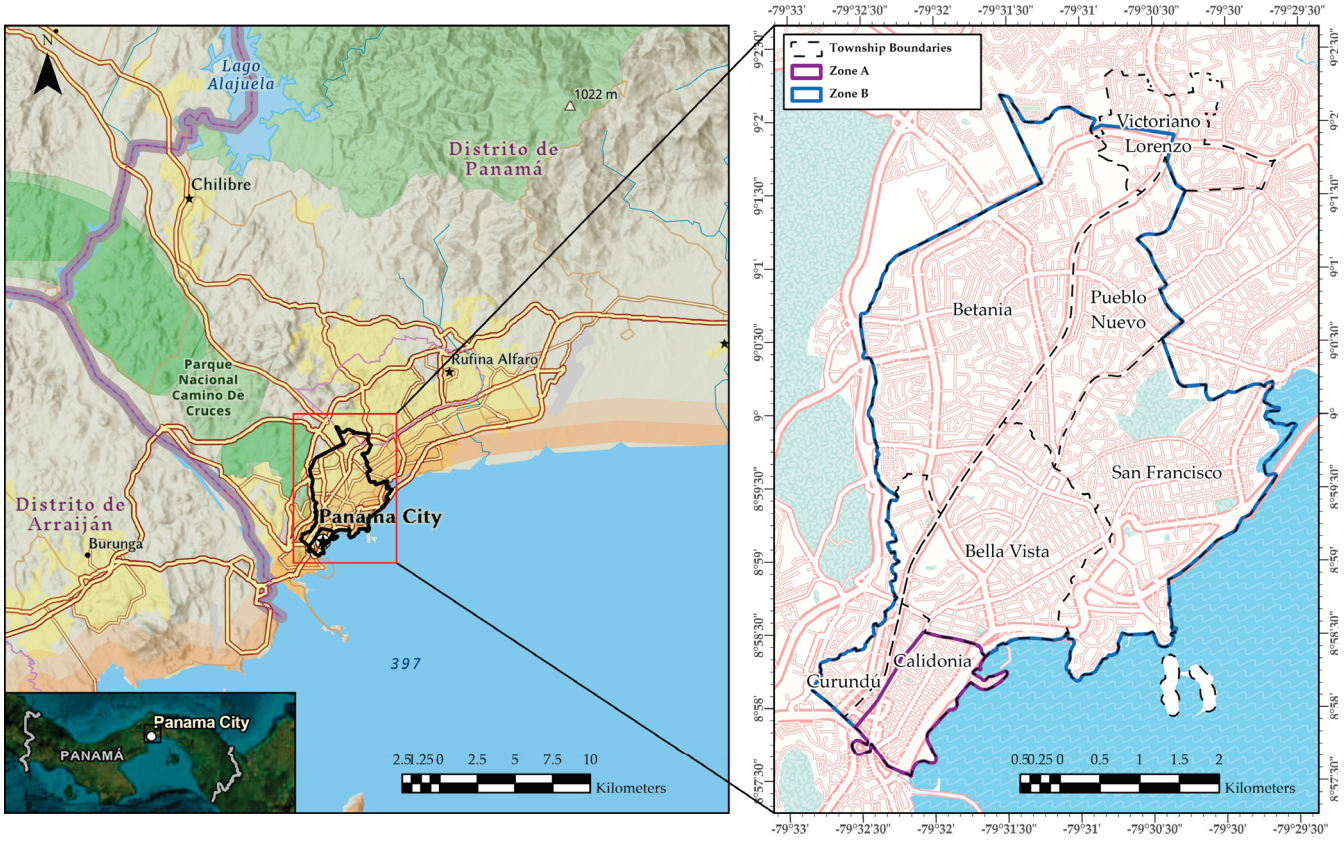

Figure 1. Location map of the study area and the townships it covers within Panama City.

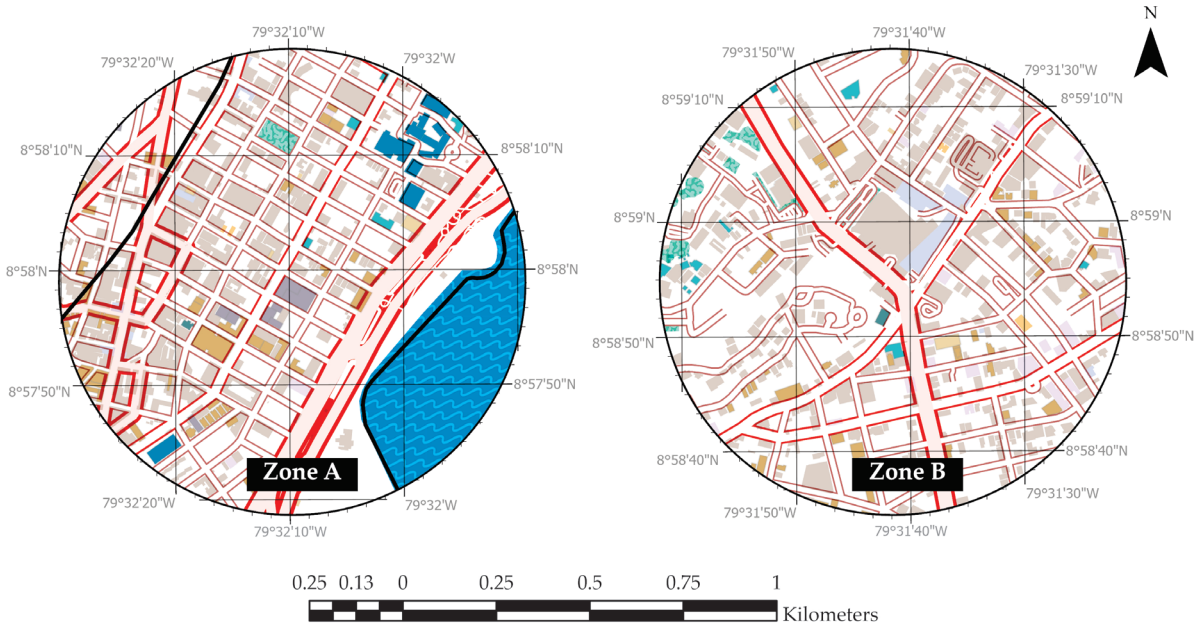

Figure 2. Extracted map segments of Zone A and Zone B in Panama City.

2.1.1. Zone A

Zone A encompasses a historic and commercial area with a high density of mixed land uses. It is characterized by older infrastructure and a mid-20th-century urbanization pattern, with its grid-like urban layout enhancing connectivity and facilitating pedestrian movement [34,35]. This zone, located partially within the Calidonia township and covering a total area of 1.62 km^2, includes aging pedestrian pathways and a dense traffic network that influence the mobility pattern.

2.1.2. Zone B

Zone B covers diverse land uses across five main townships: Curundú, Betania, Bella Vista, San Francisco, and Pueblo Nuevo, including dense residential areas [34] as well as commercial, institutional, and industrial zones. It also partially covers the districts of Calidonia and Victoriano Lorenzo. This extensive area, measuring 24.64 km^2, faces challenges related to the integration of functionally diverse areas in terms of both infrastructure and mobility.

The street network in Zone B is irregular and fragmented, which can lead to detours and longer routes for pedestrians. The irregularity in the layout reduces the efficiency of pedestrian routes, potentially discouraging walking due to the difficulty of finding direct paths, thereby creating barriers that affect accessibility [36,37]. Factors such as unplanned urban growth, uneven zoning, and topographic barriers contribute to this irregular distribution, affecting connectivity and pedestrian mobility in these settings [38,39].

2.2. Data Collection

A geodatabase (GDB) containing information on Panama's townships was used. Based on these data and the delineation of the study area, polygonal elements were generated to represent the surfaces of the zones analyzed within the GIS environment. Inside this defined section, the pedestrian network was constructed and classified, and information related to urban elements was collected.

2.2.1. Pedestrian Continuity Data Collection

Figure 3 presents a sample of the workflow carried out to characterize pedestrian continuity; Figure 3a depicts a close-up of a specific section, serving as an example of the methodology applied in the entire study area. In Figure 3b, the main streets, represented by yellow lines, were identified and extracted from OpenStreetMap (OSM), a crowdsourcing practice that enables broad and continuous information gathering through diverse contributions, providing detailed coverage of dynamic urban areas [40].

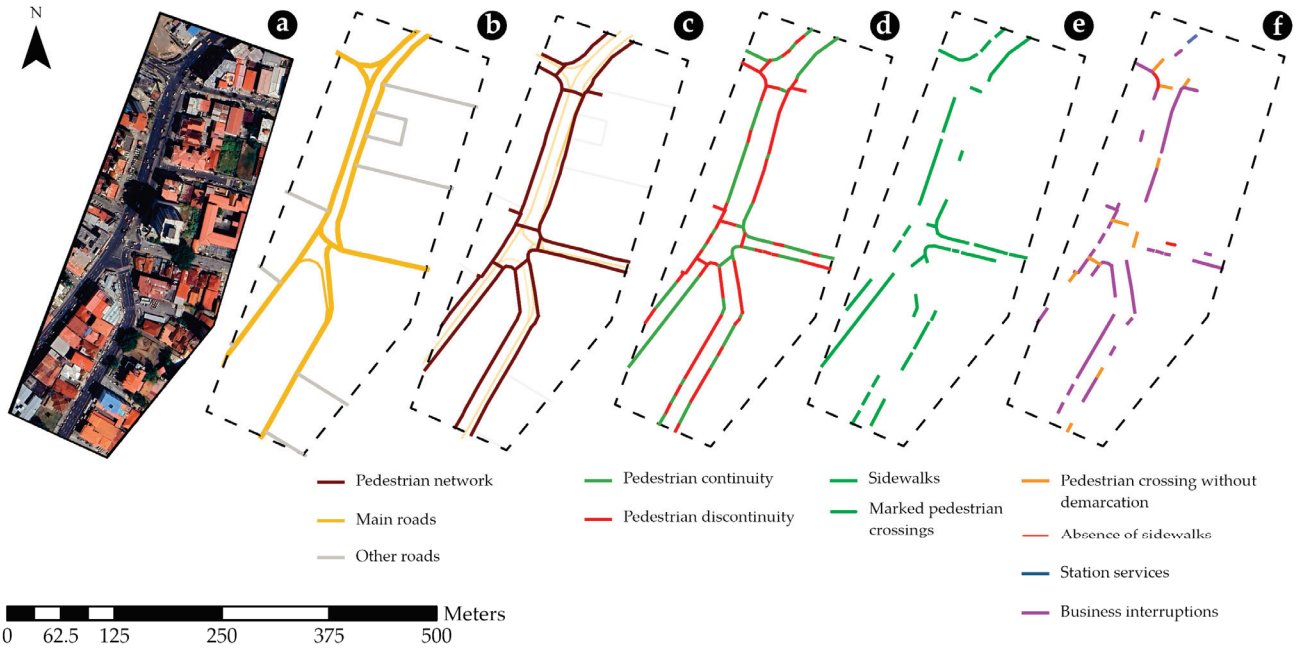

Figure 3. (**a**–**f**) Sample workflow for pedestrian network construction and continuity categorization.

As observed in Figure 3c, for the construction of the pedestrian network, linear entities were generated along both sides of the main roads, including pedestrian crossings (see

points (ii) under pedestrian continuity and (iv) under pedestrian discontinuities). The linear entities were generated in GIS using information from the main roads and Google Earth Pro (GEP) satellite images from the year 2024—shown in Figure 3a—to position them along the central axis of the pedestrian path. A total of 121.78 km of pedestrian paths were documented, including 23.02 km in Zone A and 98.76 km in Zone B.

The pedestrian network was manually segmented within the GIS environment to separate the continuous paths, shown in green, and the discontinuous ones, shown in red, in Figure 3d. The segmentation of the network was conducted by consulting the previously mentioned satellite images, supported by GSV-based inspections through a type of virtual audit [11,32].

Each segment was subsequently categorized into types of pedestrian continuities, as shown in Figure 3e, or pedestrian discontinuities, as shown in Figure 3f, based on predefined criteria, with these categories distinguished by colors in the figures. A detailed view of each type of continuity and discontinuity considered can be observed in Figure 4.

Figure 4. Classification of pedestrian infrastructure conditions.

Pedestrian continuity includes those segments where there are the following:

(i) Sidewalks that are well-maintained and free of abrupt elevation changes or permanent obstructions, allowing a smooth pathway for pedestrians.

(ii) Marked pedestrian crossings, as described by [7], which are formal crossings within the pedestrian network identified by visible horizontal signage. These crossings guide pedestrian movement using elements such as zebra crossings or pelican crossings;

however, the latter is not commonly found in Panama City. Additionally, formal crossings may include those regulated by traffic lights and pedestrian bridges.

(iii) During the step shown in Figure 3c, these linear entities were constructed by identifying zebra crossings, pedestrian traffic light-regulated intersections, and pedestrian bridges using GEP satellite imagery, as shown in Figure 3a, and then verifying and refining this information through GSV inspections and an existing GDB of formal crossings.

Pedestrian discontinuities, in contrast, refer to obstructions that completely break the continuous pathway. These are subdivided into the following:

(i) Total absence of sidewalks, forcing pedestrians to walk on the road or in areas not designated for this purpose.

(ii) Interruptions caused by commercial infrastructure, such as business entrances encroaching on pedestrian space.

(iii) Service station interruptions, similar to those classified under "caused by commercial infrastructure" but specifically addressing this type of service-oriented establishment. The categorization of these interruptions enables a specific classification and a detailed analysis of their impact on pedestrian continuity.

(iv) Pedestrian crossings without demarcation, where the lack of horizontal signage leads pedestrians to choose their own crossing points, creating multiple informal crossing zones. According to [7], such crossings usually take place at road intersections lacking formal crossings or when they are situated over 50 m away, subject to specific conditions described in their investigation.

(v) Under these guidelines, during the stage shown in Figure 3c, potential informal crossings were identified and constructed using GEP satellite images and GSV inspections. Initially, GEP satellite images were used to locate intersections as shown in Figure 3a, followed by GSV inspections to verify the absence or poor visibility of pedestrian markings.

2.2.2. Urban Elements Data Collection

Formal pedestrian crossings and bus stops were analyzed using an existing GDB that represented these features as point entities. A total of 193 at-grade pedestrian crossings, 15 pedestrian bridges, and 234 bus stops were identified within the study area. Service stations, which were not included in the existing GDB, were manually identified and georeferenced using OSM and GEP. A total of 53 service stations were mapped and incorporated into the dataset.

2.3. Data Validation

Field visits were conducted to validate the pedestrian continuity and urban elements identified through the GDB. Visual inspections were performed along predefined study routes, particularly in areas where satellite images from GEP or GSV were obstructed by trees or other elements, capturing photos and videos to document the conditions of the pedestrian environment. The validation process compared the GIS-based data with field observations to ensure consistency and accuracy [32]. Field verification is essential due to the changing nature of sidewalk continuity, especially in dynamic urban areas like Panama City, where factors such as business interruptions or maintenance work can quickly affect conditions [41]. This included verifying the presence, location, and condition of elements such as sidewalks, crossings, and service stations, as well as recording any discrepancies due to changes in the built environment.

2.4. Data Processing

2.4.1. Pedestrian Continuity Data Processing

Descriptive and comparative statistical tests were applied, including measures of central tendency (mean, median) and dispersion (standard deviation, σ), to calculate average continuity lengths and assess variability across segments.

This phase included a 95% confidence interval ($\alpha = 0.05$) to interpret data dispersion and capture continuity and discontinuity patterns in each urban zone. In studies of pedestrian continuity in fragmented urban areas, a 95% confidence interval allows for accurately capturing variability in segment length (L) and distribution. Research shows how confidence intervals aid in interpreting results in contexts with dispersed data, providing a certainty margin in areas with variable pedestrian infrastructure [42]. Furthermore, non-uniform infrastructure is suggested to impact pedestrian continuity and usage patterns [43].

2.4.2. Urban Elements Data Processing

A spatial analysis of service stations was conducted to assess their impact on pedestrian continuity and their areas of influence. Using GIS distance tools, the minimum and average distances between service stations were calculated to support the data analysis.

The data processing enabled the estimation of pedestrian discontinuities directly caused by the access points of each service station, facilitating the identification of patterns and the impacts of these facilities on urban pedestrian routes.

Buffer analysis was applied with radii ranging from 100 m to 1200 m, in increments of 100 m. The objective of this approach was to provide insights into the cumulative coverage of service stations and to analyze the spatial distribution of pedestrian discontinuities within these buffer zones.

Following the analysis of service stations, a similar approach was applied to other urban elements, including pedestrian crossings and bus stops. A point cloud representing these elements was analyzed using buffer techniques to assess their spatial distribution, while distance tools were used to evaluate proximity. Two key aspects were examined: the proximity between pedestrian crossings and the distance from bus stops to the nearest pedestrian crossing.

In selecting buffer distances for pedestrian analysis, previous studies have commonly considered various radii to assess access to transit stations. For instance, distances of 300 m [44–46] and 400 m [46,47], which correspond to an estimated 5 min walk [47], have been widely adopted. Furthermore, walking distances of 800 and 1200 m, corresponding to 10 to 15 min walks, and 1600 m, representing a 20 min walk [47], have been used to evaluate pedestrian access.

In this study, buffers were generated around each pedestrian crossing to identify areas where crossings may be spatially insufficient. These buffers were created with radii ranging from 100 m to 1500 m, in 100 m increments, following the same approach used for service station analysis to ensure comprehensive coverage of the study area.

3. Results

3.1. Pedestrian Continuity

Figure 5 illustrates the spatial distribution of pedestrian continuities, represented by green lines, and discontinuities, represented by red lines. The figure provides a view of pedestrian conditions in both Zones A and B and includes close-up views of specific sectors to visualize types of continuities and discontinuities.

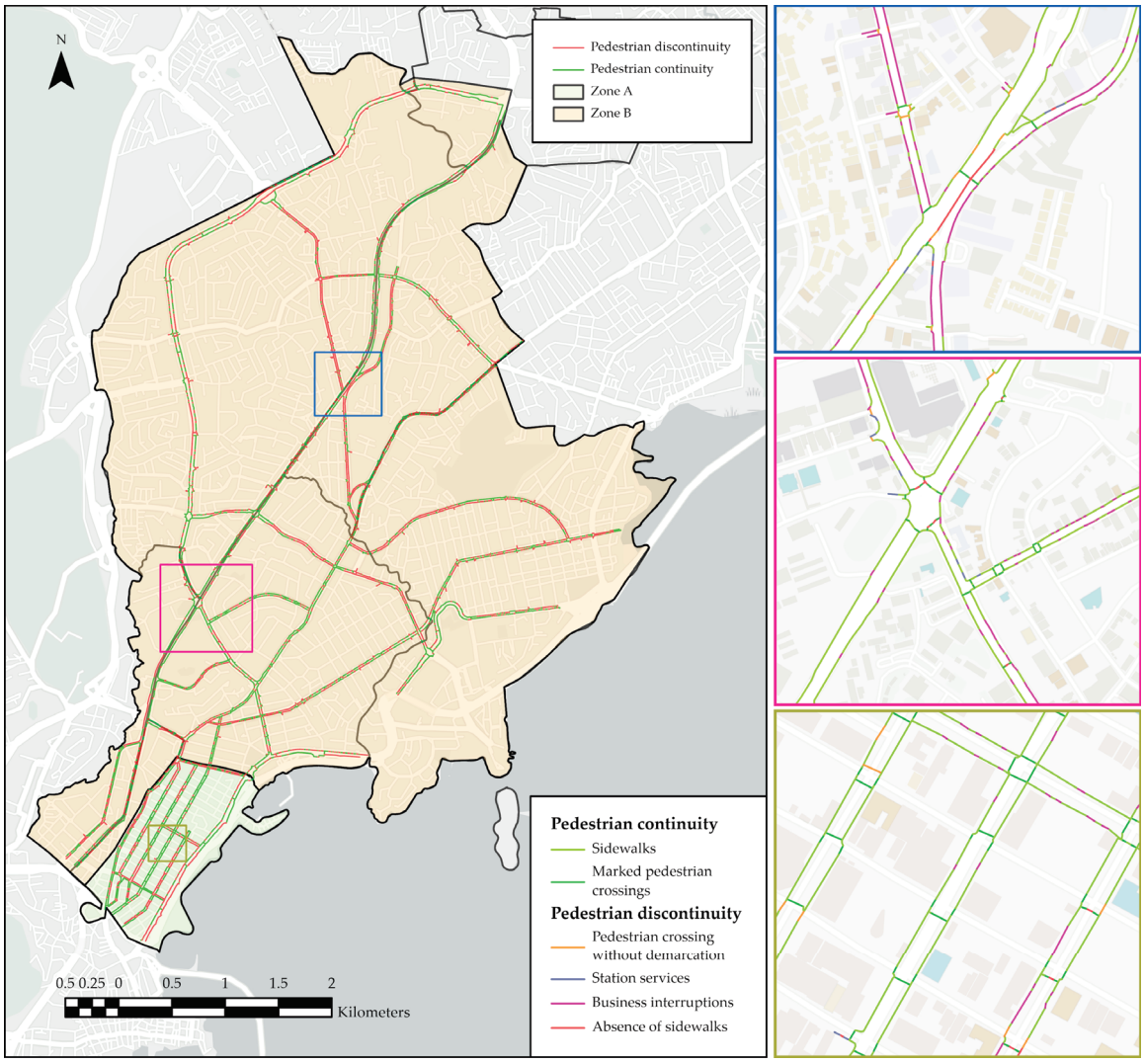

Figure 5. Map of pedestrian continuity and discontinuity in Zones A and B.

The information presented in Figure 5 is detailed in Table 1, which provides a quantitative breakdown of pedestrian continuity and discontinuity. As shown, sidewalks account for 61.91% of the total length of the pedestrian network, while marked crosswalks represent 5.64%. Together, these elements indicate that 67.55% of the whole pedestrian network analyzed is continuous. In contrast, the remaining 32.45% of the network is discontinuous. Zone A's pedestrian network shows 71.08% continuity, whereas Zone B's network shows 66.73%.

Table 1. Comparison of pedestrian continuity and discontinuity by zone.

Data	Types	Zone A (%) [a]	Relative A (%) [b]	Zone B (%) [a]	Relative B (%) [b]	Study Area (%) [a]	Rel. Study Area (%) [b]
Pedestrian continuity	Sidewalks	62.63	88.11	61.74	92.52	61.91	91.65
	Marked pedestrian crossings	8.45	11.89	4.99	7.48	5.64	8.35
Pedestrian discontinuity	Pedestrian crossings without demarcation	6.23	21.52	3.27	9.81	3.83	11.80
	Business interruptions	15.66	54.13	23.64	71.04	22.13	68.20
	Service station interruptions	0.36	1.25	1.76	5.28	1.49	4.59
	Absence of sidewalks	6.68	23.10	4.61	13.87	5.00	15.41

[a] Represents the percentage of the analyzed zone; [b] represents the relative proportion within the pedestrian continuity or discontinuity category.

Table 1 provides an overview of relative composition of pedestrian discontinuities in the compared zones. It reveals that in Zone A, 21.52% of interruptions are caused

by pedestrian crossings without demarcation, while in Zone B, they represent 9.81%. Regarding business interruptions, these account for 54.13% of total discontinuities in Zone A and 71.04% in Zone B. This suggests that in both zones, more than half of the pedestrian discontinuities are due to commercial infrastructure that interferes with continuity.

In Zone A, service stations generate a total of 82.67 m of discontinuity across three stations, with an average of 27.56 m of discontinuity per station, representing 1.25% of the total discontinuities in this zone. In Zone B, interruptions caused by service stations reach 1734.41 m, with 50 stations distributed along the study streets, yielding an average of 34.69 m of discontinuity per station and accounting for 5.28% of total discontinuities. In Zone B, the largest discontinuity generated by a single station is 74.73 m. These data indicate that Zone B not only has more service stations but also has a higher proportion of discontinuities caused by them, significantly contributing to the fragmentation of pedestrian continuity compared to Zone A.

The absence of sidewalks covers 1538.30 m in Zone A and 4556.05 m in Zone B. However, these values represent 23.10% of discontinuities in Zone A and 13.87% in Zone B. This suggests that although Zone B has a greater total length of area without sidewalks, its relative percentage is lower due to its larger extension. Thus, proportionally, Zone A has a higher ratio of areas without sidewalks in relation to its size.

By contrast, considering only the data from the continuous segments extracted from the analysis, Table 2 shows that the mean length of continuous segments in Zone A is 73.37 m (σ = 166.15 m), while in Zone B, it is 45.60 m (σ = 77.40 m). This variability is reflected in the standard deviation, which is notably higher in Zone A compared to Zone B.

Table 2. Descriptive statistics of pedestrian continuity in Zones A and B.

Statistic	Mean (m)	Median (m)	σ (m)	L_{max} (m)	95% CI (m)
Zone A	73.37	25.88	166.15	1716.14	[51.45, 95.3]
Zone B	45.60	22.27	77.40	1122.41	[41.61, 49.6]

As shown in Figure 6, pedestrian continuity exhibits considerable fragmentation and variability, where the regular grid layout of Zone A enables more continuous pedestrian routes, whereas the irregular layout of Zone B introduces more interruptions in the pedestrian network.

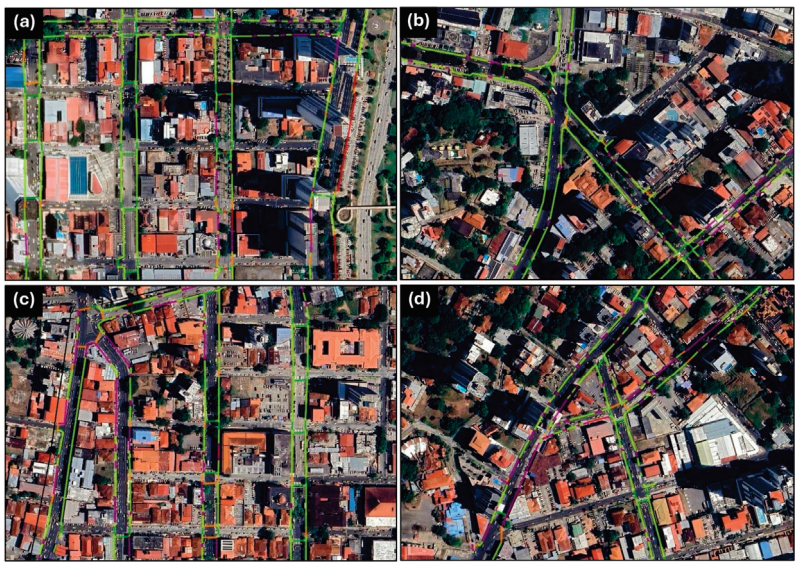

Figure 6. Urban grid comparison: (**a**,**c**) show the regular grid structure of Zone A, while (**b**,**d**) illustrate the irregular layout of Zone B.

Owing to the variability in the length of the continuous segments, Figure 7 presents a violin plot illustrating the analysis of these segments. The third quartile (Q3) of the segment lengths reaches up to 65.62 m in Zone A and up to 46.97 m in Zone B, as graphically represented in the violin plots. The wider sections indicate a higher concentration of continuous segment samples, particularly at lengths that fall below the typical pedestrian walking distances [48]. This suggests that although some segments are relatively long, a greater proportion of continuous segments in both zones are relatively short.

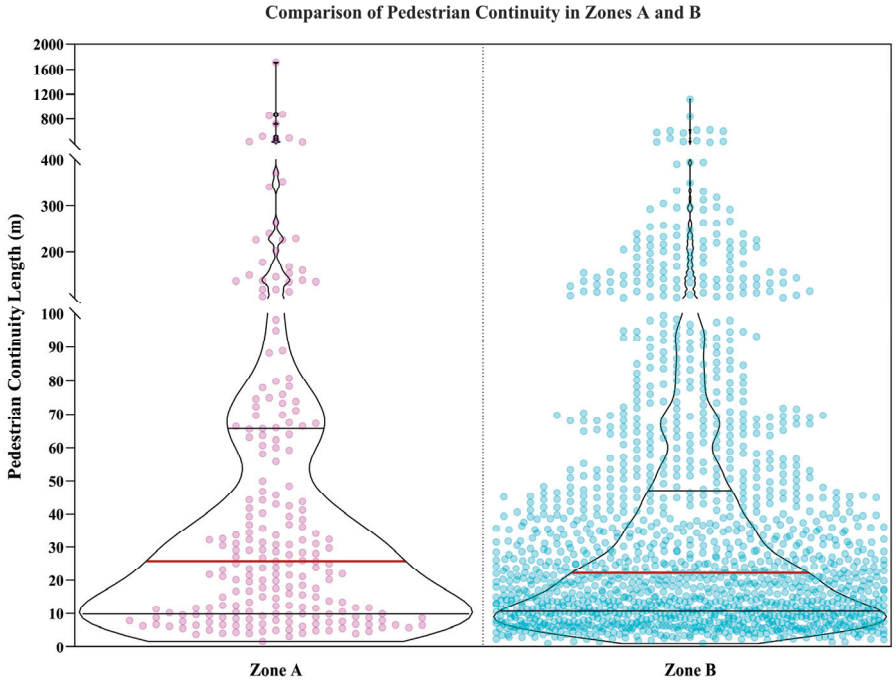

Figure 7. Violin plot showing the distribution of pedestrian continuity lengths in Zones A and B.

In Zone A, the longest recorded continuous segment extends approximately 1.72 km, while in Zone B it is 1.12 km, representing the maximum pedestrian continuity found in the urban network of each area. These values are high and considered outliers; therefore, they do not represent typical continuity patterns in each zone, as depicted in the violin plot presented in Figure 7.

3.2. Urban Elements

Within the analysis of pedestrian continuity, the impact of service stations on pedestrian discontinuities was characterized. These facilities represent a significant factor in interrupting pedestrian continuity, as each station within an area contributes to the fragmentation of pedestrian routes.

To further analyze the influence of discontinuities on the total extent, a specific spatial analysis of service stations was conducted. Figure 8 shows the zones of influence of each station: 25% of the area is within a radius of 205 m, 50% is within 315 m, and the entire area is covered with radii up to 1200 m. However, Zone A has a slightly smaller coverage radius of 1110 m.

Table 3 shows the distances between service stations in Zones A and B to contextualize their spatial distribution within the study area of the city. In Zone A, the stations are relatively more spaced, with an average distance of 696.64 m, while in Zone B, the average distance is significantly shorter at 361.31 m. This indicates that Zone A has a lower station density, with 1.86 stations per square kilometer, compared to 2.27 stations per square kilometer in Zone B, highlighting a higher concentration of stations in the latter.

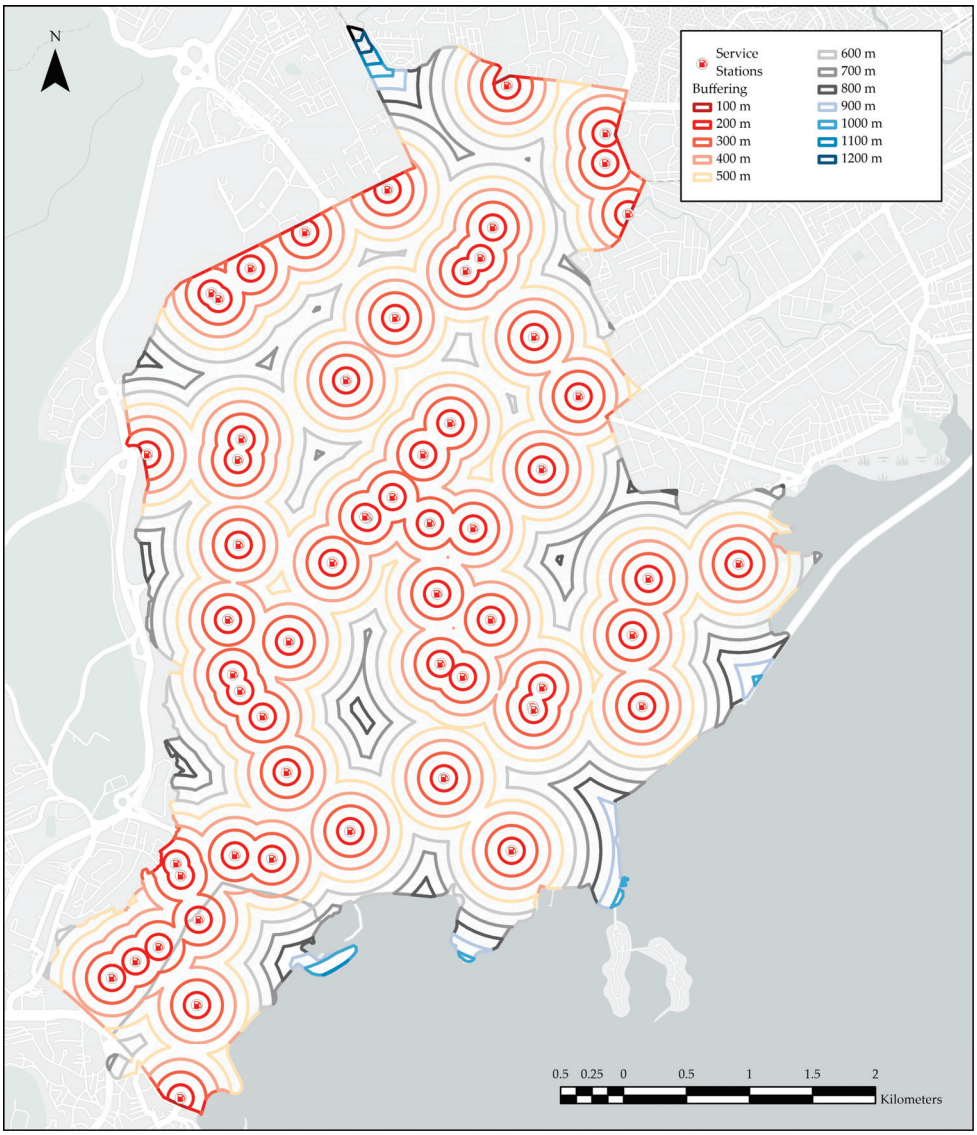

Figure 8. Map showing the distribution of service stations and their corresponding buffer zones at distances ranging from 100 to 1200 m.

Table 3. Distances between service stations in Zones A and B.

Zone	Max. (m)	Min. (m)	Average (m)
Zone A	741.78	674.07	696.64
Zone B	860.96	17.51	361.31

Figure 9 shows the location of bus stops and pedestrian crossings. In Zone A, the average distance from bus stops to the nearest pedestrian crossing is 74.76 m, while in Zone B, it is 170.63 m. The overall average distance for the entire study area is 152.68 m.

Table 4 details the distribution of distance ranges between bus stops and formal pedestrian crossings, highlighting the greater proximity observed in Zone A, where 78.95% of the measured distances fall within 100 m. In contrast, Zone B exhibits more dispersed distances, with a significant amount of 26.67% exceeding 200 m. In the overall study, 46.79% of the measured distances between bus stops and formal pedestrian crossings exceed 100 m, while 21.67% exceed 200 m

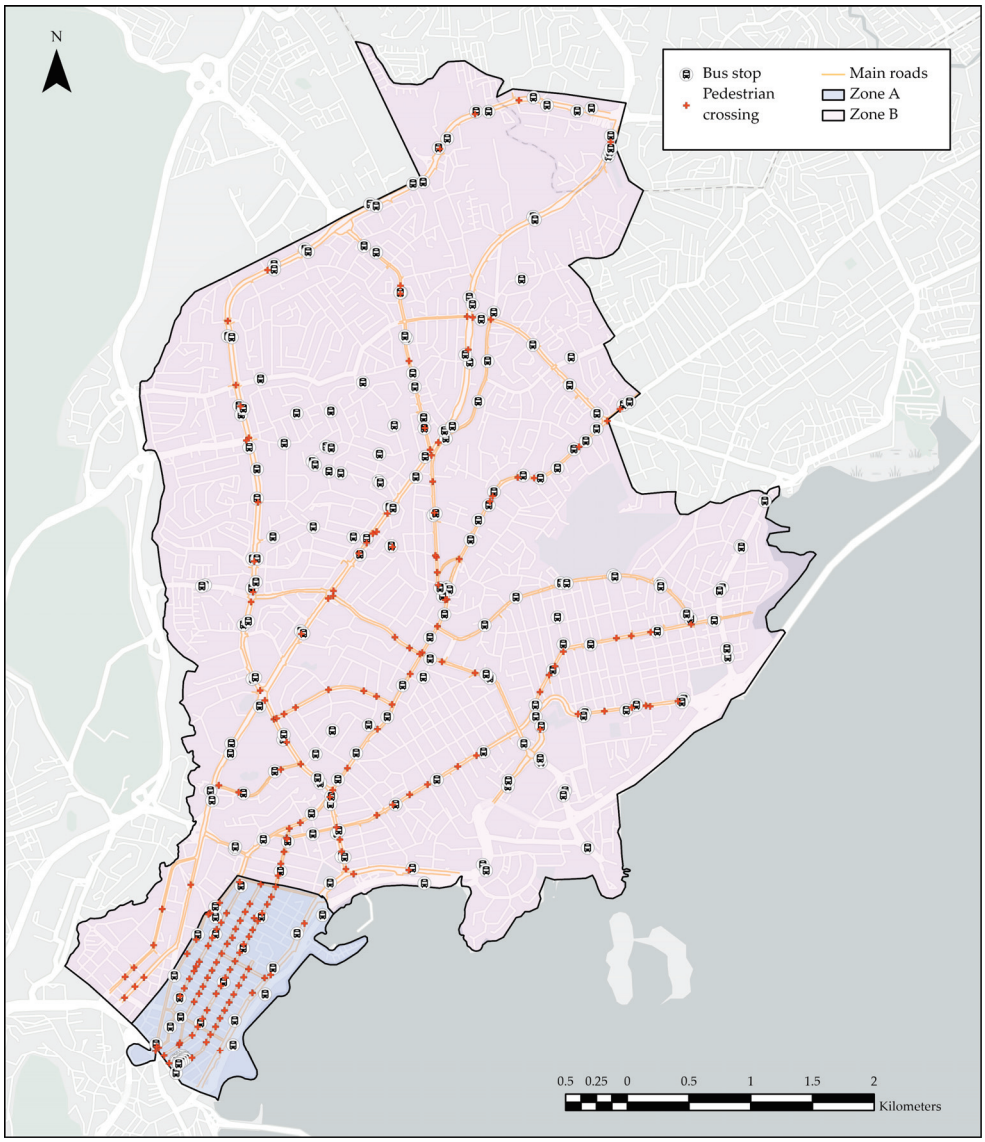

Figure 9. Map showing the locations of pedestrian crossings and bus stops within Zones A and B.

Table 4. Percentage distribution of distances between bus stops and pedestrian crossings.

Zone	0–100 m	>100–150 m	>150–200 m	>200 m
Zone A	78.95%	15.79%	5.26%	0%
Zone B	47.27%	17.58%	8.48%	26.67%
Case of study	53.20%	17.24%	7.88%	21.67%

In Zone A, the average distance between pedestrian crossings is 75.39 m (σ = 41.83 m), with the maximum distance between crossings being 338.59 m. In Zone B, the average distance is 154.32 m (σ = 129.06 m), and the maximum distance between crossings is 815.91 m. The overall average distance for the entire study area is 124.46 m (σ = 111.59 m).

Table 5 provides a detailed distribution of the distance ranges between pedestrian crossings in the study area, highlighting the higher density of crossings in Zone A, where most crossings are within 100 m of each other. In contrast, Zone B exhibits more dispersed crossings, with a significant portion of distances exceeding 200 m.

Table 5. Percentage distribution of distances between pedestrian crossings.

Zone	0–100 m	>100–150 m	>150–200 m	>200 m
Zone A	87.67%	8.22%	2.74%	1.37%
Zone B	38.33%	20.83%	16.67%	24.17%
Case of study	56.99%	16.06%	11.40%	15.54%

Figure 10a shows the buffer zones around pedestrian crossings in Zone A, where the distribution of crossings reveals a high density within relatively short distances. The greater part of the area is covered by pedestrian crossings spaced within 400 m of each other, which indicates a well-connected network that supports efficient pedestrian movement. In contrast, Figure 10b highlights the greater separation between crossings in Zone B, with some areas exhibiting disconnections of more than 600 m, especially in the northern part of the zone.

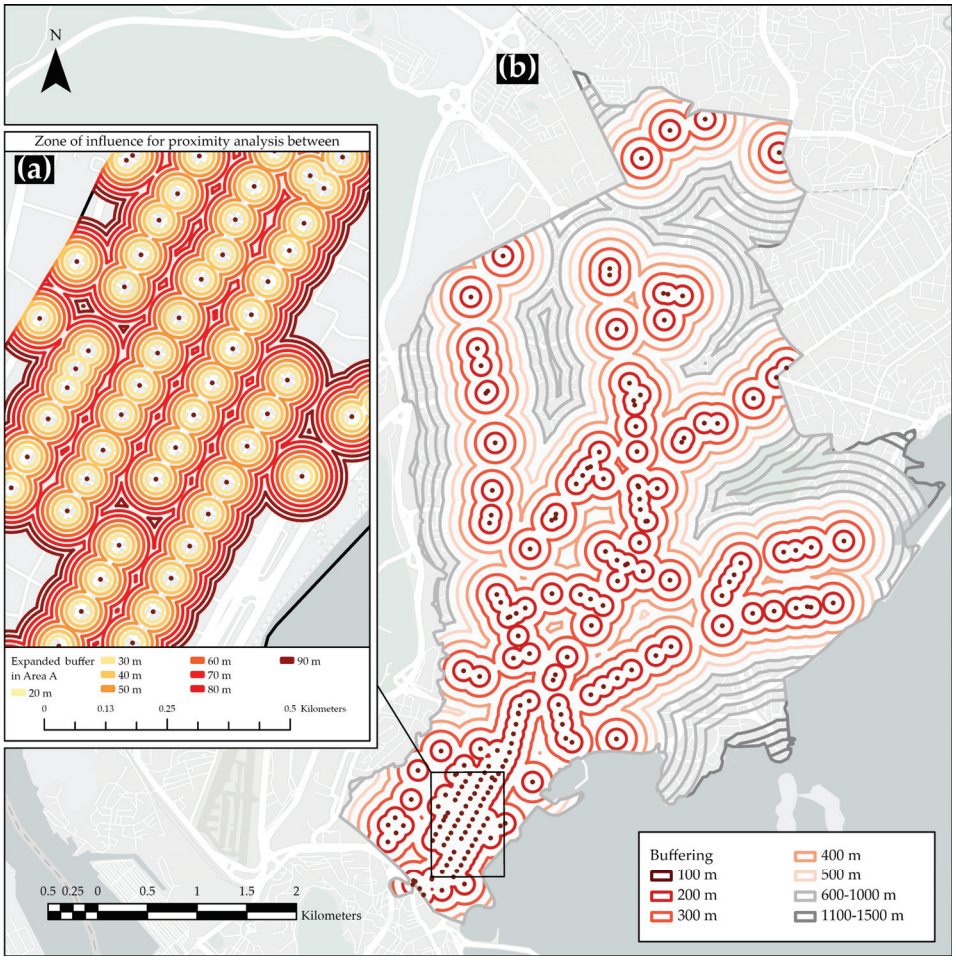

Figure 10. Zones of influence for proximity analysis between pedestrian crossings: (**a**) Close-up of Zone A analysis, illustrating distance thresholds from 20 to 90 m. (**b**) Map showing the distribution of pedestrian crossings and their corresponding buffer zones at distances ranging from 100 to 1500 m.

4. Discussion

The analysis of pedestrian structures reveals that discontinuities in both zones are considerably frequent along typical pedestrian routes, resulting from a combination of urban factors that limit continuous routes. This finding underscores the degree of fragmentation in both areas, with notable differences in average continuity, highlighting a barrier to accessibility and mobility experiences for pedestrians within Panama City.

The continuous stretches of pedestrian routes in Zone A tend to be longer and more variable, a product of dense, regular urban planning that favors extensive pedestrian segments. In contrast, Zone B presents shorter continuous stretches with less variability, reflecting a less planned urban pattern. This irregular structure in Zone B implies more pronounced fragmentation, with less consistent pedestrian routes.

Zone A's grid layout, combined with a more orderly mix of land uses, promotes longer and more direct pedestrian routes, although certain elements, such as service stations and unmarked crossings, create interruptions. Its grid-like, regular structure enhances street connectivity, facilitating shorter and more direct pedestrian routes. This regular layout allows pedestrians to follow linear routes, promoting greater pedestrian use of the space [49]. The connectivity of an urban grid directly influences the number of intersections and access points, improving the pedestrian experience by reducing physical barriers and maximizing accessible destinations within a walkable range [50]. In contrast, Zone B exhibits a more irregular urban configuration with a mix of commercial, residential, and industrial areas that limits pedestrian continuity.

Service stations in Zone B generate a greater proportion of discontinuities, reinforcing the idea that areas with an unbalanced mix of land uses tend to fragment pedestrian routes. The coexistence of different land uses in this area creates complex dynamics that impact pedestrian mobility. Pedestrian flows, influenced by commercial, industrial, and residential activities, can complicate connectivity between areas within the city. Although this diversity of uses fosters pedestrian activity and the use of public transportation, it also presents challenges due to a lack of infrastructure continuity, impacting integration between both systems [51].

The concentration of businesses in urban areas, while often seen as an asset for accessibility, can lead to significant interruptions in pedestrian mobility. Research emphasizes that urban functions, particularly land use and population density, significantly shape pedestrian movement and satisfaction. However, poorly planned commercial areas often prioritize vehicular access over continuous paths, disrupting the continuity of pedestrian networks, as observed in the case of Panama City. Studies highlight that while land use and population density influence pedestrian movement, proximity to services alone does not guarantee improved walkability [21]. Instead, inadequate integration of commercial regulations with pedestrian infrastructure exacerbates the fragmentation of pedestrian networks and undermines their effectiveness for sustainable mobility.

The impact assessment of these stations reveals that they promote car-oriented urban infrastructure [52,53]. Moreover, factors such as single-use zoning—which separates urban functions—and increased trip lengths, along with limited pedestrian and public transport accessibility, ultimately hinder pedestrian movement within the urban space [54,55].

Design guidelines recommend spacing crossings within 80–100 m to promote safe, predictable movement and reduce the likelihood of unsafe, non-designated crossings. Distances over 200 m should be avoided, as they create compliance and safety issues, increasing the chances of pedestrians choosing riskier, unauthorized crossing routes [56]. In Panama City, Zone A generally aligns with these guidelines, with most crossings within short distances, fostering a well-connected pedestrian network. In contrast, Zone B has larger gaps, with many crossings exceeding 100 m and some surpassing 200 m. These longer distances in Zone B may encourage pedestrians to bypass designated crossings in favor of more direct, unsafe routes, heightening the risk of pedestrian–vehicle conflicts.

The distance between bus stops and pedestrian crossings is crucial for both safety and the overall functionality of the transport network. In Zone B, where many bus stops exceed 100 m from crossings—and in some cases are more than 200 m—pedestrians are likely to take unsafe, non-designated routes, compromising safety and disrupting pedestrian flow.

This mirrors the challenges observed with crossing density in Zone B, where long distances encourage risky crossings. In contrast, Zone A benefits from better alignment, with most bus stops within the recommended 100 m range, though some still exceed it.

This study highlights the relationship between urban structure and discontinuities in pedestrian networks. In Zone A, more coherent planning allows for better pedestrian continuity, although elements like service stations still create interruptions. Zone B, however, faces additional challenges due to its less organized structure and higher density of service stations. To improve pedestrian accessibility and mobility, it is essential for urban planning strategies to pursue a balanced integration of urban elements that favor pedestrian continuity.

The case of Panama City illustrates how accelerated urban expansion and lack of planning have significantly impacted pedestrian routes, contributing to a fragmented pedestrian network within the urban environment. This setting presents a diverse range of land uses that, while encouraging accessibility and travel purposes, also contribute to pedestrian discontinuities, according to the study. This situation is somewhat paradoxical, as varied land use tends to promote accessibility [57,58]; however, in this urban context, it has been one of the main causes of fragmentation in pedestrian routes.

5. Conclusions

This study highlights the significant role of urban configurations in shaping pedestrian continuity and underscores the necessity for cohesive urban planning to support sustainable mobility and equitable access. By comparing Zones A and B in Panama City, clear differences in pedestrian continuity emerged. Zone A's structured grid layout enables longer and more consistent pedestrian routes, whereas Zone B's irregular and fragmented structure exacerbates discontinuities, reducing mobility and compromising safety. These findings underline the broader impact of unplanned urban growth on pedestrian infrastructure.

Key findings reveal that service stations and insufficient pedestrian crossings are important contributors to interruptions in pedestrian continuity, particularly in Zone B, where a high density of service stations reflects a car-oriented infrastructure. These elements create barriers to pedestrian mobility and integration with public transport systems. Conversely, Zone A demonstrates better alignment with design guidelines for crossing density and bus stop placement, enhancing pedestrian safety and connectivity. Addressing these challenges requires urban planning strategies that prioritize integrating street networks and urban elements, such as redesigning service station layouts and improving pedestrian continuity within mixed land-use environments.

Policy measures should emphasize proper spacing of pedestrian crossings, strategic placement of public transport stops, and mitigation of barriers from commercial infrastructures. Additionally, the findings reveal an apparent contradiction in urban contexts: while varied land use can increase accessibility, it often coincides with fragmented pedestrian networks in poorly planned environments. This study further emphasizes the need for thorough consideration of continuity in research focused on the characterization of macro pedestrian networks, particularly in cases involving challenges related to urban planning and irregular urban grids.

The proposed framework for efficient urban planning, considering the Panamanian context—where pedestrian mobility is not prioritized in urban structuring—aims to enhance the role of pedestrians within the mobility hierarchy. This study identifies a divergence between land-use diversity and pedestrian continuity, which leads to two key reflections. First, in an urban context such as Panama City, pedestrian mobility requires a more prominent and integrated role within the mobility system. Second, the interaction

between different types of continuity is recognized, highlighting how pedestrian continuity interconnects with other forms of continuity within the urban system. Urban planning policies should be directed toward an integrated system of planned continuities at the parcel level—one that considers both functionality and the dynamism of urban activities while maintaining pedestrian continuity as the primary structuring element linking the built environment with other transport modes.

Future research should explore institutional and regulatory frameworks influencing the spatial distribution of service stations and other commercial establishments. Understanding how these frameworks impact pedestrian networks, particularly in fragmented urban settings, could provide valuable insights for designing cohesive and equitable pedestrian infrastructure. Such studies would further equip urban planners and policymakers with actionable strategies to foster sustainable and inclusive urban mobility in rapidly growing cities.

Some limitations of this study arise from the fact that both the results and the comparisons between zones are presented solely in a descriptive manner. Furthermore, because the study focuses exclusively on pedestrian continuity, it does not directly measure whether continuity influences pedestrian flow or route choice, nor does it examine how pedestrian continuity might affect walkability or equity. In addition, as this study addresses the spatial distribution of urban elements, walking distances adjusted directly to pedestrian routes were not considered.

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References

1. Woldegebriel Tessema, M.; Girma Abebe, B. Quantification of Land Use/Land Cover Dynamics and Urban Growth in Rapidly Urbanized Countries: The Case Hawassa City, Ethiopia. *Urban Plan. Transp. Res.* **2023**, *11*, 2281989. [CrossRef]
2. Costa, P.B.; Neto, G.C.M.; Bertolde, A.I. Urban Mobility Indexes: A Brief Review of the Literature. *Transp. Res. Procedia* **2017**, *25*, 3645–3655. [CrossRef]
3. Abdulsamad, Q.; Mohammed, J.; Abdullah, P. Evaluation of the Existing Sidewalks in Duhok City. *J. Univ. Duhok* **2019**, *22*, 58–74. [CrossRef]
4. Vallejo-Borda, J.A.; Cantillo, V.; Rodriguez-Valencia, A. A Perception-Based Cognitive Map of the Pedestrian Perceived Quality of Service on Urban Sidewalks. *Transp. Res. Part F Traffic Psychol. Behav.* **2020**, *73*, 107–118. [CrossRef]
5. Bornioli, A.; Parkhurst, G.; Morgan, P.L. Affective Experiences of Built Environments and the Promotion of Urban Walking. *Transp. Res. Part A Policy Pract.* **2019**, *123*, 200–215. [CrossRef]
6. Valenzuela-Montes, L.M.; Talavera-García, R. Entornos de movilidad peatonal: Una revisión de enfoques, factores y condicionantes. *Eure* **2015**, *41*, 5–27. [CrossRef]
7. Cambra, P.; Gonçalves, A.B.; Moura, F. The Digital Pedestrian Network in Complex Urban Contexts: A Primer Discussion on Typological Specifications. *Finisterra* **2019**, *54*, 155–170. [CrossRef]
8. Nkurunziza, D.; Tafahomi, R.; Faraja, I.A. Pedestrian Safety: Drivers' Stopping Behavior at Crosswalks. *Sustainability* **2023**, *15*, 12498. [CrossRef]
9. Osama, A.; Sayed, T. Evaluating the Impact of Connectivity, Continuity, and Topography of Sidewalk Network on Pedestrian Safety. *Accid. Anal. Prev.* **2017**, *107*, 117–125. [CrossRef]
10. Sharifi, A. Resilient Urban Forms: A Review of Literature on Streets and Street Networks. *Build. Environ.* **2019**, *147*, 171–187. [CrossRef]

11. Stefanidis, R.-M.; Bartzokas-Tsiompras, A. Pedestrian Accessibility Analysis of Sidewalk-Specific Networks: Insights from Three Latin American Central Squares. *Sustainability* **2024**, *16*, 9294. [CrossRef]
12. Evans, G. Accessibility, Urban Design and the Whole Journey Environment. *Built Environ.* **2009**, *35*, 366–385. [CrossRef]
13. Oviedo Hernandez, D.; Dávila, J.D. Transport, Urban Development and the Peripheral Poor in Colombia—Placing Splintering Urbanism in the Context of Transport Networks. *J. Transp. Geogr.* **2016**, *51*, 180–192. [CrossRef]
14. Caballero, H.; Hidalgo, L.; Quijada-Alarcon, J. Study of Pedestrian Zone According to Superblock Criteria in the Casco Antiguo of Panama. *Sustainability* **2022**, *14*, 3459. [CrossRef]
15. García-Ayllón, S. Rapid Development as a Factor of Imbalance in Urban Growth of Cities in Latin America: A Perspective Based on Territorial Indicators. *Habitat Int.* **2016**, *58*, 127–142. [CrossRef]
16. Quijada-Alarcón, J.; Rodríguez-Rodríguez, R.; González-Cancelas, N.; Bethancourt-Lasso, G. Spatial Analysis of Territorial Connectivity and Accessibility in the Province of Coclé in Panama. *Sustainability* **2023**, *15*, 11500. [CrossRef]
17. Honiball, J.; Burger, E.; Burger, Y. Pedestrian Connectivity: A Focus on Residential Neighbourhood Sidewalks to Promote Accessibility to Public Parks. *Spatium* **2024**, *51*, 1–10. [CrossRef]
18. Lee, J.; Park, S. Investigating Pedestrian Connectivity within Apartment Complexes: A Case Study of Seoul and Singapore. *Local Environ.* **2022**, *27*, 697–711. [CrossRef]
19. Randall, T.A.; Baetz, B.W. Evaluating Pedestrian Connectivity for Suburban Sustainability. *J. Urban Plan. Dev.* **2001**, *127*, 1–15. [CrossRef]
20. Hidayati, I.; Yamu, C.; Tan, W. Realised Pedestrian Accessibility of an Informal Settlement in Jakarta, Indonesia. *J. Urban Int. Res. Placemaking Urban Sustain.* **2021**, *14*, 434–456. [CrossRef]
21. Jabbari, M.; Fonseca, F.; Smith, G.; Conticelli, E.; Tondelli, S.; Ribeiro, P.; Ahmadi, Z.; Papageorgiou, G.; Ramos, R. The Pedestrian Network Concept: A Systematic Literature Review. *J. Urban Mobil.* **2023**, *3*, 100051. [CrossRef]
22. Froehlich, J.E.; Saugstad, M.; Saha, M.; Johnson, M. Towards Mapping and Assessing Sidewalk Accessibility Across Sociocultural and Geographic Contexts. *arXiv* **2022**, arXiv:2207.13626.
23. Nag, D.; Sen, J.; Goswami, A.K. Measuring Connectivity of Pedestrian Street Networks in the Built Environment for Walking: A Space-Syntax Approach. *Transp. Dev. Econ.* **2022**, *8*, 34. [CrossRef]
24. Pearce, D.M.; Matsunaka, R.; Oba, T. Comparing Accessibility and Connectivity Metrics Derived from Dedicated Pedestrian Networks and Street Networks in the Context of Asian Cities. *Asian Transp. Stud.* **2021**, *7*, 100036. [CrossRef]
25. Jabbari, M.; Fonseca, F.; Ramos, R. Accessibility and Connectivity Criteria for Assessing Walkability: An Application in Qazvin, Iran. *Sustainability* **2021**, *13*, 3648. [CrossRef]
26. Karamitov, K.; Petrova-Antonova, D. Pedestrian Accessibility Assessment Using Spatial and Network Analysis: A Case of Sofia City. *Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci.* **2022**, *48*, 53–60. [CrossRef]
27. Tal, G.; Handy, S. Measuring Nonmotorized Accessibility and Connectivity in a Robust Pedestrian Network. *Transp. Res. Rec. J. Transp. Res. Board* **2012**, *2299*, 48–56. [CrossRef]
28. Isradi, M.; Fauziah, D.A.A.; Dermawan, W.B.; Mufhidin, A.; Mufhidin, A.; Prasetijo, J. Analysis of Sidewalk User Satisfaction in Alun-Alun Bekasi. *ADRI Int. J. Eng. Nat. Sci.* **2021**, *6*, 1–11. [CrossRef]
29. Scheltema, E.B. ReCYCLE City: Strengthening the Bikeability from Home to the Dutch Railway Station. Master's Thesis, Delft University of Technology, Delft, The Netherlands, 2012.
30. Quijada-Alarcón, J.; Rodríguez-Rodríguez, R.; Icaza, A.; González-Cancelas, N.; Bethancourt-Lasso, G. Social Perception of the Connectivity and Quality of Sidewalks in the Metropolitan Area of Panama. *J. Maps* **2024**, *20*, 2349167. [CrossRef]
31. Appolloni, L.; Corazza, M.V.; D'Alessandro, D. The Pleasure of Walking: An Innovative Methodology to Assess Appropriate Walkable Performance in Urban Areas to Support Transport Planning. *Sustainability* **2019**, *11*, 3467. [CrossRef]
32. Badland, H.M.; Opit, S.; Witten, K.; Kearns, R.A.; Mavoa, S. Can Virtual Streetscape Audits Reliably Replace Physical Streetscape Audits? *J. Urban Health* **2010**, *87*, 1007–1016. [CrossRef]
33. Santilli, D.; D'apuzzo, M.; Evangelisti, A.; Nicolosi, V. Towards Sustainability: New Tools for Planning Urban Pedestrian Mobility. *Sustainability* **2021**, *13*, 9371. [CrossRef]
34. *INEC XII Censo Nacional de Población y VIII de Vivienda 2023*; Instituto Nacional de Estadística y Censo: Panama City, Panamá, 2023.
35. Trute, M.; Treuherz, A.; Rodriguez, C.E.; Terraza, H.; Leano, J.M.; Bilbao, F.S.; Gaitan, N.M. *Plan de Renovación Urbana Para el Corregimiento de Calidonia*; Urban Design Lab: Panama City, Panamá, 2015; pp. 1–144.
36. Dietrich, U. The Pleasure of Walking in a Neighbourhood: The Pedestrian Route Network and Its Fractal Dimension as a Tool for the Assessment of the Right Balance between Chaos and Order. *Int. J. Transp. Dev. Integr.* **2022**, *6*, 155–167. [CrossRef]
37. Liu, Y.; Ding, X.; Ji, Y. Enhancing Walking Accessibility in Urban Transportation: A Comprehensive Analysis of Influencing Factors and Mechanisms. *Information* **2023**, *14*, 595. [CrossRef]
38. Angel, S. Urban Expansion: Theory, Evidence and Practice. *Build. Cities* **2023**, *4*, 124–138. [CrossRef]
39. Richter, S.M.; Bixler, R.P. Complexifying Urban Expansion: An Exploratory, Gradient-Based Approach. *Build. Cities* **2022**, *3*, 792–807. [CrossRef]

40. Saha, M.; Saugstad, M.; Maddali, H.T.; Zeng, A.; Holland, R.; Bower, S.; Dash, A.; Chen, S.; Li, A.; Hara, K.; et al. Project Sidewalk: A Web-Based Crowdsourcing Tool for Collecting Sidewalk Accessibility Data at Scale. In Proceedings of the C2019 CHI Conference on Human Factors in Computing Systems, Glasgow, UK, 4–9 May 2019. [CrossRef]
41. Fonseca, F.; Fernandes, E.; Ramos, R. Walkable Cities: Using the Smart Pedestrian Net Method for Evaluating a Pedestrian Network in Guimarães, Portugal. *Sustainability* **2022**, *14*, 10306. [CrossRef]
42. Mäki-Opas, T.E.; Borodulin, K.; Valkeinen, H.; Stenholm, S.; Kunst, A.E.; Abel, T.; Härkänen, T.; Kopperoinen, L.; Itkonen, P.; Prättälä, R.; et al. The Contribution of Travel-Related Urban Zones, Cycling and Pedestrian Networks and Green Space to Commuting Physical Activity among Adults—A Cross-Sectional Population-Based Study Using Geographical Information Systems. *BMC Public Health* **2016**, *16*, 760. [CrossRef]
43. Chudyk, A.M.; McKay, H.A.; Winters, M.; Sims-Gould, J.; Ashe, M.C. Neighborhood Walkability, Physical Activity, and Walking for Transportation: A Cross-Sectional Study of Older Adults Living on Low Income. *BMC Geriatr.* **2017**, *17*, 82. [CrossRef]
44. Alshalalfah, B.W.; Shalaby, A.S. Case Study: Relationship of Walk Access Distance to Transit with Service, Travel, and Personal Characteristics. *J. Urban Plan. Dev.* **2007**, *133*, 114–118. [CrossRef]
45. Dai, D.; Taquechel, E.; Steward, J.; Strasser, S. The Impact of Built Environment on Pedestrian Crashes and the Identification of Crash Clusters on an Urban University Campus. *West J. Emerg. Med.* **2010**, *11*, 294–301.
46. Martinuzzi, C.; Lahoud, C. *Public Space Site-Specific Assessment: Guidelines to Achieve Quality Public Spaces at Neighbourhood Level*; UN Habitat: Nairobi, Kenya, 2020.
47. Talpur, M.A.H.; Khahro, S.H.; Abro, S.; Shaikh, H. Measuring GIS-Based Pedestrian Accessibility to Bus Stops: A Sustainable Approach to Ease Urban Traffic Problems at Hyderabad, Pakistan. *Discov. Cities* **2024**, *1*, 28. [CrossRef]
48. Yang, Y.; Diez-Roux, A.V. Walking Distance by Trip Purpose and Population Subgroups. *Am. J. Prev. Med.* **2012**, *43*, 11–19. [CrossRef] [PubMed]
49. Sevtsuk, A.; Kalvo, R.; Ekmekci, O. Pedestrian Accessibility in Grid Layouts: The Role of Block, Plot and Street Dimensions. *Urban Morphol.* **2016**, *20*, 89–106. [CrossRef]
50. Busquets, J.; Yang, D.; Keller, M. *Urban Grids: Handbook for Regular City Design*; Harvard University Graduate School of Design: Cambridge, MA, USA, 2019; ISBN 9781940743950.
51. Battisti, F.; Pisano, C.; Crosas, C.; Gómez-Escoda, E.; Villavieja, E. Interplay between Land Use Planning and Functional Mix Dimensions: An Assemblage Approach for Metropolitan Barcelona. *Sustainability* **2024**, *16*, 7734. [CrossRef]
52. Assmann, C. The Emergence of the Car-Oriented City: Entanglements and Transfer Agents in West-Berlin, East-Berlin and Lyon, 1945–1975. *J. Transp. Hist.* **2020**, *41*, 328–352. [CrossRef]
53. Heinonen, J.; Czepkiewicz, M.; Árnadóttir, Á.; Ottelin, J. Drivers of Car Ownership in a Car-Oriented City: A Mixed-Method Study. *Sustainability* **2021**, *13*, 619. [CrossRef]
54. Brownrigg-Gleeson, M.L.; Monzon, A.; Cortez, A. Reasons to Pedestrianise Urban Centres: Impact Analysis on Mobility Habits, Liveability and Economic Activities. *Sustainability* **2023**, *15*, 16472. [CrossRef]
55. Newman, P.; Kosonen, L.; Kenworthy, J. Theory of Urban Fabrics: Planning the Walking, Transit/Public Transport and Automobile/Motor Car Cities for Reduced Car Dependency. *Town Plan. Rev.* **2016**, *87*, 429–458. [CrossRef]
56. Global Designing Cities Initiative Pedestrian Crossings. In *Global Street Design Guide*; Island Press: Washington, DC, USA, 2016; pp. 112–113.
57. Ewing, R.; Cervero, R. Travel and the Built Environment. *J. Am. Plan. Assoc.* **2010**, *76*, 265–294. [CrossRef]
58. Lewis McConville, M. Defining Mixed-Use: Which Land Uses Promote Walking? Master's Thesis, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, 2009. [CrossRef]

urban science

Article

Recognition and Evaluating the Indicators of Urban Resilient by Using the Network Analysis Process

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Abstract: Today's cities are increasing their space zones while becoming more vulnerable to natural disasters and man-made threats. The initial evaluation of the resilience of city systems is of great importance and helps develop policies and measures that would improve resilience. This paper, using a descriptive–analytic method, defines the characteristics of a resilient city, and natural disasters are addressed. At the same time, the process of reaching a resilient city is investigated. Then, the indicators of resilience have been defined in pillars of ecologic, physiological, social, economic, and managerial–institutional dimensions for the evaluation of a resilient city in Iran. As the sample of the study, the indicators of the study were evaluated in the city of Sanandaj and prioritized in the network analysis process (ANP). The results of this analysis showed that zones one and two, respectively, were the weakest parts regarding urban resilience. In order to move toward a resilient city, future investments should go beyond financial investment and technical solutions and consider human and community development, as well as institutional capacity and inter-organizational cooperation.

Keywords: natural disasters; urban resilient; network analysis process

1. Introduction

The scientific evidence tells us that currently, the rise of seawater levels, storms, heatwaves, droughts, changes in precipitation patterns [1,2], river floods, changes in the speed, intensity, and frequency of winds, and other climate disorders are increasing [3,4]. A lack of enough trust, unpredictability, and change are the defining features of today's world. The cities should be able to respond to the probable dangers before the occurrence of any crisis [5,6]. UN-Habitat estimates that 68% of the world's population will live in urban areas by 2050, and approximately 60% of this growth is expected to take place in Asia [7,8].

Due to the location of Iran's plateau on an area of the earth with lots of dangers, including the earthquake belt of Himalaya Alp, the orogeny zone, topographical diversity, and non-uniform natural conditions, as well as the climate changes that have occurred in recent years, the occurrence of different natural disasters is inevitable [9]. According to the accident report related to natural hazards in the UN/ESCAP, Iran is among the top 10 countries in the world in terms of disasters, and it is also third in the world in terms of losses caused by risk [10].

The future threats cannot be predicted based on the current evidence, and the state, size, and place of such threats cannot be easily forecasted either. Therefore, what matters in the occurrence of events is not only the destruction of buildings and houses, but rather it is the resilience of the economic and social structures that can ensure the sustainability of urban life and people can resume their activities in the least amount of time and city restore its dynamism and sustainability [11–14].

The evaluation of urban resilience is the first step toward resilience plans, such that it can show the vulnerability of societies and zones and their ability to adapt themselves [15,16]. This can also lead to the identification of factors contributing to resiliency,

enhancement of the key capacities of communities for further adaptation, and finally, development of resilience strategies [17,18]. The main purpose of this research was to introduce a conceptual framework for understanding the relations between the components of urban resilience and defining the indicators of the resilient city in order to identify the more vulnerable zones in the face of natural disasters.

By the beginning of the 1990s, which is known as the International Decade of Natural Disasters Reduction (IDNDR), throughout the world, different attempts have been made to create a framework for the reduction of disasters. The meeting of municipal leaders, which was planned by ICLEI in 1993 in the United Nations, was the first and biggest gathering of local governments in regard to climate changes and natural disasters. The purpose of meetings has been to enhance the awareness and commitment to attain sustainable development so that the threats could be minimized and welfare would be improved [19,20].

United Nations Office for disaster risk reduction, which is known as ISDR, is, in fact, a world information bank that provides information regarding disaster reduction, as well as activities related to the enhancement of public awareness and books, papers, and reports published in the field of crisis management. In 2008, Rockefeller Fund, in order to respond to the need for city adaptation in Asian cities with a fast rate of growth, supported some plans titled 'Asian Cities Climate Change Resilience Network' (ACCCRN) [21]. Godschalk required features of social and structural systems to create resilience. These features are as follows: Surplus, diversity, efficiency, independence, internal unity, adaptation, and cooperation power [22]. In 2008, Cutter explained the relationship between vulnerability and resilience and suggested the Disaster Resilience of Place (DROP) model for evaluating resilience [23]. In 2012 Moench and Tyler defined a framework for city resilience planning by focusing on city systems, city factors, city institutes, and other social structures [19]. In 2013, Desouza and Flanery emphasized that economic, technological, human, and natural crises are causes of the decline and destruction of physical, social, and institutional actions, and cities that are adjustable and flexible in planning and agility management can help build resilience [24].

2. Materials and Methods

2.1. Analytic Network Process (ANP)

In the first phase, ANP is used to construct a network model in order to calculate the relative weights of indicators that we reached in the previous section.

ANP, introduced by Saaty (1996), is a comprehensive decision-making technique that provides a way to input judgments and measurements to derive ratio scale priorities for the distribution of influence among the factors and groups of factors in the decision. This technique is suitable for both quantitative and qualitative data types. ANP models have two parts; the first is a control hierarchy or network of objectives and criteria that control the interactions in the system under study; the second is a network of influences among the elements and clusters [25].

The process of ANP includes the following three major steps:

Construction of model and structuring the problems: The problem should be stated in clear and logical system as a network that is decomposed. The structure can be obtained by consultation with decision-makers through techniques such as brainstorming, questionnaire, or other appropriate methods.

In next step, pairs of decision elements at each cluster are compared with respect to their importance towards their control criteria. The clusters themselves are also compared pairwise with respect to their contribution to the objective. Decision-makers are asked to respond to a series of pairwise comparisons of two elements or two clusters to be evaluated in terms of their contribution to their particular upper-level criteria. In addition, interdependencies among elements of a cluster must also be examined pairwise; the influence of each element on other elements can be represented by an eigenvector. The relative importance values are determined with Saaty's [25,26] 1–9 scale, where a score of 1 represents equal importance between the two elements and a score of 9 indicates

the extreme importance of one element (row cluster in the matrix) compared to the other one (column cluster in the matrix). Pairwise comparison in ANP is performed in the framework of a matrix, and a local priority vector can be derived as an estimate of the relative importance associated with the elements (or clusters) being compared by solving the following equation:

$$A \times w = \lambda_{max} \times w$$

where A is the matrix of pairwise comparison, w is the eigenvector, and λ max is the largest eigenvalue of A. Saaty proposes several algorithms to approximate w. In this paper, Super Decision software is used to compute the eigenvectors from the pairwise comparison matrices and to determine the consistency ratios.

Supermatrix formation: Concept of the supermatrix is similar to the process of Markov chain process. Supermatrix is capable of limiting relative weights to calculate all priorities and, as a result, cumulative effect of each element on other elements. In order to obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a supermatrix, and it is transformed into a weighted supermatrix. The weighted supermatrix is raised to the power of an arbitrarily large number to achieve convergence on the important weights, and this new matrix is called the "limit supermatrix". The final priorities of all the elements in the matrix can now be obtained by normalizing each block of this limit supermatrix [25].

2.2. Context Review

Sanandaj city, capital of Kurdistan province, is located in the geographical position of 35° and 20 min of the north latitude and 47 degrees and 18 min in the east of Greenwich (Figure 1). Sanandaj city is located on some fault in the western part and has a cold and mountainous climate, and there is also the possibility of heavy rainfalls, floods, and high winds. In 2021, the city of Sanandaj included 5 connected zones and 4 separate urban zones not studied in this research. According to the latest population and housing census in 2016, the population of this city was 412,767 people, without considering these latter zones [27].

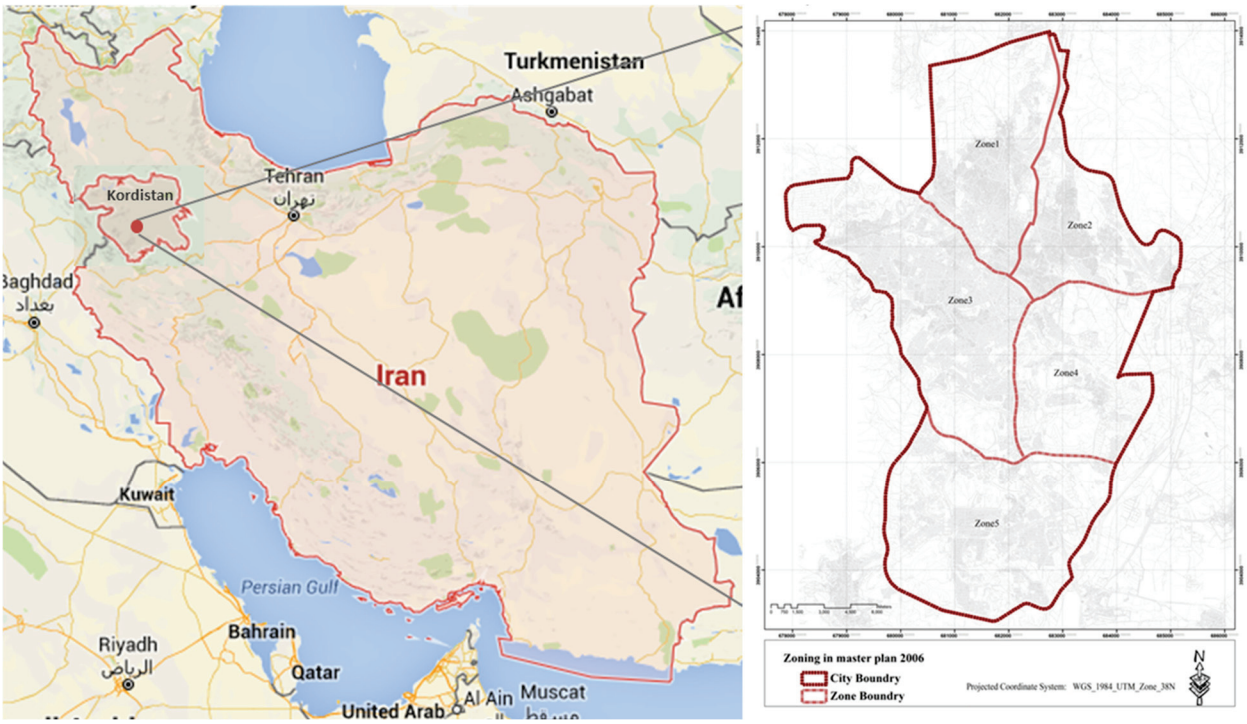

Figure 1. The situation of Sanandaj city in Iran.

2.3. Sampling

The information needed to evaluate the indicators were collected through questionnaires, interviews, field interpretations, and statistics obtained from the organizations and relevant departments. According to the population of the city of Sanandaj, the size of the sample was calculated by the Cochran formula, with the accuracy of 0.05 and 1.96 percent error, which was 384.

$$n = \frac{\frac{t^2pq}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2pq}{d^2} - 1\right)}$$

In the above formula, N is the population, n is the sample size, t is the percentage of standard error (typically 1.96), p is the proportion of the population without a specific attribute (usually 0.5), q is the proportion of the population with certain characteristics, and d is the potential efficiency [28].

The information coming below represents the indicators in the city of Sanandaj. It should be noted that the data, such as climate conditions, regulations, governmental organizations, etc., were the same for all areas and investigated generally and throughout the city.

2.4. Climate Change and Natural Disasters

Among natural factors, climate plays an important role in human activities. In 1990, according to the Intergovernmental Panel on Climate change (IPCC), climate pressures were defined as the effects that were due to the interaction of climate changes with dangerous climate events that could occur in a specific period of time [29]. The average global economic cost of disasters increased approximately six-fold from 1970 to 2000 [30].

2.5. Resilience City

This term, from the Latin root 'resilio', entered into English in the early 17th century, with the meaning 'jumping back'. There are some arguments regarding the scientific area to which this term belongs. Some have attributed it to the fields of physics and mechanics and material measurement in the recent century [31], and during 1960s, some believed that there were some roots of it in child's psychology and environmental and ecological studies [32]. Resilience was also proposed by Holling in 1973 in the area of ecology. During 2000s, the concept of resiliency was widely used in disaster risk reduction (DRR). The use of resiliency concept entered the agenda of local governments during 2000s. Resilient city is a city whose goal is to develop a community that would not be vulnerable to climate changes, natural and artificial disasters, and economic shocks [1]. The resilient city should have qualities that help it remain resilient before, during, and after crisis.

2.6. Urban Resilient Planning

Policies and resilience knowledge create two key terms: "vulnerability reduction" and "adaptation enhancement", with resilience being a combination of the two.

Vulnerability: Vulnerability is the extent to which a system can cope with the effects of climate crisis [33], and it is measured as a function of exposure and sensitivity of system to pressure factors and the measures that can be adopted before the incidence.

Adaptive Capacity: Adaptive capacity refers to the ability of the system to adapt itself to the changes and severe events and to reduce the damage in the face of consequences [34]; it also relates to measures after the incidence.

Figure 2 shows that with the increase in the urban population and the excessive use of natural resources, some climate changes occur that inflict some pressure on city systems. These systems, depending on their sensitivity and exposure to danger, may be damaged. In this regard, measures to increase adaptation can be the solution to reach a resilient city.

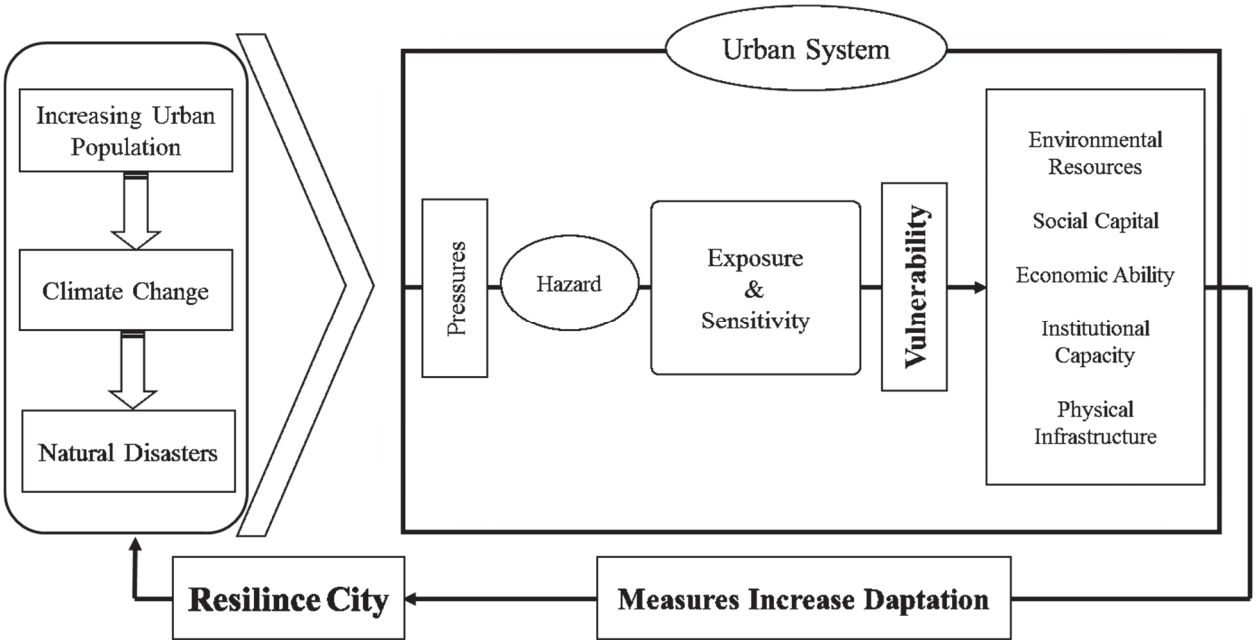

Figure 2. The conceptual relationship between natural disasters, vulnerability, adaptation, and urban resilience.

2.7. Resilience Indicators

The indicators are defined in ecologic, structural, social, economic, and managerial–institutional parameters. The importance of these parameters is explained below:

Ecologic: The most fundamental issues related to the access to drinking water, energy, and food resources. Diversification of energy sources makes it possible to meet the needs if one of the sources is damaged. Air pollution caused by dust and greenhouse gas emissions, in addition to negative effects on people's health, can be harmful to agricultural crops, agricultural development, and food security.

Structural: Density and building quality, types of building, and the related standards can be effective in the intensity of damage. In the case of incidents, rapid exit, health care services, temporary housing, and minimal possibilities needed for residents should be provided.

Social: One of the most important elements at risk is the population of urban areas. The institutionalization of a culture of prevention in the face of events and improvement in the awareness of community and its skills can reduce the number of damages incurred. Social relationships and a sense of belonging to the neighborhood can help the residents assume responsibility in helping to improve the situation.

Economic: The most reliable source of construction and improvement in Iran is based on individual or household savings. Not relying on only one sector of city's economy can prevent the paralysis of city in case a problem arises.

Managerial–institutional: If the participation and coordination of people and public institutions in crisis management can be enhanced, the progress of programs reducing the risk, management measures, and enforcement of rules can be eased and ensured. Each city, based on risks that threaten it, should have some regulations for the location of applications, construction principles, compactness, installations, and the services provided by government organizations. They also devote some funds to implementation of plans. Each of the organs involved in municipal affairs also must prepare for emergencies and natural disasters.

Table 1 shows the indicators in pillars of above-mentioned dimensions, as well as the data required for the evaluation of each index.

Table 1. Indexes used for the evaluation of city resilience [5,17,35–37].

