From Dichotomies to Dialogues

Connecting Discourses for a Sustainable Urbanism

Qu, L.; van Dorst, M.J.

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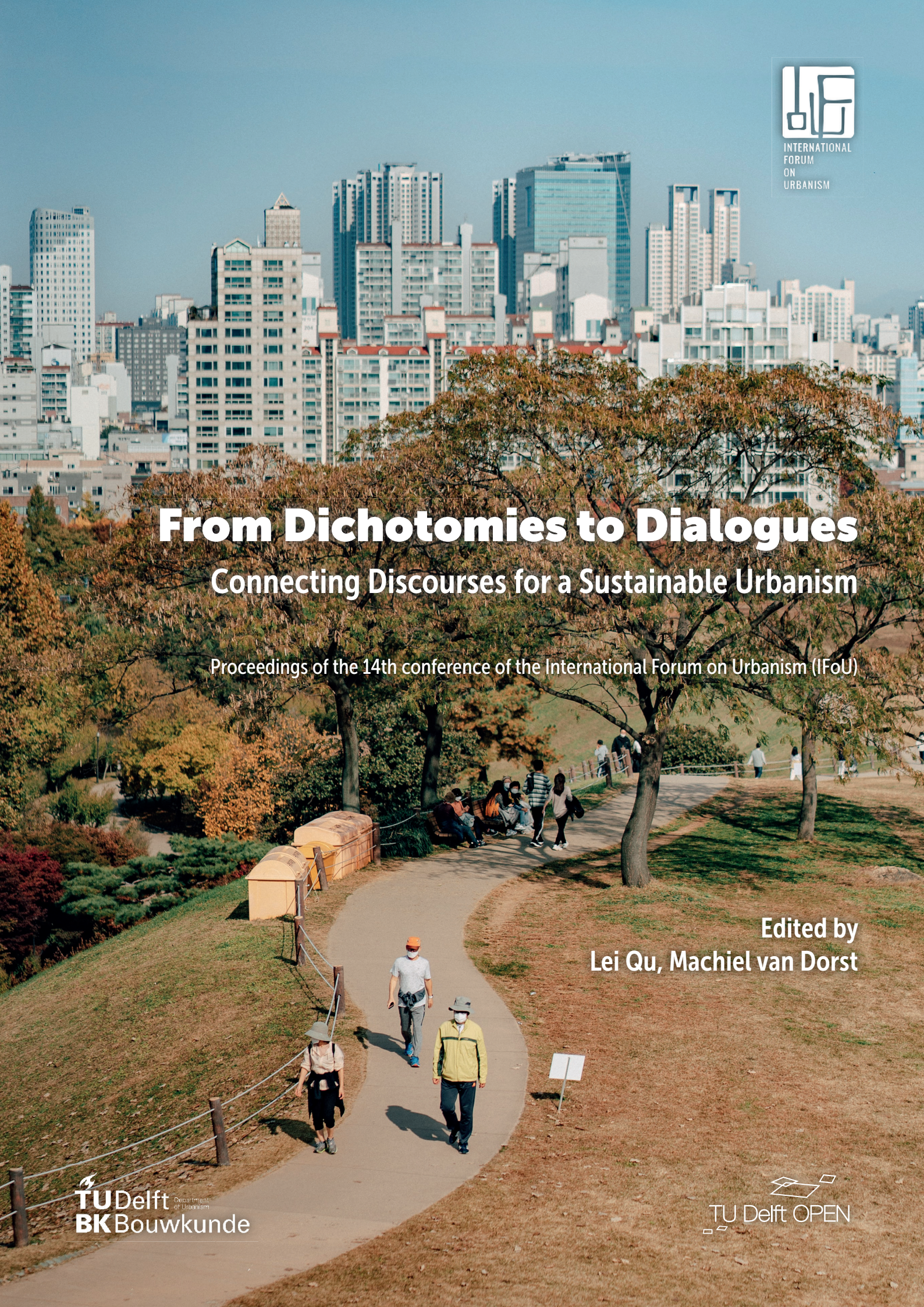

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Proceedings of the 14th conference of the International Forum on Urbanism (IFoU)

Edited by
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TU Delft Department of Urbanism
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INTERNATIONAL FORUM ON URBANISM

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Edited by Lei Qu[1] and Machiel van Dorst[2]

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[1] Dr. Lei Qu, Assistant Professor, Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology

[2] Prof.dr.ir. Machiel van Dorst, Full professor, Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology

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Editorial: Urbanism as a Way of Thinking

Lei Qu and Machiel van Dorst

Introduction

It might not be an issue to convince people that our built environment leads more and more to an imbalance between humankind and nature. However, it is hard to reach a consensus that the cause here is the growing complexity of human societies, and the built environment is just the manifestation of such complexity. Handling this complexity is a primary objective of urbanism, which also explains why urbanism is not a discipline, but a field where many disciplines come together. In their daily work, urbanists may deal with different subsystems of cities (such as the traffic systems, spatial economics, and water networks), urban issues (such as spatial justice, inclusiveness, health, and safety), or areas (such as the desakota, port areas, and downgraded neighbourhoods), which lead to a different emphasis within various discourses. As many perspectives exist in urbanism that are reflected in studies and practices by scholars, practitioners, and policymakers, as well as people's daily experiences, conflicts in interests and value systems persist, which call for dialogues on dichotomies within or between discourses.

Currently, a common circumscription of urbanism seems to take shape, which involves understanding the spatial organisation and dynamics of the built environment, and inventing new ways to maintain spatial quality and equality. Thus, urbanists design, plan, and engineer interventions in the built environment. What urbanists do may be evident, but societal goals and approaches may be diverse due to the cultural context or the used disciplines. For example, the world is not yet on the same page about the meaning of 'resilient and sustainable urbanism' and ways to approach it. Here, we find one of the most important reasons for having an open and ongoing debate on urbanism. The existing dichotomies within or between discourses need to be bridged as all urbanists face a complexity of invocations today. The challenges cities and regions face now and in the future are enormous and uncertain, to be determined or affected by unexpected extreme events like pandemics, economic crises, and climate change.

So, it is urgently needed to get beyond the dichotomies in urbanism, and, by default, urbanism should have the nature to combine these perspectives. To move forward, people involved in urbanism should be aware of each other's knowledge, qualifications, and worldviews, taking any opportunity to transcend and connect different discourses to invent better ways of achieving resilience and sustainability. With the ambition to create such opportunities, the 14th conference of the International Forum on Urbanism (IFoU) in 2021 called for papers to contribute to dialogues in five tracks that represent five types of debates over a set of dichotomies.

1. "Urban-rural Integration" and "Areas In-Between"
2. The City is an Object and a City is in Transition
3. Political Ecology and Adaptive and Transformative Framework
4. Metropolization and the Right to the City
5. Human-centred and Nature-based Approaches in Cities

These dichotomies are illustrations of tensions between prevailing discourses in urban research and give insights into what dialogues need to be built for planning and designing sustainable cities. We chose topics that include a variety of expertise in urbanism, namely spatial planning, urban governance, urban design, landscape architecture, environmental technology, and urban studies. Besides, we expect participants who join these debates to address socio-economic and environmental sustainability, including the adaptability of cities and regions to future challenges. Integrated approaches that bring science, technology, and design together are appreciated. Planning perspectives through transition management is also encouraged.

After the call for abstracts, the 14th IFoU conference successfully attracted many contributions. Papers included in this conference proceedings are published as open-access conference papers by The Evolving Scholar (ThEs) in collaboration with TU Delft OPEN, involving an open peer-review process. These include full papers (3,500 words) or short papers (2,000 words). Readers can download all published papers from the Orvium platform, as well as the draft papers that are not included in this conference proceedings but presented at the conference:
https://dapp.orvium.io/communities/613ef9d5c8b4c84c09c292bf/view

The expected dialogues

We drafted the call for papers with thoughts and expectations on the types of dialogues that are going to happen in the five tracks:

"Urban-rural Integration" is an emerging discourse often seen in recent literature about spatial development in China, derived from a national policy for more coordinated spatial development (Yang et al., 2021), particularly with the aim of rural revitalisation (Chen et al., 2021). While the narrative emphasizes integration, it reflects the rooted dichotomy between urban and rural prototypes. In contrast, "Areas In-Between" emphasizes the networks within the territory (Wandl et al., 2017), focusing on areas beyond the old city-hinterland relation. The dialogue could contribute to a multifaceted understanding of the ongoing spatial development trends in those areas outside the city cores.

The ways we plan and design cities cause short- and long-term socio-spatial consequences. Therefore, the urban form is not the only object planners and designers should deal with, but also processes happening within the built environment (Carmona, 2021). In contrast, spatial interventions need to land in cities in specific forms. The dialogue between "the city is an object" and "a city is in transition" would contribute to the understanding of cities as complex systems and transformation processes that are involved. It would lead to discussions on spatial quality and point to new ways of planning and design at the local scale.

While addressing environmental issues such as flooding, different governance approaches exist. "Political ecology" provides insights into power relations in environmental conflicts through the lens of political economy (Turner, 2016). In climate change, the scale and magnitude of challenges require cities and regions to tackle the uncertainty ahead, which calls for an "adaptive and transformative framework" (Inderberg et al., 2015). The dialogue between these two discourses is essential for deepening the understanding of the environmental issues, the dilemmas between local conditions and global challenges, and creating common ground for innovative solutions.

There has been a long-standing debate between discourses on "Metropolisation"- the growth of cities driven by economic development, and "the Right to the City" (Harvey, 2003) - the right of people to create and maintain their qualities of lives in cities, such as the sense of community and place identities. In the past, such debates often were centred around the rights of people. This track expects that a planning perspective is adopted, using spatial justice as the lens when introducing study cases and formulating narratives. Hopefully, the dialogue leads to a better understanding of planning for just transitions.

As the awareness of social and environmental sustainability is rising, there appear approaches to planning and design for cities framed as "human-centred" or "nature-based" (Seddon et al., 2020). These discourses are integral parts of future-proof scenarios for cities, not narratives to defend social or environmental values separately. In both research and practice, we see more and more integrated approaches trying to enhance the natural environment in cities while improving the livability of the cities and the well-being of people. This track expects dialogues to enhance such integrated solutions.

Results of the papers

This post-conference publication presents different aspects of – and approaches to - Urbanism. The papers in the proceedings respond to the call very well, contribute to the dialogues through numerous case studies, and offer innovative analytical methods, empirical evidence, and alternative scenarios.

For example, Track 1, "Urban-rural Integration and Areas In-Between," has two papers from a research team on 'The Java Model': The one written by Yeeun Boo and Neville Mars focuses on "Unlocking Heterogeneous Rural Landscapes through Cluster-based Land Use Analysis." It distils meso-level land-use patterns, which create opportunities to plan across boundaries and mediate between macro and micro-scale objectives. The other paper by Neville Mars and Fabien Pfaender introduces "A Time-weighted Network Analysis of the Desakota"- combining distance and travel speeds to develop a network model of the desakotas. These innovative data-driven analytical methods have shown a potential to support multi and inter-scalar design proposals that embrace the intrinsic spatial relation of the Desakotas while planning for industrial development. Besides, they contribute to the outcome of the expected dialogues in track 1- coordinated regional development without urban-rural dichotomy.

Another example is a paper from Track 4, "Metropolisation and the Right to the City," authored by M. Cecilia Marengo, "Residential Production and Spatial Inequalities, a Territorial Analysis from the 'Right to the City': The Case of Córdoba Periphery." It presents an original analysis of urban form, which demonstrates the issue of the formation of isolated housing areas in the Cordoba periphery, where land value and accessibility to facilities are lower

than in the city centre. The author explained how housing policy generated conditions to produce such new territories and how these areas have evolved through time and influenced the urban structure and the inhabitants' quality of life. The paper contributes to the dialogues of the track through an evidence-based approach.

A third example is the paper "Deurbanized Cities as Strongly Sustainable Human Settlements" from Track 5, "Human-centred and nature-based approaches in cities," co-authored by Joshua Hurtado Hurtado, Marzia Sangio, Andrés Fernández and Arta Bytyqi. This paper puts forward a radical alternative to current practices based on long-existed concepts of sustainable development, which triggered a productive debate during the conference. It promotes agroecological communities in urban areas, with a convincing argument and choice of strategic spaces – food forests, border zones, and sacred sites. Such an alternative scenario contributes to more integrated approaches, contrasting to a black/white or good/bad position on the future of urban development.

Concluding remarks

Urbanism is a way of thinking and acting needed for sustainable development; urbanists are becoming inter- and transdisciplinary, bringing science, technology, and design into their field. As the world is in a cascading of crises related to, e.g. health, energy, food, and water; as well as issues of, e.g. traffic, housing, and services, integrated approaches become increasingly relevant as most of these challenges are related to each other. Having a holistic urbanism viewpoint is the path to resilience and sustainability. Here, we are not referring to a longer list of notions, but particularly encouraging dialogues between (possibly perceived) conflicting discourses. It is not an easy task and requires everyone to step out of their comfort zone. This conference and its publication are a stepping stone towards a new culture of working together. This cultural change is needed to face the complexity of cascading crises we see today.

Acknowledgements

As the two editors-in-chief, we would like to first thank all the authors for their hard work in writing and revising the papers based on comments from reviewers and editors. Furthermore, the excellent contributions from all track editors are wholeheartedly appreciated. Besides, thanks go to the invited reviewers for their valuable comments and the copyeditor for English editing. The conference proceedings wouldn't have succeeded without the support from our publisher TU Delft OPEN and the Orvium platform. Last but not least, we would like to thank our colleagues from IFoU for their support of the conference, especially Vivienne Wang, Ye Zhang, and Diego Sepulveda.

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Track 1

Urban-rural Integration & Areas in-between

Track editors:

Dr. Alexander Wandl
Dr. Rodrigo Ordonhas Viseu Cardoso

Areas in-between are stepping out of the shadow of large metropolises. There is a growing attention to the liveability and opportunities provided by the networks of towns and small cities that constitute the 'countryside'. But although a dichotomous view of urban versus rural has been mostly overcome in recent decades, many still understand the countryside only in a city-hinterland relation, ignoring the spatial, functional, symbolic and political features of these areas in-between. The major future challenges, like climate adaptation, energy transition, reversing biodiversity loss, the shift towards circularity, housing the growing (and ageing) population, all add to the development pressure on these areas. Therefore, this dialogue will be on integrating the urban and the rural beyond utopian dichotomies and envisioning future resilient areas in-between.

Type of the paper: Peer-reviewed Conference Paper / Full Paper

The Sub-Urbanisation of New Towns: The Influence of Job-Housing Imbalance on Low-Income Groups' Job Opportunities in Tin Shui Wai, Hong Kong

Shuiyang LIN [1,*], Nai Huei Casey WANG [2] and Jeroen VAN AMEIJDE [3]

1 School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; 626050455@qq.com
2 School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; casey_wang@blend-arch.com
3 School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305
* Corresponding author

Abstract: The rapid suburbanisation of Hong Kong has been driven by the government's public housing-led planning of new towns, and the interaction between transport systems and land use. Several new towns scattered around the territory have not been able to achieve self-sufficiency, which has led to the separation of job-housing spaces, resulting in a reduced quality of life, a lack of vibrancy, and social mobility. Tin Shui Wai has attracted special attention for its social problems and mental health issues, related to urban planning. Literature and official reports indicate that the inability of new towns to be self-sufficient, and the spatial mismatch between housing and employment are the main reasons for the economic and social problems faced by residents in the area. This study analyses the relationships between the jobs-housing imbalance, employment opportunities, and low-income groups. It uses newly collected planning data to identify root causes for the lack of employment and community vibrancy for low-income groups in Tin Shui Wai, to propose recommendations for interventions in the urban fabric to promote social mobility and neighbourhood vitality. The study provides a new perspective for planning and designing community facilities, street-based retail, and active public spaces within the urban structures of Hong Kong's New Towns.

Keywords: Job-housing imbalance, Sub-urbanization, Low-income groups, New Towns, Hong Kong

Names of the track editors:
Alexander Wandl
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1. Introduction

The development of cities worldwide shows a similar pattern of transformation towards multiple sub-centres, decentralised manufacturing, and employment in service industries. Suburbanisation leads to imbalance between work and housing. As a result of the migration of employment opportunities and housing, people in need of low-cost housing are often isolated from their workplaces (Gobillon et al., 2007).

Hong Kong's first New Towns were constructed in the 1960s and 70s in response to the city's rapid economic growth and population influx. They were also conceived as a necessary means and strategy to solve urban social problems. Initially, many new towns

were successful in decentralising Hong Kong's urban structure, accommodating factory workers near existing and new industrial sites through large proportions of public housing. In the 1980s, as manufacturing moved to Shenzhen, Hong Kong's economy transformed to an economic system dominated by high-tech industry and high value-added services. As these businesses are mainly concentrated in urban areas, much of the investments in improvement of urban environment and infrastructure construction were focused on the central urban areas, leaving the new towns behind in development (Hu, 2009).

Although the development of new towns has effectively alleviated population expansion in central urban areas caused by rapid economic growth, the lack of employment opportunities in new towns has often given rise to commuter cities, resulting in the separation of jobs and housing, and associated problems. Generally speaking, commuter towns can be understood as cities with jobs-housing imbalance, which mainly supply housing and are relatively lacking in industries and jobs (Capitanio, 2018).

Job-housing imbalance has become a key urban issue around the world, especially in large cities, where job-housing imbalance often leads to an increase in commuting distance and time, a decline in residents' quality of life, increased income inequality, traffic congestion, air pollution, and reduced upward mobility (Cervero & Day, 2008; Ewing et al., 2016; Gobillon et al., 2007). If a sufficient number and diversity of jobs are available in a new town, residents will be more willing to work locally. Strategically providing adequate community facilities and jobs to meet the daily needs of residents can help mitigate job-housing separation and achieve a balanced community (Nakamura & Avner, 2021). Therefore, in new towns that experience suburbanisation, it is essential to study how local enterprises can create different employment opportunities, alleviate the problem of jobs-housing imbalance, and improve the quality of living for local residents.

Hong Kong has a series of commuter towns, similar to other large metropolitan areas across the world. The population of the new towns reached 3.44 million in 2016, accounting for 46.9% of the total population in Hong Kong (Census and Statistics Department, 2016). Most of these residents came from low-income families (Census and Statistics Department, 2016). As of 2016, 43.6 per cent of the working population living in the new towns were employed in other new towns. For example, Tin Shui Wai residents now commute to nearby Tuen Mun for employment opportunities (Census and Statistics Department, 2016).

The problem of poverty and unemployment in Tin Shui Wai New Town has come to the public's attention. Literature and official reports indicate that the inability of new towns to be self-sufficient and the spatial mismatch between housing and employment are the main reasons for the social problems faced by employed residents in the area (Chan,2009; Law et al., 2009). However, as employment opportunities have shifted from urban areas to sub-centres in the New Territories, the long journey for Tin Shui Wai residents to work is not the only obstacle to employment opportunities. In the process of suburbanisation, the lack of local employment opportunities has affected the employment channels of low-income employed residents in Tin Shui Wai (Chan, 2007; Social Welfare Department, 2004; Tong & Wong, 2007; Transport Department, 1999).