Pillars	Indicators	Explanation
Ecologic	Environmental	The use of renewable energies; air pollution rate; Access to drinking water; number and variety of energy sources; the number of water supply choices
	Geographic	Proximity to dangerous zones (fault ،beach ،volcano . . .); the rate of heat; precipitation and freezing increase
Structural	Food Security	Access to food resources; farming development
	Infrastructures	Draining facilities; civil installations; The possibility of quick exit; roads width; city installations
	Land Use	The ratio of open and green spaces; access to medical centers; the number and capacity of shelters and transitory-residence places; use mixing
Social	Public Services	Access to fundamental needs; the capacity of medical services; firefighting facilities
	Social Relations	Social relations of residents; Sense of place
	Security and Welfare	Crime rate; the number of people covered by medical insurances
	Education	People's skill in reaction and awareness of different disasters; the number of trained people
Economic	Income	Families income level; families saving
	Employment	Job security; diversity in city economy
	Insurance	Dangers insurance
Managerial And Institutional	Public Institutes	People's participation; the number of NGOs; volunteer groups of red crescent
	Governmental Organizations	Crisis management organization; credits for resistant; governmental bonuses for readiness; Supportive governmental organization; coordination between governmental institutes; the required management instruments; human, economic and technical capacity

3. Results and Discussion

3.1. The Evaluation of Adaptation Indicators

Environment: In the architecture of new districts, unlike the old ones, the focus is more on energies that are not renewable, such that design is based on the use of heating and cooling tools. Based on recent studies performed by the World Health Organization in 1100 cities in the world, during the 2003–2010 time period, in terms of air-bore particles, Sanandaj city was the third most polluted city in the world. On average, annually, there were 119.1 days with air-born particles [38].

Geographic climate: The districts located in the western part of the city, which are in the catchment of Abidar Mountain, are more in danger of floods. Regarding earthquakes, Sanandaj city is within two earthquake zones of Sanandaj-Sirjan and Zagros, and there is the possibility of earthquakes as strong as six or seven Richter in this city. According to Table 2, constant temperature fluctuations, rainfall, and freezing do not follow a uniform trend and are increased and decreased in a sinus manner, thereby making weather forecasting quite difficult.

Table 2. The rate of heat increase severe rainfall and freezing. The average of the five-year period (2009–2011).

* Title	2009	2010	2011	2012	2013
Annual temperature fluctuations (centigrade)	−3.0	−1.0	−2.1	6.1	−1.1
Annual precipitation fluctuations (millimeter)	3.189	−4.108	7.60	−2.64	1.9
Annual fluctuations in the number of freezing days	−24	46	7	−24	10

* Authors' calculations based on meteorological annuals, Sanandaj station (2012–2021).

Food Security: The considerable reduction in the annual precipitation of Sanandaj city from 490 to 360 mm, and the excessive use of underground water resources in agriculture are the main reasons for the decrease in the water resources of the city. Ignoring the agricultural potential and its correct directions have led to the addition of 13 villages to the city from 2011 to 2021 [27]. More than 800 hectares of agricultural lands around the city have witnessed the change in their application (Table 3).

Table 3. Area and the percentage of green space, gardens and agricultural land in the zones of Sanandaj city (2014).

Area and Percentage	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
area	127,582	264,660	367,224	2,039,325	334,189
Percent of the whole use	3.2	7.4	4.9	46.7	6

Infrastructures: Due to the topographical condition and the different slopes of the city, there is a network of labyrinthine streets. Many urban streets have been designed without considering the natural direction of drainage and are often perpendicular to the land slope (Figure 3). One of the problems in the energy distribution system is lagging behind technology.

Figure 3. Streets perpendicular to the general direction of earth slope.

More than 97% of the electricity distribution network is of air type in Sanandaj city [38]. The air network, due to more accessibility, is more subject to danger. In gas distribution lines, most part of the city is covered by steel pipes, while it is known that poly-ethylene pipes have such superior properties as no corrosion or rusting, flexibility in temperatures less than zero, no breakage, and thermal insulation [39].

Land use: Land use, known as the surfaces having open space, can be very effective in the adsorption of surface waters and controlling urban floods: The use of green space refers to gardens and farms. Most gardens of Sanandaj city are near the Gheshlag River in zone four, such that it could control the torrents of the river, but in recent years, with the

development of the city around this river, a large part of these lands has been destroyed and replaced by urban land use, especially residential uses.

Zone four had the highest percentage of green space. This was due to the location of Deghayeran village and agricultural lands in this zone, which have been added to the city in the recent decade.

GIS specialized center of the University of Kurdistan has identified 37 places as the accommodation centers of people suffering from natural and artificial disasters in Sanandaj based on the analysis of the data related to land use, faults, water resources, roads accessible, and city topography. These identified zones are not yet ready for the people who may suffer.

Public services: According to the survey conducted among the local people, more than 46.6 met their needs outside their neighborhood. This was due to the inappropriate distribution of land uses in the neighborhoods. According to Iran Statistics Center, in Sanandaj city, there are 135 medical centers, 38 sanitary centers, and 6 medical institutes with 1287 hospital beds. Given the centrality of Sanandaj city, the capacity of these medical centers cannot adequately meet the needs of people. Sanandaj has 5 firefighting stations and 80 operational forces. The number of firefighters in this city is half of the rate of the country (for 2500, there is one firefighter). In order to attain the standard, 80 more operational forces are required.

Demographic features: More than one-third of the Sanandaj population consisted of people younger than 15 and older than 65. As the number of people in this age range rises, rescue operations can be more difficult in emergencies. In terms of population concentration, zones two and one had the highest concentration (Table 4). If the necessary predictions and measures are not adopted, the greatest damage is likely to occur in these zones.

Table 4. Age and gender proportions of the population of Sanandaj city (2021).

The Age Ratio of Population						Gender Ratio		
Less Than 15		15 to 64		65 and More		Male	Female	Gender Ratio
Number	Percentage	Number	Percentage	Number	Percentage			
92,051	29.18	209,016	66.25	14,428	Apr-57	160,832	154,663	103.99

Social relations: The social relations of the residents in different zones of Sanandaj city were evaluated by surveying and asking them about the three factors regarding their respect for neighbors' rights, their tendency to cooperate with neighbors to resolve the problems, and their interest in asking for help in the case of emergencies. More than 80 percent of them reported strong relations.

Social security and welfare: The rate of crime in Sanandaj city was only available for addiction, thief, and suicide. This was increased from 0.56 in 2014 to 0.62% in 2016 (last census) [27]. Based on the information obtained from surveys, more than 11 percent of people had no medical insurance.

Education: The results of public surveys showed that 67.9% of people had weak skills in promptly reacting to the events. Given the motto of the Red Crescent, "each Iranian family is a saver", there should be as many educated people as the number of families so that in the case of events, they can help themselves and their families. This was very low in Sanandaj city, and the number of trained people was less than 10% of the population.

Employment: According to the census of people and houses conducted in 2016, the rate of unemployment in people older than 10 years was 32.2% in the city of Sanandaj, which was high and influenced job security. For disasters, there should be strong financial support for compensating for the damage incurred by the buildings. Based on the data obtained from the questionnaires, more than 75% of the buildings did not have this kind of insurance.

Income: In 2016 (last census), the inflation rate was 1.3 percent more than that of the income level. This creates a problem for families in meeting their basic needs, and they cannot cater to other things.

Non-governmental organizations: The duties of such organizations are not clear in city management, and there is no definition for the services provided by them. At the same time, their participation has not been predicted in the urban planning process. These are the major reasons behind the lack of participation by these organizations. The survey showed that only 51% of the residents tended to participate in city affairs.

Governmental organizations: In 2016, credits as many as billions were devoted to Kurdistan Province by the government. These credits were divided between the municipalities for the development of urban infrastructures, and they were not used for coping with unexpected events.

Based on the interviews conducted with some experts in the concerned organizations (such as gas companies, water organizations, and electricity offices), all of these are expected to be supported by the crisis management, while each of these organizations should be responsible for all their services before and after the crisis.

3.2. Evaluation of Resiliency Using ANP Model

The analytic network process (ANP) approach derived from the idea of the Markov chain is employed to deal with this dynamic situation. With this approach, the priority of motivations and the relative importance of criteria are determined simultaneously. The ANP allows both interaction and feedback within clusters of elements (inner dependence) and between clusters (outer dependence). Such feedback can capture the complex effects of interplay in human society, and this is especially important when risk and uncertainty are involved. The analytical network process (ANP) has been used to develop the framework because of the dependency on measures and the antecedents. Yet another reason to use ANP is that it provides relatively more reliable results compared to the other similar methods [40]. The steps followed to attain the priorities for the indicators using the ANP model are as follows. At first, comparative matrices of dimensions and their internal dependence, indicators, and the dependence of them were formed, and the pair comparisons were made. The weight of each of the dimensions and indicators was considered relative to one another and determined by surveying among experts, and then the paired comparative matrix of dimensions and indicators was obtained from the geometrical average of opinions received. With the forming of a network model in the Super Decisions Software and entering the average of weights, an imbalanced supermatrix, balanced supermatrix, and limit matrix were obtained. The ultimate importance vector of indicators was obtained from normalizing the limit matrix (Table 5).

Table 5. The ultimate significance of the indicators.

Adaptation Indicators	Weight
Infrastructures	0.205
NGOs	0.135
Education	0.125
Land use	0.102
Food security	0.082
Governmental organizations	0.073
Public services	0.061
Social relations	0.043
Employment	0.057
Environment	0.054
Income	0.027
Insurance	0.025
Social welfare and security	0.014

3.3. Prioritizing Zones

In the comparison of zones at this stage, first, they were prioritized relative to each other in each of the indicators, and then the priority of each indicator in every zone was determined. The scores obtained by the paired comparison of zones and indicators were

entered into Super Decision Software so that the ultimate weight of each zone relative to one another and the weight of the indicators could be obtained in relation to the current situation in Sanandaj city. Table 6 shows the weight of the indicators in Sanandaj city. As can be seen, the indicators of insurance and public services had the least weight. In other words, these indicators, in comparison to others, had an inappropriate situation in this city.

Table 6. The ordering of indicators according to the current situation in the zones of Sanandaj city.

Adaptation	Score
Insurance	0.039
Public services	0.051
Social relations	0.061
Land use	0.061
Education	0.068
Governmental organizations	0.077
Environment	0.081
Food security	0.083
Employment	0.084
Income	0.087
Social welfare and security	0.092
NGOs	0.093
Infrastructures	0.121

Table 7 shows the ultimate weight of the zones resiliency. As shown, zones two and one, respectively, had the least weight in vulnerability (Figure 4).

Table 7. The ultimate weighting of the resiliency in zones.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
resilience	0.368	0.29	0.413	0.468	0.461

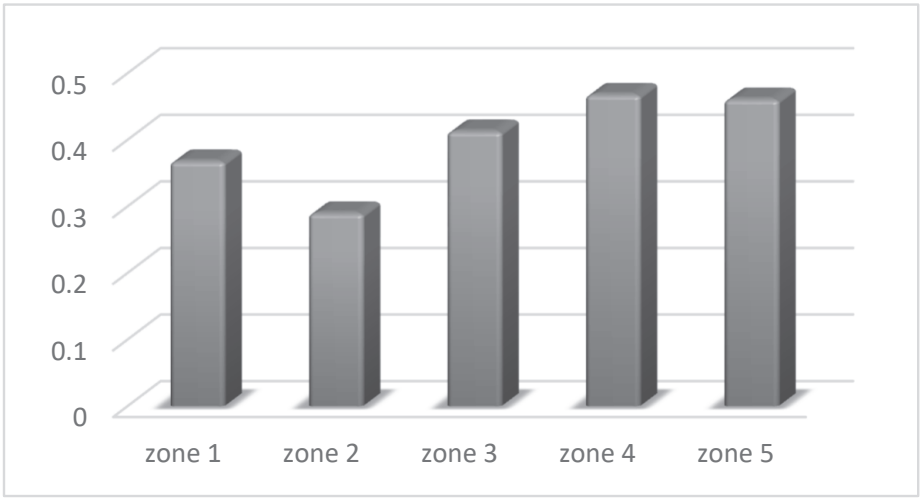

Figure 4. The ultimate weighting of the resiliency in zones.

3.4. Suggestions

Adapting to the changes and decreasing the dangers make it possible to continue development in the midst of all events, as the local governments assume responsibility for the disasters, and such disasters are not to disrupt the lives of people. Planning and developing strategies for resiliency cannot be limited to a particular framework. This should be performed according to the unique conditions of the cities and the developmental plans. The indicators that are weak or show some stagnation during a period are among those that

can hinder urban resilience. Thus, it is necessary to find causes, weaknesses, or stagnation of these indicators that, with planning, can be improved to foster resiliency.

In order to move toward a resilient city, future investments should go beyond material investment and technical solutions and should consider the development of humans, society, institutional capacity, and inter-city cooperation. One of the ways to promote investment and social trust is the development of participatory management, such that the local stakeholders can be ready for the changes. The cooperation between governmental institutions, instead of bestowing all the responsibility of coping with and preparing for things to one part, seems to be necessary. It should be noted that while the costs and measures of resilience are at the present time, the benefits can be observed in the future; as the concentration of humans and their properties in the city are increased, the possibility of losing them is also increased.

In spite of the differences between the dimensions of the city, there are some general and common measures that can help resilience, some of which are mentioned here:

Ecologic: Protecting ecologies and natural buffers for the reduction of floods and storms; preventing construction in dangerous areas; agricultural development; and designing based on the use of renewable energies.

Structural: Improving the safety coefficient in the buildings; ensuring the accessibility of the fundamental services for all and providing supportive services following disasters; protecting city infrastructures; and using the technology in constructing city installations.

Social: Developing and strengthening scientific multi-dimensional studies that are coordinated and protecting research and science centers; paving the way for education and further understanding of the relations between climate issues and city problems; and planning for the balanced distribution of population.

Economic: Using a wide variety of local economic activities; planning for the sustainability of business; strengthening the economic abilities of the citizens; and empowering those living in less developed zones.

Managerial–institutional: Creating the institutional capacity; considering resilience in preparing city plans; and developing a participative management system.

4. Conclusions

The future threats cannot be predicted based on the current evidence, and the state, size, and place of such threats cannot be easily forecasted either. Therefore, what matters in the occurrence of events is not only the destruction of buildings and houses, but rather it is the resilience of the economic and social structures that can ensure the sustainability of urban life and people can resume their activities in the least amount of time and city restore its dynamism and sustainability.

The evaluation of urban resilience is the first step toward resilience plans, such that it can show the vulnerability of societies and zones and their ability to adapt themselves. This can also lead to the identification of factors contributing to resiliency, enhancement of the key capacities of communities for further adaptation, and finally, development of resilience strategies.

The results obtained by the surveys conducted among the experts and the analysis of them in the analysis network process showed that indicators of infrastructure were important in the structural pillar, the public institutions in the managerial–institutional pillar, and education in the social pillar had the highest scores. This showed that the presence of suitable infrastructures, the participation of public institutions, and awareness of people on more helping was among other factors that could help to return to the state before the incidents and adapt to crisis conditions.

Based on the results obtained by network analysis of resiliency indicators in Sanandaj city, zones one and two were in urgent need of resiliency measures. The indicators of education, income, public services, land use, social relations, governmental organization, infrastructures, ecosystem, and demographic features achieved a score less than the average of scores, which was 0.074. Therefore, due to the weaknesses and the unsuitable conditions,

there is a need for maximum investment, and this should be seriously considered in city development planning.

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References

1. Otto-Zimmermann, K.; Balbo, A. The Global Adaptation Community Expands Its Scope. In *Resilient Cities 2: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2011*; Part I; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2012; pp. 3–9.
2. Vaghefi, S.A.; Keykhai, M.; Jahanbakhshi, F.; Sheikholeslami, J.; Ahmadi, A.; Yang, H.; Abbaspour, K.C. The future of extreme climate in Iran. *Sci. Rep.* **2019**, *9*, 1464. [CrossRef] [PubMed]
3. Fairhurst, L. Introduction: Describing Impacts at the Local Level. In *Resilient Cities: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2010 Volume 1 of Local Sustainability*; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2011; Chapter 2; pp. 213–215.
4. Hulme, M. Intergovernmental Panel on Climate Change (IPCC). In *International Encyclopedia of Geography*; Wiley: Hoboken, NJ, USA, 2020; pp. 1–7. [CrossRef]
5. Hordijk, M.; Baud, I. Inclusive Adaptation: Linking Participatory Learning and Knowledge Management to Urban Resilience. In *Resilient Cities: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2010*; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2011; Chapter 11; pp. 11111–11122.
6. World Economic Forum. *The Global Risks Report 2021*, 16th ed.; World Economic Forum: Geneva, Switzerland, 2021; p. 96. Available online: http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf (accessed on 19 December 2021).
7. UN-Habitat. *World Cities Report 2020 The Value of Sustainable Urbanization. Sereal Untuk*; UN-Habitat: Nairobi, Kenya, 2020; Volume 51, p. 51. Available online: https://unhabitat.org/sites/default/files/2020/10/wcr_2020_report.pdf (accessed on 25 December 2021).
8. Opitz-Stapleton, S.; Seraydarian, L.; MacClune, K.; Guibert, G.; Reed, S.; Uennatornwaranggoon, F.; Rumbaitis, D.C. Building Resilience to Climate Change in Asian Cities. In *Resilient Cities: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2010*; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2011; Chapter 41; pp. 41401–41411.
9. Valerio, E.; Manzo, M.; Casu, F.; Convertito, V.; Luca, C.D.; Manunta, M.; Montereoso, F.; Lanari, R.; Novellis, V.D. Seismogenic source model of the 2019, mw 5.9, east-azerbaijan earthquake (nw Iran) through the inversion of sentinel-1 dinsar measurements. *Remote Sens.* **2020**, *12*, 1346. [CrossRef]
10. United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). *The Asia-Pacific Disaster Report 2021: Resilience in a Riskier World—Managing Systemic Risks from Biological and Other Natural Hazards*; United Nations: New York, NY, USA, 2021. [CrossRef]
11. Sillmann, J.; Thorarinsdottir, T.; Keenlyside, N.; Schaller, N.; Alexander, L.V.; Hegerl, G.; Senevirante, I.S.; Vautard, R.; Zhang, X.; Zwiers, F.W. Understanding, modeling and predicting weather and climate extremes: Challenges and opportunities. *Weather Clim. Extrem.* **2017**, *18*, 65–74. [CrossRef]
12. WHO. *Health Emergency and Disaster Risk Management Framework*; WHO: Geneva, Switzerland, 2019; p. 48. Available online: https://www.who.int/hac/techguidance/preparedness/health-emergency-and-disaster-risk-management-framework-eng.pdf?ua=1 (accessed on 19 April 2022).
13. United Nations. *Disaster Risk Reduction and Resilience in the 2030 Agenda for Sustainable Development. Population Headliners*; United Nations: New York, NY, USA, 2017. Available online: http://www.ncbi.nlm.nih.gov/pubmed/20845205 (accessed on 19 April 2022).
14. Aram, F.; Solgi, E.; Baghaee, S.; Higueras García, E.; Mosavi, A.; Band, S.S. How parks provide thermal comfort perception in the metropolitan cores; a case study in Madrid Mediterranean climatic zone. *Clim. Risk Manag.* **2020**, *30*, 100245. [CrossRef]
15. Zeng, X.; Yu, Y.; Yang, S.; Lv, Y.; Sarker, M.N.I. Urban Resilience for Urban Sustainability: Concepts, Dimensions, and Perspectives. *Sustainability* **2022**, *14*, 2481. [CrossRef]
16. MacKinnon, D. Resilient City. In *International Encyclopedia of the Social & Behavioral Sciences*, 2nd ed.; Elsevier Inc.: Amsterdam, The Netherlands, 2015; pp. 561–567. [CrossRef]
17. MacClune, K.; Fajber, E.; Opitz-Stapleton, S.; Orleans Reed, S. Vulnerability assessments, sector studies, and Pilot Projects. In *Catalyzing Urban Climate Resilience*; Tyler, S., Ed.; ISET: Tbilisi, Georgia, 2012; Chapter 5; pp. 153–193.

18. Denton, F.; Wilbanks, T.J.; Abeysinghe, A.C.; Burton, I.; Gao, Q.; Lemos, M.C.; Wright, S.B. Climate-resilient pathways: Adaptation, mitigation, and sustainable development. In *Climate Change 2014 Impacts, Adaptation and Vulnerability: Part A: Global and Sectoral Aspects*; Cambridge University Press: Cambridge, UK, 2015; pp. 1101–1131. [CrossRef]
19. Moench, M.; Tyler, S. Systems, agents, institutions, and exposure, a framework for urban climate resilience planning. In *Catalyzing Urban Climate Resilience*; Tyler, S., Ed.; ISET: Tbilisi, Georgia, 2012; Chapter 2; pp. 29–69.
20. Delshad, V.; Pourvakhshoori, N.; Rajabi, E.; Bazyar, J.; Khankeh, H.R. International Agreements on Disaster Risk Management Based on World Conferences, Successful or Not: A Review Study. *Health Emergencies Disasters Q.* **2020**, *6*, 1–8. [CrossRef]
21. Tyler, S.; Moench, M. A framework for urban climate resilience. *Clim. Dev.* **2012**, *4*, 311–326. [CrossRef]
22. Godschalk, D. Urban Hazard Mitigation: Creating Resilient Cities. *Nat. Hazards Rev.* **2003**, *4*, 136–143. [CrossRef]
23. Cutter, S.; Barnes, L.; Berry, M.; Burton, C.; Evans, E.; Tate, E.; Webb, J. A place-based model for understanding community resilience to natural disasters. *Glob. Environ. Chang.* **2008**, *18*, 598–606. [CrossRef]
24. Desouza, K.; Flanery, T. Designing, planning, and managing resilient cities: A conceptual framework. *Cities* **2013**, *35*, 89–99. [CrossRef]
25. Saaty, T.L. *Decision Making with Dependence and Feedback: The Analytic Network Process*; RWS Publication: Pittsburgh, PA, USA, 1996.
26. Saaty, T.L. The Analytic Network Process. In *International Series in Operations Research and Management Science*; Springer New York LLC: New York, NY, USA, 2006; Volume 95, pp. 1–26.
27. Statistical Center of Iran. *Statistical Yearbook of Kutdistan Province 2021*; Statistical Center of Iran: Tehran, Iran, 2021.
28. Hafeznia, M.R. *An Introduction to the Research Method in Humanities*; The Organization for Researching and Composing University Textbooks in the Humanities (SAMT): Tehran, Iran, 2014.
29. Intergovernmental Panel on Climate Change (IPCC). Summary for policymakers. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability*; Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment; Cambridge University Press: Cambridge, UK; New York, NY, USA,, 2014; pp. 1–32.
30. Bendimerad, F. *Disaster Risk Reduction and Sustainable Development*; The World Bank: Washington, DC, USA, 2003.
31. Cowell, M.M. Bounce back or move on: Regional resilience and economic development planning. *Cities* **2013**, *30*, 212–222. [CrossRef]
32. Yuzva, K.; Zimmermann, M. Introduction: Toward the Resilient City. In *Resilient Cities2: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2011*; Part III; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2012; pp. 101–103.
33. Eichhorst, U.; Bongardt, M.D.; Miramontes, M. Climate-Proof Urban Transport Planning: Opportunities and Challenges in Developing Cities. In *Resilient Cities: Cities and Adaptation to Climate Change Proceedings of the Global Forum 2010*; Otto-Zimmermann, K., Ed.; ICLEI: Bonn, Germany, 2011; Chapter 9; pp. 991–1105.
34. Mccarthy, J.J.; Canziani, O.F.; Leary, N.A.; Dokken, D.J.; White, K.S. *Climate Change 2001: Impacts, Adaptation, and Vulnerability*; Cambridge University Press: Cambridge, UK, 2001.
35. Rezaei, M.R. Explain the Resilience of Urban Communities in Order to Reduce the Effects of Natural Disasters (Earthquakes). Ph.D. Thesis, University of Tehran, Tehran, Iran, 2010.
36. Rezaei, M.R. Assessing the economic and institutional resilience of urban communities against natural disasters; Case study: Earthquake in Tehran neighborhoods. *Two Q. J. Crisis Manag.* **2013**, *3*, 27–38.
37. Abedini, A.; Khalili, A. Determining the capacity infill development in growing metropolitans: A case study of Urmia city. *J. Urban Manag.* **2019**, *8*, 316–327. [CrossRef]
38. Kurdistan Province Electricity Distribution Company. 2021. Available online: http://www.kurdelectric.ir/ (accessed on 15 October 2021).
39. Kurdistan Province Gas Company. 2021. Available online: http://www.nigc-kd.ir/Gasco.aspx (accessed on 16 October 2021).
40. Khalili, A. Optimal Model Presentation for Urban Smart Growth with Emphasis on Infill Development (Case Study: Urmia City). Master's Thesis, University of Urmia, Urmia, Iran, 2016.

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Article

Sustainability, Spatial Justice and Social Cohesion in City Planning: What Does a Case Study on Urban Renaturalisation Teach Us?

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Abstract: Rapid urbanisation generates important challenges in terms of sustainability and spatial justice, but also presents opportunities to transform cities into more equitable and resilient spaces. This study addresses these issues and aims to analyse the perceptions and evaluations of the resident population of Pontevedra about urban spaces in the framework of a renaturalisation project, integrating socio-demographic and spatial justice factors. Quantitative methods such as factor analysis, cluster analysis and multiple regression were used to identify patterns of satisfaction and the use of urban spaces. This study reveals significant differences in the valuation of urban spaces according to socio-demographic variables, especially in relation to sustainability and social cohesion. The findings thus provide empirical evidence to guide more inclusive urban policies and emphasise the need to incorporate citizen participation in urban design to promote territorial equity.

Keywords: spatial justice; renaturalisation process; sustainable cities; residents' satisfaction; urban planning

1. Introduction

The number of people living in cities continues to grow [1]; there are already more than eight billion people in the world and this number is expected to increase by several billion over the course of this century [2]. The environmental costs of urban sprawl, the mobility patterns that are reproduced in cities and the dynamics of industrial production in their peripheries have led to profound social and economic transformations [3]. But it is also urban spaces that can serve as engines for change towards more sustainable and resilient local, regional and global horizons [4] provided that multiple disciplinary approaches are incorporated [5,6]. As cities seek to strike a balance between expected economic growth and the pursuit of necessary social equity, multidisciplinary urban planning presents itself as a vital tool to alleviate territorial inequalities, while promoting the pursuit of spatial and social justice [7].

In the context of an intervention project for the renaturalisation of the urban space of the city of Pontevedra (Galicia, Spain), this research pursues a better understanding of how the population experiences and values urban space according to their place of residence and socio-demographic characteristics, taking into account that territories are configured

as places that generate not only construction and production, but also experience and rootedness [8].

Pontevedra, a medium-sized Spanish city, is a pioneering example of urban regeneration. This project aims to evolve the current model of the urban transformation of Pontevedra by promoting the environmental dimension, through the renaturalisation of urban space, increasing biodiversity and recovering the connectivity of the maritime and fluvial space.

The aim is to increase urban resilience to climate change by strengthening local green infrastructure and improving ecosystem services and the connection between urban and peri-urban natural areas in Pontevedra. The project has two main objectives: (1) to renaturalise five urban spaces and (2) to design a strategy for a sustainable city with a green infrastructure network.

This study is grounded in the concepts of spatial justice and renaturalisation. Spatial justice, as articulated by Soja [7], emphasises the importance of equitable urban planning to address socio-spatial inequalities, while renaturalisation [6] focuses on the integration of natural systems into urban areas to promote sustainability and resilience. Together, these frameworks provide a foundation for understanding how urban interventions can balance ecological and social priorities to foster inclusive and sustainable cities. The equitable distribution of green spaces, a core component of spatial justice [7], is critical to ensuring that all residents benefit from renaturalisation efforts aimed at enhancing urban resilience [6]. By linking spatial justice and renaturalisation, this study contributes to the broader discourse on urban sustainability, demonstrating how these frameworks can guide policies to reduce socio-spatial inequalities.

This paper, therefore, contributes to the debate on spatial justice [9,10] by providing empirical evidence on how personal circumstances influence satisfaction with and use of the city. It also provides a framework for assessing how citizen participation can be an effective mechanism for promoting equity in access to urban resources [11,12]. By providing practical implications, it seeks to contribute to the improvement of urban policies, advocating for the reinforcement of a sense of belonging and social cohesion through green spaces. Space being a social product, it must also be a political responsibility, i.e., if it is produced, we must pay attention to how it is produced [13], considering the political spatiality of the territory [7].

To address the objectives of this study, a quantitative methodology based on the use of various statistical techniques was employed. Factor analysis allowed the identification of latent dimensions of satisfaction and urban perception, simplifying a broad set of variables into key factors such as social cohesion, sustainability and spatial maintenance. Subsequently, cluster analysis segmented the population into homogeneous groups according to their valuation patterns and socio-demographic characteristics. In addition, multiple linear regression and ANOVA analyses were applied to assess the relationships between independent variables (age, income, educational level and territorial area) and the extracted dimensions, providing a comprehensive view of the interactions between citizen perceptions and contextual characteristics and thus providing a more complete picture of urban planning in the context of intra-urban inequalities [14] that enable climate injustice in cities [15].

Why is it important to analyse how the resident population values these spaces? Well, because understanding population clusters, framed within a critical analysis of the valuation of urban spaces [13], will reveal citizens' perspectives and, with them, their influence on urban planning decisions. In this sense, incorporating the citizens' perspective can condition the success or failure of interventions in public spaces [16,17], as well as promote adjustments that ensure a more inclusive and equitable urban design. In other

words, knowing residents' opinions facilitates the promotion of urban development that responds to the real needs of the population living in the city.

> The conditions that make it possible for the city to be the space where differences and contradictions come together: for certain groups, classes or people, for certain ideas, thoughts and opinions, not to be segregated or pushed aside or sent to the peripheries, no longer of the city, but of urban life [18] (p. 160).

In this way, it will be possible to understand which inhabitants have greater access to and enjoyment of urban spaces and which experience barriers derived from their urban spatial vulnerability.

To account for this, the specific objectives of this research are to evaluate citizen perceptions, analysing how the socio-demographic characteristics of the population influence the valuation of urban spaces in Pontevedra, highlighting possible territorial and social inequalities.

This research highlights the importance of linking spatial justice with sustainable planning practices, as suggested by Soja [13], to ensure equitable access to urban opportunities while promoting environmental resilience.

Our analysis also supports Anguelovski et al. [15] argument that renaturalisation efforts must prioritise equity to avoid exacerbating territorial inequalities and climate injustices.

In addition, Harvey's [19] concept of the 'right to the city' provides a framework to understand how citizen participation in urban planning processes can mitigate the socio-spatial divides highlighted in our findings.

By addressing disparities in access to green spaces and sustainable mobility, this study aligns with broader calls for urban ecological balance, emphasising the interdependence of spatial justice and environmental sustainability [20,21].

So, despite the growing body of research on spatial justice and renaturalisation, most existing studies rely on qualitative approaches limiting their ability to systematically quantify public perceptions of urban transformation. This study addresses this gap by integrating factor analysis and cluster analysis to empirically assess socio-spatial inequalities in urban environments. This methodological framework allows for the identification of distinct patterns in public satisfaction and urban space usage, offering deeper insights into how demographic and territorial factors influence perceptions of renaturalisation. The integration of these statistical techniques represents an innovative contribution, bridging the gap between theoretical discussions of spatial justice and empirical urban policy design.

2. A Theoretical Approach to Renaturalisation and Spatial Justice: Towards Inclusive and Sustainable Urban Planning

The relationship between the built and the natural is not static; space is reinvented to configure new naturalised urban scenarios. In the city, we find a landscape mostly made up of buildings—industrial, residential and service buildings—connected by impermeable surfaces largely dedicated to road traffic, i.e., conventional civil engineering that performs mostly individual and single-purpose functions [22]. On the contrary, green infrastructure brings a wealth of ecosystem benefits, as well as a multifunctional character and an openness to multidisciplinarity to reconfigure anthropogenic habitats [16]. Specifically, green spaces in the city contribute to improving the health of populations [23–26], mitigate the effects of climate change, increase biodiversity [27] and are configured as spaces for social relations [28].

While it is true that in urban contexts nature cannot be pristine or alien to anthropic action, it is a more or less ecological and/or sustainable construction that is on the plane of the symbolic and is defined by the interaction of the community, the political sphere

and aesthetic perception. In this sense, the processes of renaturalisation seek to introduce the citizen perspective to reimagine the urban landscape collectively and in connection with nature [22], through recovery, regeneration, the creation of ecological corridors and the creation of new and varied functions for underused or abandoned spaces [17]. Some strategies that destabilise these dualities stem from cultural ecosystem services, where relational processes between actors help to connect dimensions—physical, semiotic and social—in the process of renaturalisation, raising "the public awareness on the need to protect urban nature transformed by human-nature interactions" [29] (p. 12).

2.1. A Theoretical Approach to the Urban Paradigm

Infrastructure overproduction, gentrification, sprawl, area degrowth, mobility and territorial inequality are not homogeneous, but present specificities that require adaptive approaches and need to be addressed by planning [30].

Given the exponential increase in the world's population, coupled with new energy sources, it is suggested that metropolitan expansion will take a centrifugal form [31]. The trend of emptying the countryside to concentrate the population in the cities will probably be reversed, not with the idea of returning to the countryside, but with the intention of a uniform population distribution, differentiating industrial/labour and residential purposes [31]. This urban transition on a global scale, accompanied by the "imbalance in population distribution will be accompanied by an increasing gap in the distribution of wealth" [32] (p. 25).

Even so, it is worth noting that, although "the contradictions and conflicts inherent to a class society manifest themselves almost exclusively in the city, this does not mean that their origin must automatically be sought in the city' [33] (p. 102). In fact, the definition of what constitutes the urban unit can only come from the theoretical level [34] and, therefore, we cannot understand the urban only in opposition to the rural. A standardised definition of the urban unit cannot be established since there is no demarcation of shared limits or compatibility of data, for example, in terms of the population density or size—among other indicators for measuring levels of urbanisation [30]—. We are facing extended forms of regional urbanisation, resulting in the construction of megalopolises arising from suburbanisation, the metropolitanisation of territories and infrastructural and residential decentralisation [35]. "The urbanisation of the world is a kind of exteriorization of the inside as well as interiorization of the outside" [36] (p. 474).

We must turn our attention to circulation, for the urban phenomenon is at the confluence of the city's functions; urban centres cover a given territory with networks of administration and domination, but the city itself is an integral part of the networks of production and distribution that administer and dominate it—because it is dominant and to the extent that it is dominant [37]—.

2.2. Urban Injustice and the Right to the City

Spatial justice, as defined by Soja [7], refers to the equitable distribution of urban resources and opportunities, ensuring that all individuals, regardless of their socio-economic status, have access to the benefits provided by urban environments. This concept underlines the intersection of spatial inequalities with broader socio-economic disparities, highlighting the need for urban policies that prioritise inclusivity and fairness in resource allocation. Renaturalisation, according to Lehmann [6], is the process of reintroducing natural elements, such as green spaces and ecological corridors, into urban environments to enhance both ecological resilience and social well-being. This approach seeks to bridge the gap between built and natural environments, creating multifunctional spaces that address environmental challenges while fostering community interactions and connectivity.

Urban injustice manifests itself in a variety of ways; opportunities, quality of life and well-being, health and access to urban resources are unequally distributed among the population living in an urban space [7]. Social inequalities—subject to relations of power and domination—are intrinsically linked to spatial inequalities, which is why it is at this intersection that spatial injustice appears [7]; "in all constructions there is an implicit meaning, a generative idea that space must serve" [38] (p. 20).

The right to the city, is "a common rather than an individual right since this transformation inevitably depends upon the exercise of a collective power to reshape the processes of urbanisation" [19] (p. 23). Citizens must play an active role in both the design and planning of their cities, becoming agents of change that can contribute to mitigating spatial injustice, generating new forms of urban appropriation and resistance and of transformation according to their needs, concerns and uses [7].

Applying this vision to urban planning for renaturation implies a conscious approach to equity in access to public services and infrastructure, so that all inhabitants can benefit from urban development. A democratic planning system [39] co-creates with the local community to result in a progressive and holistic approach to regeneration [40]. Meanwhile, it is true that community participation must be representative of all social strata, especially the socially excluded [16]. Both individuals and collectives have the right to claim a democratic use of city space and to reclaim their role as central actors in shaping it [19]. Thus, the process does not only respond to the order of the individual; social movements actively participate in the transformation of space, since it is the product of social interactions [41]. They emerge trying to overcome isolation and acting differently from corporate capital, real estate developers—supported by financial capital—and the state, which is enmeshed in the logic of business [19].

Under this paradigm, citizen participation becomes an essential instrument to fight against urbanisation processes that directly or indirectly deprive citizens of their decision-making capacity [21]. For this reason, it cannot be a process that is imposed vertically and from above, but must start from the basis of those who inhabit the space, who live and experience it and who, therefore, produce and change it; the community must be involved in the creation of multifunctional green spaces [42].

However, this is not without its problems; some of the obstacles to incorporating citizenship include accessibility to participation, governance barriers, sustaining engagement, integrating different attitudes and life circumstances, skills, knowledge, support and resources [39]. As well as the cost and complexity of implementing nature-based solutions in a compact space with dense grey networks [16], in the cases of industrial green infrastructure, what we find are that the biggest barriers for residents are cost overruns and a lack of political support and maintenance [17]. In short, it must be kept in mind that the processes of urbanisation, construction and urban transformation are originally processes of social imagination [43], which are conditioned into praxis by the context in which they take place.

2.3. The City on a Human Scale: Satisfaction, Appreciation and Intervention in Urban Public Space

Satisfaction with social and physical space, in this case, urban space, significantly influences the perception of happiness [44], which is a key indicator when assessing subjective well-being [45]. Regarding the relationship between happiness and satisfaction with surrounding life and greenery, socio-demographic variables are the determinant, highlighting that increasing green space alone is not enough, but must be accompanied by the needs of citizens—quality and integrated amenities [46]—. For example, an analysis of 60 countries around the world (a comparison between those with the highest and lowest GDP) finds that for those with the lowest GDP, green space is not positively correlated

with happiness. However, when GDP reaches a certain threshold, green spaces become important and are positively correlated with happiness as they are spaces for social relations and support [47].

While it is true that the difficulties associated with urban life—lax and complex social networks that produce loneliness and alienation, the sharp differences between the rich and poor, stress, competition, sensory overload or overcrowding—are shared and more palpable in processes of rapid urbanisation, the "urban malaise" does not manifest itself in all cities in the same way, as each one—very dependent on where it is located territorially—presents its own challenges and dangers [48]. Thus, human well-being is related to the level of satisfaction with the space one inhabits; the positive valuation of an urban space that responds to the needs of residents is the path to the general well-being of populations [44,45,48,49].

In this way, the analysis of satisfaction becomes an essential component in assessing the effectiveness of urban intervention and its capacity to bring about positive social change. It should be noted that subjective well-being, while related to the socio-economic status, in modern societies is more closely related to the socio-emotional status [45]. For example, lower values of the average well-being are found in gender-segregated societies than in those with high income disparities, "inequality hurts only when it interferes with the gratification of basic needs, such as our need for food or respect" [45] (p. 52).

It is, therefore, essential to understand how the resident population interprets, perceives and remembers urban space; cities must be legible, i.e., easily understood by the people who live there [49]. An environment that is legible facilitates psychological well-being, as it allows people to feel safe in their space and find their way around it, to use it. A legible space will be a well-valued space, and a well-valued space will result in greater satisfaction and thus greater subjective and objective well-being. The importance of legibility can again be linked to green spaces, since, taking into account that staying in green spaces for more than 20 min is linked to higher subjective well-being, in order for the time spent in such a space to be long enough, they must be attractive and hold the attention of the visitor; therefore, they must be understandable to the user and linked to his or her needs [16].

Jan Gehl introduces a novel approach that focuses on people, what he will call the 'human scale' [50]. He argues that urban planning should focus on creating liveable and sustainable cities, always from the perspective of the pedestrian, moving away from a focus on road traffic-centred infrastructure and putting policies for the quality of life of the inhabitants at the centre. The city must foster social interactions, ensuring that the routine needs of the people who live there are met and listened to when planning new spaces or intervening in existing ones. The meaning of streets, squares and parks is that they are used and enjoyed by the resident population. It is necessary to encourage the use of public spaces as a way of fostering greater social cohesion and promoting collective and individual well-being.

3. Methodology

This quantitative study analyses the satisfaction of the resident population of Pontevedra with their immediate urban environment. To do so, several statistical techniques will be used to clarify the synergies between the socio-demographic characteristics of the resident population and their knowledge of the city, as well as their subjective assessment of it. All of them use data extracted from a survey with a sample of 201 people, representative of the 69,697 people, aged 18 and over, resident in the city of Pontevedra in 2023. Sex and age quotas were established in proportion to each territorial area studied and the sampling process used was simple random. The data were treated following quality con-

trol processes—occupational structure—by correcting the detected biases with weighting variables. With a 95% confidence level, our sample provides an acceptable margin of error of approximately ±4.4%, which is within the range used in similar urban studies.

Starting from the population structure of the Pontevedra City Council, according to the Municipal Population Register for the year 2022, we calculated the sample size and designed the sampling procedure (Table 1) based on the establishment of quotas for sex and age group, proportional to the reference population of each Territorial Area. The population universe (≥18 years) is 69,697 people. We subdivided this population into the three areas studied, based on the section, which resulted in the following demographic structure by sex and age in each of them.

Table 1. Technical Sheet.

Universe	Population aged 18 and over registered in the Municipality of Pontevedra (69,697 people).
Sample Size	201 interviews. The fieldwork was carried out between November and December 2023.
Sampling Procedure	Simple Random Sampling (SRS), with quotas for gender and age. Face-to-face interviews with computer-assisted support (CAPI system).
Selection of Interviewees	The final selection of interviewees was made randomly on the street, following the quotas.
Sampling Error	Assuming SRS, with a significance level of 0.05, for the most unfavourable case in the overall sample, the absolute error would be 3.52%. External errors to the sampling process 0.88%. The total error is established at 4.4%.
Quality Control	The data are processed with quality control procedures, correcting detected biases using weighting variables.

The reference territory, the municipality of Pontevedra, for the purposes of this survey, was subdivided into three types of spaces. On the one hand, all the sections of what we call the compact city, which include all the sections that have high values of density and continuity. On the other hand, three corridors that showed discontinuities, but also registered high population density and space occupation. These are the sections of the Ring (Monteporreiro, Estrada de Santiago and Corredor de Marín). Finally, we included the rest of the sections in a group that we call Rurururbano, in which densities drop significantly, and the fabric is discontinuous and/or atomised.

To solve our main objective, we worked with 8 aspects that residents rated from 0 to 10 about the city. The eight aspects rated by residents—pedestrianisation, cleanliness, safety, green spaces, streets, mobility, neighbourhood and general satisfaction with the city—were carefully selected based on their relevance to urban quality of life, spatial justice and sustainability. These eight aspects were chosen because they collectively capture the key dimensions of urban life that influence residents' well-being, spatial justice, and sustainability. They reflect both the physical infrastructure (e.g., streets, green spaces and mobility) and the social and experiential qualities (e.g., safety, neighbourhood cohesion and general satisfaction) of the urban environment. By focusing on these aspects, this study aims to provide a comprehensive understanding of how different factors contribute to urban satisfaction and how they vary across demographic and territorial groups.

This study employs a 0–10 Cantril rating scale to assess urban satisfaction, a widely used approach in social sciences and urban studies [51–53]. This scale allows respondents to express a broad spectrum of opinions, from extreme dissatisfaction (0) to extreme satisfaction (10), offering greater granularity than smaller scales or semantic Likert scales. This permits more clarity, ensuring reliable responses, minimising cognitive bias and enhancing comparability across different socio-demographic groups. Additionally, its continuous structure allows for a more nuanced assessment of public perceptions, essential for identifying patterns in urban space valuation. Prior research has demonstrated the

effectiveness of this scale in evaluating subjective perceptions of urban environments, as it facilitates statistical analysis, including mean comparisons, regression models and factor analysis. Furthermore, by using the same scale for all variables we avoid having to resort to statistical normalisation.

The ratings for these aspects were analysed using factor analysis to identify latent dimensions of urban satisfaction such as social cohesion, sustainability and maintenance. These dimensions were then used in cluster analysis to segment the population into homogeneous groups based on their patterns of satisfaction and socio-demographic characteristics. The results of these analyses provide valuable insights into the factors that influence urban satisfaction and highlight areas for targeted policy interventions.

The socio-demographic control variables are age (three age groups: 18–39; 40–64; 65 and over), sex (differentiating between men and women), level of education (no schooling or primary education; compulsory; post-compulsory and university education), income (net annual income: less than 15,000; 15,000–20,000; 20,000–25,000; 25,000–30,000), social class (differentiated into manual, intermediate and services following Goldthorpe's scheme) and place of residence (compact city (with high density and continuity), ring (compact peripheral development and high population density) and rururban (low-density and atomised or discontinuous fabric)). In addition, we worked with frequency of use of green spaces, measured as the average number of days per year that each space studied is visited.

In order to know the use, an estimator has been elaborated that indicates how many times a year, on average, each citizen uses each of the spaces—visit, transit and destination—. Let n_i be the frequency of each case, x_i the time and n the total number of people who responded to the survey.

$$\vartheta = \frac{365}{\left(\frac{\sum n_i x_i}{n}\right)}$$

The estimator was applied to survey data to calculate the average annual usage of green spaces for each respondent. This metric was then used as an independent variable in statistical analyses (e.g., multiple linear regression, ANOVA) to assess its relationship with satisfaction levels, socio-demographic factors and territorial characteristics. The results of these analyses provide insights into how green space usage patterns vary across different population groups and how they influence perceptions of urban spaces.

We also use an indicator of health. This index is derived from the response to three items related to the health of the respondents. These variables were constructed using the same wording and scale used in the European Health Survey (EHSS). Two of them are objective data: the consumption of medicines in the last 15 days (C) and consultations with medical professionals in the last 4 weeks (M). The other indicator is subjective and refers to the perception of the state of health (P). The constructed indicator allows an interpretation from 0 and 100, and can be expressed as:

$$Health. = \frac{(P \times C \times M) - 1}{(\sum V_{Max} - \sum V_{Min})} \times 100$$

In the denominator of the previous formula, the difference between the maximum value achievable in the three variables analysed and the minimum possible is calculated, so that the index oscillates between 0 and 100.

The methodological strategy begins with a factor analysis to simplify and reduce the set of variables analysed. This allows them to be grouped according to their similarity, based on similar patterns of responses. The new factorial variables generated will allow us to work with classification techniques (Cluster Analyses), ANOVA or Linear Regression, to

characterise socio-demographic profiles that characterise the different population groups according to their ratings. To measure the suitability of these methods, the usual indicators are used: KMO and Bartlett's of Sphericity for Factorial, and VIF test and Determinant Coefficient for Regression.

Although these methods are widely established in urban research, their combined application in assessing perceptions of spatial justice and renaturalisation is a novel contribution. This integrated approach allows for a comprehensive understanding of how social, economic and spatial factors interact to influence urban satisfaction. Several studies have employed these techniques separately in urban planning and perception research [50,54–56], but this study advances the field by applying them collectively to examine socio-spatial inequalities and their impact on urban experiences.

To analyse the relationships between the study variables (knowledge of the space, use—measured in days per year—and satisfaction—again, on a numerical scale of 0–10—) and the independent variables, which would be the socio-demographic characteristics mentioned above, we used ANOVA and Multiple Linear Regression.

In short, the selection of the statistical techniques used is justified by the need to address, in a comprehensive manner, the complex interactions between the use of urban space, socio-demographic characteristics and levels of satisfaction/valuation of the city. In this sense, factor and cluster analysis is particularly useful, as it allows us to draw meaningful, concrete and more operational conclusions—if we want to understand the synergies between variables—from a large dataset. In turn, linear regression and ANOVA provide detailed insights into correlations and differences between different population groups.

The correlation analysis was conducted as an initial step to examine the strength and direction of relationships between urban satisfaction factors and socio-demographic variables, without implying causation. The insights gained from this analysis informed the subsequent regression model, which was used to establish predictive relationships by determining how independent variables influence urban satisfaction.

To facilitate the understanding of the territorial areas included in this study, Figure 1 shows the geographical delimitation of the Compact City (in red), the Ring (in blue) and the Rururban area (uncoloured). These classifications are essential to analyse how territorial characteristics influence citizens' perception of urban spaces.

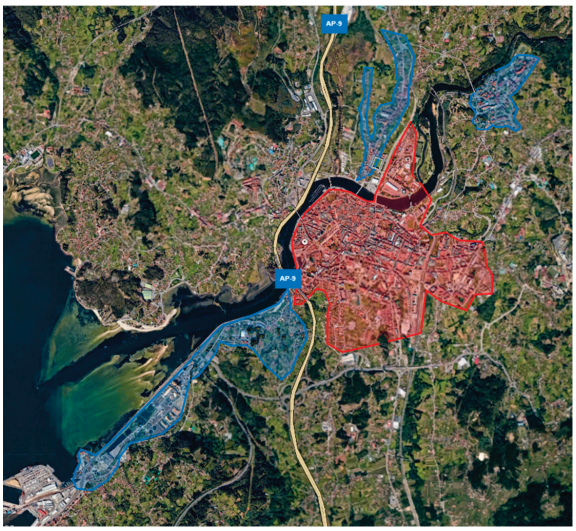

Figure 1. Aerial view of the city of Pontevedra. Note: In red is the delimitation of the Compact City and in blue, the spaces that we consider as Ring. The rest of the municipal territory is Rururbano.

4. Results and Discussion

The means and their standard deviation as well as the range of the responses obtained (theoretically possible from 0 to 10) are actually established for each variable in Table 2. The means are all high, although the dispersion that marks the range shows a greater consensus in variables such as "general satisfaction with the city", "the assessment of security" and with the "neighbourhood". On the other hand, the greatest disagreement occurs when assessing "mobility", with a high peak of standard deviation of the mean, which is reduced to the lowest value among the variables investigated.

Table 2. Satisfaction with the variables studied.

	Mean	Standard Deviation	Range
Pedestrianisation	7.36	0.82	5.00
Cleanliness	7.25	0.75	5.00
Neighbourhood	7.43	0.67	4.00
Safety	7.45	0.64	4.00
Green spaces	6.91	0.80	5.00
Streets and public spaces	7.22	0.64	5.00
Mobility	6.66	1.11	9.00
General satisfaction with the city	7.29	0.52	3.00

The factor analysis carried out in this research, through principal component analysis (PCA with a Promax rotation was used, which allows, as opposed to orthogonal rotation, the resulting factors to be correlated with each other; the point of this choice is that the variables are not completely independent, but interrelated), aimed to reduce the complexity of the data studied, specifically those related to the satisfaction variables, namely pedestrianisation, mobility, green spaces, streets, cleanliness, safety, neighbourliness and the state of the city in general (joint evaluation of all the items).

Through PCA it is possible to explain the variability in residents' urban perceptions by identifying the underlying dimensions and then interpreting them in terms of socio-demographic profiles—cluster analysis—. The suitability of this technique is supported by a KMO of 0.8 and a significant Bartlett's test of sphericity (<0.001). The analysis revealed two principal components—as shown in Figure 2—which together explain 62.297% of the total variance for the urban satisfaction variables, the first of which explains 47.563% and the second, an additional 14.735%.

The first of these is made up of evaluation indicators linked to social cohesion and the maintenance of urban space and incorporates indicators such as neighbourliness (maximum load 0.843), an evaluation of the city in general (0.843), safety (0.777), pedestrianisation (0.736), cleanliness (0.649) and the state of the streets and public spaces (0.759). The second component is oriented towards green infrastructure, mobility and sustainability. It groups together the presence of green spaces (maximum load, 0.739), mobility strategies in the city (0.632), cleanliness (0.653) and the state of the streets and public spaces (0.712), with urban functionality standing out.

Finally, three groups of evaluations have been configured, one called "sustainability", which reflects environmental awareness and its influence on satisfaction and quality of life in the city. Another is called "social cohesion", which is more related to the social aspects of the urban space, and the last one is more related to well-being from the physical aspects, called "maintenance".

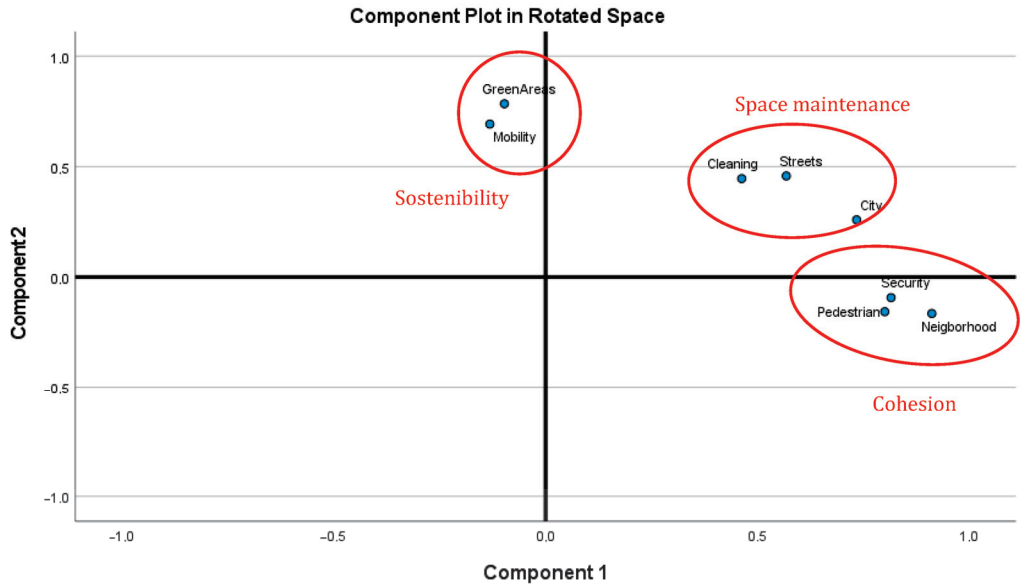

Figure 2. Component graph in rotated space. The graph shows two principal components that explain 62.3% of the total variance. The first is related to social cohesion and maintenance, while the second addresses sustainability and mobility. Both components are correlated, highlighting the interdependence of these dimensions.

The correlation coefficient between the components is 0.478, indicating that, although they address different dimensions of city perception—identified through three factors—there is, as we have already seen, an interrelation between them. In other words, social cohesion and the maintenance of urban infrastructure are not independent of sustainability and green infrastructure; rather, both dimensions contribute jointly to the satisfaction of the people who inhabit the space. Creating more pedestrian and green spaces, the better care of public infrastructure and prioritising urban safety would reinforce both dimensions. Therefore, cities should adopt a holistic approach that incorporates these aspects in an integrated manner [25], to improve the overall perception of citizens and with it, their threshold of well-being [45], while ensuring spatial justice [7] and ecological balance [57].

The factors extracted through factor analysis, such as 'social cohesion', 'sustainability' and 'maintenance', represent latent dimensions that summarise the population's perceptions of key aspects of the urban environment. These factors become dependent variables in the regression analysis, allowing us to identify how socio-demographic characteristics (age, level of education, income and territorial area) influence these dimensions.

In Table 3, we summarise the relevant results of the regression analysis for each key variable. On the one hand, the total percentage of variance explained in each model; in the next column, the variables that appear as significant in that model. Finally, the qualitative interpretation of the influence of that variable according to the sign and its interpretation in terms of the categories that compose it.

All VIF (Variance Inflation Factor) values are below, in the worst case, 2.5, so we can conclude that Multiple Regression is a suitable technique. The regression confirms the associations found in the factor analysis. It highlights how the territorial area and education shape perceptions of sustainability, while age and income affect social cohesion. The moderate correlation between the factors social cohesion and sustainability underlines the need to address them jointly. Urban policies that improve green infrastructure and sustainable mobility can also strengthen community interaction.

Table 3. Regression analysis of indicators.

Dependent Variable	% Variance Explained	Significant Variables	Direction
Cohesion	24.8%	Age Incomes Territorial area	Older age, greater cohesion Higher income, greater cohesion Smaller, more cohesion
Sustainability	7.7%	Studies Territorial area	Higher level of education, higher assessment of sustainability Greater proximity to rural, higher assessment of sustainability
Spaces maintenance	13.5	Territorial area	Greater proximity to rural, greater concern for maintenance

Thus, for the cohesion variable (24.8% of variance explained), some interesting relationships can be observed in relation to age and income. The older the age, the greater the perceived social cohesion. This may be related to greater attachment to the environment and greater participation in community social networks. The positive correlation between income and cohesion may be explained by access to higher quality urban spaces or greater involvement in activities that reinforce community interaction. These findings highlight the need to focus strategies on strengthening social cohesion in lower-income communities by designing, for example, accessible spaces that foster social interaction (e.g., neighbourhood parks).

Regarding the variable sustainability (7.7% of variance explained), it is observed that a higher educational level leads to a higher valuation of sustainability, possibly due to a higher environmental awareness. On the other hand, rural areas tend to value sustainability more highly, which could reflect a more direct connection with the natural environment or a lower perception of a negative urban impact. It would be necessary, among other aspects, to design specific educational campaigns in compact urban areas to increase environmental awareness, especially aimed at segments with lower educational levels. Furthermore, it would be necessary to consider improving accessibility to green spaces in urban areas, prioritising the connection of these spaces with the daily needs of citizens.

In relation to the maintenance of spaces (13.5% of variance explained), add that people living in rural areas are more concerned about the maintenance of spaces. This may be due to lower investment in infrastructure or a greater visibility of deficiencies in less urbanised areas.

Based on these findings, it should be added that, in order to improve the perception of sustainability, urban policies should target groups with lower educational levels and compact urban areas, where the perception is less favourable. Furthermore, it has been shown that the strong relationship between social cohesion and maintenance reinforces the idea that improving the physical state of urban spaces (cleanliness, streets) has a positive impact not only on the perception of quality, but also on the social fabric.

A Reading of the Valuation of the City in Social Terms

The correlation analysis has revealed the link between the satisfaction variables studied and the perception of the city as a whole. On the one hand, we know that the quality of streets and public spaces is a crucial factor in the positive perception of the city in global terms ($r = 0.691$), as well as community interactions ($r = 0.608$), the perception of safety ($r = 0.535$), pedestrianisation ($r = 0.538$) and cleanliness ($r = 0.520$). The synergies between the positive evaluation of the city and aspects related to sustainability, such as green spaces ($r = 0.381$) and mobility ($r = 0.219$), are not as strong. These variables are also interrelated, with cleanliness and the valuation of streets and public spaces being intrinsically related dimensions ($r = 0.644$) to perceptions of urban quality. Likewise, well-cohesive communities

are associated with pedestrianisation (r = 0.597) [58,59] and tend to be perceived as safer (r = 0.587) [60], achieving better values of well-being and perceived quality of life [61].

To do this, we addressed a hierarchical cluster. The number of groups was decided by the parsimony criterion. According to it, the number is decided based on a reduction of less than 50% of the Within Groups variance. Once the synergies between variables have been established, it is necessary to indicate how the five clusters extracted from the cluster analysis have been configured, which can be consulted in Table 4. These results are closely linked to the factors extracted, as the factor 'social cohesion' helped to identify the cluster 'urban average' and 'cohesive peri-urban'. At the same time, the sustainability factor's differentiated clusters such as 'sustainable balanced' and 'outliers'—both with low ratings—and the maintenance factor highlighted perceptions of the quality of the physical environment, being relevant in the 'resilient community' cluster where this dimension is a priority.

Table 4. Results of cluster analysis: means and percentage of the represented population.

	Cluster				
	Cohesion	**Balanced**	**Standard**	**Resilients**	**Outliers**
Cohesion	8.13	7.86	7.19	7.54	5.89
Space maintenance	7.96	7.77	7.06	6.64	7.18
Sustainability	6.34	7.60	6.81	5.51	6.18
Health	66.94	65.11	60.77	61.08	55.82
Use Green Areas	13.93	13.22	10.00	12.46	12.28
Population percentage	8.0	16.5	65.7	8.3	1.5

Table 5 below shows the analysis of each cluster according to the socio-demographic variables.

The defining characteristics of the population in the "urban average" cluster are not easily identifiable, as this is the predominant profile with 65.5% of the cases; it indicates an intermediate consensus where no significant extremes are observed. It is characterised by values around 7 out of 10 for each of the factors: social cohesion (7.19), sustainability (6.81) and maintenance (7.06). No significant differences are found with respect to gender, and it is mostly made up of people over 40 years of age, with low/middle incomes and living in the compact city.

The so-called "cohesive peri-urban" cluster (8%) is characterised by higher ratings for social cohesion (8.13) and the maintenance of urban space (7.96), with lower positive ratings for sustainability (6.34). It is mostly made up of people under 40 years of age who do not live in the compact city, with post-compulsory education or less and an average income.

In the "sustainable balanced" cluster (16.5%), the factor averages are all above 7.5 (7.86 social cohesion, 7.77 maintenance and 7.60 sustainability). Slightly more variation is found in terms of gender, with women being represented in a slightly higher percentage. No differences are found in terms of age, but differences are found in terms of territorial variables (taking into account that most live in rururban areas or in the ring) and income, with the majority being middle/high income and with occupations in the service sector.

The 'resilient community' cluster (8.2%) has the worst average score for the sustainability factor (5.51), followed by maintenance (6.64) and achieving higher scores for social cohesion (7.54). In terms of age, it moves in extremes (under 40 or over 65) and is the group with the highest volume of people with no education or primary education, with average incomes and who are part of the manual and intermediate classes.

Table 5. Cluster analysis.

		Cluster				
		Cohesion	**Balanced**	**Standard**	**Resilients**	**Outliers**
Gender	Male	51.38	41.50	51.70	46.60	48.36
	Female	48.62	58.50	48.30	53.40	51.64
Group of age	18 to 39	53.39	32.40	23.78	35.16	0.00
	40 to 64	42.46	50.41	56.33	40.42	56.02
	65 or more	4.15	17.20	19.89	24.42	43.98
Level of education	No studies or primary	7.25	3.73	1.73	14.09	7.15
	Compulsory	23.99	14.67	21.76	16.86	78.05
	Post-compulsory	30.89	14.00	17.01	28.35	14.80
	University	37.87	67.60	59.50	40.70	0.00
Annual net income	Less than EUR 15,000	19.89	27.65	45.62	28.11	65.25
	Between EUR 15,000 and EUR 20,000	44.67	20.74	36.39	23.51	23.43
	Between EUR 20,000 and EUR 25,000	21.77	37.60	11.32	35.80	11.31
	Between EUR 25,000 and EUR 30,000	13.68	14.01	6.67	12.58	0.00
Social class	Manual	27.78	23.81	20.78	31.22	100.00
	Intermediate	36.35	22.14	39.58	39.40	0.00
	Service	35.88	54.04	39.64	29.38	0.00
Territorial area	Compact city	37.01	55.49	71.63	57.02	0.00
	Ring	47.62	24.79	18.12	25.70	92.85
	Rururban	15.37	19.72	10.25	17.27	7.15

The "outliers" cluster is the smallest (1.5%) and represents an atypical group which, overall, has the lowest average score for the factors social cohesion (5.89) and sustainability (6.18). This profile suggests a higher dissatisfaction with social life (safety and neighbourliness) and sustainability (green spaces and mobility), with a moderate rating for the maintenance of streets and public spaces (7.18). It is mainly made up of people over 65 years old, living in the ring and without university studies, with low incomes and employed in manual work. Low social satisfaction, also linked to mobility and travel, may be indicative of a situation of social and economic vulnerability, with limited public resources in their area of residence.

In conclusion, the older we get, the lower the overall satisfaction with the social and sustainable dimensions (the "social cohesion" and "sustainability" factors) which may imply a mismatch between expectations and available services [61]. In terms of the territorial area, the further away from the city centre, the higher the priority given to sustainability and mobility (the 'sustainability' factor) and the more compact areas with a younger population, the higher the rating of social aspects (the 'social cohesion' factor).

One issue that all clusters share is the lower rating of the sustainability factor (green spaces and non-pedestrian mobility) compared to the others. The low sustainability scores are due to a poorer assessment of green spaces, but especially of mobility. To improve the citizen's view of the sustainability factor, it is necessary to holistically design peri-urban mobility programmes [50,58] and to improve public green spaces so that they are accessible to the entire population [42], incorporating the population's perspective in order to adapt to

the needs of urban green areas [22]. At the same time, it is necessary to observe differences according to age, adapting services to the needs of older populations [62].

Thus, the integration of the factor and cluster analysis made it possible to identify how socio-demographic factors influence the perceptions of different population groups with more homogeneous ratings.

This is key to identify differentiated patterns of satisfaction and perception in the population, allowing for the targeting of specific urban interventions according to the needs of each group. Population segmentation shows how factors such as the educational level, income and territorial area influence the perception of the urban environment, providing an empirical basis for designing more equitable public policies. The characterisation of clusters allows the prioritisation of vulnerable groups and the establishment of targeted strategies, ensuring that urban policies are not only inclusive, but also effective in reducing inequalities.

The results confirm that spatial and social inequalities are deeply interconnected, manifesting themselves both in the valuation of sustainability and in the perception of social cohesion and urban maintenance. The variability in perceptions of green spaces and sustainable mobility between clusters highlights the need for interventions to ensure equity in access to key urban infrastructures.

Integrating these differences into urban planning will allow for more tailored solutions, ensuring that interventions respond to the specific priorities and barriers of each population segment.

The findings align with the principles of spatial justice [11,13] as they highlight how unequal access to urban resources perpetuates socio-spatial disparities that urban planning must address. Our analysis supports the notion of cities as dynamic spaces where infrastructure, governance and the community interact echoing the theories of urban resilience outlined by Anguelovski et al. [15] and Fainstein [12].

By identifying gaps in mobility and green space access, our study contributes to discussions on the 'right to the city' [19,37], emphasising the need for inclusive and democratic urban planning approaches.

The emphasis on enhancing sustainability and accessibility resonates also with smart city paradigms [50] which advocate for integrating technology, community input, and environmental goals in urban development.

In addition, climate resilience strategies [6] are particularly relevant to our findings as addressing sustainability gaps through green corridors and improved urban mobility directly contributes to mitigating climate change impacts on urban populations.

Consistent with spatial justice theories [10,13], the findings also demonstrate how territorial disparities in urban environments reflect broader systemic inequalities that urban policies must confront.

The observed correlations between social cohesion, sustainability and urban maintenance highlight the interdependence of these factors, supporting Massey's [11] assertion that urban space is both a social and political construct.

So, our findings align with smart city frameworks, as proposed by Gehl [50], which emphasises the importance of prioritising pedestrian-friendly designs and accessible green spaces to foster liveable and sustainable urban environments. The low sustainability scores identified in this study are consistent with Anguelovski et al.'s [15] findings which highlight the challenges of ensuring equitable access to green infrastructure in urban planning initiatives. Contrasting with traditional smart city narratives that emphasise technology-driven solutions, our results underscore the importance of integrating community perspectives into urban planning to address territorial disparities [11].

The results contribute to climate-resilient urban planning frameworks by demonstrating how targeted investments in green infrastructure and sustainable mobility can mitigate climate vulnerability while promoting social cohesion [6,12].

This study diverges from traditional urban resilience theories by highlighting the interdependence of sustainability and social cohesion, suggesting that integrated interventions are crucial for fostering long-term urban well-being [12,19].

The findings highlight persistent sustainability gaps across clusters with limited accessibility to green spaces and suboptimal urban mobility identified as key challenges. Addressing these gaps requires the implementation of targeted strategies, such as increasing the availability of multifunctional green spaces and integrating them with public transportation networks.

In this sense, promoting active mobility (walking and cycling) and implementing eco-friendly public transportation systems can significantly contribute to improving urban sustainability. Case studies from cities like Copenhagen and Singapore, which have successfully integrated green infrastructure with sustainable transport solutions, offer valuable lessons for addressing these challenges. These examples underscore the importance of strategic investments in green infrastructure, mobility solutions and public engagement to foster sustainable urban development.

Cities should prioritise the creation of connected green corridors, ensuring that all residents have equitable access to green spaces within walking distance. Educational campaigns to raise awareness of sustainability issues, coupled with participatory urban planning processes, can ensure that interventions align with community needs and priorities.

5. Conclusions

This study contributes to the discourse on urban resilience [6] by identifying how targeted interventions in green infrastructure and mobility can simultaneously address environmental and social inequities. The integration of social cohesion, sustainability and urban maintenance in our analysis underscores the holistic approach needed to balance ecological and social justice in urban planning [12,15].

Our findings also reveal that sustainability gaps, particularly in mobility and green infrastructure, reinforce socio-spatial inequalities, which must be addressed to achieve truly inclusive urban environments [11,50].

The findings of this study reveal significant territorial inequalities in urban perception and satisfaction. As the distance from the compact city increases, public space knowledge, usage and satisfaction decline, with mobility patterns playing a crucial role. Peripheral populations, especially those commuting by private vehicles, exhibit lower spatial awareness and engagement. The analysis highlights how these territorial disparities intersect with income and educational differences, reinforcing socio-spatial inequalities.

The factor analysis results confirm that social cohesion and urban maintenance are strongly linked to positive city perceptions. High-rated variables such as safety, cleanliness, and pedestrianisation contrast with sustainability concerns, which are largely shaped by mobility constraints. Addressing these disparities requires reconsidering urban mobility patterns to enhance sustainability and accessibility. If we want citizens' assessments of urban space to be more positive in those areas in which they are most dissatisfied, we must rethink the pendular mobility patterns produced by productive dynamics [31].

The cluster analysis further underscores the variability in satisfaction levels, identifying five distinct population segments based on their perceptions of social cohesion, sustainability and urban maintenance. Despite these differences, sustainability remains the lowest-rated factor across all clusters, emphasising the need for policy interventions to improve green space accessibility and sustainable transport options.

This study underscores the necessity of differentiated urban policies that respond to specific demographic and territorial characteristics. Addressing spatial inequalities requires an inclusive approach that integrates public participation in decision making [7,50]. Ensuring that interventions align with residents' needs is essential for fostering a sense of belonging and promoting equitable urban development [9,19,38,41].

Moreover, this research highlights the broader implications of socio-economic and territorial disparities, not only in terms of access to urban spaces, but also in shaping perceptions of cohesion and sustainability. It is imperative to implement targeted public policies that address these structural barriers, particularly in peripheral and underprivileged communities where concerns over public space maintenance are more pronounced.

This analysis thus provides a good empirical basis for guiding future urban interventions. Integrating citizen assessments into planning processes will not only improve the quality of life of residents [44,45,49], but also move towards a more inclusive, sustainable [63] and resilient city in the face of today's urban challenges. But all this is not possible without multidisciplinary teams [5,6] to ensure legal frameworks and redistributive policies, to fund projects in the most vulnerable areas and to guarantee equitable access to urban resources.

On the other hand, the methodology applied to this research can be extended to other spaces with similar urban challenges, considering similarities, but above all, differences and specific challenges [48], for example, the size of the city. The correlation between social cohesion and sustainability in citizen perception is relevant in medium-sized cities, where territorial inequalities and peri-urban mobility are often common problems. Cities with these same characteristics could benefit from the creation of legible and participatively created public spaces for spatial justice [7,9,10,50]. For larger and more densely populated urban areas, integrating renaturation and NBS can be used as a strategy in the face of high levels of urbanisation and insufficient green infrastructure, as the results show that integrating citizen expectations into the design of spaces improves citizen perception, satisfaction and thus the threshold of well-being [46,47].

Although our methodology relied on robust quantitative techniques, qualitative methods such as interviews or focus groups could provide complementary insights, particularly in understanding the nuanced and subjective dimensions of residents' perceptions.

Future studies could use qualitative methods to explore the underlying motivations and emotional connections that shape urban satisfaction and perceptions, potentially uncovering factors overlooked in purely quantitative frameworks. Integrating qualitative and quantitative approaches would allow researchers to triangulate findings, thereby offering a more holistic understanding of the intersection between socio-demographic characteristics and urban perceptions.

Future research should also explore the role of emotional and identity-based factors in shaping urban satisfaction. The relatively stable overall perception of the city suggests that beyond objective characteristics such as infrastructure and services, symbolic and cultural elements contribute significantly to residents' evaluations. Localism, defined as the sense of belonging and connection to place, may influence satisfaction even in areas with identified deficiencies.

Understanding the interplay between urban transformation and place attachment is increasingly relevant, particularly in the post-pandemic context. The literature suggests that social and ecological factors, such as the length of residence, public space quality and neighbourhood social ties, impact place attachment. However, a balance must be maintained to ensure that local identity considerations do not overshadow critical unmet urban needs.

To capture these subjective dimensions, future research should integrate qualitative methodologies, including interviews, focus groups, participatory action research and perception-based mapping. Enhancing survey instruments to incorporate questions on emotional attachment, local pride and territorial identity could further refine urban perception analysis. Comparative studies between resident evaluations and external expert assessments could also help quantify potential local biases.

Addressing territorial inequalities requires targeted investment in underprivileged areas to improve access to essential urban services such as green spaces, mobility infrastructure and public amenities. Enhancing the connectivity between peripheral and central urban zones is crucial, with a focus on public transportation systems, pedestrian-friendly infrastructure and policies that foster economic integration.

Policy interventions should prioritise the equitable allocation of resources with particular attention to marginalised communities to bridge gaps in access to urban opportunities and ensure spatial justice. Strategies such as the development of mixed-use areas in peripheral regions and the creation of ecological corridors can foster more inclusive urban spaces and mitigate the socio-spatial divide.

Urban policies should aim to decentralise investments, reducing reliance on compact urban centres and enabling balanced growth across all territorial areas. To address the gaps identified in this study, urban planning initiatives should adopt a dual approach: strengthening infrastructure in peripheral areas while improving accessibility to the compact city through multimodal transportation systems.

By connecting peri-urban zones with central areas, cities can promote not only physical mobility, but also economic and social inclusion. Future research should assess the impact of these interventions to ensure they effectively reduce territorial inequalities and foster more cohesive urban environments.

Finally, longitudinal studies tracking infrastructure changes and their impact on urban satisfaction would provide valuable insights into the effectiveness of urban interventions. Establishing key indicators based on the factors studied would enable continuous monitoring and adaptive policymaking, ensuring that urban development aligns with evolving community needs.

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References

1. UN/DESA; UNCTAD; ECA; ECE; ECLAC; ESLAP; ESCWA; UNWTO. *World Economic Situation and Prospects*; United Nations Publication: Sydney, Australia, 2018.
2. UN and Secretary-General. World Population to Peak at 10.3 Billion This Century. *UN News*, 11 July 2024. Available online: https://news.un.org/es/story/2024/07/1531126 (accessed on 13 March 2025).
3. Bai, X.; Shi, P.; Liu, Y. Society: Realizing China's urban dream. *Nature* **2014**, *509*, 158–160. [CrossRef]
4. Bari, X.; McPhearson, T.; Cleugh, H.; Nagendra, H.; Tong, X.; Zhu, T.; Zhu, Y.-G. Linking Urbanization and the Environment: Conceptual and Empirical Advances. *Annu. Rev. Environ. Resour.* **2017**, *42*, 215–240. [CrossRef]
5. Bai, X.; Surveyer, A.; Elmqvist, T.; Gatzweiler, F.W.; Goneralp, B.; Parnell, S.; Prieur-Richard, A.; Shrivastava, P.; Siri, J.G.; Stafford-Smith, M.; et al. Defining and advancing a systems approach for sustainable cities. *Curr. Opin. Environ. Sustain.* **2016**, *23*, 69–78. [CrossRef]
6. Lehmann, S. Growing Biodiverse Urban Futures: Renaturalization and Rewilding as Strategies to Strengthen Urban Resilience. *Sustainability* **2021**, *13*, 2932. [CrossRef]
7. Soja, E.W. *En Busca de la Justicia Espacial*; Tirant Humanities: Valencia, Spain, 2014.
8. Ayala, G.E.T. The city as an inhabited space and source of socialisation. *Amphora* **2017**, *24*, 189–216. [CrossRef]
9. Harvey, D. *Social Justice and the City*; Arnold, E., Ed.; University of Georgia Press: New York, NY, USA, 1973.
10. Soja, E.W. The City and Spatial Justice. University of California. 2009. Available online: https://scholar.google.es/citations?view_op=view_citation&hl=es&user=B_4w1j0AAAAJ&citation_for_view=B_4w1j0AAAAJ:l7t_Zn2s7bgC (accessed on 13 March 2025).
11. Massey, D. *For Space*; SAGE Publications: Thousand Oaks, CA, USA, 2005.
12. Fainstein, S. Resilience and Justice. *Int. J. Urban Reg. Res.* **2015**, *39*, 157–167. [CrossRef]
13. Massey, D. Space, place and politics in the current conjuncture. *Urban* **2012**, *4*, 7–12.
14. Libânio, C. Cultura, criatividade e direito à cidade. In *El Derecho a la Ciudad Frente a los Desafíos Actuales*; Bonilla, O.A.L., Ed.; CLACSO: Buenos Aires, Argentina, 2021; pp. 94–106.
15. Anguelovski, I.; Connolly, J.J.T.; Pearsall, H.; Shokry, G.; Checker, M.; Maantay, J.; Gould, K.; Lewis, T.; Marolo, A.; Roberts, J.T. Why green "climate gentrification" threatens poor and vulnerable populations. *Proc. Natl. Acad. Sci. USA* **2019**, *116*, 26139–26143. [CrossRef]
16. Russo, A. Renaturing for Urban Wellbeing: A Socioecological Perspective on Green Space Quality, Accessibility, and Inclusivity. *Sustainability* **2024**, *16*, 5751. [CrossRef]
17. Masood, N.; Russo, A. Community Perception of Brownfield Regeneration through Urban Rewilding. *Sustainability* **2023**, *15*, 3842. [CrossRef]
18. Urzúa, B.V. Public space and the right to exclude. Athenea Digital. *J. Soc. Thought Res.* **2012**, *12*, 159–168.
19. Harvey, D. The right to the city. *New Left Rev.* **2008**, *53*, 23–39.
20. Massey, D. Space, Time and Political Responsibility in the Midst of Global Inequality (Raum, Zeit und politische Verantwortung inmitten weltweiter Ungleichheiten). *Erdkunde* **2006**, *60*, 89–95. [CrossRef]
21. Lefebvre, H. The Production of Space. Capitán Swing. 2013. Available online: https://dialnet.unirioja.es/servlet/libro?codigo=566234 (accessed on 13 March 2025).
22. Ministry for Ecological Transition and Demographic Challenge. National Strategy for Green Infrastructure and Ecological Connectivity and Restoration. Government of Spain. 2021. Available online: https://www.miteco.gob.es/content/dam/miteco/images/es/eniv_2021_tcm30-515864.pdf (accessed on 13 March 2025).
23. Yang, M.; Wang, D. How do Spatiotemporally Patterned Everyday Activities Explain Variations in People's Mental Health? *Ann. Am. Assoc. Geogr.* **2023**, *11*, 1781–1799. [CrossRef]
24. Ziafati, B.A.; Sharifi, A. How to Archive a Healthy City: A Scoping Review with Ten City Examples. *J. Urban Health* **2024**, *101*, 120–140. [CrossRef]
25. Ruíz, S.M.V. Making cities healthier: Urban green spaces as a tool for disease prevention. *Rev. Digit. CEMCI* **2020**, *47*, 1–10.
26. Vilcins, D.; Sly, P.; Scarth, P.; Mavoa, S. Green space in health research: An overview of common indicators of greenness. *Rev. Environ. Health* **2022**, *39*, 221–231. [CrossRef]

27. des Roches, S.; Brans, K.I.; Lambert, M.R.; Rivkin, L.R.; Savage, A.M.; Schell, C.J.; Correa, C.; de Meester, L.; Diamante, E.S.; Grimm, B.N.; et al. Socio-eco-evolutionary dynamics in cities. *Evol. Appl.* **2020**, *14*, 248–267. [CrossRef]
28. Maas, J.; van Dillen, M.E.S.; Verheij, A.R.; Groenewegen, P.P. Social contacts as a possible mechanism behind the relation between green space and health. *Health Place* **2009**, *15*, 586–595. [CrossRef]
29. Pietta, A.; Tononi, M. Re-Naturing the City: Linking Urban Political Ecology and Cultural Ecosystem Services. *Sustainability* **2021**, *13*, 1786. [CrossRef]
30. Brenner, N.; Schmid, C. The 'Urban Age' in Question. *Int. J. Urban Reg. Res.* **2014**, *38*, 731–755. [CrossRef]
31. Davis, K. The Origin and Growth of Urbanization in the World. *Am. J. Sociol.* **1955**, *60*, 429–437. [CrossRef]
32. Fathy, H. The world's urban explosion. *Courier* **1985**, *38*, 24–29.
33. Garnier, J. The trap of an urban-centric vision. David Harvey, from the right to the city to the urban revolution. *Pap. Ecosoc. Relat. Glob. Chang.* **2019**, *147*, 99–107.
34. Castells, M. *The Urban Question: A Marxist Approach*; Arnold, E., Ed.; MIT Press: Cambridge, MA, USA, 1977.
35. Soja, E.; Kanai, M. The urbanization of the world. In *The Endless City*; Burdett, R., Sudjic, D., Eds.; Phaidon: London, UK, 2007; pp. 54–69.
36. Merrifield, A. The right to the city and beyond: Notes on a Lefebvrian re-conceptualization. *City* **2011**, *15*, 473–481. [CrossRef]
37. Lefebvre, H. *The Urban Revolution*; University of Minnesota Press: Minneapolis, MN, USA, 2003; Available online: https://thecharnelhouse.org/wp-content/uploads/2017/08/Henri-Lefebvre-The-Urban-Revolution.pdf (accessed on 13 March 2025).
38. Durán, M.A. The Shared City. Knowledge, Affection and Use. Ediciones Sur. 2008. Available online: https://www.sitiosur.cl/detalle-de-la-publicacion/?la-ciudad-compartida-conocimiento-afecto-y-uso (accessed on 13 March 2025).
39. Jones, J.; Russo, A. Exploring the role of public participation in delivering inclusive, quality, and resilient green infrastructure for climate adaptation in the UK. *Cities* **2024**, *148*, 104879. [CrossRef]
40. Wang, Y.; Yang, Y.; Sun, Y.; Lyu, S.; Zhang, Z.; Liu, D.; Wei, S.; Liu, S.; Wang, M. Public perception and preferences of industrial green infrastructure in Northwest China. *Ecol. Indic.* **2023**, *156*, 111123. [CrossRef]
41. Castells, M. *The City and the Masses. Sociology of Urban Social Movements*; Alianza Editorial S.A.: Madrid, Spain, 1983.
42. Lafrenz, A.J. Designing Multifunctional Urban Green Spaces: An Inclusive Public Health Framework. *Int. J. Environ. Res. Public Health* **2022**, *19*, 10867. [CrossRef]
43. Harvey, D. *Spaces of Hope*; Akal: Madrid, Spain, 2003.
44. Costanza, R.; Fisher, B.; Ali, S.; Breer, C.; Bond, L.; Boumans, R.; Danigelis, N.L.; Elliott, C.; Farley, J.; Elliot, G.D.; et al. An Integrative Approach to Quality of Life Measurement, Research and Policy. *Surv. Perspect. Integr. Environ. Soc.* **2008**, *1*, 11–15. [CrossRef]
45. Veenhoven, R. Sociological theories of subjective well-being. In *The Science of Subjective Well-Being: A Tribute to Ed Diener*; Eid, M., Larsen, R., Eds.; Guilford Publications: New York, NY, USA, 2008; pp. 44–61.
46. Patino, J.E.; Martínez, L.; Valencia, I.; Duque, L.C. Happiness, life satisfaction, and the greenness of urban surroundings. *Landsc. Urban Plan.* **2023**, *237*, 2–17. [CrossRef]
47. Kwon, O.; Hong, I.; Yang, J.; Wohn, D.Y.; Jung, W.; Cha, M. Urban Green Space and Happiness in Developed Countries. *EPJ Data Sci.* **2021**, *10*, 28. [CrossRef]
48. Veenhoven, R. *Conditions of Happiness*; Springer: Berlin/Heidelberg, Germany, 1984. [CrossRef]
49. Lynch, K. *The Image of the City*; The MIT Press: Cambridge, MA, USA, 1990.
50. Gehl, J. *Cities for People*; Island Press: Washington, DC, USA, 2010; Available online: https://archive.org/details/cities-for-people-jan-gehl/page/n3/mode/2up (accessed on 13 March 2025).
51. Aybar, C.; Pérez, V.; Pavía, J.M. Scale matters: Unravelling the impact of Likert scales on political self-placement. *Qual. Quant.* **2024**, *58*, 3725–3746. [CrossRef]
52. Ali, M.J.; Rahaman, M.; Hossain, S.I. Urban green spaces for elderly human health: A planning model for healthy city living. *Land Use Policy* **2022**, *114*, 105970. [CrossRef]
53. Petrikovičová, L.; Kurilenko, V.; Akimjak, A.; Akimjaková, B.; Majda, P.; Ďatelinka, A.; Petrikovič, J. Is the size of the city important for the quality of urban life? Comparison of a small and a large city. *Sustainability* **2022**, *14*, 15589. [CrossRef]
54. Cerrone, D.; López Baeza, J.; Lehtovuori, P.; Quercia, D.; Schifanella, R.; Aiello, L. Implementing Gehl's Theory to Study Urban Space. The Case of Monotowns. *Sustainability* **2021**, *13*, 5105. [CrossRef]
55. Carmona, M. *Public Places Urban Spaces: The Dimensions of Urban Design*; Routledge: London, UK, 2021.
56. Tan, J.; Gu, K.; Zheng, Y. Peri-urban planning: A landscape perspective. *Plan. Theory* **2024**, *23*, 42–63. [CrossRef]
57. Nazmul, H.; Sharifi, A. Who are marginalized in accessing urban ecosystem services? A systematic literature review. *Land Use Policy* **2024**, *144*, 107266. [CrossRef]
58. Brownrigg-Glesson, M.L.; Monzón, A.; Cortez, A. Reasons to pedestrianise urban centres: Impact analysis on mobility habits, liveability and economic activities. *Sustainability* **2023**, *15*, 16472. [CrossRef]

59. Bubramanian, G.H.; Verma, M.; Verma, A. Measuring motivation and satisfaction level of visitors of a pedestrianized urban street in India for an improved quality of life. *J. Urban Plan. Dev.* **2023**, *149*, 05023026. [CrossRef]
60. Panagopoulos, T.; Stilianos, T.; Paraskevi, K.; Aikaterini, K.; Apostolos, K. The usage and perception of pedestrian and cycling streets on residents' well-being in Kalamaria, Greece. *Land* **2018**, *7*, 100. [CrossRef]
61. Allinari, H.; Dumka, A.; Verna, A. A framework for assessment of pedestrianization impacts on quality of life: Combining subjective and objective measures. *Cities* **2024**, *145*, 104688. [CrossRef]
62. Ottoni, C.A.; Sims-Gould, J.; Winters, M. Safety perceptions of older adults on an urban greenway: Interplay of the social and built environment. *Health Place* **2021**, *70*, 102605. [CrossRef] [PubMed]
63. Environmental Statement 2023: Department of Parks and Gardens. City Council of Santiago de Compostela. 2023. Available online: https://santiagodecompostela.gal/sites/default/files/2024-12/DeclaracionCastellano2023_05%20-%20ANEXO%20VII.pdf (accessed on 11 March 2025).