Therefore, the main objectives of this study are to explore the impact of employment creation by local enterprises on the improvement of the jobs-housing imbalance, explore which types of employment are more successful in the development of new towns in Hong Kong, and how they can be distributed to promote the overall ecosystem and vibrancy of the local economy.

This structure of this paper follows five stages of research. First, we summarise the impact of jobs-housing imbalance on the life of low-income residents from the academic literature. Second, we explore the relationship between job creation and remediation of the jobs-housing imbalance. Third, we study the evaluation indicators of the impact of local employment opportunities on improving the jobs-housing balance in Tin Shui Wai, the jobs-housing ratio, and the preferences and employment characteristics of low-income groups. Fourth, several case studies for creating employment conditions for low-income people and for promoting local economies are reviewed. Lastly, the insights from the previous stages are synthesized and applied to the new town planning policy in Tin Shui Wai, to implement specific strategies for the creation of local employment and increased community vibrancy.

2. Theoretical Perspectives on Job-housing Balance

The rapid expansion and renewal of cities, together with the drastic changes in urban industry and land use structures, have resulted in the widespread trend of long-distance commuting and the spatial mismatch of residences and employment in urban areas worldwide (Arthson & Jacobs, 2004). Against the background this increasing spatial differentiation directed by capital driven processes, the imbalance of jobs and housing spaces is considered one of the main reasons for increased unemployment amongst low-income people with low mobility (Weitz, 2007). These "social islands," where low-income groups are concentrated include suburbanised new towns, declining senior communities, slums on the edge of cities, and other low-income housing communities at separated or remote locations.

Employment opportunities refer to the ability of workers to overcome socioeconomic and geographical barriers and seize employment opportunities (Cervero, 1996). The suburbanisation of new towns leads to a reduction of employment opportunities in two ways: the long commuting distance makes potential jobs inaccessible and unaffordable, and the lack of local employment opportunities further isolates residents. As a result, the population in the new towns have less disposable income to spend locally, which results in the decline of the local economy, which lead to the further concentration of poverty.

To understand local employment opportunities, a variety of quantitative indicators can be measured such as the jobs-housing ratio, the job-residence-housing ratio, the local labour force ratio, the employment-population ratio, and the job-residential labour force ratio. However, the jobs-housing ratio (JHR) is the most widely used measure. Cervero originally proposed the concept of JHR, referring to the ratio of employment positions to resident population in a region. The calculation formula is:

Jobs-housing ratio (JHR) = Employment positions/Employed population.

Among them, "Employment Positions" refers to the amount of labour that can be accommodated in different industrial buildings; "Employable Population" refers to the current or planned number of workers in a region (Cervero, 1989). If this ratio is between 0.8 and 1.2, it is considered that the jobs-housing relationship in the area is balanced (Cervero, 1989, 1991). There is an assumption that only one person in each family works.

As a result, changing urban function mixes by creating a diversity of local employment options and improving job opportunities has become an essential topic of discussion on work-housing balance and one of the necessary principles for achieving sustainable urban development.

3. Precedent Studies

Vallingby, Stockholm

The planning of Stockholm's new towns began in 1945. At the very beginning, the concept of "ABC Town" was put forward, that is, to build a new city with employment, housing and a centre. The construction of the new towns was guided by Sven Markelius's "half and half" principle, in which half the working inhabitants would commute out of the city to nearby new towns and half the labour force would be drawn in from other nearby new towns. Vallingby is a typical example of this planning principle.

The new town of Vallingby, built between 1950 and 1954, was the first new town built in Stockholm after World War II. It covers an area of 170 hectares and is built on a hill. It is located 13 km west of the city centre and is connected to the city centre by metro. The designers had two expectations: first, the new town would increase local employment and reduce cross-regional traffic through a reasonable distribution of employment and housing space and become a self-balanced community. Second, the new city should have a convenient public transportation system to link with the central urban area (Xiao, 2005).

When Vallingby New Town was planned, its central services district was built around a metro station, surrounded by residential buildings. The centre has about 125 commercial retail outlets, 7,000 square meters of community service space, more than 30 restaurants and entertainment venues, dozens of retail providers, and more than 10,000 square meters of office space. The planning of these commercial facilities has attracted a large number of people to the new town, enhancing the vitality of the community and providing a balance between employment opportunities and housing (Figure 1).

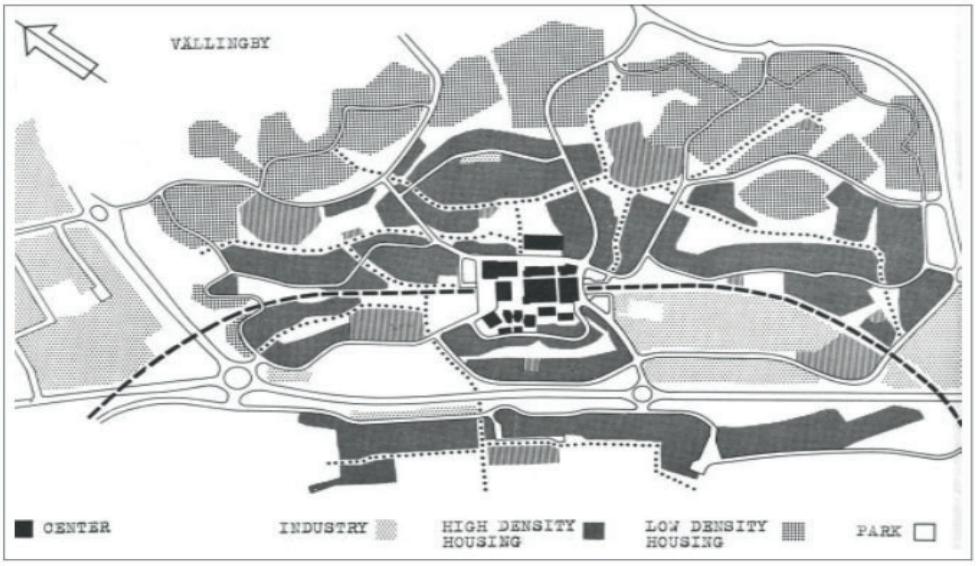

Figure 1. Distribution of housing and industry in Vallingby. Source: http://81.47.175.201/livingrail/index.php?option=com_content&view=article&id=746:2014-03-26-15-41-05&catid=28:urbandevelop%02ments&Itemid=103

Saint-Quentin-en-Yvelines

Saint-Quentin-en-Yvelines is a New Town located about 30 kilometres west of Paris. In 1968, when the first developers of began to develop the new city, the area was almost entirely composed of small towns and villages with a rural character and mature agriculture. The main objective of the new town was to even out the population across the Paris metropolitan region. Its urban planning was balanced and provided for residential areas, commercial functions, amenities, and services (Voldman, 1990).

The initial master plan for the new town created a specific system of public roads and residential areas with extensive facilities to provide a new "way of life" (Ostrowetsky, 1983), which translated into abundant green spaces, leisure activity, and community spaces. The town was structured as a group of separate 'urban units,' connected to a central urban hub. Each of the urban units were designed to unite several residential areas around a small subcentre. Each urban unit is designed to achieve a degree of self-sufficiency, through accommodating local shops, schools, and sporting facilities (Schäbitz, 2020). The spacious and attractive environmental qualities, affordable housing, and high levels of services have resulted in a large number of companies to establish themselves in Saint-Quentin-en-Yvelines, promoting an effective balance between local economic activity, employment, and housing.

In 2018, the town initiated a process of renewal, as it was found that the sense of isolation and lack of cultural vibrancy reduced its attraction to younger and higher educated professionals. Its comprehensive development plan revolves around "sustainable innovation, the ecological and environmental transition, and economic development" (Gardrat and Theulé, 2020, p.122).

Bristol Pound, Bristol

Bristol, which positions itself as one of the most sustainable cities in England, has implemented an alternative currency system designed to support the local economy and promote employment opportunities for businesses and residents of different social classes in the area (Bristol Pound, 2015). The idea for the 'Bristol Pound' arose during the 2008–2012 economic crisis, when banks and money came to be seen as "unforgiving systems." Analysis had shown how 80% of the money spent in large multinational stores was flowing out of the area, causing a drain on the local economy. This inspired the movement to develop a solid local monetary system (Dietz and O'Neill, 2013).

The Bristol Pound aimed to bring residents and local businesses together, creating a mutually supportive local trade network (LM3 Online, 2017). This local network supported for instance to allows restaurants to buy organic food produced by local farmers and

attract and retain local residents as customers. The Bristol pound was approved by the local city council, and local companies were able to pay tax in the currency. By 2015, one million Bristol Pounds had been issued in local currency, of which about £700,000 has been in active circulation, facilitating 5 million pounds in sales (Bristol Pound, 2015). While the use of the Bristol Pound has declined over time, the currency was converted to an electronic payment system with the original aims of supporting local economic sustainability and social justice.

Summarising these three case studies, it can be seen how Vallingby, a New Town near Stockholm, emphasizes that a mixed urban land use structure and a large and vibrant urban centre are conducive to promoting the spatial matching of housing and employment opportunities. Saint-Quentin-en-Yvelines near Paris focuses on improving quality of life through self-contained urban units with housing, shopping and offices, attracting local enterprises and large companies and achieving a win-win situation. The 'Bristol Pound' in the UK showcases how local community vibrancy and quality employment options can be stimulated by promoting resident to support and take part in the local economy.

Each of the case studies represents planning and management strategies that create employment conditions for residents and balance jobs and housing. Hong Kong has similar New Town urban planning principles to Vallingby and Saint-Quentin-en-Yvelines, yet is lacking similar initiatives to promote local economic and community development.

4. Case Study Analysis: Tin Shui Wai, Hong Kong

4.1 Demographics and local economy

The development of Tin Shui Wai was primarily driven by a massive demand for affordable housing. This, combined with the housing policy changes at the time, resulted in a community dominated by low-income families. The conversion of 13,200 flats for sale to rental use in the Tin Shui Wai New Town between 1998 and 2001, the cessation of the production and sale of HOS flats in 2003, and the termination of the Private Sector Participation Scheme (PSPS) have radically changed the community structure of Tin Shui Wai.

Statistics show that a typical family in Tin Shui Wai is a family of three with a monthly household income of about HK $14,000. In terms of education and workforce, they are likely to reach a maximum education level of middle school or high school equivalent. They are more likely to be employees in lower-end jobs who commute to Yuen Long or Tuen Mun for work (Law et al., 2009). Among them, the concentration of low-income people is more intensive in Tin Shui Wai North and Tin Shui Wai South (Figure 2). Statistics show that in 2016, 46% of residents in Yuet Yan Estate in Tin Shui Wai North earned less than two-thirds of the average monthly income in Hong Kong. In addition, over 41% of the residents living in Tin Yau Estate in Tin Shui Wai South are low-income workers (Census and Statistics Department, 2016).

The low purchasing power of low-income people leads to low spending in commercial and retail businesses and local economic vitality. The lack of dynamism in the local economy means limited competition, and a small number of large retail operators have created a partial monopoly, which has led to higher prices. Surveys amongst residents have shown that they prefer to go food shopping in neighbouring areas such as Yuen Long city centre, and they blame the price increase on the monopoly control of retail outlets in Tin Shui Wai's malls. Residents also believe that the monopolies have resulted in a limitation of the types of food available and, in some cases, that the quality of fresh food has been affected (Law et al., 2009).

The relatively high cost of daily expenses in Tin Shui Wai, including high travel and consumer goods costs, is complemented by a lack of economic dynamism (Law et al.,2009), the proper functioning of markets and adjustment of supply to demand. Instead of lowering prices, the large-scale retail malls and lack of local shops have resulted in price increases, which has further affected the local population's purchasing power. The resulting reduction in local economic vibrancy exacerbates the lack of employment

opportunities in Tin Shui Wai (Law et al.,2009). The lack of a significant local market mechanism is a critical factor in the town's limited employment situation.

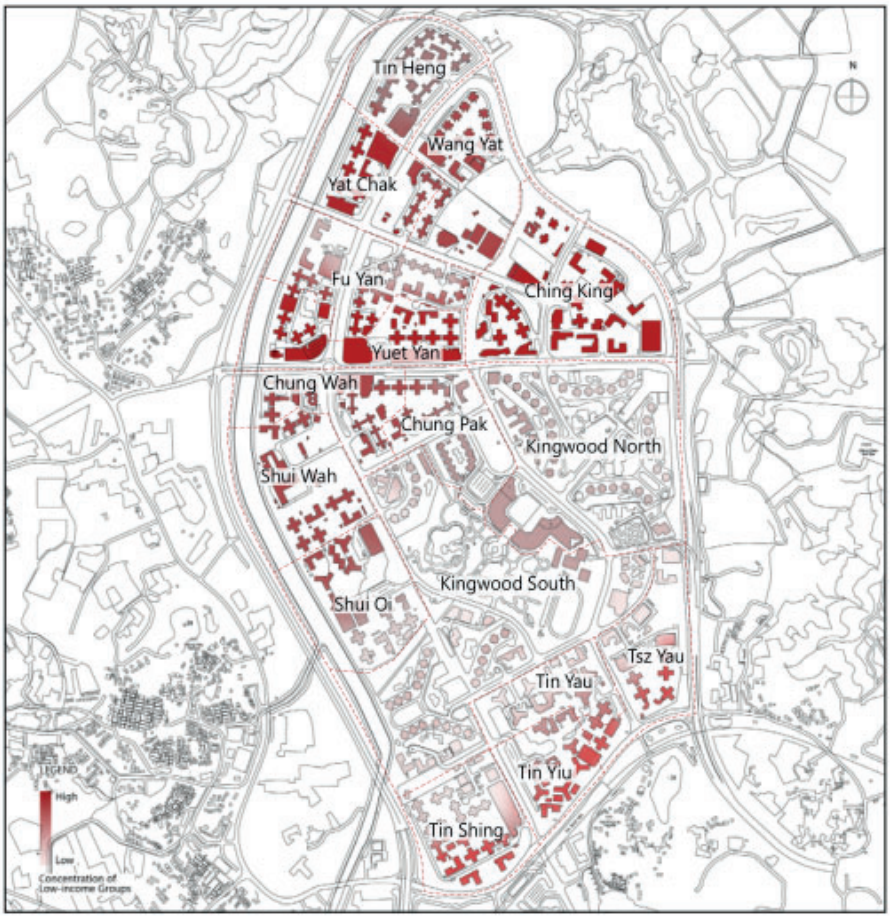

Figure 2. Distribution of low-income population (Source: Author).

4.2 Local employment and housing

As there is a mismatch between employment and housing locations for Tin Shui Wai residents, many of them have to travel to work by public transport. Surveys revealed that high transportation costs and long travel times were the main barriers to taking up jobs at distant locations (Law et al., 2009). Although the MTR Corporation, who operates the commuter rail line that connects Tin Shui Wai to other areas of Hong Kong, offers a discount on monthly tickets, people spend significant amounts of extra time changing to other forms of local transportation.

Figure 3 visualises the spatial distribution of employment and housing in Tin Shui Wai. It can be seen that the employment distribution tends to cluster around communities, commercial centres at all levels and public space areas. As most of the jobs in Tin Shui Wai are in the retail and construction industries, the working community in Tin Shui Wai is highly dependent on these sectors, not only in terms of spatial distribution but also on the employability of the majority of the population in Tin Shui Wai.

Figure 4 shows how the employment/housing ratio in most Tin Shui Wai districts is unbalanced, especially in the Tin Shui Wai Southern District. Yat Chai, a community on the north side of Tin Shui Wai, has a relatively balanced jobs-housing ratio. Most of the jobs in this area are in shopping malls and medical facilities.

Faced with accessibility barriers such as spatial mismatch, job-housing imbalance and inadequate public transport services, long-term unemployment among low-income workers in Tin Shui Wai has gradually developed into a self-perpetuating vicious cycle. A large proportion of residents become or remain unemployed and use welfare services. In 2007, the number of CSSA (welfare) recipients in Yuen Long and Tin Shui Wai accounted

for 13% of the total number of unemployed households, ranking first among the 18 districts in Hong Kong (Social Welfare Department, 2009).

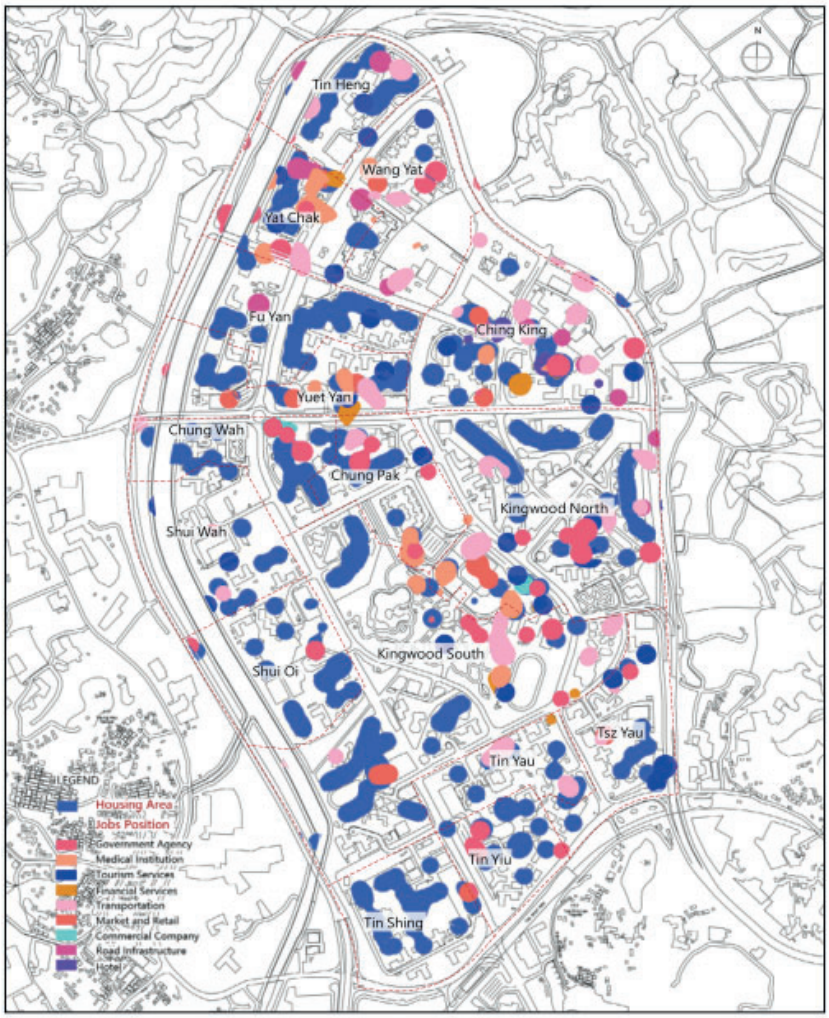

Figure 3. Jobs and housing space distribution (Source: Author)

4.3 Streets and public spaces devoid of life

The original idea for Tin Shui Wai was to create a relatively independent community consisting of self-contained estates, without a singular town centre. Although there are large parks, open spaces, and sports facilities, there are few street-level shops in Tin Shui Wai, resulting in a lack of opportunities for occasional social interaction among residents. While locally owned shops could create employment conditions for residents and promote local economic development, they also form an important part of the daily social rituals that promote mental health and well-being for vulnerable residents (Brian et al., 2014).

With its wide carriageways and lack of retail and pedestrian activity on the sidewalks, Tin Shui Wai gives the impression of being 'empty,' especially in the northern area. The modular design of Tin Shui Wai North creates more inward-looking blocks, due to the self-contained and non-contextual design of the housing estates. A large number of main roads also creates barriers, limiting the walkability of the areas and further isolating the estates from each other. Coupled with a light rail system designed on separate, fenced off rail lines, Tin Shui Wai's overall street layout has caused local division and impedes social interaction.

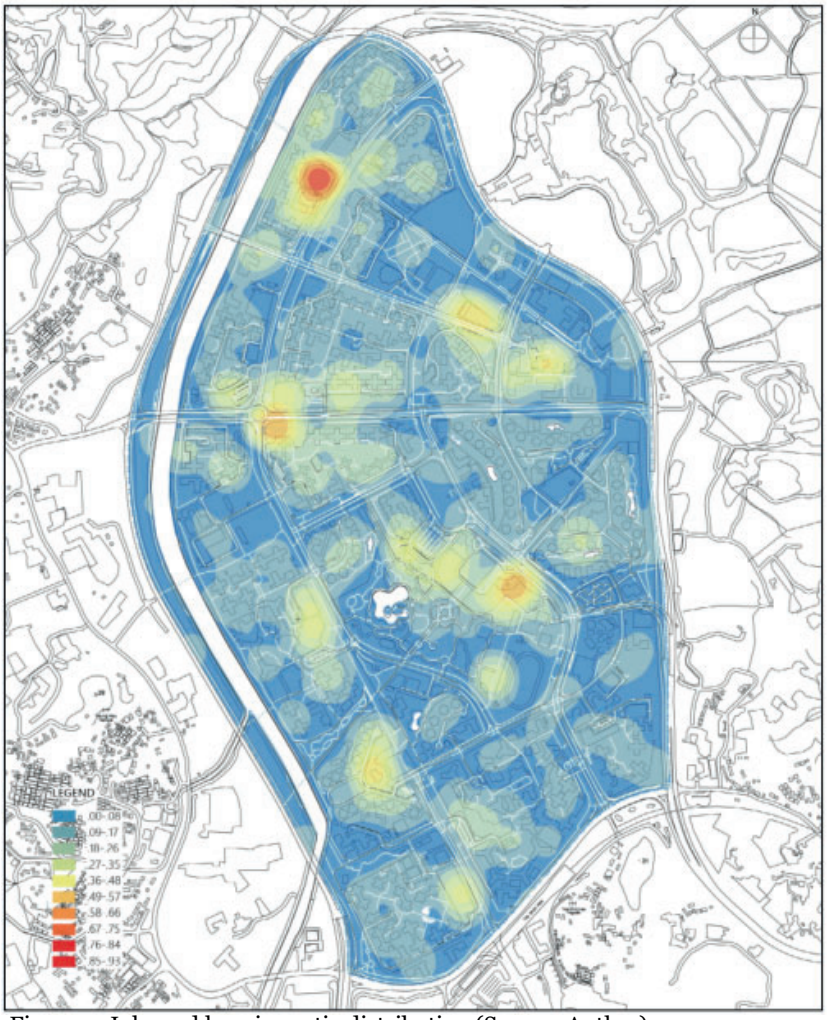

Figure 4. Jobs and housing ratio distribution (Source: Author).

A focus group interview with Tin Shui Wai residents showed that most did not have a clear opinion on whether they preferred high street stores or indoor shopping centres. Although residents do not seem to have a particular preference for the location of shops, they did regard Tin Shui Wai as a purely residential area with not much opportunity for community interaction (Law et al.,2009).

5. Discussion

This paper has outlined some of the key issues relating to the lack of employment opportunities of low-income workers in Tin Shui Wai, covering its locational aspects, urban planning, and economic and community dynamics relating to its urban layout and public spaces. In the next sections, we discuss each of these underlying causes that have led to the suburbanisation and jobs-housing imbalance in this new town, and suggest strategies for improvement of these conditions.

Local mobility and local businesses

Firstly, although large amounts of money have been invested in West Rail and Light Rail projects to shorten the commuting times to places of work (Transport Department, 1999), studies have shown that many residents still encounter significant difficulties in obtaining employment opportunities. Therefore, consideration should be given to shifting the focus from improving travel time for work travel to improving the affordability of travel, and to the creation of jobs closer to the residential locations (Metz, 2008). Other forms of transport could be supported to improve mobility, such as new types of cycling and ride-sharing services.

To address the severe mismatch between jobs and housing in Tin Shui Wai, there are several strategies that can be envisioned to help solve this problem. Government bodies can be mobilised to provide financial assistance and land space for unemployed workers in Tin Shui Wai to develop social enterprises and create local employment. For example, large community food courts with public spaces could be developed through NGOs to sell different kinds of local cuisine, increasing the interaction between neighbours, and creating more job opportunities in line with the skills and preference of local residents.

In addition, with the rapid development of e-commerce platforms, a model of integrated employment and housing can be implemented to improve socio-economic conditions and urban spaces comprehensively. For example, takeaway restaurants can be located in residential areas and rely on a critical mass of people who work or live nearby; fashion design studios can be allowed to operate in empty warehouses, promoting their brands to a global market online. In both cases, local small businesses are free to choose a location with affordable space, supported by new technologies to organise supply and delivery chains. The types of transformation would require redevelopment by investors and neighbourhoods in a self-organising manner, using flexibility in planning regulation and subsidies if necessary. Industry and urban spaces could come together to help transform neighbourhoods and enhance the urban vitality of communities.

Strategic regional collaborations

Secondly, Tin Shui Wai could take advantage of its geographical location close to Shenzhen. Increased interaction and opening up of the border crossing close to the town could create additional employment opportunities. A main highway connecting Hong Kong and Shenzhen via Shenzhen Bay Bridge is currently passing by Tin Shui Wai. Extension of the road network and public transport connections could help bring tourists from Shenzhen to Tin Shui Wai, in tandem with the creation of shopping, dining or other tourist attractions, which would in turn create new jobs. The planned New Development Area of Hung Shui Kiu, directly west of Tin Shui Wai, offers key opportunities to increase the economic platform to support local investment in attractions and infrastructure for tourism and local businesses, which could focus on the industries and lifestyle interests of the rapidly developing economy of Shenzhen.

Balancing the population

Learning from the planning principles of Vallingby, Saint-Quentin-en-Yvelines, and other precedents, policies could be formulated to gradually increase the proportion of higher-income families in the Tin Shui Wai and Hung Shui Kiu new towns, to make the composition of the community more diverse and increase local spending power. An appropriate ratio of private housing should be provided in Hung Shui Kiu, coupled with high liveability, facilities, and services that can attract middle-income families to settle there. The urban design of the New Development Area can take advantage of the locational advantages such as access to country parks, seaside recreation, and other aspects contributing to a healthy living environment. This form of social planning will help balance Tin Shui Wai's demographic structure and can attract businesses to invest in the area, which will have a positive impact on the provision of employment opportunities and the stimulation of local consumption.

If the local economy of Tin Shui Wai can be transformed towards diversified retail, street facing commercial and cultural functions and vibrant public spaces, the self-reinforcing effects of a truly self-sufficient community could be established (Jacobs, 1961). When shopping centres are complemented by markets and street-facing shops, the increased variety of facilities would provide residents with a wider range of lifestyle choices. The additional locations of commercial facilities and their adjoining public spaces help facilitate communication between residents and promote community development.

6. Conclusions

The lack of economic and social opportunities faced by low-income residents in Tin Shui Wai due to the lack of local employment opportunities shares similarities with segregated neighbourhoods and suburban districts around the world. In many of these locations, social conditions have been gradually improved through the increase in dynamism in the local economies, through socioeconomic or urban structural means, thereby increasing employment opportunities for their residents.

Research has revealed that Tin Shui Wai is experienced as an isolated new town. Low-income residents experience accessibility issues to employment opportunities arising from the time and cost associated with reaching work at great travel distances, and due to the lack of local work. When residents originally moved to the area, they were disconnected from mainstream society and from the social networks of the areas where they came from. The urban planning and public spaces of Tin Shui Wai are not conducive to forming new social networks that stimulate social mobility, as the self-contained estates are isolated from each other, and monopolised retail centres fail to facilitate a sense of community or promote societal integration.

In recent years, with the adjustment of Hong Kong's economic and spatial structure, Hong Kong's economy has shifted from manufacturing exports to producer and financial services (Tao and Wong, 2002). Due to the nature of the land use, low-skilled or otherwise less employable people are more likely to live in areas with fewer employment opportunities (Houston, 2005). Although Hong Kong's new town planning principles are similar to those of Vallingby and Saint-Quentin-en-Yvelines in terms of employment targets, Tin Shui Wai, for example, should give greater consideration to the social complexity caused by concentrated poverty and the social characteristics of low-skilled workers. In addition, due to the shortage of land in Hong Kong Island and Kowloon, and the complex land ownership issues in the suburbs and countryside of the New Territories left over from history, it is difficult to realise the traditional new town development mode. Mixed-land urban renewal may also face difficulties in the coordination of multi-party land ownership. As the city expands, the corresponding development strategy should change to adapt to the current situation, including complex ownership, the growing needs of the people and environmental issues. Suburban development remains an important way to provide urban land, and the government and urban planners will face more challenges.

This article has suggested a number of strategies to remedy the lack of local employment, economic and community vibrancy, operating at the regional, regulatory, and local dimensions. Better and new forms of transport can be introduced to improve access to employment in the region, as besides the travel time, cost, and convenience should be considered in understanding the impact of commuting on residents' quality of life. Regional opportunities, such as closer collaboration with Shenzhen and the future neighbouring new town of Hung Shui Kiu, can be capitalised upon to connect regional landscapes, people, and economies, to expand Tin Shui Wai's economy, demographics, and employment opportunities. Local economies can be stimulated by opening up planning policies, retail operations, and public spaces to introduce mixed-use, street facing town and neighbourhood facilities that promote social engagement and evolve with the aspirations of the community.

Important lessons from the challenging development history of Tin Shui Wai can be applied to the planning of future new towns in Hong Kong and elsewhere, in particular around the integration of jobs and housing. Local employment opportunities do not need to arise only from top-down planned industrial zones, but can emerge from the creation of attractive, mixed, and flexible neighbourhoods which feature good regional and local connectivity, public spaces and an urban fabric that is open to new and mixed forms of living and working.

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A Compact City for a Beautiful Countryside: Entry-points to a Discourse between Academic Research and Institutional Strategies

Henry Endemann [1]*, Gerhard Bruyns [2] and Joern Buehring [3]

[1] School of Design, The Hong Kong Polytechnic University, Hong Kong SAR, China; henry.endemann@connect.polyu.hk; ORCID ID: 0000-0003-2467-1389
[2] School of Design, The Hong Kong Polytechnic University, Hong Kong SAR, China; gerhard.bruyns@polyu.edu.hk; ORCID ID: 0000-0002-4468-6505
[3] School of Design, The Hong Kong Polytechnic University, Hong Kong SAR, China; joern.buehring@polyu.edu.hk; ORCID ID: 0000-0001-9763-8294
* Corresponding author.

Abstract: The pros and cons of the Compact City are intensively and inconclusively discussed in academia. Public institutions, however, often use the term "compact" in a more superficial way to promote sustainable urbanisation. Considering the complexity of urban spaces and the increasing presence of in-between conditions, there is a threat of compact urbanism being used as a one-sided and dichotomic paradigm: "if we build dense cities, we protect the countryside." This paper compares institutional agendas with scientific findings in order to initiate a more holistic discourse between practitioners and scholars. Guidelines for sustainable urbanisation on different institutional scales (supra-national, national, megaregional, municipal) are analysed in terms of their definitions, assumed benefits, and considered trade-offs of urban compactness, as well as their conceptualisations of urban, rural, and peri-urban spaces. It is shown that incomplete and contradictory definitions of compactness point towards a missed potential regarding the narrow use of the Compact City in current urbanisation strategies. Furthermore, partly exaggerated claims for the benefits of urban compaction are used within a city-centric framework. While this is a rather generic conclusion, it stimulates new discussion between academia and practice. The final hypotheses of the paper are that practitioners, on the one hand, need to consider complex urban realities and pick up the caution expressed in research. Academics, on the other hand, need to acknowledge the desire for urban compaction and translate their findings into constructive and concrete recommendations.

Keywords: Compact City; urban-rural integration; sustainable urbanisation; China

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1. Introduction

The 'Compact City' is a leading paradigm for urban development, supported by a majority of public institutions worldwide (Bibri, 2020; OECD, 2012). Practitioners around the world are convinced that urban compactness – which they typically define as increased physical and population densities – supports sustainability (Ahlfeldt et al., 2018; Burton et al., 1996). Academics, however, do not share this enthusiasm: compaction is found to have ambiguous social and environmental effects (Ahlfeldt et al., 2018), and the concept is regularly criticized as being a simplified antidote to urban sprawl (Rode, 2018) that supports neoliberal agendas (Kjaeras, 2020). This discrepancy hampers a constructive relationship between academia and practice in their shared desire for sustainable urbanisation.

The complexity of communication between academia and practice is further increased by the diffuse reality of urban spaces. Particularly in China, which serves as a case for this paper, a strong separation between urban and rural spaces through socio-political regulations is met with an increasingly diverse composition of in-between conditions such as the *Desakota* (cf. Z. Liu et al., 2019; McGee, 2017).

Simultaneously, some of the world's most influential institutions attempt to streamline global efforts for sustainable urban development. The United Nation's [UN] New Urban Agenda [NUA] and Sustainable Development Goals [SDG], for instance, are connected to a comprehensive monitoring-infrastructure, based on the SDG's extensive indicator system. Next to this formal and quantitative process, however, numerous critiques are expressed on the conceptual foundations and the planning model supported by the NUA (Stiftel, 2021). This means that while some of the world's largest institutions have found some kind of agreement, intensive debates continue, driven by academics and more independent voices in practice. Accordingly, the use of major strategic documents cannot be limited to formal monitoring protocols, but needs to be expected to develop its own "life," as it is continuously reproduced, reinterpreted, and rejected by individuals. The potentials of such informal dissemination are of interest for this paper.

This paper aims to analyse strategic documents from different institutions in order to identify their ambitions for urban compaction. The definitions of compactness, the assumed benefits of compactness, and the considered trade-offs of compactness are of major interest here. Furthermore, conceptualizations of urban, rural, and in-between spaces are investigated to gain an understanding of the spatial frameworks that form the basis for different compaction-ambitions.

The paper expands extensive research by the OECD, which focuses on concrete Compact City policies (OECD, 2012) and the results of empirical studies on urban compactness (Ahlfeldt et al., 2018). It also builds up on comparable research that investigates the qualitative factors that constitute ambitions for urban compaction (e.g., Kain et al., 2021). Here, particularly the synthesis of perceived benefits serves as the basis for a confrontation between the strategies outlined in the documents and the insights that can be gained from academic research. Therefore, the guiding question is: *which ambitions for urban compaction are expressed in urbanisation guidelines and in how far are their claims supported by academic research?* The following section provides some additional information on the Compact City debate and methodological considerations, followed by an analysis of the chosen strategic documents. The discussion section confronts the definitions and claimed benefits connected to urban compaction with academic research outcomes in order to scout possibilities for a more fruitful academia-practice discourse.

2. Theories and Methods

2.1. The genesis of the Compact City as a leading urban paradigm

While there are scholars who trace back the concept of the Compact City to medieval towns (e.g., Thomas & Cousins, 1996), it only receives major attention since the end of the 20th century. Breheny (1996) describes the discussion on urban form in the 20th century as being fought out between "centrists," "decentrists," and "compromisers."[1] In the latter half of the century, the increasing popularity of sustainability as a concept (Burton et al., 1996) and the perceived problems emerging from urban sprawl (Bruegmann, 2005) imposed a clear preference on this discussion, enabling the triumph of urban compaction.

"Compact City" first emerged in the 1970s in a rather mathematical proposal by Dantzig and Saaty (1973). Their spatial model finds little recognition in the field of urbanism, but their principles decisively coined the main characteristics of the Compact City: density, accessibility, and multi-functionality. Scholars do not seem to agree on a common definition of compactness (cf. Burton et al., 1996; Lee et al., 2015; Neuman, 2005; Westerink et al., 2013), but recent research by Bibri et al. (2020) shows that most characterisations of the Compact City in the 21st century revolve around these three features.

The sustainability of compact urban form is discussed at least since the 1990s, with inconclusive outcomes despite an extensive account of empirical research (Bibri, 2020; Neuman, 2005). Much of the research uses measures of population density to find correlations with travel behavior and energy use, while measures such as mixed-use are largely ignored (Ahlfeldt et al., 2018). However, researchers suggest that a focus on urban form,

[1] Examples are Le Corbusier's proposal Radiant City proposal (centrist), Frank Lloyd Wright's Broadacre City proposal (decentrist), and Ebenezer Howard's Garden City proposal (compromiser).

and particularly on population density, neglects the complex compositions and interrelations that constitute urban spaces (cf. Kjaeras, 2020; Westerink et al., 2013). It is therefore a crucial task to investigate the definitions and ambitions that different actors associate with urban compaction and thereby reveal potential simplifications, contradictions, or false assumptions (cf. Kain et al., 2020, 2021).

2.2. Methodology

The chosen documents for the analysis are shown in Table 1. In order to get a comprehensive overview of urbanisation guidelines, supra-national, national, regional, and local scales are of interest here. For national and lower scales, the focus is laid on Greater China to increase the comparability of the documents. The fact that the documents are published by different institutional scales does not necessarily mean that they are interdependent. While the rather strict administrative hierarchy in China may mean that the chosen plans built up on each other, the links between Chinese and supra-national documents are likely to be much weaker. However, even without formal dependencies, a certain influence of supra-national strategies on more local developments is to be expected (cf. Stiftel, 2021). So, the choice of documents in this paper aims to show how compaction ambitions are approached on different institutional scales – and thereby different levels of geographical specificity.

Selected documents are those that actually do mention ambitions for urban compaction or urban-rural integration. The latter is a popular term in China that is typically associated with actions of urban agglomeration and concentration as well as the "optimisation" of land-use patterns (He et al., 2019). It is, hence, somewhat related to urban compaction, but rather useful here to clarify the conception of urban-rural frameworks in Greater China. Eventually, a total of eleven different documents from seven different institutions was chosen. The three supra-national institutions – the UN, the World Bank, and the OECD – represent leading voices of urban development on a global scale. The four institutions from Greater China represent three of the most important levels of planning: the country, the region, and the city.[2] Even though the supra-national documents may not be formally used by public institutions in China, documents like the New Urban Agenda are highly influential among urban designers and planners working in practice (Caprotti et al., 2017; Stiftel, 2021). This also includes globally operating firms that guide urban development projects in China or elsewhere.

Table 1. Strategic documents analysed in this paper. The numbers indicated for the documents will be used in Table 2 and 3. The OECD reports are listed here because they were considered, but the analysis has shown that they are more academic research reports, which is why they are not considered as strategic documents in the remainder of the paper.