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Article

A New Top-Down Governance Approach to Community Gardens: A Case Study of the "*We Garden*" Community Experiment in Shenzhen, China

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Abstract: Over the past few decades, development in China (including Shenzhen) has been led by the State, meaning that the government has been responsible for major decisions in urban construction and management. However, the current enormous contradiction between people's demand for livability and Shenzhen's unequal and inadequate urban development means that leaving all the administrative work to the government alone has become unsustainable. Since 2020, Shenzhen has introduced a new urban management approach called "*We Garden*", in which the government supports public participation aimed to transform idle public lands into green spaces in the form of community gardens. Because this ongoing but novel community garden experiment is a recent development in China, literature investigating the phenomenon context, especially the associated motivations and governance structure, remains scarce. This paper aims to clarify the governance structure and operation mechanism of the Shenzhen community garden program through all stages: from planning and design through construction or implementation to management. Fieldwork with active participation, direct observation, and semi-structured, qualitative interviews as participant in a nonprofit organization revealed that the Shenzhen experiment was driven by urban environmental public governance rather than individual needs. The community garden development approach is a new top-down governance structure that expands on existing governance types in the literature, while emphasizing the key role that nonprofit organizations play in the process. Therefore, this new governance approach expands beyond the environmental improvement of urban communities, serving as a new mechanism for sustainable public participation in urban environmental protection.

Keywords: community garden; governance; top-down; Shenzhen; nonprofit organization

1. Introduction

For decades, the development process of China has been State-led, emphasizing the government's role in making major decisions about urban construction and management [1]. However, China's continuing economic growth and the improvement of urbanization (with the urbanization rate reaching a new level at 63.89%) [2] have led social development to enter a new stage where citizens, no longer satisfied with basics such as food and clothing, have also developed high expectations regarding the quality of life and their living environment. Therefore, a large contradiction has emerged between people's demand for livability and the inequality and inadequacy that have characterized urban development. In essence, this contradiction represents a conflict between population and resources that has

become prominent in Shenzhen and is at the forefront of China's economic development. Overs the course of only 40 years, Shenzhen, China's first Special Economic Zone, has become a megacity, exhibiting an explosive growth from 0.31 million to 17.56 million permanent residents, a 55-fold increase within the span of four decades. Shenzhen, which is the only city in China with an urbanization rate of 100% [3], retains about 50% of the ecological control line (In other words, the city has set aside 50% of its land to function as green lungs), severely limiting the amount of developable urban land. However, in a high-density urban environment, the green and public urban space left to the public falls far short. In the meantime, migrant young people who have become new citizens have put forward higher requirements for the quality of the living environment. The rising grassroots demands have created a situation where guidance by the government alone has become unsustainable. Therefore, in 2020, following the grassroots governance concept of "We are the cities we make" that was initiated at the national level [4], the Shenzhen Municipal Government proposed a new urban management approach called "*We Garden*". This emerging community trend in Shenzhen is transforming idle public land into green space in the form of community gardens. The government formulated the scheme with associated financial support, encouraging public participation. The local government has announced plans to build 120 community gardens in Shenzhen per year to improve the greening rate in high-density residential areas [5]. The launch of this new scheme, along with official encouragement, has led different stakeholders from government institutions, nonprofit organizations, schools, communities, and professional agencies (e.g., design and gardening companies) to come together to implement community gardens on the ground, transforming the project into a process of co-construction and governance.

In this context, developing community gardens in Shenzhen has gone beyond the basic concept of a planting space and social space in the community and is now poised to solve the contradiction between the city's future environmental development and the ubiquitous shortage of land and financial pressure, while simultaneously encouraging grassroots autonomy. Once one community has successfully implemented the idea, the process can be replicated and promoted at the municipal level at a low cost. In terms of the process of community garden planning, construction, and management, it was also found that its motivation and governance structure differed from typical patterns illustrated by the study.

Scant literature is available regarding this type of ongoing, novel community garden experiment in the Chinese context. Accordingly, this paper aims to clarify the governance structure and operation mechanism of the Shenzhen community garden program through all stages: from planning and design through construction or implementation to management. Furthermore, this investigation delved into the new mechanism of public participation in urban environmental protection in the Chinese context.

The study was based on the following research questions: (1) What is a diversity in participants/actors and their action styles? (2) How is the new community garden scheme carried out in local contexts, and what were the results? (3) How can the Shenzhen case help scholars better theorize the governance structure in community gardens and beyond the city level?

This discussion addresses these questions and identifies the relevant gaps that emerged in the research process through an initial review of the research status, motivations for community gardens, and types of governance structure in this context. Then, as a reflection of nonprofit organizations and deeply involved in the development of community gardens, we describe the study's research methods. Next, the paper will present the findings from the interviews, along with details of the process and results of the development of a particular community garden. Lastly, the focus of the discussion of the findings will center around governance structure.

By comparing the governance structure of Shenzhen with other community gardens worldwide, we believe that the model in Shenzhen (described here as top-down with public engagement driven by nonprofit organizations) complements the governance structure of

community gardens while also representing an innovative mechanism to promote public participation in urban environmental protection. This model, which will allow members of society to fully participate in the construction of green cities in the future, is innovative and reproducible from an international perspective.

2. Literature Review

A community garden—distinguished from a private garden [6]—refers to open spaces managed and operated by local community members, which allow people to work together to grow herbs, fruit, vegetables, or flowers [7–10]. It is widely acknowledged that the contemporary community garden originated in the United States in the 1970s [11,12], although some researchers have asserted that the idea originated from the two World Wars [13,14]; in any event, all conclusions point to the appearance of this phenomenon in terms of people who decided to grow food to contribute toward self-sufficiency.

To date, the number and diversity of community gardens have significantly increased. There are several streams of research on community gardens. The main stream of research has featured the social sciences, including but not limited to planning, health, geography and sociology, and education, covering topics such as social capital [15–18], health and well-being outcomes [13,19–21], and community engagement and development [7,22,23].

In our review of the previous research, we focused on the literature on the motivations, as well as governance approaches/organizational structures of community garden projects. Among the insights that emerged, we found that while community gardens can serve as an alternative food/medicine to provide economic benefit and supply healthy food and supplies, at the same time, they can also provide open spaces for social activities or recreation [24,25]. Multiple studies have reported similar motivations for building community gardens, such as consuming fresh foods, making or saving money by eating from the garden or selling produce, social cohesion, and improving health. Other identified motivations included education, enjoying nature, and enhancing environmental sustainability [26].

Another discovery was that community gardens usually start from bottom-up efforts by a grassroots community, individuals, or groups [13,17,27]. In addition to the bottom-up approach, a top-down structure organized by the public sector (e.g., municipal agencies) provide an essential complement to community garden development [28]. After comparing community gardens between fall 2011 and fall 2016, Rees & Melix (2019) found a disappearance of gardens established from the top-down and an increase in grassroots neighborhood gardens from the bottom-up, which they thought is a more pragmatic approach [29]. The bottom-up approach encourages more participation and commitment from people [30], which might improve the likelihood of a garden's longevity [31,32]. However, Rosol (2005) and Baker (2004) argued the top-down approach was a good way to ensure the effective management of gardens [33,34]. Specifically, McGlone et al. (1999) subdivided community gardens into five different governance structures under the two mentioned basic modes: top-down, top-down with community help (gardens planned, established, or managed by paid professionals with community involvement), bottom-up, bottom-up with professional help, and bottom-up with informal help [35]. Fox-Kämper et al. (2017) later expanded this theory by adding a new category called bottom-up with political and/or administrative support (PAS), which refers to using a bottom-up approach with some external support, mostly involving local government agencies that provide land, funding, and/or expertise [36].

A comparison of motivations and governance approach reveals that the ongoing Shenzhen community garden experiment differed from the previously described definitions in terms of motivation and governance structure in the Chinese context. The following points present four limitations of the prior studies and how we addressed them:

(1) Research background. Overall, few studies have taken place in non-English speaking countries [26]. In China, community gardens involving public participation in construction and management have only emerged in this decade [37]. Thus, in China (mainly in Shanghai) [38–40] and especially in Shenzhen, very little research has been

conducted, and understanding is lacking in this area, especially in terms of knowledge about how community gardens work in a Chinese context. As members involved in communication and coordination with actors, we delved deeply into the community garden in Nanshan district, Shenzhen, which can be seen as representative of China's evolving local socialist market economy in pursuit of sustainable development [41].

(2) Governance approach. The governance structure of the ongoing Shenzhen community garden development appears to be top-down with community help or PAS literally. After conducting a content analysis of articles with information on governance structures, several cases of community gardens using these two models are searched and summarized as follows: As for top-down with community help, first, most cases were involved in paid professionals from political and administrator support. For example, the Philadelphia Urban Gardening Program in America was sponsored by university cooperative extension service with technical assistance and supported by the Philadelphia Horticultural Society with materials [42], 'Dig In' community garden projects in England, Australia (same as the British case), Cape Town, and Shakashead community gardens in South Africa were all supported from a professional organization with a dedicated trust or funding [17,29,30,43]. Second, several community gardens initiated a top-down approach in the planning and implementation phases, although they underwent the transition from top-down to bottom-up during the management phase [9,10,17,44]. As for PAS, despite being a bottom-up initiative, projects have received significant support such as financial or advisory support, donations of materials, free water supply. Some received support during the construction and implementation phase, which is a common form in the planning and design phase [38,45–48]. After comparison, the governance structure of Shenzhen still has unique qualities. More information about the ongoing Shenzhen community garden governance structure is needed to promote a complete understanding, reflecting Guitart et al.'s (2012) suggestion that "future studies should shed light more on how participants garden" [26]. In focusing on the governance of the community garden, as well as the construction process, a deep understanding of the processes around participation in the community garden was gained.

(3) The role of each participant (especially nonprofit organizations). In general, the success of a community garden depends on the degree of its internal organization [17]. For example, in the case of a temporary post-earthquake community garden in central Christchurch, New Zealand, a local organization—Greening the Rubble (GtR)—acted as a coordinator that created new, linked social capital that was vital to the success of the project [48]. Similarly, even though the success of the community garden project in Shenzhen has also been closely related to nonprofit organizations, only a few studies have explored the active role of nonprofit organizations in the development of community gardens. This topic could be explored because we were involved in the entire process of community garden construction and management.

(4) Motivations. In the international or traditional sense, most community gardens are initiated on the community scale to meet individual's needs, though some are directly initiated by project managers and institutions [26]. From the perspective of future urban environmental development, few governments have directly issued community garden plans. That is to say, the motivation behind the ongoing Shenzhen community garden has changed from meeting the material, spiritual, and cultural needs of individuals to an urban management approach in which the government issued policies and encouraged public participation to realize the sustainable development of the city. Through the interview with government officials, the Shenzhen community garden was discussed in terms of giving a new mission.

3. Material and Methods

The section comprises three parts. The first introduces the overall situation of community gardens in Nanshan District of Shenzhen and describes the selected community

garden program. The second explains the six groups of participants in this experiment and their characteristics. The third discusses the data collection protocol, which unfolds participatory observations and semi-structured, qualitative interviews.

3.1. Case Selected

Nanshan District government announced that 20 community gardens will be built through public participation per year from 2020 to 2025, which means that by the end of 2025, the number of community gardens will be 100. The number of gardens, which is also the work KPI of the government, is larger than that in other districts due to the financial income level of the district.

From 2020 to 2021, as a member of the Nature Conservation (TNC, one of the world's famous Non-Government Organizations), the author participated in the whole process, from planning to completion, of 12 community garden projects in the Nanshan District. During this process, TNC, as an environmental protection organization, was responsible for providing nature-based solutions and promoting public participation. Each project took an average of nearly 3 months, and multiple projects were carried out in parallel. It is found that the governance approach would gradually tend to be the same in general. Therefore, we will select one typical case—*Pen Garden* (The names mentioned in this paper are pseudonyms)—for discussion.

Pen Garden is in an idle public green space on the roadside of Changhai Community in Nanshan District, covering a total area of about 800 square meters, and the garden renovation area is about 400 square meters. The plot has several characteristics: (1) The plot is owned by the government, avoiding insecurities such as other American community gardens being withdrawn after a certain duration [26]; (2) It was originally a public green space furnished with garden pavements and seats, but due to the lack of management, the garden is overgrown with weeds, making it difficult for people to enter, thus becoming a negative green space of urban waste (Figure 1); (3) It is located next to the traffic artery of the community and close to commercial residential areas, schools, and shops. Thus, the plot has a large flow of people every day, which can be utilized by surrounding residential residents, schools, enterprises, and even passers-by. Considering the existing issues and the promising greater social benefits, it was determined and supported by the government.

Figure 1. *Pen Garden* before the transformation. (Source: ZHOU Yu, 2020).

3.2. Participants Characteristics

In the "*We Garden*" project, all participants could be mainly divided into four categories: The first is the officials of government institutions. The effect of the community garden is their work KPI, but as a public participation project, they need to make a balance between their work standards and the needs of residents. The second refers to nonprofit organizations, including: (1) Community organizations, including foundations and Party member service centers rooted in the community. They have community influence and appeal and are essential to fostering public participation. (2) Non-Governmental Organiza-

tions that are not rooted in the community but have more technologies or resources help the community link more social capital. The third category is landscape designers from design companies. Different from the previous projects who are commissioned to design, this time they served as technical representatives to support community gardening and help the residents without any experience realize their design concepts in garden construction. The fourth category is communities, who studied, lived, or worked within about a walking distance of 500 m of the garden (in the *Pen Garden* project, mainly students). They have the greatest right to enjoy the garden and have the obligation to maintain it. The other small part is volunteers from outside the community who participate in the project.

3.3. Data Collection Methods

The methods of data collection included participant observations and semi-structured and qualitative interviews. As members of nonprofit organizations who were deeply involved in the development of community gardens, we collected information during site gardening and via meetings, impressively exploring how the various actors in this project performed through active participation and direct observations.

In addition, semi-structured, qualitative interviews were conducted between October 2020 and January 2021 among ten of the *Pen Garden* project actors (Table 1). They were recorded and transcribed. Quotations from Chinese interviews were translated into English by the authors. The interview mainly includes the following questions: (1) Their roles in the development of community garden development, and (2) Evaluations before and after participation.

Table 1. Profile of interviewees.

Interviewee	Position	Organization	Sector
Interviewee A	Deputy director	Urban Management Bureau of Shenzhen Municipality	Government
Interviewee B	Director	Urban Management Bureau of Shenzhen Municipality Nanshan District	Government
Interviewee C	Officer	Urban Management Bureau of Shenzhen Municipality Nanshan District	Government
Interviewee D	Officer	Shekou Community Foundation	Nonprofit Organization
Interviewee E	Coordinator	Shekou Community Foundation	Nonprofit Organization
Interviewee E	Landscape Designer	Local council	Designing Enterprise
Interviewee G	Landscape Designer	Local council	Designing Enterprise
Interviewee H	Teacher	Community School	Public institute
Interviewee I	Student	Community School	Public institute
Interviewee J	Student	Community School	Public institute

4. Results

In addition to the governments, each actor involved in "*We Garden*" played a particular role at different stages (including planning, pre-research, co-design, co-building/co-construction, and maintenance phase) in the community garden development. Their roles and action styles were listed in Figure 2. Among them, nonprofit organizations were involved throughout the process and were essential in promoting public engagement, as well as the success of the project. In the first four sections below, we took *Pen Garden* as an example to illustrate how nonprofit organizations cooperate with the government, communities, and professionals in the whole phase. In the last section, we listed the representative feedback from the government director, designer, and student on participating in the transformation process of *Pen Garden* with the help of nonprofit organizations.

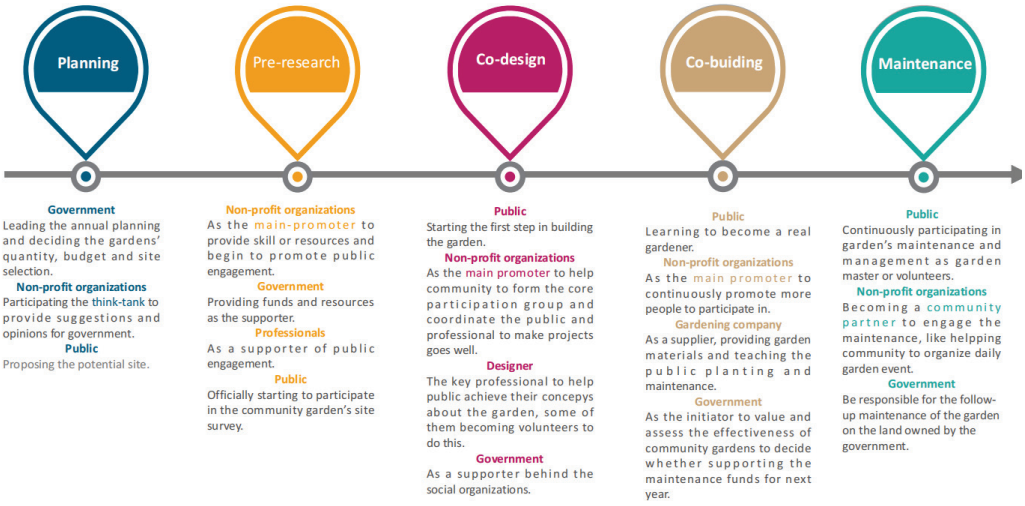

Figure 2. Roles and action styles of each actor in the whole phases of *We Garden* community garden development. (Source: Author).

4.1. The Government Involved Nonprofit Organizations in the Planning Phase

In the planning phase, the Nanshan district government took an open and innovative approach, inviting different nonprofit organizations to take part in a think tank to provide professional suggestions. Examples include TNC, which focused on urban environment conservation, and the Community Foundation, whose efforts centered around community service and governance. In the meantime, nonprofit organizations also facilitated government understanding of people's needs and provided feedback for administrative decision making. For example, when implementing the "*We Garden*" scheme, the government initially approached the community garden project as a topic for consideration; that is, it issued administrative instructions to start the site-selection process, and requested that the sub-district offices perform the preliminary investigation and make decision concerning site selection. Although the site may be located in the community, this type of compulsory approach may eventually discourage participation if it leads to situating the community garden at an inconvenient distance from the residents' activity area or causes a lack of public understanding. Therefore, the Community Foundation advised the government to adopt an open approach by encouraging the public to offer input about community garden site selections. This technique facilitated the collection of the real needs of the public and is a prerequisite for promoting public participation. The government adopted this advice, released the news of the opportunity to the public through social media, and encouraged them to submit suggestions concerning idle space in the community that they wanted to transform into a community garden. If a location qualified, the government would provide financial support according to the garden's location, area, and situation. *Pen Garden* is an example of such a garden recommended by the public. As the garden is on public land owned by the government, it can generate greater social benefits after evaluation, and for that reason, it has received government support.

4.2. Nonprofit Organizations Helped the Community Promote Public Engagement

In the next stage, the public needed to be involved in the co-design and co-construction of the community garden. This part of the process represents an area where nonprofit organizations could help with various skills and resources. In this case, *Pen Garden* had been neglected by the surrounding residents for a long time, making public participation difficult to attract. Therefore, the Community Foundation and TNC cooperated and began their efforts at a school next to the site. In cooperation with the schools, they represented the community garden project as a social practice course for students and organized an environmental education workshop, inviting a professional team of animal and plant experts and garden landscape designers to lead students in carrying out site research

(Table 2, Figure 3). This workshop was recognized by the government and the school. Teachers and students gradually became interested in community garden construction and became the main participants in this project. In addition, the Community Foundation recruited volunteers to participate via social media; nevertheless, compared with the stable groups in the school, most of the participants attracted by this temporary recruitment method were one-time contributors whose involvement was unsustainable.

Table 2. The sample site plant survey questionnaire.

Garden: *Pen Garden* Recorder: XXXX Date: XXXX						
No.	**Species Name**	**Density Class**	**Number**	**Coverage**	**Growth**	**Other**
1						
2						
...						

Figure 3. The students conducting the site survey. (Source: Action, 2020).

4.3. Nonprofit Organizations Helped the Community to Reach out to More Professional Resources

Only a few communities have experienced gardeners, and these individuals usually become the leaders of community gardens and organize their communities to carry out garden construction and maintenance. However, most of the participants had no gardening experience and consequently needed training and guidance. Under the circumstances, nonprofit organizations were able to use the resources and networks of social organizations to help them quickly find appropriate professional resources. In the *We Garden* projects, the government adopted TNC's proposal and held a community garden design competition with local foundations, design competition platforms, and other institutions to solicit good works. The winner received government funds as the competition prize through the local foundation. Some designers also participated as volunteers, working with the public to realize their design concepts. At the same time, nonprofit organizations also organized workshops and meetings to facilitate public consultation with experts and continuously promoted increasing participation.

In the *Pen Garden* project, after completing the ecological background investigation, TNC found that the original biodiversity of this place was relatively rich, making the location suitable to be transformed into a habitat garden, meaning that the focus was on protecting the area's original natural resources through low-impact design. Accordingly, TNC asked for a suitable designer for the community and organized a workshop. The workshop process included: (1) Discussion and analysis of the site survey results to determine the transformation intention characterizing the garden renovation; (2) Sketching and modeling the community garden; (3) Group sharing and exchanging ideas to determine the final plan. Twenty students, divided into five groups, participated in the whole process. Some of them proposed preserving shade plants on the site, while others come up with

the idea of creating a bird habitat. Another topic of focus involved older adults' need for a restful oasis. Finally, these ideas were integrated into the garden design (Figure 4).

Figure 4. The students in the design workshop. (Source: Action, 2020).

The cooperation described here continued into the garden construction process, gradually promoting increasing intensive public participation, which helped the community to establish a volunteer group to participate in the follow-up maintenance and management. As a result, *Pen Garden* retained the original vegetation of the site, complemented local plants, set up bird "rooms" and bathing basins with plants, created bird habitats, and added seats and sand pools for children's play. This location now features an elder-friendly, child-friendly, and rich-in-biodiversity garden, providing natural well-being for the people who live or work in proximity to the site (Figures 5–7).

Figure 5. *Pen Garden* after transformation. (Source: ZHOU Yu, 2020).

Figure 6. *Pen Garden* after transformation. (Source: CHEN Feng, 2020).

Figure 7. *Pen Garden* after transformation. (Source: CHEN Feng, 2020).

4.4. Nonprofit Organizations Encouraged the Public to Participate in the Governance

After a two-month construction, a transformed *Pen Garden* was created and entered the maintenance stage. The government's role was to evaluate and assess the effectiveness of the community gardens. After determining that the requirements had been met, the government's continuing contribution at this stage was to provide maintenance funds to the community in the first year to help the community transition to autonomy. More importantly, the nonprofit organizations proposed and adopted a method, in which a leader was elected by the participants collectively to lead the team in maintaining the community garden and finally achieve grassroots autonomy.

The first garden master of *Pen Garden* was elected by the students: a teacher who is also a biology hobbyist. He actively participated in the whole process of garden transformation,

organized students from different grades to participate, and used the community garden as his outdoor natural teaching class. This process doubtless helped the teacher and his students establish a relationship with the garden and take the initiative to maintain the garden, such as watering plants, cleaning up leaves, recording plant growth, and performing other daily work (Figure 8).

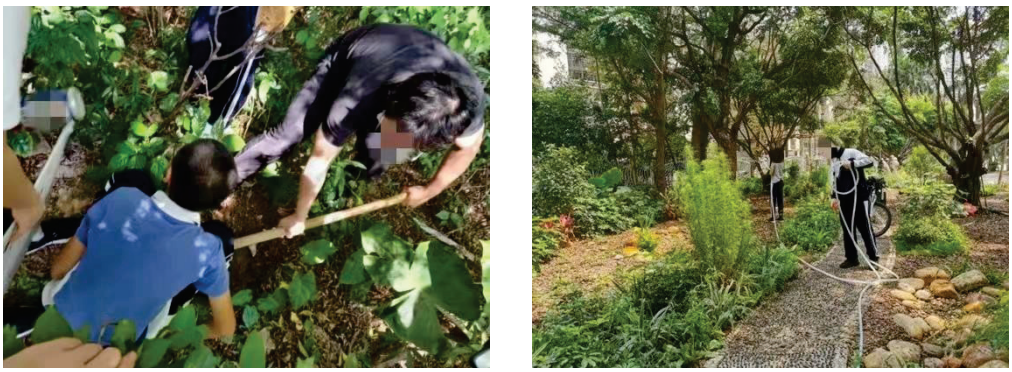

Figure 8. Student volunteers carry out garden maintenance under the guidance of teachers. (Source: CHEN Feng, 2020).

4.5. The Change and Integration of the Participants in the Community Gardens Process

We interviewed government officials, designers, and students at the *Pen Garden* to obtain their evaluations before and after participation:

(1) Interviewee A from the government said, "*I found that the process of transformation is also the process of youth environmental education. A community garden can become a place for community environmental education*". This inspiration was also reflected in government policy for the following year. The government consulted experts to develop an environmental education toolkit for gardens provided at no cost to communities to help them carry out daily gardening activities. For many officials who had previously confined their efforts to formulating policies without going on to participate in policy implementation, this action represented a change in their working methods. They are now more willing to go deep into the community, understand people's real needs, and obtain first-hand feedback.

(2) Interviewee E from a designing enterprise said, "*When we studied landscape design at the university, we were reminded to pay attention to the needs of users, but in real projects, we should cater to investors, who always pay attention to business needs*". Since most of the designers had no experience with the community garden co-construction, the workshop provided a process that changed their work-related thinking. Interviewee E continued, "*At first, I always inadvertently regarded the public at the workshop as investors, but later, I realized it was cooperation. This is different from the traditional way; now, the garden is a design work that meets the needs of users, which makes me look forward to it*".

(3) The students at the school next to the Pen Garden are the primarily participants and the biggest beneficiaries of this project. They were organized to participate from the beginning, then spontaneously carried out garden maintenance. Interviewee I from the school observed, "*Before participating in the construction, I passed this place every day but never paid attention to it. Until the first site survey, I saw many different animals and plants here, and even a bat, which made me feel that this place is alive and full of vitality*". Meanwhile, Student J from the community school said, "*During the investigation, I found that there were no chairs in the garden, nor in the surrounding areas, which was very unfriendly to the elderly, so I proposed to add chairs in the community garden in the workshop until today I install chairs by myself. When I see people sitting there, it makes me feel very fulfilled*".

5. Discussion

In the "*We Garden*" program, the process of public engagement moved from the top (government) in the form of guidance to the bottom (community) in the form of autonomy. The overarching motivation for launching a community garden laid in the Shenzhen government's desire to change the image of state-led development in urban management [49], reduce financial pressure, and return more green space to the city while encouraging public engagement. Moreover, the project represents a governmental exploration of grassroots autonomy, as well as the implementation of the governance concept of "We are the cities we make" at the national level.

In the first place, in the case of a city that is characterized by its immigrants, starting from the top-down was necessary. Despite Shenzhen's 17.56 million permanent residents, its census-registered population is only 5.84 million [50]. As a result of this difference in the city's population, most of the people living in Shenzhen have no sense of belonging to the community, making their willingness to participate in public affairs relatively low. This environment complicates following a bottom-up governance approach characteristic of Shanghai, Guangzhou, and cities with more native-born residents. Therefore, the *We Garden* scheme, which offered a top-down policy with governmental support and guidance, was of great significance in promoting social participation in public environmental governance in Shenzhen.

However, in light of China's unique socialist institutions, this top-down public participation scheme was itself contradictory. Public attitudes toward the government policy often hover between "for" and "against", and cooperation between the two sides is limited. This circumstance makes the coordination of nonprofit organizations indispensable. On the one hand, nonprofit organizations are government partners. Thus, even as these organizations give full play to the advantages of dealing with public relations as the main promoters, they must also accurately transmit government information in an approachable way that will avoid the public perception of strong governmental intervention in the process of participation. Moreover, this approach provides members of the community with adequate decision-making space, which is the key to effective co-construction. From the community side of the equation, nonprofit organizations serve as community partners, gather feedback about public needs, help members of the public establish an autonomous mechanism, and promote public engagement. In contrast, a scheme that is only promoted by the government without the participation of nonprofit organizations will eventually be dominated by administrative forces and implemented in the form of ordinary garden construction projects, lacking the element of community involvement and shared motivation. Thus, an approach characterized by government investment, recruitment, design, and construction in terms of organizing residents' activities exerts limited influences and is often short-lived, meaning that a government-driven process would make the community garden scheme unsustainable and ineffective.

After the construction of the community garden under consideration had been completed, the government began to encourage grassroots autonomy in the management stage. It is consistent with several cases that transitioned from top-down to bottom-up during the management phase in the literature review [9,10,17,44]. The Shenzhen experiment has improved management feasibility by engaging both top-down and public participation in the planning and construction stages of the community garden, followed by encouraging grassroots autonomy in the management stage, which may be conducive to the sustainability of the community garden as some researchers proposed [31,32]. This kind of grassroots autonomy management deserves more attention in later research, especially support in the form of government funding is later reduced or eliminated.

Through the analysis presented in this paper, we found that the Shenzhen approach differed from the six governance structures summarized in the literature review. The Shenzhen approach is unique compared with two particular structures out of the six. First, in contrast to the top-down with community assistance approach, nonprofit organizations joined as volunteers and served the community free of charge in Shenzhen (some designers

as well), which is not paid, as the literature and cases showed [17,29,30,42,43]. Following an approach that includes some of the same elements as the PAS approach and its typical cases [38,45–48], the Shenzhen Municipal Government has taken the initiative to provide funds, land, and professional knowledge to the community on a top-down basis, launching this scheme, while remaining well aware that a solely government-driven scheme would be unsustainable. Therefore, the municipal government has called for the development of more community gardens as a method of public engagement.

These considerations led to formulation of a new (seventh) category: top-down with public engagement driven by nonprofit organizations. We define it as the government taking the lead in launching the policy, providing matching funds and land support, while nonprofit organizations offer coordination and assistance, mitigate administrative intervention, and promote public participation in the planning and design, construction, and management stages of community garden development. The roles and action styles of the main participants are summarized as follows:

(1) Government as the initiator: The community garden scheme has been promoted from top to bottom in the form of policy. The government has been the main supplier of funding and resources for the community. The government monitors the scheme via KPI, promotes and supervises its on-time completion, and assesses the effectiveness of community gardens.
(2) Nonprofit organizations as the engine: Their participation methods and roles change dynamically through different stages of the project, including government think tanks, project promoters, community partners, and other roles. Their involvement persists throughout the whole process of the project, giving full play to the ability and value in dealing with public relations. These entities also promote effective communication between the government and the public, as well as the public and experts. Nonprofit organizations are the key to the success of the project, and without their participation, enormous obstacles will arise that may be insurmountable.
(3) Experts/designers and community locals as the public: Experts and designers provide professional knowledge and skills to inexperienced participants. At the same time, this approach also represents a new model for them to build with the community. Unlike traditional landscape projects, instead of magnifying their responsibility, community garden projects call for them to be more like partners cooperating with the community. Community members include residents, nearby workers, and teachers or students, among others. The participation of community members can be characterized a passive-to-active process. In particular, focusing on people's actual needs can foster public engagement. Thus, members of the public are the main part and the biggest beneficiary of social engagement, linking community garden connections to increased social impact and sustainability that extended beyond policy considerations.

6. Conclusions

First, the findings supported theorizing a new governance structure (top-down with public engagement driven by nonprofit organizations), which differs from the six previously identified governance structures. Compared with the bottom-up approaches, this governance structure has been shown to facilitate public participation faster and more effectively. Moreover, in comparison to other top-down approaches, this new model may be more sustainable and resilient because it involves more social engagement. We also highlighted the critical role that nonprofit organizations have played throughout the process in fostering the development of community gardens by dealing with public relations and facilitating effective communications among other actors. Nonprofit organizations play an indispensable role, acting as government partners in delivering information from top to bottom, as well as community partners, in helping the public establish an autonomous mechanism. Moreover, these organizations build a communication bridge between the government and the public.

The second point to be made here is historical and evolutionary: community gardens were originally the product of the economic depression, mainly targeted to meet the needs of individuals, but in today's China, this type of project has become a way for the government to promote public participation in urban environmental conservation efforts. From a broad perspective, this governance approach can increase the area of urban green space, uphold standards of high quality, and improve the ecological service function. Meanwhile, from a grassroots perspective, such a program can help public attitudes toward community gardening from passive to active, effectively enhancing public awareness of participation and the decision-making ability available through public participation. While this approach is eminently applicable to the environmental improvement of urban communities, it is also worth referencing in urban projects related to community governance (e.g., urban renewal). Briefly stated, this concept comprises a new sustainable public participation mechanism in urban environmental protection in the Chinese context.

Although the findings reported in this paper provide a new governance structure and dynamics for community gardens in the existing literature, more empirical studies are needed to further test and refine these findings. In addition, since most *We Garden* projects have only recently completed the preliminary management stage, the sustainability of the subsequent management based on grassroots autonomy is a worthy topic for further study.

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References

1. Logan, J.R. People and plans in urbanising China: Challenging the top-down orthodoxy. *Urban Stud.* **2018**, *55*, 1375–1382. [CrossRef]
2. The Seventh Population Census of China. Available online: http://www.stats.gov.cn/tjsj/tjgb/rkpcgb/qgrkpcgb/202106/t20210628_1818826.html (accessed on 12 November 2021).
3. Liu, X.; Zhang, Y. Study on population carrying capacity of Shenzhen based on p-e-r three elements. *Urban Insight* **2019**, *6*, 70–83.
4. Renmin Chengshi Renmin Jian. Available online: http://m.cnr.cn/news/CNRshengman/shkc/ (accessed on 23 October 2021).
5. With the Participation of Residents, 120 Community Gardens Will Be Built in Shenzhen This Year. Available online: http://www.sznews.com/news/content/2021-06/07/content_24279945_3.htm (accessed on 10 September 2021).
6. Ferris, J.; Norman, C.; Sempik, J. People, land and sustainability: Community gardens and the social dimension of sustainable development. *Soc. Policy Adm.* **2001**, *35*, 559–568. [CrossRef]
7. Holland, L. Diversity and connections in community gardens: A contribution to local sustainability. *Local Environ.* **2004**, *9*, 285–305. [CrossRef]
8. Pudup, M. It takes a garden: Cultivating citizen-subjects in organized garden projects. *Geoforum* **2008**, *39*, 1228–1240. [CrossRef]
9. Kingsley, J.; Townsend, M.; Henderson-Wilson, C. Cultivating health and wellbeing: Members' perceptions of the health benefits of a Port Melbourne community garden. *Leis. Stud.* **2009**, *28*, 207–219. [CrossRef]
10. Austin, E.; Johnston, Y.; Morgan, L. Community gardening in a senior centre: A therapeutic intervention to improve the health of older adults. *Ther. Recreat. J.* **2006**, *40*, 48–56.
11. Lawson, J. *City Bountiful: A Century of Community Gardening in America*; University of California Press: Berkeley, CA, USA, 2005.

12. Armstrong, D. A survey of community gardens in upstate New York: Implications for health promotion and community development. *Health Place* **2000**, *6*, 319–327. [CrossRef]
13. Egli, V.; Oliver, M.; Tautolo, E.S. The development of a model of community garden benefits to wellbeing. *Prev. Med. Rep.* **2016**, *3*, 348–352. [CrossRef]
14. Twiss, J.; Dickinson, J.; Duma, S.; Kleinman, T.; Paulsen, H.; Rilveria, L. Community gardens: Lessons learned from California healthy cities and communities. *Am. J. Public Health* **2003**, *93*, 1435–1438. [CrossRef]
15. Glover, T. Social capital in the lived experiences of community gardeners. *Leis. Sci.* **2004**, *26*, 143–162. [CrossRef]
16. Alaimo, K.; Reischl, T.M.; Allen, J.O. Community gardening, neighbourhood meetings, and social capital. *J. Community Psychol.* **2010**, *38*, 497–514. [CrossRef]
17. Firth, C.; Maye, D.; Pearson, D. Developing 'community' in community gardens. *Local Environ.* **2011**, *16*, 555–568. [CrossRef]
18. Kingsley, J.; Foenander, E.; Bailey, A. "It's about community": Exploring social capital in community gardens across Melbourne, Australia. *Urban For. Urban Green.* **2020**, *49*, 126640. [CrossRef]
19. George, D.R.; Rovniak, L.S.; Kraschnewski, J.L.; Hanson, R.; Sciamanna, C. A growing opportunity: Community gardens affiliated with US hospitals and academic health centers. *Prev. Med. Rep.* **2015**, *2*, 35–39. [CrossRef]
20. Caraher, M.; Dowler, E. Food projects in London: Lessons for policy and practice—A hidden sector and the need formore unhealthy puddings . . . sometimes. *Health Educ. J.* **2007**, *66*, 188–205. [CrossRef]
21. Wakefield, S.; Yeudall, F.; Taron, C.; Reynolds, J.; Skinner, A. Growing urban health: Community gardening in South-East Toronto. *Health Promot. Int.* **2007**, *22*, 92–101. [CrossRef]
22. Eggert, L.; Blood-Siegfried, J.; Champagne, M.; Al-Jumaily, M.; Biederman, D. Coalition Building for Health: A Community Garden Pilot Project with Apartment Dwelling Refugees. *J. Community Health Nurs.* **2015**, *32*, 141–150. [CrossRef]
23. Bell, S.; Cerulli, C. Emerging Community Food Production and Pathways for Urban Landscape Transitions. *Emerg. Complex. Organ.* **2012**, *14*, 31–34.
24. Von Hassell, M. *The Struggle for Eden: Community Gardens in New York City*; Praeger: Santa Barbara, CA, USA, 2002.
25. Glover, T.D.; Parry, D.C.; Shinew, K.J. Building relationships, accessing resources: Mobilizing social capital in community garden contexts. *J. Leis. Res.* **2005**, *37*, 450–474. [CrossRef]
26. Guitart, D.; Pickering, C.; Byrne, J. Past results and future directions in urban community gardens research. *Urban For. Urban Green.* **2012**, *11*, 364–373. [CrossRef]
27. Ikeda, Y. Cultivating Urban Spaces The Community Garden Movement in New York City. *Jpn. Rev. Cult. Anthropol.* **2019**, *20*, 007–042.
28. Rees, A.; Wade, J. *Converting Vacant Lots into Assets: Comparing National Community Garden Programs to Community Garden Projects in Columbus GA*; Csu ePress: Columbus, GA, USA, 2011.
29. Rees, A.; Melix, B. Landscape discourses and community garden design: Creating community gardens in one mid-sized southern US city. *Stud. Hist. Gard. Des. Landsc.* **2019**, *39*, 90–104. [CrossRef]
30. Raniga, T. An Evaluation of Community Partipation in Attempts to Start a Community Garden Project in the Shakashead Community. Ph.D. Dissertation, University of Natal, Durban, South Africa, 2009.
31. Howe, J.; Wheeler, P. Urban food growing: The experience of two UK cities. *Sustain. Dev.* **1999**, *7*, 13–24. [CrossRef]
32. D'Abundo, M.L.; Carden, A.M. Growing wellness: The possibility of promoting collective wellness through community garden education programs. *Community Dev.* **2008**, *39*, 83–94. [CrossRef]
33. Rosol, M. Community gardens−A potential for stagnating and shrinking cities? Examples from Berlin. *Die Erde* **2005**, *136*, 165–178.
34. Baker, L.E. Tending cultural landscapes and food citizenship in Toronto's community gardens. *Geogr. Rev.* **2004**, *94*, 305–325. [CrossRef]
35. McGlone, P.; Dobson, B.; Dowler, E.; Nelson, M. *Food Projects and How They Work*; YPS & Joseph Rowntree Foundation: New York, NY, USA, 1999.
36. Fox-Kämper, R.; Wesener, A.; Münderlein, D.; Sondermann, M.; McWilliam, W.; Kirk, N. Urban community gardens: An evaluation of governance approaches and related enablers and barriers at different development stages. *Landsc. Urban Plan.* **2018**, *170*, 59–68. [CrossRef]
37. Qian, J. *The Absence of the Landscape: Community Gardens in the Context of Urban PIanning*; Southeast University: Nanjing, China, 2011.
38. Kou, H.; Zhang, S.; Liu, Y. Community-engaged research for the promotion of healthy urban environments: A case study of community garden initiative in Shanghai, China. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4145. [CrossRef]
39. Zou, H.; Yu, H. Urban Regeneration: Shifting from Production of Space to Community Empowerment-Case Study of Knowledge and Innovation Community Garden in Shanghai. *Glob. Urban Stud.* **2018**, *11*, 1–15.
40. Liu, Y.; Fan, H.; Wei, M.; Yin, K.; Yan, J. From edible landscape to vital communities: Clover nature school community gardens in Shanghai. *Landsc. Archit. Front.* **2017**, *5*, 72–84. [CrossRef]
41. Ng, M.K. Sustainable development in the rapidly growing socialist market economy of Shenzhen: Bottom-up efforts and top-down policies. *disP-Plan. Rev.* **2002**, *38*, 42–50. [CrossRef]
42. Blair, D.; Giesecke, C.C.; Sherman, S. A dietary, social and economic evaluation of the Philadelphia urban gardening project. *J. Nutr. Educ.* **1991**, *23*, 161–167. [CrossRef]
43. Karaan, A.S.M.; Mohamed, N. The performance and support of food gardens in some townships of the Cape Metropolitan Area: An evaluation of Abalimi Bezekhaya. *Dev. South. Afr.* **1998**, *15*, 67–83. [CrossRef]

44. Kingsley, J.; Townsend, M. 'Dig In' to social capital: Community gardens as mechanisms for growing urban social connectedness. *Urban Policy Res.* **2006**, *24*, 525–537. [CrossRef]
45. Glover, T.D. The story of the Queen Anne Memorial Garden: Resisting a dominant cultural narrative. *J. Leis. Res.* **2003**, *35*, 190–213. [CrossRef]
46. Moore, S. Forgotten roots of the green city: Subsistence gardening in Columbus, Ohio, 1900–1940. *Urban Geogr.* **2006**, *27*, 174–192. [CrossRef]
47. Rosol, M. Public participation in post-Fordist urban green space governance: The case of community gardens in Berlin. *Int. J. Urban Reg. Res.* **2010**, *34*, 548–563. [CrossRef]
48. Montgomery, R.; Wesener, A.; Davies, F. Bottom-up governance after a natural disaster: A temporary post-earthquake community garden in Central Christchurch, New Zealand. *Nord. J. Archit. Res.* **2017**, *3*, 147.
49. Zhan, Y. Beyond neoliberal urbanism: Assembling fluid gentrification through informal housing upgrading programs in Shenzhen, China. *Cities* **2021**, *112*, 103111. [CrossRef]
50. Wang, J.; Huang, Y.; Teng, Y.; Yu, B.; Wang, J.; Zhang, H.; Duan, H. Can buildings sector achieve the carbon mitigation ambitious goal: Case study for a low-carbon demonstration city in China? *Environ. Impact Assess. Rev.* **2021**, *90*, 106633. [CrossRef]

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Relationships between Density and per Capita Municipal Spending in the United States

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Abstract: The objective of this research is to determine the relationship between land use, particularly density, and per capita spending levels in cities across the United States. A model was developed using data from the U.S. Census Bureau's Annual Survey of State and Local Government Finances to estimate the impacts of population-weighted density and other factors on per capita municipal spending. This study focused on municipal spending for eight categories that theoretically could be influenced by land use development: fire protection, streets and highways, libraries, parks and recreation, police, sewer, solid waste management, and water. Density was found to be negatively associated with per capita municipal expenditures for the following cost categories: operational costs for fire protection, streets and highways, parks and recreation, sewer, solid waste management, and water; construction costs for streets and highways, parks and recreation, sewer, and water; and land and existing facility costs for police, sewer, and water. Results were insignificant for other cost categories, and a positive relationship was found for police operations costs. In general, results support the conclusion that increased density is associated with reduced per capita municipal spending for several cost categories.

Keywords: land use; density; sprawl; municipal expenditures; budgets

1. Introduction

Municipalities need to consider how the development of land use patterns influences municipal budgets. Land use characteristics relate to several aspects of urban planning. For example, land use patterns have been shown in many studies to impact travel behavior [1,2]. Some research has also examined how land use and neighborhood characteristics relate to household transportation expenditures [3,4]. While the impacts of land use patterns on travel behavior and household expenditures are important for policy makers to understand, land use characteristics can also affect city expenditures.

Lower density, auto-oriented developments require more infrastructure per capita than do more compact developments. Sprawling cities have more miles of streets and water and sewer pipes per person to maintain, and services such as trash collection and fire and police protection have more miles to cover per person. This can result in an increase in per capita infrastructure, maintenance, and service costs for cities. More compact developments can lead to cost savings through economies of scale and economies of geographic scope [5]. Economies of scale are exhibited when the marginal cost of providing services to each additional person decreases as more residents cluster within a smaller geographic area. Economies of geographic scope are found when the marginal cost decreases as each person locates more closely to existing major public facilities.

The research question that this study attempts to address is whether it costs more per capita for lower density cities in the United States to provide services and to build and maintain infrastructure, compared to cities with higher population densities. While research on the relationships between land use and municipal spending is not as extensive as that focused on travel behavior, some research has shown how more sprawling development patterns can increase costs for cities [5–9]. Most U.S. research has been on

smaller studies or has relied on county-level data. Results have also been found to vary between studies. This study contributes to the literature by conducting a national study of cities across the United States.

The objective of this research is to determine the relationship between land use, particularly density, and per capita spending levels in cities across the United States for different spending categories. A model was developed using data for 2012–2016 from the U.S. Census Bureau's Annual Survey of State and Local Government Finances. This data source provides individual city spending levels for several different spending categories. This study focused on municipal spending for eight categories that theoretically could be influenced by land use development: fire protection, streets and highways, libraries, parks and recreation, police, sewer, solid waste management, and water. Results from the model show how density and other independent variables are associated with per capita municipal expenditures.

This paper is organized as follows. Section 2 provides a review of previous research related to density, the relationships between density and per capita municipal spending, and the effects of other factors on city expenditures. The research model and data are described in Section 3, while Sections 4 and 5 provide the results and a discussion.

2. Literature Review

Lower density developments are often characterized as auto-oriented, suburban types of development with larger lot sizes, single family homes, and noncontiguous development, while higher density developments are more compact with a mix of housing types. Density influences a city in many ways. Boyko and Cooper [10] conducted an extensive literature review examining both the advantages and disadvantages of higher urban densities. As they found, there are several advantages to higher urban densities with regard to mobility, efficient use of land or resources, social equity and diversity, economics, and others. For example, some of the economic advantages that they cited from the literature include enabling investments in new and better community amenities, promoting a critical mass needed to support local businesses, attracting additional businesses and other amenities, allowing for a more efficient use of urban services, increasing productivity levels, and others. Regarding use of land and resources, they found advantages from making better use of resources and infrastructure, reducing development pressure on agricultural and industrial land and existing greenspace, and others. Mobility and accessibility benefits result by reducing travel distances and creating an environment where transit is more viable and efficient, and more trips can be made by walking and bicycling. They also found environmental benefits from reduced fossil fuel emissions. Boyko and Cooper [10] also noted several disadvantages of higher urban densities found in the literature. These include disadvantages related to mobility (e.g., congestion), land use (e.g., limited recreational opportunities or availability of open space, pollution), social or psychological aspects (e.g., loss of privacy, noise and nuisance, stress, constraints on individual behavior, social inequality, decreased sense of community, crime), and economics (e.g., increased costs of housing and goods and services, costs to build and maintain high-density projects). Boyko and Cooper [10] examined many relationships with density but cited only a few studies related to local government expenditures. However, there has been additional research in this area.

Lynch and Zimmerman [11] argued that large portions of the city budget, such as street construction and maintenance, water and sewer infrastructure, fire protection and police services, solid waste removal, and school transportation, are affected by the geographic pattern of development. The costs of many of these services depend, to some extent, on the distance traveled. For some services, such as fire and police, denser development could potentially reduce the number of facilities, vehicles, and personnel required.

While land use patterns and public expenditures are theoretically related, a review of early empirical research by Carruthers and Ulfarsson [7] concluded that the relationship

between urban form and public service spending was ambiguous and controversial. Muro and Puentes [5], on the other hand, reviewed the literature and concluded that more compact developments can lead to cost savings for road building, water and sewer, and annual operations and service delivery. A number of additional studies have been conducted since these earlier literature reviews.

Burchell and Mukherji [12] examined the effects of sprawl versus managed, or smart, growth on land and infrastructure consumption as well as real estate development and public services costs in the United States. Sprawl was defined as including noncontiguous development, larger lot sizes, and lower floor-to-area ratios for nonresidential development. Smart growth was described as more compact and concentrated around existing urban centers, limiting peripheral developments and reducing the need for new infrastructure. Results showed the substantial savings for water and sewer infrastructure, road infrastructure, and local public service costs that would result by pursuing smart growth development instead of conventional sprawl.

Carruthers and Ulfarsson [7] conducted an empirical analysis of the relationship between alternative development patterns and spending, using data for a cross-section of 283 metropolitan counties for 1982–1992. They studied twelve measures of public spending: total direct spending, capital facilities, roadways, other transportation, sewerage, trash collection, housing and community development, police protection, fire protection, parks, education, and libraries. They found that the per capita cost of many services decreases with density, after controlling for property value. Specifically, they found that per capita costs for capital facilities, roadways, police protection, education, and total public spending declined with increases in density.

The authors of that study followed up with an analysis of per capita spending by all continental U.S. counties in 2002 [6]. In this study, they found that density is negatively associated with total direct spending and spending for education, parks and recreation, police protection, and roadways. For other costs, the effect of density was marginally significant or insignificant, and it was positively associated with spending for housing and community development. They also found that the percentage of county land that was developed had a positive effect on most types of spending. They concluded that, on balance, high-density, compact development costs less to support. Regarding the magnitude of the effect, Carruthers and Úlfarsson [6] estimated that, in 2002, if development everywhere was 25% more dense, public services would cost USD 3.63 billion less annually, and the average county would save USD 1.18 million, with the largest effect being for spending on roadways.

While the research by Carruthers and Úlfarsson [6,7] was based on county-level data across the United States, other studies have analyzed the effects of land use and urban form on spending in specific municipalities or counties. For example, the city of Halifax, Canada, studied how different settlement patterns affect the cost of services delivered by the city [13]. They studied eight different types of development patterns, and similar to other research, they found that cost decreases with density for many services, especially for roads but also for libraries, parks and recreation, police, fire, water, transit, and sewer. Specifically for roads, they estimated that the cost per household is $1053 CAD for low-density rural development (2.5 acres per dwelling unit), $280 CAD for low-density suburban (8100 sq ft per dwelling unit), $124 CAD for mid-density urban (2400 sq ft per dwelling unit), and $26 CAD for high-density urban (760 sq ft per dwelling unit). Total per household costs ranged from $5240 CAD for low-density rural to $1416 CAD for high-density urban. They also noted that operations and maintenance make up 60% to 90% of the overall service costs.

Other municipalities and counties have conducted similar studies with similar results. Fulton et al. [8] compiled and analyzed 17 case studies conducted by municipalities as well as at regional, state, or national levels. They classified development patterns into two different categories and examined the costs associated with each. Developments were classified as either smart growth or conventional suburban. They defined smart

growth as being characterized by more efficient use of land, greater land use mix, and better connections between streets and neighborhoods. Conventional suburban was then defined by less efficient use of land, separated land uses, and development designed primarily for driving. Their main findings were that smart growth development costs about one-third less for upfront infrastructure and saves an average of 10% on ongoing delivery of services, specifically for police, ambulance, and fire [8]. Edwards and Xiao [14] studied the fiscal impacts of annexation and found that the effects on municipal spending are impacted by changes in municipal density levels. They found that if annexation is accompanied by higher densities, the city will experience lower increases in per capita spending levels.

Several studies of Spanish municipalities have also shown a negative relationship between population density or spawl and per capita expenditures [9,15–17]. For example, Hortas-Rico and Solé-Ollé [9] conducted an empirical analysis of 2500 Spanish municipalities and found that low-density development patterns lead to greater costs for providing local public services. Gielen et al. [16] found that waste collection, sanitation, water, road cleaning, and public lighting were most sensitive to sprawl.

While much of the research has been focused on metropolitan areas, similar results have been found in mostly rural or nonmetropolitan areas of Montana and Wyoming [18–21]. In urban areas, developments with one-acre lots on the edge of the city would be considered sprawl, but in rural Natrona County, Wyoming, the issue is large 35–50-acre ranchettes or developments with 6–10-acre lots far from any city or the nearest highway. In this setting, encouraging developments with one-acre lots adjacent to a city was found to significantly reduce the budget gap for the county [19].

Most of the research has been focused on costs, but development patterns can also impact revenue potential. Some research has shown that denser development patterns produce an increase in property tax revenue per acre [8,22]. Fulton et al. [8] found that smart growth generates ten times more tax revenue per acre than conventional suburban development.

Not all research, however, has shown the financial benefits of increased density and smart growth development patterns. Kotchen and Schulte [23] conducted a meta-analysis of 125 cost-of-community-service studies conducted through 2007 that compared the ratio of expenditures to revenue. For residential areas, they estimated a negative relationship between density and this ratio, as expected, but they did not find it to be statistically significant. Further, they found a positive relationship for commercial/industrial and agricultural/open space areas.

Some costs could potentially increase with density. For example, crime could increase with density, resulting in greater police operation costs per capita. According to Glaeser and Sacerdote [24], crime may increase with density because of greater proximity between potential victims and criminals, lower transport costs, and greater returns to crime.

Holcombe and Williams [25] found mixed results. They found that for cities with population less than 500,000, higher population density was associated with lower per capita expenditures on highways and sewers, but this relationship did not hold for larger cities. Further, per capita expenditures on services, such as police, increased with density for cities with population above 500,000, and there was no relationship for smaller cities. Their general conclusion was that for cities larger than 50,000, per capita expenditures are not associated with density. Further research by Holcombe and Williams [26] found no relationship between sprawl and highway expenditures and, actually, a positive relationship between population density and highway expenditures.

The research is mixed, but there is some evidence that increased density and smart growth development patterns reduce public service expenditures for local governments. A number of studies have shown a reduction in total costs. With regard to specific services, different studies provide different results. While it may be expected that many costs would decrease with density, most studies tend to show some cost reductions to be significant and others not significant or nonexistent. Many studies find costs decrease

with density for roadways, police, and fire protection, while others show similar results for parks and recreation, libraries, or education. Fewer studies have shown reductions in costs for water, sewer, or sold waste, though this may be expected. Some costs have also been shown to increase with density, such as housing and community development or police.

Besides density, previous research has examined several other factors that can influence per capita municipal expenditures. Many studies have examined the effect of population size and whether economies of scale exist. Some research shows that smaller municipalities exhibit higher per capita costs than larger municipalities [27]. The evidence is mixed, however, and many studies find that either economies of scale do not exist or that economies of scale exist up to a point, and if population grows past that point, per capita spending rises, resulting in a U-shaped cost function [15,28–30]. For example, research of Spanish municipalities found that economies of scale can be realized until the population reaches a critical size of about 10,800 [28], and a study of French communes found similar results but with a critical size of just 400, though the paper noted that about half of French communes have a population below this level [29]. Research in Queensland, Australia, found economies of scale up to about 99,000, with larger cities experiencing diseconomies [30].

Holcombe and Williams found constant returns to scale for U.S. cities with a population greater than 50,000 [31], and Drew et al. [32] found no evidence of economies of scale for local governments in New South Wales, Australia, after controlling for population density. Other research in Spain showed no clear relationship between population size and per capita spending [17]. Callanan et al. [33] found a weak link between population size and expenditures in Irish local governments. Their research mostly found limited economies of scale, with a few exceptions where it was more prominent. Tran et al. [34] found that population size has a positive effect for some types of spending and a negative effect for others for South Australian local governments.

The effect of population growth has also been studied. Rapid growth could create a need for increased infrastructure investment. Some research has shown that greater population growth is related to increased per capita spending [15,17]. On the other hand, some studies have shown that growth reduces per capita cost as the added population helps share in the cost of services [6]. Other research has found mixed effects of population growth [34] or no effects [25].

The economic level of a community is also a likely contributor to per capita spending. Areas with higher income levels or greater per capita GDP are likely to demand a higher level of services and infrastructure and have a greater ability to support it. Research has shown that higher levels of income or per capita GDP generally relate to higher government expenditures [15,17,35]. Rios et al. [35] found that economic factors were more important than demographic or political factors in determining spending for Spanish municipalities.

Many of the previous studies have been conducted in Europe or Australia. Research in the United States on density by Holcombe and Williams [25] found contradictory results. Their research was limited to cities with a population of 50,000 or larger. Other U.S. studies have relied on county-level data or examined a smaller sample of cities, and many are based on older data. The current study contributes to the literature by researching a larger sample of U.S. cities and providing additional evidence regarding the unsettled question of how population density relates to per capita expenditures for U.S. cities.

3. Methods and Data

A model was developed to estimate the impacts of land use and other factors on per capita municipal spending. The model was used to estimate spending for eight categories of expenditures that could be influenced by land use development. These included fire

protection, streets and highways, libraries, parks and recreation, police, sewer, solid waste management, and water.

Municipal expenditures can be influenced by both demand and cost factors. If there is a greater demand for services, expenditures may increase. Likewise, if costs to provide the service increase, expenditures would also likely increase. Land use can be considered a cost factor, because as densities decrease, it may become more costly for cities to provide services, as measured per capita. Other cost factors include labor costs and other input costs. Demand may be influenced by income levels. Areas with higher income levels may demand and have the capacity to support increased spending on services and infrastructure. As noted in the previous section, some studies have shown a positive relationship between income and per capita spending. The age of a neighborhood could also impact demand for some services, though fewer studies have considered this factor. Older neighborhoods may have greater needs for some services, such as fire protection and infrastructure maintenance and repair. Population growth could also impact per capita expenditures, either positively or negatively, as discussed in the previous section [6,15,17]. Total population may also have an impact on per capita expenditures, either positive or negative, if either economies or diseconomies of size exist.

Municipal expenditure data are available from the U.S. Census Bureau's Annual Survey of State and Local Government Finances. Expenditure data were obtained for five years, 2012–2016, for a cross-section of municipalities for the eight expenditure categories previously listed. For each spending category, the survey further categorized the expenditures as being for current operations, construction, and land and existing structures. Therefore, with eight categories and three different types of expenditures, there are 24 outcome variables.

Population-weighted density was used as a measure of land use. To calculate weighted density, the density of each Census block group in the city was first calculated. Then, a weighted average of the block group densities was calculated, with each block group weighted by its population. The population-weighted density provides a more accurate description of the density where people live, as compared to the conventional population density.

Population data were obtained from the 2016 American Community Survey (ACS) 5-year data. Population change was measured as the percentage difference from the 2010 Census to the 2016 ACS 5-year data. Data for per capita income and median house age were also obtained from the ACS. Because wage data were correlated with income, and appropriate wage data for each municipality could not be obtained, it was excluded from the model.

The final model included log forms of the dependent variable and for population, density, and per capita income. The equation is as follows:

$$\ln ME_{ij} = \beta_0 + \beta_1 \ln POP_i + \beta_2 POPCH_i + \beta_3 \ln WDEN_i + \beta_4 \ln PCI_i + \beta_5 HAGE_i + \varepsilon_i \quad (1)$$

where:

$\ln ME_{ij}$ = log of per capita municipal expenditures in city i for spending category j;
$\ln POP_i$ = log of population for city i;
$POPCH_i$ = percentage change in population for city i from 2010 to the 2016 5-year estimate;
$WDEN_i$ = log of weighted population density for city i;
$\ln PCI_i$ = log of per capita income for city i;
$HAGE_i$ = median house age in city i.

The dependent variable is the annual average per capita expenditures by a city on a given spending category over the 2012–2016 period. Population will be negatively related to per capita spending if economies of size exist and positively related if diseconomies exist. Population growth could have either positive or negative effects on per capita spending levels, depending on if the increased needs for investment and services is outweighed by the added population that helps share the costs. It is hypothesized that density is negatively related to per capita expenditures, meaning that spending is expected to decrease as density increases. Income is hypothesized to be positively related

to spending, as income may be an indicator of demand, or ability to pay for services and infrastructure. Median house age is hypothesized to be positively related to spending, holding other variables constant, because older neighborhoods may have a greater need for some services.

Cities with a population below 25,000 were excluded from the analysis, which resulted in a total of 1102 cities in the dataset. However, not every city provided data for every category. Most cities provided data for operations spending for most categories, with the exception of library expenditures, which had 535 responses. Fewer cities provided data for construction or for land and existing facilities, and some categories had especially fewer responses, such as libraries and solid waste. Table 1 provides descriptive statistics for per capita spending for each category. Average per capita expenditures for operations ranged from USD 37 for libraries to USD 253 for police. Capital expenditures were greatest for streets and highways, sewer, and water.

Table 1. Per capita municipal spending data, cities with population greater than 25,000.

Spending Category	N	Mean	Median	Standard Deviation	Minimum	Maximum
				dollars per capita		
Operations						
Fire	942	164.55	157.13	76.51	1.99	567.97
Streets/highways	994	93.32	81.06	55.15	2.64	457.33
Libraries	535	37.01	30.52	28.17	0.09	206.58
Parks and recreation	954	88.92	74.11	78.19	0.60	1331.94
Police	998	253.06	232.74	108.28	2.13	1077.97
Sewer	902	111.19	98.22	72.36	0.64	619.49
Solid waste	814	69.70	61.74	48.39	0.07	594.77
Water	826	139.48	121.39	84.71	0.12	746.93
Construction						
Fire	114	7.68	5.36	7.35	0.04	38.92
Streets/highways	593	87.55	67.95	77.12	0.04	578.89
Libraries	58	9.34	3.61	14.09	0.13	81.43
Parks and recreation	382	33.02	18.05	79.70	0.15	1406.53
Police	120	13.29	6.66	18.85	0.01	111.86
Sewer	418	71.92	44.14	82.96	0.02	673.67
Solid waste	68	16.43	7.14	37.77	0.09	294.83
Water	416	79.66	52.34	112.26	0.51	1356.78
Land and Existing Facilities						
Fire	357	7.40	5.36	7.88	0.01	53.29
Streets/highways	362	14.58	7.03	24.83	0.01	219.23
Libraries	84	3.26	1.68	4.15	0.06	24.18
Parks and recreation	373	8.84	4.41	12.44	0.06	98.39
Police	471	7.72	5.96	6.90	0.04	53.14
Sewer	222	25.95	9.17	61.91	0.13	694.14
Solid waste	138	7.84	5.58	8.23	0.03	52.17
Water	218	19.68	9.77	28.72	0.11	217.38

The average city in the dataset had a population of 116,256, 5.3% population growth from 2010 to the 2016 ACS 5-year estimate, a population-weighted density of 5309 people per square mile, per capita income of USD 28,985, and median house age of 43 years (Table 2). Median values were 53,280 for population and 3644 for population-weighted density.

Table 2. Descriptive statistics for independent variables, cities with population greater than 25,000.

	N	Mean	Median	Standard Deviation	Minimum	Maximum
Population	1102	116,256	53,280	336,038	25,031	8,550,405
Population change	1094	5.3%	3.9%	7.3%	−9.5%	83.3%
Population-weighted density	1097	5309	3644	5830	602	74,473
Per capita income	1097	28,985	26,553	9768	12,747	82,350
Median house age	1097	43	41	16	10	77

4. Results

Results show that density has a significant effect for many spending categories. The estimated coefficient for density is negative and statistically significant for six of the eight operational cost categories (Table 3). Density is shown to be negatively associated with per capita operational costs for fire protection, streets and highways, parks and recreation, sewer, solid waste management, and water. Density, on the other hand, was found to be positively related to police operational costs. A possible explanation for this positive effect is that denser areas may have higher crime rates due to increased interaction between people. The effect of density was not statistically significant for library operational costs.

Table 3. Results for models of per capita municipal expenditures, operational costs.

Independent Variable	Fire	Streets/ Highways	Libraries	Parks and Recreation	Police	Sewer	Solid Waste	Water
Intercept	−4.424 *** (−6.25)	−5.668 *** (−8.48)	−16.007 *** (−10.37)	−9.087 *** (−8.92)	−4.685 *** (−9.56)	1.800 * (1.78)	−2.405 * (−1.94)	−1.867 ** (−2.20)
Population	0.163 *** (6.41)	−0.014 (−0.58)	0.052 (1.03)	0.200 *** (5.54)	0.088 *** (5.02)	0.105 *** (2.88)	0.108 ** (2.53)	0.055 * (1.84)
Population change	−0.340 (−1.06)	−0.742 ** (−2.39)	−1.926 *** (−2.68)	0.084 (0.18)	−0.794 *** (−3.51)	0.329 (0.73)	0.379 (0.69)	0.314 (0.84)
Density	−0.132 *** (−3.57)	−0.266 *** (−7.61)	−0.059 (−0.78)	−0.209 *** (−3.97)	0.090 *** (354)	−0.314 *** (−5.71)	−0.203 *** (−3.25)	−0.141 *** (−3.04)
Per capita income	0.105 (1.61)	0.488 *** (7.89)	1.160 *** (8.25)	0.593 *** (6.27)	0.124 *** (2.75)	−0.311 *** (−3.30)	−0.067 (−0.58)	0.001 (0.01)
Median house age	0.016 *** (9.15)	0.013 *** (7.63)	0.011 *** (3.01)	−0.005 * (−1.94)	0.006 *** (5.12)	0.008 *** (3.21)	0.014 *** (4.60)	0.006 *** (2.98)
N	936	988	531	948	992	897	808	821
R^2	0.1549	0.1475	0.1481	0.1187	0.1908	0.0554	0.0349	0.0148

* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$; t-values are in parentheses.

In the construction costs models, density is negative and statistically significant for streets/highways, parks and recreation, sewer, and water, indicating that per capita construction costs are lower in these categories as densities increase, while the relationship is insignificant for the other cost categories (Table 4). In the land and existing facilities costs models, density is negative and statistically significant for police, sewer, and water, indicating that per capita land and existing facility costs are lower in these categories as densities increase (Table 5). For police costs, while the results show a positive correlation between density and operational costs, there was a negative relationship between density and land/existing facility costs.

Table 4. Results for models of per capita municipal expenditures, construction costs.

Independent Variable	Fire	Streets/ Highways	Libraries	Parks and Recreation	Police	Sewer	Solid Waste	Water
Intercept	−11.65 *** (−2.75)	−11.39 *** (−7.46)	−3.401 (−0.42)	−15.20 *** (−6.44)	−8.581 * (−1.75)	−4.637 ** (−2.13)	−10.962 (−1.26)	−4.172 ** (−2.25)
Population	−0.016 (−0.13)	0.047 (0.93)	−0.263 (−1.46)	0.231 *** (3.20)	−0.066 (−0.47)	0.358 *** (5.08)	−0.069 (−0.39)	0.195 *** (3.29)
Population change	−0.071 (−0.05)	1.145 (1.62)	10.678 * (1.76)	0.453 (0.45)	0.778 (0.41)	1.435 (1.55)	−1.747 (−0.34)	4.033 *** (3.45)
Density	−0.133 (−0.61)	−0.316 *** (−3.94)	0.283 (0.59)	−0.259 ** (−2.02)	−0.164 (−0.59)	−0.544 *** (−4.89)	−0.395 (−1.01)	−0.391 *** (−3.83)
Per capita income	0.679 (1.64)	0.993 *** (7.03)	−0.175 (−0.21)	1.024 *** (4.56)	0.495 (1.00)	0.100 (0.48)	0.911 (1.02)	0.121 (0.69)
Median house age	0.015 (1.29)	0.010 *** (2.63)	−0.006 (−0.24)	0.002 (0.25)	0.012 (0.98)	0.019 *** (3.53)	0.022 (0.99)	0.018 *** (3.60)
N	111	589	56	379	117	414	66	411
R^2	0.0352	0.0998	0.1525	0.0911	0.0235	0.0794	0.0737	0.0629

* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$; t-values are in parentheses.

Table 5. Results for models of per capita municipal expenditures, land and existing facilities costs.

Independent Variable	Fire	Streets/ Highways	Libraries	Parks and Recreation	Police	Sewer	Solid Waste	Water
Intercept	−3.699 (−1.47)	−5.651 * (−1.81)	−12.549 ** (−2.18)	−5.103 * (−1.87)	−4.850 ** (−2.58)	−3.917 (−0.90)	5.303 (0.97)	−5.248 (−1.38)
Population	−0.124 (−1.48)	−0.373 *** (−3.64)	−0.303 * (−1.97)	−0.129 (−1.40)	−0.104 * (−1.66)	−0.140 (−1.06)	0.005 (0.04)	0.023 (0.21)
Population change	−2.744 * (−1.89)	−2.378 (−1.35)	−6.668 ** (−2.27)	−2.306 (−1.57)	−2.328 ** (−2.32)	0.829 (0.55)	0.261 (0.09)	1.643 (1.03)
Density	−0.119 (−0.87)	−0.202 (−1.21)	−0.148 (−0.47)	−0.013 (−0.09)	−0.243 ** (−2.38)	−0.217 (−0.96)	−0.557 ** (−2.54)	−0.542 *** (−2.77)
Per capita income	0.171 (0.73)	0.663 ** (2.30)	1.117 ** (2.04)	0.219 (0.84)	0.314 * (1.78)	0.153 (0.36)	−0.659 (−1.19)	0.403 (1.08)
Median house age	−0.024 *** (−3.60)	−0.008 (−1.05)	−0.006 (−0.41)	−0.024 *** (−3.41)	−0.009 * (−1.77)	0.022 ** (2.34)	0.011 (0.91)	0.013 (1.48)
N	353	359	83	368	466	221	135	215
R^2	0.1103	0.1064	0.2159	0.0658	0.0863	0.0467	0.1098	0.0532

* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$; *t*-values are in parentheses.

Overall, the models clearly show a general negative relationship between density and per capita municipal expenditures for several cost categories. Since the dependent variable and density are both in log form, the estimated parameters can be interpreted as elasticities. Statistically significant elasticities of per capita costs with respect to population-weighted density are shown in Table 6, based on the overall results shown in Tables 3–5. Elasticities for operations costs ranged from −0.13 for fire protection to −0.31 for sewer and was 0.09 for police. These results indicate that a 10% increase in density would reduce operational costs for fire protection by 1.3%, streets and highways by 2.7%, sewer by 3.1%, etc. Greater elasticities were found for capital costs, where significant, such as −0.32 for streets/highways construction, −0.39 for water construction, −0.54 for sewer construction, and −0.56 for solid waste land/existing facilities.

Table 6. Estimated elasticities of per capita expenditures with respect to population-weighted density.

Cost Category	Operations	Construction	Land and Existing Facilities
Fire	−0.132	ns	ns
Streets/highways	−0.266	−0.316	ns
Libraries	ns	ns	ns
Parks and recreation	−0.209	−0.259	ns
Police	0.090	ns	−0.243
Sewer	−0.314	−0.544	ns
Solid Waste	−0.203	ns	−0.557
Water	−0.141	−0.391	−0.542

ns = Not statistically significant.

Results also show significant relationships for other variables. Population was found to have a positive and statistically significant relationship for many of the operational costs and some construction costs, suggesting per capita costs increase with increases in population, but negative relationships were found for some land and existing facility costs. Population change was found to have a negative effect for some operational costs and land and existing facilities costs, consistent with findings from previous studies, suggesting per capita costs are lower for cities experiencing greater growth. On the other hand, population change was positively associated with per capita construction costs for water and libraries. Per capita income was found to be positively associated with per capita costs in many cases, as expected, though it was negative for sewer construction.

Median house age was positive and statistically significant in all operational cost models except for parks and recreation. This suggests older neighborhoods require increased operational expenditures, except that parks and recreation expenditures were higher in cities with newer housing. Construction costs for streets/highways, sewer, and water were also higher in cities with older housing, everything else equal. There is some correlation between the age of a neighborhood and density, as older neighborhoods tend to be denser. The density contributes to lower costs, while the age of the buildings and infrastructure may contribute to higher costs.

5. Discussion

This study attempts to understand the relationship between population density and per capita expenditures for U.S. cities. Results show that weighted population density is significantly associated with many municipal spending categories. This confirms the study's hypothesis. Density is shown to be negatively associated with per capita operational costs for fire protection, streets and highways, parks and recreation, sewer, solid waste management, and water, while being positively related to police operational costs. Density is also negatively associated with per capita construction costs for streets/highways, parks and recreation, sewer, and water and with per capita land and existing facilities costs for police, sewer, and water. The negative relationship can be explained by a need for less infrastructure in a denser city to serve a given population, and economies can be achieved in providing services by reducing the distance traveled.

The findings are consistent with those of previous studies showing a negative association between density and public service expenditures for local governments [5–9,12,15–21]. This study contributes to the literature by conducting a large-scale analysis of cities across the United States. While many previous studies found costs decreased with density for roadways and fire protection, this study also found the same for sewer, water, solid waste, and parks and recreation.

The results from this study may differ from those found by Holcombe and Williams [25], but there are some similarities. They found infrastructure expenditures to decline with density for cities with a population less than 500,000, which is consistent with our results, but no such relationship for larger cities. It should be noted that most of the cities in our study had a population below 500,000, with the median population being 53,280. This study had a greater focus on smaller cities. Unlike Holcombe and Williams [25], our study found negative relationships regarding per capita costs for some services, but similar to Holcombe and Williams, a positive association between police costs and density was found.

The positive association between density and police operational costs is also consistent with research by Glaeser and Sacerdote [24] that found higher crime rates in large cities due to several reasons, including higher pecuniary benefits for crime in large cities and lower probabilities of arrest and recognition. They argued that returns to crime increase with density, and density provides greater proximity between potential victims and criminals. On the other hand, our results show that land and existing facilities costs for police decrease with density. This may be because denser cities need less land or facilities to serve a given population.

The study also provides additional evidence regarding other factors such as population, population change, income, and median house age. The study found economies of scale for some costs for land and existing facilities, but for most cost categories, the study found either no effect or diseconomies. These findings are consistent with the literature, which has generally shown either little or no evidence of economies of scale or evidence of diseconomies for cities above a threshold size [15,17,28–33]. Results are also consistent with previous studies showing the effect is different for different spending categories [33,34]. There are mixed results in the literature regarding the effect of population growth on per capita spending. The results from this study are also mixed, showing that population growth can reduce some costs per capita by spreading out the

expenditures over a growing population, but it can also lead to an increased need for construction to meet the needs of the growing city, thereby raising costs. This study found that to be the case for water and library construction costs, but no effect was found for other construction costs. The effect of income was positive in many cases, which was expected and is consistent with previous findings [15,17,35].

Lastly, the study also showed a positive relationship between median house age and per capita spending for most operational costs studied. The effect of house or neighborhood age has not been as widely studied. The result differs from research in Spain by Bastida et al. [17] that found a negative relationship, but it is consistent with Carruthers and Ulfarsson [6] who found a positive relationship between spending and the percentage of houses built before 1940. This finding is expected because older neighborhoods may have greater needs for some services. Controlling for housing age is also important for understanding the impact of density, because older neighborhoods often have a greater population density.

One limitation of this study is that it focused on weighted population density as a measure of land use, though there are many other measures of land use that could also be considered, such as land use mix, accessibility, street network characteristics, street length per dwelling unit, etc. Because this study consisted of a large-scale, city-level analysis of cities across the country, data for other land use characteristics were lacking. Additional study could focus on these other factors, though density tends to be correlated with other land use characteristics. Areas with greater density tend to have more land use mix, better accessibility, better transit services, shorter blocks, and better options for walking or biking. Further analysis could also consider other explanatory variables such as crime rate, poverty rate, tax rates, age of the population, public sector union strength, share of voters who are Democratic or Republican, city industrial composition, and local labor market conditions. Large-scale data for many of these factors were not available for this analysis but could provide some additional insights.

The findings have important implications for the fiscal sustainability and resiliency of cities. By increasing population density, cities can use resources more efficiently and reduce the cost per person of constructing and maintaining infrastructure and providing services. Practices that cities can employ to achieve these outcomes include focusing on infill development, providing a diversity of housing types beyond single family homes, avoiding noncontiguous development, promoting more compact development with smaller lot sizes and multiple-use buildings, and building cities at a human scale, where distances between buildings and activities are shorter. Many cities are pursuing these strategies to promote sustainability, reduce automobile use, and create more vibrant, livable communities. This research provides further evidence that these strategies also lessen the burden on taxpayers and reduce some types of municipal spending.

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References

1. Ewing, R.; Cervero, R. Travel and the Built Environment. *J. Am. Plan. Assoc.* **2010**, *76*, 265–294. [CrossRef]
2. Litman, T.; Steele, R. *Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior*; Victoria Transport Policy Institute: Victoria, BC, Canada, 2018.