No.	Institution	Document	Scale
1	United Nations	UN-Habitat, 2017	Supra-National
2	United Nations	UN-Habitat, 2020	Supra-National
3	World Bank	Lall et al., 2021	Supra-National
4	OECD	OECD, 2012	Supra-National
5	OECD	Ahlfeldt et al., 2018	Supra-National
6	Chinese Communist Party	CCP, 2016	National
7	Chinese Communist Party	CCP, 2020	National
8	Coalition for Urban Transitions	Ye et al., 2020	National
9	Greater Bay Area	GBA, 2019	Megaregional
10	Hong Kong SAR	HKSAR, 2016	City-Regional
11	Hong Kong SAR	HKSAR, 2016	City-Regional

[2] In the Chinese case, it seems logical to use a *megaregion* for the regional scale. In other parts of the world, a metropolitan region or a province might be a more suitable scale of investigation. See Harrison and Gu (2021) for a description of scales of planning in China, and Hesse (2015), Wachsmuth (2015) or Wheeler (2009) for discussions on the importance of planning scales on a more global level.

The paper combines textual analysis with research synthesis. It is therefore qualitative interpretive research, followed by meta-analytical research. This is a typical procedure in studies of the built environment, because it allows researchers to harness insights from a variety of relevant disciplines (Du Toit & Mouton, 2013). Documents are firstly analysed by getting a general overview of their strategic aims as well as their geographical and thematic scope. Secondly, passages that are concerned with urban compaction and are searched and interpreted with regards to the statements they make on definitions, ambitions, or concerns. Thirdly, the documents' conception of urban-rural frameworks are identified. Lastly, the identified statements of all documents are categorised in order to find consistencies and contradictions between them. The following section presents the outcomes of this analysis.

3. Results – The Compaction-Ambitions of Public Policy

The analysis of strategic urbanisation documents is broadly separated into two parts: global urbanisation guidelines and location-specific urbanisation guidelines. While the first part highlights propositions with the ambition to be applicable to urban spaces around the world, the second part allows for a multi-scalar investigation of urban planning and design propositions by public institutions in Greater China.[3]

Results of the textual analysis of the documents are presented hereafter. The general purpose of the documents is shortly described, followed by a synthesis of the examination of the documents' mentioning of ambitions for urban compaction and, if applicable, their conceptions of urban-rural frameworks.

3.1. Global urbanisation guidelines

Five different documents have been analysed as examples for global urbanisation guidelines, representing three different institutions. Firstly, the UN's recent efforts are represented through the "New Urban Agenda" [NUA] (UN-Habitat, 2017) and the "World Cities Report 2020" (UN-Habitat, 2020). Secondly, the World Bank's report "Pancakes to Pyramids: City Form to Promote Sustainable Growth" (Lall et al., 2021) represents a recent publication of one of the world's largest financial institutions. Lastly, two research reports by the OECD are taken as examples for the views of another powerful economic institution.

The NUA presents "a shared vision for a better and more sustainable future" (UN-Habitat, 2017, p. iv). Organised around 175 statements, it formulates commitments for prosperous, equitable, and ecological urban development. Four of the statements mention compactness, frequently distinguished from "density." Compactness is used as an antidote to urban sprawl without a concrete definition. Similar vagueness can be observed with regards to an "urban-rural continuum" and "peri-urban areas," which are mentioned several times but also without further definition.

In 2020, UN-Habitat published the "World Cities Report 2020," a document that builds upon the NUA and emphasizes the multi-layered benefits of sustainable urban development. It presents Compact Cities as "desirable goals on their own" (UN-Habitat, 2020, p. 106) and lists actions that are likely to lead towards them. Concrete definitions of compactness are still missing.

The most recent report to be investigated here comes from the World Bank (Lall et al., 2021), who argue that a shift from horizontal expansion to vertical densification – from "Pancakes to Pyramids" - is essential for sustainable growth. The report is more data-driven than the UN's documents and investigates correlations between urban form and economic prosperity. On more than 150 pages, there are only a handful of literal mentions of urban compaction, but the term is taken as an equivalent of vertical growth. Short remarks on the trade-offs of "physical compactness" (Lall et al., 2021, p. 69) are made. The overall conclusion is that compaction is beneficial for a city's prosperity.

The OECD's work is slightly different, because there are no "flashy" strategic documents, but two major research reports with a more academic approach (i.e., Ahlfeldt et al., 2018; OECD, 2012). Both these reports present coherent and comprehensive definitions of urban compactness and use empirical research methods. The results of this research were mentioned above and will be used later on. What is of more interest for this section

[3] See the previous section (2.2.) for more specific comments on the selection of documents.

is the commitment on the OECD's official website that compact urban form can "maximise the economic, social and environmental potential of cities."[4] This clear preference to urban compaction partly contradicts he more nuanced results of their research reports, particularly Ahlfeldt et al.'s (2018) comprehensive literature review.

3.2. Location-specific urbanisation guidelines

Guidelines for urbanisation in Greater China were analysed through three different scales: the national scale (The People's Republic of China), the mega-regional scale (The Guangdong-Hong Kong-Macao Greater Bay Area), and the city-scale (The Hong Kong Special Administrative Region of the People's Republic of China). With one exception (i.e., Ye et al., 2020), all the documents are produced and published by the respective governmental bodies, which give a broad impression of ambitions for urban development on different scales.

On the national scale, China's two most recent five-year plans (CCP, 2016; CCP, 2021) provide a suitable introduction. These 5-year plans have a similar character as the NUA, as they formulate a large number of statements of intention, formally expressed through sentences that start with "We will . . . ." The documents outline holistic plans for China's development.[5] The term compact is not directly mentioned, apart from the expressed intention to "build high-density and public transit-oriented compact cities with integrated functions" (CCP, 2016, p. 96). What is mentioned more frequently is the intention for "coordinated" and "integrated" urban-rural development. A precise explanation of what this entails is not given, but a recurring theme in the five-year plans is both the strengthening of large cities as centers of development and the protection, restoration, or creation of rural areas.[6] These ambitions do have some similarities with the common understanding of compaction as a form of urban containment and the protection of natural landscapes. However, further clarification on the overlaps between compaction and urban-rural integration is needed, because the key characteristics of both concepts may actually be quite different.

Shortly before the 14th five-year-plan (CCP, 2021), a strategic document was published that has more similarities with the global urbanisation outlines presented earlier: Ye et al. (2020) articulate a vision to inform the urbanisation strategies of the 14th five-year-plan. Their report is rather city-centric and therefore hardly mentions the urban-rural agenda expressed by the Chinese government. They do, however, put much emphasis on their aim to build "compact, connected, clean cities." Within this triangle, Ye et al., (2020) define compactness as the combination of "liveable density" and "adjacent development" (p. 32) that shares the feature "mixed land-use" with connectivity and the feature "material efficiency" with clean cities. This comparatively comprehensive definition of urban compactness guides them to make extensive statements on the potential sustainability benefits of urban compaction.

The mega-regional scale is examined here through the Guangdong-Hong Kong-Macao Greater Bay Area [GBA], located in and around the South-Chinese Pearl River Delta. It describes one of the world's leading urban agglomerations, extensively investigated by academic research and tremendously supported by the Chinese government since 2015 (Hui et al., 2020). An important cornerstone in the GBA's development is its "Outline Development Plan" (GBA, 2019), which formulates ambitions in a similar fashion as the CCP's five-year-plans. Statements on the GBA's future "Spatial Layout" mostly mention compactness in relation to urban-rural integration and related ambitions for efficiency and livability. Few conclusions can be drawn from this, but it shows how China's national guidelines are picked-up in regional development strategies.

Lastly, two consecutive documents about Hong Kong's urban development strategies are taken as an example for compaction-ambitions on the city-scale, namely "Hong Kong 2030+" (HKSAR, 2016a), and "Planning and Urban Design for a Liveable High-Density City" (HKSAR, 2016b). The latter elaborates on the urbanisation dimension of the goals articulated in the former. Besides some vagueness surrounding the distinction between the Compact City and other models such as Transit-Oriented-Development, the reports also conceptualize compactness as a fixed condition at some points: while they mention some approaches to measure compactness, they also tend to use formulations such as "[in]

[4] See www.oecd.org/regional/cities/compact-urban-development.htm; accessed 28 September, 2021.
[5] This means that urbanisation is one of many chapters - alongside statements on education, governance, the industrial system, the financial economy, and digitalization.
[6] For example, expressed through the intention to "exploit the catalytic role played by central cities and urban agglomerations" (CCP, 2021, p. 18) and to "build a charming, unspoiled, and harmonious countryside that is a beautiful and pleasant place to live" (CCP, 2016, p. 101).

a compact city such as Hong Kong [...]" (HKSAR, 2016a, p. 30). Such wording poses the risk of seeing compactness as a static feature and not acknowledging the high variety in the degrees of compactness that can be observed even in a territory like Hong Kong. A similar threat emerges from the presentation of an "Urban-Rural-Countryside-Nature Continuum" (HKSAR, 2016b, p. 42), which shows some awareness of in-between conditions, but effectively translates this notion into a particularly harsh urban-rural dichotomy. Despite these conceptual deficiencies, particularly the document that focuses on urban development (i.e., HKSAR, 2016b) carefully articulates ambiguities surrounding the effects of compaction.

3.3. Synthesis - Deficiencies and core issues for further investigation

The analysis of nine[7] different planning documents allows for an informative synthesis that also guides towards the analytical confrontation that will be presented in the discussion section. Key take-aways are presented hereafter as a summary of two tables (2, 3) that provide an overview of the insights gained from the documents.

The most striking deficiency observed in the documents is the inconsistency in definitions. Compactness is distinguished – and thereby seen as something different – from a number of terms. While features like vibrancy or walkability are indeed not commonly seen as core characteristics of urban compactness, the distinction between compactness and multi-functionality or accessibility of public transport is contradictory to widely accepted core features of the Compact City (cf. Bibri, 2020; Burton, 2002; Dantzig & Saaty, 1973). As seen in Table 2, these two features are regularly seen to be somehow related but not part of compactness, which suggests that compactness is mainly understood as a form of morphological or economic density (cf. Ahlfeldt et al., 2018).

Table 2. Terms that compactness is mentioned along with - and thereby distinguished from:

Compactness is mentioned along with . . .	. . . in documents:
Density	1, 6
Polycentrism	1
Integration	2, 10
Mixed-use	1, 6, 10
Connectivity	1, 8
Walkability	2
Public transport access	3, 6, 10, 11
Uniqueness	10
Vibrancy	10
Health	10
Inclusion	10
Support	10
Air Quality	2
Cleanliness	8

The assumed benefits of compactness point towards the key issues for the selection of academic studies later on. The most frequently mentioned benefits are efficiency and the prevention of urban sprawl (see Table 3). Six out of the nine documents claim that urban compactness increases efficiency. While some documents specify that they mean the efficiency of resources, most of them leave the distinction between different forms of efficiency completely open. A similar issue can be observed in the mentioning of broader

[7] Table 1 shows eleven documents, but the OECD documents are eventually not counted in the synthesis because they have a more scientific character. This is why nine documents are of relevance here.

development paradigms, where it is vaguely claimed that Compact Cities are "sustainable" or "resilient." The assumed benefit of compactness to prevent sprawl is more nuanced, as more concrete effects such as reduced land consumption, the reduced need to build "new cities," and the conservation of biodiversity are mentioned.

The trade-offs related to urban compactness that are regularly mentioned in academic research find little to no attention in the analysed reports. The World Bank's report (Lall et al., 2021) briefly refers to a missing consensus regarding the correlations between transport emissions and urban compactness. This corresponds with Ahlfeldt et al.'s (2018) observation that "sustainable mode choice" is the most frequently researched effect of the Compact City. HKSAR (2016b) hints at the potential conflict between compactness and livability. Other than that, the nine documents show a purely positive image of urban compactness. The following section confronts this strong preference with outcomes of academic research and positions it in a larger professional debate.

Table 3. Assumed benefits of increasing urban compactness.

Assumed benefit. . .	. . . in documents:
Compact Cities are "goals on their own"	2 (p. 106)
Economic Prosperity	
- Economies of scale	1, 2, 10
- Wealth	3
- Innovation	10
Efficiency	
- (Resource) efficiency	1, 2, 8, 9, 10, 11
Broad Values	
- Resilience	1
- Sustainability	1, 10, 11
- Environmental value	2
Sprawl	
- Preventing urban sprawl	1, 8, 10
- No "new cities"	2 (p. 97)
- Clear growth boundaries	6
- Less land consumption	8, 10
- Protect natural ecosystems	8, 9, 11
- Conserve biodiversity	8
- Food security	1
Transport	
- Reduced greenhouse gas emissions	2, 3
- Cleaner energy	2, 3
- Less motorized transport	2, 3
- Shorter work commutes	8, 10
Socio-cultural	
- Attraction of migrants	8
- Vibrancy	9, 10, 11
- Diversity	9
- Taken as movie sets	11

4. Discussion - Confronting Strategic Ambitions with Academic Research

The analysis points at some core issues. Arguably, the most urgent discussion to have here is the confrontation between assumed benefits of urban compaction and the results of academic research. To a certain extent it is expected – and even understandable – that practitioners tend to have a less critical a less precise view of concepts such as the Compact City. Hence, the observation that a statement is too vague or does not acknowledge certain ambiguities is important to mention here, but it is unlikely to be a significant contribution to research. Therefore, particular emphasis is laid on actual contradictions – statements made in the documents that are not only vague, but also *reject* the findings of academic research.

As mentioned earlier, extensive debate on the sustainability of compact urban form remains inconclusive since several decades. Neuman (2005) argues that not urban form itself, but the flows associated with this form are decisive for an area's sustainability. Thinking within the three general sustainability dimensions, Bibri et al. (2020) note that "the economic goals of sustainability dominate over the environmental and social goals."[8] The fact that most documents analysed here state that compactness is generally sustainable may therefore turn out to be a threat to the debate because it generalises the overall potential of compactness while rejecting some crucial academic research efforts. Other benefits to be discussed here need to be seen in this context.

One of the biggest claims made in the documents is that compaction increases efficiency. Empirical research shows that this is indeed the case for multiple forms of efficiency, such as energy consumption, water consumption, and waste management (Shi et al., 2016); economic CO2 efficiency (Y. Liu et al., 2014); or the efficiency of delivering public services (Ahlfeldt et al., 2018). However, all of these studies also make cautionary notes regarding specific forms of efficiency. Therefore, the claim that more compactness equals more efficiency is a simplification, but it seems to be mostly covered by empirical research.

Another long-standing claim that is supported by many of the documents is that urban compaction prevents urban sprawl. All but one of the documents from Greater China make some reference to this assumed benefit. And indeed, authors such as Ewing and Hamidi (2017) point out the negative impacts related to "sprawl," particularly emissions and health. But the problem here is of a more conceptual nature: theoretical research argues that compaction in one place does not necessarily prevent sprawl in another place (cf. Kjaeras, 2020). Theories such as 'Planetary Urbanisation' even argue that urban concentration *requires* dispersion elsewhere (Brenner & Schmid, 2015). Accordingly, compaction may be preferred over dispersion, but compact development does not eliminate the emergence of less compact spaces. This seems particularly logical when the definition of compactness is reduced to physical density. However, this is also a rather theoretical argument, which might explain why it is not mentioned in the analysed documents.

Several other benefits are presented in the documents. More sustainable transport emissions, for instance, are discussed extensively in the Compact City literature. The ambiguous outcomes of this debate are widely ignored in the documents. However, Ahlfeldt et al. (2018) synthesize that the effects of compaction on "sustainable mode choice" are largely positive. They similarly show that economic effects such as increased innovation or productivity can indeed be increased through compaction. No research is known to the authors that investigates links between compactness and vibrancy. But the assumption can be made that once more it is the combination of different features that is likely to create vibrancy. Density alone does not increase social interaction, but a mix of functions and appropriate access to them may do so.

5. Conclusion

The analysis of compaction ambitions in strategic documents shows that there is confusion about the definition of compactness. Except for the Coalition for Urban Transitions (i.e., Ye et al., 2020) – a cross-institutional initiative – none of the documents presents an explicit conceptualization of compactness. The incomplete and inconsistent definitions put forward in the documents paint a dismal image of the use of compaction in urban

[8] Ahlfeldt et al. (2018) confirm that while the economic effects of compaction are mostly positive, social, and environmental effects are more ambiguous.

practice. While this is a very academic statement that may disregard the requirement of urbanisation outlines to be straight-forward and operational, it points at one novel and significant conclusion: the documents separate compactness from features that academic research considers to be part of it. This means that practitioners may actually see compactness to be *less* broad as a concept than academics do. The analysis suggests that academics can encourage practitioners to use a wider definition of the Compact City than they currently do.

Regarding the claims for the benefits of compaction, multiple exaggerations can be identified. As mentioned above, this is to be expected. However, many of the trade-offs mentioned here comply with common sense, and therefore not mentioning them poses some risk of overlooking them. Particularly in a top-down planning system like in Greater China (cf. Harrison & Gu, 2021), the acknowledgement of ambiguities on some of the highest institutional levels could have enormous effects. The acknowledgement of in-between spaces may help to reach a more nuanced understanding of compaction in different contexts – even though this is yet another academic claim that is easier said than done.

The careful conclusions made here already point at the limitations of this research. The analyzed documents are highly influential in current urban development debates, but the sample size is obviously too small to make general statements. Furthermore, the links between the broad strategic outlines made in the documents and more concrete policies and planning actions needs to be clarified in order to gain more insights on the impacts of the claims that were identified and discussed here. Accordingly, this paper should be seen as an initial investigation into possible dialogues between practitioners and academics. Further research may include a more comprehensive analysis of relevant documents as well as in-depth conversations with practitioners themselves. The conclusions made here should therefore be seen as bold statements to spark interest in this controversy and to construct hypotheses to be tested further.

With this cautionary note in mind, some suggestions for improved synergies between academia and practice can be made. Firstly, the authors of strategic urbanisation guidelines should be encouraged to use the Compact City as a multi-faceted concept that is informed by density, accessibility, and mixed-use. Secondly, the holistic conception of the Compact City can be used to specify locally applicable thresholds, differentiating between different parts of the world and different parts of urban-rural frameworks – including, of course, in-between conditions. Lastly, scholars should pay more attention to translating empirical findings into concrete guidelines for compact development. Practitioners' desire for compaction should be acknowledged and used for constructive recommendations that encourage urban compaction where it is needed.

Contributor statement

Conceptualization, Data Curation, Formal analysis, Investigation, Project administration, Writing – Original Draft: Author 1

Supervision, Writing - Review & Editing: Author 2, Author 3

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The Java Model: Unlocking Heterogeneous Rural Landscapes through Cluster-based Land Use Analysis

Yeeun Boo [1,*] and Neville Mars [2]

[1] MSc student at TU Delft; estherboo94@gmail.com; 0000-0001-7294-6100
[2] Director of Dynamic City Foundation / MARS Architects; nevillemars@me.com
* Corresponding author

Abstract: In recent years, the unfolding collisions between urban and rural systems have shifted much of the planning community's focus to the countryside. Understanding and guiding the rapid transformations of peri-urban landscapes, such as Java's fragile desakota, are of critical importance. However, we must acknowledge that the integrity of foundational planning concepts can quickly erode within the peri-urban contexts. Without the traditional core and hinterland hierarchies, models such as the 'compact city' lose their integrity. More disconcerting, the centralised planning schemes that dominate in emerging markets tend to further muddle these topographies, without addressing the needs of rural communities. These spatial dynamics lay bare two urgent challenges: first, developing the planning methods that are informed at the micro-level, whilst possessing the potential to scale up to become coherent macro-level strategies; and second, implementing the appropriate geospatial tools that can analyse the heterogeneous landscapes. To this end, this paper explores the 'cluster-based' land use analysis methods. Applied to Central Java, they distill 'meso-level' land use patterns that create opportunities to plan across the political boundaries and mediate between macro and micro scale objectives. As GIS-clusters weigh cultural, agricultural, and natural systems within one model, proposed as RGB elements, this advances the resiliency planning approaches that are rooted within the region.

Keywords: Rural-urban integration, RGB clustering, GIS model, desakota, Java Island

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1. Introduction: Desakota lost – colliding morphologies and ideologies

Java, the world's most populated island, is also one of the world's fastest urbanising regions (Firman, 2017; Wilonoyudho et al., 2017). Faced with profound challenges, as well as real opportunities, Indonesia's government is dedicated to delivering a comprehensive plan for its layout by 2045. It will consist of all the generic elements of contemporary global urbanism, including highways, ports, and high-technological and industrial hubs. But rapid transformations bring a real risk, most notably to Java's unique and fragile *desakota*.[1]

The desakota, Indonesia's version of a densely populated rural settlement typology, is much researched (Geertz & Association for Asian Studies, 1963; McGee, 1991; McGee, 2015; McGee, 2017). However, models to comprehensively plan the peri-urban settings are scarce (Tacoli, 1998; Hudalah, Winarso, and Woltjer, 2007). Gradually evolved in unison with the geography, the desakota has covered Java's hinterland with the vast networks of compact villages. Being a virtually autarkic productive landscape, the desakota

[1] Desakota is a peri-urban landscape typology of Java Island. The term, coined by T.G. McGee in the early 1990s, is an agglutination of the words 'desa' (village) and 'kota' (city).

has progressively been incorporated within the economic spheres of Java's urban centres (DST, 2008; Wilonoyudho et al., 2017). Notably in the post-2008 economic crisis, the arrival of global capital has accelerated the generic urban-industrial transformations (Handayani, 2013). At a time when its qualities of resilience, self-sufficiency, compactness, and carbon storage are deemed critically in the fight against the climate change, below the radar, the intricate socio-spatial, cultural, and ecological cohesion of the desakota is eroding. In part planned, in part informal, Java's expanding territorial dependencies on the globally connected and industrialising economy are spawning a new 'hybrid' landscape that defies the conventional planning (Champion & Hugo, 2004).

This spatial challenge, most palpable in ASEAN+ countries, reveals a predicament at the centre of all regional planning endeavours: balancing the progress and preservation (Wilonoyudho et al., 2017). Representing the opposing scales, speeds, and ideologies, the large projects of generic neoliberal urbanism are crudely juxtaposed, while at once countless micro transformations surreptitiously seep into the desakota's fine-grain networks. The ensuing spatial dynamics, opportunistically forged on the intersection of global and local, as well as planned and unplanned transitions, demand the critical examination, advanced geospatial analysis, and most urgently, new planning models that can mediate – and ultimately integrate – the disparate socio-economic realities across the colliding scalar hierarchies. As echoed in Indonesia's Climate Change Sectoral Roadmap (ICCSR), rural land use is the overriding, yet much overlooked, parameter to this equation. The desakota underscores the need for the process-driven urban discipline that can foster a more contiguous, and thus more resilient rural-urban continuum.

2. Eroding landscapes, eroding theories

2.1. Land matters

Over the last decade, prognostications around climate change have become bleaker and broader. Today, few aspects of human activity are considered beyond its sphere of influence. In diametric response, the urban planning disciplines have gained determination and a renewed focus: resilience is the new mantra. It moves beyond the insular notion of environmental sustainability, to prepare for the reality of climate-related calamities and catastrophes. This new mission is particularly forceful, as it ties in with neoliberal 'global city' narratives, structured around dynamics of global land markets and geared to attract the global investments (Aspinall, 2013). As Adam Ross notes, schemes formulated around risk and resilience binary are 'shedding theoretical conjecture' of mitigating the impending doom scenarios, and instead offer the actionable strategies to 'defend and develop' (Adams, 2018).

But defend and develop for whom? What is the risk, and who defines it? 'Resilience urbanism' must be chalked up as a *panda principle*[2]; as yet another planning concept fraught with contradictions and ambiguity (Mars & Homsby, 2008). While the poorest communities in emerging economies are known to be affected most directly by climate change, they rarely attract the level of investments needed for meaningful risk reduction schemes. The tremendous pressure on megacities provides a smokescreen of urgency – to build new towns, power stations, reclamation dams, highways, and other conduits. The biggest blueprint of greenfield proposals attracts the capital for schemes that barely ease the pressure on existing cities. Projects like Indonesia's new capital on Borneo, East Kalimantan, fail to adhere to the multifaceted and regional nature of the resiliency challenge. Instead, they are likely to syphon off funds and technical support to the distant locales, leaving the vulnerable communities scrambling for aid and political agency (Bracke, 2016; Butler, 2016).

Beyond the practical predicaments, resilience urbanism reveals the profound conceptual inconsistencies (Adams, 2014). Planning for resilience implies a close interaction between the city and its regional context, and between the built and the natural environment writ large. Expanding the eco-city agenda, the ultimate ambition of resilience urbanism must be to reconstruct the urbanity as nature. In reality, we are in the process of turning nature into forms of urbanity. Cynical theorists would argue that the city, as mankind's implicit habitat, is a natural construct. But the growing scholarly research in charting 'planetary urbanism' underscores the grim reality of Lefebvre's once radical hypothesis of 'complete urbanisation' (Brenner & Schmid, 2012). Encroachment of man-made systems into natural ecologies is an insidious, but a primary driver of landscape erosion and land use fragmentation, which ultimately threatens the ecological system to collapse.

[2] A planning objective that is irrefutably well intentioned, but remains undefined, or too vague to be critically assessed or effectively implemented.

Irreversible transformations of environs such as East Kalimantan, a vast biodiverse carbon sink, are testament to the complex interdependencies with distant human needs and resultant urban-industrial, infra-logistic, and agricultural expansions. Carbon storage is just one of the critical functions that non-urban spaces, such as woods, peatlands, and pastures, fulfil. According to the ranking of *Project Drawdown*,[3] the first comprehensive strategy to mitigate the global CO2 levels, 15 are related to land use, dealing with soil health, bio-sequestration, agriculture, and industrial-scale harvesting of renewable energy amongst its top 20 most impactful solutions. This supports our premise that 'land use integration' is a cornerstone of sustainability, and a principal step towards achieving the regional resilience. Moving beyond the common definitions of territorial organisation in relation to the transport systems, we define land use integration as the project to forge regional configurations that benefit the resilience and productivity of man-made and natural ecologies, both independently *and* in relation to each other.

2.2. Dispersed metropolis

As urban systems continue to scatter across the wider territories, an isolated approach of either landscape becomes ever more illogical. Rural and urban systems ultimately compete for the same space, to the detriment of both. Hybrid morphologies in between are formed in the wake of their collisions, which lack the qualities of city and man-made systems, of rural countryside and productive landscapes, and of ever scarcer natural and inviolate settings.

The emergence of amalgamated topographies makes planning for resilience more difficult. Within their sphere, principles integral to sustainable planning, such as the compact city model, quickly erode. Compactness has long been the protagonist of sustainable urbanism (CEC, 1990; Burton, Jenks & Williams, 2003; Jabareen, 2006; UN-Habitat, 2014; Hofstad, 2012). However, within the context of Asia's burgeoning urban regions, this model is being challenged both practically and conceptually (Neuman, 2005). On a practical level, promoting compactness in hyper-dense and expansive megacities, which struggle to manage their booming populations and maintain their outdated infrastructures, is too counterintuitive to have much political traction.

In areas where regional planning is well established, the compact city model can offer a useful general planning principle. It can bring spatial cohesion and tackle fragmentation by strengthening the gravitational pull that exists between centre, suburb, and the outer peripheries (Hofstad, 2012). But on a conceptual level, the static and linear nature of the model is ultimately incompatible with the dynamic onslaught of all urbanisation – a challenge most apparent in the erratically expanding metro-regions of the 'Asian tigers.' Within the scattered constellations of edgeless cities, it is inconceivable to objectively define both *when* to lock in growth, and *where* to draw the 'red line' of an aspired urban growth boundary (Lang, 2003).

The regional dimensions of resilience urbanism greatly exacerbate these challenges. Striving for compact urban forms can minimise average commutes, land consumption, and city fragmentation, but there is a complex balance to be struck. The metabolic needs of a city from food and water to renewables require space for production and storage and additional energy for transportation. The concept of *artificial cities*[4] illustrates this challenge (Mars & Homsby, 2008). Reliant on the resources to be piped in over great distances, even when they concentrate a large amount of infrastructure and built-up programme within a small urban footprint, their operations remain unsustainable.

2.3. Regional blindspot

The desakota's vast, capillary networks are the structural antithesis of the imagined metro-core and green hinterland dichotomy. Full functional and spatial integration is achieved since this landscape typology casually folds natural, agricultural, and cultural strands within a single system (McGee, 2017). As a densely populated habitat, the desakota comes as close to a synthesis between urban and natural ecologies as is seemingly possible. Adapted to the local geographies and local resource flows, its delicate waterways and intricate infrastructure have sufficed, right up to the present.

Today, however, Java's agrarian output is no longer sufficient, leaving rural communities struggling to support themselves both economically and as sustenance farmers (Breman & Wiradi, 2002). New highways bring economic relief within reach of remote villages. But, as rural communities are roped in by Java's urban economies, extending logistic networks mount pressure on existing infrastructure, while land use transformations accelerate.

[3] www.Drawdown.org

[4] A city that cannot survive without resources from beyond its field of gravity.

Unlike China's dramatic reform era urban overhaul, Java's spatial transformation is not confined to urban centres, nor to its 'Extended Metropolitan Regions.' Instead, Java is drawn out across its productive landscape – home to around 100 million people, of which 65% live in villages officially labelled as desakota. While extensively documented since the early 1990s, the ubiquitous desakota typology is rapidly mutating beyond its initial definition. Once being self-contained and local, the vast strands of villages, forced to operate at the scale of global supply chains, are spawning the landscapes that "resist being taken-up into a more formal urban system of interconnected, functionally specialised zones" (Cairns, 2002, p.118).

A growing rural-urban codependence and spatial fusion renounces models solely based on either top-down planning of metro-region development, or on preserving local rurality in isolation. The planning discourse in Java has certainly moved beyond a stagnant progress and preservation binary. But basic predicaments remain: how to plan regional growth objectively, and how to implement regional visions locally? With an average density of nearly 1000 p/km^2, hybridisation introduces a 'post-desakota' condition that demands solutions unfolded within a rural-urban continuum, in order to optimise what has been referred to as an 'agro-manufacturing complex' (Metro Java 2045, 2021).

However, Central Java's emergent hybrid countryside presents the profound new planning challenges. Geographers continue to meticulously map Java's land use changes as they evolve (Verburg & Bouma, 1999; Setiawan, Yoshino & Philpot, 2013; Buchori et al., 2017; Handayani et al., 2020; Indarto & Hakim, 2021). But, intertwined at a granular level, the detailed pixel maps used to map the heterogeneous landscape and to track its changes obfuscate the clear interpretations of regional development trends. Micro-precision mostly fails to inform policymakers and planners alike. Conversely, vector maps, applied to indicate the political boundaries, zones of spatial policy, and discrete planning projects fail to depict any programmatic interaction within their lines. The intermediary scale between national policy and local action presents an administrative and epistemological blind spot. The gaps between urban theory and planning practice widen.

3. Methods: The RGB-cluster model

3.1. The premise of unifying R/G/B

It is acknowledged that the simple division of urban and rural is no longer valid (Healey, 2007; Tacoli, 1998; Webber, 1998). The hybrid characteristics of rural-urban continuum in influence of global economies has developed different methods of analysis to define the demarcation of urban and rural within the concept of dispersed urbanisation, urban sprawl, or peri-urban. The large number of papers adopted the population size as the indicator of classification (UN Statistical Commission, 2020; Buchori et al., 2017; Setyono, Yunus and Giyarsih, 2016). Incorporated quantitative or mixed method, framing the rural and urban has elaborate through material characteristics and functions as well as socio-economic indicators (Handayani, 2013). Meanwhile, an advanced effort to detecting and map the different land use types has been carried by employing the remote sensing imagery techniques (Yoshino, Setiawan, and Shima, 2017; Jatayu, Rustiadi, and Pribadi, 2020). These detailed pixel maps can overwhelm, though not as an issue of data visualisation. Most of previous research entails the administrative boundary as a unit of analysis, or the single operation of land-use function. The formal approach delineates the embedded political division along bureaucratic silos, while the latter neglects the dynamism and complex interactions between land use functions, consequently both failing to address the integrative and systematic strategies.

The central Java's rural-urban continuum reveals that its people, settlements, and landscapes comprise a fine mesh. Regardless of the scale you observe the region, all components are present throughout in fractal-like repetition. If the city is defined by the collocation of people and infrastructure, planning the future of Java must be conceived as a collocation of urban and non-urban landscapes. To inform regional land use integration, we must combine cultural (red), agricultural (green), and natural (blue) systems[5] within a single geospatial model. This triunity is referred as the "RGB-cluster model" in this research.

Our approach leverages following aspects to provide the renewed representation of land use classification. First, the exploration of material conditions of land use associated with the location-based geographic information adapted using Quantum Geographic Information System (QGIS) software. Second, the conceptualisation of renewed land use

5 In the broadest sense, the RGB functional divisions correspond with 'built-up,' 'unbuilt,' and 'protected' land, and in turn, with 'consumptive,' 'productive,' and 'restorative' systems, respectively.

taxonomy that is hybrid and co-constituted. Third, pixel-based representation where the complexity of descriptive geometries is simplified into quantitative cells. Beyond the administrative boundaries, this allows the comprehensive understanding of java Island as a whole, distilling the regional urbanisation patterns.

3.2. Data preparation

The RGB-cluster model weighs the presence of general land use types R, G, and B, and maps these as different clusters of proportionally specific mixtures within one integral system. The selection of RGB variables presents a crucial step in defining the resolution of the clusters.

The Indonesia Geospatial Portal, *Ina-Geoportal*, is the official national platform that provides open-source data of land use cover. In addition, *OpenStreetMap (OSM)* delivers various geospatial data sets, including buildings and infrastructural networks. The other publicly available sources from the organisations such as European Environment Agency (EEA) have informed this study. Numerous trials allowed us to hone in on an optimal resolution for the cluster patterns, given the limited availability of geospatial data. The buildings, tree coverage, and the waterway were tested as the principal data sets. In order to enhance the resolution of the patterns, the additional variables, such as demography (population), infrastructure (road network of highway and residential street), and natural geographical settings (elevation and slope) were subsequently included as final RGB-cluster model. These non-functional land-use variables reflect the landscape conditions of Central Java, in turn, closely reflecting local agricultural practice. A detailed description of the RGB variables are described in Table 1.

Table 1. Variables classified for the RGB-cluster model

Variable	Year	Feature	Raster class	Source
R				
Building	-	Point	0-1	OSM
Number of population	2018	Raster	original value	WorldPop[6]
Road network (fast/slow)	-	Polyline	0-1	OSM
G				
Tree coverage percentage	2010	Raster	0-1	GLAD[7]
Irrigation line	-	Polyline	0-1	Ina-Geoportal
B				
Elevation (DEM)	1988	Raster	original value	EEA[8]
Slope	-	Raster	1-5	Derived from DEM
Waterway	-	Polyline	0-1	Ina-Geoportal

3.3. Applying the cluster analysis to the RGB-cluster model

The cluster analysis is an exploratory approach within statistical data analysis, when dealing with problems of classification. Called *typological analysis*, cluster analysis visualises the spatial patterns based on their similar characteristics or the 'distance' between observations. The traditional distance-based cluster analysis was applied to quantitative (continuous) variables. However, the use of mixed data including qualitative (categorical) data has been increased in recent studies, requiring other suitable methods.

For all grid cells covering Java island, each value of RGB variables were allocated to the corresponding cells. Then, the two-step clustering method was employed using SPSS. The two-step clustering method is applicable to both continuous and categorical data, which is a relevant precondition in this study. The iterative algorithm applies trial-and-error processes. Two-step clustering derives an optimised number of clusters, yet the final number can be arbitrarily decided by the researcher. Through the iterative process, the group of seven explains the heterogeneous, yet exclusive characteristics of the pattern.

Before performing the cluster analysis, the before-mentioned RGB variables were translated into a grid of pixels. The basic grid size was decided in relation to the preferred

[6] Hansen et al., (2013). *Global 2010 Tree Cover (30m)* [data file]. University of Maryland, Department of Geographical Science and USGS [producer]. Global Land Analysis & Discovery [distributor]. Retrieved from https://glad.umd.edu/dataset/global-2010-tree-cover-30-m.
[7] Centre for Humanitarian Data (n.d.). *Indonesia – Population Counts* [data set]. OCHA Services [distributor]. Retrieved from https://data.humdata.org/dataset/worldpop-population-counts-for-indonesia.
[8] EEA. (2003). *World digital elevation model (ETOPO5)* [data file]. M. Edwards and Washington University [producer]. EEA [distributor]. Retrieved from https://www.eea.europa.eu/data-and-maps/data/world-digital-elevation-model-etopo5.

resolution. In this study that is 1 km. When rasterised, the method of *kernel density* was applied to weigh the geographical agglomeration of each value of each variable. In order to make the values comparable, the raster surfaces were then rescaled and normalised within a range between 0 and 1 – with the exception of the numbers representing population and elevation. In addition, the slope derived from the elevation data was reclassified into a range of 1 to 5 as reflected by its optimised natural classification.

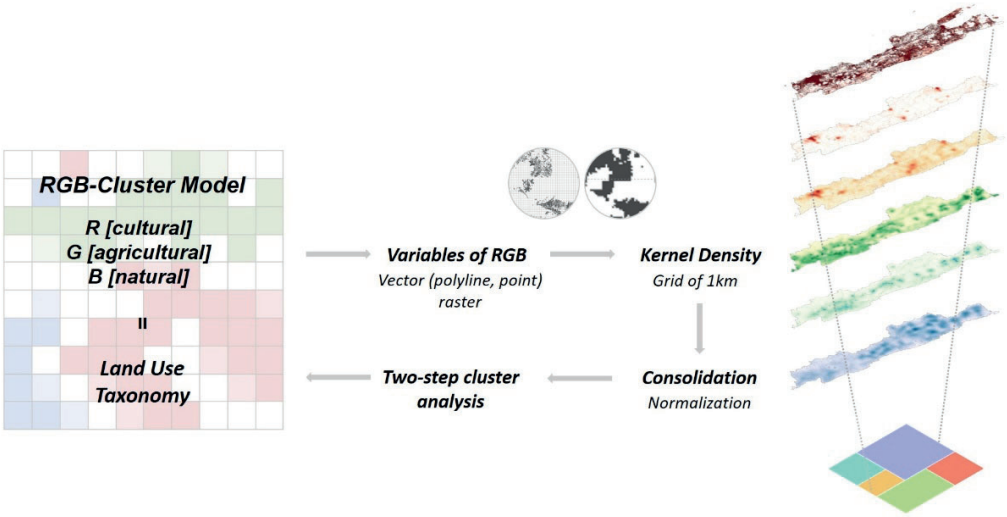

Figure 1. The overall research method and process. (*source*: Authors)

4. Results: a cluster-based land use taxonomy for Central Java

4.1. A new land use taxonomy

The results of the clustering method are presented in Figure 2. The map reveals the seven land use patterns of similar characteristics based on the mixture of RGB landscape components. It seems that the consolidation of population density with the natural condition of elevation and slope is reflected in the gradient of the clusters that corresponds to the transition from desolate mountain peak to compact bustling urban cores.