3. Deka, D. Relationship Between Households' Housing and Transportation Expenditures: Examination for Lifestyle Perspective. *Transp. Res. Rec. J. Transp. Res. Board* **2015**, *2531*, 26–35. [CrossRef]
4. Haas, P.; Morse, S.; Becker, S.; Young, L.; Esling, P. The Influence of Spatial and Household Characteristics on Household Transportation Costs. *Res. Transp. Bus. Manag.* **2013**, *7*, 14–26. [CrossRef]
5. Muro, M.; Puentes, R. *Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns*; The Brookings Institution Center on Urban and Metropolitan Policy: Washington, DC, USA, 2004.
6. Carruthers, J.I.; Úlfarsson, G.F. Does "Smart Growth" Matter to Public Finance? *Urban Stud.* **2008**, *45*, 1791–1823. [CrossRef]
7. Carruthers, J.I.; Ulfarsson, G.F. Urban Sprawl and the Cost of Public Services. *Environ. Plan. B Plan. Des.* **2003**, *30*, 503–522. [CrossRef]
8. Fulton, W.; Preuss, I.; Dodds, A.; Absetz, S.; Hirsch, P. *Building Better Budgets: A National Examination of the Fiscal Benefits of Smart Growth Development*; Smart Growth America: Washington, DC, USA, 2013.
9. Hortas-Rico, M.; Solé-Ollé, A. Does Urban Sprawl Increase the Costs of Providing Local Public Services? Evidence from Spanish Municipalities. *Urban Stud.* **2010**, *47*, 1513–1540. [CrossRef]
10. Boyko, C.T.; Cooper, R. Clarifying and Re-Conceptualising Density. *Prog. Plan.* **2011**, *76*, 1–61. [CrossRef]
11. Lynch, P.; Zimmerman, C. Land Use and Municipal Budgets: The Fiscal Connection. In *Government Finance Review*; Government Finance Officers Association: Chicago, IL, USA, 2015.
12. Burchell, R.W.; Mukherji, S. Conventional Development Versus Managed Growth: The Costs of Sprawl. *Am. J. Public Health* **2003**, *93*, 1534–1540. [CrossRef]
13. Halifax Regional Municipality. *Settlement Pattern and Form with Service Cost Analysis*; Halifax Regional Municipality: Halifax, NS, USA, 2005.
14. Edwards, M.M.; Xiao, Y. Annexation, Local Government Spending, and the Complicating Role of Density. *Urban Aff. Rev.* **2009**, *45*, 147–165. [CrossRef]
15. Benito, B.; Bastida, F.; Guillamón, M.D. Urban Sprawl and the Cost of Public Services: An Evaluation of Spanish Local Governments. *Lex Localis J. Local Self-Gov.* **2010**, *8*, 245–264. [CrossRef]
16. Gielen, E.; Riutort-Mayol, G.; Miralles i Garcia, J.L.; Palencia Jiménez, J.S. Cost Assessment of Urban Sprawl on Municipal Services Using Hierarchical Regression. *Environ. Plan. B Urban Anal. City Sci.* **2021**, *48*, 280–297. [CrossRef]
17. Bastida, F.; Guillamón, M.-D.; Benito, B. Municipal Spending in Spain: Spatial Approach. *J. Urban Plan. Dev.* **2013**, *139*, 79–93. [CrossRef]
18. Lieske, S.N.; McLeod, D.M.; Coupal, R.H.; Srivastava, S.K. Determining the Relationship between Urban Form and the Costs of Public Services. *Environ. Plan. B Plan. Des.* **2012**, *39*, 155–173. [CrossRef]
19. RPI Consulting. *Natrona County Fiscal Impact Analysis: Impact of Development Patterns on Public Service Costs*; Sonoran Institute: Tucson, AZ, USA, 2012.
20. RPI Consulting; Sonoran Institute. *Fiscal Impact Analysis of Future Growth Scenarios: Beaverhead County: Montana*; Sonoran Institute: Tucson, AZ, USA, 2007.
21. Sonoran Institute; RPI Consulting; Geodata Services, Inc. *Gallatin County, Montana: Fiscal Impact Analysis*; Sonoran Institute: Tucson, AZ, USA, 2009.
22. Mckeeman, A. Land Use, Municipal Revenue Impacts, and Land Consumption: A Study of Property Tax Revenue per Acre in Fairfax County, Virginia. Master's Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA, 2012.
23. Kotchen, M.J.; Schulte, S.L. A Meta-Analysis of Cost of Community Service Studies. *Int. Reg. Sci. Rev.* **2009**, *32*, 376–399. [CrossRef]
24. Glaeser, E.L.; Sacerdote, B. Why Is There More Crime in Cities? *J. Political Econ.* **1999**, *107*, S225–S258. [CrossRef]
25. Holcombe, R.G.; Williams, D.E.W. The Impact of Population Density on Municipal Government Expenditures. *Public Financ. Rev.* **2008**, *36*, 359–373. [CrossRef]
26. Holcombe, R.G.; Williams, D.W. Urban Sprawl and Transportation Externalities. *Rev. Reg. Stud.* **2010**, *40*, 257–273.
27. Christoffersen, H.; Larsen, K.B. Economies of Scale in Danish Municipalities: Expenditure Effects versus Quality Effects. *Local Gov. Stud.* **2007**, *33*, 77–95. [CrossRef]
28. Hortas-Rico, M.; Rios, V. Is There an Optimal Size for Local Governments? A Spatial Panel Data Model Approach. *Reg. Stud.* **2020**, *54*, 958–973. [CrossRef]
29. Breunig, R.; Rocaboy, Y. Per-Capita Public Expenditures and Population Size: A Non-Parametric Analysis Using French Data. *Public Choice* **2008**, *136*, 429–445. [CrossRef]
30. Drew, J.; Kortt, M.A.; Dollery, B. Did the Big Stick Work? An Empirical Assessment of Scale Economies and the Queensland Forced Amalgamation Program. *Local Gov. Stud.* **2016**, *42*, 1–14. [CrossRef]
31. Holcombe, R.G.; Williams, D.W. Are There Economies of Scale in Municipal Government Expenditures? *Public Financ. Manag.* **2009**, *9*, 416–438.
32. Drew, J.; Kortt, M.A.; Dollery, B. Economies of Scale and Local Government Expenditure: Evidence from Australia. *Adm. Soc.* **2014**, *46*, 632–653. [CrossRef]
33. Callanan, M.; Murphy, R.; Quinlivan, A. The Risks of Intuition: Size, Costs and Economies of Scale in Local Government. *Econ. Soc. Rev.* **2014**, *45*, 371–403.

34. Tran, C.-T.T.D.; Dollery, B.; Pérez-López, G. An Empirical Analysis of the Determinants of Per Capita Municipal Expenditure in South Australian Local Government. *Public Financ. Manag.* **2018**, *18*, 285–312.
35. Rios, V.; Pascual, P.; Cabases, F. What Drives Local Government Spending in Spain? A Dynamic Spatial Panel Approach. *Spat. Econ. Anal.* **2017**, *12*, 230–250. [CrossRef]

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Article

Towards a Retailess City? A Comparative Analysis of the Retail Desertification between a Global and a Local Commercial Strips in Barcelona

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Abstract: The relationships between the circuits of the urban economy and retail desertification are analysed based on two retail strips in Barcelona: Passeig de Gràcia, a central hub with global reach, and the Sants-Creu Coberta strip, which responds to the demand for consumption on a local, everyday scale. The hypothesis is that the relationships between these circuits and retail desertification behave differently depending on their relative position in the city with respect to consumption flows. This is tested with a one-to-one analysis of the uses of ground floor premises in both strips for 2016 and 2021, using data from the Commercial Censuses of the Barcelona City Council and Barcelona Provincial Council, respectively. Each ground floor premises is classified as superior, lower or vacant, which allows the process to be mapped from 2016 to 2021 for each of the premises. The article provides, first and foremost, an original systematisation of the behaviour, relationships, and observed forms between the circuits and desertification, and secondly, it demonstrates the differential behaviour of these relationships and forms through case studies, indicating that retail desertification is the main cause of economic and landscape change.

Keywords: urban economy circuits; retail desertification; Barcelona

1. Introduction

On 17 January 2023, the European Parliament approved a motion to create the European Capital of Local Trade. This initiative proposes that each year, a city or municipality in the EU should host a number of conferences focused on commercial space management and innovation in urban policies (2023) [1]. The proposal is articulated by the European Federation of Traders' Associations *Vitrines d'Europe*, which brings together associations from Italy, Spain, France, Portugal and Belgium. Barcelona will be the first to host this initiative, given the strong weight of commerce in the city (1.6 million inhabitants and 59,000 commercial activities at street level in 2022).

The initiative takes place in a context of important changes in the commercial structure of Barcelona [2–5] and other cities in southern European countries, such as Portugal [6–10], Italy [11–14] or France [15–19]. These changes are dominated by the progressive closure of "local" establishments and a deepening concentration of consumption around fewer companies in the sector, whether in physical shops or, above all, online retailers. This process of retail decline has often been referred to as the *retail apocalypse* [20,21], while urban geographers are proposing to call it *retail-less cities* [22–24].

In recent years, and especially since the COVID-19 pandemic, numerous studies and analyses have been carried out on the impact of the retail apocalypse in different contexts and using different research techniques. We highlight the work of Chun et al. [25] in which they address the impact of e-commerce on retail employment, based on the analysis of more

than 30,000 million transactions made with credit cards in Korea. In their article, they point out the reduction of retail employment and its shift to other sectors such as restaurants and personal services. Talen and Park [26], for their part, point to the transformation of the retail industry, demographic changes and the increase in retail costs as causes of the difficulties it is facing. This was analysed through in-depth interviews with business organisations in Chicago. And finally, in the European case, we can highlight the analysis of the impact of retail on social interaction and urban planning based on the case of Malmö, pointing out the challenges facing retail in terms of employment, formats and demand in the real estate sector [27].

In order to understand the processes and manifestations of commercial systems, such as the closure of shops, this research uses the theory of urban economy circuits [28–30] as a theoretical and analytical framework for approaching the changes from a broader perspective. The theory is based on the dialectical existence of two circuits: the superior, highly capitalised and sophisticated, and the lower, under-capitalised and with a simpler structure. The theory was designed to characterise the urban economy of least-developed countries; however, it has been applied to Europe on several occasions [31]. Nevertheless, this work vindicates its temporal and spatial validity and appropriateness by analysing two commercial hubs in Barcelona.

This article makes four main contributions: (i) it applies this theory in a new context, the commercial system of Barcelona; (ii) it operationalises this theory at the scale of the commercial establishment using process mapping (2016–2021); (iii) it identifies new analytical variables that improve the understanding of the relationships between the circuits and how their forms crystallise in the city; and (iv) it demonstrates the differential behaviour of these relationships and forms through case studies, indicating that commercial desertification is the main cause of economic and landscape change Four contributions that respond to the two main objective: (1) analysing the relationships between urban economy circuits and retail desertification, based on two case studies, contrasting one that represents a globally central hub and another that represents everyday life scale, and (2) analysing pre-pandemic trends regarding retail desertification, that allows for a more accurate subsequent assessment of the pandemic's impact on trends that have either intensified or slowed down.

This article analyses two strips in Barcelona to explore the relationship between the superior and lower circuits and the closing of commercial establishments. The first strip, Passeig de Gràcia, is a global and metropolitan hub that captures the consumption flows of international tourists. The second strip, Sants-Creu Coberta, which crosses the neighbourhoods of Sants, Hostafrancs and La Bordeta, specialises in local consumers. The hypothesis is that the connections between the two circuits of the urban economy and the closed commercial premises vary depending on the relative position of the city's locations concerning the flows of consumption. This hypothesis is verified through a one-to-one analysis of the uses of commercial premises in both areas for 2016 and 2021, employing data from the Commercial Censuses of the Barcelona City Council and the Barcelona Provincial Council, respectively.

2. Theoretical Framework: Urban Economy Circuits and Retail-Less Cities

2.1. Circuits of the Urban Economy

This research develops the theory of the urban economic circuits, elaborated by Santos in 1975 in *L'espace partagé, les deux circuits de l'economie urbaine* [28], a work in which the Brazilian geographer links globalisation and the social life and urbanisation of territories. Globalisation is understood here as a process of modernisation based on three ascending variables: (a) the unicity of a technical system, which is based on communication and information techniques [32–34]; (b) the convergence of moments, making it possible to know what is happening in any part of the world and, at the same time, send command orders from any point on the planet to another [35,36]; and (c) the existence of a single

driving force, which is the globally produced surplus value, i.e., the global integration of markets, based on money, finance, consumption, debt and credit [37–39].

The modernisation process impacts specific spaces and territories with a particular history of relations between the objects and actions they contain [40]. In other words, globalisation impacts different *used territories*. Thus, the modernisation process integrates the different ways in which societies use their territories. The territorial divisions of labour are the result of the fact that:

> "actors occupy certain parts of the built environment. However, locations are not permanent and their duration depends on the equation between the cost of place in the urban fabric and the capacity to add value to products and services. Hence the migration of fewer capitalised firms and the incessant reorganisation of urban centralities in this extensive built environment" [41]

Therefore, the differential impact and insertion of modernisation in the territory results in urban economic circuits, i.e., a set of economic activities developed at different levels of capital, technology and organisation [28,30,41]. So, circuits must be understood as the city's mode of existence. In this way,

> "the city is seen as a single system whose movement is given by communicating vessels that are the circuits; in such a way that it is only possible to recognise and understand one of the circuits concomitantly with the identification and understanding of the other. Far from being simply a duality, the superior circuit and lower circuit reveal its unitary existence and its dialectic opposition" [42]

Then, the circuits of the urban economy are a tool for the interpretation of space and urbanisation. This theory identifies the connections and distribution of the different types of economic activities in the metropolis. The superior circuit consists of economic activities closely linked to the modern, globalised economy, which are more highly capitalised, technologically advanced and intensely organised. This circuit is home to large companies, multinational corporations, supermarket chains, franchises, outlets, shopping centres and other large-scale production and distribution activities. The activities of the superior circuit make intensive use of technology and advertising to attract consumers and have better access to credit and other financial resources [28,43,44] (Table 1).

Table 1. Circuits of urban economy scheme [28].

Variables	Upper Circuit	Lower Circuit
Capital-Work	Capital intensive	Work intensive
Organisation	Complex and hierarchical	Simplified
Technology	Innovative	Rudimentary
Advertisements	Scientifically planned	Informal
Discounts	Periodic sales	Result of negotiation
Credit	Institutionalised	Informal
Territorial logic	Vertical	Horizontal
Property	SA or transnational	Unipersonal or family-owned

In contrast, the lower circuit includes locally based economic activities, which tend to be less capitalised, technologically simpler and less bureaucratically organised. These activities include small shops, local markets, street vending, and activities that generally produce and distribute on a small scale. The lower circuit is oriented to respond to the daily needs of the population, so it has a more direct relationship with the local consumer. Investment and access to credit for activities in this circuit tend to be more restricted. Lastly, another specific variable of the lower circuit is low-skilled and low-income migrant workers [28]. The less capitalised economic activities of the lower circuit emerge to satisfy the consumption and labour needs of the working class [42]. There has been an exponential growth of the population living below the poverty line in the urban peripheries, which has generated a greater demand for more affordable goods and services of the lower circuit.

As previously mentioned, these two circuits are not independent, and their relationship goes beyond duality. Each circuit exists as opposed to the other, forming a dialectical unit [30,41]. In other words, because of their common origin and dependent existence, the circuits do not have autonomy of meaning on their own and, therefore, require the opposite to exist as a category.

The first connection between the circuits is the internal or intra-circuit relationship, which horizontally articulates them, resulting in the concentration and contiguity of both activities [45]. Secondly, there is a vertical inter-circuit relationship, which shows their relational existence. This vertical articulation can be complementary: "when the superior circuit sells a good to the lower circuit or when the former uses some external economy, outsourcing tasks in favour of an under-capitalised agent" [45]. But it can also be a hierarchical complementary relationship when "small businesses or street vendors drain the surplus goods of the superior economy, or when global and national networks reach the peripheral areas and end up diminishing the size of the markets of the lower circuit" [45]. These relationships, and how the retail apocalypse influences them, are the subject of analysis of this research.

2.2. Retail-Less Cities

The concept of retail apocalypse was used for the first time in 2017 in the USA [21] to refer to the massive closure of shopping centres caused by the Great Recession (2007–2012) [20]. A process that is also known as *death malling* or *demalling* [10,12,46]. It has spread throughout the world, affecting above all shopping centres in the urban peripheries. This restructuring of the commercial distribution sector led to the massive closure of peripheral shopping centres, the emergence of online shopping as the main channel for capturing consumer income and the opening of smaller establishments closer to the densest residential areas, especially in the food sector [47].

This process in Mediterranean Europe has also meant the destruction of hundreds of thousands of commercial establishments, given the heavy weight of the small-scale business sector, which is unable to cope with this inter-company competition [3,48–50]. Particularly evident since COVID-19, studies dealing with the retail apocalypse have incorporated in their definition the closure of all physical retail formats, regardless of their location, size or capitalisation pattern [22,24,51]. In this sense, the concept refers to the definitive closure of commercial establishments at the street level [52].

To respond to the crisis, large transnational companies restructure circulation and distribution, leveraging the fixed and flowing opportunities [40] offered by the geographical space [53]. Their strategy consists of reducing fixed establishments, which means closing their street-level shops, while increasing the flows from improved online sales, something feasible thanks to the logistics revolution [54–56]. This process is evident in the banking and fashion sectors [23]. First, the establishments in commercial hubs of the urban peripheries, whether in metropolitan neighbourhoods or medium-sized cities, are being closed down [57]. This is a particularly dramatic situation in the fast fashion area of shopping centres, as these types of establishments have acted as a magnet for the rest of the retail sector. Subsequently, as a result of COVID-19, the process is identified in all commercial areas, including the most central ones [51,58].

The consolidation of large business oligopolies in e-commerce, such as Amazon and Alibaba [59], deepens the modernisation differential compared to small and medium-sized companies in the retail sector, which have traditionally dominated in Mediterranean cities [19,57]. The inability to invest in business competitiveness forces many of these companies to close, leading to commercial desertification. These small and medium-sized businesses find it difficult to adapt to changes in consumer habits (home delivery, opening hours, quantity and diversity of stock and prices, etc.) [60,61].

In addition to the disruptive effect exerted by e-commerce on street-level trading, there is also the increase in the price of land, which reduces the profit rate of the business, especially for those on a lease. This makes the process of locating commercial activities

more selective. As a result, there is a tanking of commercial establishments and *commercial gentrification*, a process that has already been analysed in the high streets of the UK [62].

3. Area of Study, Methodology and Sources of Information

3.1. Area of Study

The case studies are part of Barcelona's commercial system, which is structured based on different centres and hubs (Figure 1). Shopping centres, distributed throughout the urban peripheries and the Eixample district, represent the highest level. Then come the department stores. At a lower level is the network of municipal markets, which supply goods to a significant part of Barcelona's neighbourhoods. Below this, there are various commercial areas with different levels of dynamism depending on the neighbourhood. At the neighbourhood level, a total of 22 associations of strips or commercial areas are identified, organised by the public-private foundation "Eixos" but with clear differences in terms of vitality hierarchy [2], being much more dynamic than those commercial areas that in 1990 were identified as areas of commercial concentration [63] and that correspond eminently to commercial areas of the left Eixample.

On this hierarchy of the commercial system, Barcelona's Shopping Line can structure consumption on a metropolitan scale while receiving the influx of international tourism. The Shopping Line, which starts from Avinguda Diagonal toPasseig de Gràcia and the large department stores such as El Corte Inglés and El Triangle in Plaça Catalunya, organises the maximum commercial hierarchy of the city of Barcelona, which is diffused through the Eixample and the historic city centre. Thus, a dual commercial structure is observed, based on the tourist axis and others at the neighbourhood level.

The Passeig de Gràcia, which forms part of this five-kilometer Shopping Line running from Plaça Francesc Macià to Plaça Catalunya, is the first part of this commercial system. It combines the attraction of metropolitan consumption and international and national tourism, justifying its high placement in the hierarchy, while at the same time orienting the real estate market in Barcelona [64,65]. As you can see in Figure 2, it is a boulevard with wide sidewalks, trees, monumental benches and the well-known lampposts designed by Gaudí. Other nodes and spaces appear that are specialised mainly in tourist consumption, such as the Las Arenas shopping centre, the Barceloneta neighbourhood, or the commercial axis of Avenida Gaudí, near the Sagrada Familia, many of them organised in the private association Barcelona Oberta, the Union of Tourist Commercial Strips of Barcelona.

Prestigious residential and commercial activities appeared in the Passeig de Gràcia after the construction of the urban gardens between the old village of Gràcia and Barcelona in the 19th century [66]. The bourgeoisie started living here after moving away from the historic city centre or returning from the American colonies. Now, it is an important tourist destination because of the numerous modernist buildings of great heritage interest by renowned architects such as Antoni Gaudí and Domènech i Montaner, for instance, La Pedrera, Casa Ametller, Casa Batlló, and Casa Lleó Morera.

Barcelona started building an area similar to a central business district in the mid-20th century, with the bankarisation of the lower floors of buildings. From the end of the nineteen-eighties, the banks started leaving Passeig de Gràcia and the premises were progressively occupied by transnational retail companies such as INDITEX [67]. Despite the recent financial restructuring, the banks moved to Avinguda Diagonal, an extension of the shopping line closer to the residential areas with the highest purchasing power in Barcelona (the Sarrià—Sant Gervasi district) [68]. Currently, fast fashion is the dominant sector in these premises corresponding to Upper Circuit, such as Guess, Chanel or H&M, located in the old Banc Vitalici d'Espanya building, and Zara, in the old Banc Rural i Mediterrani building [64]; the lower circuit would be represented by simple restaurants and some family-owned businesses, such as La Vaca Paca; and finally, the vacant premises are characterised by being of large dimensions (Figure 3).

Then, there is the four-kilometre-long Carrer de Sants-Creu Coberta, which links the neighbourhoods of Sants, Hostafrancs, Badal and La Bordeta and is the longest commercial

strip in Europe with a history spanning 200 years. It connects the Collblanc road, in the neighbouring municipality of L'Hospitalet de Llobregat, with Plaça d'Espanya, the historic gateway to the city of Barcelona.

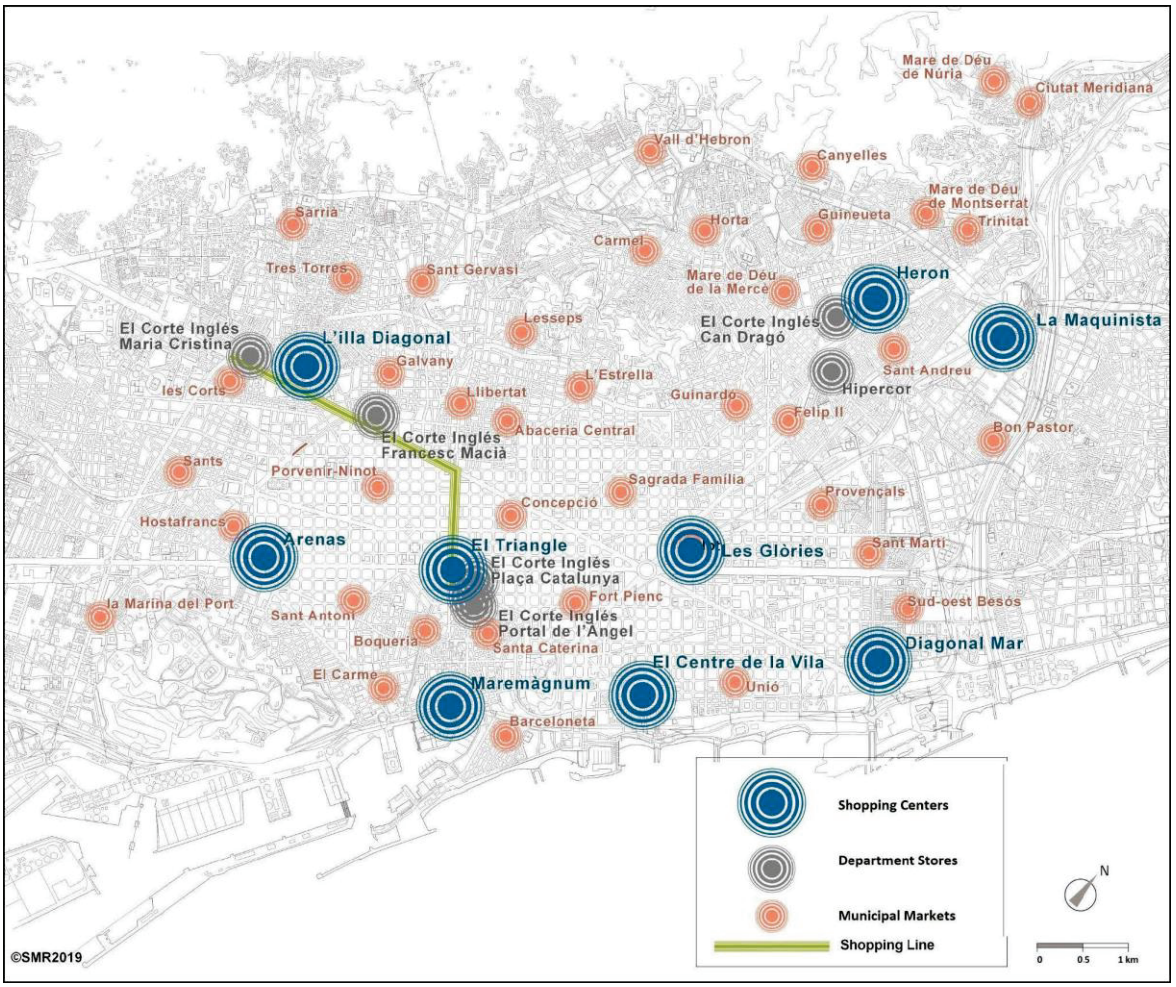

Figure 1. Shopping Line, shopping centres, municipal markets and large stores in Barcelona. Source: Prepared by the authors.

Figure 2. Passeig de Gràcia. Source: Photograph by the authors.

With origins well before Passeig de Gràcia, the urban development of Carrer de Sants dates back to Roman times, acting as a connection between the Roman city of Barcino and the Via Augusta. However, Carrer de Sants only became heavily urbanised and consolidated as a commercial street after the 19th-century industrialisation due to the building of numerous industries in Sants and the consequent demographic explosion [68,69].

Figure 3. The current retail landscape on the Passeig de Gràcia strip. Each image illustrates a commercial premise of Upper Circuit, Lower Circuit, and Vacant. Source: Photograph by the authors.

Currently, the Sants-Creu Coberta shopping area has more than 800 shops, most of which are organised in two traders' associations [70]. Associationism is one of the distinctive traits of the neighbourhoods of Sants and Hostafrancs. It can be traced to the first industrial revolution, which gave rise to a workers' movement and a political and community tradition that is still present today in cooperatives and the social relations of the neighbourhoods [71]. In addition to these commercial premises, the area is surrounded by other facilities such as the Hostafrancs and Sants markets, libraries, the Cotxeres community centre, and numerous public spaces.

These commercial associations are largely responsible for resisting the modernisation of these commercial strips. Recently, with the City Council on the left, and as a result of the municipal policy "Obrim carrers" (Let's open up the streets), the Sants-Creu Coberta strip is one of two streets closed to traffic on weekends, opening up a space for different activities. A policy of commercial dynamisation with ambivalent results, according to the neighbours and shopkeepers of the commercial area [72] (Figure 4).

Figure 4. The Sants-Creu Coberta strips axis on a traffic-less Saturday. Source: Photograph by the authors.

Therefore, Sants-Creu Coberta represents the typical and traditional shopping street of a neighbourhood of Barcelona. It resists the onslaught of tourism and gentrification found in Passeig de Gràcia because it presents its own dynamics and logic with shops that cater to the everyday needs of residents (Figure 5). The upper circuit of the economy is characterised

by food distribution companies, such as Caprabo or the frozen food company, La Sirena. The lower circuit is dominated by small grocery stores and kebab restaurants, for example. As for the vacant premises, many of them correspond to old family businesses (Figure 5). As observed from the description of both cases, urban economic circuits are implemented through various commercial forms according to the strips and areas (Figure 6).

Figure 5. The current retail landscape on Sants-Creu Coberta strip. Examples corresponding to a commercial premise of Upper Circuit, Lower Circuit, and Vacant.

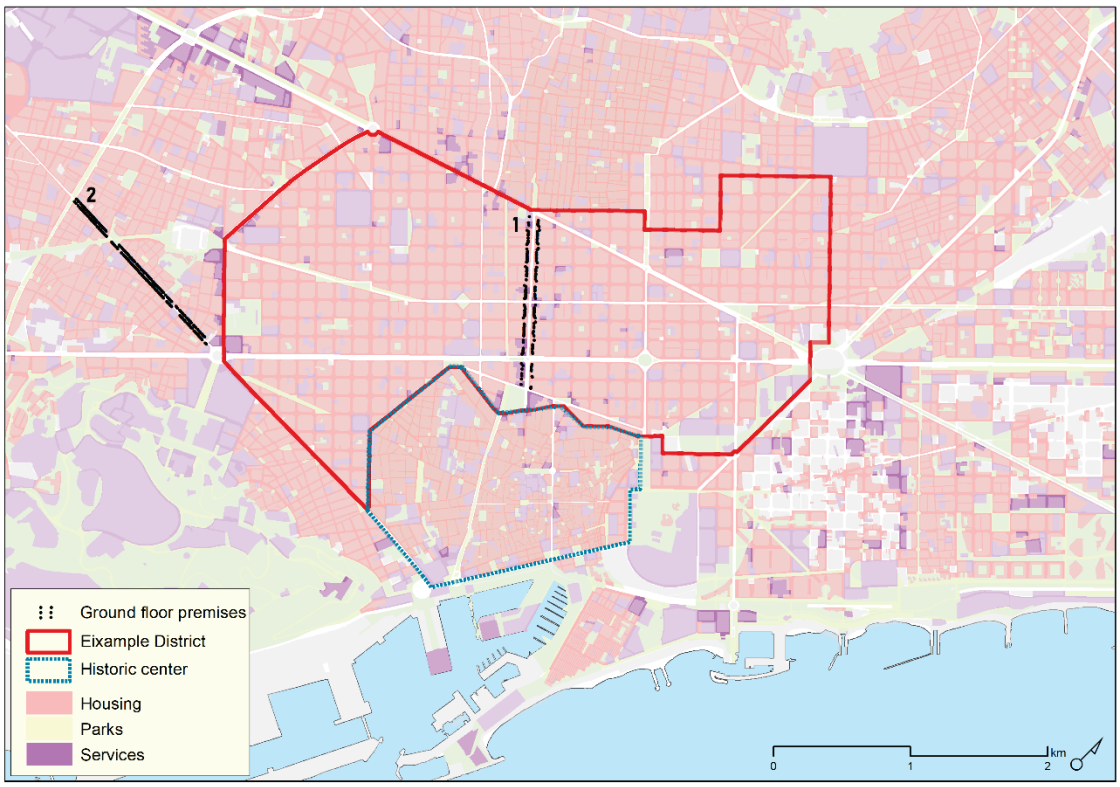

Figure 6. Commercial premises in the two areas analysed, (1) Passeig de Gràcia and (2) Sants-Creu Coberta. Source: Barcelona City Council/Barcelona Provincial Council. Source: Prepared by the authors.

3.2. Methodology

The experimental part of this comparative article explores the changes that two contrasting commercial areas in Barcelona have undergone over five years. Thus, the study gathers data from two commercial censuses relating to 2016 and 2021, drawn up by different institutions, in order to cover the longest possible period.

On the one hand, there is the *Cens d'Activitats Econòmiques de l'Ajuntament de Barcelona* [73,74], a census of all ground floor premises in the municipality which has been used extensively in previous studies [24,75–78]; the 2016 and 2019 editions had the same structure. It has been previously discussed in Morcuende & Lloberas [24]. On the other hand, there is the *Cens d'Eixos Comercials*, which consists of the 2020 and 2021 editions, carried out by the Barcelona Provincial Council [79], which consists of a characterisation of the shops in the streets of different cities, considered to be the most important in the Barcelona area.

The process of validation and operationalisation of the two databases to generate compatible and comparable one-to-one records. A one-to-one relationship links two fields from different data sets (censuses, in this case) in a single table. This made the 2016 and 2021 (one by one) characterisation possible, enabling an individual analysis of their evolution consisted of the automatic and manual cross-referencing of data. A manual review of the data was necessary when comparing the two censuses drawn up by different bodies because the databases did not have a common key field linking them, nor did their geolocation coincide completely, even though there was a certain proximity between the points. Thus, the data revealed 153 common records in Passeig de Gràcia and 343 in Carrer de Sants, a total of 496 establishments present in both censuses (Figure 6).

The empirical proposal is developed from the typological classification of the premises in two moments (2016 and 2021), using three categories: vacant, superior circuit (active), and lower circuit (active). For this purpose, it has been necessary to identify whether the establishment is active or not, and if so, to determine which sector of the economy it belongs to. In the first case, it is a simple classification. However, to identify whether an establishment belongs to the higher circuit or not, it is necessary to apply the criteria described below.

The criteria used to define the establishments within the superior circuit are based on the characterisation outlined in the study Ciutat Profile [80]. To belong to the superior circuit, a company has to (i) have a brand with retail locations in more than half of the shopping centres in Catalonia or (ii) have stores in more than a quarter of the cities in Catalonia with more than 50,000 inhabitants.

(i) $R > S/2$

S = total number of shopping centres in Catalonia
R = number of retail locations of the brand in catalan shopping centres

(ii) $T > C/4$

C = total number of cities with more than 50,000 inhabitants in Catalonia
T = number of catalan cities with more than 50,000 inhabitants where a brand has an establishment

However, as some cases do not fit this classification, two more criteria are suggested. The first consists of determining whether the brand has more than five points of sale, a requirement imposed by COMERTIA—COMERTIA is the Catalan association of family-run retail companies that brings together around fifty companies with at least one online point of sale and/or three physical points of sale, a minimum of 25 employees and a minimum annual turnover of 3 million euros—on companies who wish to become members of the association [81,82]. The second criterion applies to luxury brands not located in Catalan shopping centres with no more than five establishments in the same region, a value that can be surpassed globally. This last criterion demonstrates a high level of organisation and management.

Once the establishments have been characterised in both years, it is possible to analyse the changes in category (superior, lower and vacant) from one year to the other. There are nine possible change or permanence combinations between 2016 and 2021: from lower to vacant, from superior to lower, from vacant to vacant, etc. The evolution of these three categories is represented in percentage and chromatically—the chromatic selection of the change matrices is expressed by the value to differentiate the three categories in the vertical

strips (2016), while for the horizontal strips (2021), the hue has been used—in the change matrices and the mapping of the axis (Figures 7–9).

These possible combinations are represented graphically in the nine intersections between the categories of the three vectors of the vertical strips (A_{16}, B_{16}, C_{16}), corresponding to 2016, and the three vectors of the horizontal strips (A_{21}, B_{21}, C_{21}), corresponding to 2021. The intersections in the change matrices show the percentage of premises within each combination, i.e., a dynamic situation. Meanwhile, the sums show the percentage of premises that in 2016 (ΣA_{16}, ΣB_{16}, ΣC_{16}) or 2021 (ΣA_{21}, ΣB_{21}, ΣC_{21}) were part of each of the three categories, i.e., the static situation at each moment.

Thus, this matrix is useful to observe the status of the axis at two specific points in time and makes it possible to appreciate the changes that have taken place during the analysed period through the intersections of axis. To understand the process, it is essential to ask the following question: What category did the premises belong to in 2016 that now correspond to category A/B/C in 2021? (Figure 7).

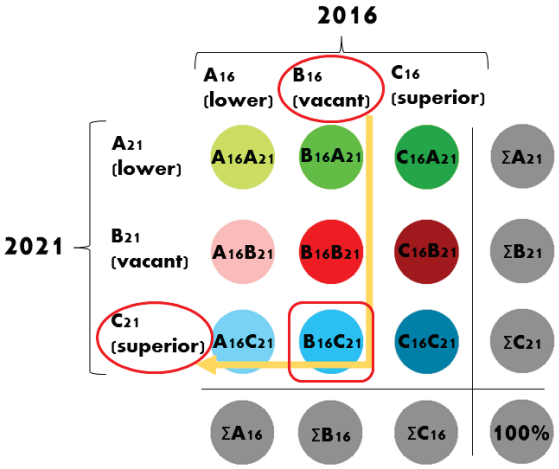

Figure 7. Diagram with matrix changes and an example of how to read them. Source: Prepared by the authors.

The sum of the second column represents the percentage of establishments that belonged to category B (B_{16}) in 2016. The different intersections of column B_{16} with the files A_{21}, B_{21}, and C_{21} show the possible combinations between categories: $B_{16}A_{21}$, $B_{16}B_{21}$, and $B_{16}C_{21}$. At the empirical level, it shows the percentage of premises that have changed from category B in 2016 to each of the three categories in 2021. Specifically, the combination highlighted in Figure 7 would be B_{16} C_{21}, i.e., the percentage of premises that in 2016 were vacant (B_{16}) and that have been absorbed by the superior circuit in 2021 (C_{21}); or, in other words, the percentage of premises in the superior circuit in 2021 (C_{21}) that in 2016 belonged to the vacant circuit (B_{16}).

4. Results: The Urban Economy Circuits in Passeig de Gràcia and in the Sants-Creu Coberta Street Strips

This section shows the results of the analysis methodology for each case study. It presents the quantification of the changes between circuits and the building of ground floor premises, as well as a brief qualitative description of some representative examples of the process.

4.1. Passeig de Gràcia

Passeig de Gràcia, as a traditional boulevard of Barcelona's bourgeoisie, is currently home to a large part of the city's luxury fashion shops. It is an area specialising in fashion (fast fashion and luxury) (Bershka, Stradivarius, H&M, Zara, Mango, Benetton, Massimo Dutti; Hilfiger, Levi's, Diesel, Burberry, Armani, Boss, Dior, Gucci, Max Mara, Adolfo

Domínguez) and personal accessories (jewelry, clothing, leather goods and design) (Cartier, Rolex, Montblanc, Bulgari, Swarovski, Piquadro, Prada, Louis Vuitton), where the superior circuit is in a dominant position, representing 69% of the 153 commercial establishments on ground floors in 2021. In addition to the luxury shops, there are other complementary businesses, such as cafés and restaurants [83].

It should also be noted that this area has experienced a significant rise in vacant premises, from only 1% to 9%. The superior circuit has the most closures, representing 8/74 points (11%), proportionally higher than closures in the lower 1/26 points (3%). During this period, the superior circuit is the most affected due to the high number of closures, which are only partially compensated by the absorption of some premises from the lower circuit. Thus, there seems to be a dynamic in which desertification is absorbed by the superior circuit while trying to compensate by absorbing premises from the lower circuit (Figure 8).

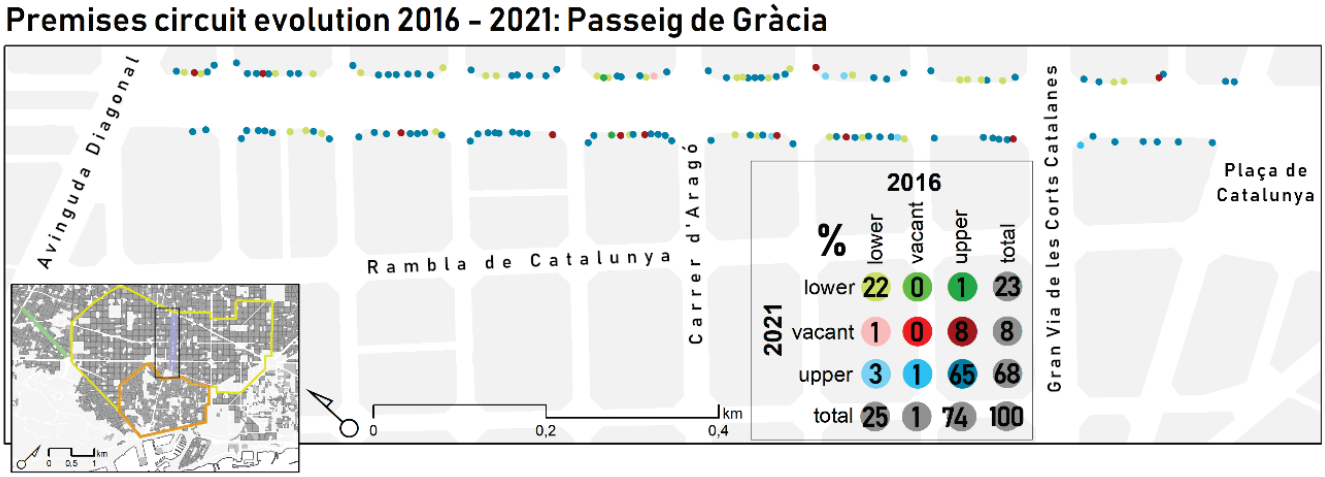

Figure 8. Premises circuit evolution in Passeig de Gràcia (2019–2021). Source: Prepared by the authors.

Regarding the shops in particular, many of the closures of the superior circuit are actually relocations within the avenue itself, as in the case of Nike and Camper, or towards the neighbouring Rambla Catalunya, such as Nespresso and Lottusse. Examples of the absorption of the lower circuit by the superior one includes the cases of the bars La Vaca Paca and La Baguetina Catalana, the restaurant Tenorio or the Llorenç jewelers. In this sense, the lower circuit on Passeig de Gràcia in 2021 was characterised by medium-capitalised establishments such as Euskal Herria Txapela, Tascón shoe shop, Torres wine cellar, Bagues-Masriera and Gràcia jeweler's, Villa del Arte art gallery, and Citrus restaurant, among others.

4.2. Carrer de Sants-Creu Coberta Strips

The undeniable characteristic feature of the economic activities carried out in the Carrer de Sants-Creu Coberta strip is the multi-sectoriality—a common feature of the lower circuit—of the 343 ground-floor commercial premises (73%) in 2021, despite the efforts of the superior circuit to adapt to the diversity of the area. This strip is home to food shops—supermarkets, corner shops, butchers, etc.—(La Sirena, Caprabo, Consum, Mercadona, Ametller Origen), as well as clothing and home accessories—fashion clothing, shoes and leather, jewelers, perfumeries, homeware, technology, toys, gifts...—(Pull&Bear, Calzedonia, Inside; Bosanova, Misako, Querol; Equivalenza, San Remo; Cex; Drim, Muy Mucho, Flying Tiger), catering services—cafés and bars—(Granier, 365, Panet, KFC), beauty services—manicure and hairdressing—, telecommunications (Orange, Movistar, Yoigo), financial services—banks and pawnshops—and health services—opticians, hearing aids and dentists—(Multiópticas, Óptica Universitaria; GAES, Vitaldent, Dentix).

Concerning the evolution of the commercial typology, it is worth highlighting the permeability between circuits of ground floor premises. Thus, differences are not massive but indeed significant: some shops change category from the lower circuit to the superior, and vice versa, implying a high turnover between circuits within the strips. However, there is a compensatory effect: the lower circuit gains three points from the superior circuit, while the superior circuit gains four points. Evaluating the strength of each circuit requires knowing its permanence rate, which is lower in the superior circuit, 13/19 points (68%), than in the lower circuit, 65/74 points (88%) (Figure 9).

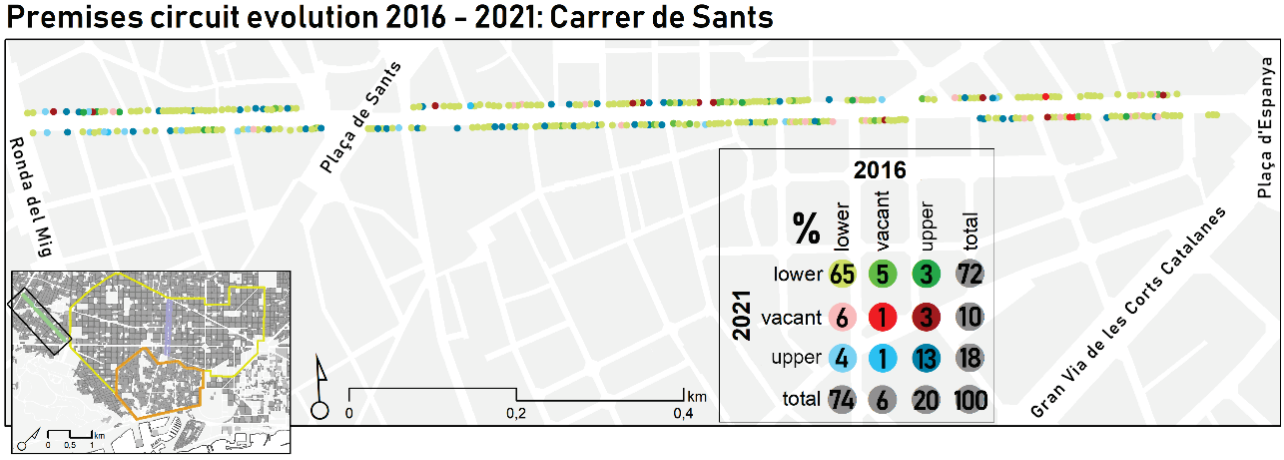

Figure 9. Premises circuit evolution in Carrer de Sants-Creu Coberta (2019–2021). Source: Prepared by the authors.

Another noteworthy feature is the low number of establishments that have remained closed during the period analysed, with a stay rate of only 1%. This reflects the remarkable dynamism of this commercial hub, in contrast to the alarming stay rates for the Sants-Montjuïc district [24].

The number of closed shops within this period is proportionally higher in the superior circuit, 3/19 points (16%), than the 5/74 points from the lower circuit. Bank branches are at the forefront of this loss of premises by the superior circuit: three from Banc Sabadell, one from Banc Popular and one from Caixa Bank. The same trend continues when looking at the new shops that were vacant in 2016, in which only 1/7 points are now businesses in the superior circuit, while 5/7 points (71%) are in the lower circuit. The superior circuit only reactivates two stores: Bio Carrefour and Ametller Origen; while the lower circuit reactivates fifteen: G&T Nails, Wines & Drinks, Solo Frikis, barber shops, and grocery stores, among others.

In conclusion, in 2021, the superior circuit maintained a percentage of establishments similar to the one it had in 2016, from 19% to 18%. The reduction of superior circuit premises during this period is compensated by new openings (losing 3/19 and 3/19 points to vacant and lower respectively but gaining 1/18 and 4/18 from these categories). Similarly, in 2021, the lower circuit maintains a similar proportion of establishments to that of 2016, going from 74% to 73%, at the expense of the capacity of retaining establishments, 65/74 points, 88%. Another strong aspect is the versatility of occupying premises that were vacant in 2016 (5/7 points).

5. Discussion

Although there are significant quantitative differences between the two analysed areas (153 commercial premises in Passeig de Gràcia to 496 in the Sants-Creu Coberta strips), what is most relevant is that both areas are representative of different manifestations of urban economic circuits. In general terms, these differences are the result of the distinct characteristics of their urban built environment and macro-economic policies [84] that affect each urban space and the intra-circuit relationship.

The general trend of the dialectical coexistence between the two circuits suggests that the superior circuit is expanding at the expense of the lower circuit in response to the growing process of business concentration [41]. In light of the retail apocalypse caused by e-commerce and the logistics revolution—including last-mile delivery [85] and the pressure of the housing market [58], the mentioned concentration of capital is still occurring. However, this process does not have a landscape crystallisation of the superior circuit in the city's streets or shopping malls. In this context, the trend indicates a shift towards a more selective and targeted approach in locating the activities of the superior circuit. This means focusing only on the most strategic locations, particularly those closely linked to higher human traffic, typically observed in the main streets [86], shopping malls [87] and areas with high purchasing power.

In this sense, the expansion of consumption and the dynamism of trade that tourism exerts is clear [88]. This is especially true if, apart from the innate importance of the experience in tourist shopping, there are also economic incentives such as duty-free shops (−21% of the price). Another decisive factor has been the contraction of the purchasing power of Barcelona residents, resulting from the repeated crises of the last 15 years (Great Recession, COVID-19 and generalised inflation). Against this backdrop, the adaptation of supply to tourist demand is evident, leading to what some authors call *commercial gentrification* [9,61]. Previous publications [51] have already underscored the significance of global tourism in the commercial viability of Barcelona's city centre. This reliance was proven after the COVID-19 lockdowns when tourism had not yet recovered, the number of businesses shuttered in the city centre was much higher than in neighbourhoods.

In the case of the luxury sector, shop location is even more crucial because points of sale have to be in streets of high symbolic and cultural value [89]. In Europe, these streets are usually the most prestigious and expensive ones. In order to achieve this, the luxury sector has a strong alliance with financial and real estate capital [37,90]. These streets become specialised in luxury brands as they set rental prices for commercial premises, thus filtering the activities that can be located there and orienting the real estate market of the entire metropolitan area [91].

There may be exceptions, especially when the business owns the commercial premises, as is the case with the Santa Eulàlia shop, owned by the same family since 1843 (Associació de Comerciants del Passeig de Gràcia, 2019). This highlights the significant role of the real estate market in shaping horizontal relations within the superior circuit, leading to discernible differences in modernisation processes among various commercial spaces within the city. In some, the physical location of the superior circuit is essential for their business success, as happens with the luxury sector that seeks emblematic and pedestrianised streets [92,93]. Elsewhere, the rising price of land makes it difficult to open new establishments and encourages the closure of existing ones [94].

The high specialisation of Passeig de Gràcia, seen in the strong continuity and horizontal concentration of shops, is mirrored in the stability of the brands along this street throughout the analysed period, i.e., little commercial rotation. This reflects the hegemony of an oligopoly comprised of global corporations within the luxury and ready-to-wear fashion sectors for clothing and accessories [95]. A harmony in the luxury sector that holds true after the effects of COVID-19 when, despite the total freeze on international tourism, the luxury brands in Passeig de Gràcia continue to be the same as before [51].

The horizontal solidarity, the complementarity among different commercial establishments, of the superior circuit in the Sants-Creu Coberta strips is weaker than in Passeig de Gràcia because there is less variety of shops and, at the same time, there are no luxury shops. The socio-economic structure of the neighbourhoods is similar to that of the Barcelona Metropolitan Area in terms of average income per household per year (38,988 €) [96]. This circuit is characterised by companies that produce general consumption and convenience goods and services, which rely on passersby. Food distribution companies stand out because they have changed the commercial location model from peripheral hypermarkets to

a model based on proximity to demand, within the neighbourhoods, as other research in Argentina [97] and Portugal [98] has already shown.

The superior circuit also includes commercial activities of personal accessories such as perfumeries and jewellery shops. The services of the superior circuit are characterised by a semi-intensive use of capital, whether from medium-high trained workers, fixed capital, or a relatively high stock of products. These characteristics are complemented by commercial health services and establishments related to hearing and optics, for example, typical of a neighbourhood with an ageing demographic structure. The group of services also includes bank branches which, although they have disappeared en masse, are still present in the area under investigation.

The dominant role of the lower circuit in the Carrer de Sants-Creu Coberta strips is a result of the characteristics of the urban built environment, with a strong weight of small plots and family businesses due to the social-political composition of the neighbourhood. Despite their dominance, lower-circuit family businesses have been declining as they have not been able to cope with inter-company competition and online sales. Family businesses with rental agreements have been the worst off, and many have had to close once the owners retired [99].

The high price of real estate in cities such as Barcelona and the growing involvement of private investment funds [100] have made the real estate market an important analytical dimension for understanding the functioning of the two circuits [42]. Although it is not directly linked to the process of e-commerce, which through the revolution in logistics is driving the increase in commercial flows and, in parallel, the disappearance of fixed assets, the increase in the cost of commercial premises is hindering activity on ground-floor rental premises. This fact affects both the superior and lower circuits albeit with different intensities.

Regarding the superior circuit, the increase in the price of land is corrected by the use of logistics centres located in the metropolitan area and last-mile logistics (Ranieri et al., 2018). The luxury sector acts differently, maintaining shops in central locations as an advertising strategy through flagship stores related to the symbolic economy of the central streets [101].

On the other hand, the lower-circuit shops of Sants-Creu Coberta, which employ migrant, low-skilled workers, can afford to pay rent. Most of these shops are small food establishments (less than 150 square metres) [61,102] that the legislation allows to open until 11 p.m. or services related to cosmetics such as hairdressers, pedicures and massages. Additionally, there are several family businesses that own their commercial premises and therefore have a higher affordability index, resulting in greater economic viability. Although the ownership of the premises is an advantage that helps them extend the life expectancy of the business, they cannot compete with others that strongly invest in logistics, e-commerce and advertising [103]. This process can be seen in sectors such as electronics and clothing.

The greater social inequalities in Latin American metropolises compared to Barcelona are likely to enhance our understanding of the different behaviors of urban economic circuits in these two contexts. There is a significant vertical differential between Passeig de Gràcia and Sants-Creu Coberta in Barcelona. However, the presence of superior circuits in less central neighbourhoods is much more pronounced than in the peripheries of Latin American metropolises. In these Latin American peripheries, the lower circuit focused on survival dominates [42,45]. In contrast, top companies of superior circuits in Barcelona have also expanded into the more popular areas of the city. An example of this expansion into Barcelona's popular peripheries is the major Spanish food retailer Mercadona [104]. Nonetheless, the increasing social inequality in the Catalan metropolis suggests a convergence in the paths of commercial modernisation between these two territorial contexts. Retail activities related to the survival of lower-income groups are also expected to expand across all areas of Barcelona.

6. Final Evaluations

Theoretical and empirical conclusions can be presented after analysing and discussing the relationships between urban economic circuits and commercial desertification in two areas of Barcelona. Firstly, Table 2 summarises the relationships observed through the matrices and their cartographic representation. Thus, retention and assimilation result in three forms: concentration—the expansion or permanence of a circuit in an area where it is already dominant—dispersion—the expansion or permanence of a circuit in an area where it is not dominant—and desertification—expansion of premises without activity.

Table 2. Analytical diagram of the relationship between the circuits of the urban economy and commercial desertification.

Trend	Behaviour	Relation	Forms		
			Activity		Non-Activity
Continuity	Resilient	Retention	Dispersion	Concentration	Desertification
Change	Predatory	Assimilation	Dispersion	Concentration	Desertification

Retention is an internal relationship of each circuit, where resilient behaviour manages to keep control over a certain location, thus reinforcing the tendency to continuity. On the other hand, assimilation responds to a predatory behaviour through which the circuits absorb premises of the opposite, assuming a changing trend. It is important to note that this theoretical and synthetic approach to the relations between circuits and commercial desertification does not seek to homologate the superior and lower circuits, which, by definition, cannot behave in the same way. The fact that the lower circuit is dominant—more present—in a strip does not mean that it does not operate under the logic of domination of the superior circuit, as is exemplified by the use of credit and other financial instruments by the establishments of the lower circuit.

Secondly, this research uncovers which and what type of relationships are present in each strip. The data shows concentration forms in both axes, resulting in a retention ratio of 65%, indicating a high degree of continuity. However, concentration can also be due to an assimilation ratio, explained by the position of the strips within the system of metropolitan centralities. Thus, geography matters. That is to say, those shopping centres specialising in the lower circuit, such as Sants-Creu Coberta, increase their concentration in this circuit through the assimilation of establishments from the superior circuit and vice versa; shopping centres specialising in the superior circuit, such as Passeig de Gràcia, increase their concentration in this circuit through the assimilation of establishments from the lower circuit.

The differences arise in the dynamics of change. While Passeig de Gràcia shows two significant forms—concentration and desertification—as a result of a relationship of assimilation, the Sants-Creu Coberta strips show all three, adding dispersion because the superior circuit assimilates premises from the lower circuit, where the former is not dominant.

Nevertheless, and looking now at the values that define the structures of the axis—the percentages in grey in the diagrams (Figures 6 and 7)—and not so much at the relationships between the circuits and commercial desertification—the percentages in colour—more diversity of assimilation relationships does not necessarily translate into structural changes.

Thus, although there is a greater diversity of relations in the Sants-Creu Coberta strips, the structure is more static, with fewer changes, than in Passeig de Gràcia. This is explained by the rotation intensity between circuits, which means that movements are compensated in Sants-Creu Coberta and not in Passeig de Gràcia. In the latter, there are more uncompensated structural changes derived from a strong increase in total commercial desertification (from 1% to 9%). In the case of Sants-Creu Coberta, the percentage of premises that have opened and have been closed in the lower circuit is the same. The most significant conclusion to draw from this is that commercial desertification is the primary

cause of the change. This is because it alters the values of concentration and dispersion, rather than inter-circuit relations, which have already demonstrated concentration [45].

Desertification has impacted both axes, rebuilding the commercial landscape and changing the values of concentration and dispersion. At this point, the research formulates the hypothesis that e-commerce and the land market play a role in commercial desertification, affecting both areas but with different intensities. In Passeig de Gràcia, the rapid growth of online sales among superior circuit retailers has led to significant commercial desertification in the last five years. On the other hand, the desertification on Carrer de Sants could be related to the increase in the price of land and its effects on the market for rental premises—especially among those on a rental basis—which explains why, in 2016, the percentage of closed establishments was already very high on this street (7%).

It is necessary to understand in more detail how the commercial upheaval represented by COVID-19 has specifically manifested in the two commercial strips. What is known is that, in general, there has been an increase in the number of closed ground-floor premises in the whole of Barcelona (between 2019 and 2022, closed commercial premises have increased by 4578, reaching 7180). Some ground-floor premises have remained closed due to exorbitant rental prices, as has happened in streets like Ferran in the historic centre, while in the neighbourhoods, establishments have been closing due to changing consumer habits. It is also known that the number of restaurants in 2022 increased significantly compared to 2019. In conclusion, this paper assists to evaluate with more precision the impacts of COVID-19 on the accentuation and characterisation of a trend—retail apocalypse—that, as demonstrated, began years before the pandemic.

The analysis of urban economy circuits emerges as a powerful theoretical tool for addressing urban complexity. Traditional classifications of economic activities, such as the United Nations' International Standard Industrial Classification (ISIC), are becoming less explanatory in today's context. The dialectical process of capital concentration underscores this theory by allowing for the identification of uneven geographical development through retail activities. The theory's explanatory capacity should facilitate better design of retail policies. Currently, retail policies and their regulation are predominantly based on superficial aspects and classification centred on supply. The theory of urban economy circuits would enable the formulation of urban policies with a more holistic perspective of the contemporary urban economy. It would address issues related to labour, social inequalities, and the technologisation of everyday life, thus complementing the traditional perspective focused on commercial supply. This approach highlights the importance of qualitative fieldwork in urban and commercial geography, a crucial analysis technique for better understanding contemporary urban complexity.

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References

1. Barcelona City Council. European Capital of Local Retail; Barcelona City Council: Barcelona. 2023. Available online: https://europeanretailcapital.com (accessed on 25 May 2024).

2. Carreras, C.; Martínez-Rigol, S. Treinta años de consolidación de la sociedad de los consumidores. In *Ciudad Comercio y Consumo: Nuevas Perspectivas para su Estudio Geográfico*; Silveira, M.-L., Bertoncello, R., Di Nuicci, J., Eds.; Café de las Ciudades: Buenos Aires, Argentina, 2020; pp. 25–46.
3. Carreras, C.; Frago, L.; Montesinos, E. Rescaling Retail and Consumption in the Contemporary Barcelona Area. *Boll. Soc. Geogr. Ital.* **2021**, *14*, 37–49.
4. Frago, L. Dinámicas comerciales y de consumo en la Barcelona metropolitana y regional: Entre la modernización y la desertización. In *Ciudad Comercio y Consumo: Temas y Problemes Desde la Geografía*; Silveira, M.L., Bertoncello, R., Di Nucci, J., Eds.; Café de las Ciudades: Buenos Aires, Argentina, 2020; pp. 225–248.
5. Frago, L. Fragmentación urbana y comercio de proximidad: Un ensayo sobre el proyecto Superilla en Barcelona. *Tlalli. Rev. Investig. Geogr.* **2022**, *8*, 116–139. [CrossRef]
6. Barata-Salgueiro, T.; Guimarães, P. Public Policy for Sustainability and Retail Resilience in Lisbon City Center. *Sustainability* **2020**, *12*, 9433. [CrossRef]
7. Cachinho, H.; Paiva, D. The Enactment of Fast and Slow Time Regimes by Urban Retail and Consumer Services. *Ann. Am. Assoc. Geogr.* **2021**, *111*, 2005–2022. [CrossRef]
8. Cachinho, H.; Salgueiro, T.B. Os sistemas comerciais urbanos em tempos de turbulência: Vulnerabilidades e níveis de resiliência. *Finisterra* **2016**, *51*, 89–109. [CrossRef]
9. Guimarães, P.P.C. The Transformation of Retail Markets in Lisbon: An Analysis through the Lens of Retail Gentrification. *Eur. Plann. Stud.* **2018**, *26*, 1450–1470. [CrossRef]
10. Guimarães, P.P.C. Shopping Centres in Decline: Analysis of Demalling in Lisbon. *Cities* **2019**, *87*, 21–29. [CrossRef]
11. D'Alessandro, L. (Ed.) *City, Retail and Consumption*; Università degli studi di Napoli: Naples, Italy, 2015; Volume 76, pp. 35–47.
12. D'Alessandro, L.; Sommella, R.; Viganoni, L. Malling, Demalling, Remalling? Mutamenti e Nuove Pratiche del Commercio e del Consumo nell'Area Metropolitana di Napoli. *AGEI—Geotema* **2016**, *51*, 71–77.
13. Dallari, F.; Curi, S. (Eds.) *Regional Logistics Performance. Regione Logistica Milanese e l'Europa a Confronto*; Camera di Commercio di Milano Monza Brianza Lodi: Milan, Italy, 2020; pp. 1–121.
14. Manzini, E. *Abitare la Prossimità. Idee per la Città dei 15 Minuti*; Egea: Milan, Italy, 2021; Volume 22, p. 178.
15. Arnaud, G.; Lemarchand, N. *Le Commerce Cans Tous ses Etats. Espaces Marchands et Enjeux de Société*; Presses Universitaires de Rennes: Rennes, France, 2014.
16. Delage, M.; Baudet-Michel, S.; Fol, S.; Buhnik, S.; Commenges, H.; Vallée, J. Retail Decline in France's Small and Medium-Sized Cities Over Four Decades: Evidences from a Multi-Level Analysis. *Cities* **2020**, *104*, 102790. [CrossRef]
17. Dugot, P. *Commerce et Urbanisme Commercial dans la Fabrique de la Ville Durable*; Presses Universitaires du Midi: Toulouse, France, 2019; Volume 63, pp. 179–180.
18. Gasnier, A. Le Commerce dans la Ville, entre Crise et Résilience: Comment Réparer, Adapter, Aménager les Territoires Marchands? Presses Universitaires de Rennes: Rennes, France, 2019; p. 297.
19. Razemon, O. *Comment la France a Tué Ses Villes*; Rue de l'Échiquier: Paris, France, 2017; Volume 192, p. 18.
20. Philipose, S. Retail Apocalypse: The Death of Malls Retailers & Jobs. Independently Published, 2019.
21. Townsend, M.; Surane, J.; Orr, E.; Cannon, C. *America's "Retail Apocalypse" Is Really Just Beginning*; Bloomberg: New York, NY, USA, 2024; pp. 1–11. Available online: www.bloomberg.com/graphics/2017-retail-debt/ (accessed on 21 August 2024).
22. Carreras, C. Barcelona as a city without commerce. A vueltas con el modelo urbano. *Position* **2022**, *8*, 1–25.
23. Carreras, C.; Frago, L. Could a Retail-Less City Be Sustainable? The Digitalization of the Urban Economy against the City. *Sustainability* **2022**, *14*, 4641. [CrossRef]
24. Morcuende, A.; Lloberas, D. Retail Apocalypse as a Differential Urbanisation Symptom? Analysis of Ground Floor Premises' Evolution in Barcelona between 2016 and 2019. *Sustainability* **2022**, *14*, 13652. [CrossRef]
25. Chun, H.; Joo, H.; Kang, J.; Lee, Y. E-Commerce and Local Labor Markets: Is the "Retail Apocalypse" Near? *J. Urban Econ.* **2023**, *137*, 103594. [CrossRef]
26. Talen, E.; Park, J. Understanding Urban Retail Vacancy. *Urban Aff. Rev.* **2021**, *58*, 702–726. [CrossRef]
27. Brynhildsen, M. *The Retail Evolution and Urban Transformation: An Analysis of Challenges, Social Implications, and Municipal Adaptation in Malmö City*; Lunds Universitet: Lund, Sweden, 2021.
28. Santos, M. *O Espaço Dividido: Os dois Circuitos da Economia Urbana dos Países Subdesenvolvidos*, 2nd ed.; Viana, M.T.R., Ed.; EdUSP: São Paulo, Brasil, 2004; Volume 2, pp. 91–114.
29. Silveira, M.L. Metrópolis brasileñas: Un análisis de los circuitos de la economía urbana. *Eure* **2007**, *33*, 149–164. [CrossRef]
30. Silveira, M.L. *Circuitos de la Economía Urbana. Ensayos sobre Buenos Aires y São Paulo*; Editorial Café de las Ciudades: Buenos Aires, Argentina, 2016; Volume 1, p. 401.
31. Lloberas, D. *Els Circuits de L'economia Urbana i els Seus Efectes Sobre L'espai Urbà: Verticalitats i Horitzontalitats a Lisboa*; Universitat de Barcelona: Barcelona, Spain, 2020.
32. Santos, M. *Técnica, Espaço, Tempo: Globalização e Meio Técnico-Científico Informacional*; Universidade de São Paulo: São Paulo, Brasil, 1994; p. 70.
33. Castells, M. *L'Era de la Informació: Economia, Societat i Cultura*; UOC: Barcelona, Spain, 2003; p. 6.
34. Massey, D. *For Space*; SAGE: London, UK, 2005; pp. 227–234.

35. Santos, M. *Por Uma Outra Globalização: Do Pensamento Único à Consciência Universal*; Record: Rio de Janeiro, Brasil, 2000; Volume 22, p. 978.
36. Smith, N. *Uneven Development: Nature, Capital, and the Production of Space*; Blackwell: London, UK, 1984; p. 198.
37. Aalbers, M.B. Financial Geography III: The Financialization of the City. *Prog. Hum. Geogr.* **2020**, *44*, 595–607. [CrossRef]
38. Arroyo, M.; Silva, A.M.B. *Instabilidade dos Territórios: Por uma leitura crítica da conjuntura a partir de Milton Santos*; FFLCH—USP: São Paulo, Brasil, 2022; Volume 1, pp. 49–66.
39. Harvey, D. *The Limits to Capital*; Verso: New York, NY, USA, 2006; Volume 3, p. 34.
40. Santos, M. *A Natureza do Espaço: Técnica e Tempo, Razão e Emoção*; Hucitec: São Paulo, Brasil, 1996; Volume 2, p. 260.
41. Silveira, M.L. Circuitos de la economía urbana y nuevas manifestaciones del comercio metropolitano. *Cidades* **2014**, *11*, 78–91. [CrossRef]
42. Silveira, M.L. Modo de existência da cidade contemporânea: Uma visão atual dos circuitos da economia urbana. *Cidades* **2022**, *14*, 25–48.
43. Boscariol, R.A. Financeirização, circuitos da economia urbana e produção do espaço urbano no Brasil. *PatryTer* **2020**, *3*, 234–250. [CrossRef]
44. Silveira, Maria Laura; Metrópolis, fenómeno técnico y nuevas divisiones del Trabajo. *Rev. Geográfica Venez.* **2020**, *61*, 478–494.
45. Silveira, M.L. Modernização contemporânea e nova constituição dos circuitos da economia urbana. *GEOUSP Espaço Tempo* **2015**, *19*, 78–91. [CrossRef]
46. Cavoto, G. Demalling. Una Risposta alla Dismissione Commerciale. *J. Interdiscip. Stud. Archit. Urban.* **2014**, *3*, 222.
47. Barata-Salgueiro, T.; Cachinho, H.; Guimarães, P. Comércio, Consumo & Governança Urbana. In *Comércio, Consumo & Governança Urbana*; Barata-Salgueiro, T., Cachinho, H., Guimarães, P., Eds.; Centro de Estudos Geográficos: Lisbon, Portugal, 2020; pp. 1–22. [CrossRef]
48. Childs, M.; Blanchflower, T.; Hur, S.; Matthews, D. Non-Traditional Marketplaces in the Retail Apocalypse: Investigating Consumers' Buying Behaviours. *Int. J. Retail Distrib. Manag.* **2020**, *48*, 262–286. [CrossRef]
49. Helm, S.; Kim, S.H.; Van Riper, S. Navigating the 'Retail Apocalypse': A Framework of Consumer Evaluations of the New Retail Landscape. *J. Retail. Consum. Serv.* **2020**, *54*, 101683. [CrossRef]
50. Mende, M.; Noble, S.M. Retail Apocalypse or Golden Opportunity for Retail Frontline Management? *J. Retail.* **2019**, *95*, 84–89. [CrossRef]
51. Frago, L. Impact of COVID-19 Pandemic on Retail Structure in Barcelona: From Tourism-Phobia to the Desertification of City Center. *Sustainability* **2021**, *13*, 8215. [CrossRef]
52. Spanke, M. *Retail Isn't Dead: Innovative Strategies for Brick and Mortar Retail Success*; Springer International Publishing: Berlin/Heidelberg, Germany, 2020.
53. Dicken, P.; Kelly, P.F.; Olds, K.; Wai-Chung Yeung, H. Chains and Networks, Territories and Scales: Towards a Relational Framework for Analysing the Global Economy. *Glob. Netw.* **2001**, *1*, 89–112. [CrossRef]
54. Levinson, M. *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*; Princeton University Press: Princeton, NJ, USA, 2016; Volume 2, p. 2586.
55. Danyluk, M. Capital's Logistical Fix: Accumulation, Globalization, and the Survival of Capitalism. *Environ. Plann. D Soc. Space* **2018**, *36*, 630–647. [CrossRef]
56. Franco, E. *Commercio e Logistica: Criticità e Sfide per il Governo del Territorio*; Maggioli: Rimini, Italy, 2022; p. 66.
57. Frago, L. La Metamorfosi del Centre a les Capitals Comarcals: Entre Tradició i Postmodernitat. Ph.D. Thesis, Universitat de Barcelona, Barcelona, Spain, 2011.
58. Nanda, A.; Xu, Y.; Zhang, F. How Would the COVID-19 Pandemic Reshape Retail Real Estate and High Streets through Acceleration of E-Commerce and Digitalization? *J. Urban Manage.* **2021**, *10*, 110–124. [CrossRef]
59. MacGillis, A. *Fulfillment: Winning and Losing in One-Click America*; Farrar, Straus and Giroux: New York, NY, USA, 2021; p. 400.
60. Tamini, L. *Re-Activation of Vacant Retail Spaces. Strategies, Policies and Guidelines*; Springer Briefs in Applied Sciences and Technology; Springer: Berlin/Heidelberg, Germany, 2018; Volume 1, p. 11159.
61. Costa, J.; Castro, R. SMEs Must Go Online—E-Commerce as an Escape Hatch for Resilience and Survivability. *J. Theor. Appl. Electron. Commer. Res.* **2021**, *16*, 3043–3062. [CrossRef]
62. Hubbard, P. The Battle for the High Street: Retail Gentrification, Class and Disgust. In *The Battle for the High Street: Retail Gentrification, Class and Disgust*; Springer: Berlin/Heidelberg, Germany, 2017. [CrossRef]
63. Carreras, C.; Domingo, J.; Sauer, C. *Les Àrees de Concentració Comercial de la Ciutat de Barcelona: Barcelona, Ciutat de Compres*; Cambra Oficial de Comerç, Indústria i Navegació de Barcelona: Barcelona, Spain, 1990; Volume 14, pp. 37–49.
64. Burgos, R. *Els amos del Passeig de Gràcia: Una Radiografia del Poder*; Tarrés, M.M., Vinton, R., Borràs, J., Eds.; Pol·len Edicions: Barcelona, Spain, 2019; Volume 22.
65. Carreras, C. *Atles Comercial de Barcelona*; Ajuntament de Barcelona: Barcelona, Spain, 2003; Volume 978, p. 384.
66. Alberch, F.R.; Giralt, R.J. *Enciclopèdia de Barcelona*; Enciclopèdia Catalana: Barcelona, Spain, 2005; Volume 64, pp. 51–66.
67. Formentí, G. *Inditex a la Conquesta d'Edificis Emblemàtics de les Ciutats*; University of Barcelona: Barcelona, Spain, 2018. Available online: https://hdl.handle.net/2445/130697 (accessed on 8 July 2024).
68. Carreras i Verdaguer, C. L'estructura de la Propietat i Morfologia Urbana a Hostafrancs. *Rev. Cat. Geogr.* **1982**, *5*, 71–86.

69. Morcuende, A. Rupturas Urbanas. Análisis de las Relaciones Entre la Morfología Urbana y la Estructura Social en la Barcelona Contemporánea. Ph.D. Thesis, Universitat de Barcelona, Barcelona, Spain, 2018. Available online: https://hdl.handle.net/2445/127050 (accessed on 8 July 2024).
70. Barcelona City Council. *Creu Coberta—Sants United Establishments. Europe's Longest Shopping Street*; Barcelona City Council: Barcelona, Spain, 2015.
71. Ayuntamiento de Barcelona. *Associació per L'impuls de l'Economia Cooperativa i Comunitària de Sants-Montjuïc*; Ayuntamiento de Barcelona: Barcelona, Spain, 2015; Volume 21, p. 874.
72. Etevé; Cuerva, A. Sants Reprèn Obrim Carrers amb Divisió Entre els Comerciants. Betevé, Sept 4. 2023. Available online: https://beteve.cat/mobilitat/sants-obrim-carrers-divisio-comerciants (accessed on 25 May 2024).
73. Barcelona City Council. *Cens D'activitats Econòmiques en Planta Baixa de la Ciutat de Barcelona 2016*; Barcelona City Council: Barcelona, Spain, 2016. Available online: https://opendata-ajuntament.barcelona.cat/data/ca/dataset/cens-activitats-comercials (accessed on 25 May 2024).
74. Anguera-Torrell, O.; Cerdan, A. Which Commercial Sectors Coagglomerate with the Accommodation Industry? Evidence from Barcelona. *Cities* **2021**, *112*, 103112. [CrossRef]
75. Crosas, C.; Gómez-Escoda, E. Mapping Food and Health Premises in Barcelona. An Approach to Logics of Distribution and Proximity of Essential Urban Services. *ISPRS Int. J. Geo-Inf.* **2020**, *9*, 746. [CrossRef]
76. Garcia, X.; Garcia-Sierra, M.; Domene, E. Spatial Inequality and Its Relationship with Local Food Environments: The Case of Barcelona. *Appl. Geogr.* **2020**, *115*, 102140. [CrossRef]
77. Goossensen, M.; Garcia, X.; Garcia-Sierra, M.; Calvet-Mir, L.; Domene, E. The Role of Convenience Stores in Healthy Food Environments: The Case of Barcelona (Spain). *Cities* **2023**, *133*, 104118. [CrossRef]
78. Londoño-Cañola, C.; Serral, G.; Díez, J.; Martínez-García, A.; Franco, M.; Artazcoz, L.; Ariza, C. Retail Food Environment around Schools in Barcelona by Neighborhood Socioeconomic Status: Implications for Local Food Policy. *Int. J. Environ. Res. Public Health* **2023**, *20*, 649. [CrossRef] [PubMed]
79. Perfil de Ciutat. Clonatge Comercial a Catalunya. Available online: www.diba.cat/web/comerc/clonatge-comercial (accessed on 21 August 2024).
80. COMERTIA. Catalan Association of Family Retail Businesses (2023). COMERTIA. Who Are We? Available online: www.comertia.net (accessed on 21 August 2024).
81. Montesinos, E. Comertia, L'Associació Catalana de les Empreses Comercials. In *La Nova Geografia de la Catalunya Post-Covid*; Burgueño, J., Ed.; Societat Catalana de Geografia: Barcelona, Spain, 2021; p. 188.
82. Paris, M. (Ed.) Making Prestigious Places. In *How Luxury Influences the Transformation of Cities*; Routledge: London, UK; New York, NY, USA, 2018; pp. 81–91.
83. Silveira, M.L. Nuevos rostros financieros del comercio, del consumo y del medio construido urbano: Indagando acerca de sus elementos constitutivos. In *Ciudad Comercio y Consumo: Nuevas Perspectivas para su Estudio Geográfico*; Silveira, M.L., Bertoncello, R., Di Nucci, J., Eds.; Café de las Ciudades: Buenos Aires, Argentina, 2020; pp. 47–76.
84. Rodrigue, J.P. The Distribution Network of Amazon and the Footprint of Freight Digitalization. *J. Transp. Geogr.* **2020**, *88*, 102825. [CrossRef]
85. Theodoridis, C.; Ntounis, N.; Pal, J. How to Reinvent the High Street: Evidence from the HS2020. *J. Place Manag. Dev.* **2017**, *10*, 380–391. [CrossRef]
86. Rao, F. Resilient Forms of Shopping Centers Amid the Rise of Online Retailing: Towards the Urban Experience. *Sustainability* **2019**, *11*, 3999. [CrossRef]
87. Carreras, C.; Frago, L. Patrimonio comercial y turismo. Los establecimientos emblemáticos de Barcelona turística. *Cenário Rev. Interdiscip. Tur. Territ.* **2018**, *4*, 09–26. [CrossRef]
88. Zukin, S. *The Cultures of Cities*; Blackwell: Oxford, UK, 1995; Volume 1, p. 336.
89. Domínguez, G.B.; Rigol, S.M.; Frago, L.; Verdaguer, C.C.I.; Bernardos, G. Las apropiaciones de la ciduad a la hora de la globalización: Las estrategias del capital ruso y chino en el mercado inmobiliario de Barcelona. *Scr. Nova* **2014**, *493*, 1–17.
90. Barata-Salgueiro, T. Fragmentação Sócio-Espacial e Comércio de Luxo. *Tlalli Rev. Investig. Geogr.* **2022**, *8*, 86–115. [CrossRef]
91. Associació de Comerciants del Passeig de Gràcia. Barcelona Passeig de Gràcia. Barcelona. 2019. Available online: https://barcelonapaseodegracia.com/en/about-us/ (accessed on 15 April 2024).
92. Özdemir, D.; Selçuk, İ. From Pedestrianisation to Commercial Gentrification: The Case of Kadıköy in Istanbul. *Cities* **2017**, *65*, 10–23. [CrossRef]
93. Shin, H.S.; Woo, A. Analyzing the Effects of Walkable Environments on Nearby Commercial Property Values Based on Deep Learning Approaches. *Cities* **2024**, *144*, 104628. [CrossRef]
94. Tot Barcelona. Closures of Lifelong Shops that Barcelona Premisses. Tot Barcelona. March 25 2023. Available online: www.totbarcelona.cat/es/sociedad/cierres-comercos-toda-vida-barcelona-encuentra-faltar-332919 (accessed on 21 August 2024).
95. Deloitte. *Global Powers of Luxury Goods 2022: A New Wave of Enthusiasm in Luxury Contents*; Deloitte: London, UK, 2022. Available online: www.deloitte.com/global/en/Industries/consumer/analysis/gx-cb-global-powers-of-luxury-goods.html (accessed on 8 July 2024).
96. Ruiz-Almar, E.; Velasco i Relats, A. *Factors de Risc i Vulnerabilitat a l'AMB Vinculats a la COVID-19*; Assaig Metodològic; Àrea Metropolitana de Barcelona (AMB): Barcelona, Spain, 2020; pp. 1–25.

97. Nucci, J.D. Concentración y uso corporativo del territorio en Argentina: La lògica territorial de Carrefour. *Cuad. Geográficos* **2015**, *54*, 186–208.
98. Cachinho, H.; Morgado, P.; Guimarães, P.; Silva, D.G. O ciclo espacial do comércio retalhista alimentar: Evidências da Área Metropolitana de Lisboa. In *Comércio, Consumo & Governança Urbana*; Barata-Salgueiro, T., Cachinho, H., Guimarães, P., Eds.; Universidade de Lisboa, Centro de Estudos Geográficos: Lisbon, Portugal, 2020; pp. 176–197.
99. Savini, F.; Aalbers, M.B. The De-Contextualisation of Land Use Planning through Financialisation: Urban Redevelopment in Milan. *Eur. Urban Reg. Stud.* **2016**, *23*, 878–894. [CrossRef]
100. Ranieri, L.; Digiesi, S.; Silvestri, B.; Roccotelli, M. A Review of Last Mile Logistics Innovations in an Externalities Cost Reduction Vision. *Sustainability* **2018**, *10*, 782. [CrossRef]
101. Zukin, S. *Naked City: The Death and Life of Authentic Urban Places*; Oxford University Press: Oxford, UK, 2009; Volume 6, pp. 17–19.
102. Government of Catalonia. *Law 18/2005, of December 27, Retail Equipments*; Official Bulletin of the Government of Catalonia: Barcelona, Spain, 2005; Volume 18, p. 400.
103. Government of Catalonia. Executive Decree 1/2009, of 22 December, on Commercial Facility Regulations. *Doc. Of. General. Catalonia* **2009**, *9*, 5534.
104. Àrea Metropolitana de Barcelona. *La Cistella Bàsica Metropolitana. Cost, Esforç i Inflació per a la Població Metropolitana. Estudis Territorials*; Àrea de Desenvolupament de Polítiques Urbanístiques: Barcelona, Spain, 2022; Volume 14, p. 282.

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Spatial Economic Analysis of Manufacturing Firms Located in the Vicinity of Cape Town International Airport

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Abstract: Manufacturing activities are at the heart of contemporary capitalist economies, with observable geographical patterns of production. Debates about the interconnections between transportation technology advancements and land use acknowledge that airports can influence the spatial distribution of firms, including those involved in manufacturing. However, the manufacturing-related literature describes the land-use mix of airports and their surroundings without an in-depth spatial economic analysis of the firms positioned near airports. This study aimed to conduct a spatial economic analysis of manufacturing firms positioned in the environs of Cape Town International Airport, South Africa. Primary data were collected through survey interviews conducted with the representatives of 23 manufacturing firms situated in the environs of the airport. The study discovered the potential existence of a spatial cluster of manufacturing firms. This cluster is characterized by dense inter- and intraindustry linkages within the study area. It is recommended that planning authorities and other stakeholders augment the clustering of manufacturing firms in the vicinity of Cape Town International Airport, which comprises firms with direct and indirect linkages with the airport.

Keywords: Cape Town International Airport; manufacturing; Cape Town; linkages; agglomeration economies; clustering

1. Introduction

Manufacturing has been an essential driver of economic development throughout the history of capitalism [1]. Despite the proclaimed transition to the so-called post-industrial age, commodity production and distribution processes are still crucial in contemporary capitalist economies characterized by the growing services sector [1,2]. During particular periods in history, specific geographical production patterns were observable, and with the transition from one production regime to another, the range of locational outcomes was extended. As shifts occurred, a continuum of spatial responses became noticeable, spanning from the reorganization of industrial zones established in the earlier regimes of accumulation to the development of new industrial areas [3].

Although the direction of causality is not always clear-cut [4], the literature acknowledges that transport infrastructure, directly and indirectly, positively impacts development and the economy [5–7]. This influence manifests in several interrelated ways. First, the availability of quality transport infrastructure improves the attractiveness of an area [5], an attribute essential for investment opportunities. Second, improved access augments trade linkages, which could span different geographical scales and administrative boundaries. Third, accessibility generates positive externalities from the firms' interactions with other firms and with markets [6]. These manifestations affect the efficiency of individual firms and, most importantly, influence the organization of economic activity across space [6].

Against this backdrop of the potential influence of transport infrastructure on development, the empirical literature has acknowledged that in different contexts across the

globe, the environs of airports are characterized by the concentration of manufacturing establishments [8–16]. The existing literature, however, describes the land-use mix of the environs of airports without comprehensively analying the spatial economic attributes of the manufacturing establishments situated in the environs of airports. This is the gap that this study intended to fill. The literature asserts that the appropriate location choice can assist companies in gaining a competitive advantage and improving overall operational performance [17]; hence, location is one of the critical factors that influence the success of companies [18].

Furthermore, despite the aforementioned importance of manufacturing in the contemporary economy, it has historically been argued that the amount of empirical research is not proportionate to the significance of the geography of industrial establishments in metropolitan areas [3]. Thus, it is imperative to empirically analyze the role of airports in the placement and operations of manufacturing establishments. Therefore, this study aimed to conduct a spatial economic analysis of the manufacturing firms in the vicinity of Cape Town International Airport, South Africa. This paper addresses two specific objectives:

- Analysis of the linkages of the manufacturing firms positioned in the vicinity of Cape Town International Airport, and
- Analysis of the locational behaviour of the manufacturing firms positioned in the vicinity of Cape Town International Airport.

The remainder of the paper is structured as follows. The next section focuses on the review of the literature, concentrating specifically on the conceptual frame of reference that this paper hinges on. The third section discusses the research methods adopted to address the aim of the study. The fourth section presents the results of the analysis conducted. The final section concludes the paper.