Cluster 1 is the volcanic mountainous area, which is highlighted by the degree of tree coverage, elevation, and slope. Cluster 2 illustrates the mountain villages located on the mountain ridges. Conversely, cluster 5 represents the urban cores with a peak value in population and both fast and slow road systems. This corresponds to the major urban centres of Semarang, Yogyakarta, Klaten, as well as a small part of Magelang. The next level is cluster 4, which ranks second highest in terms of population and road network, however, the difference with the urban cores is greater. This cluster is also characterised by a high concentration of waterways, hinting at a dominant agricultural land-use function. Cluster 6, mostly located along the coastal line of Java island, has the lowest value in elevation and slope. The area geologically overlaps with the alluvial plain. Cluster 3 is comprised of relatively undeveloped areas between the larger clusters, with a low level of primary roads. Finally, cluster 7 predominantly contains the irrigated rice paddies that concentrate on eastern Java.

The clusters can be labelled as follows:

- *Cluster 1: Mountain ranges*
- *Cluster 2: Mountain villages*
- *Cluster 3: In-between zones*
- *Cluster 4: Dispersed urbanised areas*
- *Cluster 5: Urban cores*
- *Cluster 6: Low lands*
- *Cluster 7: Irrigated paddies*

Table 2. The average value of land-use composition for each cluster

Variable	C1	C2	C3	C4	C5	C6	C7

R							
Buildings (0~1)	0.01	0.01	0.01	0.05	**0.41**	0.04	0.06
Number of population [inh]	268	591	478	1,970	**9,660**	931	1,633
Fast road network (0~1)	0.06	0.08	0.07	0.13	**0.43**	0.09	0.16
Slow road network (0~1)	0.05	0.07	0.09	0.22	**0.57**	0.10	0.20
G							
Tree coverage (0~1)	**0.66**	0.56	0.29	0.24	0.13	0.19	0.26
Irrigation line (0~1)	0.02	0.01	0.02	0.02	0.03	0.03	**0.40**
B							
Elevation [m]	**1,151**	467	158	154	121	25	157
Slope (1~5)	**4.87**	4.54	3.66	2.55	2.20	1.82	2.43
Waterway (0~1)	0.45	0.26	0.27	0.31	0.17	0.15	0.27

Bold indicates the highest value in the variable

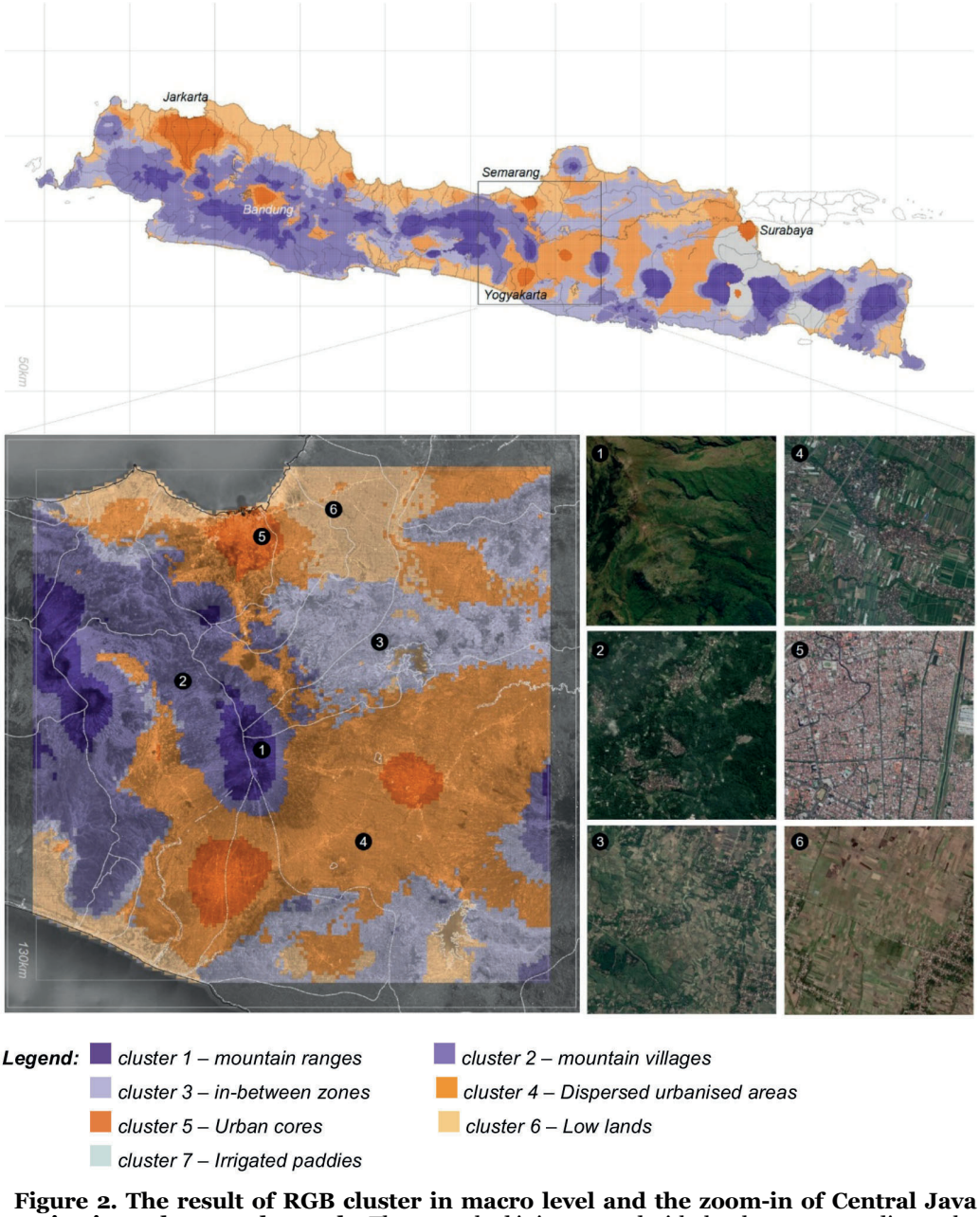

Figure 2. The result of RGB cluster in macro level and the zoom-in of Central Java region in 130km x 130km scale. The watershed is intersected with the cluster map to dissect the

meso-scale into local zones. Each cluster 1–6 is zoomed in aerial photos of the corresponding numbered area in the bottom-left map to illustrate the morphology. Note that the cluster 7 does not appear in the target are of Central Java region. (*source*: aerial images from Google Map)

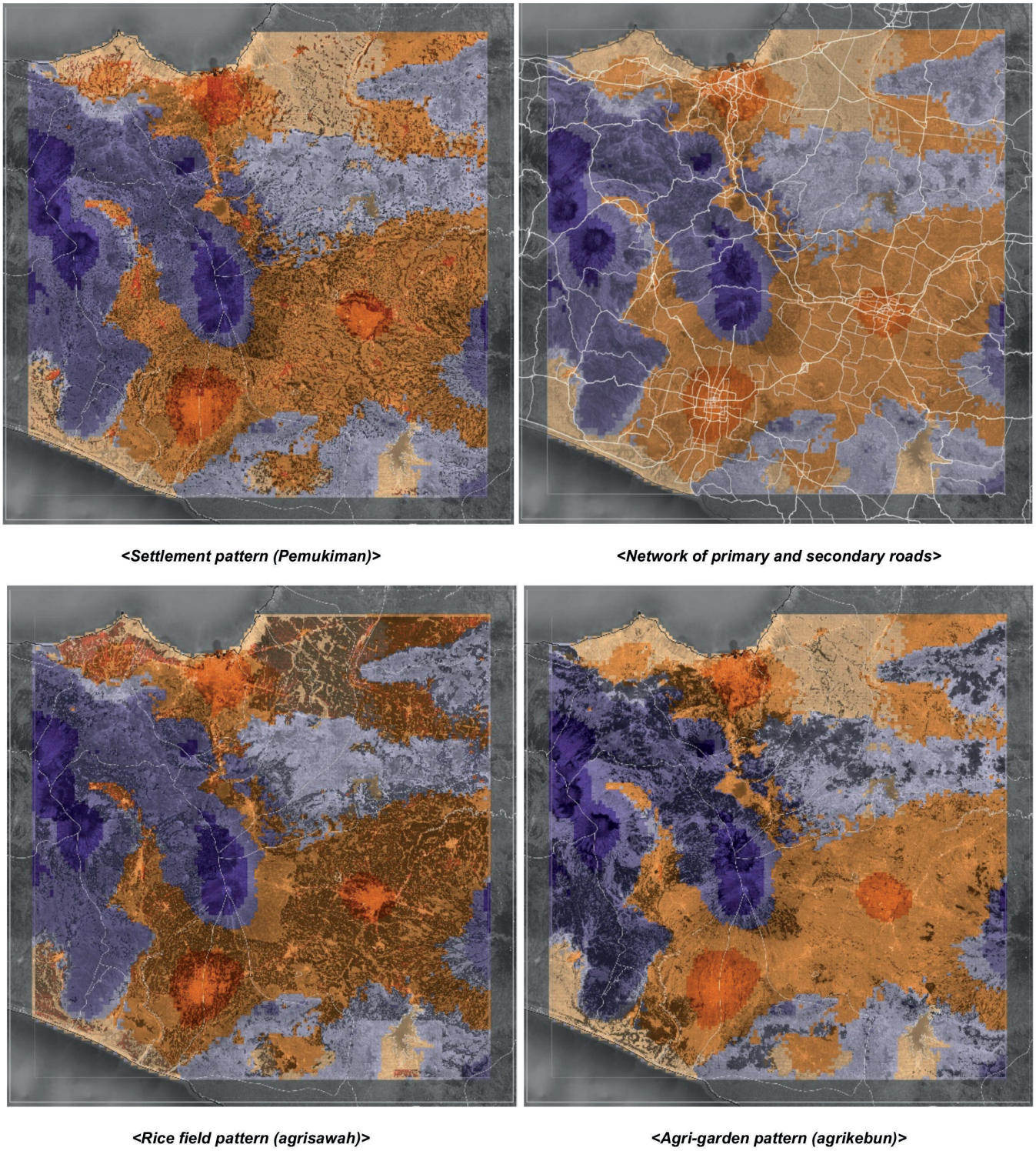

Figure 3. The result of RGB cluster focused on the 130km x 130km of Central Java region with overlapping the different land-use covers. It is identifiable that the rice fields intersect with the cluster 4, the orange pattern of dispersed urbanisation areas, while the agricultural gardens overlap with cluster 2, the purple pattern of mountain villages. (*source*: aerial images from Google Map; land cover data from Ina-Geoportal)

Interpretation of population and road densities indicates the ongoing urban development, as well as the potential in future development. Specifically, public works of large-scale infrastructure in developing countries present an opportunity to shape regional development and economic growth, leading to alleviation in poverty (Tambunan, 2008; Seetanah, Ramessur, and Rojid, 2009). Table 3 reviews the statistics on population density and road density for each cluster. The density is not only calculated by area, but also by the number of inhabitants within a respective service capacity. It is evident that cluster 5, the urban core, ranks highest in population and network density, while cluster 1, the mountains, appears to be ranking lowest. These edge outliers are excluded from in-depth interpretation. In terms of service demand and supply, the cluster 3 and 6 have, comparatively, a high primary road network per person, 0.232 and 0.214, respectively. This indicates that within these clusters, that offer good accessibility at the macro level, there is potential for industry to congregate. At the same time, highways contribute to a dissecting of landscape and communities, potentially reducing connectivity for residents. Meanwhile, the high density of residential streets implies the potential of local activities and interaction in space. Cluster 4, the dispersed urbanisation area, has the highest density of residential streets with respect to both area-base and service-base followed by cluster 5. Therefore, these clusters can be strategically linked with empowering grassroots communities to attract the participation of multiple stakeholders.

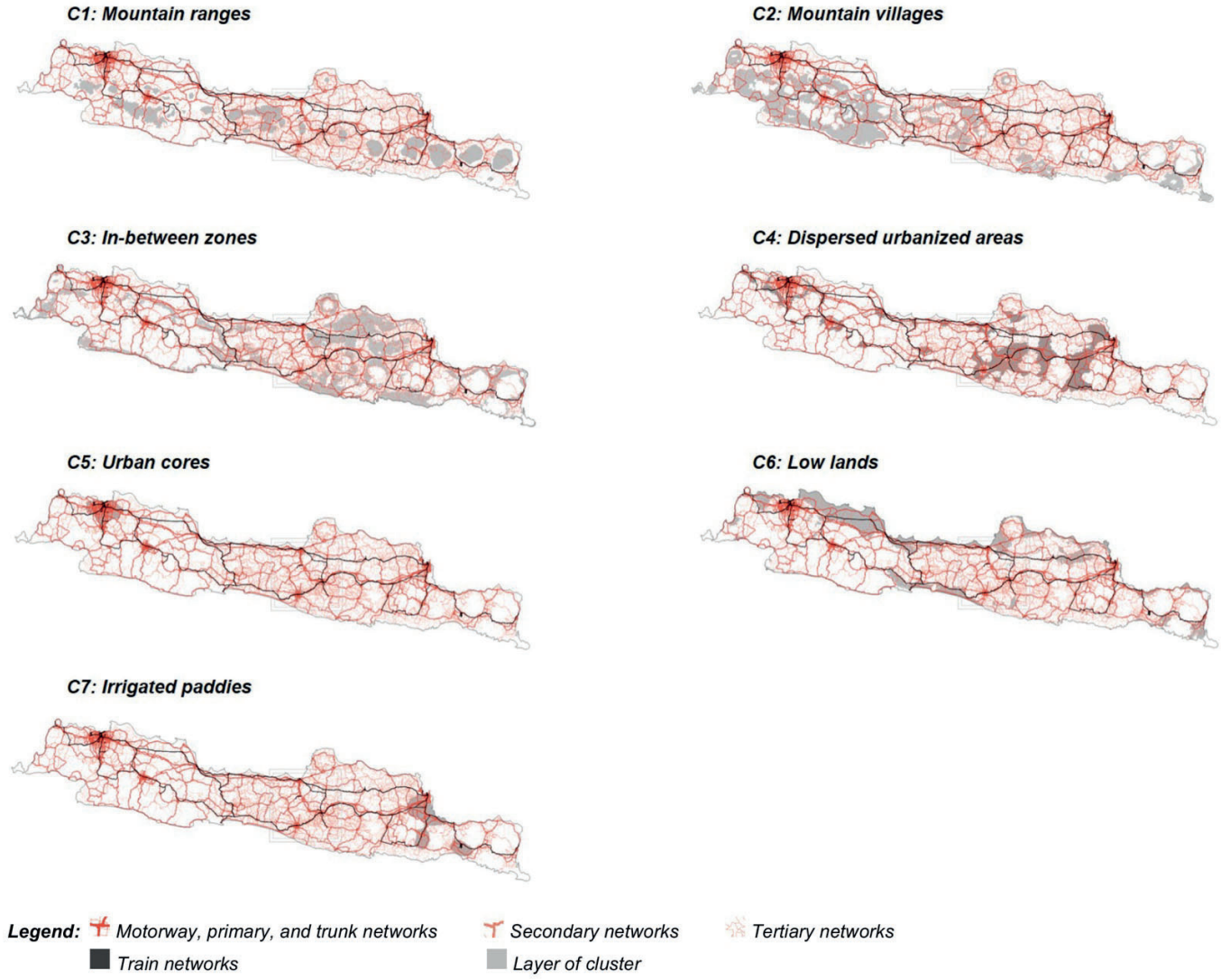

Figure 4. The comparison of major infrastructures layered on each cluster. (*source*: road networks from OSM articulated by QGIS)

Table 3. The statistical summary of population and road networks for each cluster.

		C1: Mountain ranges	C2: Mountain villages	C3: In-between zones	C4: Dispersed urbanized areas	C5: Urban cores	C6: Low lands	*C7: Irrigated paddies*
Area		15,113 km² *(11.86%)*	30,703 km² *(24.07%)*	31,749 km² *(24.89%)*	19,441 km² *(15.24%)*	4,365 km² *(3.42%)*	21,526 km² *(16.88%)*	4,504 km² *(3.42%)*
Population density *(total number)*		**267 /km² (4,047,794 inh)**	591 /km² (181,156,512 inh)	478 /km² (181,156,512 inh)	1,970 /km² (38,307,306 inh)	**9,660 /km² (42,164,391 inh)**	931 /km² (20,031,337 inh)	1,633 /km2 (7,354,220 inh)
Primary road density	*length*	**0.043 km/km²**	0.083 km/km²	0.111 km/km²	0.329 km/km²	**0.902 km/km²**	0.199 km/km²	0.263 km/km²
	service	0.159 m/inh	0.143 m/inh	**0.232 m/inh**	0.167 m/inh	**0.093 m/inh**	0.214 m/inh	0.161 m/inh
Secondary road density	*length*	0.077 km/km²	**0.075 km/km²**	0.113 km/km²	0.216 km/km²	**4.816 km/km²**	0.102 km/km²	0.144 km/km²
	service	0.287 m/inh	0.127 m/inh	0.236 m/inh	0.109 inh/pop	**0.499 m/inh**	0.109 m/inh	**0.088 m/inh**
Tertiary road density	*length*	**0.217 km/km²**	0.248 km/km²	0.338 km/km²	0.653 km/km²	**0.936 km/km²**	0.297 km/km²	0.472 km/km²
	service	**0.813 m/inh**	0.420 m/inh	0.706 m/inh	0.331 m/inh	**0.097 m/inh**	0.320 m/inh	0.289 m/inh
Residential street density	*length*	**0.103 km/km²**	0.152 km/km²	0.145 km/km²	1.072 km/km²	**6.403 km/km²**	0.344 km/km²	0.822 km/km²
	service	0.386 m/inh	**0.257 m/inh**	0.303 m/inh	0.544 m/inh	**0.663 m/inh**	0.370 m/inh	0.503 m/inh

The bold indicates the highest and lowest value in each category. The light grey highlights the second highest value in each road density category, while the darker grey demonstrates the second lowest value.