2. Literature Review: A Conceptual Frame of Reference

The placement of economic activity in the environs of airports is typically analyzed through the normative models of airport-led development, which are used worldwide to advance proposals on the idealized urban form of activities understood to be linked to or dependent upon airports. A plethora of such models include the airport city, aerotropolis, airport region, airfront, global transpark, airport corridor, airea, decoplex, aircity, aeropolis, aeropark, aviopolis, avioport, flight forum, sky city, airpark, aero city and aeroscape [16]. The model that is dominantly used in contemporary literature and practice (and more explicit on the placement of manufacturing activities) is the so-called aerotropolis. The aerotropolis is a sub-region in which land use, infrastructure and different elements of the economy in a territory hinge on a major airport. The logic of the aerotropolis is that businesses in the region benefit from the speedy connectivity to suppliers, markets and business partners inter-regionally, nationally and globally [19]. The aerotropolis is anchored by the core airport area, which is responsible for providing logistics services. The airport area is surrounded by manufacturers and distribution centres responsible for the speedy transportation of inputs and manufactured products [20]. Notwithstanding the wide use of the aerotropolis in urban and regional planning policy, it is essential to acknowledge that most aerotropolis developed organically and were driven by, among other factors, market forces [21].

Informed by a relational view of the economy, Mokhele and Geyer [22] highlighted several concepts appropriate to the analysis of the positioning of economic activities in general and, specifically, development in the environs of airports. These concepts, which have traditionally been central to analyzing the positioning of economic activities in human geography and allied disciplines, include linkages, agglomeration economies and clustering. These are given substance by the closely associated concepts of space, proximity and pattern (Figure 1).

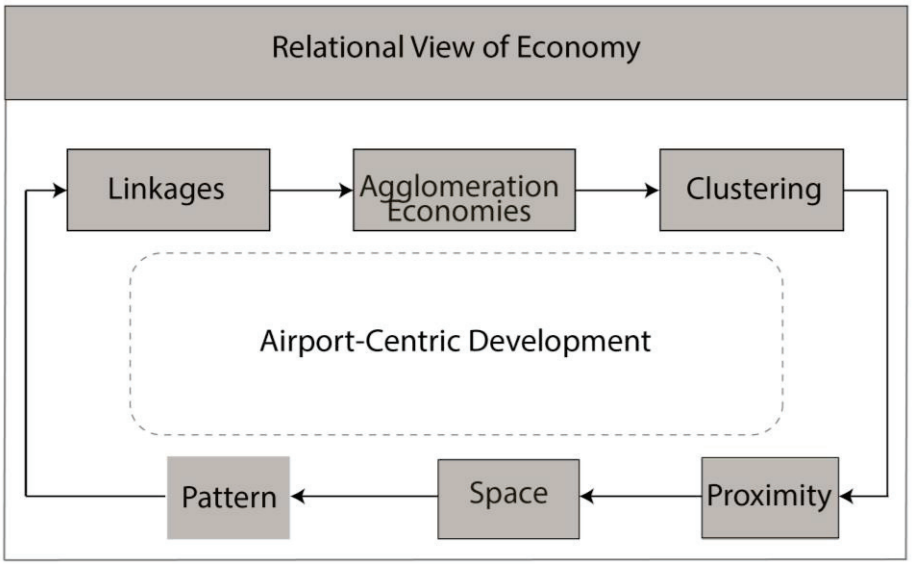

Figure 1. Conceptual foundation for analysing the environs of airports.

Although agglomeration economies have received considerable and diverse attention throughout history, the seminal work of Parr [23] arguably presents the most comprehensive dissection of the concept, which is understood to consist partly of internal economies and partly of external economies. The economies that are internal to the firm are controlled by that firm concerned and are not directly influenced by the activities of other firms. These are typically classified into economies of scale and of scope. The concept of internal economies of scale, also referred to as economies of horizontal integration, denotes benefits to the firm that result from increases in the extent of its operations. Internal economies of scope (lateral integration) are realized because of the firm's diversity of products and/or services. The notion of economies of scope is based upon the logic that an undertaking by a firm of two or more activities could happen more efficiently than would be the case if different firms performed such activities [23–25]. It is important to note that agglomeration economies based on internal economies do not necessarily result in the spatial concentration of firms but typically result in the individual firms involved becoming large [23].

Unlike internal economies, external economies are influenced by the actions of other associated firms and are beyond the total control of the individual firm [23]. External economies comprise localization economies, urbanization economies and activity-complex economies. Localization economies emanate from the common location of independent firms in the same economic sector or industry [26–28]. Though external to the firm, these economies are internal to the industry [23]. Agglomeration economies of this nature were advanced by Marshall [29], and they formed the foundation for what is known as industrial districts. Urbanization economies are typical of diversified urban areas, and they result from the common location of firms involved in different activities [27–30]. For instance, urbanization economies could result from the use of transport infrastructure [31], such as airports. Urbanization economies, which are external to the individual firm and the industry or sector, are internal to the urban concentration area [32]. It is argued that urbanization economies may be interpreted as economies of scope, that is, as benefits emanating from the scope or diversity of products and services within the urban concentration area [23]. Activity-complex economies result from the common location of a set of firms that exist in a production or service provision chain, which forms an activity complex. These economies are primarily a function of the interrelatedness of firms. In this regard, a firm has backward or upstream linkages to the firms supplying it and forward or downstream linkages to the firms it supplies. Activity-complex economies are external to the individual firm but internal to the complex or concentration to which it belongs [23].

Linkages, which denote the flows of information, materials and/or services between firms and within a firm, are essential for the realization of agglomeration economies highlighted previously. The linkages of a firm can be classified into three categories, the first two of which are backward linkages, which provide goods and/or services as input to the firm's activities or output, and forward linkages, which provide links with the customers buying its products or services. Backward and forward linkages are synonymous with upstream and downstream linkages, respectively. If businesses are connected through an input–output (buyer and supplier) structure, the downstream industry forms the market for the upstream industry [33–36]. Therefore, the firms in a vertical arrangement are partners and collaborators [33]. The third category pertains to horizontal, lateral or sideways linkages, which are interactions with other firms involved in the same processes that share customers and technology [34]. The horizontal dimension thereby consists of economic agents who share the market [33]. All in all, the concept of linkages used in the paper refers to the flow of information, materials and services in accordance with the categories of forward, backward and lateral linkages as well as linkages within a firm.

The existence of linkages and the resultant agglomeration economies can result in the clustering of firms. Two interrelated categories of clustering, which are differentiated by spatial proximity, can be discerned in the literature. In the first interpretation, clusters are defined as linked firms located in the same geographical area à la Porter [34]. These are regarded as spatial clusters. The literature has identified different groupings of spatial clusters, which include the pure agglomeration model, industrial-complex model and social-network model [36]; they also include Marshallian and Italianate industrial districts, hub-and-spoke industrial districts, satellite platforms and state-anchored industrial districts [37].

In the second interpretation of organizational clustering, clusters are understood as firms that are linked, regardless of their separate geographical locations. The paper adopts the position that clustering can be based on agglomeration economies that are internal or external to a firm. In terms of the internal dimension, when different units of a firm (such as headquarters, branches and production units) have functional linkages with each other, whether situated within the same geographical area, city, country or even across national borders, such a situation would be interpreted as an organizational cluster resulting from internal economies. There might, however, be instances in which the operations of the units of multi-locational firms are not dependent upon one another, implying weak (or an absence of) linkages [38].

As noted earlier in this section, the concepts of agglomeration economies, linkages and clustering are given substance by the equally elastic concepts of space, proximity and pattern. Unlike absolute space, which is essentially a fixed frame that contains economic agents and their activities, relative space is defined by the interrelations between economic agents [39,40]. In the relational understanding, space does not exist without linkages and underlying relationships [41]. Space cannot be comprehensibly understood without the concept of proximity or distance, where, generally, a distinction can be made between geographical and organizational proximity [42]. Although geographical proximity denotes the physical distance between actors, organizational proximity refers to the closeness of actors regardless of the physical distance between them (refer to the previous overview of spatial and organizational clustering). Finally, the activities of firms are understood to create particular patterns in absolute, relative or relational space. Traditionally, the geographical patterns in absolute space have comprised points, lines and areas, understood through the measures of, for instance, point pattern, nearest neighbour analysis and quadrant sampling [43]. In light of the relational view of space and proximity, this paper is inclined towards a position that the driving forces of airport-centric developments in general (and manufacturing firms in particular) may not create patterns that are mappable in geographical space.

The nuanced conceptual frame of reference above (amid the influence of transport infrastructure on economic development and a plethora of normative models of airport-led development) was used to inform the analysis and findings that this paper reports on.

3. Methods

3.1. Study Area

As alluded to in the Introduction section, the paper is based on the study area of the environs of Cape Town International Airport, South Africa (Figure 2). The study area comprised two levels of analysis, namely the landholding of the airport and the neighbouring industrial zones of Airport City and Airport Industria. Established in 1954, Cape Town International Airport is located in the City of Cape Town municipality, Western Cape province. As the second busiest airport in the country, Cape Town International Airport handled 40,943 tonnes of cargo in the 2020/2021 financial year, a decline from 68,191 tonnes in the previous financial year [44] that was arguably because of COVID-19-related travelling restrictions. The area around the airport is one of the primary industrial nodes in the City of Cape Town municipality. This attribute makes it an appropriate focus area for investigating the connection between manufacturing firms and airports. The origins of the concentration of manufacturing in the vicinity of the airport can be traced to the 1970s and 1980s, when the government promoted industrial activity within the area by, for instance, zoning acres of land for industrial purposes [38].

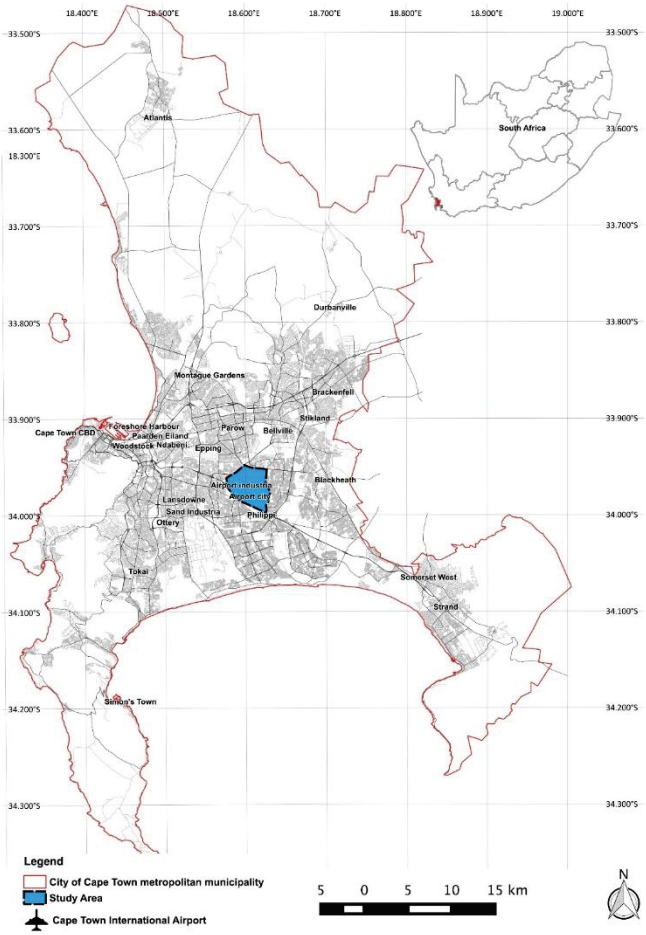

Figure 2. Study area within the broader context. Adapted from Mokhele and Mokhele [45].

3.2. Methods

3.2.1. Firm Database Collation

In preparation for the descriptive survey, manufacturing firms positioned in the vicinity of Cape Town International Airport were documented through the triangulation of the following secondary sources:

- The business database available on the Airport Industria City Improvement District's website [46], which contained information on the firms' business names, business

street addresses and telephone numbers [38]. Manufacturing firms were identified from a generic database on the website through the description of activities conducted by the firms, i.e., manufacturing;

- Microsoft Excel spreadsheet obtained from the City of Cape Town municipality, which contained information on the firm names, types of economic activity conducted, contact details and physical addresses of manufacturing firms situated in Airport Industria;
- Google Maps, which entailed manually clicking and viewing the details of the firms listed online [38];
- Company websites, where available, were used to cross-check the information obtained from the Airport Industria website, the City of Cape Town industrial study and Google Maps.

Following the data cleaning and verification processes, 67 manufacturing firms were catalogued using a combination of the four sources mentioned above. The requisite information was captured on Microsoft Excel and consolidated into a single database that contained details on each firm's business name, physical address and telephone number. The physical addresses were subsequently used to create a geographical information system (GIS) shapefile of all manufacturing firms within the study area. This was done to aid the visual depiction of the geographical distribution of the firms, as presented in the Findings section.

3.2.2. Descriptive Survey

The study hinged on a descriptive survey approach, which intends to learn about a population by analyzing a sample [47]. However, because it is unnecessary to sample a population of fewer than 100 elements [47], an attempt was made to interview the representatives of all 67 manufacturing firms within the study area. Primary data were collected in November 2021 using a process in which, depending on their willingness to participate, the firms' representatives were asked to respond to a structured questionnaire containing a range of open- and closed-ended questions. The questionnaire contained 31 questions that can be grouped into three main categories, as summarized in Table 1.

Table 1. Main elements of the questionnaire.

Data Categories	Specific Data Required
General characteristics and locational behaviour	Description of the firm's manufacturing activities
	Ownership of the firm's premises
	Year of establishment
	Location-choice reasons
	Number of employees
Use of the Cape Town International Airport	Shipping and receiving of cargo through the airport
	Frequency of shipping or receiving goods through the airport
Interactions with other companies	Interactions with the neighbouring firms
	Importance of face-to-face meetings
	Use of subcontractors
	Location of the subcontractors
	Origin of the firm's inputs
	Destination of the firm's outputs

With each interview lasting a maximum of 10 min, the researcher asked for employees who occupied senior positions or owners of the firms, as they were the ones who would know the information required.

Although face-to-face interviewing was the preferred data collection technique, some firm representatives requested that the researcher leaves the questionnaires so, in the man-

ner of self-administered questionnaires, they would complete them when an opportunity arose. To complement face-to-face interviews and self-administered questionnaires, the researcher conducted telephonic interviews with some representatives of the manufacturing firms that were not available for face-to-face interviews and did not state a preference for the self-administered option. In addition to being comparable to face-to-face interviews, telephonic interviews save time and are cheaper to conduct [48,49].

Of a population of 67 manufacturing firms, 23 participated in the survey using the three data collection techniques mentioned above. This response rate represented 33% of the manufacturing firms' population near Cape Town International Airport. This response rate, however, makes the study susceptible to non-response bias [50].

3.2.3. Data Analysis

This study undertook two forms of analysis: basic statistical analysis (frequency distributions) conducted in Microsoft Excel and spatial analysis. Spatial analyses (comprising kernel density and buffer analysis) were undertaken through ArcGIS to determine the geographical patterns of manufacturing firms in the vicinity of CTIA. Kernel density was employed to establish and visually depict the intensity of manufacturing firms in the vicinity of the airport. Kernel density calculates the density of manufacturing firm points employing a prescribed bandwidth where the value is highest at the location of a particular point and decreases with the increasing distance from that point [47]. The buffer technique was employed to establish the geographical proximity of the manufacturing firms to the airport.

4. Findings

4.1. Composition and Overview of the Manufacturing Firms

Manufacturing firms were not evenly distributed across the study area. Most firms were situated in Airport Industria, followed by a few in Airport City, whereas three firms were located on the landholding of Cape Town International Airport. However, it is noted in Figure 3 that the density of the manufacturing firms was higher in Airport City, followed by Airport Industria north and south of the Airport Approach Road. While noting that the representatives of 23 firms participated in the survey, Figure 3 displays the locational pattern of the population of 67 manufacturing firms.

To establish the mix of the manufacturing firms in the vicinity of the airport, the firms were, as informed by the information gathered from the survey interviews, grouped into the applicable divisions of the South African Standard Industrial Classification (SIC) [51]. Table 2 reflects the diversity of business activities of the manufacturing firms in the vicinity of Cape Town International Airport, which range from wood products manufacturing to fabricated metal products manufacturing. The findings show that there was no unique manufacturing specialization in the vicinity of the airport.

It was also imperative to analyze the size of the manufacturing firms, where the number of employees was used as a proxy for size. The Republic of South Africa [52] proposes the following categories of the size of manufacturing establishments: micro (up to 5 employees); very small (up to 20 employees); small (up to 50 employees); and medium (up to 200 employees). It was discovered that 22.7% of the firms employed fewer than 10 people; a similar number of the firms (constituting 22.7%) employed fewer than 20 people; 18.2% employed between 30 and 40 people. Only a minute number of the firms (9.1%) were medium-sized and had between 100 and 150 employees. The findings show that the majority of the firms (about 45%) employed between 1 and 19 people, providing evidence that most manufacturing firms located in the vicinity of Cape Town International Airport were very small.

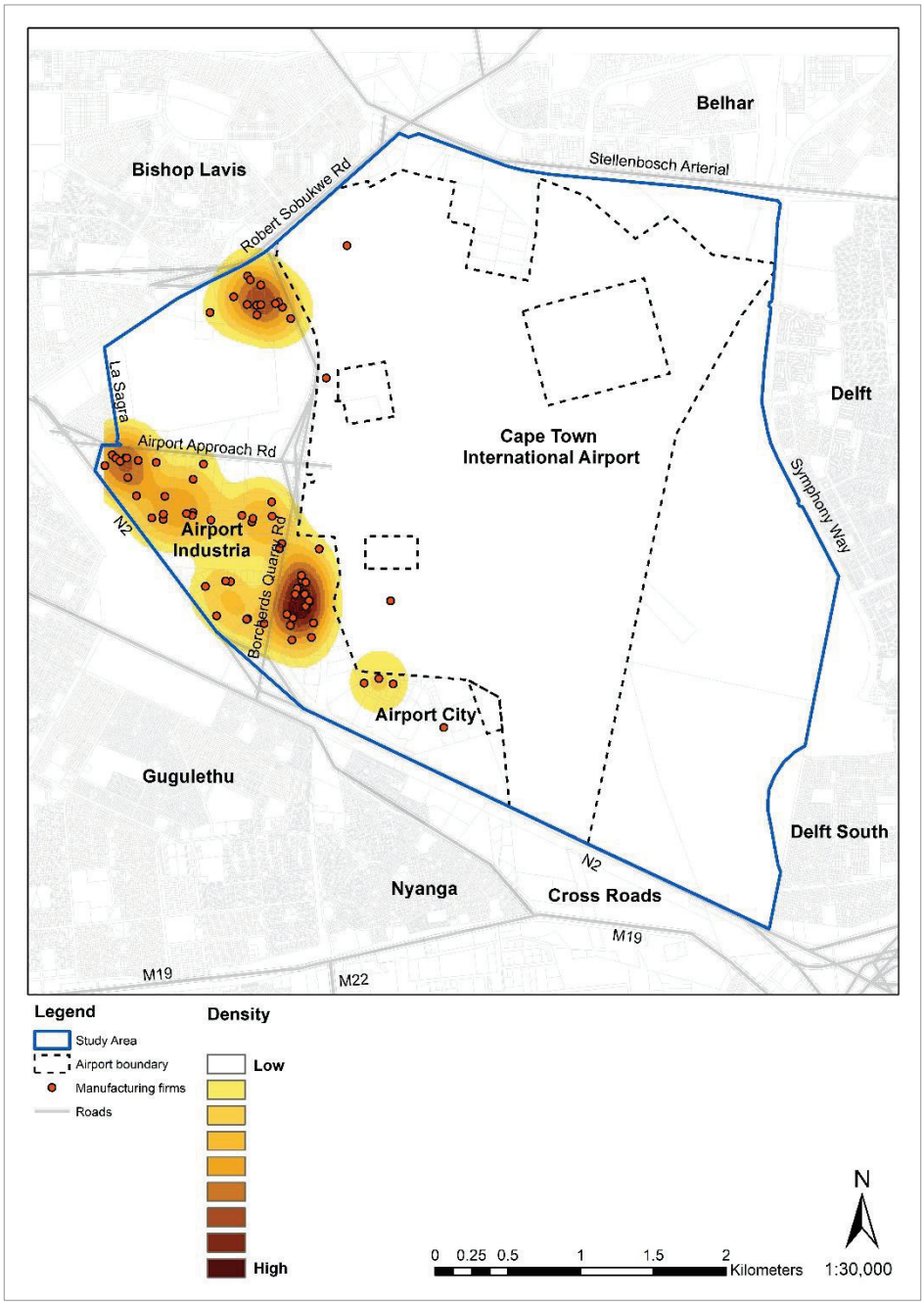

Figure 3. Spatial distribution of manufacturing firms.

Against the backdrop of the size of the manufacturing firms, the majority of the firms (54.5%) confirmed that they did not have multi-office structures, and the remaining firms (45.5%) stated that they had multi-office structures. Per the previous discussion on the size of firms, the findings provide evidence that manufacturing firms in the environs of Cape Town International Airport were predominantly (very) small stand-alone establishments.

It was discovered that the significant majority (70%) of the manufacturing firms with multi-office structures were branches, 20% were subsidiary firms and 10% were head offices. As most of the firms around the airport were branches, it can be interpreted that they were possibly linked to their headquarters and other branches located elsewhere. It was discovered that 31% of the headquarters of the branch firms around the airport were located across different provinces of South Africa; 9.1% of the firms were subsidiaries

whose parent firms were located outside South Africa. The findings show that the presence of multinational companies was limited in the vicinity of Cape Town International Airport.

Table 2. Mix of manufacturing firms located around Cape Town International Airport.

SIC Manufacturing Subcategories	Number of Firms	Percentage
Manufacture of wood, wood products and cork	2	8.7%
Manufacture of food products	2	8.7%
Manufacture of other non-metallic mineral products	2	8.7%
Manufacture of computer, electronic and optical products	1	4.3%
Manufacture of machinery and equipment	2	8.7%
Manufacture of furniture	1	4.3%
Manufacture of chemicals and chemical products	1	4.3%
Manufacture of textiles	1	4.3%
Manufacture of rubber and plastic products	3	13%
Manufacture of other transport equipment	1	4.3%
Manufacture of motor vehicles, trailers and semi-trailers	1	4.3%
Manufacture of chemicals and chemical products	1	4.3%
Manufacture of fabricated metal products	1	4.3%
Other manufacturing	4	17.4%
Total	23	100%

Communication between the branches and their headquarters as well as between subsidiaries and their parent firms was analyzed to ascertain the frequency of intrafirm linkages essential for the internal economies discussed in the Literature Review section. The findings reveal that 40.9% of the branches and/or subsidiaries communicated with their headquarters daily, and 31.8% of the branches communicated with other branches daily. This shows the existence of dense intrafirm linkages that are not contained by the geographical space and physical distance between head offices and branches.

4.2. Linkages, Agglomeration Economies and Clustering

4.2.1. Linkages with the Airport

The linkages between the manufacturing firms and the airport, in part, ascertain the airport's significance on the placement and operations of the firms and the potential existence of urbanization economies. Table 3 shows that over half (56.5%) of the manufacturing firms used Cape Town International Airport for airfreight purposes.

Table 3. Manufacturing firms that used Cape Town International Airport.

Manufacturing firms	Number	Percentage
Firms that use the airport	13	56.5%
Firms that do not use the airport	10	43.5%
Total	23	100%

Figure 4 shows that most firms that used the airport for airfreight purposes were positioned within a 1–2 km radius of the airport.

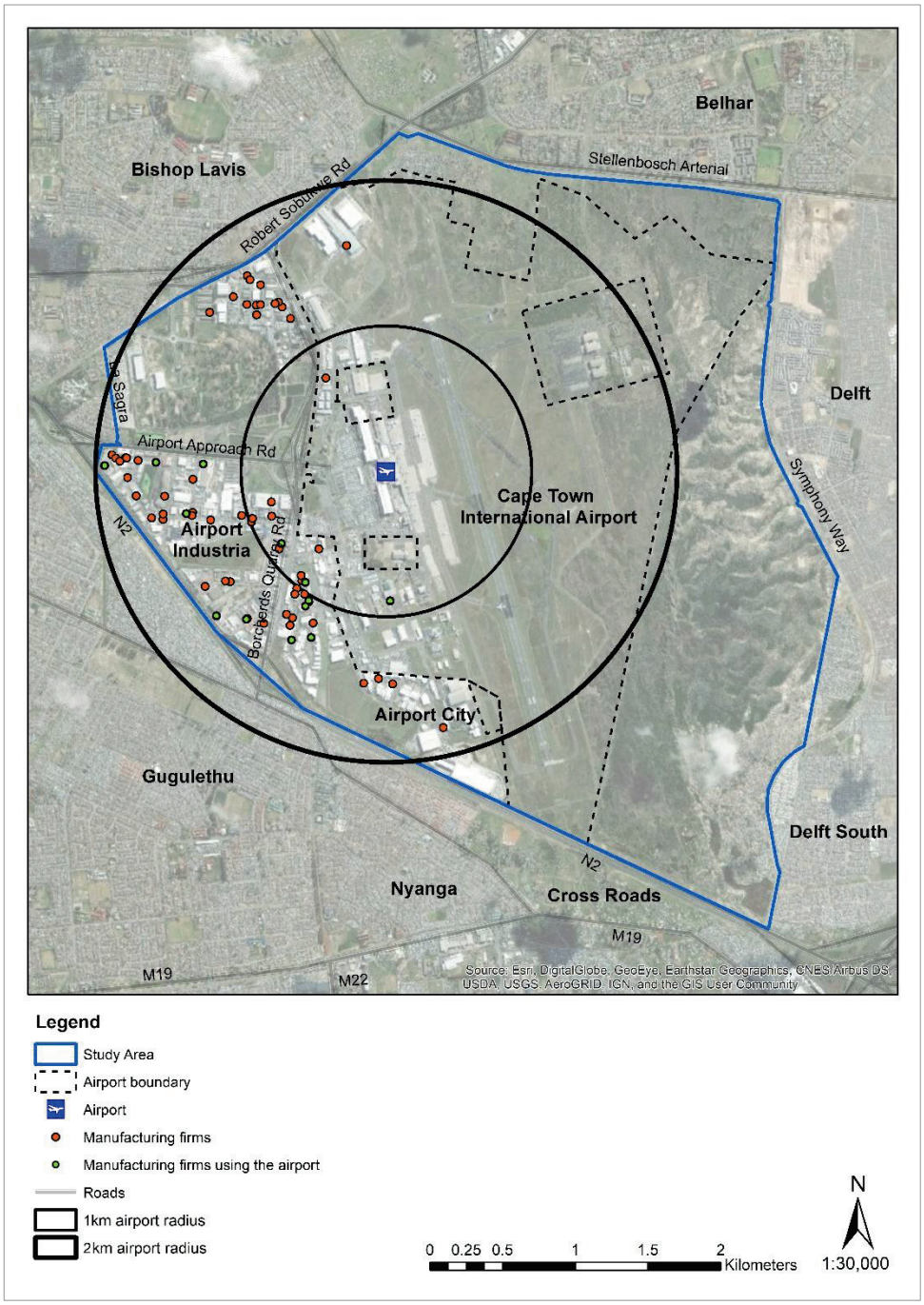

Figure 4. Manufacturing firms that use the airport for airfreight purposes.

Of the firms that used the airport for airfreight purposes, 47.1% specifically used it to receive raw materials or input to the manufacturing processes, whereas 52.9% specifically shipped their finished products through the airport.

Building upon this discussion, it was essential to analyze the frequency of the use of the airport in order to establish the level of the airport's significance on the operations of the manufacturing firms. Figure 5 shows that most firms (30.8%) received their raw materials and/or shipped their products through the airport at least every three months (quarterly), whereas a lower number of the firms (constituting 15.4%) used the airport daily, weekly, fortnightly and yearly. A much smaller number of the firms (representing 7.7%) used the airport once per month. Given that the findings depict that a smaller number of the firms used the airport daily, weekly and fortnightly, it can be asserted that most manufacturing

firms did not use Cape Town International Airport regularly. The findings suggest that the manufacturing firms possibly interacted more regularly with suppliers, distributors and buyers through other modes of transport.

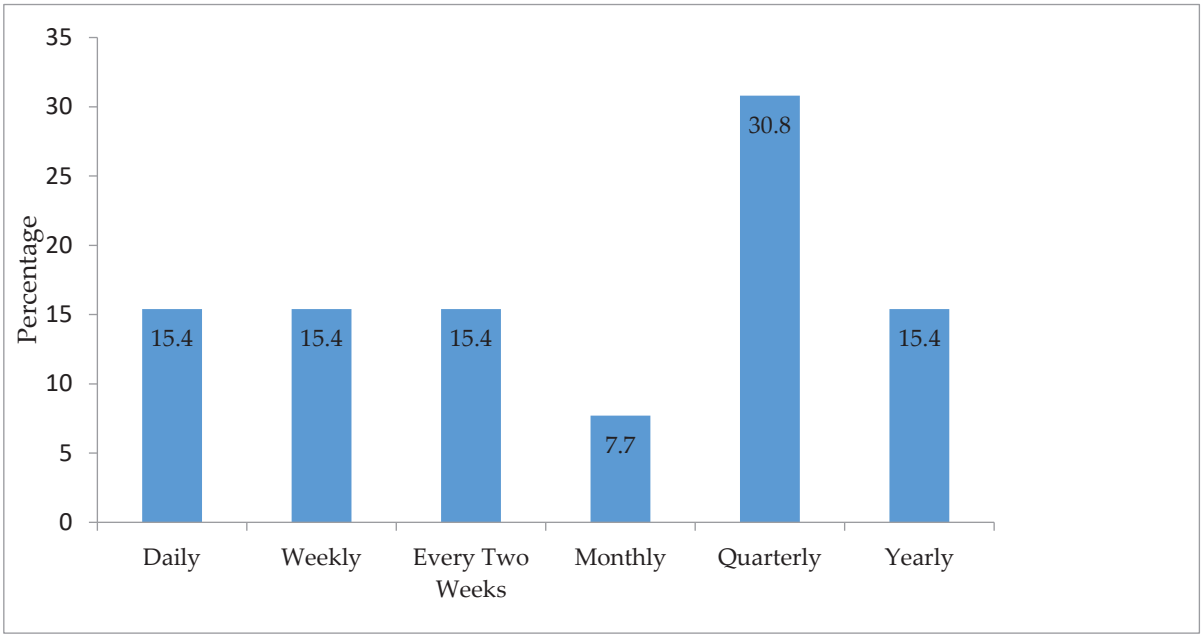

Figure 5. Frequency of airport use.

4.2.2. Linkages with Firms around the Airport and Elsewhere

As agglomeration economies depend upon linkages, it was crucial to analyze the inter- and intraindustry linkages of the manufacturing firms in the vicinity of Cape Town International Airport. The interaction between firms in the economy reflects a peculiar relationship involving a balance of competition and cooperation [53]. The findings reveal that the significant majority (78.3%) of the manufacturing firms located in the vicinity of the airport had business interactions with other companies that were situated within the study area, whereas a smaller number of the manufacturing firms (constituting 22.7%) confirmed that they did not have business interactions with their neighbouring establishments. These geographically close linkages within the study area show signs of a potential spatial cluster.

Despite the aforesaid dense business linkages within the study area, the findings reveal that face-to-face engagements were not strictly important in business interactions. Most firms (57.9%) did not value face-to-face engagements when conducting business with the neighbouring firms. Fewer than half of the firms relied on face-to-face interactions with the neighbours. The findings bring into question, at least in part, scholars who argue that face-to-face interactions are highly critical to the successful coordination of the economy [54].

The manufacturing firms confirmed that they had business interactions with the neighbouring firms in the following sectors: manufacturing, transportation, storage and logistics and wholesale and retail. As shown in Figure 6, more than half (54%) of the manufacturing firms had business connections with the neighbouring transport, storage and logistics firms, possibly for transporting the input and/or finished products. The literature notes a close relationship between the logistics sector and manufacturing, whose analysis is essential for improving the efficiency of the two sectors [55]. Historically, logistics activities were associated with manufacturing because logistics demand mainly came from the firms that needed to store their input and products [56].

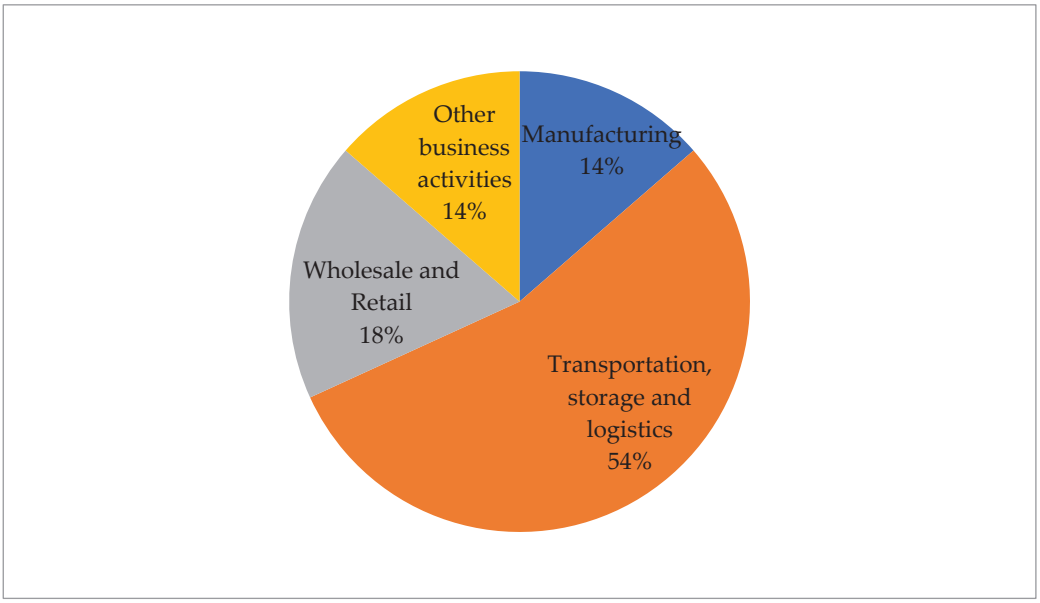

Figure 6. Business linkages of the firms located around Cape Town International Airport.

Approximately 14% of the firms noted that their business interactions were with the manufacturing firms located in the vicinity of the airport, depicting intraindustry linkages that could result in localization economies. As discussed in the Literature Review section, traceable to the seminal work of Marshall [29], localization economies are benefits that stem from the co-location of companies in the same industry [57]. In this regard, the business interactions of the manufacturing firms show possibilities of localization economies stemming from geographically proximate intraindustry linkages.

To elaborate on the findings presented in Figure 7, the intraindustry and interindustry interactions of the manufacturing firms located on and around Cape Town International Airport encompassed sales, marketing, procurement, transport and logistics and repairs and services. As shown in Figure 6, most (56.3%) of the interactions revolved around transport and logistics activities. Services and repair constituted 12.5% of the business interactions between the manufacturing firms and other firms in the airport's environs. Sales, marketing and procurement each constituted a small percentage (6.3%) of the interactions between manufacturing firms and neighbouring establishments.

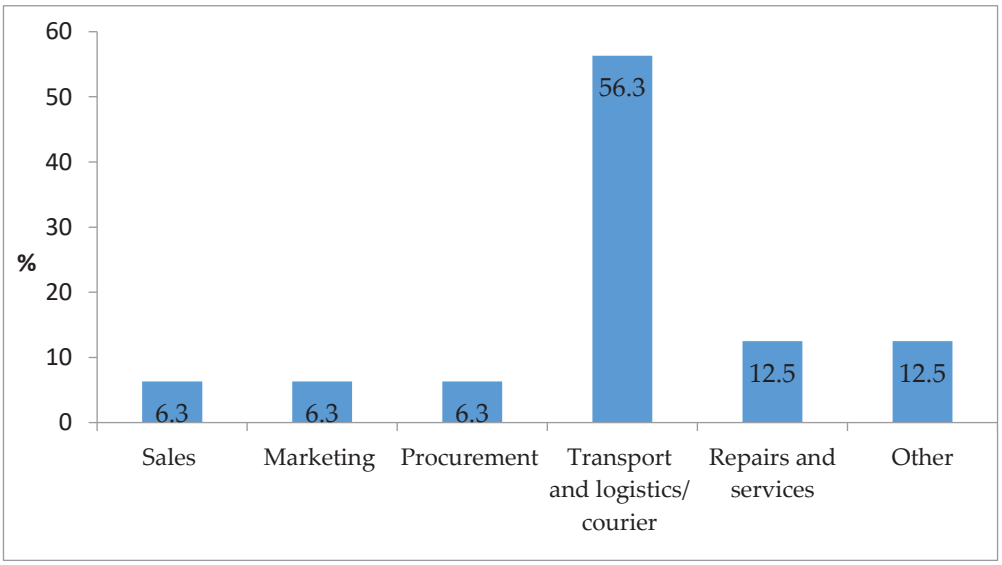

Figure 7. Nature of business interactions with neighbouring firms.

Only 17.4% of the manufacturing firms confirmed hiring employees from the surrounding firms, whereas most (82.6%) never hired employees from the neighbouring establishments. Similarly, 17.4% of the respondents confirmed losing some employees to their neighbouring counterparts. The findings show that the firms positioned within the same geographical location or within the same cluster may transfer knowledge, skills and even personnel from one organization to another. However, as most manufacturing firms did not hire employees from the neighbouring firms, it can be commented that the firms around the airport potentially utilized other means of knowledge-sharing instead of employing personnel from the neighbouring companies. This element is elaborated on below in the discussion about linkages/business interactions within the study area.

It was also pertinent to analyze the existence of subcontracting to, at least in part, decipher the extent of interfirm linkages of the manufacturing firms across different geographical scales. Kawasaki, cited in Kimura [58], defines subcontracting as the contractual relationship in which one firm conducts commissioned work under the dominant position of another firm. A popular strategy, subcontracting offers the involved parties benefits pertaining to cost savings [59]. By nature, subcontracting services between (large and small) firms enhance interfirm linkages that could contribute to developing industrial clusters or districts if the linkages occur within the same geographical area. As shown in Table 4, on the one hand, about 61% of the manufacturing firms subcontracted the services of other firms; on the other, 52% of the manufacturing firms located in the environs of Cape Town International Airport subcontracted their services to other companies.

Table 4. Subcontracting of services.

Subcontracting of Services	Yes Count and %	No Count and %	Total
Manufacturing firms that use services of other companies as subcontractors	14 60.9%	9 39.1%	23 100%
Manufacturing firms that subcontract their services to other companies	12 52.2%	11 47.8%	23 100%

The literature argues that firms in industry agglomerations are inclined to subcontract [58]; hence, it was essential to ascertain the location of the firms that subcontracted their services to the manufacturing firms on and around the airport and vice versa. Most subcontracted firms (47.4%) were located elsewhere in the City of Cape Town municipality, and 21.1% were located within the study area, showing signs of spatial clustering. A small number (constituting 5.3%) of the subcontracted manufacturing firms were outside South Africa (Table 5). It is noted that the manufacturing firms located in the environs of Cape Town International Airport were more related (i.e., from a subcontracting point of view) to the firms that were located elsewhere in Cape Town and thereby valued geographical proximity more at a metropolitan scale as opposed to the environs of the airport.

Table 5. Location of the subcontracted firms.

Location	Count	Percentage
In and around Cape Town	4	21.1%
Elsewhere in Cape Town	9	47.4%
Elsewhere in the Western Cape province	2	10.5%
In other provinces	3	15.8%
Outside South Africa	1	5.3%
Total	19	100%

As shown in Figure 8, the majority (38.1%) of the firms that subcontracted the services of the manufacturing firms in the vicinity of Cape Town International Airport were located elsewhere in the City of Cape Town municipality, and 23.8% of the firms were situated in other provinces of South Africa. A small number (9.5%) of the firms that subcontracted the services were located within the study area, whereas 14.3% of the manufacturing firms that subcontracted the services of the manufacturing firms were located outside South Africa. Similar to the previous discussion, the findings show the possibility of subcontracting-related agglomeration at a metropolitan or municipal scale.

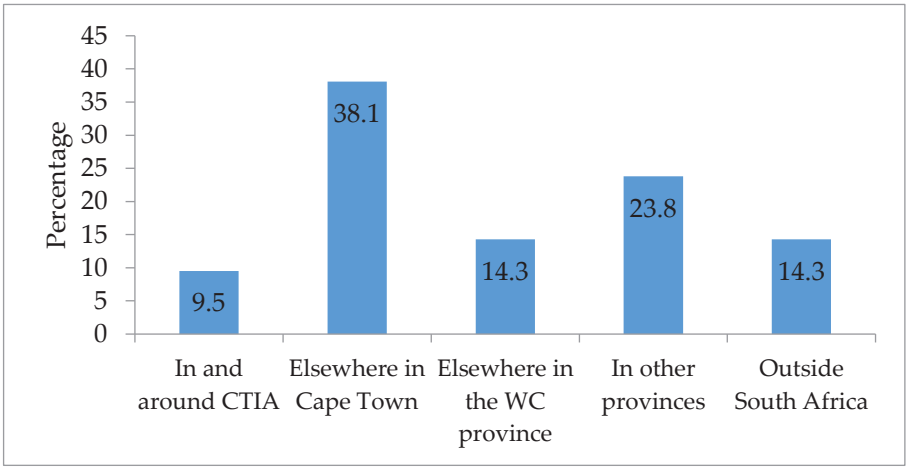

Figure 8. Location of the firms that subcontract the services of the manufacturing firms.

It was also crucial to analyze the backward and forward linkages of the manufacturing firms. The analysis uncovered that the majority (33.3%) of the manufacturing firms located in the environs of Cape Town International Airport obtained their inputs predominantly outside South Africa, 26.2% of the manufacturing firms obtained their inputs from areas within the City of Cape Town municipal area, 21.4% of the firms obtained their inputs from other provinces and a smaller number of the firms (constituting 7.1%) obtained their input from the firms located on and around Cape Town International Airport (Figure 9). The findings show that geographical proximity is not a determinant, as most of the firms sourced their inputs from geographically distant locations extending beyond the borders of South Africa. This could partly explain the linkages between the firms and the airport while acknowledging that the input or output from other countries may be transported through road and sea-based modes of transport.

In terms of the destination of the output of the manufacturing firms, the findings presented in Figure 10 show that most firms (24%) sent their output to other provinces of South Africa, namely Gauteng and KwaZulu-Natal, and 23% of the firms within the study area sent their products to other places within the Western Cape province. This shows that geographical proximity was not a significant factor, as only 11% of the firms confirmed that their products were delivered within the study area. The foregoing findings on the source of input and destination of final products, in part, negate the assertion that, regarding industries that are vertically linked through an input–output structure, the upstream industry is drawn to areas where there are many downstream firms [29]. Venable's [29] assertion is based on the influence of demand linkages and cost linkages on the placement of firms. Unlike in the case of the source of inputs, notably, no manufacturing firms located in the environs of the airport indicated that they sent their products to other countries.

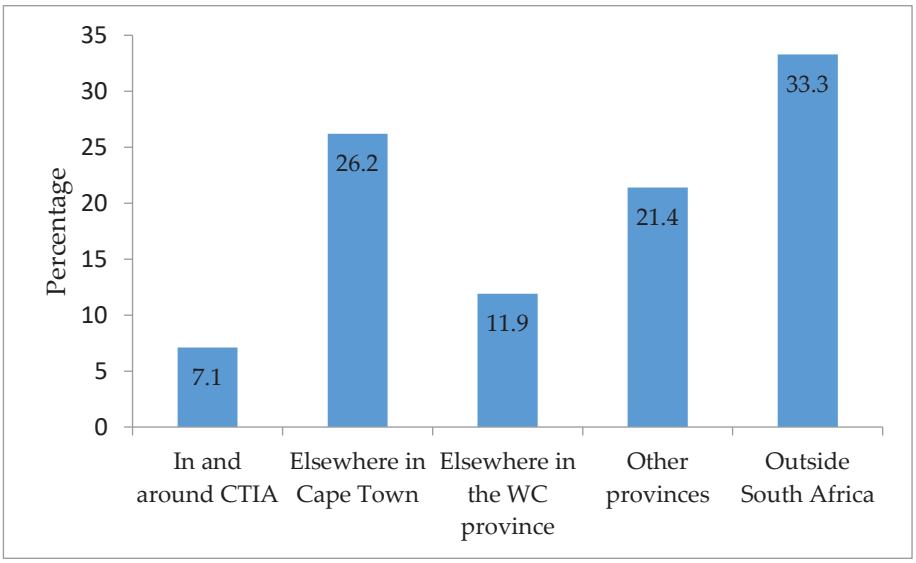

Figure 9. Origin of the inputs used by the manufacturing firms.

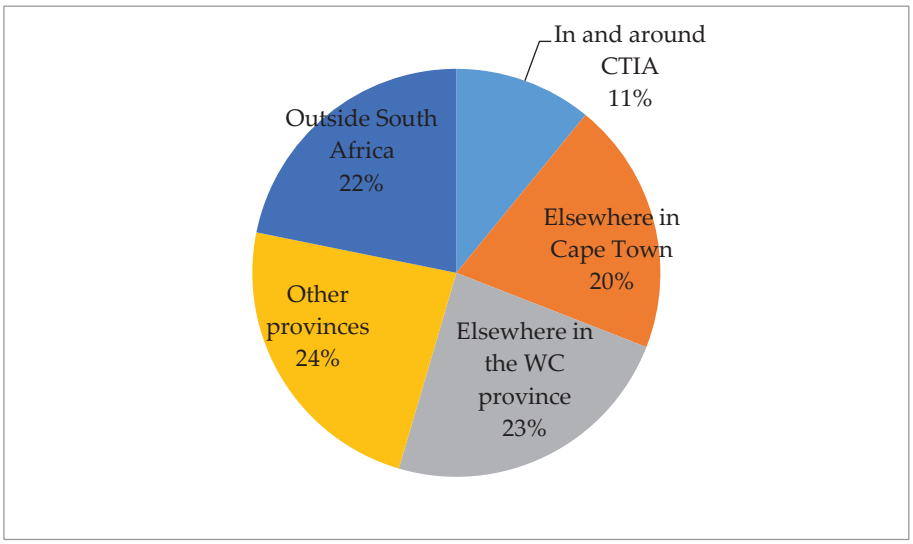

Figure 10. Destination of output.

4.3. Locational Behaviour

As shown in Figure 11, one representative (constituting 4.8%) confirmed that their firm was established in the study area in the early 1900s before Cape Town International Airport (formerly called DF Malan) was opened in 1954. It should, however, be noted that, notwithstanding this response, other studies [38] report that even in 1958 after the airport's opening, there was no urban development within the study area. Another firm (representing 4.8%) confirmed it was established on the premises between 1950 and 1969. Furthermore, 9.5% of the manufacturing firms were established at their premises between 1970 and 1989. Most of the firms (42.9%) were located at their premises between 1990 and 2009, whereas 38.1% were located there between 2010 and 2021. Providing a partial explanation of these findings, though not explicitly referring to manufacturing firms, Mokhele [38] notes that a large part of Airport Industria was developed in 2000, and at the time, Airport City, which is to the south of the airport, was not yet established. The findings thereby reveal that manufacturing firms are relatively young regarding the year of location at the current premises in the vicinity of the airport.

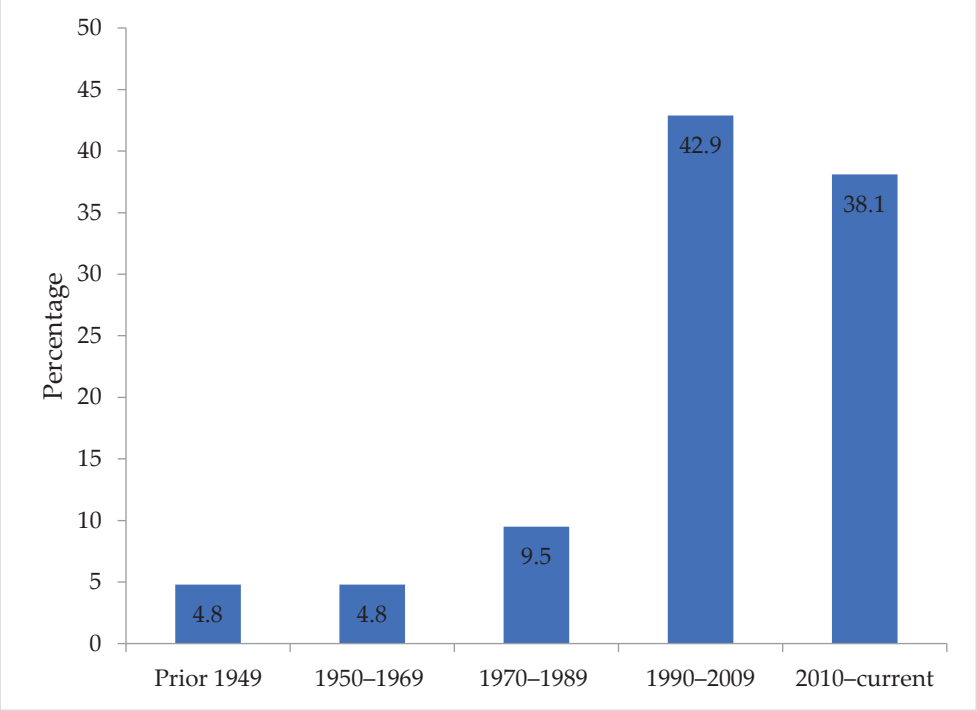

Figure 11. Years of the establishment of manufacturing firms around Cape Town International Airport.

More than half (54.5%) of the respondents of the manufacturing firms confirmed that prior to being located on their current premises, their firms were located elsewhere, whereas 45.5% of the firms reported that they had always been situated in the vicinity of Cape Town International Airport. It should be noted that among the firms that were previously located elsewhere, a significant majority (75%) used to be situated in other industrial sites or business premises within the City of Cape Town municipal area, whereas 25% were previously located at other premises within the study area, which reflects some stickiness of the study area and the municipal area. Stickiness is defined as the ability of an area to attract and, most importantly, retain businesses [31].

Table 6 shows that most manufacturing firms (60%) relocated from the previous premises because they lacked adequate space to run their business operations efficiently. For instance, some respondents cited inadequate storage facilities at their previous premises. Additionally, 10% of the representatives of the manufacturing firms pointed out that they moved from their previous premises because they had acquired land to build their infrastructure. The other 10% of the respondents moved from their previous locations because they wanted their companies closer to freight distribution companies near the airport. Another 10% of the firms explicitly noted that they moved to the current sites because they wanted to be closer to the airport, whereas the remaining 10% of the respondents chose the current sites because of other reasons.

In addition to the "push" factors from the previous locations above, it was crucial to investigate the "pull" factors that influenced the placement of the manufacturing firms in the vicinity of Cape Town International Airport. As shown in Figure 12, the majority (52.6%) of the manufacturing firms were attracted to their current location by the centrality of the study area, and 21.1% of the firms explicitly cited the advantages of being located close to Cape Town International Airport. In addition, 15.8% of the manufacturing firms noted that the study area was advantageous due to its proximity to significant local, regional and national road networks. A few (5.3%) of the firms pointed out that the current location was ideal because they were positioned geographically close to the concentration of freight distribution companies. In addition, the current premises had adequate space, which was required for their daily operations. It can be commented that most manufacturing firms

selected their locations not purely for airport-related reasons but primarily because of the centrality and accessibility of the study area. There were, however, nuances of preferring to locate close to airport-related firms.

Table 6. Reasons for relocation.

Reasons for Relocating	Count	Percentage
Acquired and/or built own premises	1	10%
Close to the airport	1	10%
Lack of space	6	60%
Close to freight companies	1	10%
Other	1	10%
Total	10	100%

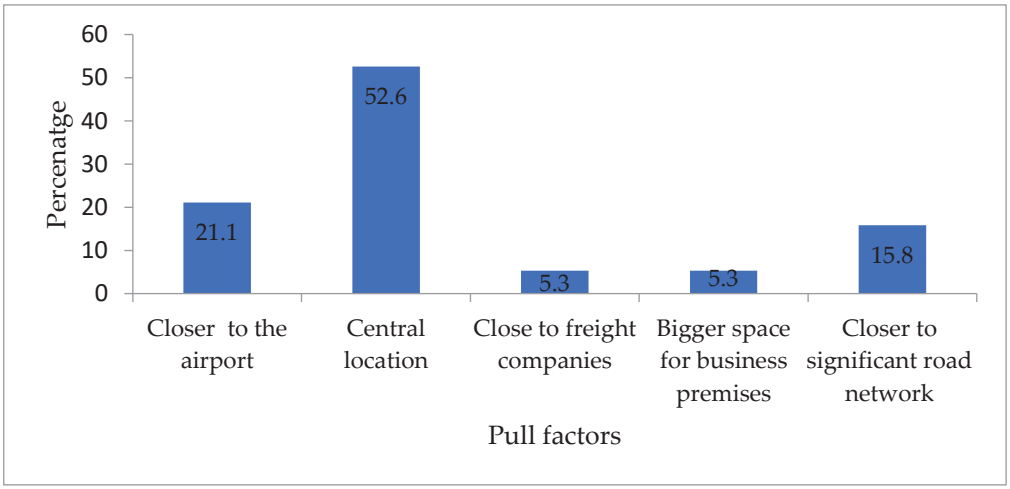

Figure 12. Advantages of the study area.

Although there were benefits that influenced the placement of the manufacturing firms, it was also crucial to investigate the disadvantages associated with the environs of Cape Town International Airport. As shown in Figure 13, 36% of the respondents confirmed that the study area was not ideal, as their firms were negatively impacted by traffic congestion and high rentals. In addition, 7% of the respondents pointed out that their firms were adversely affected by the noise from the aircraft landing and taking off. Another 7% highlighted security concerns in the study area. Notably, 14% of the respondents did not note any disadvantages, reflecting complete satisfaction with the study area.

To analyze the extent of the disadvantages of the study area, it was essential to ascertain areas the firms would move to in case they had to relocate from their current premises. Figure 14 shows that the majority (40%) of the firms preferred to relocate to other industrial sites across the City of Cape Town municipality, and 13.3% of the firms preferred to relocate to the neighbouring premises in the environs of Cape Town International Airport, i.e., they preferred to relocate from their current sites to other sites within the study area. A significant number (33.3%) of the manufacturing firms were satisfied with their location and had no intention of relocating, corroborating a high number that did not note disadvantages in the previous discussion. Meanwhile, 6.7% of the firms preferred to relocate to other provinces in South Africa, and the remaining 6.7% of the manufacturing firms preferred to relocate to other countries outside South Africa. The findings, once again, point to the stickiness of the study area and the metropolitan area wherein the firms preferred to move to areas within the municipality or not move at all.

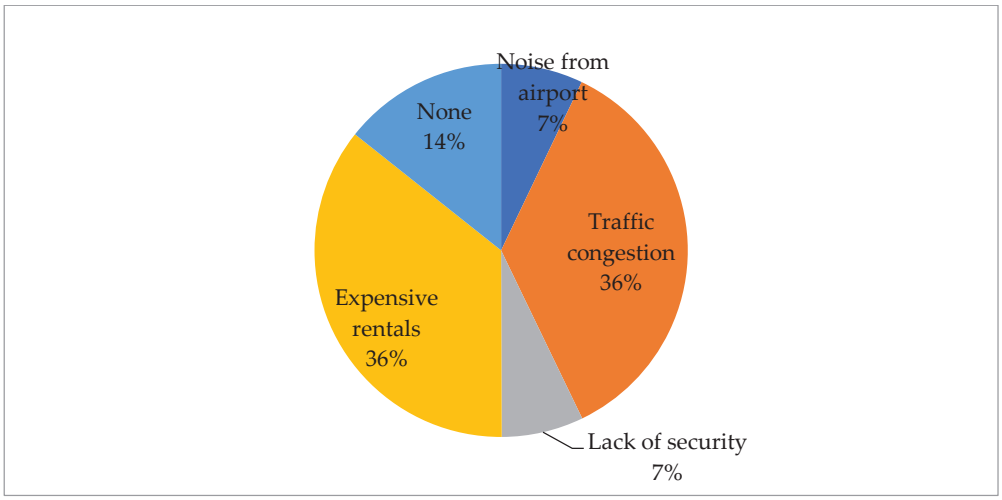

Figure 13. Disadvantages of the study area.

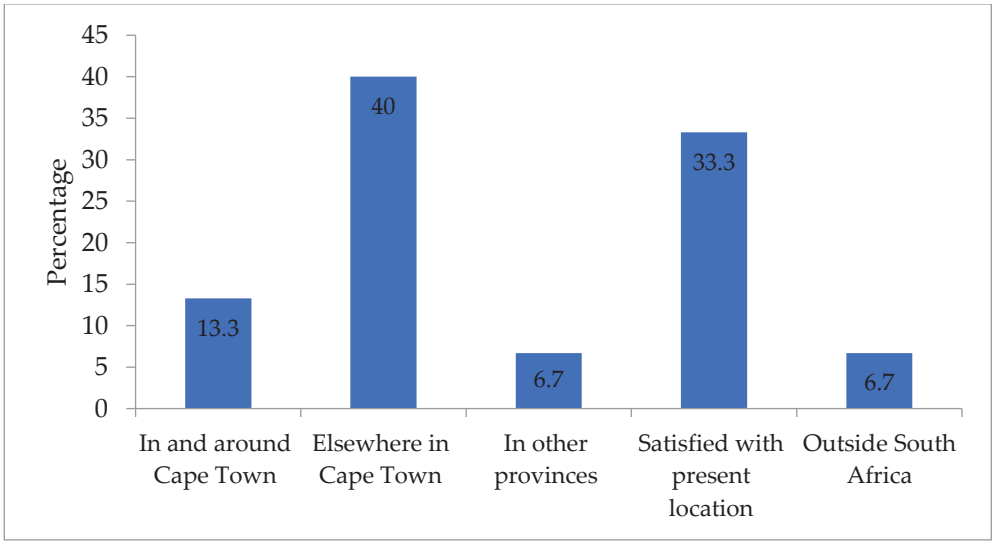

Figure 14. Preferred location if firms were to relocate from their premises.

5. Conclusions

Against the backdrop of the manufacturing-related literature that merely describes the land-use composition of airports and the environs, this article reports the findings of a spatial economic analysis of the manufacturing firms positioned near Cape Town International Airport, South Africa. In light of the intra- and interindustry linkages between the manufacturing firms and the neighbouring companies within the study area, it can be concluded that the concentration of manufacturing firms has signs of a spatial cluster. This cluster predominantly accommodates small firms that do not have multi-office structures and also young establishments with regard to the year of their placement within the study area. The airport appears to be part of the glue that binds the cluster, given that most firms use the airport for airfreight purposes (for transporting input to the manufacturing processes and/or the firms' output), albeit the frequency of use varied. Although some firms may not have direct linkages with the airport, they have linkages with those that utilize the airport for shipping purposes. Centrality and accessibility of the study area as well as the concentration of logistics-related firms were found to be the main factors that influenced the location-choice decisions of the manufacturing firms. The high rate of business interactions between manufacturing firms and logistics-related firms within the study area cements the importance of these factors. The study also discovered vital

signs of the stickiness of the environs of Cape Town International Airport, pertaining to the attractiveness of the study area and its ability to retain manufacturing firms.

In light of the study's findings, the municipality and relevant stakeholders are encouraged to explore the possibilities of harnessing the clustering of manufacturing firms in the vicinity of Cape Town International Airport, including supporting and augmenting the underlying intra- and interindustry linkages. The focus should not only be on the firms that have direct airfreight-related linkages with the airport but also on the firms that have indirect linkages with the airport by being associated with the airport-related firms. This nuanced consideration could, for instance, be used to inform planning guidelines or planning frameworks for placing manufacturing firms (and firms in associated economic sectors) in the vicinity of the airport. This approach would ensure that agglomeration economies are fully realized for the benefit of the firms positioned near the airport and for the economy of the municipality at large.

To shed further light on the topic, it is recommended that future studies analyze, among other factors, the institutional arrangements that influence the placement of manufacturing firms in the vicinity of airports. Combined with the findings reported in this paper, that analysis would provide policymakers with further insight into how to plan for industrial clusters or industrial districts in the environs of airports.

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References

1. United Nations Economic Commission for Africa. *Transformative Industrial Policy for Africa*; Economic Commission for Africa: Addis Ababa, Ethiopia, 2016.
2. Haraguchi, N.; Cheng, C.F.C.; Smeets, E. The importance of manufacturing in economic development: Has this changed? *World Dev.* **2017**, *93*, 293–315. [CrossRef]
3. Scott, A.J. *New Industrial Spaces. Flexible Production Organization and Regional Development in North America and Western Europe*; Pion Limited: London, UK, 1988.
4. Button, K.; Yuan, J. Airfreight transport and economic development. *Urban Stud.* **2013**, *50*, 329–340. [CrossRef]
5. Tveter, E. The effect of airports on regional development: Evidence from the construction of regional airports in Norway. *Res. Transp. Econ.* **2017**, *63*, 50–58. [CrossRef]
6. Gibbons, S.; Wu, W. Airports, access and local economic performance: Evidence from China. *J. Econ. Geogr.* **2020**, *20*, 903–937. [CrossRef]
7. Küçükönal, H.; Sedefoğlu, G. The causality of air transport and socio-economics factors: The case of OECD countries. *Transp. Res. Procedia* **2017**, *28*, 16–26. [CrossRef]
8. Keeble, D.E. Airport location, exporting, and industrial growth. *Town Ctry. Plan.* **1968**, *36*, 209–214.
9. Struyk, R.J.; James, F.J. *Intrametropolitan Industrial Location: The Pattern and Process of Change*; Lexington Books: Lexington, MA, USA, 1975.
10. Delaney, G. Electronics multinationals in the Cork region and Limerick/Shannon. *Ir. Geogr.* **1988**, *21*, 101–103. [CrossRef]
11. Giuliano, G.; Small, K. Subcentres in the Los Angeles region. *Reg. Sci. Urban Econ.* **1991**, *21*, 163–182. [CrossRef]
12. McMillen, D.P.; McDonald, J.F. Suburban subcentres and employment density in metropolitan Chicago. *J. Urban Econ.* **1998**, *43*, 157–180. [CrossRef]
13. Rogerson, C.M. High-technology clusters and infrastructure development: International and South African experiences. *Dev. South. Afr.* **1998**, *15*, 875–905. [CrossRef]
14. Sohn, J. Information technology in the 1990s: More footloose or more location-bound. *Pap. Reg. Sci.* **2004**, *83*, 467–485. [CrossRef]

15. Prosperi, D.C. Airports as centres of economic activity: Empirical evidence from three US metropolitan areas. In Proceedings of the REAL CORP 007, Vienna, Austria, 20–23 May 2007.
16. Mokhele, M. Spatial economic attributes of O.R. Tambo and Cape Town airport-centric developments in South Africa. *J. Transp. Supply Chain Manag.* **2018**, *12*, a344. [CrossRef]
17. Chen, L.; Olhager, J.; Tang, O. Manufacturing facility location and sustainability: A literature review and research agenda. *Prod. Econ.* **2014**, *149*, 154–163. [CrossRef]
18. Rahman, S.M.T.; Kabir, A. Factors influencing location choice and cluster pattern of manufacturing small and medium enterprises in cities: Evidence from Khulna City of Bangladesh. *J. Glob. Entrep. Res.* **2019**, *9*, 61. [CrossRef]
19. Kasarda, J.D. Aerotropolis. In *The Wiley Blackwell Encyclopedia of Urban and Regional Studies*; Orum, A., Ed.; John Wiley & Sons: Hoboken, NJ, USA, 2019. [CrossRef]
20. Huo, B.; Guo, M. How does an aerotropolis integrate? A case from Zhengzhou airport economy zone. *Logistics* **2021**, *5*, 26. [CrossRef]
21. Kasarda, J.D.; Canon, M.H. Creating an Effective Aerotropolis Master Plan. Regional Economic Review 5. 2016. Available online: http://aerotropolisbusinessconcepts.aero/wpcontent/uploads/2016/08/CreatingAnEffectiveAerotropolisMasterPlan2.pdf (accessed on 10 December 2022).
22. Mokhele, M.; Geyer, H.S. A theoretical foundation for investigating the spatial economic attributes of airport-centric developments. *Bull. Geogr. Socio-Econ. Ser.* **2021**, *54*, 21–31. [CrossRef]
23. Parr, J.B. Missing elements in the analysis of agglomeration economies. *Int. Reg. Sci. Rev.* **2002**, *25*, 151–168. [CrossRef]
24. Panzar, J.C.; Willig, R.D. Economies of scope. *Am. Econ. Rev.* **1981**, *71*, 268–272.
25. Miyazaki, T. Economies of scope and local government expenditure: Evidence from creation of specially authorized cities in Japan. *Sustainability* **2021**, *13*, 2684. [CrossRef]
26. Sohn, J. Industry classification considering spatial distribution of manufacturing activities. *Area* **2014**, *46*, 101–110. [CrossRef]
27. Baldwin, J.R.; Brown, W.M.; Rigby, D.L. Agglomeration economies: Microdata panel estimates from Canadian manufacturing. *J. Reg. Sci.* **2010**, *50*, 915–934. [CrossRef]
28. Fitjar, R.D.; Rodriguez-Pose, A. Nothing is in the air. *Growth Chang.* **2017**, *48*, 22–39. [CrossRef]
29. Marshall, A. *Principles of Economics: An Introductory Volume*, 8th ed.; Macmillan and Co.: London, UK, 1920.
30. Niu, Y.; Ding, C.; Knaap, G.-J. Employment centers and agglomeration economies: Foundations of a spatial economic development strategy. *Econ. Dev. Q.* **2014**, *29*, 14–22. [CrossRef]
31. Isard, W. *Location and Space-Economy*; The Massachusetts Institute of Technology Press: Cambridge, MA, USA, 1956.
32. Andersson, M.; Larsson, J.P.; Wernberg, J. The economic microgeography of diversity of specialization externalities—Firm-level evidence from Swedish cities. *Res. Policy* **2019**, *48*, 1385–1398. [CrossRef]
33. Malmberg, A.; Maskell, P. The elusive concept of localization economies: Towards a knowledge-based theory of spatial clustering. *Environ. Plan. A* **2002**, *34*, 429–449. [CrossRef]
34. Porter, M.E. *The Competitive Advantage of Nations*; Free Press: New York, NY, USA, 1990.
35. Venables, A.J. Equilibrium locations of vertically linked industries. *Int. Econ. Rev.* **1996**, *37*, 341–359. [CrossRef]
36. Gordon, I.R.; McCann, P. Industrial clusters: Complexes, agglomeration and/or social networks? *Urban Stud.* **2000**, *37*, 513–532. [CrossRef]
37. Markusen, A. Sticky places in slippery space: A typology of industrial districts. *Econ. Geogr.* **1996**, *72*, 293–313. [CrossRef]
38. Mokhele, M. Spatial Economic Attributes of Airport-Centric Developments in Cape Town and Johannesburg. Ph.D. Dissertation, Stellenbosch University, Stellenbosch, South Africa, 2016.
39. Friedmann, J.; Alonso, W. (Eds.) Part 1. Space and planning introductory note. In *Regional Development and Planning: A Reader*; The Massachusetts Institute of Technology Press: Cambridge, MA, USA, 1964; pp. 17–20.
40. Garretsen, H.; Martin, R. Rethinking (new) economic geography models: Taking geography and history more seriously. *Spat. Econ. Anal.* **2010**, *5*, 127–160. [CrossRef]
41. Massey, D. *For Space*; Sage: London, UK, 2005.
42. Boschma, R. Proximity & innovation: A critical assessment. *Reg. Stud.* **2005**, *39*, 61–74.
43. Coffey, W.J. *Geography: Towards a General Spatial Systems Approach*; Methuen: London, UK; New York, NY, USA, 1981.
44. Airports Company South Africa (ACSA). Integrated Annual Report. 2021. Available online: https://www.airports.co.za/Documents/ACSA%20IAR%202021.pdf (accessed on 19 January 2022).
45. Mokhele, M.; Mokhele, T. Spatial Configuration of Logistics Firms Relative to Cape Town International Airport, South Africa. *Logistics* **2022**, *6*, 49. [CrossRef]
46. Airport Industria CID (City Improvement District). Business Directory. 2021. Available online: www.airportcid.co.za (accessed on 2 October 2021).
47. Leedy, P.D.; Ormrod, J.E. *Practical Research. Planning and Design*, 11th ed.; Pearson: Boston, MA, USA, 2015.
48. Babbie, E. *The Practice of Social Research*, 9th ed.; Wadsworth: Belmont, CA, USA, 2001.
49. Sheskin, I.M. *Survey Research for Geographers*; Association of American Geographers: Washington, DC, USA, 1985.
50. Sedgwick, P. Non-response bias versus response bias. *BMJ* **2014**, *348*, g2573. [CrossRef]
51. Statistics South Africa. *Standard Industrial Classification of All Economic Activities (SIC)*, 7th ed.; Statistics South Africa: Pretoria, South Africa, 2012.

52. Republic of South Africa. National Small Business Amendment Act. The Presidency, Cape Town, South Africa. 2003. Available online: https://www.gov.za/sites/default/files/gcis_document/201409/a26-03.pdf (accessed on 20 January 2022).
53. Belussi, F.; Caldari, K. At the origin of the industrial district: Alfred Marshall and the Cambridge school. *Camb. J. Econ.* **2009**, *33*, 335–355. [CrossRef]
54. Storper, M.; Venables, A.J. Buzz: Face-to-face contact and the urban economy. *J. Econ. Geogr.* **2004**, *4*, 351–370. [CrossRef]
55. Yan, B.; Dong, Q.; Li, Q.; Yang, L.; Amin, F.U.I. A study of the interaction between logistics industry and manufacturing industry from the perspective of integration field. *PLoS ONE* **2022**, *17*, e0264585. [CrossRef] [PubMed]
56. Solis-Trapero, E.; Plaza-Tabasco, J.; Sanchez-Mateo, H.S.M. Recent evolution of spatial patterns of logistics activity in metropolitan contexts: The case of the urban region of Madrid. *J. Andal. Stud. (REA)* **2019**, *37*, 94–124. [CrossRef]
57. Claver-Cortés, E.; Marco-Lajara, B.; Manresa-Marhuenda, E. Types of agglomeration economies: Effects on business innovation. *Contemp. Econ.* **2016**, *10*, 217–232. [CrossRef]
58. Kimura, F. Subcontracting and the performance of small and medium firms in Japan. *Small Bus. Econ.* **2002**, *18*, 163–175. [CrossRef]
59. Holl, A. Production subcontracting and location. *Reg. Sci. Urban Econ.* **2008**, *38*, 299–309. [CrossRef]

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Review

Planning Tools to Revitalise Urban Vacant Land from Ecological Perspectives: A Systematic Review

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Abstract: Urban vacant land availability offers revitalisation opportunities in the form of improving ecological functions. However, less is known about the available planning tools with which to mobilise this effort. Hence, this systematic review adopts ecological perspectives to explore planning tools to revitalise urban vacant land. The search strategy employs Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines to track original research on vacant urban land from selected electronic databases. The search revealed thirty-six studies focusing on substance-oriented planning tools (indicator systems, Geographic Information System (GIS), models/simulations, field surveys, and experiments) and process-oriented tools (questionnaire surveys, the Delphi method, focus groups, and interviews). This review suggests that future studies adopt hybrid planning tools that combine the essence of substance- and process-oriented tools. Furthermore, as a framework, it recommends taking a stepwise approach at various planning stages to revive vacant land. Additional studies from the perspective of growing cities are necessary to provide insights into urban vacant land revitalisation planning, considering the competing objectives of economic prosperity and green space preservation.

Keywords: urban vacant land; planning tools; vacant land revitalisation; vacant land planning; urban green spaces

1. Introduction

As part of the urban fabric, vacant land contains complex social-ecological patches that host multiple benefits; thus, transforming such land into green spaces could promote urban greening [1–3]. Several existing policies and programmes concerning vacant urban land revitalisation should be addressed. First, many municipalities have utilised city-specific policies and programmes and designated a unit to oversee this process and foster efficient intergovernmental cooperation [4,5]. A shrinking city's adaptation strategy must consider its slowing growth rate and shift attention to improving the standard of living for its populace [6]. Rightsizing can be accomplished, for example, by ensuring that a city's planning system is closely aligned with the needs of current and future communities so as to improve unstable markets and impoverished neighbourhoods [7]. Expanding green spaces in the form of community gardens, urban agriculture, and greenways is also central to urban greening strategies [8].

Densification has been proposed in Europe, in which most cities face urban sprawl, to improve the connectivity and accessibility of infrastructure and services. This strategy can be implemented through brownfield regeneration, urban renewal, vacant land redevelopment, and building vertical extension [9]. Infill development encourages mixed-use and social interaction, while preventing future land vacancies from spreading to the surrounding area [10]. Furthermore, the resulting compact urban fabric promotes spatial proximity by reducing reliance on transportation and promoting walkability [11].

Another aspect of vacant land revitalisation policy is encouraging community involvement in planning and management, particularly in the greening strategy in residential zones. Municipalities should maintain an extensive database of vacant land, complete with information about the land's classification and suitability for various uses, in order to inform the general public about the prospects for its potential use [12]. They can encourage partnerships with the public and private sectors to contribute to and fund community projects. In addition, decision-makers and community members can brainstorm repurpose ideas and discuss the challenges involved in establishing and managing vacant land [13]. This platform empowers diverse communities, especially marginalised and impoverished ones. Furthermore, putting vacant land to interim use offers a platform via which the neighbourhood can co-author social, cultural, and economic activities on undeveloped land [1,14,15]. Property owners gain several advantages from the conditional public use of their property, including subsidised land clean-up, tax exemptions, and lower maintenance costs [16]. Such initiatives may promote the creation of new green spaces, thereby enhancing residents' quality of life and the surrounding area's aesthetic appeal.

Planning tools help urban practitioners to gauge the landscape capacity of vacant lands and project their potential to improve urban ecosystem health. However, it is necessary to distinguish between the types of tools and their application in the planning processes. Planning tools are classified as substance-oriented, process-oriented, and hybrid [17]. Substance-oriented planning tools seek to investigate the urban environment's conditions and project the effects of spatial development. Geographic Information System (GIS) and urban models are examples of substance-oriented tools. Meanwhile, process-oriented tools promote the inclusion of experts and stakeholders in decision-making. Related dialogues are typically mediated through platforms such as focus groups and interviews to generate ideas and achieve consensus. Hybrid planning tools, on the other hand, combine elements of the substance- and process-oriented tools to build a feasible action plan. Within the context of reviving vacant land, there seems to be indecisiveness regarding the most appropriate approach. At the same time, previous studies have attested to the urban vacant land's potential to provide ecological qualities similar to those of formal urban green spaces, such as preserving biodiversity [18–22]. Consequently, this unity in terms of promoting urban greening provides an assumption for the current study, that the planning tools utilised by urban practitioners are similar within these differing contexts.

A great deal of research has focused on the application of tools in urban green space planning. For example, the GIS, as a tool, and remote sensing data have been widely used to map urban green spaces [23–25], detect green cover change [26–29], and map urban green space vegetation [30,31]. These urban greening studies mainly discussed the use of planning tools in managing formal green spaces, or green areas formally maintained by municipalities or other governing bodies. However, systematic reviews of planning tools to determine the ecological potential of vacant lands have been scarce. These include assessing the land conditions, exploring the land's ecological potential, and evaluating the overall performance of restored sites. Identifying the best planning tools with which to revive vacant land is crucial to attaining the benefits of the conservation and rehabilitation of these areas.

A recent review by Kim et al. [13] synthesised evidence of vacant land revitalisation through community engagement in shrinking cities. The study offered vital insights into several approaches to addressing land vacancy; however, the potential of other planning tools has yet to be systematically reviewed. This study seeks to address this gap. The method used for this study involves gathering relevant studies on a specific topic that fulfil the eligibility criteria to answer preformulated research questions [32]. In this review, the central task involved exploring constructive approaches to advocating for vacant land revitalisation from ecological perspectives. The focus was on planning tools that facilitate assessment, decision-making, and monitoring. The current study aims to:

(1) explore the present status of studies on planning tools to revive urban vacant land from ecological perspectives, and (2) develop a stepwise framework to revitalise vacant land.

2. Materials and Methods

2.1. Eligibility Criteria

This systematic review focuses on planning tools with which to revive urban vacant land from ecological perspectives. It defines urban vacant land as undeveloped or developed land that may host natural or planted vegetation, structures, or remnants of previous use. The authors' decision to focus on ecological approaches to reviving urban vacant land does not in any way disregard the equal importance of the economic and social spectrums. Rather, the goal is to seek opportunities to increase a city's resilience in the face of climate change through nature-based solutions. Enhancing the ecological values of vacant land creates a solid foundation for increasing urban resilience, securing cities from known and unprecedented climate change threats, and thus, promoting economic and social prosperity. This review also covered studies discussing general revitalisation with multiple planning objectives (environmental, economic, and social), as well as those that were without specific goals but did employ planning tools taken from ecological approaches.

2.2. Search Strategy and Keywords

The search strategy employed the 'Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)' guidelines by focusing on electronic databases, including Scopus and Science Direct (Figure 1). In August 2021, a systematic literature search was conducted to identify relevant studies according to the specified eligibility criteria. Keywords were utilised to represent urban vacant land ('vacant land', 'urban vacant land', 'urban vacant lot'), revitalisation efforts ('revitalisation', 'redevelopment', 'greening'), and ecological-themed phrases ('wildlife', 'urban wildlife', 'trees', 'vegetation', 'greening', 'soil', 'water', 'air', 'urban biodiversity', 'biodiversity', 'green corridor', 'blue corridor', 'green infrastructure'). Relevant studies were also retrieved using other methods, such as snowballing.

2.3. Study Selection Process

The initial database search identified 50 studies, which were further filtered to include only original research articles written in English and published between 2011 and 2021. This date range was selected because a previous general literature search on urban vacant land revealed that revitalisation efforts had gained traction during these years. After further screening, 12 studies from the database search and 24 studies obtained via other methods were selected for this review.

2.4. Data Extraction

Table 1 lists 36 studies utilising planning tools in different planning stages, including information on the author/s and study context (country).

Table 1. Selected studies on planning tools for vacant land revitalisation.

Planning Tools to Revitalise Urban Vacant Land												
			Substance-Oriented Tools					Process-Oriented Tools				
	Author/s	Country	GIS	Model/Simulation	Indicator System	Field Survey	Experiment	Focus Group	Interview	Delphi Method	Questionnaire Survey
Phase I Mapping and classification	[33]	USA	●								
	[34]	USA	●								
	[2]	USA	●								
	[19]	USA	●								
	[35]	USA	●			●					
	[36]	USA	●	●							
	[12]	USA	●			●					
	[37]	USA				●					
	[38]	USA	●								
	[39]	Ecuador									●
Phase II Decision-making	[40]	USA	●	●							
	[41]	USA		●							
	[42]	Canada			●						
	[43]	Canada		●							
	[44]	USA	●		●						
	[45] *	USA	●		●	●		●			
	[46]	USA	●	●							
	[47]	Brazil	●		●						
	[48] *	Canada		●		●					●
	[49]	China					●				
	[50]	USA	●		●						
	[10]	USA	●	●	●						
	[51]	USA	●								
	[52]	Germany	●	●							
	[53] *	Romania	●		●					●	
	[54]	USA	●	●							
	[55]	USA		●							
	[56]	Spain					●				
	[57]	USA					●				
	[58] *	Portugal		●					●		
	[59]	USA		●							
Phase III Monitoring	[60]	USA			●	●					
	[61]	USA		●	●	●					
	[62]	USA			●	●					
	[63]	USA						●			●
	[64] *	USA			●	●		●			
	Total		19	13	11	9	3	3	1	1	4

* Hybrid planning tools.

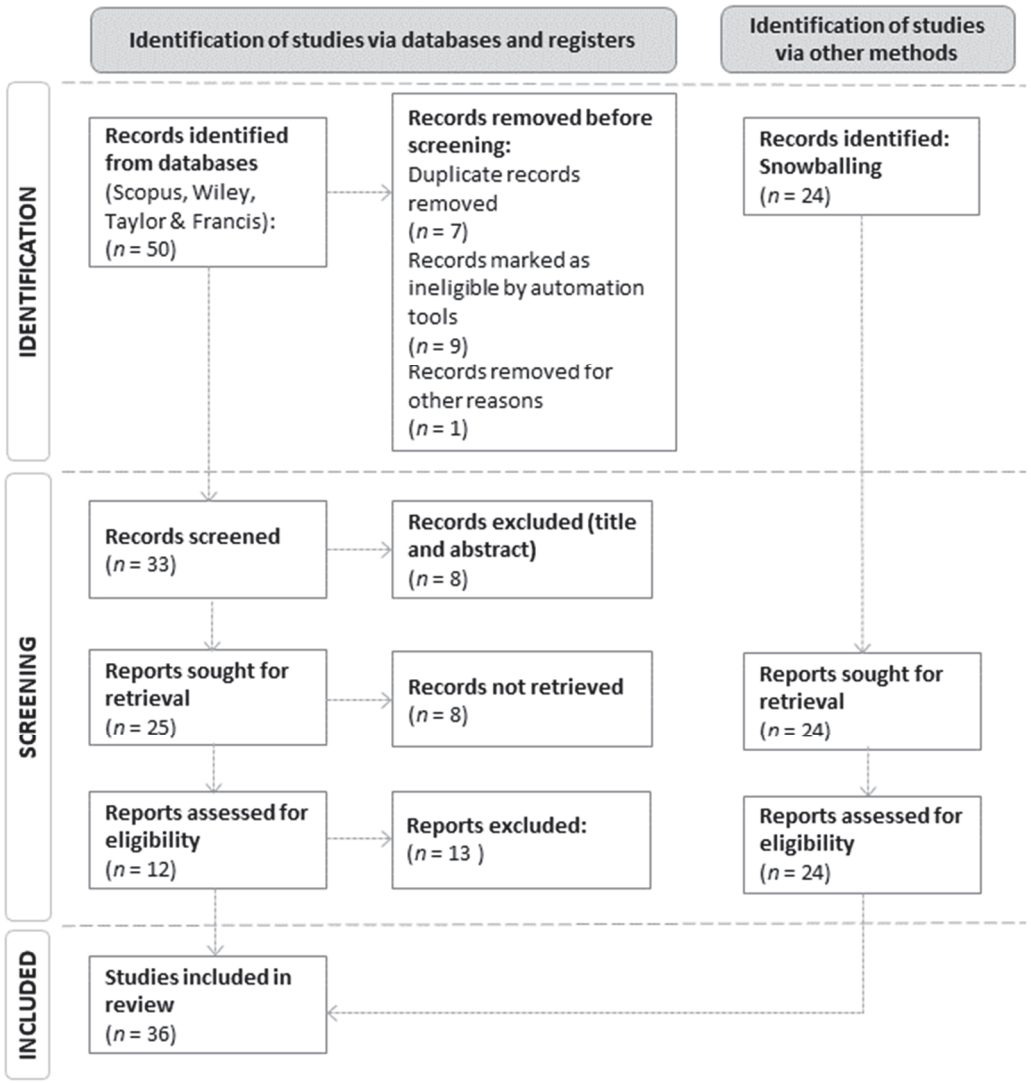

Figure 1. Flow chart of the systematic review process based on PRISMA guidelines.