Overall, Central Java, which is the study area of the overarching Metro Java 2045 project, is undergoing widespread urban transformations (Handayani, 2013). The government aims to upgrade the road system to become a network of tollways between Semarang and Yogyakarta, potentially forging a future urban belt. The cluster analysis at the regional scale for Central Java unlocks an embedded pattern, which broadly coincides with the 'one-hour city' corridor as explored in a parallel study[9] of the Metro Java 2045 project. It can be expected that a trait of contiguousness can be found along the western segment where urban areas agglomerate (dark orange). This intriguing correlation will be further explored in ensuing steps of the project, with the aim to formulate an alternative development vision and planning strategy for the region.

4. Discussion: A call for benchmarking contiguousness

Central Java is one large, fairly discrete landscape system. Metro Java 2045 departs from the observation that the more progressive models that planning theory prescribes (i.e., integrated, compact, collaborative, scenario-driven) are hard to implement in populous, agrarian societies undergoing a leapfrog transition towards globalised urban economies. The fluid topological field of urban drivers that is emerging on the regional scale, abnegates the bureaucratic silos typical of centralised planning cultures and the rigid templates of commercial 'best practices.' In response, the young crossover discipline of environmentalism-meets-urbanism is generating a myriad of loosely related methods and tactics. Early design compendiums, such as 'Ecological Urbanism,' shed light on the plethora of disparate interventions that are currently on the table (Mostafavi, Mohsen and Doherty, 2016). Land use integration offers a means to prioritise them. As land is a finite and increasingly scarce resource, its value should be assessed within a matrix that weighs both economic and environmental criteria.

In emerging markets, where volatile land transmutations are common, land use integration is most pertinent and efficacious. However, land use strategies are rarely on the agenda (Verhaeghe & Zondag, 2009). This raises two long-term concerns: first, once urban land use patterns are largely consolidated, so become the embedded energy patterns related to city operations and user behaviour; second, despite planning, path dependence of urban systems drives its fragmented configurations towards more fragmentation. As Alain Bertaud notes, beyond 5 million inhabitant cities will likely fracture (Bertaud, 2018). Growing concerns for the future of Java's desakota will inevitably put land use integration on Indonesia's agenda – ideally sooner rather than later.

The clusters comprise a taxonomy of regional landscapes that offers practical insights, by attributing surface areas to point data. The common landscape characteristics within each cluster allow planners to respond with area specific strategies that can unfold at regional scales. To incorporate the critical role of water within the landscape (relating to draughts or flooding, as conduits of nutrients and pollutants, etc.), the land use clusters can be further refined by intersecting them along the borders of local watersheds (Figure 2). The resultant regions introduce an effective size for community-centred planning. Within these agglomerations are concentrations of a handful to several dozen villages. Their landscape and ecological commonalities allow for spatial strategies to be formulated around shared challenges, that extend beyond each individual village. This should aid in formulating spatial strategies, that are informed by specific landscape conditions but can scale up to apprise national policies and planning objectives. First, to achieve more resilient land use systems, based on the premise that land use integration is a critical benchmark for mediating Java's diverse mix of peri-urban functions. Second, aligning national objectives of economic growth, poverty reduction, and self-sufficiency through infrastructure, and urban-industrial development with local objectives of cultural, agricultural, and landscape heritage preservation. Similarly, the clarity that the meso level clusters offer, transferred from the regional macro level, should aid local communities to build alliances around shared challenges, circumventing current 'tragedy of the commons' scenarios. During 'Metro Java 2045's final stage of fieldwork, the practical efficacy of this method will be put to the test.

[9] Mars, N. & Pfaender, F. (2021, November). *The Java Model – a time-weighted network analysis of the desakota*. [preprint]. The Evolving Scholar, IFoU 14th Edition.

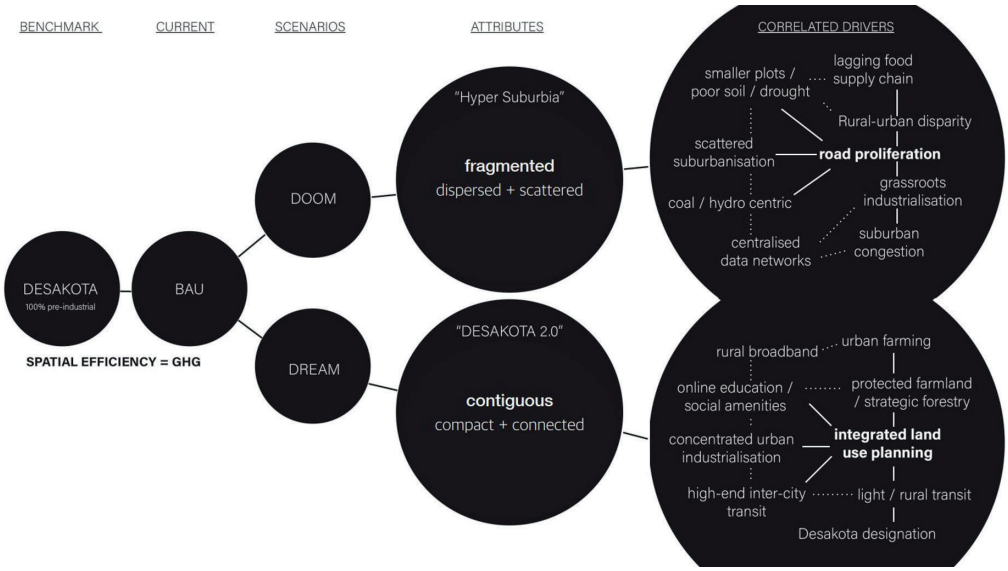

Figure 5. The pre-industrial desakota as benchmark for dream and doom scenario (*source*: Authors)

5. Conclusions

Beyond the hazards of megacity Jakarta, Java island is characterised by a heterogeneous lattice of rural communities, the desakota. Though being rural, this unique landscape typology maintains city-level densities across the entire island of 145 million inhabitants. As Indonesia's government rolls out its 2045 infrastructure and development projects, this presents a palpable predicament; central planning schemes fail to adhere to the intricacies of local socio-spatial geographies. In a context where 'affordances' rather than regulations drive urbanisation, both formal and informal urban incentives can undermine the innate integrity of the desakota. This underscores the need for integration.

This research introduces the RGB-cluster model as an approach to map contiguousness at the meso level for mixed-use landscapes. Our data support the integration of macro-level spatial analyses and micro-level collaborative planning strategies. The land use clusters advance this objective by introducing a strategic intermediary level of planning analysis, which is currently largely absent. Furthermore, the heterogeneous, intricately connected land use patterns are introduced as a structural quality of the desakota, while at once complicating higher scale planning objectives. The ability of land use cluster analyses to interpret larger patterns within this spatially complex system allows us to frame regional planning projects around the new metric of contiguousness.

During the final stage of the project, we aim to conclude with an overview of the challenges urbanists face when operating across scales and methodologies; how can the planner-mediator apply dialogue to tackle the planning predicaments typical of peri-urban regions undergoing rapid transition? These cluster model integrating urban-rural continuum allow for a tailor-made response organised around collective spatial challenges, rather than political boundaries. This approach should facilitate the scaling up of strategies from the local to the regional level. Transitioning between scales, methods, and understandings will be the challenge of the project, which will be documented and critically observed throughout the research process.

Contributor statement

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Innovation-oriented Border Region Development: Planning Strategies for Mutually Beneficial Urban Development between Shenzhen and Hong Kong

Keyi CHEN [1], Nai Hui Casey WANG [2] and Jeroen VAN AMEIJDE [3]

[1] School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; keyi.chen@link.cuhk.edu.hk
[2] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; casey_wang@blend-arch.com
[3] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305

Abstract: In recent years, numerous studies have shown that the Regional Innovation System (RIS) approach can make important contributions to the generation of innovation and economic development. Additionally, the key role of Higher Education Institutions (HEIs) in innovation systems has been increasingly acknowledged. Amidst the regulatory changes and ongoing economic progress of the region, the future of the Hong Kong-Shenzhen border region is bound for transformation, but there is a lack of research on its potential development. This study explores RIS theories and analyses the current development status and existing challenges around Hong Kong-Shenzhen cross-border collaboration. It analyses examples of innovation-oriented urban planning strategies and summarizes the key planning, urban design, and management principles that nurture innovation ecosystems comprising of multiple types of stakeholders. Applying these principles to the Lok Ma Chau section of the Hong Kong-Shenzhen border region, the study explores a mixed-use urban planning model that shapes innovative forms of live-work environments, which can attract talent and investment. It concludes that regional economic development can be supported through strategic infrastructure that supports businesses, as well as localised improvements in the quality of living.

Keywords: regional innovation system; cross-border cooperation; higher education institutions; Hong Kong; Shenzhen

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1. Introduction

In recent years, numerous studies have shown that the regional level plays a significant role in the generating new knowledge and economic development. The Regional Innovation System (RIS) approach has made an important contribution in this respect, highlighting the importance of spatial proximity and favourable institutional structures for innovation activities (Trippl, 2010).

Additionally, Higher Education Institutions (HEIs) are becoming increasingly important in innovation systems (Etzkowitz, 2008; Kruss et al., 2015). Universities play an important role in the creation, dissemination, and use of knowledge (Kruss et al., 2015) and knowledge-based economies (Mansfield, 1991), and contribute to educated workforces (Pillay, 2011). From the perspective of RIS, they are indispensable elements in a region, providing knowledge, resources, and human capital (Arbo and Benneworth,

2007). However, research has concluded that the contributions of universities are mainly successful in regions with a good foundation for innovative industries (Segal, 1985; Lawton Smith et al., 2003; Lawton Smith et al., 2005; Tian Miao et al., 2015). This synergy might not be achievable in less-developed areas such as border regions.

Shenzhen and Hong Kong are facing economic restructuring and there is an urgent need for technological innovation. Although Shenzhen has well-established innovation and Research & Development (R&D) industries, it has encountered challenges in the development of its higher education industry, which limits the development of its innovation system. Compared with Hong Kong, Shenzhen has fewer HEIs. In contrast, Hong Kong has strong local HEIs, but weak industrial R&D (Kang & Jiang, 2020). Under such circumstances, the two cities have the potential to complement each other. What's more, in the existing literature on local innovation systems in Hong Kong and Shenzhen, discussions on the role of HEI in local innovation systems are largely restricted to local HEI (e.g., Cai and Liu, 2014; Chen and Kenny, 2007; Wang, Lin & Li, 2010), there is a lack of research on border regions.

By 2047, the Shenzhen-Hong Kong border will cease to exist. This will also mean the revision of the "one country, two systems" policy. Hong Kong and Shenzhen can move towards integration, but how this will affect the border area is still unknown (Bolchover and Hasdell, 2009). Although each city has its own vision for cooperation, there is no unified vision plan to coordinate the development of the two cities. To address these knowledge gaps, this research explores existing literature on innovation system and analyses the current innovation systems in Hong Kong and Shenzhen, which are adjacent but significantly different.

2. Regional Innovation System Theories

Haken (1984) first proposed the theory of synergy in "The Science of Structure: Synergetics." He believed that synergy is within an open system, each subsystem spontaneously forms an orderly structure in time, space, and function through synergy. Since then, the 'collaborative theory' has been applied to the field of innovation research, and the 'collaborative innovation theory' has emerged. Recently, the 'triple helix theory' has been introduced to further improve the theory of collaborative innovation, pointing out that "government-industry-university-research cooperation is the 'third mission' of universities and research institutions in addition to teaching and scientific research." The 'University-government-enterprise' model can improve resource integration and collaboration between different types of stakeholders, and in successful cases of this model, the collaboration leads to the different entities independently implement innovations (Etzkowitz, 2003).

However, with the rapid development of society and the continuous optimisation of innovation models, the limitations of the traditional triple helix theory have gradually been exposed (Zhang & Huang, 2013). Civil society as new innovation entity is included in the innovation system, and the triple helix model has developed into a quadruple helix model based on 'government-enterprise-university-civil society.' This new model pays more attention to the innovation environment and participation of the public and has a clearer division of functions for each innovation entity. The government acts as coordinator and is responsible for the operation and regulation of the system and the construction of the innovation environment; the enterprises are responsible for technology research, improvement and transformation of innovation, and universities and scientific research institutions are responsible for basic research and development and the cultivation of innovative talents (Wu & Shen, 2014); civil society is responsible for using products and giving timely feedback.

Early research on Regional Innovation Systems (RIS) mainly focused on national innovation systems. In 1987, Freeman defined the national innovation system for the first time. He proposed that the national innovation system is an organisational system composed of various enterprises, related industry institutions and various public sectors, and has certain innovative functions (Freeman, 1987). After the concept of the national innovation system was put forward, an upsurge of innovation system research was set off worldwide (Qi, 2021). Cooke (1998) of the University of Cardiff in the UK first expounded the concept of the RIS in the book "Regional Innovation System: The Role of Governance in a Globalized World." He posed that a regional innovation system is a system of

geographically distributed, interconnected production enterprises, research institutions, and higher education institutions, and this system supports and generates innovation. Asheim and Isaksen (1997) argue that a regional innovation system is a regional cluster composed of supporting organisations around two types of actors and their interactions. The first category of main actors are industrial clusters and related supporting industries in the region; the second category contains institutional infrastructure including universities, research institutions, technical intermediaries, industry associations, and financial institutions (Asheim and Isaksen, 2002).

3. Precedents and Case Study Analysis

The study presented in this paper started with research into the current composition of innovation systems in Hong Kong and Shenzhen. It then conducted an analysis of two precedent case studies that included innovation-oriented urban planning strategies that achieved economic and cultural collaboration. Based on these precedents, planning principles, and design guidelines for innovation ecosystems were formulated. The second part of the study consisted of site research for the Hong Kong and Shenzhen border region, collecting relevant information on the urban processes and structures in this region, including land use planning, transportation networks, infrastructure, and surrounding environment, as well as social and economic activities on both sides of the Shenzhen River. The final stage of the study explores a strategic development scenario for a case study site at Lok Ma Chau, defining an urban planning mechanism that could support the cooperation between the two adjacent innovation systems.

3.1. Existing Innovation Systems in Hong Kong and Shenzhen

Based on further literature research, the current strengths, and opportunities for strategic improvement within the existing innovation systems in Hong Kong & Shenzhen can be formulated.

Hong Kong: An international financial metropolis

The Hong Kong government's initiative to promote innovation is mainly to provide an intermediate platform to connect different stakeholders and provide financial policy support to improve government efficiency. To further promote the development of innovative technologies, Hong Kong established the Innovation and Technology Commission (ITC) in 2000 and the Hong Kong Science and Technology Park (HKSTP) in 2001. In 2015, the Innovation and Technology Bureau (ITB) was set up to strengthen the connection between various stakeholders and generate greater synergy (ITB, 2017). In parallel with the establishment of innovation-related departments, the Hong Kong Government is committed to strengthening investment in the innovation and technology sector (Chan, 2017, 2018). As of March 31, 2021, the government's financial support for innovation and technology had reached 10,071.5 million HKD (ITF, 2021). The government has also formulated a technical talent introduction plan, which aims to supports qualified companies to invite overseas and mainland scientific and technological talents to come to Hong Kong for research and development work through fast-track processing arrangements (ITC, 2020).

Hong Kong has advanced higher education, but its R&D industry and innovation are relatively weak. According to government statistics (Tables 1), about 93% of Hong Kong's GDP comes from the tertiary industry (HKSAR Census and Statistics Department, 2019), which reflects the single and strong dependence of Hong Kong's economic structure. It is this unbalanced economic development that has weakened Hong Kong's performance in innovative technologies. Compared to Shenzhen, Hong Kong's expenditure on innovative industries and its proportion are also lagging behind (Wang, 2018). In 2019, Hong Kong's R&D expenditure (US $3387 million) was only about 20% of that of Shenzhen (US $20543 million). In addition, Hong Kong's expenditure on innovative industries as a percentage of GDP (0.92%) is approximately 22% of Shenzhen's (4.2%) (Shenzhen Bureau of Statistics, 2019; HKSAR Census and Statistics Department, 2019). On the contrary, the higher education sector in Hong Kong has excellent universities and plays an important role in innovative research and development activities. Of the eight government-funded universities in Hong Kong, five of them are ranked in the top 100 in the 2021 QS World University Rankings. This shows that the research capabilities of universities of Hong Kong are globally competitive (QS, 2021).

Table 1. Hong Kong's industrial structure

Industrial structure	2018	2019
Secondary industry	6.9%	6.6%
Tertiary industry	93.1%	93.4%

Table 2. Shenzhen's industrial structure

Industrial structure	2018	2019
Secondary industry	39.6%	39.0%
Tertiary industry	60.3%	60.9%

Shenzhen: An innovation city

Compared to Hong Kong, Shenzhen's higher education industry is less developed, which restricts the development of its innovation system. In order to solve this problem, the Shenzhen Municipal Government has implemented strategies of cooperation with regional and international universities, increasing investment in higher education industries and formulating incentive policies to attract talent (Kang & Jiang, 2020). In 2000, the Shenzhen Municipal Government issued the first policy – "Regulations on Encouraging Overseas Chinese to Start Businesses in Shenzhen" to encourage overseas Chinese to participate in the development of Shenzhen (Shenzhen Municipal Government, 2007). In 2010, the Shenzhen Municipal Government launched its own overseas high-end talent recruitment program, called the "Peacock Plan." The purpose of the program is to recruit outstanding innovative talents and advanced research teams from abroad to Shenzhen, with the expectation of developing the local economy and industry through innovative technologies (Shenzhen Municipal Government, 2011). In 2020, the programme had introduced a total of 162 peacock teams and innovative scientific research teams (Shenzhen Municipal Government, 2020). Established in 1999, the Shenzhen Virtual University Park is an Industry-University-Research innovation park in accordance with the "one park and multiple schools" model. To attract more universities to join the SZVUP, the Shenzhen government provides preferential policies for joining universities. So far, a total of 60 renowned universities, including 44 universities in Mainland China, six universities in Hong Kong, and seven international universities, have joined the initiative (SZVUP, 2012).

3.2. Precedents

By analysing two international precedents of innovation ecosystems, it is possible to extract insights on the measures, management mechanisms, and experiences that could apply to future Hong Kong and Shenzhen innovation and integration projects. The case studies were chosen because of their multi-facetted nature, combining a range of stakeholders, policies, and supporting infrastructures which have resulted in a proven track record of successful incremental growth and productivity gains. While these precedents do not involve cross-border collaboration, they offer valuable insights applicable to a future Hong Kong-Shenzhen border region managed within a context of increased governmental alignment.

High Tech Campus Eindhoven (HTCE), the Netherlands

The Eindhoven High Tech Campus was once the location of the R&D headquarters of the Philips Group in the Netherlands. Within only five years, the initially closed R&D centre had transformed into an open science and technology campus, thanks to the forward-thinking policies and collaboration between government, university and local companies. In 2015, the area was named 'the smartest campus in the world' by *Forbes Magazine*. The experiences around the planning, design, and management of the Eindhoven High-tech Park offer valuable lessons for innovation campus development projects in Hong Kong and Shenzhen border region:

i) *Giving leading companies a powerful driving role:* This project was anchored around leading institutions such as Philips and the Eindhoven University of Technology (TU/E), a top research university in Europe. The leading role of these institutions attracted a range of other technical

institutions, small and medium-sized enterprises, and created a collaborative ecosystem of research and innovation entities and supporting infrastructure.

ii) *Creating an open environment and promote resource sharing:* The most successful part of its planning was to implement urban design and architecture strategies that create an open environment that promotes resource sharing. Besides this open campus environment, the district promotes resource sharing through knowledge sharing events, shared facilities and organisations that actively pursue collaborative research activities.

iii) *Increased services:* the campus was supported by dedicated government services to streamline and optimise the processes of company registration, recruitment, and settling in of talented people, and to protect research outcomes, and help bringing innovations onto the market. A wide range of functional and social support functions is located in the area, including banks, print ships, restaurants, meeting rooms, health and fitness centres, etc.