3. Results and Discussion

3.1. Characteristics of the Studies

This review encompasses 36 studies discussing vacant land revitalisation planning tools. These studies covered planning tools that can be further classified as substance- and process-oriented tools (Figure 2). Substance-oriented planning tools are indicator systems, field surveys, GIS, models/simulations, and experiments. Majority of the studies utilised GIS (n = 19), followed by models/simulations (n = 13), indicator systems (n = 11), field surveys (n = 9), and experiments (n =3). Process-oriented planning tools include experts and community involvement using focus groups, the Delphi method, interviews, and questionnaire surveys. Two studies employed process-oriented tools with the community and expert involvement, and five used hybrid planning tools, combining the substance- and process-oriented tools.

3.2. Study Settings

Most of the studies were conducted in North America, with the majority originating from the United States (n = 26), and three were from Canada. The remaining studies were conducted in South America (n = 2), Europe (n = 4), and Asia (n = 1), in Shaanxi, China. Figure 3 represents the geographical distribution of the studies selected for this review.

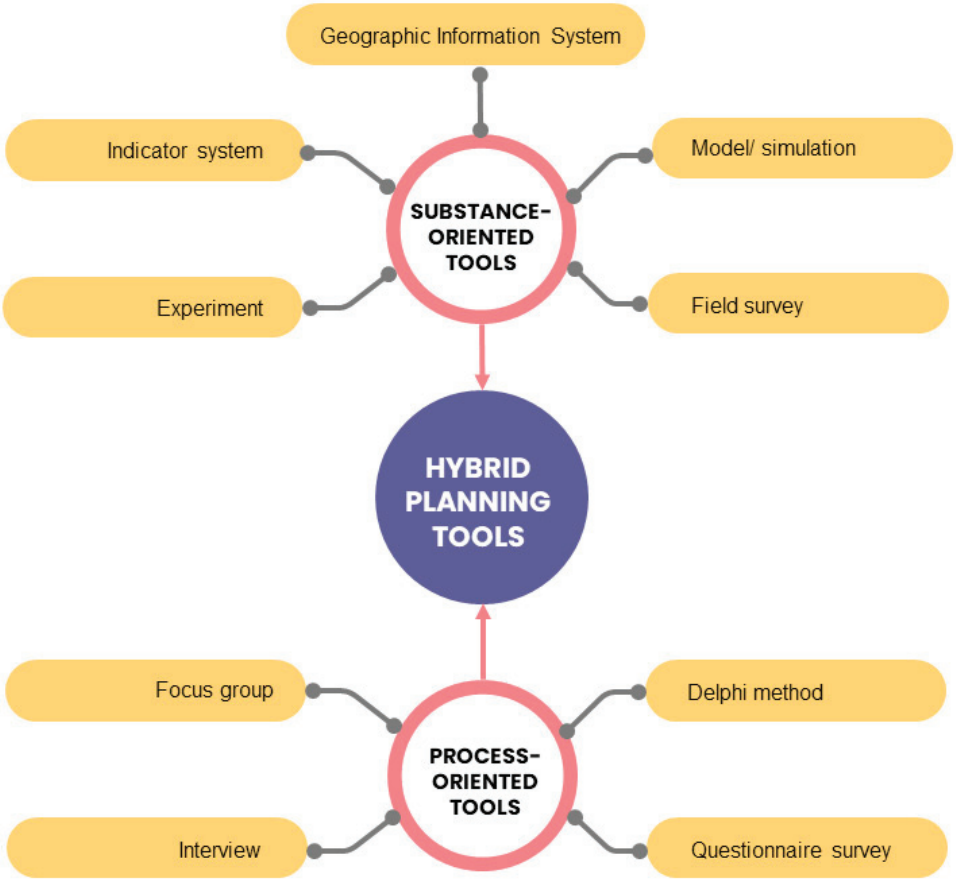

Figure 2. Planning tools to manage urban vacant land revitalisation planning.

3.3. Planning Tools to Revive Urban Vacant Land

The first step in understanding the spatial distribution and site characteristics involved in urban planning is mapping and classifying land. Urban mapping creates spatial data by examining the processes that influence how a city is seen, imagined, and lived in [65]. Mapping is also necessary for researchers and professionals working in the built environment to identify urban transformation capacities. Urban practitioners utilise GIS and remote sensing data to streamline the mapping process and enable a more thorough examination of the area in question. In this regard, several studies have highlighted the use of GIS applications in mapping and assessing vacant land. Kremer et al. [33] used this approach in a land cover classification study to identify vacant parcels' social and ecological characteristics in New York City. Similarly, McPhearson et al. [2] developed an assessment tool to capture vacant parcel heterogeneity. This tool identifies priority areas for social-ecological transformation by facilitating the quantification of ecological and social variables. Additionally, aerial photographs allow for analysing urban vacant land's structure, function, and economic benefits, as Kim et al. [19] demonstrate. These studies show the importance of mapping as a first step towards revitalising vacant land by identifying and classifying the social and ecological characteristics of vacant parcels.

Despite the availability of remotely sensed data to aid in land mapping and preliminary assessment, conducting an inventory of the actual urban vacant land is still necessary to allow researchers to identify site qualities. To accurately capture the actual conditions of vacant parcels, field observation is typically required when assessing site characteristics. Researchers' analysis of the results also enables them to determine how land characteristics, neighbourhood characteristics, and land cover relate to one another [33]. Additionally, it is advantageous to involve communities in this process because they may have useful local knowledge that the researchers are unaware of. Zefferman et al. [37] used a case

study to identify potential vacant land for biodiversity conservation and conducted a field survey with citizen scientists to observe the existing flora and fauna. Similarly, Drake et al. [35] involved the local community in conducting vacant land inventories using smartphones; however, a lack of access to cloud-based and desktop GIS applications can be a limitation. Nevertheless, citizen involvement represents an affordable means of primary data collection. Community involvement can also spur further engagement and foster community empowerment in the form of neighbourhood improvement decision-making.

Figure 3. Geographical distribution of the selected studies on planning tools to revive urban vacant land.

A typology of vacant land can depict patterns and ecological characteristics that help identify potential issues and select the best kind of greening strategy. Desktop studies employing GIS, satellite, or aerial imagery, as well as field surveys, can all be used to establish the land's typology. Table 2 lists several studies that create various land vacancy types using these methods and tools. Kim et al.'s [12] comprehensive examination of urban vacant land used field observations and aerial photographs to construct a typology based on physical, biological, and social characteristics. Alternatively, Maldonado López et al. [39] developed vacant land typologies based on literature reviews, expert interviews, and an online survey. Urban vacant land's value and potential benefits can be determined by classifying the land and identifying its economic, ecological, sociocultural, and policy components [39]. Thus, determining the types of vacant land that are suitable for restoration is crucial and can help guide regeneration planning.

Goal setting for the revitalisation effort takes centre stage in Phase 2 of the planning process. Indicator systems, GIS, models/simulations, and experiments are all examples of decision-support systems and analytical planning tools that can be used to envision potential futures for redeveloping vacant land. Through its many spatial analysis tools, GIS is a powerful resource for identifying the areas with the greatest potential for urban greening. McClintock et al. [34] utilised remotely sensed data to map areas with potential for urban agriculture. Using hotspot analysis in GIS, Smith et al. [51] mapped potential greening areas by focusing on privately owned land lacking buildings and impervious surfaces.

In addition, the spatial analysis tools available in GIS can be used to assess the potential to revive vacant land. Based on the generated suitability map, vacant land reclamation strategies may be suggested, along with functions and activities that improve the city's ecological or social health. With a focus on privately owned land that is devoid of buildings and impervious surfaces, Pearsall [36] discovered the potential of green conversions of vacant parcels to reduce urban heating inequities. This was accomplished by examining socio-spatial patterns using land surface temperature (LST) and the normalised difference vegetation index (NDVI). The Python script in GIS was developed and implemented by Newman et al. [38] to prioritise vacant lands requiring immediate intervention, particularly in cities that are shrinking and experiencing land inactivity. The tool could support a smart decline policy that prioritises citizens' health and well-being by improving the quality and accessibility of green spaces. Furthermore, it is crucial to take into account how long urban land has been vacant, as this will likely have a more significant impact on a city than the overall number of vacant properties [38].

Table 2. Vacant land typologies with the intended purposes.

Author	Purpose	Typology
[33]	Actual uses of vacant lots	Unused land, private house, commercial/industrial, community garden, park, tree cover in residential streets, sport fields, road, roadside pavement or sidewalk, junk yard, parking lot, non-commercial parking, other.
[2]	Land cover type	Fine vegetation, coarse vegetation, paved surface, building cover, water.
[35]	Land cover type	Parcels with structure—vacant building, vacant land, occupied building. Parcels without structure—parking lot, open space (park, garden, or cemetery), utility or rail, lot.
[12]	Land cover type	Post-industrial sites, unattended sites with vegetation, derelict sites, natural sites, transportation-related sites.
[39]	Potential use in economic, ecological, sociocultural, and policy respects	Abandoned land, undeveloped land, post-industrial land, land held for speculation, derelict land.

In addition, urban professionals can use a measurement technique called an indicator or index system, which establishes parameters for data collection. The tool is useful because it would be impractical to list all physical, environmental, social, and economic constraints and opportunities within the study areas [66]. Examples of indicator systems utilised to assess vacant land in the studies reviewed here are shown in Table 3. In a deindustrialised urban South American context, Sanches and Pellegrino [47] established criteria and indicators with which to assess the greening potential of derelict and vacant urban land by considering environmental, social, and economic factors. This analysis provided greening potential scores for vacant parcels in São Bernardo do Campo, Brazil, and indicated their use (social, environmental, or socioenvironmental) to prioritise vacant land greening. Within the context of Ploieşti, a sprawling European city, Gavrilidis et al. [53] developed criteria with which to assess vacant land's suitability for new urban green spaces, and thus introduce an urban sprawl control framework. The process concluded with identifying the nearest available vacant land in the selected urban functional zone. Morckel [50], on the other hand, conducted a suitability analysis based on criteria that were used as variables in selecting and prioritising vacant land naturalisation in a shrinking city. As demonstrated by these studies, the establishment of indicator systems enables suitability analysis facilitated by GIS to prioritise vacant parcels' revitalisation along ecological and social dimensions. An indicator system also envisions researchers' and urban planners' agenda and underlying objectives in decision-making and facilitates knowledge transfer between experts and nonexperts [67].

Table 3. Indicator systems to assess vacant land revitalisation.

Author	Objective	Criteria/Indicators
[47]	Identifying the greening potential of derelict and vacant lands in urban areas.	Ecology—habitat diversity, impact on the surroundings, connectivity with other green spaces, priority for ecological restoration, viability for ecological restoration. Stormwater—stormwater retention and treatment (volume and quality). Community—mobility, pedestrian pathway and cycle routes, accessibility, deficit in terms of green spaces, potential for use by the community, social inclusion, and cohesion.
[45]	Community garden site suitability index.	Adjacent water sources, solar access, size, vehicular access, surface and vegetation, land-use conflicts.
[50]	Using suitability analysis to select and prioritise naturalisation efforts in legacy cities.	Contiguous vacant land, prospective vacant land, ownership, green land use, parks, green buffer, industrial land use, water features, property values, population change.
[53]	The framework assesses which model of UGS is best for planning based on available vacant lands in a city's urban functional zone.	Management cost, ease of construction, acceptance, efficiency in combating climate change, air quality improvement efficiency, income generation, biodiversity benefits and conservation, social network simulation, specificity (dependent on natural characteristics).
[10]	Socioenvironmental factors via which to determine development potential and ecological values of vacant land.	Population, soil, property value, land cover, land use, Federal Emergency Management Agency (FEMA) flood plains, hurricane risk zones, conservation area, proximity to amenities.
[42]	Site suitability index for determining the temporary reuse of vacant land.	Neighbourhood quality, development potential, visual quality, compatibility, transportation, vulnerable populations.
[60–63]	Assess vacant land management in response to a vacant parcel reuse program (condition–care scale).	Mismanaged, unmanaged, periodically managed, regularly managed, small-scale gardens and other cues to care, moderate-scale gardens and other cues to care, extensive gardens and other cues to care.

In some cases, citizen involvement can become a crucial aspect of reviving vacant land. Kirnbauer and Baetz [42] created a prototype of a community-based decision-support tool with which to assess the suitability of reusing vacant land. It helps citizens identify, inventory, and evaluate site suitability regarding the temporary use of vacant land. In a further extension of the same decision-support tool, the authors integrated the additional capability to produce design drawings for the vacant land reuse strategy and perform lifecycle cost analysis [43]. The tool highlights the potential to develop vacant urban land and allows for exploring trade-offs between various design alternatives. The site suitability criteria used in evaluating potential vacant sites for community gardens were developed by Eanes and Ventura [45], who incorporated input from experts and stakeholders. The site suitability evaluation process has three steps: (1) an analysis of previous inventories of vacant land, (2) an examination of community gardens already in place, and (3) obtaining input from experts and gardeners. Therefore, it is advantageous to involve the local community, as they have a deep understanding of the area, which is essential for urban practitioners and experts. Furthermore, this involvement could also promote social inclusion in place regeneration.

Planning models approximate city systems, which are represented in the form of logical and mathematical notation to enable scientific predictions [68]. These models may be quantitative or qualitative representations of phenomena, systems, or issues found in the real world [41]. Software for simulation and modelling, which integrates various environmental parameters, makes it easier to calculate projected land transformation

during the decision-making process. It helps to model ecological processes on vacant land, such as the cooling effect, create networks of green spaces, and apply connectivity metrics or least-cost methods. The use of simulations in urban green space studies is similar to its use in previous studies that have investigated the effects of urban green space vegetation on cooling benefits [69], as well as the adsorption capabilities of atmospheric particulate matter [70].

Smart decline strategies primarily aim to manage declining neighbourhoods with limited resource availability. Land parcel demolition can be adopted to guide the defragmentation of urban green spaces. Frazier and Bagchi-Sen [46] mapped targeted land demolition using connectivity metrics to defragment urban green spaces. On the other hand, Johnson et al. [41] introduced a municipal shrinkage planning model to generate development strategies that jointly optimise multiple objectives associated with residential satisfaction and scale economies in terms of development and equity. One essential consideration when strategising about vacant land revitalisation is addressing the multiple objectives of urban planners. Planning models can facilitate complex decision-making involving competing objectives. Jacobs et al. [40] developed MURL-CLE (Maximizing Utility for the Reuse of Land), an open-source model in a web-based software platform, for repurposing vacant land. Additionally, a GIS-based decision-support tool provides a policy-oriented framework and methodology with which to balance competing vacant land planning objectives. Pearsall et al. [44] used a GIS-based multi-objective land allocation (MOLA) tool within a policy-oriented framework to balance competing green space, commercial, and residential planning objectives.

Planning models have also been used to simulate vacant land's potential as urban green corridors. Two studies included in this review integrated modelling software and GIS for this purpose. Newman et al. [10] proposed structural connections between vacant lands with low development potential and high ecological prospects, which were selected by applying a raster-based suitability analysis process in GIS. These connections were mapped using the least-cost path model in the Linkage Mapper software to link habitat patches, wildlife conservation areas, wetlands, riparian corridors, and small-scale green spaces. Zhang et al. [54] introduced a two-stage connectivity modelling process, assessing landscape connectivity patterns using the FRAGSTATS software programme and identifying priority locations for green corridors on vacant lands using the least-cost path approach. Next, Kelleher et al. [55] developed an infiltration–excess model to assess the cumulative potential of vacant lands for use in stormwater management. Additionally, Koch et al. [52] integrated the application of modelling, visualisation techniques, and socioeconomic data to assess the projection of cool and compact cities. Notably, these studies were conducted in cities with prevalent land vacancies due to urban shrinkage, thus offering opportunities to defragment urban green spaces by integrating vacant land areas of ecological and hydrological significance.

Photo-elicitation simulates the evocation or anticipation of a simulated future, simplifying interactions between decision-makers and stakeholders [58]. Using this approach, Costa et al. [58] sought community input on interim planning for vacant land. In their study of an interim strategy, Todd et al. [48] introduced three stages of design guidelines for a strategy: predesign considerations, case study site selection, and guideline application. The goals of the guidelines were to communicate the design intent to the necessary stakeholders and convert contaminated vacant lands into public green space. This finding is aligned with other research that used comparable methods to analyse the public's acceptance of wilderness in urban green spaces [71], as well as representing an instrument that can be used in a landscape-based research design phytoremediation strategy [72]. Urban practitioners can also encourage experts and the community to participate in decision-making to reach an agreement on development objectives that is consistent with the decision-makers' initial values. Participatory workshops were introduced by Lindquist and Campbell-Arvai [59] to design and test Land.Info, a decision-support system that is used in redesigning vacant land and based on video games. This simulation tool identifies goals that are pertinent to

the community and associated landscape characteristics, such as stormwater management and sociocultural advantages. This method demonstrates the benefits of the co-design process and its outcomes, with participants valuing the chance to observe how design goals shifted as they manipulated the virtual environment.

In addition to the decision-support system, experimental studies are essential in determining how vacant land can enhance ecological function. Recent studies have uncovered three experimental studies that highlight ecological restoration efforts on vacant land, with two concentrating on soil rehabilitation techniques. These include mulching methods, straw blankets, bark plots, wood shavings [55], and phyto-management using biofuel crops and bio-stabilised material [56]. Anderson and Minor [57] also investigated four methods via which to increase native plant diversity in vacant lands: seed bombing, broadcast seeding, planting plugs, and intensive gardening. These three studies provide essential evidence for practical, low-cost strategies to restore degraded urban soil and increase the prevalence of native vegetation.

The third planning stage emphasises the monitoring and ongoing evaluation of the effort to revitalise vacant land. Strategies for greening vacant land can be assessed by means of an indicator system. Simultaneously, a survey can help evaluate the success of the strategies, particularly those that involve the local community. Chicago's Large Lot Programme is a community-based vacant land revitalisation initiative, and four case studies have shown how this programme uses a condition–care index to track and evaluate landscape change over time [60–62,64]. The programme enables locals to buy nearby vacant land and carry out activities such as cleaning up the blighted area and adding features that enhance its aesthetic value. Based on the same programme, Jeong et al. [63] examined the voluntary leisure activities of locals who planted trees in their vacant lots, highlighting the potential for citizen-owned vacant land to revitalise urban neighbourhoods. This evidence suggests that the programme's ownership being transferred to residents near vacant land improved the state and maintenance of the parcels. In addition, it may be possible to anticipate the community's land use and recreation preferences by observing their routines. A similar programme has been introduced in Detroit to mobilise residents to eradicate blight and improve the appearance of vacant lots [73]. This programme, Clean and Green, is a citywide goal to improve municipal services and residents' quality of life by reducing maintenance costs [60]. A more equitable and fruitful co-design process between experts and citizens can be fostered through community involvement, resulting in landscape designs that are both user-centric and sustainable [59]. This opportunity allows them to explore their ideas and visions, which improves the quality of decision-making.

3.4. Framework to Revitalise Urban Vacant Land: A Stepwise Approach

Figure 4 depicts a framework for urban vacant land revitalisation from an ecological standpoint. It emphasises a step-by-step approach to the phases and examples of tools to help in the planning process: Phase I (mapping and classification), Phase II (decision-making), and Phase III (monitoring and maintenance). Several factors should be taken into account as the best practices for managing vacant land evolve. This requires sharing accurate geospatial data through an open-access system [74]. It is essential to maintain an accurate database of a city's vacant land distribution to track the quantity and quality of and potential for growth in these areas. These steps involve key planners and development stakeholders in decision-making, making site suitability assessments easier [58]. Local governments that are interested in implementing or expanding their GIS and remote sensing data capacity should be prepared for a complex process, as these technologies demand substantial data-processing capabilities and trained specialists to manage the associated data.

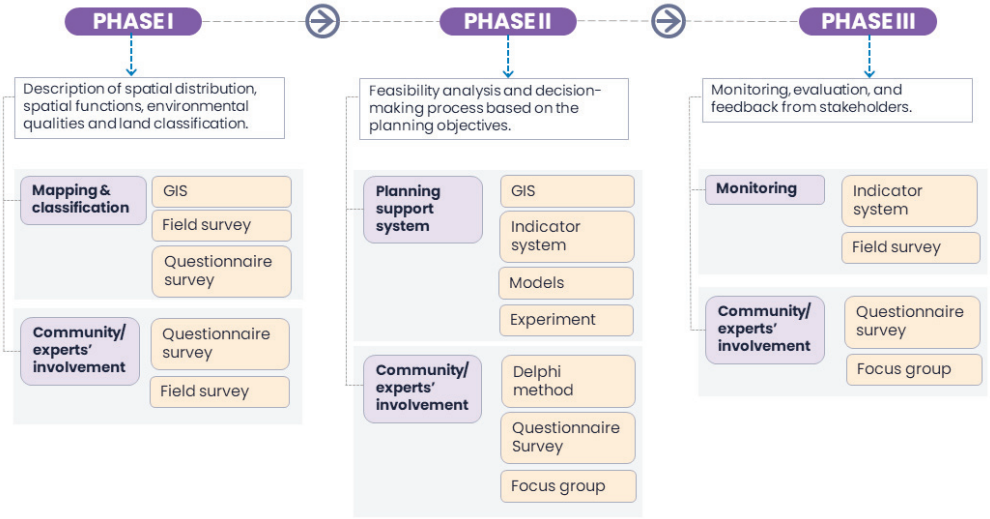

Figure 4. Framework for urban vacant land revitalisation: a stepwise approach.

Urban planners may benefit from simulations and models that reflect real-world phenomena, helping them make better decisions and account for all the factors that matter. Time-series aerial and street-level imagery is a more time- and cost-effective alternative to field observation for tracking the greening of vacant land. During this stage, it is also important to perform fine-scale analyses of landscape change in order to facilitate ongoing monitoring. Along with a random selection of lots, a concurrent large-scale assessment is also necessary to ensure a more effective process [60].

Notably, majority of the studies examined in this review are concentrated in the United States, primarily in declining cities, while those from Europe and South America offered viewpoints from shrinking and sprawling cities. Thus, there may be a contextual constraint due to the emphasis on shrinking and sprawling cities, in which the situation in growing cities may be disregarded. Although this analysis focuses on vacant land planning in all types of cities, perspectives on growing cities are relevant because they may reveal problems that are not present in more established, declining, or expanding cities.

3.5. Future Research

We offer three recommendations based on the findings of this systematic review. First, reviving urban vacant land necessitates adopting a holistic approach to deliver optimal outcomes. As suggested in this review, a stepwise approach that aims to provide a general idea of the planning processes, with recommendations of the tools or methods to be used for each task, may be the most appropriate. The selection of tools will also depend on the planning objectives, data availability, and data acquisition feasibility. It is imperative to consider the data-creation and monitoring process to ensure that local governments with low levels of resources will not find this process challenging to implement [51,74].

Second, the current study recommends utilising hybrid planning tools to revive vacant land, which supports an interactive process that ensures optimal output from the communicative and analytical aspects of planning [75]. Clarifying the guidelines for conducting productive, interactive sessions with stakeholders can also help translate project aims into usable workflows [76]. For example, visualisations in manual or digital illustrations can play an important role in communicating perceptions and design intentions between planning professionals and the participating communities [77]. Furthermore, clear ownership, resource allocation for maintenance, competency, and access to tools and technology are all critical components of an organisation's readiness for such efforts [78].

Third, future research must focus on vacant land revitalisation efforts from a growing city perspective. In growing cities, especially in Asia and Africa, land utilisation decisions for urban development demand careful consideration for sustainable land use. Comparing

the various approaches to valorising vacant land in this context will provide a different point of view, and thus help to guide other cities in managing vacant land resources.

4. Conclusions

The present study synthesised the existing literature on planning tools to revive urban vacant land from ecological perspectives. The review characterised these tools as substance-oriented, process-oriented, and hybrid. These tools manage the planning process, including identifying land characteristics and land assessment, simulating analysis, and monitoring the fulfilment of the overall goals. Urban practitioners can optimise the available tools and resources to plan and monitor vacant land, and thus encourage better-informed decisions and successful vacant land revitalisation. While this review focused on planning tools that emphasise the ecological improvement of vacant land, the benefits/potential outcomes along the economic and social dimensions can be observed in most of these studies' findings. These include the potential for the green conversion of vacant lands to mitigate urban heating, which causes thermal discomfort among vulnerable populations. Furthermore, turning vacant parcels into community gardens for urban agriculture will address food-deficit issues and promote social inclusion by encouraging local community involvement. From a shrinking city's perspective, this move will improve the quality of life of the urban inhabitants, attract new investments, and ultimately, encourage the repopulation of declining cities. On the other hand, regenerating urban voids in growing and sprawling cities through urban greening will increase the likelihood of new green space availability and accessibility to urban inhabitants. In addition, it ensures that efficient infrastructure and amenities are made accessible to the community.

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References

1. Németh, J.; Langhorst, J. Rethinking urban transformation: Temporary uses for vacant land. *Cities* **2014**, *40*, 143–150. [CrossRef]
2. McPhearson, T.; Kremer, P.; Hamstead, Z.A. Mapping ecosystem services in New York City: Applying a social-ecological approach in urban vacant land. *Ecosyst. Serv.* **2013**, *5*, 11–26. [CrossRef]
3. Anderson, E.C.; Minor, E.S. Vacant lots: An underexplored resource for ecological and social benefits in cities. *Urban For. Urban Green.* **2017**, *21*, 146–152. [CrossRef]
4. Kim, G. The Public Value of Urban Vacant Land: Social Responses and Ecological Value. *Sustainability* **2016**, *8*, 486. [CrossRef]
5. Hou, D.; Song, Y.; Zhang, J.; Hou, M.; Connor, D.O.; Harclerode, M. Climate change mitigation potential of contaminated land redevelopment: A city-level assessment method. *J. Clean. Prod.* **2018**, *171*, 1396–1406. [CrossRef]
6. Prener, C.G.; Braswell, T.H.; Monti, D.J. St. Louis's "urban prairie": Vacant land and the potential for revitalization. *J. Urban Aff.* **2020**, *42*, 371–389. [CrossRef]
7. Schilling, J.; Logan, J. Greening the rust belt: A green infrastructure model for right sizing America's shrinking cities. *J. Am. Plan. Assoc.* **2008**, *74*, 451–466. [CrossRef]
8. Pallagst, K.; Vargas-Hernández, J.; Hammer, P. Green Innovation Areas—En Route to Sustainability for Shrinking Cities? *Sustainability* **2019**, *11*, 6674. [CrossRef]

9. Laprise, M.; Lufkin, S.; Rey, E. An operational monitoring tool facilitating the transformation of urban brownfields into sustainable neighborhoods. *Build. Environ.* **2018**, *142*, 221–233. [CrossRef]
10. Newman, G.D.; Smith, A.L.; Brody, S.D. Repurposing vacant land through landscape connectivity. *Landsc. J.* **2017**, *36*, 37–57. [CrossRef]
11. Beames, A.; Broekx, S.; Schneidewind, U.; Landuyt, D.; Meulen, M.V.D.; Heijungs, R.; Seuntjens, P. Amenity proximity analysis for sustainable brownfield redevelopment planning. *Landsc. Urban Plan.* **2018**, *171*, 68–79. [CrossRef]
12. Kim, G.; Miller, P.A.; Nowak, D.J. Urban vacant land typology: A tool for managing urban vacant land. *Sustain. Cities Soc.* **2018**, *36*, 144–156. [CrossRef]
13. Kim, G.; Newman, G.; Jiang, B. Urban regeneration: Community engagement process for vacant land in declining cities. *Cities* **2020**, *102*, 102730. [CrossRef] [PubMed]
14. Wesener, A. Temporary urbanism and urban sustainability after a natural disaster: Transitional community-initiated open spaces in Christchurch, New Zealand. *J. Urban.* **2015**, *8*, 406–422. [CrossRef]
15. Patti, D.; Polyak, L. From practice to policy: Frameworks for temporary use. *Urban Res. Pract.* **2015**, *8*, 122–134. [CrossRef]
16. Rall, E.L.; Haase, D. Creative intervention in a dynamic city: A sustainability assessment of an interim use strategy for brownfields in Leipzig, Germany. *Landsc. Urban Plan.* **2011**, *100*, 189–201. [CrossRef]
17. Runhaar, H.; Driessen, P.P.J.; Soer, L. Sustainable urban development and the challenge of policy integration: An assessment of planning tools for integrating spatial and environmental planning in the Netherlands. *Environ. Plan. B Plan. Des.* **2009**, *36*, 417–431. [CrossRef]
18. Gardiner, M.M.; Burkman, C.E.; Prajzner, S.P. The value of urban vacant land to support arthropod biodiversity and ecosystem services. *Environ. Entomol.* **2013**, *42*, 1123–1136. [CrossRef]
19. Kim, G.; Miller, P.A.; Nowak, D.J. Assessing urban vacant land ecosystem services: Urban vacant land as green infrastructure in the City of Roanoke, Virginia. *Urban For. Urban Green.* **2015**, *14*, 519–526. [CrossRef]
20. Kowarik, I. Urban wilderness: Supply, demand, and access. *Urban For. Urban Green.* **2018**, *29*, 336–347. [CrossRef]
21. Anderson, E.C.; Minor, E.S. Assessing social and biophysical drivers of spontaneous plant diversity and structure in urban vacant lots. *Sci. Total Environ.* **2019**, *653*, 1272–1281. [CrossRef] [PubMed]
22. Villaseñor, N.R.; Chiang, L.A.; Hernández, H.J.; Escobar, M.A.H. Vacant lands as refuges for native birds: An opportunity for biodiversity conservation in cities. *Urban For. Urban Green.* **2020**, *49*, 126632. [CrossRef]
23. Kopecká, M.; Szatmári, D.; Rosina, K. Analysis of Urban Green Spaces Based on Sentinel-2A: Case Studies from Slovakia. *Land* **2017**, *6*, 25. [CrossRef]
24. Huang, C.; Yang, J.; Jiang, P. Assessing Impacts of Urban Form on Landscape Structure of Urban Green Spaces in China Using Landsat Images Based on Google Earth Engine. *Remote Sens.* **2018**, *10*, 1569. [CrossRef]
25. Haase, D.; Jänicke, C.; Wellmann, T. Front and back yard green analysis with subpixel vegetation fractions from earth observation data in a city. *Landsc. Urban Plan.* **2019**, *182*, 44–54. [CrossRef]
26. Kanniah, K.D. Quantifying green cover change for sustainable urban planning: A case of Kuala Lumpur, Malaysia. *Urban For. Urban Green.* **2017**, *27*, 287–304. [CrossRef]
27. Deng, J.; Huang, Y.; Chen, B.; Tong, C.; Liu, P.; Wang, H.; Hong, Y. A methodology to monitor urban expansion and green space change using a time series of multi-sensor SPOT and Sentinel-2A images. *Remote Sens.* **2019**, *11*, 1230. [CrossRef]
28. Yang, G.; Zhao, Y.; Xing, H.; Fu, Y.; Liu, G.; Kang, X.; Mai, X. Understanding the changes in spatial fairness of urban greenery using time-series remote sensing images: A case study of Guangdong-Hong Kong-Macao Greater Bay. *Sci. Total Environ.* **2020**, *715*, 136763. [CrossRef]
29. Dinda, S.; Das Chatterjee, N.; Ghosh, S. An integrated simulation approach to the assessment of urban growth pattern and loss in urban green space in Kolkata, India: A GIS-based analysis. *Ecol. Indic.* **2021**, *121*, 107178. [CrossRef]
30. Ucar, Z.; Bettinger, P.; Merry, K.; Akbulut, R.; Siry, J. Estimation of urban woody vegetation cover using multispectral imagery and LiDAR. *Urban For. Urban Green.* **2018**, *29*, 248–260. [CrossRef]
31. Yan, J.; Zhou, W.; Han, L.; Qian, Y. Mapping vegetation functional types in urban areas with WorldView-2 imagery: Integrating object-based classification with phenology. *Urban For. Urban Green.* **2018**, *31*, 230–240. [CrossRef]
32. Mengist, W.; Soromessa, T.; Legese, G. Method for conducting systematic literature review and meta-analysis for environmental science research. *MethodsX* **2020**, *7*, 100777. [CrossRef] [PubMed]
33. Kremer, P.; Hamstead, Z.A.; McPhearson, T. A social-ecological assessment of vacant lots in New York City. *Landsc. Urban Plan.* **2013**, *120*, 218–233. [CrossRef]
34. McClintock, N.; Cooper, J.; Khandeshi, S. Assessing the potential contribution of vacant land to urban vegetable production and consumption in Oakland, California. *Landsc. Urban Plan.* **2013**, *111*, 46–58. [CrossRef]
35. Drake, L.; Ravit, B.; Lawson, L. Developing a Vacant Property Inventory through Productive Partnerships: A University, NGO, and Municipal Planning Collaboration in Trenton, New Jersey. *Cities Environ.* **2016**, *8*, 6.
36. Pearsall, H. Staying cool in the compact city: Vacant land and urban heating in Philadelphia, Pennsylvania. *Appl. Geogr.* **2017**, *79*, 84–92. [CrossRef]
37. Zefferman, E.P.; McKinney, M.L.; Cianciolo, T.; Fritz, B.I. Knoxville's urban wilderness: Moving toward sustainable multifunctional management. *Urban For. Urban Green.* **2018**, *29*, 357–366. [CrossRef]

38. Newman, G.; Kim, Y.; Kim, G.; Lee, R.J.; Gu, D.; Forghanparast, K.; Goldberg, D. A python script for longitudinally measuring the duration of vacant land uses. *J. Spat. Sci.* **2022**, *67*, 129–141. [CrossRef]
39. Maldonado López, J.I.; Kim, G.; Lei, Y.; Newman, G.; Suppakittpaisarn, P. An assessment method and typology for the regeneration of vacant land in Quito, Ecuador. *Urban For. Urban Green.* **2021**, *62*, 127130. [CrossRef]
40. Jacobs, S.; Dyson, B.; Shuster, W.D.; Stockton, T. A Structured Decision Approach for Integrating and Analyzing Community Perspectives in Re-Use Planning of Vacant Properties in Cleveland, Ohio. *Urban Land Use* **2013**, *6*, 163–188. [CrossRef]
41. Johnson, M.P.; Hollander, J.; Hallulli, A. Maintain, demolish, re-purpose: Policy design for vacant land management using decision models. *Cities* **2014**, *40*, 151–162. [CrossRef]
42. Kirnbauer, M.; Baetz, B.W. A prototype community-based planning tool for evaluating site suitability for the temporary reuse of vacant lands. *Int. J. Urban Sustain. Dev.* **2014**, *6*, 221–240. [CrossRef]
43. Kirnbauer, M.; Baetz, B. Prototype Decision-Support System for Designing and Costing Municipal Green Infrastructure. *J. Urban Plan. Dev.* **2014**, *140*, 04014004. [CrossRef]
44. Pearsall, H.; Lucas, S.; Lenhardt, J. The contested nature of vacant land in Philadelphia and approaches for resolving competing objectives for redevelopment. *Cities* **2014**, *40*, 163–174. [CrossRef]
45. Eanes, F.; Ventura, S. Inventorying Land Availability and Suitability for Community Gardens in Madison, Wisconsin. *Cities Environ.* **2015**, *8*, 2.
46. Frazier, A.E.; Bagchi-Sen, S. Developing open space networks in shrinking cities. *Appl. Geogr.* **2015**, *59*, 1–9. [CrossRef]
47. Sanches, P.M.; Pellegrino, P.R.M. Greening potential of derelict and vacant lands in urban areas. *Urban For. Urban Green.* **2016**, *19*, 128–139. [CrossRef]
48. Todd, L.F.; Landman, K.; Kelly, S. Phytoremediation: An interim landscape architecture strategy to improve accessibility of contaminated vacant lands in Canadian municipalities. *Urban For. Urban Green.* **2016**, *18*, 242–256. [CrossRef]
49. Wang, J.; Liu, H.; Wu, X.; Li, C.; Wang, X. Effects of different types of mulches and legumes for the restoration of urban abandoned land in semi-arid northern China. *Ecol. Eng.* **2017**, *102*, 55–63. [CrossRef]
50. Morckel, V. Using suitability analysis to select and prioritize naturalization efforts in legacy cities: An example from Flint, Michigan. *Urban For. Urban Green.* **2017**, *27*, 343–351. [CrossRef]
51. Smith, J.P.; Li, X.; Turner, B.L. Lots for greening: Identification of metropolitan vacant land and its potential use for cooling and agriculture in Phoenix, AZ, USA. *Appl. Geogr.* **2017**, *85*, 139–151. [CrossRef]
52. Koch, F.; Bilke, L.; Helbig, C.; Schlink, U. Compact or cool ? The impact of brown fi eld redevelopment on inner-city micro climate. *Sustain. Cities Soc.* **2018**, *38*, 31–41. [CrossRef]
53. Gavrilidis, A.A.; Niță, M.R.; Onose, D.A.; Badiu, D.L.; Năstase, I.I. Methodological framework for urban sprawl control through sustainable planning of urban green infrastructure. *Ecol. Indic.* **2019**, *96*, 67–78. [CrossRef]
54. Zhang, Z.; Meerow, S.; Newell, J.P.; Lindquist, M. Enhancing landscape connectivity through multifunctional green infrastructure corridor modeling and design. *Urban For. Urban Green.* **2019**, *38*, 305–317. [CrossRef]
55. Kelleher, C.; Golden, H.E.; Burkholder, S.; Shuster, W. Urban vacant lands impart hydrological benefits across city landscapes. *Nat. Commun.* **2020**, *11*, 1563. [CrossRef]
56. Míguez, F.; Gómez-Sagasti, M.T.; Hernández, A.; Artetxe, U.; Blanco, F.; Castañeda, J.H.; Lozano, J.V.; Garbisu, C.; Becerril, J.M. In situ phytomanagement with Brassica napus and bio-stabilised municipal solid wastes is a suitable strategy for redevelopment of vacant urban land. *Urban For. Urban Green.* **2020**, *47*, 126550. [CrossRef]
57. Anderson, E.C.; Minor, E.S. Assessing four methods for establishing native plants on urban vacant land. *Ambio* **2021**, *50*, 695–705. [CrossRef]
58. Costa, P.; Brito-Henriques, E.; Cavaco, C. Interim reuse in urban derelicts: Uncovering the community's attitudes and preferences through scenario-elicitation. *Cities* **2021**, *111*, 103103. [CrossRef]
59. Lindquist, M.; Campbell-Arvai, V. Co-designing vacant lots using interactive 3D visualizations—Development and application of the Land.Info DSS. *Landsc. Urban Plan.* **2021**, *210*, 104082. [CrossRef]
60. Gobster, P.H.; Hadavi, S.; Rigolon, A.; Stewart, W.P. Measuring landscape change, lot by lot: Greening activity in response to a vacant land reuse program. *Landsc. Urban Plan.* **2020**, *196*, 103729. [CrossRef]
61. Gobster, P.H.; Rigolon, A.; Hadavi, S.; Stewart, W.P. Beyond proximity: Extending the "greening hypothesis" in the context of vacant lot stewardship. *Landsc. Urban Plan.* **2020**, *197*, 103773. [CrossRef]
62. Gobster, P.H.; Rigolon, A.; Hadavi, S.; Stewart, W.P. The condition-care scale: A practical approach to monitoring progress in vacant lot stewardship programs. *Landsc. Urban Plan.* **2020**, *203*, 103885. [CrossRef]
63. Jeong, W.; Stewart, W.P.; Gobster, P.H.; van Riper, C.J. Green Leisure: Resistance and Revitalization of Urban Neighborhoods. *Leis. Sci.* **2021**, 1–21. [CrossRef]
64. Rigolon, A.; Banerjee, D.; Gobster, P.; Hadavi, S.; Stewart, W. Transferring Vacant Lots to Private Ownership Improves Care and Empowers Residents: Evidence From Chicago. *J. Am. Plan. Assoc.* **2021**, *87*, 570–584. [CrossRef]
65. Dovey, K.; Ristic, M.; Pafka, E. Mapping as Spatial Knowledge. In *Mapping Urbanities: Morphologies, Flows, Possibilities*; Dovey, K., Pafka, E., Ristic, M., Eds.; Routledge: New York, NY, USA, 2018; pp. 1–16.
66. Turnhout, E. The effectiveness of boundary objects: The case of ecological indicators. *Sci. Public Policy* **2009**, *36*, 403–412. [CrossRef]

67. Mair, S.; Jones, A.; Ward, J.; Christie, I.; Druckman, A.; Lyon, F. A Critical Review of the Role of Indicators in Implementing the Sustainable Development Goals. In *Handbook of Sustainability Science and Research*; World Sustainability Series; Springer: Cham, Switzerland, 2018; pp. 41–56. [CrossRef]
68. Batty, M. Classifying urban models. *Environ. Plan. B Plan. Des.* **2016**, *43*, 251–256. [CrossRef]
69. Yang, J.; Hu, X.; Feng, H.; Marvin, S. Verifying an ENVI-met simulation of the thermal environment of Yanzhong Square Park in Shanghai. *Urban For. Urban Green.* **2021**, *66*, 127384. [CrossRef]
70. Deng, S.; Ma, J.; Zhang, L.; Jia, Z.; Ma, L. Microclimate simulation and model optimization of the effect of roadway green space on atmospheric particulate matter. *Environ. Pollut.* **2019**, *246*, 932–944. [CrossRef]
71. Hwang, Y.H.; Yue, Z.E.J.; Ling, S.K.; Tan, H.H.V. It's ok to be wilder: Preference for natural growth in urban green spaces in a tropical city. *Urban For. Urban Green.* **2019**, *38*, 165–176. [CrossRef]
72. Wilschut, M.; Theuws, P.A.; Duchhart, I. Phytoremediative urban design: Transforming a derelict and polluted harbour area into a green and productive neighbourhood. *Environ. Pollut.* **2013**, *183*, 81–88. [CrossRef]
73. Kim, G. An integrated system of urban green infrastructure on different types of vacant land to provide multiple benefits for local communities. *Sustain. Cities Soc.* **2018**, *36*, 116–130. [CrossRef]
74. Xu, S.; Manzke, N.; De Lange, N.; Zülsdorf, J.; Kada, M.; Ehlers, M. Identification of potential urban development areas and extraction of urban land use information based on open source data. In Proceedings of the 10th International Conference on Environmental Engineering, ICEE 2017, Vilnius, Lithuania, 27–28 April 2017. [CrossRef]
75. Pelzer, P.; Geertman, S.; van der Heijden, R. Knowledge in communicative planning practice: A different perspective for planning support systems. *Environ. Plan. B Plan. Des.* **2015**, *42*, 638–651. [CrossRef]
76. van Dijk, T.; Ubels, H. How Dutch professionals conduct interactive design sessions to foster 'shared understanding. *Environ. Plan. B Plan. Des.* **2016**, *43*, 464–479. [CrossRef]
77. Gnatzy, T.; Warth, J.; von der Gracht, H.; Darkow, I.L. Validating an innovative real-time Delphi approach—A methodological comparison between real-time and conventional Delphi studies. *Technol. Forecast. Soc. Change* **2011**, *78*, 1681–1694. [CrossRef]
78. Ganis, M.; Minnery, J.; Mateo-Babiano, I. Planning people–places: A small world network paradigm for masterplanning with people in mind. *Environ. Plan. B Plan. Des.* **2016**, *43*, 1075–1095. [CrossRef]

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Article

Exploration of the Relationship Between the Population and Football Stadiums in Romania

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Abstract: A sport is a specific human activity with deep cultural and social meanings that involves cooperation and competitiveness according to well-established rules. One of the most representative sports at the local and global levels is football thanks to the large number of people and resources involved in supporting it. The aim of the study is to explore the connection between communities and football stadiums at a spatial level (development region, county and cities). From a methodological point of view, multicriteria analysis (eight criteria, four for the population and four for football stadiums) was utilized to determine and define the various relationships between the population and football stadiums. The obtained results highlighted, at the spatial level, the existence of some non-correlations between the population and football stadiums. Thus, the existence of strong relationships at the level of development regions (75%), followed by those established at the level of cities (24.1) and counties (2.4), were identified. The strongest relationships were established in the Northwest, Central and South development regions; in Bihor County and in cities like Bucharest, Brașov, Constanta and Iași.

Keywords: football stadium; spatial analysis; sport; population; Romania

1. Introduction

Man is a biological being endowed with intelligence and competitive spirit. Intelligence is an attribute that has developed over time under the pressures and restrictions imposed by the characteristics of the natural environment, in which it has evolved as an integral part of it. The first obstacles that man had to overcome, with the help of intelligence and endosomatic (at first) and exosmotic (later) means, were those of securing his primary needs (food, shelter, rest, security, etc.). Once overcome, other needs appeared, including those of belonging, recognition, respect, etc. [1,2]. Their satisfaction imposed, on man and human collectivities, a balance between cooperation and competitiveness, thus shaping the social side of humanity. History has shown us that the lack of balance between cooperation and competitiveness always led to the emergence and manifestation of unfortunate phenomena and struggles both between individuals and between human groups. So, the entire history of humanity is a history of creativity (the cooperative side) and inter-human disputes (the competitive side). This aspect was also well known by the scholars and elites of the great Greek and Roman civilizations [3]. Thus, it is not by

chance that the stadiums from this period acted as sports sanctuaries, reflecting the balance between cooperation and competitiveness. Cooperation was reflected in the construction of stadiums through the participation of the whole community, while competitiveness was found in sports competitions, where cities and different human communities faced each other through the participants in sports games.

Stadiums are evidence of the creation and mastery of human collectives. They date back to the period of Ancient Greece as structures specially designed to hold sports competitions [3]. Over time, they have undergone minor conceptual and structural mutations, while significant changes can be noted in terms of the construction techniques, materials and symbolism used [4].

Stadiums are spaces with architectural–cultural value and significant political, cultural and sporting dimensions that play a crucial influence in the structuring and systematization of cities, sites and urban landscapes [5–7]. The integration of football stadiums into urban environments highlights their role as key elements in urban planning, contributing not only to the cultural and social fabric of cities but also to their architectural identity and spatial organization. These structures function as focal points in urban landscapes, influencing the distribution of infrastructure and services, shaping community interactions and stimulating economic activities. Furthermore, football stadiums often become symbols of civic pride and local identity, representing a city's ability to host major events and promoting urban regeneration by attracting investment and improving local amenities [8,9]. Conservation (with an emphasis on buildings, terrain and landscape) is a great challenge considering the dynamic comfort and security needs of spectators and athletes [6,10]. Building new stadiums is a real challenge for local communities, given the high costs of construction and maintenance, with significant implications for the spatially sustainable development of a human community. Now, more than ever, against the backdrop of increasing pressure on exhaustible resources, sustainable development through rational management between current needs and the need to conserve resources is emerging as a desideratum worthy of consideration, including in the construction of football stadiums.

In this context, this study aims to spatially analyze (at the level of the development region, county and cities) the relations between the population and football stadiums in Romania.

The research hypotheses focused on the following facts:

- The distribution of the population has a direct influence on the distribution of stadiums at a spatial level, in the sense that development regions, counties and cities with many inhabitants can better support the existence of stadiums due to the larger number of potential spectators.
- The characteristics of the population (age, gender and number of employees) are influencing factors in the spatial distribution of football stadiums, so that in developing regions, counties and cities with a young, active male population and with a larger number of employees, the population is more likely to spend time in football stadiums, thus better supporting their existence.

The research questions are as follows: Are there relationships between the population and football stadiums in Romania? If so, what kind of relations exist between the population and football stadiums in Romania? What are the levels of spatial approach at which these relationships are established?

The importance and relevance of this approach emerges from the significance of the stadiums for the local communities, from the architectural style adopted, the uniqueness and singularity of the buildings, the locations of the stadiums within the localities, the events with emotional charge generated by the performance of new sporting actions for

the local communities that hosted them, whether they will still host them, etc. Thus, the stadiums represent an expression of the evolution of sports and their role in Romanian society over time. Establishing the relationship between the population and football stadiums is important for understanding the impact these structures have on the local economy, social cohesion and urban development. Thus, by attracting spectators and major events, football stadiums stimulate the economy while also contributing to strengthening the community identity and improving urban infrastructure. At the same time, this research provides insights into how the spatial distribution of football stadiums aligns with the dynamics of urban development, offering practical implications for improving urban planning strategies in Romania.

Literature Review

A sport is the expression of the spatio-temporal manifestation of human cooperation and competitiveness; at the same time, it can represent an element of identity for both the individual and the human community of which he/she is a part [11,12]. Through its ability to bring people together in shared experiences, sports serve as a platform for strengthening social cohesion and reinforcing cultural values, thereby contributing to the strengthening of the collective identity of communities in diverse spatial and temporal contexts [13,14].

Sports are part of our social and cultural fabric, with a social and commercial power that makes them a powerful force globally [15]. However, in the literature, with some exceptions, there has been a neglect of sport research, ignoring one of the central components of popular culture around the world [16]. However, the studies conducted attempted to answer a number of research questions, among which some stand out. The position of sports in a society seeks to answer a number of questions: Is a sport an end in itself? What is the essence of sports? Is playing an essential element in sports? Are sports a necessity or a luxury? What impact does politics have on sports [17]?

In sports, soccer is the most popular sport in the world [18–21], being easy to play and practiced in almost any circumstance. It is perceived differently from one actor (fan, player and referee) to another depending on their experiences [22]. Scientists perceive football according to the field they come from. Most of the specialized literature that we know deals with the technological aspect of football. All the studies that offer training go in this direction, with football being seen almost entirely as the technical and tactical abilities of an individual player and strategic cooperation skills within a team [22]. Frank and Steets (2010) talk, in their book, about the connection between the environment created in a stadium at a football match and about the masculine identity that the players of this game have [23]. In the last decades, with the increase in the number of practitioners in different sports branches, we can discuss the progressive replacement of religion with sports and how it has an immense power to exercise passion, to offer an emotional escape and to bind fraternal friendships. Sports have become an inevitable reality that connects the public environment with intimate experiences, giving the opportunity to research and understand all their dimensions. Thus, the evolution of modern sports in Europe and their links with politics, class and gender can be clearly observed [24].

Exploring the vast world of sports, we find numerous studies and research that say that sports have been imitated and assimilated, becoming symbols of national and cosmopolitan identities. Also, this field has become extremely important at the international level, having a primary role in shaping the post-millennial global culture [25–27].

Many of the published studies talk about the athlete's identity, which is associated with the sport he/she practices. Many times, sports lead to conflicts in the community, to heated discussions and, often, to deep disappointments [28]. In Romania, the most popular

sport is football, and it is governed by the FRF (Romanian Football Federation). In 2020, Romania had over 700 thousand football players, of which 300 thousand were registered and constant participants in a football competition. Of these, approx. 126 thousand participate in competitions organized under the auspices of the FRF, and over 171 thousand participate in grassroots competitions, i.e., amateur football. Also, in 2020, we had over 2500 senior and junior girls. A study from 2022 confirms the fact that Romania had, in that year, 75 Romanian footballers registered with clubs abroad [29].

In recent years, the interest in football in Romania has grown, addressing complex and complete topics such as the psychology of football, the anatomy of football, the sociology of football and topics related to injury prevention, recovery after injuries and problems related to recovery after treatment effort [30–32].

Also, an analysis of the specialized literature highlighted the roles of sports and sports infrastructure in urban development and regeneration [33–36]. In this context, stadiums can be seen as multifunctional entities, with multiple possibilities of use, being able to host specific sports activities, act as conference centers, provide accommodations and catering structures, shops, etc. [37–40]. Due to having multiple purposes (sporting, cultural, commercial, etc.), special attention has been paid to the reconstruction of these emblematic elements for the local community, being an integral part of urban renewal and regeneration [37,41–43]. Considering their relatively accessible locations, most of the stadiums represent a motivational factor of prime importance for tourism, with roles and functions in diversifying the local offerings, extending the length of stay, the economic efficiency of tourism, etc. [44–46].

In this context, although there are numerous studies and research that have highlighted the existing relationships between sports and populations [47–49], specifically between the population and football [50,51], there are no studies that highlight the links between the population and football stadiums viewed from the perspective of the population's capacity to support these very expensive infrastructure elements. The methodology used in this study can also be used in other geographical regions with similar characteristics to Romania in order to design and build sports infrastructure, especially football stadiums, in close connection with the population and its defining characteristics.

2. Materials and Methods

The exploration of the spatial relationships between the population (4 variables) and the football stadiums (4 variables) at the spatial level (development region, county and city) involved the use of the multicriteria analysis method [52,53]. The limited number of variables for the analyzed aspects is a weak point of the study, but the need to cover the entire studied area, which is structured from 8 development regions, 42 counties and 66 cities where the football stadiums are located, was taken into account. Thus, in the present case, establishing and knowing the relationship between the population and football stadiums requires the use of four defining variables for the population (X1. size of the population; X2. gender of the population; X3. age of the population; X4. average number of employees), respectively, for football stadiums (Y1. number of football stadiums; Y2. capacity; Y3. UEFA category; Y4. age) (Table 1). Obtaining the aggregate values for the population and football stadiums was achieved by using the min–max normalization method [54–57].

Table 1. Sets of variables and types of data established for study analysis.

Criteria	Variables	Sub-Variables	Type of Data
X. Population	X1. Size of population	Total number of population members	Quantitative
	X2. Gender	Number of males in population	Quantitative
		Number of females in population	Quantitative
	X3. Population age	Number of population members aged 0–14	Quantitative

Table 1. *Cont.*

Criteria	Variables	Sub-Variables	Type of Data
		Number of population members aged 15–64	Quantitative
		Number of population members aged over 65	Quantitative
	X4. Average number of employees	Average number of employees	Quantitative
Y. Football stadiums	Y1. Number of stadiums	Number of stadiums	Quantitative
	Y2. Capacity	Number of seats	Quantitative
	Y3. Elite category	The number of stadiums by elite category	Qualitative
	Y4. The age of the stadiums	Number of stadiums by year of building	Quantitative
		Number of stadiums by year of rehabilitation	Quantitative

The methodology for carrying out the present study involved the following stages:

1. The identification and processing of population information was conducted in 2024 from the databases of the National Institute of Statistics of Romania, regarding the 2021 Population and Housing Census in Romania [58] and TEMPO ONLINE, section FOM104D—The average number of employees per county and city [59]; those with reference to football stadiums were collected from the official websites of football stadiums and the list of football stadiums in Romania [60,61].

The population and football stadium criteria values have been rendered according to the matrix below [52,54–56]:

$$Z = [z_{ab}] = \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1n} \\ z_{21} & z_{22} & \cdots & z_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ z_{r1} & z_{r2} & \cdots & z_{rn} \end{bmatrix} \quad (1)$$

where each element z_{ab} represents the value of a specific variable (e.g., population size, gender distribution, etc.) for a reference unit (such as a development region, county or city). The r rows correspond to the reference units, while the nnn columns denote distinct types of variables collected for each reference unit.

2. The data set, comprising 8 variables (4 related to the population and 4 associated with football stadiums), underwent a scaling process to standardize the data. The following formula was applied [54–56]:

$$C_{ab} = (z_{ab} - \min z_{ab})/(\max z_{ab} - \min z_{ab}) \qquad z_b \in S, \qquad c_{ab} = [0, \ldots, 1] \quad (2)$$

Following the normalization process, the real values of the z_{ab} variables are transformed into values between 0 and 1, with the minimum–maximum normalization method

thus ensuring the comparability of the studied variables and the implementation of the multicriteria analysis.

3. The aggregate values for the population and football stadiums were obtained by using normalized values.

$$g_b = \sum_{b=1}^{n} c_{ab} \qquad (a = 1, \ldots r) \tag{3}$$

The evaluation of the criterion by the value of the variable is carried out using the synthesis value G_a:

$$G_a = \frac{1}{n} \sum_{b=1}^{n} g_a \qquad (a = 1, \ldots r),\ G_i = G_a \in [0, \ldots, 1] \tag{4}$$

where G_a represents the mean value for the a category, with a spanning from 1 to r, n denoting the total count of variables evaluated within each category and g_a corresponding to the specific value for the a-category.

4. The classification of development regions, counties and cities into value groups according to the synthetic index related to the population and football stadiums was achieved following the determination of the constant value z [46,54,55]:

$$\mathrm{M}(G_a) = \max G_a - \min G_a \ \mathrm{t} = \frac{\mathrm{M}(G_a)}{4} \tag{5}$$

Group 1: $G_a \in (\max\{z_{ab}\} - \mathrm{t}, \max\{z_{ab}\}]$—the highest level ($G_a \in (0, 0.25]$);
Group 2: $G_a \in (\max\{z_{ab}\} - 2\mathrm{t}, \max\{z_{ab}\} - \mathrm{t}]$—an average level ($G_a \in (0.26, 0.5]$);
Group 3: $G_a \in (\max\{z_{ab}\} - 3\mathrm{t}, \max\{z_{ab}\} - 2\mathrm{t}]$—a small level ($G_a \in (0.51, 0.75]$);
Group 4: $G_a \in [\min\{z_{ab}\}, \max\{z_{ab}\} - 3\mathrm{t}]$—a very low level ($G_a \in ([0.76, 1]$).

Here, M(G_a) represents the range G_a values, max (G_a) is the maximum value within the G_a data set, and min (G_a) is the minimum value within the G_a data set.

5. The relationship index (I) between the population and football stadiums is calculated [43,44].

The cartographic depiction of the relationship between the two indicators was achieved by visualizing the distribution of the relationship index values, determined using the coefficients attributed to each reference unit (such as development region, county and locality). Thus, the relationship index (I) between the population and football stadiums is a normalized value, given by the following equation:

$$\mathrm{I} = \frac{CoefP - CoefF}{CoefP + CoefF},\ \text{where} - 1 \leq \mathrm{I} \leq 1 \tag{6}$$

I = index of the relationship between the population and football stadiums;
CoefP = coefficient given to the population;
CoefF = coefficient given to football stadiums.

6. We established the constant value t to classify development regions, counties and localities into value groups according to the type of relationship between the population and football stadiums [41–43].

The spatial analysis of the relationship index assumed its classification into 4 classes, calculated based on the interval between

$$M(G_a) = \max G_a - \min G_a \; t = \frac{M(G_a)}{4} \quad (7)$$

Group 1: $G_a \in (\max\{z_{ab}\} - t, \max\{z_{ab}\}]$—weak positive relationship ($G_a \in (0.5, 1]$);
Group 2: $G_a \in (\max\{z_{ab}\} - 2t, \max\{z_{ab}\} - t]$—strong positive relationship ($G_a \in (0, 0.5]$);
Group 3: $G_a \in (\max\{z_{ab}\} - 3t, \max\{z_{ab}\} - 2t]$—negative strong relationship ($G_a \in (-0.5, 0]$);
Group 4: $G_a \in [\min\{z_{ab}\}, \max\{z_{ab}\} - 3t]$—negative weak relationship ($G_a \in ([-1, -0.5]$).

Here, $M(G_a)$ is the range of the quantity G_a, $\max(G_a)$ is the maximum value in the set of G_a, and $\min(G_a)$ represents the minimum value in the set of G_a.

The software used for data processing and analysis at the spatial level (development region, county and city) was Excel (Microsoft Office 365) and ArgGis 10.8.

3. Results

3.1. Romania's Population

The population is one of the most representative factors with a determining role in terms of the spatial distribution of football stadiums from a quantitative and qualitative point of view. The quantitative characteristics are represented by the number of structures, the allocated area and the capacity or the number of seats, while the qualitative ones refer to the degree of comfort and equipment, the year of construction and the year of rehabilitation. In this context, the knowledge of the spatial distribution of the population is an essential component that should be reflected in the way the infrastructure is distributed in general and that is specific to sport in particular, in this case being the distribution of football stadiums.

In order to explore the relationship between the population and football stadiums at a spatial level (development region, county and locality), the following defining information about the population was used: namely the total number of population members; population gender (number of male population members; number of female population members); age of the population (the number of the population members aged 0–14; the number of the population members aged 15–64; the number of the population aged members over 65) and the average number of employees.

Thus, in 2021, according to the data obtained from the census, the population of Romania was 19,053,815 inhabitants, of which 9,808,275 were women (51.5%), and the remaining 9,245,540 were men (48.5%). Regarding the structure of the population by age group, a large share of the population between the ages of 15 and 64 (64.3%) was noted, followed by the population members over 65 (19.6%) and children aged under 14 years (16.1%). The average number of employees was 5,209,493 people, which represents 27.3% of the total population. After normalizing and quantifying the four criteria associated with the population (Table 1) in Romania, across development regions, counties and localities, a synthetic population value was derived, ranging from 0 to 1.

The analysis of the distribution of the synthetic population index at the level of development regions indicates the existence of the following hierarchy: South (0.91), Northeast (0.72) and Ilfov–Bucharest (0.51), followed by the Northwest (0.49), Center (0.39), Southeast (0.16), Southwest (0.15) and West (0) (Figure 1). The Southern Development Region recorded the highest synthetic population index (0.91), having a population of 3,269,318 inhabitants, of which 1,676,805 are women (51.3%) and 1,592,513 are men (48.7%). Regarding the structure by age categories, the share of the population between the ages of

15 and 64 (2,087,877, 63.9%) is noteworthy, followed by the population over 65 (691,654, 21.2%) and children aged between 0 and 14 years (489,787, 15%). The number of employees was 897,155 people (17.2% of the total). At the opposite pole with the lowest synthetic population index (0) was the Western Development Region. The Western Development Region has a population of 1,668,921 inhabitants, of which 862,567 are women (51.7%) and 806,354 are men (48.3%). Regarding the structure by age categories, the share of the population between the ages of 15 and 64 was the largest (1,079,186, 64.7%), followed by the population over 65 (337,784, 20.2%) and children aged between 0 and 14 years, (251,951, 15.1%). The number of employees was 391,000 people (7.5% of the total).

At the county level, the top synthetic index values for the population were observed in Bucharest (0.25), followed by Prahova (0.056) and Bihor (0.055) (Figure 1). The territorial administrative unit of Bucharest has a population of 1,716,961 inhabitants, of which 926,212 are women (53.9%) and 790,749 are men (46.1%). Regarding the structure by age categories, the share of the population between the ages of 15 and 64 was the largest (1,119,862, 65.2%), followed by the population over 65 (333,080, 19.4%) and children aged between 0 and 14 years (264,019, 15.4%). The number of employees was 988,103 people (19% of the total). Prahova County has a population of 695,119 inhabitants, of which 360,105 are women (51.8%) and 335,014 are men (48.2%). Regarding the structure by age categories, the share of the population between the ages of 15 and 64 (446,547, 64.2%) is noteworthy, followed by the population over 65 (148,400, 21.3%) and children aged between 0 and 14 years, (100,172, 14.4%). The number of employees was 248,860 people (4.8% of the total). Bihor County has a population of 551,297 inhabitants, of which 283,444 are women (51.4%) and 267,853 are men (48.6%). Regarding the structure by age categories, the share of the population between the ages of 15 and 64 was greatest (358,871, 65.1%), followed by the population over 65 (100,424, 18.2%) and children aged between 0 and 14 years, (92,002, 16.7%). The number of employees was 248,416 people (4.8% of the total).

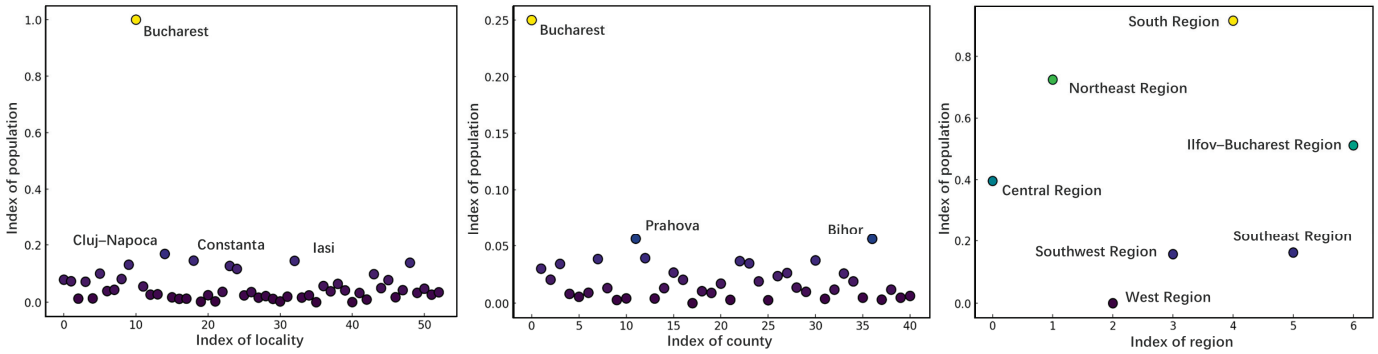

Figure 1. The distribution of the synthetic value of population at the locality, county and regional levels.

Among the 54 localities analyzed that host football stadiums with a capacity exceeding 4000 seats, the highest synthetic population index values were recorded in the cities of Bucharest (1), Cluj-Napoca (0.16) and Constanța (0.14) (Figure 1). Cluj-Napoca has a population of 286,598 inhabitants, of which 151,830 are women (53.3%) and 134,768 are men (47.0%). Regarding the structure by age category, the share of the population between the ages of 15 and 64 was the largest (191,482, 66.8%), followed by the population over 65 (53,576, 18.7%) and children aged between 0 and 14 years, (41,540, 14.5%). The number of employees was 186,456 people (3.6% of the total). The municipality of Constanța has a population of 263,688 inhabitants, of which 141,370 are women (53.6%) and 122,318 are men (46.7%). Regarding the structure by age category, the share of the population between the ages of 15 and 64 (163,449, 62.0%) is the largest, followed by the population over 65

(60,845, 23.1%) and children aged between 0 and 14 years, (39,394, 14.9%). The number of employees was 122,371 people (2.3% of the total).

Typological analysis based on the synthetic population index revealed distinct patterns at different levels of analysis. At the level of development regions, four types of regions were identified: regions with a very high value (between 0.76 and 1; one region, 12.5%), regions with a high value (between 0.76 and 1; two regions, 25.0%), regions with a low value (between 0.26 and 0.5; two regions, 25.0%) and regions with a very low value (between 0.0 and 0.25; three regions, 37.5%). At the county level, only one category was identified, consisting of counties with a very low value (between 0.0 and 0.25; 42 counties, 100%). In contrast, at the locality level, two categories of cities were identified: those with a very high value (between 0.76 and 1; Bucharest, 2.4%) and those with a very low value (between 0.0 and 0.25; 53 localities, 97.6%) (Figure 2).

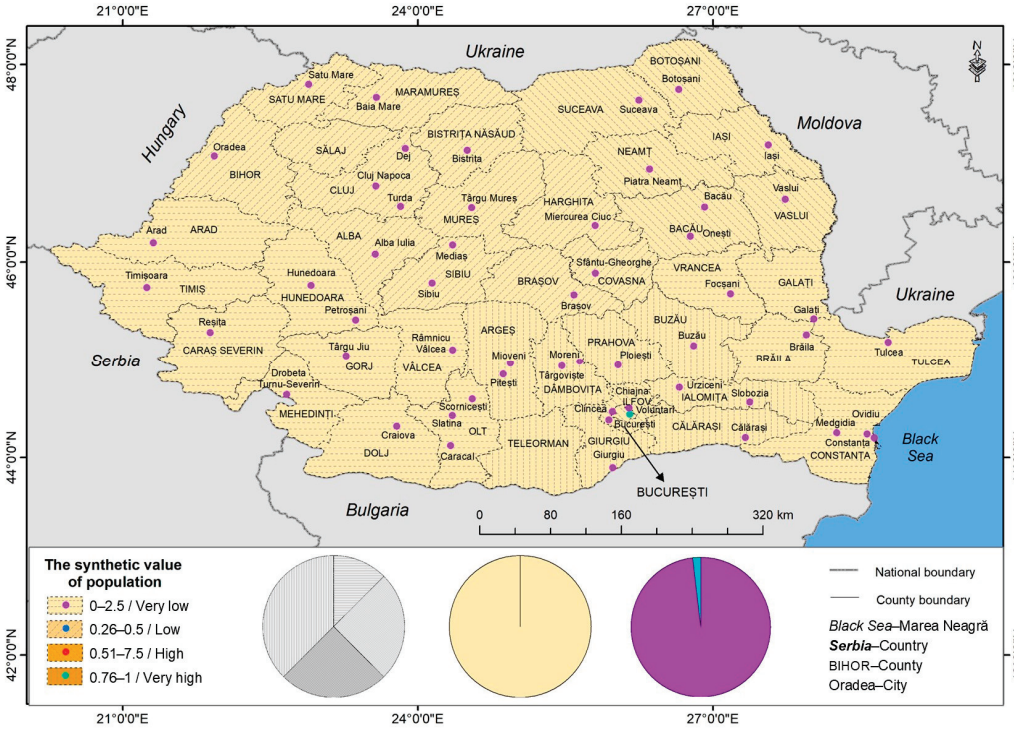

Figure 2. Spatial distribution of the synthetic value of the Romanian population.

3.2. Football Stadiums in Romania

Romania is represented, in terms of infrastructure focused on the practice of football, by the existence of 66 stadiums with a capacity of over 4000 seats each, totaling 878,816 seats, located in 54 localities in 40 counties (Figure 3). Among the analyzed stadiums, the oldest is the Miercurea Ciuc Stadium, built in 1904. Except for this one, in Romania, the first football stadiums appeared immediately after the creation of Great Romania (from 1918), so the first sports units of this type were built in 1920 (in the cities of Galați and Bucharest), followed by those in 1921 (Hunedoara), 1924 (Slatina and Oradea), etc.

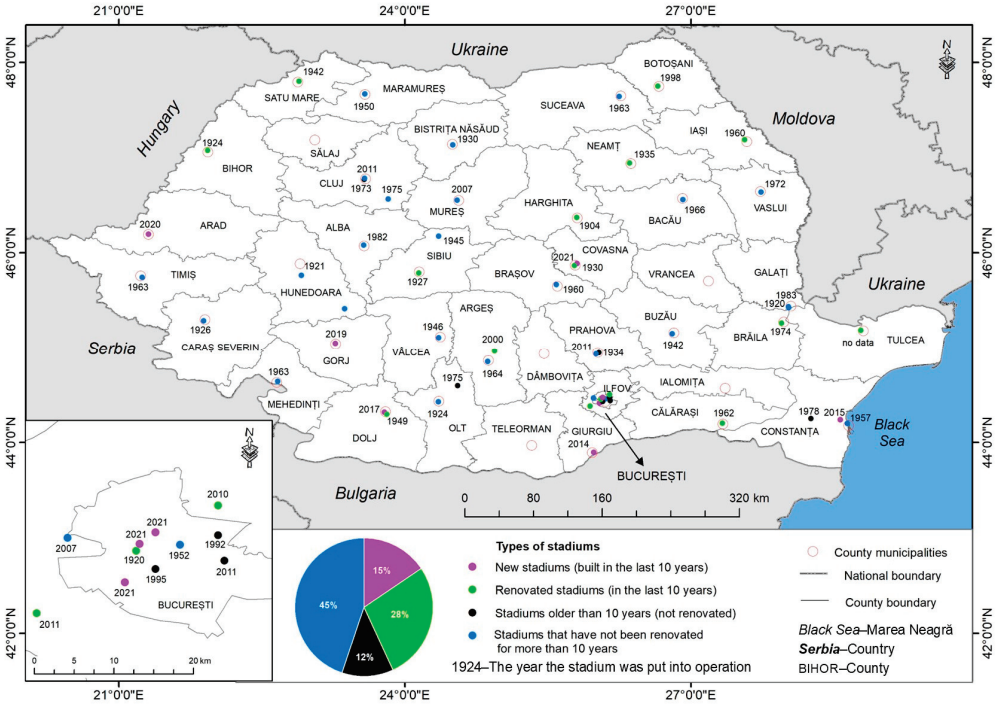

Figure 3. Spatial distribution of football stadiums in Romania with a capacity of more than 4000 seats.

The newest stadiums were completed in 2020 (Francisc von Neuman in Arad), 2021 (Steaua, Rapid Arena and Arcul de Triumf stadiums in Bucharest and Sepsi in Sfantu-Gheorghe) and 2023 (Eugen Popescu Stadium in Târgoviște), while another nine football stadiums are in the process of completion (Table 1).

The analysis by typological categories of the stadiums in Romania revealed the following situation: 45%, 26 units (stadiums with a renovation age of more than 10 years); 28%, 16 units (stadiums renovated in the last 10 years); 15%, 9 units (new stadiums, built in the last 10 years) and 12%, 7 units (older stadiums, not renovated) (Figure 3).

Going over the small number of such structures, compared to the population of Romania, which was 19,038,098 people on 1 January 2022 [58,59], and their needs, it can be seen that the share of functional, new or newly rehabilitated ones is small (43%, 25 units). However, in the detailed analysis of the stadiums renovated in the last 10 years, some non-functional aspects of them can be observed. One such example is the Iuliu Bodola stadium, built in 1924 and successively rehabilitated in 2004, 2007 and 2015.

To investigate the relationship between the population and football stadiums at a spatial level (development region, county and locality), the following defining information about football stadiums was used: namely the number of stadiums; the capacity of the stadiums; the elite category and the age of the stadiums (the year of construction, respectively, and the year of their rehabilitation).

After the normalization and quantification of the four criteria associated with football stadiums in Romania (Table 1), at the levels of development regions, counties and cities, a synthetic value for football stadiums was determined, ranging from 0 to 1.

The analysis of the distribution of the synthetic index for football stadiums at the development region level reveals the following hierarchy: Ilfov–Bucharest (0.94), South (0.78) and Southwest (0.71), followed by the Center (0.54), West (0.51), Southeast (0.438), Northwest (0.43) and Northeast (0.23) regions (Figure 4). The Ilfov–Bucharest Development Region registered the highest synthetic index regarding football stadiums (0.94), having

11 stadiums (16.7% of the total) with a capacity of 113,325 seats (12.9% of the total), while at the opposite pole, the lowest synthetic index was recorded in the Northeast Development Region (0.23), where there were 7 stadiums (10.6% of the total) with a capacity of 82,912 seats (9.4% of the total).

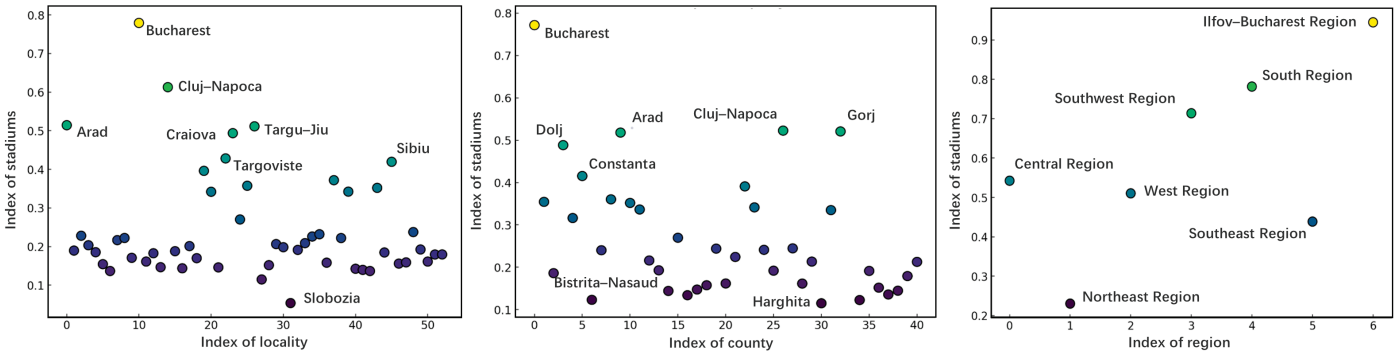

Figure 4. The distribution of the synthetic value of stadium at the locality, county and regional levels.

At the county level, the highest values of the synthetic index for football stadiums were observed in Bucharest (0.77), Arad (0.522) and Cluj (0.52), while the lowest values were recorded in the counties of Harghita (0.11) and Bistrița Năsăud (0.12) (Figure 4). Sălaj and Teleorman counties do not benefit from any football stadium with a capacity greater than 4000 seats; therefore, the synthetic value of football stadiums for these two counties was not calculated.

At the city level, the highest values of the synthetic index for football stadiums were recorded in Bucharest (0.77), Cluj-Napoca (0.61) and Arad (0.51), while the lowest values were recorded in the cities of Olt (0.13), Harghita (0.11) and Ialomița (0.05) (Figure 4).

The typological analysis of the synthetic index for football stadiums revealed the following situations based on the level of analysis: At the development region level, four categories of regions were identified: regions with a very high value (between 0.76 and 1; two regions, 25.0%), regions with a high value (between 0.5 and 0.76; three regions, 37.5%), regions with a low value (between 0.26 and 0.5; two regions, 25.0%) and regions with a very low value (between 0.0 and 0.25; one region, 12.5%). Based on the synthetic values related to football stadiums at the county level, four types of counties were identified: those with a very good value (between 0.76 and 1; 1 county, 2.4%), those with a good value (between 0.75 and 0.5; 3 counties, 7.1%), those with a weak value (between 0.26 and 0.5; 10 counties, 23.8%) and those with a very weak value (between 0.0 and 0.25; 25 counties, 59.5%). A similar pattern emerged from the analysis of the synthetic values of football stadiums at the city level. The cities were categorized as follows: those with a very high value (between 0.76 and 1; 1 city, 1.9%), a high value (between 0.5 and 0.75; 3 cities, 5.6%), a low value (between 0.26 and 0.5; 10 cities, 18.5%) and a very low value (between 0.0 and 0.25; 40 cities, 74.1%) (Figure 5).

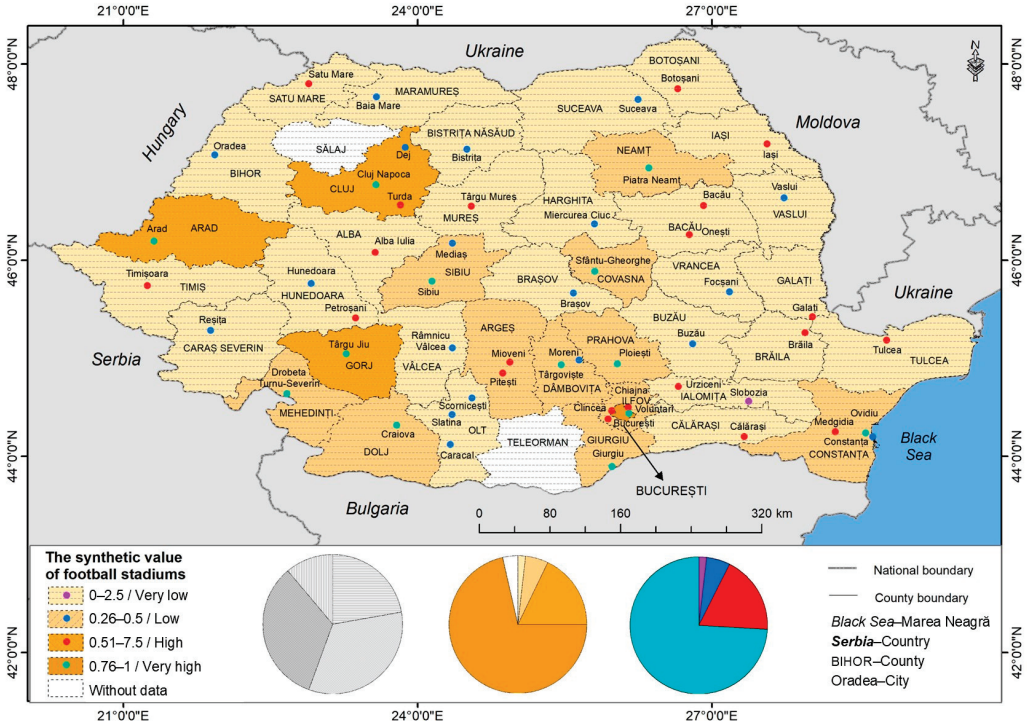

Figure 5. Spatial distribution of the synthetic value of football stadiums in Romania.

3.3. Relations Between the Population and Football Stadiums in Romania

Following the analysis of the relationship index between the population and football stadiums in Romania, at the spatial level (development region, county and locality), based on the eight analyzed criteria, the following types of relationships were identified:

(1) Weak negative relationships, characterized by index values ranging from $[-1; -0.5]$, were identified in 2 development regions (25.0%), 39 counties (92.9%), and 41 cities (75.9%). This type of relationship indicates that the population values are either zero or lower than those associated with football stadiums (Figures 6 and 7). For instance, in the West and Southwest Development Regions, the population values were 0 and 0.156484957, respectively, compared to the football stadium values of 0.510335409 and 0.713751832. Similarly, in Buzău County, a relationship index of -1 was observed, derived from the ratio of the population index (0.0) to the football stadium index (0.147281618). Regarding this type of relationship at the locality level, we mention Ilfov, Olt and Constanța where the population index values (0.000268894, 0.000622124 and 0.002269193) were lower than those related to football stadiums (0.231860021, 0.142361238 and 0.396021006).

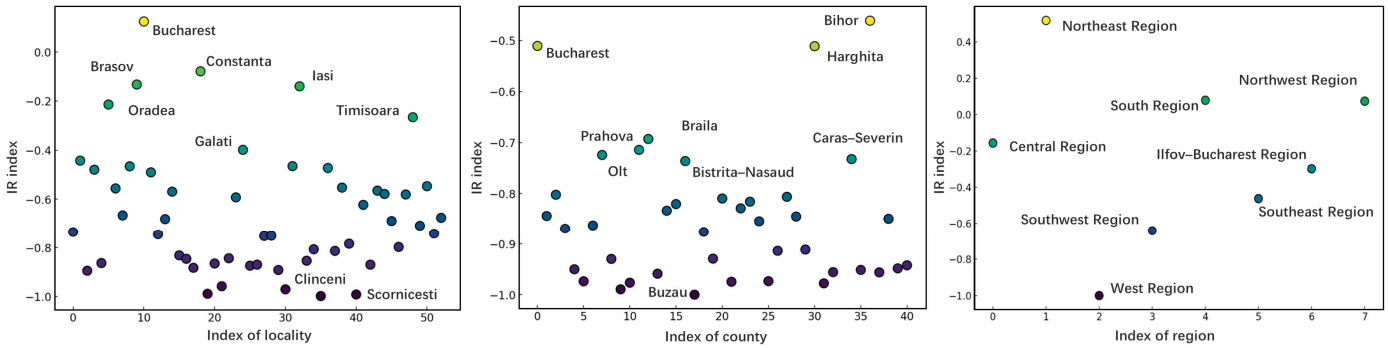

Figure 6. The distribution of relationship types between the population and football stadiums at the locality, county, and regional levels.

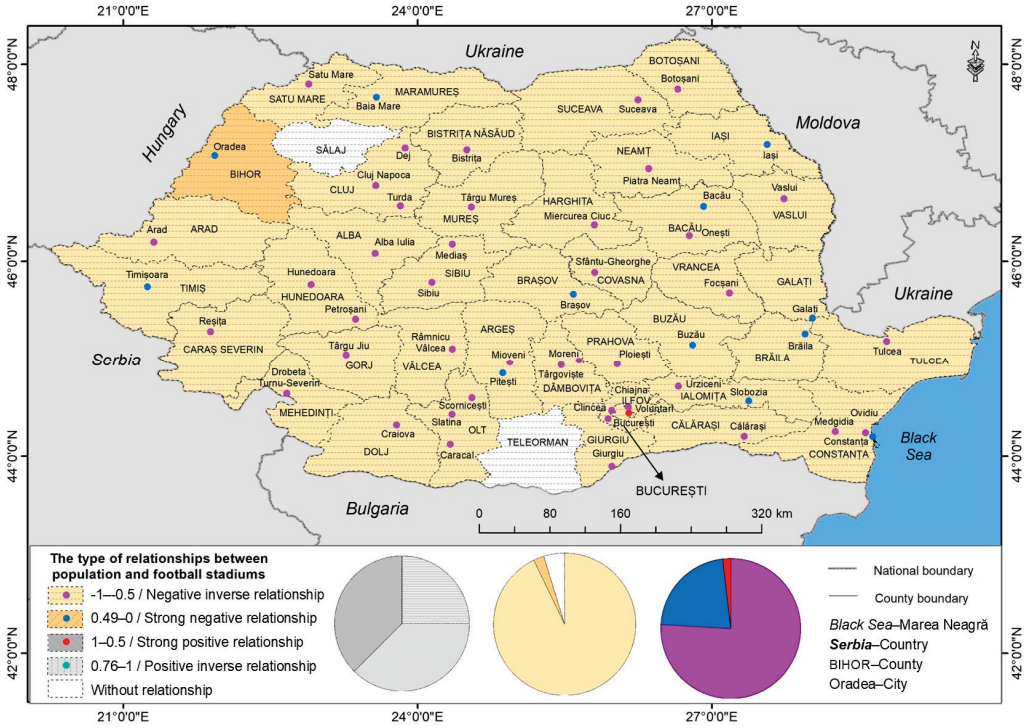

Figure 7. Spatial distribution of the types of relationships between the population and football stadiums in Romania.

(2) Strong negative relationships, with relationship index values ranging between −0.51 and 0, were observed in 3 development regions (37.5%), 1 county (2.4%), and 12 localities (22.2%) (Figures 6 and 7). These relationships are characterized by population values being lower than the corresponding values for football stadiums. Thus, for the Ilfov–Bucharest, Southeast and Center Development Regions, the population values were 0.511295494, 0.161579611 and 0.395843817, while the specific values for football stadiums were 0.944710031, 0.438559322 and 0.542372881, respectively. A comparable situation was observed in Bihor County, characterized by a value for the relationship index of −0.461113854, resulting from the ratio of the population index (0.055941796) to the index of football stadiums (0.151678297). Regarding this type of relation at the locality level, we mention Brașov, Constanta and Iași, where the values of the population index (0.130803651, 0.145060331 and 0.144312265) were lower than those related to football stadiums (0.170756629, 0.169859653 and 0.191263739).

(3) Strong positive relationships, with relationship index values ranging between 0 and 0.5, were identified in three development regions (37.5%), zero counties (0.0%), and one locality (1.9%) (Figures 6 and 7). In this case, the population values are higher than those specific to football stadiums. Thus, for the Northwest, Northwest and Southern Development Regions, the population values were 0.499256316, 0.724344256 and 0.915406286, while the specific values for football stadiums were 0.430548559, 0.230271026 and 0.781516587. A similar situation was also noted regarding the city of Bucharest, characterized by a relationship index with a value of 0.124118446 resulting from the ratio of the population index (1) to the index of football stadiums (0.779171943).

(4) Weakly positive relationships, characterized by relationship index values between 0.51 and 1, were not identified. This type of relationship is typically defined by football stadium values being equal to zero or lower than the corresponding population-specific values.

4. Discussion

Sports, particularly football, are one of the fundamental interests of modern society, with significant impacts across social, cultural, political and other domains. This fact calls for and requires their analysis at a spatial level (development region, county and locality) through multicriteria methods that include both quantitative and qualitative variables. According to this idea, establishing and knowing the relationships between the population and football stadiums is a necessary activity, having a major impact on the judicious distribution of the resources needed to build the sports infrastructure. The working hypotheses from which the present approach started, according to which there are strong relations between the population and football stadiums, were partially confirmed only at the level of 6 development regions (75%), 1 county (2.4%) and 12 localities (24.1%). This is explained by the complexity and dynamics of the determinants that can influence the relationship between the population and football stadiums. Among the factors we mention are political, economic, cultural, social, etc. So, explaining the relationship between the population and football stadiums has proven to be a particularly interesting and difficult aspect to quantify. The difficulty of quantification comes from the lack of information with national coverage on the three levels of analysis studied (development region, county and city). Overcoming this obstacle could represent a desirable future that requires resources to be commensurate with the area studied and the accuracy and precision of the desired results to be obtained. With all these inconveniences and disadvantages that the study has, it represents a step forward in researching the relationships between the population and football stadiums.

Among the weak points of the research, it is noted that only large stadiums with a capacity of over 4000 seats were considered in the study. Another weakness was the low number of indicators due to the lack of data and information covering the three levels of analysis, both for the population and for football stadiums. The lack of data was the reason why, regarding the population, we used the data from the 2021 Population and Housing Census of Romania. Despite this, we mention the fact that the trends regarding the population do not change from one year to another, so the objective of the research did not suffer for this reason.

Over time, numerous studies have been carried out that used a working methodology like the one used in the present study, aiming at cultural heritage [62], urban functionality [63], social and economic development [52,64,65] and tourism [46,54–57]. Considering that football stadiums are points of convergence for a population that loves sports events, with a strong spatial impact, new future studies are needed to highlight: the mechanisms by which football stadiums attract the population from the territory; the motivations of the population's participation in sports events; the perception of the population, decision makers and service providers towards sports, specifically football; determining factors; population attraction area; etc.

While the study provides significant insights into the relationship between the population and football stadiums, future research could benefit from incorporating a sensitivity analysis to assess the robustness of the findings. This would help identify how variations in input parameters or criteria weights might influence the results. Additionally, the exclusion of smaller stadiums, which often play a vital role in local communities, represents a limitation that could be addressed in future studies. Including such facilities may offer a more comprehensive understanding of the spatial distribution of sports infrastructure and its alignment with population characteristics. These enhancements would strengthen the methodology and provide more actionable insights for policymakers and urban planners.

5. Conclusions

Following the current research, it emerged that the relations between the population and football stadiums are complex and multidimensional, involving economic, social, cultural and urban aspects. Understanding and analyzing the spatial relationships between the population and football stadiums is essential for developing an effective approach to allocating financial resources for sports infrastructure. This approach considers the spatial distribution across development regions, counties and cities, aligning investments with the population size and defining characteristics such as the gender, age, purchasing power, leisure time and preferences.

The lack of information covering the three levels of analysis—development region, county and city—led to some limitation of the index of the relationship between the population and football stadiums in Romania, with it being defined by eight indicators: four for the population, four for football stadiums. However, the synthetic values of the population and football stadiums in Romania were calculated on three levels of spatial analysis, namely the development region, county and city. The analysis of the synthetic population values at the spatial level highlighted the following: the development regions of the South, Northeast and Ilfov–Bucharest; the counties of Bucharest, Prahova and Bihor and the cities of Bucharest, Cluj and Constanța. In contrast, the synthetic values for football stadiums were highest in the regions of Ilfov–Bucharest, South and Southwest; the counties of Bucharest, Cluj and Arad and the cities of Bucharest, Cluj-Napoca and Arad. Furthermore, based on the synthetic values of the population and football stadiums, three types of relationship between the population and football stadiums in Romania were established as follows: slightly negative relationships (2 development regions, 39 counties and 41 cities), relationships strongly negative (3 development regions, 1 county and 12 cities) and strongly positive relationships (3 development regions and 1 city). Weakly positive relationships were not identified. Also, in Teleorman and Sălaj counties, there were no relations between the population and football stadiums due to the total lack of football stadiums with a capacity of over 4000 seats.

Therefore, from the spatial analysis of the distribution of relations between the population and football stadiums in Romania, the existence of a normal situation (prevailing strong positive and negative relations) was found, which tests the research hypothesis but at the level of 6 development regions (75%), 12 localities (24.1%) and 1 county/district (Bihor County, 2.4%). The results of the study underline how the spatial distribution of football stadiums can guide urban planning decisions, contributing to the coherent and functional development of cities in Romania.

Author Contributions: Conceptualization, G.V.H. and G.C.B.; methodology, G.V.H. and G.C.B.; software, T.C.; validation, T.C., M.Ș. and G.V.H.; formal analysis, G.V.H.; investigation, M.L.H.; resources, M.Ș. and M.L.H.; data curation, T.C.; writing—original draft preparation, G.V.H.; writing—review and editing, G.C.B. and M.Ș.; visualization, M.L.H.; supervision, G.V.H. All authors have read and agreed to the published version of the manuscript.

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References

1. Maslow, A.H. A theory of human motivation. *Psychol. Rev.* **1943**, *50*, 370–396. [CrossRef]
2. Foramitti, J. A framework for agent-based models of human needs and ecological limits. *Ecol. Econ.* **2023**, *204*, 107651. [CrossRef]
3. Zekioglu, A.; Kalkan, N. Anatolian Cultural Heritage: Ancient Stadiums Related to Sport or Physical Culture? *Univers. J. Educ. Res.* **2019**, *7*, 106–110. [CrossRef]
4. Gürel, E.; Akkoç, U. Stadyum: Benzerlikler, Koşutluklar ve İzdüşümler. *Uluslararası Sos. Araştırmalar Derg.* **2011**, *4*, 346–370.
5. Kiuri, M.; Reiter, S. Olympic stadium design: Past achievements and future challenges. *ArchNet-IJAR Int. J. Archit. Res.* **2013**, *7*, 102–117.
6. Kiuri, M.; Teller, J. Olympic stadiums and cultural heritage: On the nature and status of heritage values in large sport facilities. *Int. J. Hist. Sport* **2015**, *32*, 684–707. [CrossRef]
7. Ilieș, A.; Caciora, T. Mapping the Scottish university football competitions. A dual performance model: Organized sports and professional training. *Geosport Soc.* **2020**, *12*, 72–90. [CrossRef]
8. Balletto, G.; Borruso, G.; Tajani, F.; Torre, C.M. Gentrification and sport. Football stadiums and changes in the urban rent. In *Computational Science and Its Applications—ICCSA*; Springer International Publishing: Berlin/Heidelberg, Germany, 2018; pp. 58–74.
9. Bradbury, J.C. The impact of sports stadiums on localized commercial activity: Evidence from a Business Improvement District. *J. Reg. Sci.* **2022**, *62*, 194–217. [CrossRef]
10. Velluet, P. Wembley Stadium—The loss of the much-valued twin-towers. Sustaining Memory. *Sport. Herit. Sustain. Mem. Conserv. Bull.* **2012**, *68*, 23.
11. Houlihan, B. Sport, national identity and public policy. *Nations Natl.* **1997**, *3*, 113–137. [CrossRef]
12. Ward, T. Sport and national identity. *Soccer Soc.* **2009**, *10*, 518–531. [CrossRef]
13. Sabbe, S.; Bradt, L.; Roets, G.; Roose, R. Revisiting the notion of cohesion in community sport: A qualitative study on the lived experiences of participants. *Leis. Stud.* **2019**, *38*, 274–287. [CrossRef]
14. Raw, K.; Sherry, E.; Rowe, K. Sport for social cohesion: Exploring aims and complexities. *Sport Manag. Rev.* **2022**, *25*, 454–475. [CrossRef]
15. Jarvie, G. *Sport, Culture and Society: An Introduction*, 2nd ed.; Routledge: London, UK, 2012.
16. Hargreaves, J. *Sport, Culture and Ideology*, 1st ed.; Routledge: London, UK, 2014.
17. McIntosh, P.C. *Sport in Society*; Watts: London, UK, 1968.
18. Palacios-Huerta, I. Structural changes during a century of the world's most popular sport. *Stat. Methods Appl.* **2004**, *13*, 241–258. [CrossRef]
19. Cleland, J. *A Sociology of Football in a Global Context*; Routledge: London, UK, 2015.
20. Kirim, A.B. The Role of Local Government Area Administrators in The Development of Football in Taraba State Nigeria. *Solo Int. Collab. Publ. Soc. Sci. Humanit.* **2025**, *3*, 69–82.
21. Yu, W.; Liao, W.; Zhong, Y.; Guan, Y. International youth football research developments: A CiteSpace-based bibliometric analysis. *Heliyon* **2025**, *11*, e41663. [CrossRef]
22. Heinilä, K. Football at the Crossroads: I. Football as a Social System. *Int. Rev. Sport Sociol.* **1969**, *4*, 5–30. [CrossRef]
23. Frank, S.; Steets, S. *Stadium Worlds: Football, Space and the Built Environment*; Routledge: London, UK, 2010.
24. Mangan, J.A. *The Cultural Bond: Sport, Empire, Society*; Routledge: London, UK, 2013.
25. Chaeroni, A.; Muspardi, M.; Ahmed, M.; Talib, K.; Orhan, B.; Lani, M.; Asuti, Y.; Kurnaz, M. Sports as an Instrument of Nationalism and Patriotism: A Systematic Literature Review on the Role of Sports in Shaping National Identity in Various Countries. *Retos* **2024**, *61*, 1038–1049. [CrossRef]
26. Weber, R. Banal Europeanism? Europeanisation of football and the enhabitation of a Europeanised football fandom. In *Sport and Nationalism*; Routledge: London, UK, 2024; pp. 55–71.
27. Storey, D. Footballing journeys: Migration, citizenship and national identity. *J. Geogr. High. Educ.* **2024**, *48*, 22–30. [CrossRef]
28. Guilianotti, R. *Football, Violence and Social Identity*; Routledge: London, UK, 2013.
29. Romanian Football Federation. Available online: https://www.frf.ro/ (accessed on 2 May 2024).
30. Balint, G. *Theoretical Bases and Means of Action for the Specific Physical Training of Football Players*; Pim: Iași, Romania, 2008.
31. Hancăș, P.A.; Gozu, B. Training in the lactate tolerance zone in the game of soccer improves performance. *Palestrica Third Millenn. Civiliz. Sport* **2012**, *13*, 124–129.
32. Marinău, M. Issues concerning the use of strength and power practice, during the preparatory period, for U19 youth football players. *GeoSport Soc.* **2017**, *6*, 7–13.
33. Kiuri, M. The Intangible Heritage of Olympic Stadiums. In Proceedings of the Virtual Workshop I: "The Significance of Sardar Vallbhbhai Patel Stadium, Ahmedabad, India, 2 June 2021; WMF: New York, NY, USA, 2021; pp. 1–8.

34. Rosentraub, M. Book review for The New Cathedrals: Politics and Media in the History of Stadium Construction. *J. Urban Aff.* **2009**, *31*, 641–643. [CrossRef]
35. Kiuri, M. Olympic values-based learning as an effective tool for environmental protection. The social impact and cultural significance of sustainable Olympic stadium design. In Proceedings of the Olympic Values-Based Learning as an Effective Tool for Environmental Protection 56th International Session for Young Participants, Athens, Greece, 11–25 June 2016; International Olympic Academy and the International Olympic Committee: Athens, Greece, 2017; pp. 108–121.
36. Yüce, A.; Katırcı, H.; Yüce, S.G. Examination of sustainable features of stadiums as an integral part of sustainable urban development: The case of Turkey. *Int. J. Sports Mark. Spons.* **2020**, *22*, 142–163. [CrossRef]
37. Kozma, G.; Czimre, K.; Bács, B.A.; Ilieş, A.; Pfau, C.S.; Bulz, G.C.; Bács, Z. A Special Type of Multifunctional Stadiums: Great Forest Stadium in Debrecen (Hungary). *Buildings* **2022**, *12*, 2261. [CrossRef]
38. Fabula, S.; Nielsen, R.S.; Barberis, E.; Boros, L.; Winther, A.H.; Kovács, Z. Diversity and local business structure in European urban contexts. *Hung. Geogr. Bull.* **2021**, *70*, 65–80. [CrossRef]
39. Fekete, D.; Morvay, S. A kreatív városok kulturális-turisztikai-pénzügyi potenciáljának kvantitatív összehasonlító elemzése (Debrecen, Győr és Veszprém példáján). *Területi Stat.* **2020**, *60*, 548–566. [CrossRef]
40. Greenberg, M.J. Sports facility financing and development trends in the United States. *Marq. Sports L. Rev.* **2004**, *15*, 93.
41. Newsome, T.H.; Comer, J.C. Changing intra-urban location patterns of major league sports facilities. *Prof. Geogr.* **2000**, *52*, 105–120. [CrossRef]
42. Kozma, G. Sport as an element in the place branding activities of the local governments. *GeoJournal Tour. Geosites* **2010**, *3*, 133–143.
43. Kozma, G.; Teperics, K.; Radics, Z. The changing role of sports in urban development: A case study of Debrecen (Hungary). *Int. J. Hist. Sport* **2014**, *31*, 1118–1132. [CrossRef]
44. Tütünkov-Hrisztov, J.; Müller, A.; Molnár, A. The appearance of sport as a travel motivation in traveling habits. *Geosport Soc.* **2020**, *12*, 31–43. [CrossRef]
45. Edensor, T.; Millington, S.; Steadman, C.; Taecharungroj, V. Towards a comprehensive understanding of football stadium tourism. *J. Sport Tour.* **2021**, *25*, 217–235. [CrossRef]
46. Herman, G.V.; Grama, V.; Ilieș, A.; Safarov, B.; Ilieș, D.C.; Josan, I.; Buzrukova, M.; Janzakov, B.; Privitera, D.; Dehoorne, O.; et al. The Relationship Between Motivation and the Role of the Night of the Museums Event: Case Study in Oradea Municipality, Romania. *Sustainability* **2023**, *15*, 1738. [CrossRef]
47. Kim, A.C.H.; Ryu, J.; Lee, C.; Kim, K.M.; Heo, J. Sport participation and happiness among older adults: A mediating role of social capital. *J. Happiness Stud.* **2021**, *22*, 1623–1641. [CrossRef]
48. da Silva Rodrigues, G.; da Silva Sobrinho, A.C.; Costa, G.P.; da Silva, L.S.L.; de Lima, J.G.R.; da Silva Gonçalves, L.; Júnior, C.R.B. Benefits of physical exercise through multivariate analysis in sedentary adults and elderly: An analysis of physical fitness, health and anthropometrics. *Exp. Gerontol.* **2025**, *200*, 112669. [CrossRef]
49. Li, X.Y. The relationship between quality of sports friendships and mental health in Chinese junior high school students: The bidirectional chain mediating effects of sport motivation and exercise adherence. *BMC Public Health* **2025**, *25*, 52. [CrossRef]
50. Nawabi, D.H.; Bedi, A.; Tibor, L.M.; Magennis, E.; Kelly, B.T. The demographic characteristics of high-level and recreational athletes undergoing hip arthroscopy for femoroacetabular impingement: A sports-specific analysis. *Arthrosc. J. Arthrosc. Relat. Surg.* **2014**, *30*, 398–405. [CrossRef] [PubMed]
51. Hernández-Simal, L.; Calleja-González, J.; Calvo, A.L.; Aurrekoetxea-Casaus, M. Birthplace Effect in Soccer: A Systematic Review. *J. Hum. Kinet.* **2024**, *94*, 227. [CrossRef] [PubMed]
52. Kiselakova, D.; Stec, M.; Grzebyk, M.; Sofrankova, B. A multidimensional evaluation of the sustainable development of European Union countries—An empirical study. *J. Compet.* **2020**, *12*, 56–73. [CrossRef]
53. Patro, S.G.K.; Sahu, K.K. Normalization: A preprocessing stage. *Iarjset* **2015**, *2*, 20–22. [CrossRef]
54. Boc, E.; Filimon, A.L.; Mancia, M.-S.; Mancia, C.A.; Josan, I.; Herman, M.L.; Filimon, A.C.; Herman, G.V. Tourism and Cultural Heritage in Beius, Land, Romania. *Heritage* **2022**, *5*, 1734–1751. [CrossRef]
55. Deac, L.A.; Herman, G.V.; Gozner, M.; Bulz, G.C.; Boc, E. Relationship between Population and Ethno-Cultural Heritage—Case Study: Crisana, Romania. *Sustainability* **2023**, *15*, 9055. [CrossRef]
56. Herman, G.V.; Tatar, C.F.; Stasac, M.S.; Cosman, V.L. Exploring the Relationship Between Tourist Perception and Motivation at a Museum Attraction. *Sustainability* **2023**, *16*, 370. [CrossRef]
57. Herman, G.V.; Blaga, L.; Filimon, C.; Caciora, T.; Filimon, L.; Herman, L.M.; Wendt, J.A. Spatial Distribution of Relationship between Historical Monuments and Tourism: The Case Study of Bihor County in Romania. *Land* **2024**, *13*, 668. [CrossRef]
58. Population and Housing Census. 2021. Available online: https://www.recensamantromania.ro/ (accessed on 20 May 2024).
59. National Institute of Statistics. Statistical Database, TEMPO ONLINE. Available online: http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table (accessed on 20 May 2024).

60. Stadiums in Romania. Available online: https://worldofstadiums.com/europe/romania/ (accessed on 25 May 2024).
61. List of Romanian Stadiums. Available online: https://en.wikipedia.org/wiki/List_of_football_stadiums_in_Romania (accessed on 25 May 2024).
62. Król, K. Assessment of the Cultural Heritage Potential in Poland. *Sustainability* **2021**, *13*, 6637. [CrossRef]
63. Sojda, A.; Wolny, M. The Impact of Standardisation Method on Smart City Ranking. *Organ. Manag. Ser.* **2020**, *142*, 83–94. [CrossRef]
64. Della Spina, L.; Giorno, C. Cultural Landscapes: A Multi-Stakeholder Methodological Approach to Support Widespread and Shared Tourism Development Strategies. *Sustainability* **2021**, *13*, 7175. [CrossRef]
65. Rymuza, K.; Bombik, A. Multidimensional Analysis of Social and Economic Development of Some Counties in Mazovia Voivodeship. *Acta Sci. Polonorum. Oeconomia* **2014**, *13*, 81–93.

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Article

Complicating 'Suburbanization' and Spatial Assimilation: The Complex Residential Patterns of Southeast Asian Americans in the Minneapolis-St. Paul Metropolitan Area from 1990 to 2010

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Abstract: Although spatial assimilation has often been defined as the process whereby a group attains residential propinquity with majority members of a host society, we argue that for certain immigrant groups, substantial suburbanization does not necessarily lead to racial integration. Our analysis using data from the U.S. Census Bureau reveals that between 1990 and 2010, Southeast Asian former refugees in the Minneapolis-St. Paul Metropolitan Statistical Area experienced substantial suburbanization, which is expected given their improved socioeconomic status. However, Southeast Asians' suburbanization has not led to residential propinquity with non-Hispanic Whites. Despite a small decline in Southeast Asians' overall segregation at the metropolitan area level during the previous two decades, their segregation levels, as measured by the dissimilarity index, remained unchanged or increased in the central city and the suburbs. Furthermore, our findings reveal different ethnic concentration and segregation patterns among four Southeast Asian subgroups, complicating the meaning of 'suburbanization' as simply a process in which people move from the inner city to its less urban outskirts. The finding that substantial suburbanization coexists with high levels of segregation and ethnic concentration raises questions about the assumptions of both the spatial assimilation and place stratification models of immigrant residential processes and outcomes.

Keywords: immigrant spatial assimilation; place stratification; suburbanization; racial segregation; Southeast Asian former refugees

1. Introduction

Nearly five decades ago, Leo Schnore pointed out that "just as there is no satisfactory definition of 'suburbs,' so also is there no consensus regarding the meaning of 'suburbanization'" [1]. This remains the case today. Some have defined suburbanization as the movement of people from the central city to its less urban outskirts within the same metropolitan area [2]. Others have defined it as "a process involving the systematic growth of fringe areas at a pace more rapid than that of core cities, [and] a lifestyle involving a daily commute to jobs in the center" [3]. Still, some point out that suburbanization reflects "a political creation brought about by the division of urban space into mutually exclusive units of local government" [4]. Nevertheless, "suburbanization" has often been conceptualized as a critical "step" or precursor to another outcome: immigrant spatial assimilation. According to Alba et al. [5], "the identification of suburbanization as a key step in the process of spatial or residential assimilation is well established for past [European] immigrant groups".

In this paper, we use United States Census data to examine the suburbanization, segregation, and ethnic concentration of four former refugee groups from Southeast Asia—Cambodians, Hmong, Laotians, and Vietnamese—within the Minneapolis-St. Paul metropolitan area of Minnesota between 1990 and 2010. We limit the category of Southeast Asian to these four groups because their generally lower and more heterogeneous social

class backgrounds distinguish them from other post-1965 immigrants from Southeast and East Asia who have tended to be of higher social class statuses [6–8]. Specifically, we aim to address three interrelated questions: (1) how and to what extent has the suburbanization of individual Southeast Asian former refugee groups changed in the Minneapolis-St. Paul Metropolitan Statistical Area between 1990 and 2010? (2) how has Southeast Asians' suburbanization affected their degree of racial segregation in the central city and in the suburbs? (3) how does understanding the differences between these Asian subgroups improve our understanding of urban geographic processes?

Our paper contributes to the literature on immigrant groups' urban geographic processes in at least three ways. First, we call attention to the problem of lumping various Asian American subcategories into a single racial category, Asian, when studying racial segregation in the United States. Although past studies have suggested that Asians are the least segregated among racial minority groups [9], we suspect that segregation levels vary across Asian American groups. We show in this paper that despite living in the same state, Southeast Asians' degree of segregation differs from that of other Asians. Furthermore, we show that even within the category of "Southeast Asians", there are between-group differences with respect to ethnic concentration, suburbanization and segregation patterns.

Second, rather than side with one side or the other debate on whether minority groups experience spatial assimilation or place stratification (of which more below), we argue that certain immigrant groups can experience substantial suburbanization alongside substantial residential segregation and persistent ethnic concentration. We call attention to the possibility that immigrant groups can experience different or divergent urban geographic processes—that is, different combinations of suburbanization, ethnic concentration, and racial segregation—depending on their unique contexts of reception.

Finally, we chose the Minneapolis-St. Paul MSA as a site to examine urban geographic processes such as immigrant suburbanization, segregation, and ethnic concentration because past research on immigrant residential patterns has mostly examined cities such as New York, Los Angeles, San Francisco, Miami, and Chicago. It is well documented that immigrant settlements are expanding into medium and small cities away from coastal cities, some of which used to be immigrant gateways and some of which are new gateways [10–12]. Minneapolis-St. Paul or the Twin Cities collectively is a re-emerging immigrant gateway city in the sense that it received significant waves of European immigrants in the mid- to late-1800s [13]; however, it was not until the late 1970s that the city began receiving significant numbers of immigrants again, namely, refugees from Southeast Asia [14]. As we describe below, tens of thousands of Southeast Asian refugees have settled and formed vibrant communities in the Minneapolis-St. Paul MSA since the late 1970s. Yet, we currently do not know whether or to what extent these communities are similar to or different from other Asian American communities, such as Asian American enclaves in New York or Chinese American ethnoburbs in Los Angeles [15].

We will proceed as follows. First, we review the relevant theoretical and empirical literature on minority residential processes and outcomes in the United States. Second, we provide a succinct background of Southeast Asian former refugees' contexts of reception in Minnesota. Third, we describe our data sources and measurements. Next, we present the evidence on Southeast Asians' patterns of suburbanization, levels of segregation, and degrees of ethnic concentration. Then, we discuss the implications of our findings for understanding immigrant groups' complex urban geographic processes.

1.1. Minority Residential Processes

In the United States, two theoretical models or perspectives on minority groups' residential processes/outcomes have been predominant. These are the spatial assimilation model and the place stratification model on minority residential processes and outcomes. We discuss each of these in turn before discussing trends in suburbanization in the United States.

In one of the earliest sociological works to deploy the term, Massey and Mullan define spatial assimilation as "the process whereby a group attains residential propinquity with

members of a host society" [16]. They continue, "In the United States, it has generally involved the movement of minority groups out of established racial and ethnic neighborhoods into a larger urban environment inhibited primarily by 'nonethnic' native whites" (Massey and Denton 1984, 837). More recent studies define spatial assimilation similarly as the "movement by immigrant minorities away from ethnic enclaves and into communities where the ethnic majority predominates" [5]. Implicit in the definition of spatial assimilation is the assumption that immigrants and ethnic minorities desire residential propinquity with the majority, which, in the context of the U.S., are Whites. Yet, whether some or most non-White immigrants want to live near Whites is an open empirical question. By assuming that ethnic minority immigrants want to live near Whites, spatial assimilation ignores the real possibility that some immigrants may want to live near co-ethnics in order to maintain an ethnic community.

A related assumption of the spatial assimilation model is that immigrant settlement in the central city is a temporary phenomenon and that "over time. . .social mobility and acculturation [will] bring about the spatial assimilation of minority groups in urban society" [17]. It is thought that as an immigrant minority group becomes more acculturated and especially as it achieves socioeconomic mobility, its members will engage in suburbanization in order to "improve their spatial position in urban society" [17] and increase their or their children's life chances (Massey and Denton 1988b, 613; Massey and Mullan 1984, 837-8). According to Massey and Denton [17], "both socioeconomic mobility and acculturation reduce the social distance between minority members and native whites, so the former's entry into a [suburban] neighborhood does not spark hostility, resistance, and systematic out-migration by the latter".

The second perspective on minority groups' residential processes and outcomes is the place stratification perspective [18]. Rather than assume that a minority group's socioeconomic status or prior acculturation will lead them toward integration, this perspective posits that the established and privileged residents of an area often "employ exclusionary strategems, such as zoning regulations, to maintain their superior position" [19]. In addition, the following was noted: "Among the targets of exclusion are minorities such as African-Americans and Latinos, who thus find it difficult or impossible to enter the best residential environments and must pay more than Whites to significantly improve their surroundings" [19]. Because of exclusionary practices, even as minorities undergo suburbanization, they may remain concentrated in areas with higher proportion of minorities and disadvantaged people rather than achieve residential propinquity with Whites [19]. However, by assuming that segregation is largely a result of external exclusion, proponents of place stratification ignore or minimalize the possibility that segregation may be partly the result of human choice or preference.

Although the spatial assimilation and place stratification perspectives differ in their explanations for the occurrence of segregation, both perspectives implicitly assume that ethnic segregation or, put differently, ethnic concentration represents an undesirable social condition. As Dunn points out, urban researchers of different schools of thoughts have generally theorized ethnic concentration "as a spatial outcome of oppressions, and as part of the process of the reproduction of oppression" [20]. Even though urban theorists of the Chicago School recognized "the supportive role which ethnic concentrations had for recent migrants", they "held that the permanent retention of a distinguishable ethnic identity by 'newcomer' groups was negative" as such retention presumably stunts assimilation [20].

Rather than side with one side or the other debate on whether groups experience spatial assimilation or place stratification, we call attention to the possibility that *non-White immigrant* suburbanization may be qualitatively different from White European suburbanization and more similar to racial minority suburbanization (and segregation) but equivalent to neither. Unlike the spatial assimilation perspective, we do not make the assumption that immigrants always want to achieve residential propinquity with Whites or that such propinquity represents social equality. Second, rather than assume, as the place stratification perspective does, that segregation represents inequality and is primarily the result of external exclusion, we recognize that ethnic immigrants have some personal

and collective agency even when faced with discrimination and that immigrants and their families may prefer to live closer to members of their ethnic group for any number of reasons. Moreover, we recognize that ethnic concentration does not necessarily represent economic stagnation, just as suburbanization does not necessarily represent economic success. For, in some cases, suburbanization could simply be a byproduct of economically successful ethnic concentration rather than the goal of ethnic concentration. In other words, ethnic concentration could represent a viable alternative to traditional spatial assimilation (i.e., dispersal or exit from the inner city into its less urban outskirts).

Next, we draw on the theory of immigrant segmented assimilation [21] to offer an alternative framework for thinking about non-White immigrants' divergent settlement patterns.

1.2. Divergent Settlement Patterns: An Alternative Framework

Just as immigrant groups' unique contexts of exit and contexts of reception could produce divergent socioeconomic outcomes, we suggest that immigrants' contexts of exit and reception could shape the formation of ethnic immigrant communities and, subsequently, ethnic immigrants' divergent settlement patterns. In segmented assimilation theory [21], the contexts of exit refer to the political conditions under which an immigrant group exited their country of origin and the set of social class standing as well as human capital, such as language, job skills and education that immigrants bring along with them. On the other hand, the contexts of reception entail a number of factors in the place of settlement: (a) the policies of the receiving government, whether these are exclusive, passive acceptance, or active encouragement; (b) the manner of reception by the public or established residents, whether prejudiced, indifferent, or supportive; (c) the existence and type of co-ethnic communities and networks, whether poor, entrepreneurial or professional; cohesive or not, etc.; and (d) the conditions of the labor market (the extent of its bifurcation) [22,23]. As we are interested in explaining divergent settlement patterns, we highlight some factors in the contexts of exit and the contexts of reception that could affect non-White immigrant groups' residential processes and outcomes.

Besides the social class standing and human capital that an immigrant group brings with it, it is important to consider an immigrant group's pre-migration settlement patterns, especially those settlement patterns that group members have come to consider as ideal for their living arrangements. For instance, an immigrant group that preferred to live in small, dispersed communities in its former country might tend to prefer the same living arrangements in a new host society. Conversely, a group that has, as a result of war and forced displacements, been compelled to live in close proximity to its ethnic members for protection may, over time, come to appreciate living in concentrated communities; once group members arrive in a new host society, they might desire recreating these kinds of living arrangements in response to real and perceived threats to safety, cultural and linguistic isolation or other economic and non-economic hardships.

However, regardless of how strong group members' settlement preferences and tendencies may be, the opportunities for realizing them could be constrained, at least for a time, by structural factors in the contexts of reception. First, the federal government that is in charge of immigration and resettlement policies can create and implement policies that determine where immigrants are able to settle initially. For instance, during the late 1970s and throughout the 1980s, Southeast Asian refugees were subjected to U.S. government-sanctioned policies that deliberately dispersed and resettled them across various U.S. cities and states [24]. Second, established residents could receive immigrants positively, negatively, or be indifferent to them. Within the U.S., many immigrants and racial minorities, including those with incomes comparable to Whites, cannot simply pick and choose which neighborhoods to move into or where to buy their homes [25]. More often than not, their choices are constrained by circumstances not of their choosing. Individuals' and families' decisions to move or stay put might be influenced by both economic and non-economic factors, such as their perception of how Whites and other racialized minority groups who share their contexts might react to new residents. Third, whether ethnic immigrants are able

to form communities in a particular area could also depend on whether there are existing co-ethnic communities in such area. It may be the case that an ethnic community may never emerge, let alone reach the point of ethnic concentration, if there is not a critical number of ethnic members who interact and define themselves as members of the same ethnic community. Finally, the conditions of the labor market could impact both the formation and development of ethnic communities in particular areas. For instance, whether immigrants and their families can become gainfully employed in an area could affect whether new immigrants decide to move into the area. If jobs are plentiful and stable and if a large segment of employed immigrants are able to meet their basic needs of housing, schooling, medical care, etc., immigrants may stay longer in an area, forming visible ethnic immigrant neighborhoods. As immigrants become more established residents and economically mobile, they could establish formal organizations, associations and businesses to serve their and other residents' needs. A community's institutional completeness, in turn, could reinforce ethnic concentration. Given Hmong's, Cambodians', Laotians' and Vietnamese's relatively similar contexts of exit (i.e., the foreign-born among them are refugees of war or children of refugees), and contexts of reception (they all settled in Minnesota), we are interested in whether these groups all experience similar residential patterns or divergent residential patterns.

1.3. Historical Trends in Suburbanization and Residential Segregation

Since the 1980s, researchers have documented the levels of suburbanization and patterns of residential segregation among four major racial categories: non-Hispanic Whites, Blacks, Hispanics, and Asians. Using 1970 and 1980 United States Census data on 59 major Metropolitan Statistical Areas (SMSAs), Massey and Denton found that, in 1970, Blacks (0.201) had substantially lower levels of suburbanization compared to Hispanics (0.461) and Asians (0.431) [4]. However, between 1970 and 1980, "the average black suburbanization increased significantly, from 0.201 to 0.282 in 1980" [4]. Despite the increases in Blacks' suburbanization, "blacks, compared with other minority groups, remain highly concentrated in central cities, and, within these areas, they experience very high levels of residential dissimilarity and spatial isolation from non-Hispanic whites, especially in the Northeast and Midwest" [4].

Contrary to Blacks' suburbanization pattern, Massey and Denton (1988b, p. 597) found that the suburbanization of Hispanics stagnated in most SMSAs between 1970 and 1980 [4]. On the other hand, Asian suburbanization "increased significantly in nearly all metropolitan areas" during the 1970s [4]. Furthermore, Massey and Denton observed, "even SMSAs with well-established [Asian] enclaves, such as San Francisco, experienced considerable suburbanization" [4]. These findings led Massey and Denton to conclude that "Asians appear, therefore, to deviate from the traditional American immigrant pattern by bypassing inner-city enclaves as a first step in the process of spatial assimilation" [4]. The focus on Asians as a whole category, however, may hide significant within-group differences with respect to suburbanization.

Some studies have found that among most post-1965 immigrants to the United States, suburbanization has tended to increase rather than decline over time. Using the 1980 and 1990 United States Census data, Alba et al. found that although the suburbanization levels of various Asian and Latino immigrant groups differed from one another, suburbanization has generally held steady or increased over time across all groups [5]. For example, between 1980 and 1990, Chinese, Filipinos, Koreans, Asian Indians, Vietnamese, Cubans, and Afro-Caribbeans each experienced increases in the percentage of their populations living in the suburbs. During the same period, Mexicans experienced only a slight increase in the percentage living in suburbs. Alba et al. suggest that ethnic groups' different suburbanization trajectories may be due to differences in their average household incomes. Specifically, lower household incomes are associated with residence in the central cities, whereas higher household incomes are associated with residence in the suburbs [5]. Alba and his collaborators note that "the Vietnamese are somewhat less likely than other Asians

to reside in suburbs [and that] [t]his may be a result of their modest incomes and frequent refugee status" [5].

More recently, studies have also begun to explore the spatial assimilation of ethnic groups and racial categories within "inner" and "outer" suburban rings, also known as "mature" and "developing suburbs", respectively [26–28]. Aware of the Fair Housing Act of 1968, which prohibits housing discrimination, and its potential positive impact on racial minorities' opportunity to live in the suburbs, some scholars have defined inner/mature suburban rings as places within the suburb where the majority of housing was built in 1969 or earlier and outer/developing suburban rings as those places within the suburb where the majority of housing was built in 1970 or later [26,27]. Using 2012–2016 American Community Survey data, Argeros [26] found that all racial and ethnic groups in his study—Whites, Blacks, Asians, and Hispanics—were more likely to reside in the outer suburban rings, which has higher SES levels and lower poverty rates, than in the inner suburban rings of America's major suburbs. However, interestingly, Asian households are more likely than Black, Hispanic, and White households to reside in the outer suburban rings. Argeros attributes this to Asians' comparatively higher median household income, education, and homeownership [26].

Recent studies using United States Census data have found that Blacks, Hispanics and Asians in various United States metropolitan areas continue to experience substantial levels of racial segregation [29]. For instance, Logan points out that although Black–White segregation has gradually declined between 1980 and 2010, by the late 2000s, Blacks were still, on average, highly segregated as indicated by their dissimilarity index (D) of 59.1. On the other hand, the segregation level of Hispanics as well as that of Asians remained essentially unchanged during this thirty-year period. By 2010, the dissimilarity index for Hispanics was 48.5, while it was 40.9 for Asians, indicating the persistence of moderately high levels of segregation [30].

Although several studies have examined either segregation or suburbanization among United States immigrants [5,31–39], since Massey and Denton's article in the late 1980s [4], few studies have investigated the intersection between immigrant groups' suburbanization and their residential segregation (Jones [40] is an exception). This is surprising given that these processes are probably intertwined in complex ways when it comes to immigrant groups and their assimilation outcomes. As Kaplan and Woodhouse remind us, "Groups vary considerably, not only in their cultural makeup but also in the financial, human, and other resources they possess" [41]. At the same time, the contexts that social groups encounter could vary widely in terms of their "history, culture, economic opportunity, and [relationship with] the political state" [41]. Within the context of the United States, many racial minorities, including those with incomes comparable to Whites, cannot simply pick and choose which neighborhoods to move into or where to buy their homes [25]. More often, their choices are constrained by the context or a set of circumstances not of their choosing. For instance, individuals' and families' decision to move or stay put might be influenced by both economic and non-economic factors, such as their perception of how Whites and other racialized minority groups who share their contexts might react to new residents. Investigating immigrant groups' suburbanization without paying attention to their racial segregation gives us, at best, an incomplete understanding of immigrants' lives in urban American cities. Thus, we suggest that it is crucial to investigate immigrants' suburbanization alongside their segregation. Doing so might help us to not only understand both of these processes better but also broaden our understanding of the interracial dynamics in a certain place. Understanding the interracial dynamics in a particular context could, in turn, help us to assess immigrant groups' relative degree of assimilation along more than one axis.

The increased attention in the literature on racial categories and ethnic groups other than Whites and Blacks suggests that scholars are trying to move beyond the Black-and-White racial paradigm when studying spatial assimilation in the United States. However, to date, little research has examined the spatial assimilation of more recent Asian immigrant

groups such as Southeast Asian former refugees. Nevertheless, investigating the spatial assimilation of Southeast Asian former refugees is important for at least two reasons.

First, although previous studies of immigrant spatial assimilation have yielded some helpful information about immigrants, these studies have tended to lump various Asian and Hispanic groups into single categories. However, as Alba and Logan point out, "statistically convenient categories—such as 'Asian' and 'Hispanic'—[are not only] unlikely to capture adequately racial and ethnic diversity", but could also be potentially misleading [31]. The assumption of Asian homogeneity, whether intended or not, is highly problematic for a number of reasons. First, unlike economic migrants from Asia, such as many Chinese, Koreans, and Japanese, most Southeast Asians migrated as political refugees from the war-torn countries of Cambodia, Laos, and Vietnam. Second, Cambodians, Hmong, Laotians, and Vietnamese immigrated in irregular 'waves' starting in 1975. As political refugees, the majority of Southeast Asians, especially those of later immigration waves, came with very limited financial and human capital [42]. Furthermore, during the late 1970s and throughout the 1980s, Southeast Asian refugee groups were subjected to United States government-sanctioned policies that deliberately dispersed and resettled them across various United States cities and states [24]. Unlike other Asian immigrants with substantial socioeconomic status (SES), most Southeast Asians could not readily choose which neighborhoods to settle into. Given the policies of dispersal and Southeast Asian refugees' relatively low SES upon arrival, it is reasonable to assume that Southeast Asian refugees have been more limited in their ability to choose where they want to live compared to other higher-SES Asian and Latino immigrant groups. Yet, little research has systematically examined how Southeast Asian former refugees' residential patterns have changed or remained the same since the 1980s.

Second, studying the suburbanization of Southeast Asian groups affords us the opportunity to study another important aspect of spatial assimilation: residential segregation or integration. At the time of this writing, most Southeast Asian refugees have been in the United States for 25 to 40 years. Significant economic and social changes have occurred in their communities over the last three decades [43,44]. Yet, at present, we know relatively little about how Southeast Asians' changing socioeconomic status affects their ability to move into predominantly white neighborhoods. Moreover, we still know little about Southeast Asians' degrees of segregation from Whites as well as from various other non-White racial categories, including Blacks, Hispanics, and other Asians. The availability of United States Census data enables us to study how Southeast Asian former refugees have adjusted to the changing and diverse demographics in major United States cities.

1.4. Background of Southeast Asians' Resettlement in Minnesota

Prior to 1975, no Southeast Asian community existed in Minnesota. However, by October of 1975, Minnesota had become the state to receive the largest number of refugees in the Midwestern U.S. [45]. Like a dozen or so other U.S. states, Minnesota was part of one of the largest refugee resettlement efforts in U.S. history. In 1975, the U.S. admitted 120,000 of the more than two million Southeast Asian (formerly Indochinese) refugees from the war-torn, U.S.-backed countries of South Vietnam, Cambodia and Laos [7]. In December 1975, the Lutheran parishes in Rochester, Minnesota received 1791 Vietnamese refugees [46]. In that same month, one of the first Hmong refugee families settled in Minneapolis [47]. By the end of 1975, 3802 Southeast Asian refugees had been resettled in Minnesota—2.3 percent of the 129,792 Southeast Asian refugees in the U.S. at that time [48]. By 1981, about a third of the 20,000 Hmong in the U.S. lived in St. Paul [46]. By October 1984, the State's Refugee Program Office estimated the total number of Southeast Asian refugees to be about 26,000. Of these, 10,000 were Hmong, 6000 were Vietnamese, 6000 were Cambodians, and 4000 were Laotians (Downing et al., 1984). As we will see, Hmong remain the largest group of Southeast Asians in Minnesota.

According to Vang, "From 1976 to 1978, [Hmong families] resided primarily in the Central, Near North, Phillips, and Powderhorn neighborhoods in the city of Minneapolis" [47]. However, by 1979, some Hmong had moved to St. Paul [47]. In the only empirical

study of Southeast Asian refugee settlement patterns in Minnesota that we know of, Hendricks estimated that in December 1980, of the 4131 Southeast Asian families who had medical assistance eligibility records and lived in Minnesota, 41 percent lived in St. Paul while 26 percent of them lived in Minneapolis [49]. Consistent with this, Downing and his associates observed that "the majority of Hmong, and Indochinese [Southeast Asian] refugees in general, are concentrated in the central cities [Twin Cities]" [50].

The population of Southeast Asians, but especially Hmong in Minnesota, grew significantly during the 1980s and 1990s. From 1990 to 2000, the Southeast Asian population grew from 76,094 to 84,062, comprising more than half of Minnesota's Asian population (166,217). Hmong's population increased from 41,800 to 45,443, making them the largest (at 30.1 percent) of all Asian groups. The Vietnamese population increased from 18,824 to 20,570. Although they were fewer compared to Asian Indians (19,963) and Chinese except Taiwanese (18,622), the populations of Laotians (9940 to 11,516) and Cambodians (5530 to 6533) also grew during that period [51]. Whereas in the 1980s, Fresno, California was considered by some as the "capital of the Hmong" in America [52], by the 2000s, Minneapolis-St. Paul had come to replace Fresno as the Hmong capital of America or even the "Hmong capital of the world" [47]. Much of this growth can be traced to Southeast Asians' secondary migration, which was both compelled and voluntary.

Initially, the U.S. government, through its Department of Health, Education, and Welfare (HEW), reimbursed state agencies and voluntary agencies (Volags) for providing welfare, medical, and social services to Southeast Asian refugees [53]. The government had previously promised that aid would last for 36 months after arrival. However, in May 1982, it shortened it to 18 months after arrival. To make matters worse, states such as Washington and Oregon, which previously relied on federal aid to support Southeast Asian refugees, chose not to allot any special funds to continue the support to refugees after their federal aid programs were cut. Southeast Asian refugees, most of whom lacked the English skills and formal credentials to find gainful employment, were left with difficult choices: to stay or to move elsewhere. Having few options, many Southeast Asian refugees migrated to states such as California, Illinois, Louisiana, Minnesota and North Carolina in search of jobs [24,54,55]. However, many Hmong also migrated in order to be reunited with lineages, subclans or co-ethnic communities [56,57].

According to the 2000 U.S. Census, the Minneapolis-St. Paul MSA was home to 2,968,806 persons. Of this, 86.1 percent were White, 5.3 percent were Black, 4.1 percent were Asian, 3.3 percent were Hispanic (of any race), and 2.1 percent were of mixed racial background. By 2010, the Minneapolis-St. Paul MSA population had grown to 3,154,469. Of this, 78 percent were non-Hispanic Whites, 7.5 percent were non-Hispanic Blacks, 5.9 percent were non-Hispanic Asians, 5.5 percent were Hispanics, and 3.1 percent were "Other". Southeast Asians made up the majority (51.2 percent) of the Asian population not including Hawaiians and Pacific Islanders, in this MSA [58]. As one of the oldest places of Southeast Asian refugee resettlement (1975–2006), the Minneapolis-St. Paul MSA presents an ideal opportunity to observe the ethnic concentration, suburbanization and segregation patterns of Cambodians, Hmong, Laotians and Vietnamese over time. We focus our attention on this in the rest of this paper.

2. Materials and Methods

Our primary data consist of the Decennial Census of Housing and Population for 1990, 2000, and 2010, and the 2006–2010 Public Use Microdata Sample (PUMS) data of the American Community Survey. We also used census tract level data from the professional version of Social Explorer (Social Explorer, Inc., Bronxville, NY, USA) to compute the dissimilarity indices as well as the proportion of Southeast Asian suburbanization within the seven-county Minneapolis-St. Paul metropolitan area. In the rest of this article, we use the terms non-Hispanic Whites, non-Hispanic Blacks, and non-Hispanic Asians (not including Hawaiians or Pacific Islanders), as these are identified in the United States Census. The term "Southeast Asians" refers to Cambodians, Hmong, Laotians, and Vietnamese collectively. We will refer

to specific ethnic groups when comparing groups. Admittedly, each Southeast Asian group is comprised of persons from different immigration cohorts (e.g., some immigrated earlier than others) as well as different generational cohorts (e.g., some were born abroad, others were born in the U.S.). Given the limitations inherent in aggregated United States census tract data, we were unable to distinguish between United States-born persons and foreign-born persons without losing ethnic specificity (i.e., Hmong, Cambodian, Laotian, Vietnamese). As such, the category of Southeast Asian actually includes persons who are immigrants as well as persons who are the children of immigrants. Nevertheless, United States immigrant communities have rarely, if ever, been comprised of solely foreign-born persons or families. In this paper, we are interested primarily in immigrant group patterns and outcomes rather than in individual-level variables or relationships.

2.1. Definition of Suburbanization

The United States Office of Management and Budget defines metropolitan statistical areas (MSAs) as geographical areas that "have at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties" [59]. Analytically, a metropolitan statistical area contains a core and a periphery. The United States Census defines a "central city" as the city or set of qualifying cities with the largest population in an MSA [60]. In 2010 and 2000, the Minneapolis-St. Paul-Bloomington MSA was comprised of 13 counties, 2 of which are located in Wisconsin. These 13 counties include Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington and Wright counties in Minnesota and Pierce and St. Croix counties in Wisconsin. However, prior to that, in 1990, the Minneapolis-St. Paul MSA consisted of only 11 counties (Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Washington, Wright, and St. Croix counties).

Following the conventions of the United States Census Bureau, we define the suburban population as the proportion of the population that resides outside of the central city but within the metropolitan statistical area [4]. We are aware of some of the limitations of defining suburbs in this way (see, for instance, the discussion by Massey and Denton [4]). However, others have followed a similar approach in defining suburbs [60]. In this paper, we count the cities of St. Paul and Minneapolis as the "central city" of the Minneapolis-St. Paul MSA and take the remainder of the MSA to be suburbs. We will also refer to these areas as "metro central city" and "metro suburbs".

2.2. Definition of Dissimilarity Index

As one of the most widely used measures of residential evenness, the index of dissimilarity measures the departure from evenness between two social groups. This index ranges from 0 to 100, and represents the proportion of the minority population that would have to move to another neighborhood in order to achieve an even distribution across the larger geographic area under study [17]. An index score between 0 and 30 is considered low segregation, an index between 30 and 60, moderate segregation, and an index score equal to or above 60 suggests that there is high segregation between the two groups [4]. A difference of less than five points is usually considered a negligible difference [61]. The dissimilarity index ($\boldsymbol{D}$) is calculated as follows:

$$\boldsymbol{D}=\frac{\mathbf{1}}{\mathbf{2}}\sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{N}}\left|\frac{\boldsymbol{b_i}}{\boldsymbol{B}}-\frac{\boldsymbol{w_i}}{\boldsymbol{W}}\right|$$

where, supposing that we are calculating the dissimilarity for Blacks and Whites, $\boldsymbol{b_i}$ is the Black population of the $\boldsymbol{i}^{\text{th}}$ areal unit (in our case, the census tract represents neighborhoods); $\boldsymbol{B}$ is the total Black population of the large geographic entity (in our case, MSA) for which the index of dissimilarity is being calculated; $\boldsymbol{w_i}$ is the White population of the i^{th} areal unit (census tract); and $\boldsymbol{W}$ is the total White population of the large geographic entity for which the index of dissimilarity is being calculated. When interpreting the results on

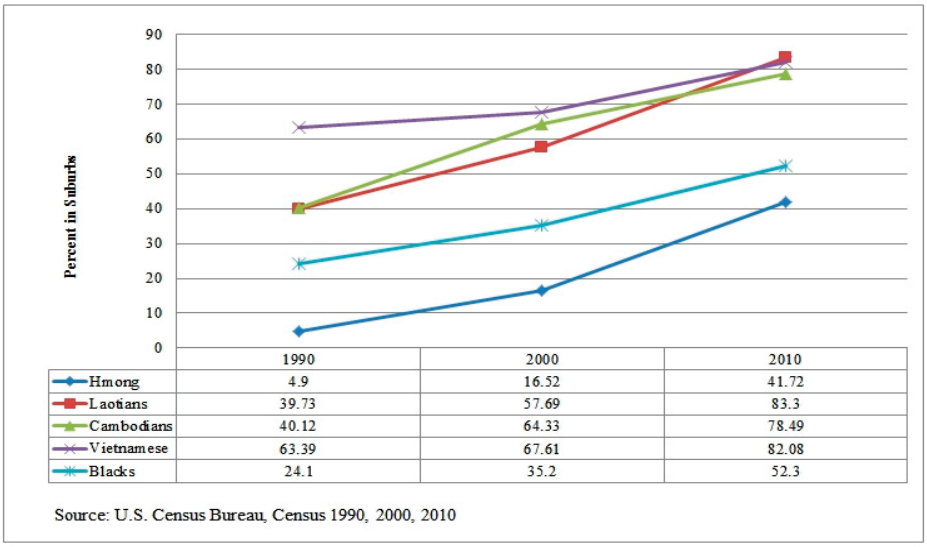
segregation, we are aware that the dissimilarity index may be inaccurate and less reliable when a group's population is less than 1000 [62]. This is less of a concern to us in this paper since the populations of the individual racial and ethnic categories (White, Black, Asian, Southeast Asian, etc.) that we study number more than 1000 within the Minneapolis-St. Paul MSA, including its central city and suburbs.

In using the dissimilarity index, we are aware that it is one of at least five indicators of racial segregation, that none of these indicators is superior to the rest, and that no single indicator can capture all the aspects of racial segregation. Given our research questions and considering the constraints of space, we decided to use the dissimilarity index because it is one of the most commonly used measures of racial segregation and therefore might enable us to compare our findings with past findings.

3. Results

3.1. Trends in Southeast Asian Americans' Suburbanization

Trends in the suburbanization of Blacks, Cambodians, Hmong, Laotians, and Vietnamese in the Minneapolis-St. Paul MSA are presented in Figure 1. In 1990, Hmong were by far the least suburbanized (4.9 percent lived in suburbs) of all the five minority groups, including Blacks. In contrast, Vietnamese were the most suburbanized (63 percent of them lived in suburbs). Laotians and Cambodians were virtually similar in terms of their degree of concentration in the suburbs (40 percent). Compared to Blacks, 24 percent of whom were in suburbs, Cambodians, Laotians, and Vietnamese were more likely to live in the suburbs in 1990. However, the decades after 1990 saw a number of significant changes. Next, we discuss the major trends in suburbanization for each of the Southeast Asian groups.



	1990	2000	2010
Hmong	4.9	16.52	41.72
Laotians	39.73	57.69	83.3
Cambodians	40.12	64.33	78.49
Vietnamese	63.39	67.61	82.08
Blacks	24.1	35.2	52.3

Figure 1. Percent in suburbs by ethnic group and year, Minneapolis-St. Paul MSA, 1990–2010.

3.1.1. Hmong

Between 2000 and 2010, the Hmong population in Minnesota experienced a significant shift toward suburbanization. This stands in sharp contrast to the preceding decade that witnessed substantial growth in the concentration of Hmong in the central cities of Minneapolis and Saint Paul (see Figure A1 in Appendix A). It should be noted that the Hmong population in Saint Paul increased by about 12 percent (26,509 to 29,662 persons) during this decade, albeit much more slowly than in previous decades. (Saint Paul's Hmong population is second only to that of Fresno, California—the city with the largest Hmong population (31,771 as of 2010) of any city in the United States). On the other hand, the Minneapolis-based Hmong population decreased by more than 28 percent (10,489 to 7512 persons). Altogether, including these central cities and their suburbs, there were about 61,500 Hmong living in the Minneapolis-St. Paul MSA in 2010 (see Table 1).

Table 1. Population, Income, and Home Ownership Distribution by Race and Ethnicity in the Minneapolis-St. Paul MSA, 2010.

			Median Household Income *		**Percent Home Ownership ***	
	Number in MSA	Percent	Metro City	Metro Suburbs	Metro City	Metro Suburbs
NH White	2,458,958	(78.0)	$73,600	$78,100	79.4	81.7
NH Black	238,128	(7.5)	$28,000	$31,300	25.4	33.1
NH Asian (Non-Hawaiian/PI)	185,854	(5.9)	$73,000	$57,000	55.0	61.8
Other Asian (Non-Hawaiian/PI)	90,738	(2.9)	$78,004	$72,520	52.6	65.1
Southeast Asian	95,116	(3.0)	$70,000	$47,000	61.9	59.3
Cambodian	6015	(0.2)	$92,000	$50,700	76.8	52.5
Hmong	61,504	(1.9)	$25,000	$38,000	23.3	49.7
Laotian	7299	(0.2)	$30,800	$70,600	73.8	78.3
Vietnamese	20,298	(0.6)	$71,000	$66,800	57.9	85.6
Hispanic	173,968	(5.5)	$41,700	$47,300	44.8	52.1
All Others	97,561	(3.1)	–	–	–	–
Total	3,154,469	(100.0)	$63,500	$70,000	67.3	73.7

Scheme 2010. American Community Survey 2006–2010. * Weighted samples (median household income in 2009 dollars); "Metro" refers to the 2010 Minneapolis-St. Paul MSA as approximated by Public Use. Microsample Areas (PUMAs), excluding Pierce and St. Croix counties.

While there was a broad shift to suburbanization, much of the growth occurred only in the inner ring suburbs adjacent to Minneapolis (Brooklyn Center and Brooklyn Park) and Saint Paul (Maplewood, North Saint Paul, Little Canada, Vadnais Heights as well as Cottage Grove). Growth in Hmong populations also occurred in some suburbs more distant from the central cities including Woodbury, Oakdale, Blaine and Coon Rapids. Moreover, many of the Hmong residents in some suburban communities such as Brooklyn Center and Brooklyn Park resided in census tracts with high and growing concentrations of Hmong.

However, by 2010, Hmong remained substantially less suburbanized (42 percent) compared to Laotians (83 percent), Vietnamese (82 percent), and Cambodians (79 percent), and moderately less suburbanized than Blacks (52 percent). Not only were Hmong less suburbanized in the Minneapolis-St. Paul MSA, they were also more ethnically concentrated in particular neighborhoods. Compared to other Southeast Asians, Hmong tended to live with co-ethnics forming concentrated neighborhoods (see Table 2). Indeed, as early as 1990, highly concentrated neighborhoods of Hmong (i.e., tracts with over 2000 persons of the same ethnicity) can already be found in Ramsey County. For example, in 1990, census tract 305, which lies within the city of St. Paul and is six miles northeast of downtown St. Paul, was home to 2106 Hmong residents. This census tract is bounded by W. Larpenteur Avenue in the north, E. Magnolia Avenue in the south, Rice Street on the west and roughly N. Westminster St. on the east.

Population size cannot entirely explain Hmong's tendency to form highly concentrated ethnic neighborhoods. For instance, in 2000, when the Vietnamese in Minnesota were reported to be about 18,800, there was not a single census tract that contained more than 1000 Vietnamese persons and only one census tract that contained between 500 and 999 Vietnamese residents (Table 2). In contrast, in 1990, when Hmong numbered about 16,800, one census tract contained over 2000 Hmong persons, another census tract contained between 1000 and 1999 Hmong, and six census tracts contained between 500 and 999 Hmong. Moreover, although about 10,100 Laotians resided in Minnesota by 2010, there was no census tract that contained more than 500 Laotians. In summary, Hmong experienced substantial suburbanization between 1990 and 2010; however, the majority (58 percent) of their population continued to reside in the central city.

Table 2. Neighborhood Concentrations by Ethnic Group and Year, in Minneapolis-St. Paul MSA, 1990–2010.

	1990	2000	2010
Cambodian Population	3858	5530	7850
Number of Census Tracts with 1000–1999 Ethnics	0	0	0
Number of Census Tracts with 500–999 Ethnics	0	0	0
Number of Census Tracts with 200–499 Ethnics	1	1	3
Hmong Population	16,833	41,800	63,619
Number of Census Tracts with 2000–2999 Ethnics	1	1	0
Number of Census Tracts with 1000–1999 Ethnics	1	5	8
Number of Census Tracts with 500–999 Ethnics	6	14	25
Number of Census Tracts with 200–499 Ethnics	11	35	52
Laotian Population	6381	9940	10,065
Number of Census Tracts with 1000–1999 Ethnics	0	0	0
Number of Census Tracts with 500–999 Ethnics	0	0	0
Number of Census Tracts with 200–499 Ethnics	2	3	4
Vietnamese Population	9387	18,824	23,544
Number of Census Tracts with 1000–1999 Ethnics	0	0	0
Number of Census Tracts with 500–999 Ethnics	0	1	1
Number of Census Tracts with 200–499 Ethnics	1	6	8

Source: U.S. Census Bureau, Census 1990, 2000, 2010.

3.1.2. Cambodians

Cambodians displayed a mixed picture of suburbanization (see Figure A2 in the Appendix A). By 2010, about 6000 Cambodians were living in the Minneapolis-St. Paul MSA. The Cambodian populations showed modest decreases in both the Minneapolis (−3 percent) and Saint Paul (−13 percent) central cities. Much of the most impressive growth in the Cambodian population was in non-inner ring suburbs including Shakopee, Eagan, Lakeville, and Eden Prairie. Lower rates of growth to established Cambodian populations were seen in inner ring suburbs including Bloomington and Richfield, though significant growth occurred in other suburbs including Cottage Grove and Brooklyn Park. Notable population growth also occurred in the outstate communities of Rochester and Faribault. With the declining Cambodian population in Saint Paul, Rochester had the largest Cambodian community of any city in Minnesota in 2010. Moreover, as the data in Table 2 suggest, the Cambodian population tended to be dispersed rather than concentrated in particular neighborhoods in the Minneapolis-St. Paul MSA. Between 1990 and 2010, there was no neighborhood that contained 500 or more Cambodian persons.

3.1.3. Laotians

Laotian residential patterns shifted to what might be called an advanced level of suburbanization during the 2000–2010 decade (see Figure A3 in Appendix A). There was a mass exodus of Laotians from the central cities of Minneapolis (−54 percent) and Saint Paul (−73 percent). By 2010, Laotians, who numbered about 7300 in the Minneapolis-St. Paul MSA, had become the most suburbanized (83 percent) of all the Southeast Asian groups, including Vietnamese. The most impressive growth in Laotian population growth occurred in non-inner ring suburbs including Shakopee, Burnsville, and Savage. Some inner ring suburbs also lost Laotian residents including Richfield and Brooklyn Center. With the substantial decline in Laotian populations in Minneapolis and Saint Paul, the West Metro suburb of Brooklyn Park had the largest enumerated Laotian population in the state in 2010. Some growth was evident in outstate Minnesota Laotian communities as well in Rochester, St. Cloud, Worthington and Mountain Lake. Like Cambodian residents, Laotian residents tended to be more dispersed throughout the Minneapolis-St. Paul MSA.

3.1.4. Vietnamese

In 2010, the Vietnamese population in the Minneapolis-St. Paul MSA was about 20,300. During the 2000–2010 period, Vietnamese also showed a strong pattern toward suburbanization and movement out of the central cities of Minneapolis (−32 percent) and Saint Paul (−19 percent) (see Figure A4 in Appendix A). The larger percent increases in Vietnamese populations occurred in the non-inner ring suburbs of Blaine, Shakopee, Savage, Lakeville and Apple Valley. As with Laotians, the West Metro suburb of Brooklyn Park replaced the two central cities as the large Vietnamese population centers in the metro area. The Vietnamese community in outstate Rochester also showed notable growth over the decade.

Furthermore, the available evidence suggests that Southeast Asians who live in the suburbs do not necessarily have higher socioeconomic resources than those who live in the central city. As Table 1 shows, the median household income of Southeast Asians in the suburbs of the Minneapolis-St. Paul MSA ("Metro Suburbs") was USD 47,000 in 2009. In comparison, the median household income of their counterparts in the central city ("Metro City") was USD 70,000. Cambodians exemplify this phenomenon; their central-city population had a median household income of USD 92,000, which is almost twice as high as the median household income of their suburban counterparts. Consistent with their higher income background, about 77 percent of Cambodians in the central city owned homes compared to 53 percent of Cambodians who owned homes in the suburbs. In contrast to Cambodians and Vietnamese, Hmong and Laotians appear to be more similar to non-Hispanic Blacks and Hispanics in terms of the relationship between their household income and their residency. That is, suburbanized Hmong and Laotians tended to have substantially higher median household incomes than their counterparts in the central city. None of this is meant to negate the fact that people and their families need some financial resources in order to move from place to place and in order to maintain their living in certain areas, whether these are central cities or suburbs. Nevertheless, the findings here suggest that Southeast Asians' level of suburbanization (or, conversely, level of central city living) not only varies by group but cannot be entirely explained by socioeconomic factors. Next, we examine Southeast Asians' residential segregation.

3.2. Trends in Southeast Asians' Residential Segregation

Table 3 presents trends in the racial segregation, as measured by the dissimilarity index (D), of non-Hispanic Whites, non-Hispanic Blacks, non-Hispanic Asians, and Southeast Asians in the Minneapolis-St. Paul MSA. It is important to note that during the 1990s and 2000s, White–Southeast Asian segregation was just as high (D > 60), or even slightly higher than White–Black segregation. Despite a small decline in their segregation level, by 2010, White–Southeast Asian remained moderately segregated (D = 56.5). Although studying Southeast Asians' segregation from Whites is crucial, it reveals only part of the complex story of race relations in the Minneapolis-St. Paul MSA. To obtain a better understanding of the variety and extent of racial segregation in this area, we also examine Southeast Asians' segregation from non-Hispanic Blacks and other Asians.

In contrast to their high level of segregation from non-Hispanic Whites, Southeast Asians were substantially less segregated from non-Hispanic Blacks within the MSA. In fact, Southeast Asians' segregation from non-Hispanic Blacks has been declining since 1990 such that by 2010, the segregation level between Southeast Asians and non-Hispanic Blacks was significantly lower (D = 41.7) than the segregation level between non-Hispanic Whites and Southeast Asians (D = 56.5).

Moreover, the data suggest that Southeast Asians experienced greater racial segregation than other Asians did. For instance, in 1990, the segregation level between non-Hispanic Whites and other Asians who are not Southeast Asians (D = 30.2) was substantially lower than the segregation level between Southeast Asians and non-Hispanic Whites (D = 62.6). However, the segregation level between non-Hispanic Whites and other Asians has increased during the last two decades such that by 2010, the dissimilarity index

was 37.9. Interestingly, by 2010, Southeast Asians remain almost as segregated from other Asians (D = 52.3) as they are from non-Hispanic Whites (D = 56.5), and both of these patterns have changed very little between 1990 and 2010.

Table 3. Dissimilarity Indices by Ethnicity and Year, Minneapolis-St. Paul MSA, 1990–2010.

Minneapolis-St. Paul MSA	Dissimilarity Index			Change between 1990 and 2010
	1990	2000	2010	
NH White-NH Black	62.0	60.1	52.9	−9.1
NH White-NH Asian	41.3	45.0	43.0	1.7
NH Black-Southeast Asian	48.4	40.3	41.7	−6.7
Other Asian-Southeast Asian	55.0	57.4	52.5	−2.5
NH White-Other Asian (Non-SEA)	30.2	33.7	37.9	7.7
NH White-Southeast Asian	62.6	63.3	56.5	−6.1
NH White-Hmong	85.4	80.1	70.3	−15.1
NH White-Vietnamese	48.3	50.3	46.9	−1.4
NH White-Laotian	69.6	66.8	59.2	−10.4
NH White-Cambodian	71.9	64.6	57.5	−14.4

Source: U.S. Census Bureau, Census 1990, 2000, 2010.

However, Southeast Asians' experiences with racial segregation are not uniform. Between 1990 and 2010, Hmong (−15.1), Laotians (−10.4), and Cambodians (−14.4) each experienced some decline in their segregation from non-Hispanic Whites. In spite of this, Laotians' and Cambodians' segregation remained moderately high and Hmong's segregation remained very high. Hmong were clearly the most segregated (D = 70.3) while Vietnamese were the least segregated (D = 46.9). It is important to note that Vietnamese's segregation level was essentially unchanged between 1990 and 2010. However, just as data that lump Asians together can hide within-group differences, data at the MSA level could hide variations across places with respect to segregation. Next, we examine whether racial segregation patterns differ between central cities and suburbs.

3.2.1. Segregation in the Central City

Table 4 presents trends in the segregation of non-Hispanic Whites, non-Hispanic Blacks and Southeast Asian groups in the central city and suburbs of the Minneapolis-St. Paul MSA between 1990 and 2010. The data show several complex trends and patterns of racial segregation in the central city and the suburbs.

Table 4. Dissimilarity Indices by Ethnicity and Year, Minneapolis-St. Paul MSA, 1990–2010.

	1990		2000		2010		Change between 1990 and 2010	
	Central City	Suburbs	Central City	Suburbs	Central City	Suburbs	Central City	Suburbs
NH White-NH Black	56.4	42.2	51.8	47.6	49.6	46.8	−6.8	4.6
NH White-NH Asian	51.4	29.6	51.1	36.3	53.4	37.6	2.0	8.0
NH Black-Southeast Asian	52.1	36.8	44.2	33.0	48.4	35.7	−3.7	−1.1
Other Asian-Southeast Asian	52.9	39.8	59.7	40.6	57.5	45.7	4.6	5.9
NH White-Other Asian (Non-SEA)	35.4	27.9	30.7	34.4	37.0	38.2	1.6	10.3
NH White-Southeast Asian	64.2	44.8	63.6	47.7	70.0	45.7	5.8	0.9
NH White-Hmong	72.1	82.5	70.0	65.2	75.0	60.1	2.9	−22.4
NH White-Vietnamese	53.4	46.7	52.7	49.7	48.5	47.1	−4.9	0.4
NH White-Laotian	67.8	68.2	63.9	66.0	65.5	58.8	−2.3	−9.4
NH White-Cambodian	70.7	70.7	62.3	65.1	61.7	57.0	−9.0	−13.7

Source: U.S. Census Bureau, Census 1990, 2000, 2010.

The evidence suggests that Southeast Asians as a group experienced higher racial segregation in the central city than in the suburbs. For example, in 2000, White–Southeast

Asian segregation was very high in the central city (D = 64.0) and moderately high in the suburbs (D = 47.7). It is important to note that even as White–Black segregation in the central city declined (−6.8) between 1990 and 2010, White–Southeast Asian segregation in the central city actually increased (5.8) during this period. Indeed, by 2010, Southeast Asians in the central city (D = 70.0) were much more segregated than non-Hispanic Blacks in the central city (D = 49.6). Among Southeast Asians in the central city, Hmong were the most segregated (D = 75.0), while Vietnamese were the least segregated (D = 48.5). Importantly, Laotians (D = 65.5) and Cambodians (D = 61.7) were also highly segregated in the central city.

3.2.2. Segregation in the Suburbs

Like the central city, the suburbs display some complex segregation patterns. Between 1990 and 2010, Asians in the suburbs became more rather than less segregated from non-Hispanic Whites (D increased by 8 points). On the other hand, the segregation level of Southeast Asians stayed about the same in the suburbs (D = 45.7 or moderately high). However, there are some marked inter-group differences with respect to segregation. By 2010, Vietnamese in the suburbs (D = 47.1) were substantially less segregated than Cambodians (D = 57.0), Laotians (D = 58.8), and Hmong (D = 60.1) in the suburbs. Among Southeast Asians in the suburbs, Hmong experienced the largest decrease in terms of their segregation from non-Hispanic Whites. However, this is not too surprising considering that Hmong's segregation level was extremely high (D = 82.5) in 1990. Cambodians in the suburbs experienced a similar but less substantial decrease in their segregation level; however, the same caveat about high initial segregation applies to them. Nevertheless, Hmong's segregation was unexpectedly severe given their socioeconomic resources. Even though Hmong's median household income in the suburbs (USD 38,000) was somewhat higher than that of Blacks (USD 31,300), Hmong in the suburbs (D = 60.1) were substantially more segregated than Blacks in the suburbs (D = 46.8).

Interestingly, by 2010, Vietnamese remained just as segregated in the suburbs as they were in the central city. In fact, this pattern has sustained since 1990 when Vietnamese residency in the central city and suburbs appears to make no difference to their segregation level. Curiously, this pattern of convergence in segregation level between the central city and suburban areas also is found among non-Hispanic Blacks, who are arguably much more established residents in the MSA. For example, by 2010, non-Hispanic Blacks in the suburbs (D = 46.8) were about as segregated as their counterparts in the central city (D = 49.6). Moreover, we can tell from looking at the segregation level between non-Hispanic Whites and other Asians who are not Southeast Asians in the suburbs that their relationship is increasingly segregated rather than integrated (D increased by 10.3 points between 1990 and 2010). These findings suggest that for racial minority and non-white immigrant groups, residential segregation from non-Hispanic Whites has a tendency to level off rather than continue to decline as racial minorities and immigrants become more suburbanized. In summary, although Southeast Asians in the central city tend to experience higher segregation than their counterparts in the suburbs of the Minneapolis-St. Paul MSA, living in the suburbs has not resulted in residential propinquity with non-Hispanic Whites.

4. Discussion

At the outset of our paper, we posed three questions: (1) how and to what extent has the suburbanization of individual Southeast Asian former refugee groups changed in the Minneapolis-St. Paul Metropolitan Statistical Area between 1990 and 2010? (2) how has Southeast Asians' suburbanization affected their degree of racial segregation in the central city and in the suburbs? (3) how does understanding the differences between these Asian subgroups improve our understanding of urban geographic processes? Our data show that during the 1990 to 2010 period, Southeast Asians in the Minneapolis-St. Paul Metropolitan Statistical Area experienced substantial suburbanization. However, Southeast Asians' suburbanization has occurred alongside moderately high to very high

levels of residential segregation in both the central cities and suburbs. However, not all Southeast Asian ethnic groups experienced the same levels of suburbanization, segregation, or concentration. For instance, a clear majority (58 percent) of Hmong Americans remained in the central cities, particularly St. Paul, and Hmong experienced greater racial segregation than any of the other Southeast Asian groups as well as Blacks. Vietnamese, who were the least segregated among Southeast Asians, remain just as segregated as Blacks in both the central cities and the suburbs. Taken together, our set of findings complicates any simple meaning or definition of "suburbanization" and raises questions about the assumptions of both the spatial assimilation and place stratification perspectives on immigrant residential processes. Next, we discuss the first of our questions before turning our attention to the second and third questions.

How has Southeast Asian Americans' suburbanization been possible over time? We suggest that Southeast Asians' suburbanization was probably facilitated by a combination of factors and processes, including the gradual accumulation of financial capital, families' recognition of and responses to specific economic constraints and opportunities, changes in families' residential preferences, and the lack of substantial new Southeast Asian immigration into the central cities. For most individuals and groups in American society, the accumulation of financial capital is a gradual, difficult, and uncertain process rather than a fast, easy or inevitable one. Southeast Asian refugees, unlike other economic immigrant groups in the U.S., arrived with diverse social class backgrounds, much less resources and fewer transferable language and work skills and credentials (because the skills that they possessed were often devalued by employers in the host society). Consequently, they experienced higher levels of poverty and had a much more difficult time accumulating financial capital than other European or non-refugee immigrant groups [63,64]. As such, in the late 1970s and early 1980s, homeownership was simply out of reach for the vast majority of them. Nevertheless, Southeast Asian Americans' family and household poverty levels have been declining since the 1980s and 1990s [65]. The decline in Southeast Asian Americans' overall poverty probably enabled some to afford to move out of the inner cities and into the suburbs, where the cost of housing tended to be higher.

The fact that Southeast Asians' gradual suburbanization partly reflects their gradual accumulation of financial capital can be inferred from the reports that most of the suburbs into which Southeast Asians have moved are aging suburbs—as indicated by U.S. census data on the median year in which housing structures were built. These aging suburbs are adjacent to the two central cities: St. Paul and Minneapolis. This finding is similar to previous findings that Black households in the 1970s gained access to only aging suburbs that have been abandoned by higher-socioeconomic Whites, who have moved into the exburbs far away from the central cities [66]. As a result, despite having moved further away from the central cities, Blacks remain closest to it compared to Whites. To be sure, socioeconomic resources cannot entirely explain Southeast Asians' suburbanization or their continued segregation.

During the economic recession of the mid- to late-2000s, home foreclosures pushed some established residents out of their homes both in the central cities and in the suburbs. At the same time, the frequency of foreclosures produced a population that demanded both rental and owned property. This demand for rental property kept rent prices fairly high or at least stable for the rest of the population who rent their homes. Working Southeast Asian adults recognized this economic opportunity (i.e., cheap foreclosed homes and lower mortgages for homes compared to previous decades, and easier access to home loans). The relatively lower prices of homes, including homes in the suburbs in this decade, made it more possible for Southeast Asian who had been renters to buy older homes in these neighborhoods. Even some Southeast Asian who already owned homes opted to let go of their high-mortgage homes in order to repurchase newer but less expensive homes.

But perhaps even more important than cost-benefit considerations, Southeast Asians' residential preferences have developed and changed over time due to real and perceived social circumstances. Like most residents, many established Southeast Asian residents are

keenly aware that access to certain sets of important resources is affected by one's location. For example, this includes access to better public schools, but also access to cleaner streets, more parks and public places of accommodation, more responsive police, less regular police surveillance (lower perceived risk of racial profiling), etc. Southeast Asian children born in the late 1970s were now in their mid-20s; many of them have graduated from college and are employed. Their wages supplemented individual households' incomes, increasing their capacity to purchase homes in the suburbs. The more culturally and linguistically acculturated and more economically mobile generation is both more cognizant of the racial stratification of our American society—a society that encourages association with lighter-skin people and discourages association with darker-skin people—and more able to afford to move into predominantly white neighborhoods, if they choose to. This does not mean they can always choose where they want to live—because racism against Asians and racial minorities in general remains pervasive—but it means they have more options than their parents.

However, our findings question the expectation that all immigrant groups will continue to move to the suburbs as their socioeconomic standing improves. Our data show that, contrary to this expectation, Cambodians with higher median household incomes reside and disproportionally own homes in the central city as opposed to the suburbs where their lower-income counterparts are found. Moreover, a clear majority of Hmong residents remained in the central cities, particularly St. Paul, despite improvements in their overall socioeconomic status during the previous two decades. To what extent might this have to do with racial discrimination in housing or racism against Asians in the broader society? To what extent might this have to do with ethnic members' own preferences to live and work among people who look like them? While these questions are beyond the scope of our study, we encourage future research to explore them.

How has suburbanization affected Southeast Asians' degree of racial segregation? Our data show that although Southeast Asians in the central city tended to experience higher segregation than their counterparts in the suburbs of the Minneapolis-St. Paul MSA, living in the suburbs has not resulted in residential propinquity with non-Hispanic Whites. As we have seen, between 1990 and 2010, Asians in the suburbs became more rather than less segregated from non-Hispanic Whites. During the same period, the segregation level of Southeast Asians in the suburbs stayed about the same (D = 45.7 or moderately high). Indeed, our data indicate that Southeast Asians in the suburbs are less segregated from non-Hispanic Blacks in the suburbs than they are from Whites or other Asians in the suburbs. This suggests that suburban Southeast Asians are, on average, less separated from (or living closer to) non-Hispanic Blacks than they are from either non-Hispanic Whites or other non-Hispanic Asians. Once again, there were some marked differences between Southeast Asians in terms of residential segregation. By 2010, Vietnamese in the suburbs were substantially less segregated than Cambodians, Laotians, and Hmong in the suburbs. Nevertheless, Vietnamese in the suburbs remained just as segregated from Whites as Blacks in the suburbs were from Whites.

The spatial assimilation model, which predicts that immigrants will move into the suburbs as their socioeconomic status improves, is unable to explain (a) why a clear majority of Hmong residents remained in the central cities, particularly St. Paul, despite improvements in their overall socioeconomic status during the previous two decades or, relatedly, (b) why Hmong have formed ethnic concentrations in areas adjacent to the central city. Instead of focusing on "assimilation", perhaps we should focus more on the variety and complexity of immigrants' and immigrant groups' spatial processes and outcomes. One important finding of our study is the persistence of ethnic concentration, especially the concentration of Hmong in the Minneapolis-St. Paul metro area as indicated by their high levels of neighborhood clustering and residential segregation.

One of the key lessons of our study is that even though Hmong, Cambodians, Laotians and Vietnamese share similar experiences of having been displaced refugees, immigrating to the U.S. during the same historical period (1970s), and resettling in the same state (Minnesota), their spatial processes and, more specifically, their residential patterns, are not

necessarily alike. Indeed, our data suggest that each of these groups has unique residential patterns that cannot be explained by increases in their socioeconomic status alone. Although segmented assimilation theory, by taking account of immigrant groups' unique contexts of exit and contexts of reception, can reliably predict immigrant groups' socioeconomic outcomes or social mobility prospects, it may be less able to predict groups' residential patterns, at least without greater specification. We suspect that this may be because non-White immigrants' residential processes involve complex, dynamic individual and collective actions, social, economic, and political opportunities and constraints, institutional processes and state policies, and evolving social norms and interactions—factors that are affected by social and economic factors but are not necessarily determined by it. Perhaps by further specifying the processes and mechanisms and by clarifying how they work in tandem with government reception policies, labor markets, and public reception to condition groups' residential constraints and opportunities, segmented assimilation theory may be further developed to predict groups' residential patterns.

Furthermore, the residential patterns of Southeast Asians as a group, at least up to this historical period, differ from those of other East Asian groups who have resided in the United States for much longer and are more established in U.S. metropolitan areas. For example, Li showed that Chinese Americans formed an "ethnoburb" or "ethnic suburb" in the San Gabriel Valley in Los Angeles. By ethnoburb, she means "suburban ethnic clusters of residential areas and business districts in large American metropolitan areas. . ..[which are] characterized by both vibrant ethnic economies, due to the presence of large numbers of ethnic people, and strong ties to the globalizing economy, revealing their role as outposts in the emerging international economic system" [67]. Even though Hmong Americans are highly concentrated in the Twin Cities and have vibrant ethnic economies, they do not (yet) appear to be an "ethnoburb" in the sense that they lack strong ties to the globalizing economy and do not currently serve as outposts in the emerging economic system. Nevertheless, both Hmong Americans in the Twin Cities and Chinese Americans in the San Gabriel Valley do have at least one thing in common: ethnic concentrations with various ethnic businesses, some of which are thriving.

How does understanding the differences (and similarities) between these subgroups improve our understanding of urban geographic processes? The varied residential patterns of Southeast Asian subgroups suggest that there cannot be a one-size-fits-all model of immigrant spatial processes or outcomes. Just as the spatial assimilation model cannot fully explain why a large proportion of Hmong and Cambodian Americans remain in the central city, place stratification cannot fully account for why Vietnamese Americans have become quite suburbanized. Given that each immigrant group experiences its own unique contexts of exit and contexts of reception, which can shape their members' resources and opportunities and possibly their residential assimilation process and outcome [21,22], models of immigrant spatial process or outcome, should, at the minimum, take immigrant groups' unique contexts of exit and reception into account when studying immigrant groups' urban spatial processes and outcomes. Since immigrant groups' contexts of reception are subject to change rather than remaining static, we should expect changes, such as interruptions, inconsistencies, reversals, and so on, in immigrant groups' spatial processes and outcomes.

5. Conclusions

In recent decades, former refugees from Laos, Cambodia, and Vietnam have experienced suburbanization in the re-emerging immigrant gateway city of Minneapolis-St. Paul, Minnesota. However, their suburbanization has not resulted in residential propinquity with the majority population (Whites). Instead, Hmong, Laotians, Cambodians and Vietnamese remain moderately or severely segregated in both the central cities and the suburbs, sometimes, even more segregated than Blacks. The varied spatial processes and diverse outcomes of Southeast Asian subgroups in the St. Paul-Minneapolis metro area of Minnesota complicate the meaning of "suburbanization" and challenge the assumptions of both spatial assimilation and place stratification models of immigrant residential outcomes.

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Appendix A

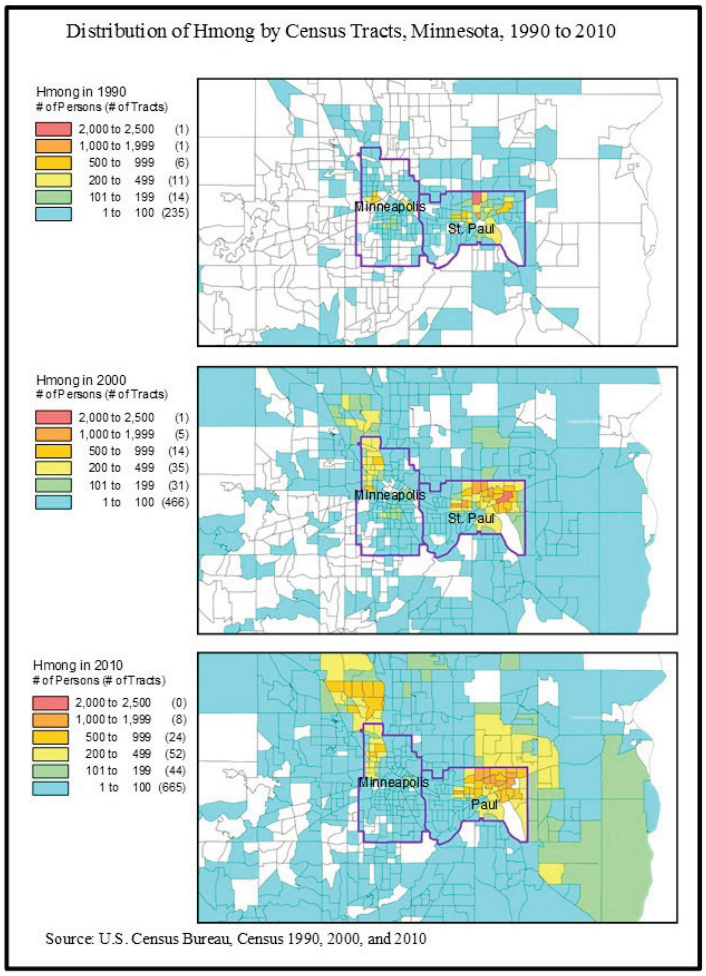

Figure A1. Map of the distribution of Hmong Americans by Census Tracts, Minnesota, 1990 to 2010.

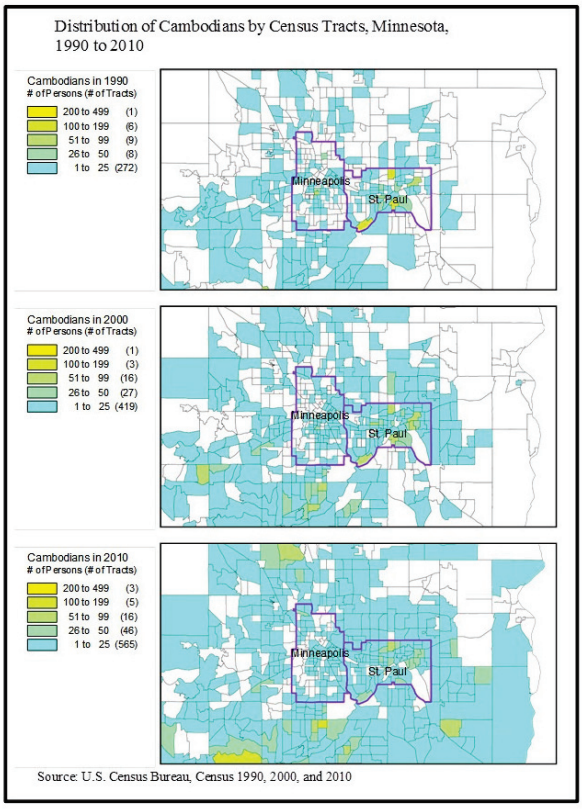

Figure A2. Map of the distribution of Cambodian Americans by Census Tracts, Minnesota, 1990 to 2010.

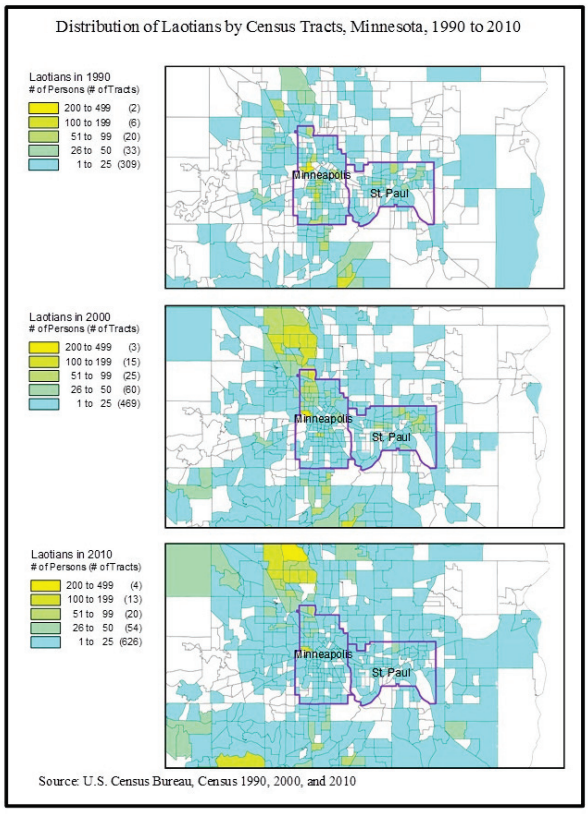

Figure A3. Map of the distribution of Laotian Americans by Census Tracts, Minnesota, 1990 to 2010.

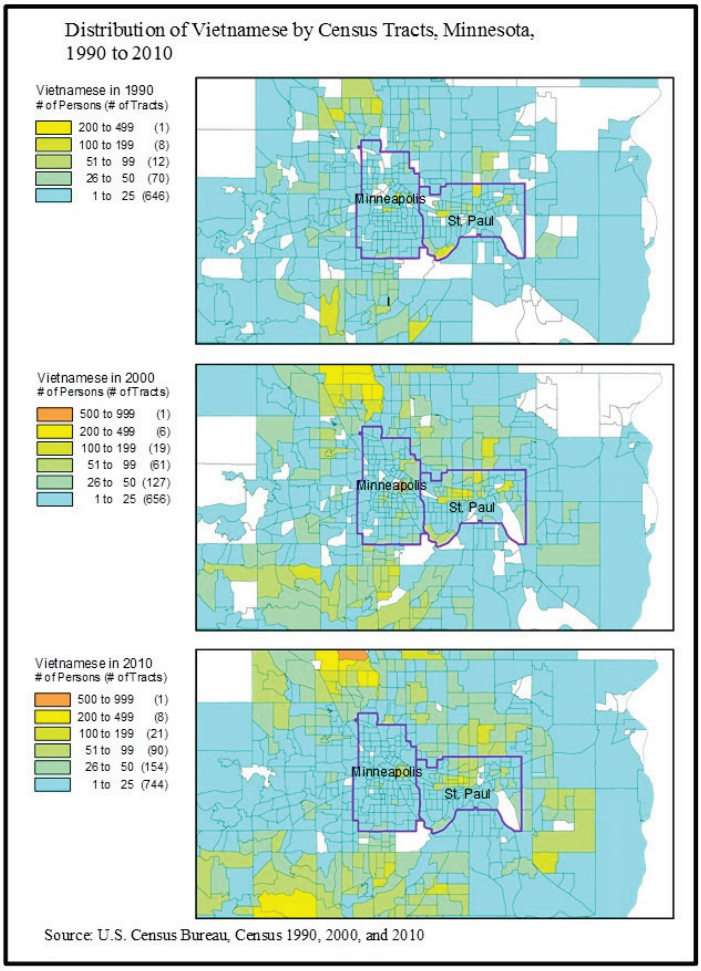

Figure A4. Map of the distribution of Vietnamese Americans by Census Tracts, Minnesota, 1990 to 2010.

References

1. Schnore, L.F. *The New Urban History: Quantitative Explorations by American Historians*; Princeton University Press: Princeton, NJ, USA, 1975.
2. Frey, W.H. White flight and central city loss: Application of an analytic migration framework. *Environ. Plan. A* **1979**, *11*, 129–147. [CrossRef] [PubMed]
3. Jackson, K.T. *Crabgrass Frontier: The Suburbanization of the United States*; Oxford University Press: New York, NY, USA, 1985.
4. Massey, D.S.; Denton, N.A. Suburbanization and segregation in U.S. metropolitan areas. *Am. J. Sociol.* **1988**, *94*, 592–626. [CrossRef]
5. Alba, R.D.; Logan, J.R.; Stults, B.J.; Marzan, G.; Zhang, W. Immigrant groups in the suburbs: A reexamination of suburbanization and spatial assimilation. *Am. Sociol. Rev.* **1999**, *64*, 446–460. [CrossRef]
6. Feliciano, C. Does Selective Migration Matter? Explaining Ethnic Disparities in Educational Attainment among Immigrants' Children1. *Int. Migr. Rev.* **2005**, *39*, 841–871. [CrossRef]
7. Rumbaut, R.G. The structure of refuge: Southeast Asian refugees in the United States, 1975–1985. *Int. Rev. Comp. Public Policy* **1989**, *1*, 97–129.
8. Zhou, M.; Kim, S. Community forces, social capital, and educational achievement: The case of supplementary education in the Chinese and Korean immigrant communities. *Harv. Educ. Rev.* **2006**, *76*, 1–29. [CrossRef]
9. Massey, D.S.; Denton, N.A. Trends in the residential segregation of Blacks, Hispanics, and Asians: 1970–1980. *Am. Sociol. Rev.* **1987**, *52*, 802–825. [CrossRef]
10. Zúñiga, V.C.; Hernández-León, R.N. *New Destinations: Mexican Immigration in the United States*; Russell Sage Foundation: New York, NY, USA, 2005.
11. Donato, K.M.; Tolbert, C.; Nucci, A.; Kawano, Y. Changing faces, changing places: The emergence of new nonmetropolitan immigrant gateways. In *New Faces in New Places: The Changing Geography of American Immigration*; Massey, D.S., Ed.; Russell Sage Foundation: New York, NY, USA, 2008; pp. 75–98.
12. Singer, A. Twenty-first century gateways: An introduction. In *Twenty-First Century Gateways: Immigrant Incorporation in Suburban America*; Singer, A., Hardwick, S.W., Brettell, C.B., Eds.; Brookings Institution Press: New York, NY, USA, 2009; pp. 3–30.
13. Chiat, M.J.; Proshan, C. *German Jews in Minnesota: 1845–1910*; Concordia College: Moorhead, MN, USA, 1984; pp. 168–181.

14. Fennelly, K.; Orfield, M. Impediments to the integration of immigrants: A case study in the Twin Cities. In *Twenty-First Century Gateways Immigrant Incorporation in Suburban America*; Singer, A., Hardwick, S.W., Brettell, C.B., Eds.; Brookings Institution Press: New York, NY, USA, 2009; pp. 200–224.
15. Li, W. *Ethnoburb: The New Ethnic Community in Urban America*; University of Hawaii Press: Honolulu, HI, USA, 2012.
16. Massey, D.S.; Mullan, B.P. Processes of Hispanic and black spatial assimilation. *Am. J. Sociol.* **1984**, *89*, 836–873. [CrossRef]
17. Massey, D.S.; Denton, N.A. The dimensions of residential segregation. *Soc. Forces* **1988**, *67*, 281–315. [CrossRef]
18. Logan, J.R.; Alba, R.D. Locational returns to human capital: Minority access to suburban community resources. *Demography* **1993**, *30*, 243–268. [CrossRef]
19. Alba, R.D.; Deane, G.; Denton, N.; Disha, I.; McKenzie, B.; Napierala, J. The role of immigrant enclaves for Latino residential inequalities. *J. Ethn. Migr. Stud.* **2014**, *40*, 1–20. [CrossRef] [PubMed]
20. Dunn, K.M. Rethinking ethnic concentration: The case of Cabramatta, Sydney. *Urban Stud.* **1998**, *35*, 503–527. [CrossRef]
21. Portes, A.; Zhou, M. The New Second Generation: Segmented Assimilation and Its Variants. *Ann. Am. Acad. Political Soc. Sci.* **1993**, *530*, 74–96. [CrossRef]
22. Portes, A.; Rumbaut, R.G. *Immigrant America: A Portrait*, 2nd ed.; University of California Press: Berkeley, CA, USA, 1996.
23. Portes, A.; Rumbaut, R.G. *Legacies: The Story of the Immigrant Second Generation*; University of California Press: Berkeley, CA, USA, 2001.
24. Desbarats, J. Indochinese resettlement in the United States. *Ann. Assoc. Am. Geogr.* **1985**, *75*, 522–538. [CrossRef]
25. Darden, J.T.; Kamel, S.M. Black Residential Segregation in the City and Suburbs of Detroit: Does Socioeconomic Status Matter? *J. Urban Aff.* **2000**, *22*, 1–13. [CrossRef]
26. Argeros, G. Racial and ethnic group spatial assimilation in inner and outer suburban rings. *Soc. Sci.* **2018**, *7*, 229. [CrossRef]
27. Anacker, K.B.; Niedt, C.; Kwon, C. Analyzing segregation in mature and developing suburbs in the United States. *J. Urban Aff.* **2017**, *39*, 819–832. [CrossRef]
28. Anacker, K.B. Analyzing census tract foreclosure risk rates in mature and developing suburbs in the United States. *Urban Geogr.* **2015**, *36*, 1221–1240. [CrossRef]
29. Logan, J.R.; Stults, B.J. *The Persistence of Segregation in the Metropolis: New Findings from the 2010 Census*; Project US2010 Census Brief; Washington, DC, USA, 2011; Available online: https://s4.ad.brown.edu/Projects/Diversity/data/report/report2.pdf (accessed on 1 May 2023).
30. Logan, J.R. The Persistence of Segregation in the 21st Century Metropolis. *City Community* **2013**, *12*, 160–168. [CrossRef]
31. Alba, R.D.; Logan, J.R. Variations on two themes: Racial and ethnic patterns in the attainment of suburban residence. *Demography* **1991**, *28*, 431–453. [CrossRef]
32. Allen, J.P.; Turner, E. Spatial Patterns of Immigrant Assimilation. *Prof. Geogr.* **1996**, *48*, 140–155. [CrossRef]
33. Clark, W.A.V. Race, Class, and Space: Outcomes of Suburban Access for Asians and Hispanics. *Urban Geogr.* **2006**, *27*, 489–506. [CrossRef]
34. Clark, W.A.V.; Blue, S.A. Race, Class, and Segregation Patterns in U.S. Immigrant Gateway Cities. *Urban Aff. Rev.* **2004**, *39*, 667–688. [CrossRef]
35. Dawkins, C.J. Exploring Recent Trends in Immigrant Suburbanization. *Cityscape* **2009**, *11*, 81–97. [CrossRef]
36. Frey, W.H.; Farley, R. Latino, Asian, and Black Segregation in U.S. Metropolitan Areas: Are Multi-ethnic Metros Different? *Demography* **1996**, *33*, 35–50. [CrossRef]
37. Logan, J.R.; Stults, B.J.; Farley, R. Segregation of minorities in the metropolis: Two decades of change. *Demography* **2004**, *41*, 1–22. [CrossRef]
38. Martin, M.E. *Residential Segregation Patterns of Latinos in the United States, 1990–2000: Testing the Ethnic Enclave and Inequality Theories*; Routledge: New York, NY, USA, 2007.
39. Zhou, M.; Logan, J.R. In and Out of Chinatown: Residential Mobility and Segregation of New York City's Chinese. *Soc. Forces* **1991**, *70*, 387–407. [CrossRef]
40. Jones, R.C. The Ambiguous Roles of Suburbanization and Immigration in Ethnic Segregation: The Case of San Antonio1. *Urban Geogr.* **2008**, *29*, 196–223. [CrossRef]
41. Kaplan, D.H.; Woodhouse, K. Research in ethnic segregation I: Causal factors. *Urban Geogr.* **2004**, *25*, 579–585. [CrossRef]
42. Rumbaut, R.G.; Ima, K. *The Adaptation of Southeast Asian Refugee Youth: A Comparative Study*; Final Report to the Office of Resettlement; US Office of Refugee Resettlement: Washington, DC, USA, 1988.
43. Cortes, K.E. Are refugees different from economic immigrants? Some empirical evidence on the heterogeneity of immigrant groups in the United States. *Rev. Econ. Stat.* **2004**, *86*, 465–480.
44. Kibria, N. Household structure and family ideologies: The dynamics of immigrant economic adaptation among Vietnamese refugees. *Soc. Probl.* **1994**, *41*, 81–96. [CrossRef]
45. Park, S. *Indochinese Refugee Resettlement Office, 1975–1986*; Minnesota Historical Society: Saint Paul, MN, USA, 2017.
46. Kelly, G.P. Coping with America: Refugees from Vietnam, Cambodia, and Laos in the 1970s and 1980s. *Ann. Am. Acad. Political Soc. Sci.* **1986**, *487*, 138–149. [CrossRef]
47. Vang, C.Y. *Hmong America: Reconstructing Community in Diaspora*; University of Illinois Press: Urbana, IL, USA, 2010.
48. HEW Task Force for Indochina Refugees. *Report to the Congress*; Social Security Administration, Ed.; Office of the Secretary of Health, Education, and Welfare: Washington, DC, USA, 1976.

49. Hendricks, G. *Indochinese Refugee Settlement Patterns in Minnesota*; Center for Urban and Regional Affairs: Minneapolis, MN, USA, 1981.
50. Downing, B.T.; Olney, D.P.; Mason, S.R.; Hendricks, G.L. *The Hmong Resettlement Study*; Southeast Asian Refugee Studies Project Center for Urban and Regional Affairs; University of Minnesota: Minneapolis, MN, USA, 1984.
51. Carlson, G. *Asians in Minnesota, 2000*; Minnesota State Demographic Center: St. Paul, MN, USA, 2002.
52. Yang, K. The Hmong in America: Twenty-five years after the U.S. secret war in Laos. *J. Asian Am. Stud.* **2001**, *4*, 165–174. [CrossRef]
53. U.S. Congress. *Statement of J. Kenneth Fasick, Director, International Division, U.S. General Accounting Office on Indochina Refugee Assistance Programs*; U.S. Government Printing Office: Washington, DC, USA, 1979.
54. Nguyen, M.H.; Haines, D. Vietnamese. In *Case Studies in Diversity: Refugees in America in the 1990s*; Haines, D.W., Ed.; Greenwood Publishing Group: Westport, CT, USA, 1997; pp. 34–56.
55. Fass, S.M. Through a glass darkly: Cause and effect in refugee resettlement policies. *J. Policy Anal. Manag.* **1985**, *4*, 554–572. [CrossRef]
56. Finck, J. Secondary Migration to California's Central Valley. In *The Hmong in Transition*; Hendricks, G.L., Downing, B.T., Deinard., A.S., Eds.; Center for Migration Studies of New York: Staten Island, NY, USA, 1986; pp. 184–187.
57. Miyares, I.M. *The Hmong Refugee Experience in the United States: Crossing the River*; Garland Pub: New York, NY, USA, 1998.
58. U.S. Census Bureau. *Census 2000 and Census 2010*; Social Explorer, U.S. Census Bureau: Washington, DC, USA, 2010.
59. U.S. Census Bureau. Housing Patterns and Core-Based Statistical Area. Available online: https://www.census.gov/topics/housing/housing-patterns/about/core-based-statistical-areas.html (accessed on 1 May 2023).
60. Berube, A.; Frey, W.H. *A Decade of Mixed Blessings: Urban and Suburban Poverty in Census 2000*; The Brookings Institution, Center on Urban & Metropolitan Policy: Washington, DC, USA, 2002.
61. Kantrowitz, N. *Ethnic and Racial Segregation in the New York Metropolis; Residential Patterns Among White Ethnic Groups, Blacks, and Puerto Ricans*; Praeger: New York, NY, USA, 1973.
62. Wahl, A.-M.G.; Gunkel, S.E.; Shobe, B., Jr. Becoming neighbors or remaining strangers? *Latinos and residential segregation in the Heartland. Great Plains Res.* **2005**, *15*, 297–327.
63. Sakamoto, A.; Woo, H. The Socioeconomic Attainments of Second-Generation Cambodian, Hmong, Laotian, and Vietnamese Americans. *Sociol. Inq.* **2007**, *77*, 44–75. [CrossRef]
64. Rumbaut, R.G. Vietnamese, Laotian, and Cambodian Americans. *Interdiscip. Perspect. New Immigr.* **2001**, *1*, 308–346.
65. Marsh, R.E. Socioeconomic status of Indochinese refugees in the United States: Progress and problems. *Soc. Secur. Bull.* **1980**, *43*, 11–20.
66. Galster, G.C. Black suburbanization: Has it changed the relative location of races? *Urban Aff. Q.* **1991**, *26*, 621–628. [CrossRef]
67. Li, W. Anatomy of a new ethnic settlement: The Chinese ethnoburn in Los Angles. *Urban Stud.* **1998**, *35*, 479–502. [CrossRef]

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Empowering Urban Tourism Resilience Through Online Heritage Visibility: Bucharest Case Study

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Abstract: Urban tourism resilience has become an important issue in light of the recent COVID-19 crisis, and heritage tourism represents an opportunity to recover from recent losses and develop resilient, sustainable planning for this sector. Important cities in CEE countries, such as Bucharest, are particularly affected, as in their case, the recent recovery in tourism overlaps with efforts to promote a positive image to replace identity labels associated with their communist past. In this context, online digital exposure to cultural heritage is of significant interest for resilient, sustainable tourism planning. Analyzing the most frequently online-promoted objectives through a mixed-methods approach, this study is an innovative empirical attempt to statistically uncover the online projected image of Bucharest. The main results show that despite the intended image projection, the Romanian capital's communist heritage remains one of its most important landmarks, especially for international tourists. Other essential features that influence the frequent promotion of heritage objectives that represent the Romanian national culture include the representativeness of the monuments or institutions (e.g., museums) and their accessibility (i.e., their location in the center of Bucharest or close to local attractions). These results are important for the strategic planning of urban tourism in the region.

Keywords: urban tourism; heritage promotion; landmarks; online images; blogs

1. Introduction

Urban tourism resilience has become a major theme of sustainable planning and development policies in the world's major cities in the post-pandemic era. As old and new urban destinations sought to recover from the period of non-tourism and silent tourism [1,2], resilience was adopted as a new paradigm for hospitality recovery and blended with the older, more holistic 'multi-pillar paradigm of sustainable development' [3]. Bucharest has a rich, complex cultural heritage dating back to the Middle Ages, reflecting important radical changes in different historical phases [4]. The city has become progressively more attractive, increasing its international tourist demand considerably in recent decades [5] and attracting foreign tourists, unexpectedly during the COVID-19 period, as it hosted mega sporting events [6].

According to the National Institute of Statistics [7], the number of inbound tourists increased by 2.5% in December 2023 compared to December 2022, which is evidence of the post-pandemic recovery. This increase was registered due to the gradual lifting of travel restrictions. This makes Bucharest one of the first European capitals to be visited as a tourist destination post-COVID-19.

This fact was also a direct result of the post-communist efforts to rebrand tourism that were undertaken before the COVID-19 pandemic. Since the early 1990s, Eastern European destinations sought to highlight cultural leisure attractions as key strategic elements to change tourism perceptions in competition with consecrated European destinations under the new postmodern mobility paradigm [5], which emphasized the new travel interests of the postmodern leisure traveler demanding "smaller-scale specialized niche marketing" [8] (p. 427).

A recent study [9] underscored the importance of sightseeing experiences for contemporary travelers and identified certain heritage objectives in Bucharest (e.g., the Palace of Parliament, the Cotroceni Palace, the Romanian Athenaeum, the Village Museum "Dimitrie Gusti", the Stavropoleos Church, Herăstrău Park, and the Cişmigiu Gardens) as main attractions for foreign tourist demand. The opinions and evaluations of international visitors as co-creators of tourism products, WOM (word-of-mouth) promoters, and travel influencers play a central role in the overall perception of a destination's image [9,10]. Recent research has therefore emphasized the essential role that travel marketing and social media platforms for digital destination branding, travel blogs, booking sites, and livestreams play in the online image of cultural heritage, promotion, and accessibility of destinations [11–14].

In this context, embracing another perspective, our study aims to highlight the main heritage objectives promoted by specialized platforms, booking sites, and/or blogs as the first options for travel and sightseeing in Bucharest. Further advertised through electronic word-of-mouth (eWOM) and social media platforms, these objectives reach, in the end, a gradually wider audience, defining the iconic nature of a destination.

The analysis addresses the following research questions:

RQ1. What are the attractions and landmarks most frequently promoted/mentioned by online sources for tourism in Bucharest?

RQ2. Which main factors/elements determine the attractiveness and selection for the online promotion of attractions and heritage objectives in Bucharest?

The paper is structured as follows: The next section (Section 2) comprises a literature review on the discussed topic. The third section focuses on the materials and the mixed methods used to conduct the theoretical, empirical analysis of the online exposure of cultural heritage and digital online accessibility of the city of Bucharest. The fourth section presents the main results of the research design and metadata used to highlight the main tourist attractions advertised online for the Romanian capital. The fifth part includes a discussion of the main findings, their implications, possible policy recommendations, and the study's conclusions.

2. Literature Review and Context Analysis

2.1. Urban Tourism Resilience Connected to Cultural Heritage and the Particularities of CEE Destinations

Cultural heritage tourism is seen as a factor of regional development, especially for peripheral regions that are at the same time far from political administrative centers and off-the-beaten-path travel destinations [15]. From the perspective of European cohesion and economic development, this is also the case for Bucharest and Romania. The geographical regions and cities of the post-communist CEE countries were particularly exposed to globalization and neoliberalization trends in the travel and mobility markets. They were forced to create new attractive identities for tourism and business activities [16] that would counterbalance the uniform labeling and negative images induced by the media [5] and break away from any association with communism [17,18]. With the recently gained 'freedom' [19], CEE countries have experienced important and rapid changes in tourism in the post-communist period.

Urban tourism resilience is a topic with particular connotations in these countries in which large cities and particularly national and regional capitals developed tourism related to cultural heritage as a main factor of urban development in the post-industrial economic period [20]. CEE urban destinations became part of the global tourismification phenomenon, as many preserved and displayed complex historical settings [21] and were particularly interested in attracting tourists searching for authentic off-the-beaten-track attractions through old monuments and city center historic districts [22]. A large number of studies, many of which are dedicated to European destinations, emphasize an obvious connection between cultural heritage and increased visitors in the context of international tourism [23]. The literature dedicated to post-socialist cities (e.g., in Romania and Serbia) emphasizes the complex role of culture in achieving urban regeneration and, therefore, increasing urban economic competitiveness with regard to tourism development in Eastern Europe, particularly for second-tier cities lagging behind their Western European peers that have continued to enjoy the richness and diversity characteristic of liberal societies [24,25]. Tourism and leisure activities are also a solution for sustainable integrated regeneration urban strategies dealing with complex ecological problems in the post-industrial era, which particularly hit post-socialist cities, overlapping important traditional industrial centers in CEE countries [26].

As explained above, in the urban tourism sustainability and resilience paradigm displayed by these countries, two opposing currents interfere. On the one hand, there is a clear break from the communist past, particularly emphasized by post-communist destinations that deconstructed socialist images based on previous 'propagandist imagery and discourses' [27] while adopting a Westward-looking orientation in an attempt to reshape national identities and promote and interpret dissonant national heritage [28]. At the same time, a second, opposite collective feeling of popular nostalgia for the socialist past was highlighted by the literature, as seen in the case of Tirana (Albania) with the regeneration of socialist architectural urban elements of the city through museumification strategies [29]. Contentious heritage spaces connected to communist monuments were also exemplified in the case of Sofia (Bulgaria), involving places of collective memories that attract social dissension, generate ideological and social interferences and intra- and intergenerational debates, and provoke public manifestations [30].

In ex-communist territories, and particularly in large cities and capitals, there are important buildings described as dissonant heritage, representing symbols of totalitarianism (e.g., impressive buildings as symbols of power, headquarters of the regime, and residences of former leaders). Tourism is a way to grant use value and economic sustainability to such architecture [31] that is otherwise contested by an important mass of residents and dissonant with the new post-socialist identities that CEE countries attempted to reconstruct and advertise mainly by 'decommunization' and emphasis on the pre-socialist "Golden Age" and the Westernization/Europeanization of their urban areas [32].

In terms of urban tourism development and economic resilience for these cities located in Eastern Europe, one of the biggest challenges of the last few decades was, therefore, the transformation of "post-socialist heritage. . .into new market-led major visitor attractions", deconstructing the socialist iconic images and propaganda through the design of new cultural landscapes and post-socialist perspectives [33] (p. 145).

2.2. Online Cultural Heritage Visibility and Urban Tourism Resilience in a Post-COVID Context

Online marketing communication and planning have been highlighted as key factors in the effective valorization of resources [34]. Planning mechanisms, multilevel governance, financial resources, consistent support for local tourism, and the reinvention of cities have been identified as key variables to be addressed in post-crisis scenarios for the recovery

and sustainability of urban tourism, with obvious positive effects on this sector for the resilience of cities [3,35]. In the recent scientific literature published during and after the COVID-19 pandemic, urban challenges and crises connected to terms like sustainability and resilience have been prioritized as topics.

One of the main concerns for tourism research has been the relationship between these last two variables and the identification of tourism development models that could best meet their principles [36]. Urban tourism, which involves the protection and better valorization of cultural heritage, has emerged as a core element of effective and sustainable strategic spatial planning for European capitals and major regional centers, despite their different administrative and cultural approaches caused by the prevailing political leadership in the last decades of the 20th century [37]. The harmonization of sustainability and resilience paradigms for post-crisis cultural tourism represents a real necessity for urban destinations, particularly regarding Eastern European destinations [38]. Not uniformly defined, tourism resilience is a multidimensional complex concept related to economic resilience, which is mainly described by elements of resistance, recovery, reorientation, and renewal [39], through which a domain copes with aggressive, restrictive, and/or challenging factors or incidental events that limit its development and normal functioning.

Virtual tourism attributes in general, and in relation to cultural heritage in particular, were greatly increased during the COVID-19 crisis, which reinforced tourists' desire to visit destinations through immersive virtual experiences [40]. The COVID-19 outbreak provoked an unprecedented global shock to tourism industries, with the lockdown effects generating demand volatility for many countries and almost all segments of the business [41]. In this context, digitalization permeated all areas of professional and private existence, and the online virtual environment of visited destinations and the view through cameras became fundamental common elements of contemporary visual geographies perceived on booking platforms and travel blogs [42–44]. Photographs of inbound tourists reflect both the subjectivity of tourists and objective descriptions and reflections of the visual aesthetics of destinations, providing a valuable source of data for tourism studies that rely on photo-sharing or social media platforms [45]. The elements of the tourist cityscape, including the inventory of main attractions, which are most visible in the photos and promoted on official websites, platforms, and blogs, play an important role in branding and marketing an area [46]. eWOM and user-generated reviews represent a new phase of development and a more powerful tool than physical WOM for the tourism sector, increasing during the COVID-19 pandemic, determining the reputation of places, and influencing travel decisions through online information searches [47]. Recent studies have confirmed that potential tourists are influenced by online reviews and consumer opinions in their decision-making processes [48], further emphasizing the importance of travel vloggers and travel bloggers for portraying destinations [12,49].

For certain destinations, studies have confirmed that recognizing heritage images can enhance the tourism experience, promote the attractions' visibility and accessibility for tourists, maintain interest in local architecture, and encourage conservation efforts [50]. Architecture and iconic buildings are an essential part of the urban heritage that makes up a city's image and brand [51] as urban tourism models have developed, making historic cities and their heritage increasingly important in recent years [52]. The presence of major heritage attractions (e.g., museums, monuments, and important historical buildings) on the internet and their appearance at the top of the search engine results or accessibility through relevant information, easily available for potential tourists, is of major importance for what could be called heritage 'online exposure' [53], enhancing overall tourist access and determining tourist motivation to visit these sites.

Adaptive reuse and heritage conservation should currently be a priority in historic city centers such as Bucharest. Studies have shown that tourists' perception of the level of preservation of a heritage site can bring added value to the conservation function of cultural objectives [54]. At the same time, the visualization of tourist attractions, as well as the on-site tourist experiences during the visit, greatly influence revisit intention [5].

2.3. Main Aspects of the Case Study

Romania and its capital have continuously developed and expanded their international tourist attractions in recent decades, resulting in a significant increase in accommodation capacity and tourist demand. According to official statistics, domestic demand for Bucharest doubled in terms of both arrivals and overnight stays in the period of 1996–2023, mainly due to the polarizing functions of the capital city and numerous business events. Business tourists are also opting for leisure visiting activities, either individually—since they sometimes have a few spare hours between the business meeting and their departure to their residence—or during extra events associated with the segment of congresses and/or conferences they attend as a core activity that determines their business travel. Foreign tourists coming to Bucharest recorded an increase after 1990 and especially after 2007 (when Romania's accession to the EU was registered), from 217,120 arrivals in 1990 to 1,210,580 in 2018, exceeding 55% of the total demand in the last few years before the COVID-19 pandemic. In terms of overnight stays, foreign demand is even more important and accounted for over 60% of the total tourism demand for Bucharest in the years before COVID-19. The average length of stay of international demand has also increased in recent years (2.4 days was the highest value registered in 2022 and 2023), but it still remains low, as the vast majority of visitors usually come to the city for business reasons or for a short vacation. Recent studies have identified an increasing interest in Romania and Bucharest as a leisure destination for international tourists. The development of air transport in Europe and the important traffic concentrated at Henry Coandă Airport (which handles almost 60% of the total passenger traffic in Romania) have made Bucharest an ideal destination for a weekend getaway, which is gradually being discovered and promoted by individual travelers and bloggers who advertise their shared experiences of this off-the-beaten-track urban destination.

Despite the foundation of the Bucharest Tourism Board as an association meant to coordinate the efforts of all stakeholders involved in promoting the tourism destination of Bucharest in 2014 [55] and the initiative of Bucharest City Hall to find consultants to elaborate a consistent adapted tourism strategy [56], the capital of Romania lacks a coherent tourism marketing strategy. The existing Integrated Urban Development Strategy expressed the need for integrated socio-economic development of cultural heritage and tourism in Bucharest. Among its six main priorities, it explicitly mentions the need to elaborate and implement a tourism development and marketing strategy that should promote cultural tourism in Bucharest [57]. Other important divergent efforts were directed toward developing a tourism promotion site for Bucharest that was redesigned in 2016 [58,59], while the site BUCUREŞTI.RO [60] is still currently looking for partners that will collaborate on its development.

In this context, the promotion of cultural tourism, the online visibility of heritage attractions, and the preservation and renewal of Bucharest's old city center and its landmarks as core elements testifying to the historically evolving lifestyles and complex culture of this capital city in Southeast Europe seem particularly important. Lacking a clear marketing and promotion strategy while defining itself as a growing attraction destination for both domestic and international visitors, Bucharest is a perfect case study for investigating

the research questions formulated above, leading to important findings and input for policymakers and local and regional tourism stakeholders in the present context.

When considering previous studies focusing on the tourism attractiveness of cultural heritage sites in post-communist destinations, our research has an obvious original thematic approach focusing on the online visibility of urban landmarks in Bucharest that, to the best of our knowledge, has not been employed previously. Despite the simplicity of the empirical methodology, this research may offer valuable suggestive results that could be of interest to both academic readers and practitioners, the latter of whom may be interested in designing future integrated marketing tourism policies adapted to the current context.

3. Materials and Methods

As stated in numerous studies, information and communication technologies (ICTs) have become "essential in tourism destination management", as "tourists have become more experienced and digitally literate" [61] and have gained further access to them via big data, the internet, social media, and the emerging blogging and vlogging phenomena [62], while influencing travel behavior.

The exploratory aim and research questions of this study, focusing on the overall tourism demand for Bucharest, initially determined the internet research and the selection of data sources and data collection. Travel marketing websites, travel blogs, and even booking or ticketing websites were part of our final list, which included a total of 65 web sources from which the data were extracted (Table 1). The search was performed from November to December 2024 by using different combinations of keywords in both English and Romanian, such as: '*Bucureşti*; *turism*', '*Bucharest*; *tourism*', '*sightsee; Bucharest*', '*promotion; Bucharest*', '*promovare*; *Bucureşti*', '*tourism attractions; Bucharest*' '*rute turistice*; *Bucureşti*', '*travel blog*; *Bucharest*', '*visit Bucharest*', '*What to do in Bucharest*', '*what to see in Bucharest*', '*Bucharest; travel tips*', etc. Supplementary searches for Bucharest on booking and ticketing platforms were conducted. Google keyword combination search results revealed numerous sources of marketing and destination promotion for the Romanian capital, including a significant number of blogs (Table 1). Booking and ticket sales platforms, as well as commercial and general information platforms, were discovered as online information and promotion sources for tourist attractions in Bucharest. Marketing, tourism, booking, and general information platforms belong either to public or private entities (e.g., institutions or associations), while blogs represent individual private sources. The common feature that validated these data sources in our research was the fact that they displayed publicly available information from which our metadata were extracted, and most of all, the websites appeared at the top of the search engine results [53].

Table 1. Types of online sources promoting sightseeing and the main cultural attractions in Bucharest.

Type of Site/Platform	Marketing and Tourism Platforms	Blogs	Booking and Ticketing Platforms	General Information Platforms	Total
	35	16	9	5	65

Computed by the authors (data collected in November–December 2024).

From each source, the first ten landmarks, monuments, and attractive places were extracted in the order in which they were presented by the online web source. The online sources presenting less than ten objectives were eliminated. Even though empirical data extraction is more time-consuming, it was essential for our study because our objective did not require the software analysis and technical steps needed for studies on unstructured texts as in other cases [63]. Moreover, this was the most convenient method of data collection, taking into consideration the heterogeneity of how web information is displayed

(e.g., the presentation of heritage objectives through text or pictures) and the numerous sources, but also the fact that the data volume did not require excessive human resources, nor was it time-consuming.

Our initial research phases consisted of reading and empirically selecting sources that promoted at least ten tourist attractions for the city under study. Then, the first ten tourist objectives advertised on each website were extracted, which allowed us to register their mention order, as both keyword extraction and hierarchical sorting have been validated as important methodological steps in cultural heritage evaluation studies [64]. To facilitate data mining for further statistics and visualization techniques, the obtained raw data were cleaned and encoded by coding labels that allowed for the transformation of different mentions of monuments and landmarks in Bucharest using shorter uniform labels. Data cleaning and curation were performed in Excel using specific commands and functions to reduce as much as possible the bias resulting from their manual introduction, which could not have been performed otherwise, and further ensured easy software analysis. The comparatively small amount of data allowed for thorough, rigorous verifications that eliminated errors resulting from initial manual encoding and software commands.

Furthermore, quantitative statistics representing the frequency and volume of advertising within the selected sample of the top landmarks and monuments in Bucharest, as well as complementary semantic analyses, were performed using Excel and the Voyant tools, respectively, as adapted available software resources already used in other qualitative data mining studies [65,66]. Supplementary graphs underlining statistics on the hierarchical mention of individual monuments were created to highlight the importance of different types and/or groups of monuments that share certain characteristics or common features and elements.

The complementary semantic analyses, which were also performed on selected data from the final sample list of web sources, took advantage of the data mining and cleaning performed beforehand. The final data pool was cleansed of words unnecessary for the current analysis (verbs, prepositions, conjunctions, etc.) and helped us to present accurate word cloud images that clearly highlight the types and/or names of monuments and landmarks in Bucharest.

4. Main Results

Considering the popularity of Bucharest's main heritage objectives and landmarks, the Palace of the Parliament, the second largest building in the world, formerly known as Casa Poporului/House of the People, a sign of the former communist regime and a megalomaniac architectural project realized under Ceauşescu's regime, is definitely the number one tourist attraction for international tourists. The building is promoted by marketing and booking platforms as well as blogs on eWOM opinions as one of the top ten most important destinations and one of the first three most important landmarks of Bucharest (Figure 1a,b, Figure 2 and Figure 3a). Reference studies [28] have noted that it represents a controversial legacy of communism, attracting tourist gazes and curiosity in the central area of the city, symbolically associating its significant size and the history of the building with totalitarianism and Ceauşescu's role in its construction. The building is particularly contested by Romanians, who see it as quite inappropriate for what they wish to represent in light of post-communist achievements and recently won democracy. This is literarily symbolized by the building's current designation and primary function as the seat of the modern parliament and, thus, the democratic legislature [28] and is in contrast to their efforts to create and market new positive identitarian images about Romania and to attract inbound tourism and increase related spending [67]. However, the view of communism remains an important trend, at least among foreign visitors. In online

sources, both on marketing platforms and travel blogs, Ceauşescu's villa is mentioned among the first three options of the top ten list of places to visit in Bucharest (Figure 1a).

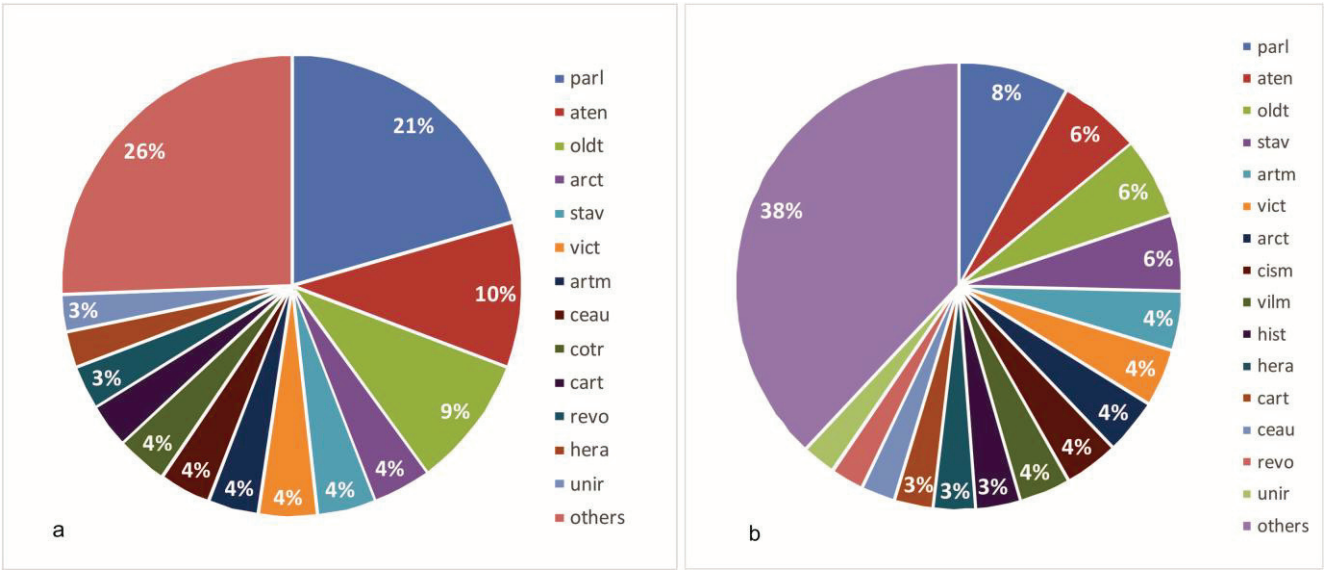

Figure 1. The total number of mentions of main heritage objectives and tourist attractions in Bucharest: (**a**) Among the first three mentions within the top ten mention lists in the study sample; (**b**) considering the total number of mentions within the top ten mention lists in the study sample. parl—Parliament Palace; aten—Romanian Athenaeum; oldt—Old Town; arct—Arch of Triumph; stav—Stavropoleos Church; vict—Victoriei Avenue; artm—National Museum of Art of Romania; ceau—Ceauşescu's mansion; cotr—Cotroceni Palace; cart—Cărtureşti Library; revo—Revolution Square; hera—Herăstrău Park; unir—Unirii Square; cism—Cişmigiu Park; vilm—Village Museum; hist—National History Museum of Romania.

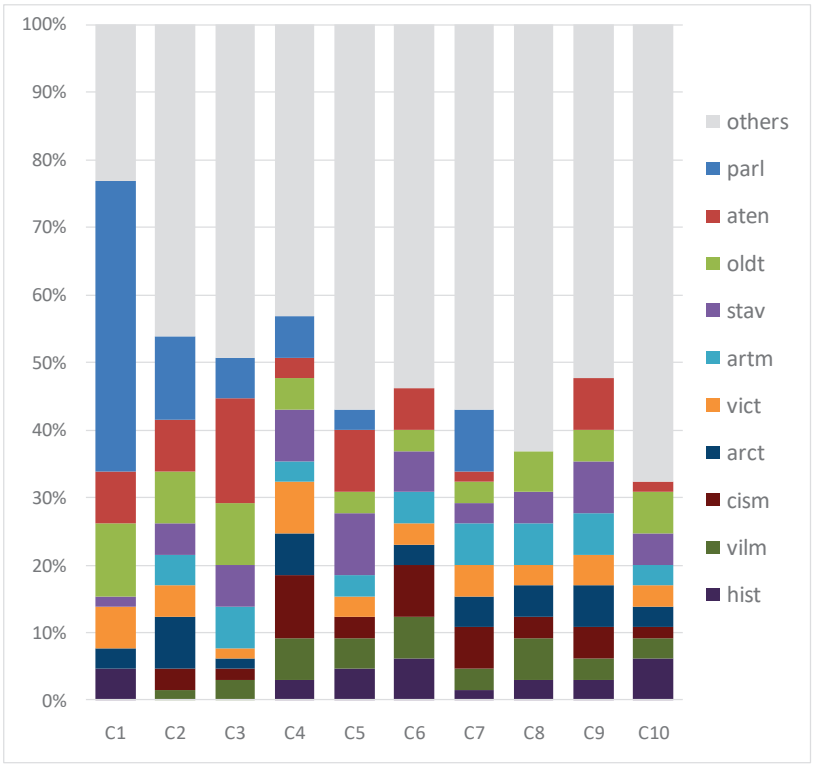

Figure 2. The most frequently mentioned heritage objectives and tourist attractions in Bucharest within the top ten mention lists of the study sample.

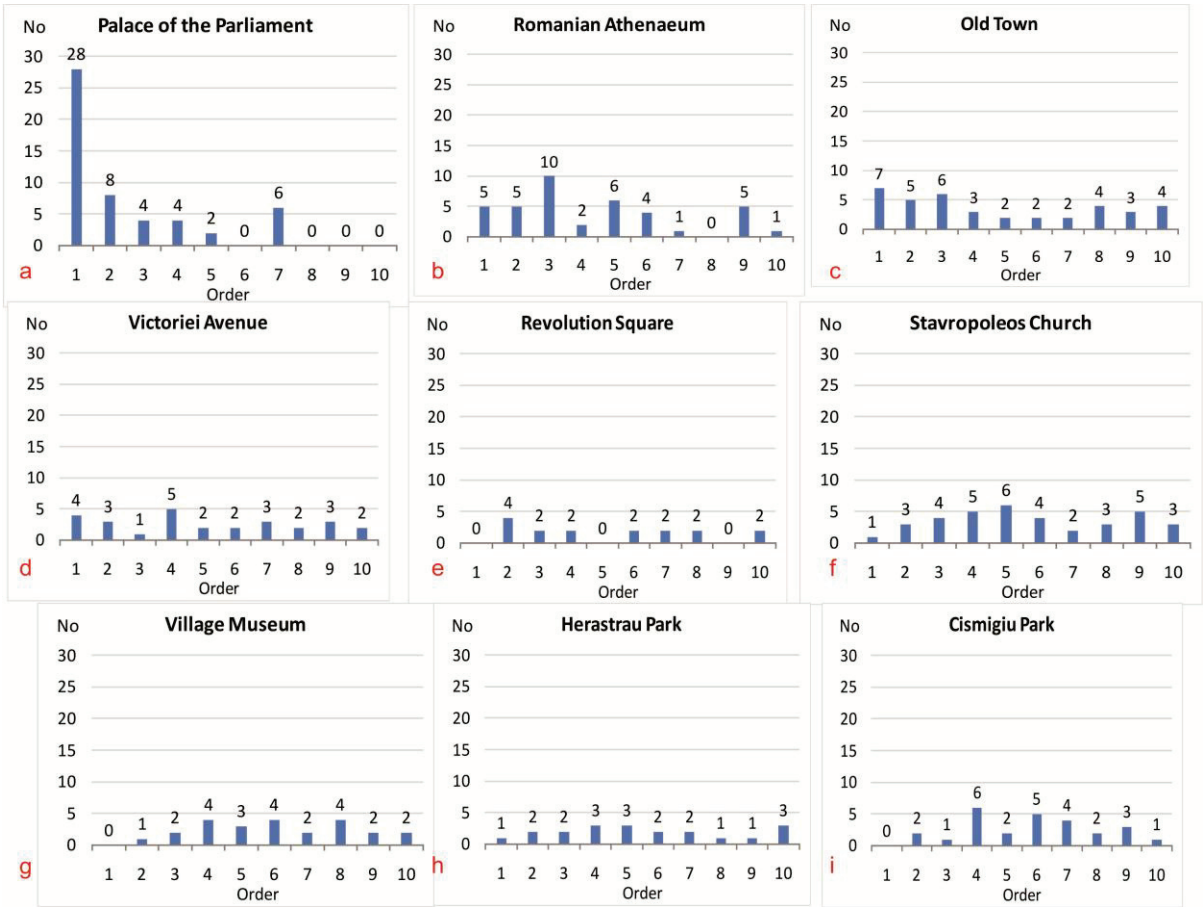

Figure 3. The most frequently mentioned heritage objectives and tourist attractions in Bucharest within the top ten mention lists in the study sample (the order of mentioning—x-axis; the number of mentions—y-axis). (**a**) Palace of the Parliament; (**b**) Romanian Athenaeum; (**c**) Old Town; (**d**) Victoriei Avenue; (**e**) Revolution Square; (**f**) Stavropoleos Church; (**g**) Village Museum; (**h**) Herăstrău Park; (**i**) Cişmigiu Park.

The popularity of heritage objectives reflects a combination of historical, architectural, cultural, religious, and social elements (with reference to the current use of the buildings). In second place among the most promoted monuments in Bucharest on the online sources included in the study's sample, one finds the Romanian Athenaeum (Figures 1a,b and 3b). As a cultural symbol associated with the George Enescu International Festival of classical music, this monument is representative of the 19th-century French-inspired architectural aesthetic that characterized important monuments in the center of Bucharest during the pre-communist Golden era of cultural flourishing and architectural innovation. Another monument from the royal period that commemorates Romania's victorious past is the Triumphal Arch, which is the first of three monuments in Bucharest included in the city's top ten landmarks (Figures 1a,b and 2).

The 'Old Town', or 'Old Center', is inevitably one of the most visited areas by both visitors and residents and is recommended by most sources in our sample as a must-see in Bucharest (Figures 1a,b, 2 and 3c). The cityscape is characterized by "a medieval urban fabric (narrow streets) and architecturally valuable buildings (from the 18th and 19th centuries)" [54] (p. 2360). The historic center of the city is home to numerous important heritage sites (e.g., churches and museums) but also institutions (e.g., the National Bank of Romania) and numerous restaurants and catering establishments, which provided funding for the renovation and preservation of the built heritage, thus ensuring the adaptive reuse and economic sustainability of many buildings [68] after a long and controversial

restitution process that began after the 1989 revolution [5]. The Stavropoleos Monastery Church, located in the Old Town, is a religious monument associated with the important Greek community in Bucharest and has been preserved over the centuries in contrast to an important inn complex typical of the architecture of the medieval capital that surrounded it and no longer exists. Built in the autochthonous Brâncovenesc style and located in the Old Town, the monument is consistently listed by numerous online sources as one of Bucharest's top ten tourist attractions (Figures 2 and 3e).

Calea Victoriei/Victoriei Avenue is another landmark that is repeatedly mentioned among the top ten tourist attractions not to be missed when visiting Bucharest (Figures 1a,b, 2 and 3d) and can be connected to other important objectives, such as squares (Old Center and Revolution Square (Figure 3e)), monuments (Romanian Athenaeum), and important museums (National History Museum of Romania and National Art Museum of Romania) (Figure 2). Victoriei Avenue crosses the Old Center of Bucharest and is one of the oldest streets in the Romanian capital, which once connected the Old Royal Court with other central institutions. Like the Arch of Triumph, its name commemorates Romania's victory in the War of Independence (1877–1878).

The museums in Bucharest are also among visitors' favorites, as they reflect the Romanian way of national manifestation in the fields of history, art, and science, which ideally coincides with the restoration of identity through "individuality and difference" from the former common political past of the CEE countries in the post-communist era [69] (pp. 126–127). Among the ten most important sights in Bucharest, one should also mention the Village Museum. During the communist era, this type of museum was considered part of the promotion of rural heritage among city dwellers as a "strong reminder of their rural roots" [8] (p. 428) and capitalized on the emotional attachment to place in a complex region from the point of view of urban–rural relations [70]. With the new tourist development trends promoting sustainable rural tourism in CEE countries and reprocessing the national image from a historical perspective for marketing purposes, this type of museum has been revitalized as a tourist attraction, especially for the demand of foreign tourists [67].

The parks are also popular tourist attractions for visitors to large urban areas, and large parks near the historic Old Town, such as Cișmigiu, or near other attractive objectives, such as Herăstrau Park near the Village Museum, are named among the top ten places to visit in Bucharest by several different online sources (Figures 1b and 3h,i).

In this way, the above graphs reveal the monuments and heritage objectives promoted by current online sources for Bucharest as a travel destination, empirically answering the first research question. The results confirm, 35 years after the revolution, the findings in previous studies that state that, one of the most important heritage attractions tourists 'gaze into' and are still invited to visit at present by both tourism platforms and visitors' blogs is the communist megalomaniac building of the Palace of Parliament, representing a dissonant post-communist institutional symbol of pluralist democracy [28].

The popularity of the destinations reflects a combination of historical, architectural, cultural, religious, and social elements (with reference to the current use of the buildings) but also advantages in terms of accessibility related to their location close to the city center, on main transport routes (major central boulevards or the main route to the airport), or close to other important popular monuments and tourist attractions. Romania, and Bucharest in particular, as a tourist destination, offers a wide variety of tourist attractions that reflect European cultural influences from the West and the East, as well as a mix of historical attractions that develop a historical perspective. Alongside the quantitative empirical analysis, the complementary qualitative software techniques have synthesized and clearly presented some keywords that denote the main characteristics and types of cultural heritage that have been promoted and found particularly attractive by tourists (Figure 4).

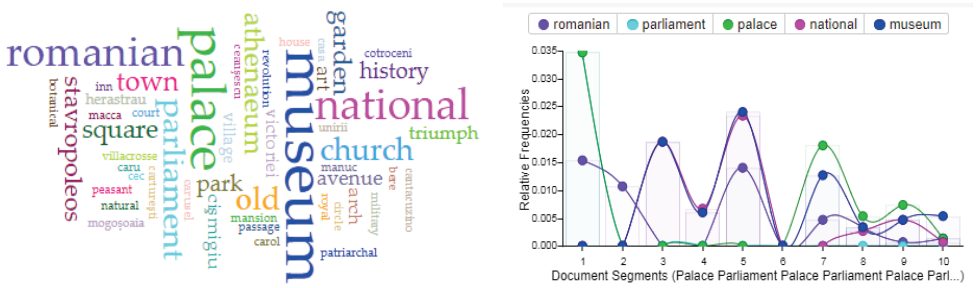

Figure 4. Word cloud summary based on the top ten mentions of cultural heritage objectives and tourist attractions in Bucharest within the research sample.

The first result of the qualitative analysis of the sample texts clearly shows the importance of *Romanian* and *national* as the main attributes of the advertised institutions and monuments, such as *museums* and *palaces*, which are objectives with high national heritage value. Other important terms in the word cloud above (Figure 4) are *church* (and the particularly sonorous name of Stavropoleos), *garden* (mentioned for the Botanical Garden and some parks, e.g., Cişmigiu gardens), *square* (mentioned for Revolution, University, Unirii, or Victoriei squares), and *park* (mentioned for Cişmigiu, Herăstrău, and selectively for other examples of parks in Bucharest). In this way, the word cloud highlights elements that reflect national symbols, monumental buildings, cultural institutions of particular importance, places of historical significance, and places of relaxation (e.g., green areas and squares, including shopping areas, restaurants, and hospitality units), underlining the main motivations for cultural visitors potentially attracted to Bucharest as an urban tourism destination.

The nature of advertised cultural heritage in relation to the different types of tourism motivation and the complementary qualitative analysis provided the answer to the second research question.

In addition to a cultural heritage objective's popularity and fame via its importance for the knowledge of national cultural identity, its location and/or accessibility represent a third factor that determines both the attractiveness and the selection for online promotion and exposure of cultural heritage attractions in Bucharest.

From the point of view of localization and accessibility, the above-mentioned destinations can be divided into and/or linked to the following two main locations:

- Attractions and monuments located in the center of Bucharest (e.g., Palace of Parliament, Unirii Square, Old Town, Stavropoleos Church, Victoriei Avenue, Romanian Athenaeum, Revolution Square, Romanian National Museum of Art, and Cişmigiu Park). Most of the advertised tourist attractions are concentrated here.
- Those located on the express bus line to Henry Coandă (Otopeni) Airport in the northern part of the city. The attractions in this area are just as significant but less frequented than those in the center. These include Bucharest's largest park, Herăstrău, which is very popular and visited all year round by both foreign tourists and locals; the Village Museum, which is located near Herăstrău Park and recognized and visited mainly by people/tourists interested in Romanian traditions; and the Ceauşescu Mansion/Palatul Primaverii (Spring Palace), which attracts a large number of tourists, especially people interested in recent history and the dictatorship period. These are usually frequented by tourists passing through the area on their way to the airport or specifically visiting different monuments or Bucharest landmarks.

5. Discussion and Conclusions

Particularly prominent urban tourism destinations in CEE countries, such as Bucharest, face major challenges in the implementation of marketing planning for the development of cultural tourism activities. According to the scientific literature [18], this sector has been prioritized in this European region in order to create a positive image that reflects the new socio-political realities and is free from any association with the totalitarian communist regimes that shaped its political orientation in the second half of the 20th century. Despite the image projection sought by tourist board managers, administrative authorities, and even residents, the images and texts available online are fraught with obvious contradictions, as sometimes architectural monuments (the Palace of Parliament) or intangible heritage (the figure of Ceauşescu) linked to the communist legacy can be a strong tourist attraction for foreign visitors.

Despite the important online exposure of monuments that are a reminder of the communist period (such as the Palace of Parliament or Ceauşescu's villa), Bucharest has a rich ecclesiastical architecture, displaying important architectural monuments from the end of the 19th century and the interwar period (e.g., the Romanian Athenaeum, the old Royal Palace that houses the National History Museum of Romania, and the Triumphal Arch). In addition to these interesting architectural monuments, Bucharest is also home to numerous churches and monasteries that are the result of the city's development in recent decades as the administrative capital of Romania. Today, the city includes modern attractions that offer tourists places to relax, such as parks, squares, thermal baths, shopping centers, libraries, and business complexes.

Beyond their fame or the architectural, historical, and aesthetic values that the monuments have (e.g., size, architectural style, and connection to historical moments or personalities), the location and accessibility of the monuments are important factors that determine their fame and, consequently, the number of visitors. As expected, most visitors, and consequently the most promoted monuments, are located in the central area of Bucharest, while a different group of frequently promoted monuments can be found in the northern area.

The online exposure of these objectives improves their online accessibility and promotion, which, in the long run, can further enhance the attractiveness of the most visible cultural monuments and institutions in Bucharest as part of the new framework paradigm of creative place-making that proposes the creation of stories and images as resources for the sustainable development of destinations [71].

Many blogs and marketing platforms provide information about sights and monuments that can be visited, as well as restaurants worth visiting, digitally promoting and practically defining the current landscape of virtual Bucharest as a destination, thus influencing and orienting the choice of future visitors. Online promotion, visibility, and heritage accessibility are, therefore, essential elements for the resilience and sustainability of urban tourism today and need to be considered in the future strategic planning of this area by tourism development stakeholders.

Based on the research results in this paper, the following policy recommendations could be made for tourism development in relation to cultural heritage in Bucharest:

- Extend the visibility and promotion of cultural heritage through the design and development of tourism products proposing flagship iconic objectives and supplementary associated attractions based on either the theme and/or the location of main tourism attractors (e.g., visits to the National Museum of Contemporary Art hosted by the building of the Palace of Parliament; visits to the Museum of Communism located in the Old Town, associated with visits to the Palace of Parliament or Ceauşescu's residence; visits to Stavropoleos Church, associated with visits to Sf. Anton Church in

the Old Town, located near the ruins of the Old Royal Court of Bucharest or other old churches in the city center).

- Extend the visibility and promotion of urban cultural heritage all over Bucharest through the design and development of thematic routes. Starting from the qualitative results in our study and types of heritage that could raise tourist interest, one could see a possible tour of Bucharest's palaces (e.g., Suţu Palace, part of Bucharest's Municipality Museum; Cantacuzino Palace, near the National Museum "George Enescu"), churches (in the Old Town and the monasteries around Bucharest), gardens, and famous squares (e.g., Revolution Square, University Square), or a red tourism tour (to be designed and adapted for different target groups).
- Digitalization of cultural heritage for both its valorization and better promotion, starting with the implementation of QR codes as a means of information and continuing to the design of adapted specialized applications for different types of users, which may determine immersive cultural tourism experiences.
- The design of creative cultural products and adapted events that should value both iconic landmarks and less well-known monuments that could be visited in Bucharest, either on an open access basis or on different occasions.
- The association of cultural products and attractions with corporate events and business tourism (e.g., conferences or fairs) that would increase both the visibility and the financial sustainability of cultural heritage preservation and valorization for visiting purposes.

The original analysis performed in our study was based on a mixed quantitative and qualitative methodological approach aiming to obtain suggestive exploratory research results on the online exposure and visibility of the most important elements of cultural heritage in Bucharest. Considering the lack of dedicated studies on this topic for this important urban tourism destination in Romania and the lack of updated marketing and promoting strategies, the contribution of our study could be considered valuable input for both the future scientific literature and future integrated strategies for tourism development. The simple empirical methodological approach makes the results easy to communicate to various types of stakeholders interested in the tourism sector and representing the tourism industry, administrative authorities, cultural institutions, etc. The suggestively illustrated results could encourage practitioners to consider scientific input and public–private multi-stakeholder partnerships as a basis for the design of future integrated policies that are better adapted to the territorial context and its dynamics.

The exploratory character of this study and its pseudo-experimental perspective on the visualization of cultural heritage in Bucharest through simple Google search exercises from the perspective of a normal user, as well as the extraction and computing of data (collected from heterogeneous sources and displayed in various forms, e.g., photos or text), determined the novelty of our research results, which were empirical as well as suggestive and interesting. Despite its simplicity, the methodological approach was appropriate to answer the two research questions and successful at revealing important quantitative aspects of the online promotion of cultural heritage elements in Bucharest through marketing platforms, booking sites, and blogs. They represent valuable, scientifically validated input for the development of future strategies addressing this area, which is particularly promising for Bucharest and has seen increasing trends in international tourism demand in recent years, both before and after the COVID-19 pandemic.

Regardless of these contributions, this research has some limitations that suggest possible future research directions. One limitation includes the volume and type of data and metadata that did not allow for more complex analysis. The extraction of more complex information (e.g., connected to websites and tourism platforms) that would allow

for the application of more complex quantitative and qualitative research methods and the achievement of more sensitive analysis should be a priority for further investigations on this topic. Complementary databases and techniques (e.g., surveys or interviews with tourism development stakeholders) should also be considered for further analysis. Comparative studies and research results for other large cities in Romania or cities within CEE countries could also be considered to extend research on the visibility and online exposure of cultural heritage in the future.

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References

1. Gössling, S.; Scott, D.; Hall, M. Pandemics, tourism and global change: A rapid assessment of COVID-19. *J. Sustain. Tour.* **2021**, *29*, 1–20. [CrossRef]
2. Cheer, J.M. Human flourishing, tourism transformation and COVID-19: A conceptual touchstone. *Tour. Geogr.* **2020**, *22*, 514–524. [CrossRef]
3. Brochado, A.; Rodrigues, P.; Sousa, A.; Borges, A.P.; Veloso, M.; Gómez-Suárez, M. Resilience and Sustainable Urban Tourism: Understanding Local Communities' Perceptions after a Crisis. *Sustainability* **2023**, *15*, 13298. [CrossRef]
4. Surugiu, C.; Tudorache, D.M.; Aştefănoaiei, R.M.; Surugiu, M.R. Bucharest cultural heritage through the eyes of social media users. *Anatolia* **2021**, *33*, 576–587. [CrossRef]
5. Lequeux-Dincă, A.I.; Preda, M.; Taloş, A.M. Empirical evidences on foreign tourist demand perception of Bucharest. *Almatourism-J. Tour. Cult. Territ. Dev.* **2018**, *9*, 95–116. [CrossRef]
6. Lequeux-Dincă, A.-I.; Sava, A.-A.; Teodorescu, C.; Gheorghilaş, A.; Clius, M. Sport Event Tourism in Bucharest. UEFA EURO 2020 Case Study. *Sustainability* **2022**, *14*, 14543. [CrossRef]
7. NIS—National Institute of Statistics—Romania. Turismul în Luna Decembrie 2023—Newsletter. 2024. Available online: https://insse.ro/cms/sites/default/files/com_presa/com_pdf/turism12r23.pdf (accessed on 10 December 2024).
8. Hall, D.R. Tourism development and sustainability issues in Central and South-Eastern Europe. *Tour. Manag.* **1998**, *19*, 423–431. [CrossRef]
9. Surugiu, C.; Surugiu, M.-R.; Grădinaru, C. Targeting Creativity Through Sentiment Analysis: A Survey on Bucharest City Tourism. *Sage Open* **2023**, *13*, 1–17. [CrossRef]
10. Chi, C.G.Q.; Qu, H. Examining the structural relationships of destination image, tourist satisfaction and destination loyalty: An integrated approach. *Tour. Manag.* **2008**, *29*, 624–636. [CrossRef]
11. Confetto, M.G.; Conte, F.; Palazzo, M.; Siano, A. Digital destination branding: A framework to define and assess European DMOs practices. *J. Destin. Mark. Manag.* **2023**, *30*, 100804. [CrossRef]
12. Maheshwari, S.; Raman, R.K. *Travel Influencers, Reference Module in Social Sciences*; Elsevier: Amsterdam, The Netherlands, 2024. [CrossRef]
13. Lo, P.-S.; Tan, G.W.-H.; Aw, E.C.-X.; Ooi, K.-B. Shared moments, lasting impressions: Experience co-creation via travel livestreaming. *J. Hosp. Tour. Manag.* **2024**, *58*, 456–466. [CrossRef]
14. Mariani, M.M.; EkStyven, M.; Nataraajan, R. Social comparison orientation and frequency: A study on international travel bloggers. *J. Bus. Res.* **2021**, *123*, 232–240. [CrossRef]

15. Harfst, J.; Syrbe, R.-U.; Kern, C.; Wirth, P.; Sandriester, J.; Pstrocka-Rak, M.; Dolzblasz, S. Cultural Tourism and Governance in Peripheral Regions. *Int. J. Tour. Res.* **2024**, *26*, e2733. [CrossRef]
16. Light, D.; Creţan, R.; Voiculescu, S.; Jucu, I.S. Introduction: Changing Tourism in the Cities of Post-communist Central and Eastern Europe. *J. Balk. Near East. Stud.* **2024**, *22*, 465–477. [CrossRef]
17. Hall, D. Destination branding, niche marketing and national image projection in Central and Eastern Europe. *J. Vacat. Mark.* **1999**, *5*, 227–236. [CrossRef]
18. Hughes, H.; Allen, D. Cultural tourism in Central and Eastern Europe: The views of 'induced image formation agents'. *Tour. Manag.* **2005**, *26*, 173–183. [CrossRef]
19. Horáková, H. Post-Communist Transformation of Tourism in Czech Rural Areas: New Dilemmas. *Anthropol. Noteb.* **2010**, *16*, 59–77.
20. Vaishar, A.; Šťastná, M.; Zapletalová, J. From industry to cultural tourism: Structural transformation of the second-order city. Case Brno. *Cities* **2025**, *158*, 105685. [CrossRef]
21. Jansen-Verbeke, M. Tourismification of Historical Cities. *Ann. Tour. Res.* **1998**, *25*, 739–742. [CrossRef]
22. Kowalczyk-Anioł, J. Rethinking tourism-driven urban transformation and social tourism impact: A scenario from a CEE city. *Cities* **2023**, *134*, 104178. [CrossRef]
23. Karner, M.J.; Husseini de Araújo, S.; Escher, A.J.; Soares, S.B.V.; Ribeiro, Z.L.; Pöschl, S.N.; Ramos, J.O.; Rocha e Silva, G.R.; Schneider, K. "Culture-touristification" of colonial towns in the interior of Brazil. *Erdkunde* **2024**, *78*, 225–244. [CrossRef]
24. Neducin, D.; Krklješ, M.; Gajić, Z. Post-socialist context of culture-led urban regeneration—Case study of a street in Novi Sad. Serbia. *Cities* **2019**, *85*, 72–82. [CrossRef]
25. Popa, N.; Pop, A.-M.; Marian-Potra, A.-C. Culture-led urban regeneration in post-socialist cities: From decadent spaces towards creative initiatives. *Cities* **2025**, *158*, 105707. [CrossRef]
26. Navratil, J.; Krejci, T.; Martinat, S.; Pasqualetti, M.J.; Klusacek, P.; Frantal, B.; Tochackova, K. Brownfields do not "only live twice": The possibilities for heritage preservation and the enlargement of leisure time activities in Brno, the Czech Republic. *Cities* **2018**, *74*, 52–63. [CrossRef]
27. Ilovan, O.-R. The Development Discourse during Socialist Romania in Visual Representations of the Urban Area. *J. Urban Hist.* **2022**, *48*, 861–895. [CrossRef]
28. Light, D. Gazing on communism: Heritage tourism and post-communist identities in Germany, Hungary and Romania. *Tour. Geogr.* **2000**, *2*, 157–176. [CrossRef]
29. Manahasa, E.; Manahasa, O. Nostalgia for the lost built environment of a socialist city: An empirical study in post-socialist Tirana. *Habitat Int.* **2022**, *119*, 102493. [CrossRef]
30. Debruyne, N.; Nazarska, G. Contentious heritage spaces in post-communist Bulgaria: Contesting two monuments in Sofia. *J. Hist. Geogr.* **2024**, *83*, 176–190. [CrossRef]
31. Sokołowicz, M.E.; Przygodzki, Z. The value of ambiguous architecture in cities. The concept of a valuation method of 20th century post-socialist train stations. *Cities* **2020**, *104*, 102786. [CrossRef]
32. Balockaite, R. Coping with the unwanted past in planned socialist towns: Visaginas, Tychy, and NowaHuta. *Slovo* **2013**, *24*, 41–57.
33. Naumov, N.; Weidenfeld, A. From socialist icons to post-socialist attractions: Iconicity of socialist heritage in Central and Eastern Europe. *Geogr. Pol.* **2019**, *92*, 379–393. [CrossRef]
34. Stoica, I.; Orzan, G.; Dobrescu, A.; Radu, A.C. Online Marketing Communication Using Websites. A Case Study of Website Utility in Accessing European Funds in the Tourism Field Regarding Northeastern Romania. *Procedia Econ. Financ.* **2015**, *23*, 926–935. [CrossRef]
35. Romero-Lankao, P.; Gnatz, D.M.; Wilhelmi, O.; Hayden, M. Urban Sustainability and Resilience: From Theory to Practice. *Sustainability* **2016**, *8*, 1224. [CrossRef]
36. Metaxas, T.; Psarropoulou, S. Sustainable Development and Resilience: A Combined Analysis of the Cities of Rotterdam and Thessaloniki. *Urban Sci.* **2021**, *5*, 78. [CrossRef]
37. Klepej, D.; Marot, N. Considering urban tourism in strategic spatial planning. *Ann. Tour. Res. Empir. Insights* **2024**, *5*, 100136. [CrossRef]
38. Mandić, A.; Petrić, L.; Pivčević, S. Harmonizing sustainability and resilience in post-crisis cultural tourism: Stakeholder insights from the Split metropolitan area living lab. *Tour. Manag. Perspect.* **2025**, *55*, 101331. [CrossRef]
39. Radulescu, R.; Meleca, A. Tourism Resilience and the EU Regional Economy. In Proceedings of the 18th International RAIS Conference on Social Sciences and Humanities, Princeton, NJ, USA, 17–18 August 2020; pp. 268–276.
40. Yin, Z.-Y.; Huang, A.-M.; Huang, Z.-Y. Virtual tourism attributes in cultural heritage: Benefits and values. *Tour. Manag. Perspect.* **2024**, *53*, 101275. [CrossRef]
41. Hu, Y.; Lang, C.; Corbet, S.; Wang, J. The impact of COVID-19 on the volatility connectedness of the Chinese tourism sector. *Res. Int. Bus. Financ.* **2024**, *68*, 102192. [CrossRef]
42. Stylianou-Lambert, T. Tourists with cameras: Reproducing or Producing? *Ann. Tour. Res.* **2012**, *39*, 1817–1838. [CrossRef]

43. Jacobs, J. Listen with Your Eyes; Towards a Filmic Geography. *Geogr. Compass* **2013**, *7*, 714–728. [CrossRef]
44. Spettu, F.; Achille, C.; Fassi, F. State-of-the-ArtWeb Platforms for the Management and Sharing of Data: Applications, Uses, and Potentialities. *Heritage* **2024**, *7*, 6008–6035. [CrossRef]
45. Wang, X.; Mou, N.; Zhu, S.; Yang, T.; Zhang, X.; Zhang, Y. How to perceive tourism destination image? A visual content analysis based on inbound tourists' photos. *J. Destin. Mark. Manag.* **2024**, *33*, 100923. [CrossRef]
46. Cerić, D.; Więckowski, M.; Timothy, D.J. Visual representation of tourism landscapes: A comparative analysis of DMOs in a cross-border destination. *J. Destin. Mark. Manag.* **2024**, *34*, 100932. [CrossRef]
47. Baka, V. The becoming of user-generated reviews: Looking at the past to understand the future of managing reputation in the travel sector. *Tour. Manag.* **2016**, *53*, 148–162. [CrossRef]
48. Hu, X.; Yang, Y. Determinants of consumers' choices in hotel online searches: A comparison of consideration and booking stages. *Int. J. Hosp. Manag.* **2020**, *86*, 102370. [CrossRef]
49. He, J.; Xu, D.; Chen, T. Travel vlogging practice and its impacts on tourist experiences. *Curr. Issues Tour.* **2022**, *25*, 2518–2533. [CrossRef]
50. Sasithradevi, A.; Nathan, S.; Chanthini, B.; Subbulakshmi, T.; Prakash, P. MonuNet: A high performance deep learning network for Kolkata heritage image classification. *Herit. Sci.* **2024**, *12*, 242. [CrossRef]
51. Kaika, M. Architecture and crisis: Re-inventing the icon, re-imag(in)ing London and re-branding the City. *Trans. Inst. Br.* **2010**, *35*, 453–474. [CrossRef]
52. Ong, J.L.T.; Smith, R.A. Modelling Urban Tourism in Historic Southeast Asian Cities. *Urban Sci.* **2021**, *5*, 38. [CrossRef]
53. Ćamilović, D. The Internet Presence of Belgrade Museums in the Service of Cultural Tourism. In Proceedings of the Fourth International Scientific Conference, Tourism in Function of Development of the Republic of Serbia: Tourism as a Generator of Employment (TISC 2019), Vrnjačka Banja, Serbia, 30 May–1 June 2019; pp. 500–517.
54. Merciu, F.-C.; Petrişor, A.-I.; Merciu, G.-L. Economic Valuation of Cultural Heritage Using the Travel Cost Method: The Historical Centre of the Municipality of Bucharest as a Case Study. *Heritage* **2021**, *4*, 2356–2376. [CrossRef]
55. Bucharest Tourism Board. 16 December 2014. Available online: https://www.trendshrb.ro/evenimente/bucharest-tourism-board/ (accessed on 8 February 2025).
56. Ghira, A. Primăria Bucureștiului Sondează Piața Pentru a Realiza Strategia de Promovare a Turismului în Capitală. 13 April 2022. Available online: https://www.economica.net/strategie-promovare-turism-bucuresti_575649.html?uord=RQ-ZWvb-tTjdRm5hUUkxlrRYLsQvwpdH/r-aRBhVX1MhiGIo9FOqIE2LsdOtLHFImaIWYHh8/DyxKRcUqVE9Z2iqVntiobiCYfMvmcRFOb-8SEuJJPfshzXyRneuUXkxnuNRYvEy (accessed on 8 February 2025).
57. Bucharest City Hall & World Bank Group (February 2022) IUDS (Integrated Urban Development Plan). Available online: https://estibucuresti.pmb.ro/pdf/sidu/en/STRATEGY-DEVELOPMENT.pdf (accessed on 8 February 2025).
58. Ghira, A. Bucureştiul Are Un Nou Site Pentru Promovarea Turistică. Cum Arată Capitala în Mediul Online. 30 January 2016. Available online: https://www.economica.net/bucurestiul-are-un-nou-site-pentru-promovarea-turistica-cum-arata-capitala-in-online_113848.html (accessed on 8 February 2025).
59. Available online: https://www.seebucharest.ro/ (accessed on 8 February 2025).
60. Available online: https://www.b.ro/ (accessed on 8 February 2025).
61. Leelawat, N.; Jariyapongpaiboon, S.; Promjun, A.; Boonyarak, S.; Saengtabtim, K.; Laosunthara, A.; Yudha, A.K.; Tang, J. Twitter data sentiment analysis of tourism in Thailand during the COVID-19 pandemic using machine learning. *Heliyon* **2022**, *8*, e10894. [CrossRef] [PubMed]
62. Luong, T.-B.; Ching-Hua Ho, C.-H. The influence of food vloggers on social media users: A study from Vietnam. *Heliyon* **2023**, *9*, e18259. [CrossRef] [PubMed]
63. Li, G.; Law, R.; Vu, H.Q.; Rong, J.; Zhao, X.R. Identifying emerging hotel preferences using Emerging Pattern Mining technique. *Tour. Manag.* **2015**, *46*, 311–321. [CrossRef]
64. Zhang, S.; Lin, J.; Feng, Z.; Wu, Y.; Zhao, Q.; Liu, S.; Ren, Y.; Li, H. Construction of cultural heritage evaluation system and personalized cultural tourism path decision model: An international historical and cultural city. *J. Urban Manag.* **2023**, *12*, 96–111. [CrossRef]
65. Dumitrache, L.; Nae, M. Romanian Food on an International Plate: Exploring Communication, Recipes, and Virtual Affect in Culinary Blogs. *Berichte Geogr. Landeskd.* **2023**, *96*, 54–72. [CrossRef]
66. Lequeux-Dincă, A.-I.; Preda, M.; Vijulie, I. Authentic Romanian Gastronomy—A Landmark of Bucharest's City Center. *Tour. Hosp.* **2024**, *5*, 251–275. [CrossRef]
67. Hall, D. Rural Tourism Development in Southeastern Europe: Transition and the Search for Sustainability. *Int. J. Tour. Res.* **2004**, *6*, 165–176. [CrossRef]
68. Amato, A.; Andreoli, M.; Rovai, M. Adaptive Reuse of a Historic Building by Introducing New Functions: A Scenario Evaluation Based on Participatory MCA Applied to a Former Carthusian Monastery in Tuscany, Italy. *Sustainability* **2021**, *13*, 2335. [CrossRef]
69. Smith, M.K. *Issues in Cultural Tourism Studies*, 3rd ed.; Routledge: London, UK, 2015; pp. 114–142.

70. Ianos, I.; Cocheci, R.-M.; Petrişor, A.-I. Exploring the Relationship between the Dynamics of the Urban–Rural Interface and Regional Development in a Post-Socialist Transition. *Urban Sci.* **2024**, *8*, 47. [CrossRef]
71. Tan, S.-K.; Tan, S.-H. A creative place-making framework—Story-creation for a sustainable development. *Sustain. Dev.* **2023**, *31*, 3673–3691. [CrossRef]

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