Aalto University Regional Innovation Ecosystem

Aalto University is located in Espoo, an area in the metropolitan area of Helsinki that is famous for high-tech manufacturing. The university has created an innovation and entrepreneurial (E&I) ecosystem based on its inherent regional innovation advantages. The development model focuses on student entrepreneurship and supporting start-ups. As a result, Aalto University is now the birthplace of several highly productive innovation and entrepreneurial companies in Finland. Some of the mechanisms for success are the energetic student-led entrepreneurial movement, supported by the university's senior leadership team (Graham, 2014). Learning from Aalto University's successful experience in building a Finnish innovation and entrepreneurship ecosystem, and evaluating the existing conditions in Hong Kong and Shenzhen, the following recommendations can be distilled:

i) *Breed a positive innovation environment:* local governments can promote the introduction of high-quality services, resources and human capital into the regional innovation system through targeted initiatives and policies. Enterprises are invited to work together to connect supply chains, exchange experts, and expertise, and together create a multi-level network of innovative companies.

ii) *Encourage public participation:* Aalto University's innovation and entrepreneurship ecosystem encourages the integration of regional public cultures, media, and people. On one hand, this creates and open and supportive atmosphere for education, innovation, and entrepreneurship to promote the long-term sustainable development of the innovation industries. On the other hand, the increased public discourse and information dissemination helps the government to plan innovation and entrepreneurship strategies through timely information feedback, so as to achieve collaboration between universities, governments, innovative enterprises, the public and other stakeholders.

iii) *Establish a deregulated and decentralized governance model:* The model promoted by the Finnish government provides an enabling environment for Aalto University and the enterprises within the area. Aalto University enjoys a high degree of decision-making power and autonomy, and this bottom-up model is conducive to cooperation and consultation between university and companies, and to the connectivity of the innovation and entrepreneurial ecosystem to the outside world.

3.3. Research into the Hong Kong and Shenzhen border region

The Hong Kong and Shenzhen Cross-border Area (Frontier Closed Area) was established by HK-British government in June 1951. It was set up to prevent illegal migration and other illegal activities from mainland China and elsewhere. Because of the strict control and lack of human activities, the cross-border area became a natural habitat

for flora and fauna. In 2008, the Hong Kong government reduced the Cross-border Area to 400 hectares, freeing up a large vacant area with a high potential for development.

Urban form and land use

In relation to urban form and land use, analysis shows that the Luohu and Futian Districts in Shenzhen are already highly developed, densely populated, and urbanised areas. in contrast, the border areas of Hong Kong are dominated by natural landscapes such as farmland and villages, and some relatively isolated new towns. In terms of land use, the Futian Financial Centre and the Luohu Commercial Centre in the border area of Shenzhen are mainly commercial and residential. In contrast, Hong Kong's border areas are mainly residential land and rural land (Figure 1). Generally, the urban fabric and land use in the border areas of Shenzhen and Hong Kong are quite different, and the boundaries are obvious.

Transport networks

Shenzhen has formed a comprehensive road network extending in all directions, and the roads are further extended to the Shenzhen-Hong Kong border region. However, due to the restrictions on movement across the Hong Kong border, the road network does not have a good connectivity across the border region. Shenzhen's subway network covers the city's main urbanised area and also several of its recently emerged satellite nodes. Hong Kong's northern New Territories are relatively sparsely served by MTR lines, with the East Rail Line and West Rail Line mainly serving many of Hong Kong's new towns. Currently, Shenzhen and Hong Kong have two interoperable cross-border railways. The first is the East Rail Line, which connects Hong Kong and mainland border crossing at Lowu/Luohu and Lok Ma Chau/Futian Checkpoint, and the second is the Hong Kong-Shenzhen-Guangzhou High Speed Rail, which connects Shenzhen Futian Station and Hong Kong West Kowloon Station (Figure 2).

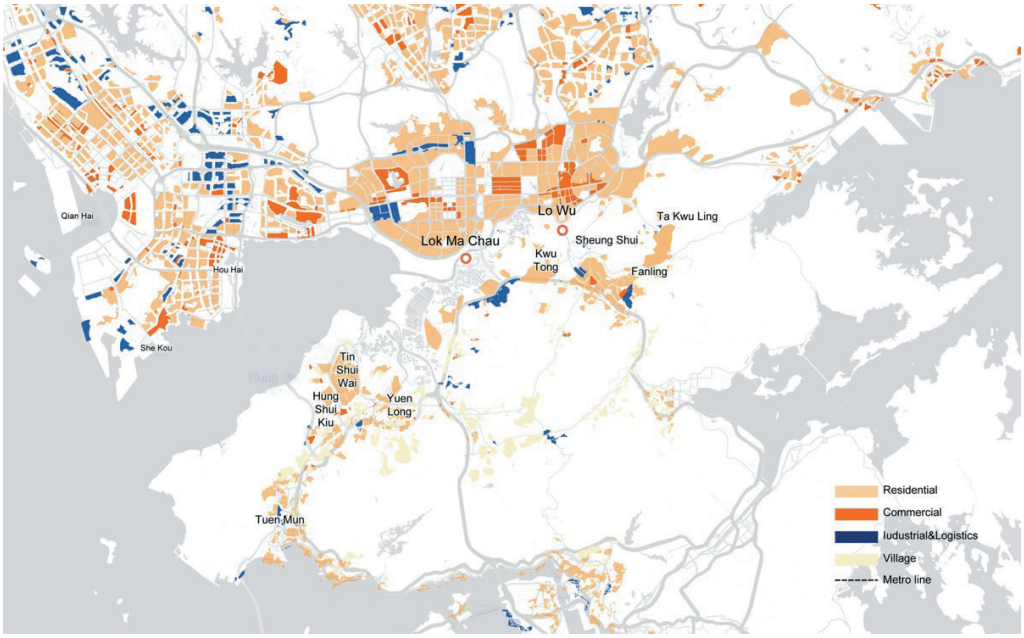

Figure 1. Imbalance of urban form at the Hong Kong & Shenzhen Border

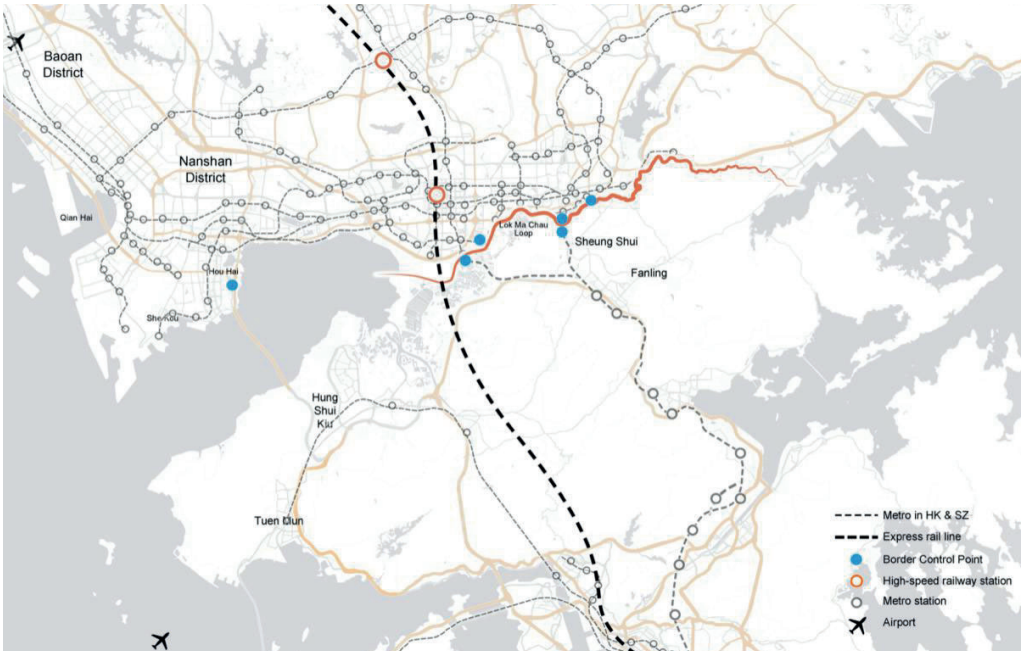

Figure 2. Transport networks at the Hong Kong - Shenzhen Border

4. Strategic Development Opportunities

Based on the above analysis of the border region between Shenzhen and Hong Kong, the Lok Ma Chau Loop and Shenzhen Huanggang Port areas were selected as the site to test strategies to implement a cross-border innovation district at the urban planning and urban design levels (Figure 3). The Lok Ma Chau Loop is close to the Huanggang and Futian ports, which are the two main ports connecting Hong Kong and Shenzhen. The site is close to the Futian Central District, which is the commercial, financial and cultural centre of Shenzhen. It was created by the rerouting of Shenzhen river, and is already planned to be developed into a collaborative technology and innovation area. The area has a strategic location along the newly planned 'development corridors' in between Hong Kong and Shenzhen, connecting to a major transit hub in the integrated infrastructure networks of the future Greater Bay Area. The implementation of the Lok Ma Chau technology area has suffered delays due to regulatory differences and other organisational difficulties, which are projected to be increasingly manageable as further connective infrastructures and economic and institutional collaborations are being developed.

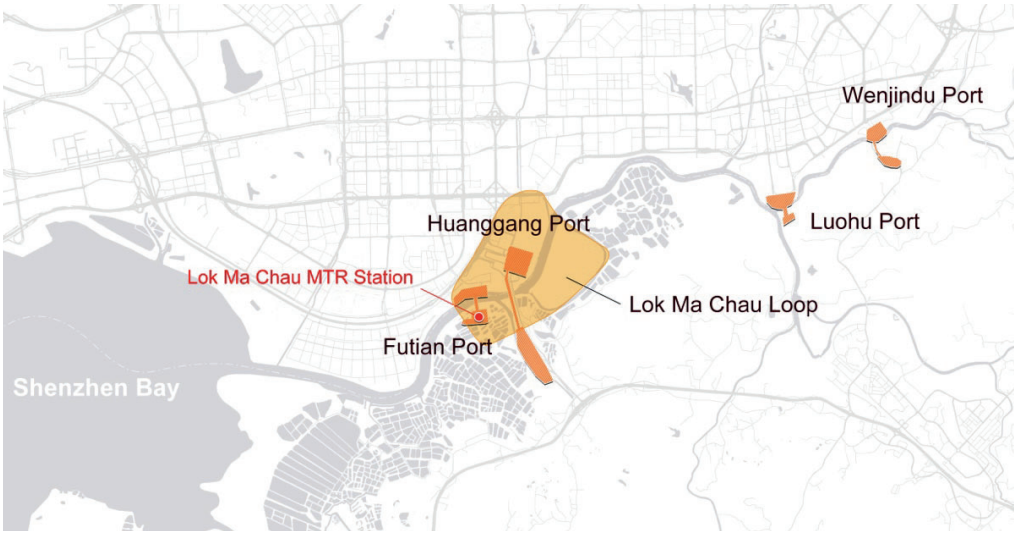

Figure 3. Case study site around the Lok Ma Chau Loop area

4.1. Planning principles

Based on the insights from the literature and case studies around Regional Innovation Systems, strategies for the translation of border region collaboration principles can be translated into planning principles. The principles are aimed at expanding and strengthening the Hong Kong-Shenzhen innovation ecosystems, facilitating high-level cooperation strengthening the region's international competitive position. Following the examples of the High-Tech Campus Eindhoven and Aalto University's innovation ecosystem, and adapted towards the regional characteristics and local conditions, this study proposes a specific implementation path for a new Shenzhen-Hong Kong cross-border innovation ecosystem.

Form a Shenzhen-Hong Kong co-city coordination and management mechanism

The first measure would be to facilitate facilitating high-level cooperation, identifying strategic partner collaborations and formulate policies, infrastructure, and support programmes from the government-level point of view. It would be recommended to set up a Hong Kong and Shenzhen science and technology cooperation department to coordinate and handle the multi-faceted approach to promote innovation and collaboration between the different territories and stakeholders.

Expand the role and services of local government

The second measure should involve the creation of additional policies, programmes and incentives to optimise access to the area for new enterprises, scientific research institutions, and regional and international talent. As it is important to support a dynamic sector, government services should be accessible or implemented with high speeds and efficiency. Policies should be put in place to encourage enterprises, scientific research institutions, and universities to open up to the outside world, to build an "open innovation and collaboration platform," and create a mature innovation ecosystem that creates a supportive, creative, and progressive atmosphere.

Stimulate industrial clusters to improve the efficiency of the regional innovation system

As innovation is not isolated, but tends to occur in clusters (Qi, 2021), it would be recommended to establish the first clusters of leading companies into the innovation area and promote their leading role to attract small and medium-sized enterprises to join the growing cluster. Government support and special arrangements could be made with these "anchor-institutions," to kick-start the gradual emergence of an ecological development model of "large enterprises + small and medium enterprises + scientific research institutions + universities" (Qi, 2021).

4.2. Urban Environment Qualities for a Contemporary Innovation District

In the final stage of this study, the economic and governmental policy ambitions formulated around the goals of creating an innovation ecosystem were translated in spatial urban planning and urban design goals. This translation from planning to urban neighbourhood qualities helps to explore the spatial mechanisms such as function mixture, density, infrastructure, and public services planning to help the innovation area become successful as an urban environment that is attractive and supportive for companies and institutions, as well as for the people that work for these.

An Urban Infrastructural Framework

One of the first and most important urban planning related design challenges is to design a comprehensive spatial framework that can serve as an open platform and support network for the institutions and people moving into the innovation area. Instead of planning a car dominated urban district where road infrastructure takes priority, a wider system of traffic, business and social infrastructures should be designed that enables flexibility, collaboration, and liveability. In the case study application (Figures 4 and 5), the theoretical model of the 'mat-building' was referenced to envision a combined urban system of slow traffic roads, public transport, public spaces, and blue/green landscape features. The grid system was adopted to ensure a market-driven flexible provision land-leasing, also promoting function mixing within each plot and vertically within buildings. Integration with existing rail stations is key to ensure seamless connectivity with the urban context.

Human-centric Urban Design

As the key success factor for innovation districts is the attraction of talented people and their families, the emphasis of the urban design strategy is liveability. The area will not only spaces for work, but also for living and recreation, and offering high quality and varied urban spaces. Walkability is ensured by reducing and hiding car roads and car parks, creating small urban plots intersected by alleyways and courtyards, and generous greening, seating, street-facing retail, coffee shops, and restaurants. Existing assets such as waterfront areas can be turned into large parks to offset high-density urban neighbourhoods with high-quality natural environments and recreation. Investment in design, construction, and maintenance will ensure the attraction and interaction of high-value companies and institutions, and can support international and local talents to stay and grow, together with the development of the district over time.

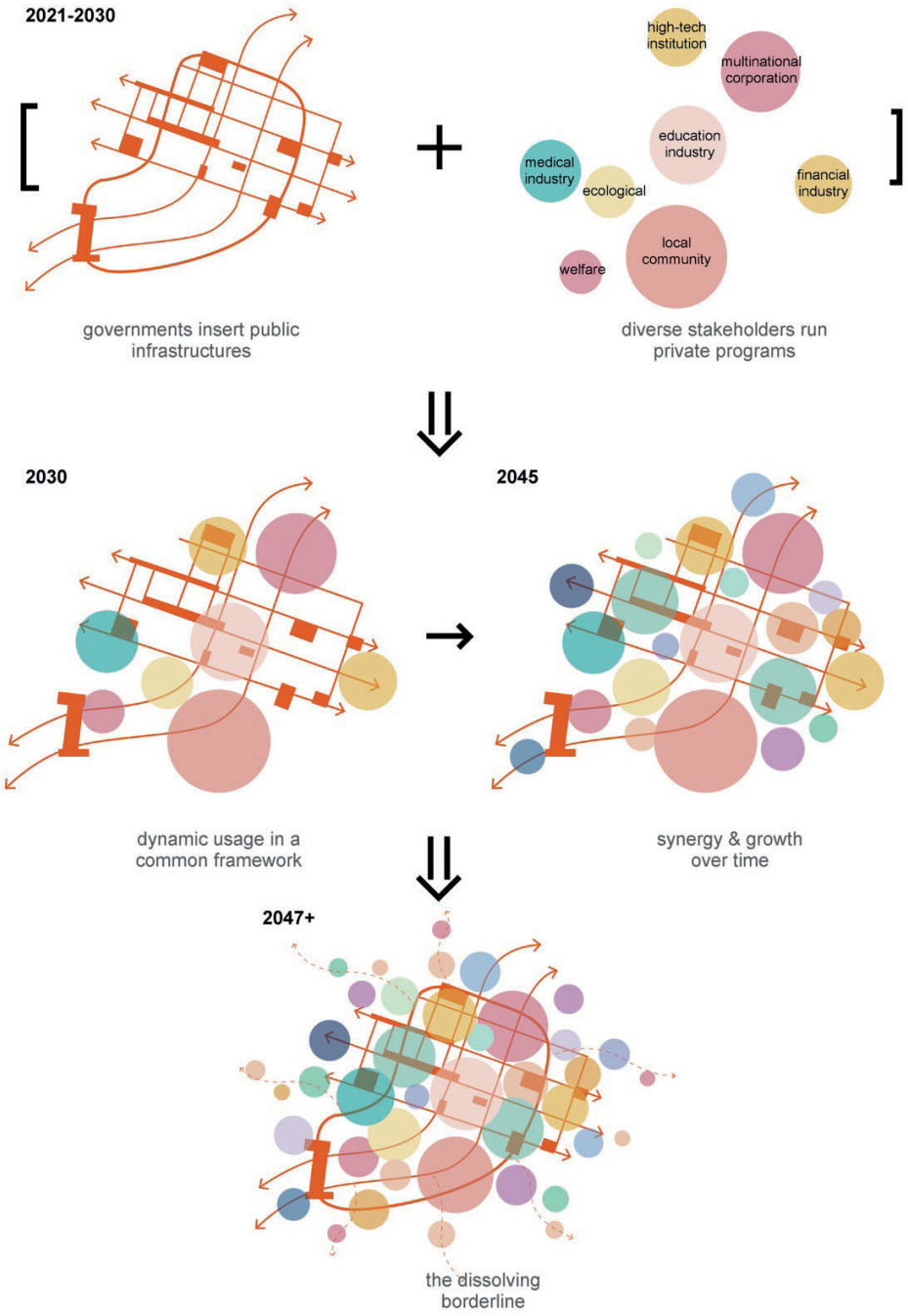

Figure 4. Strategy framework

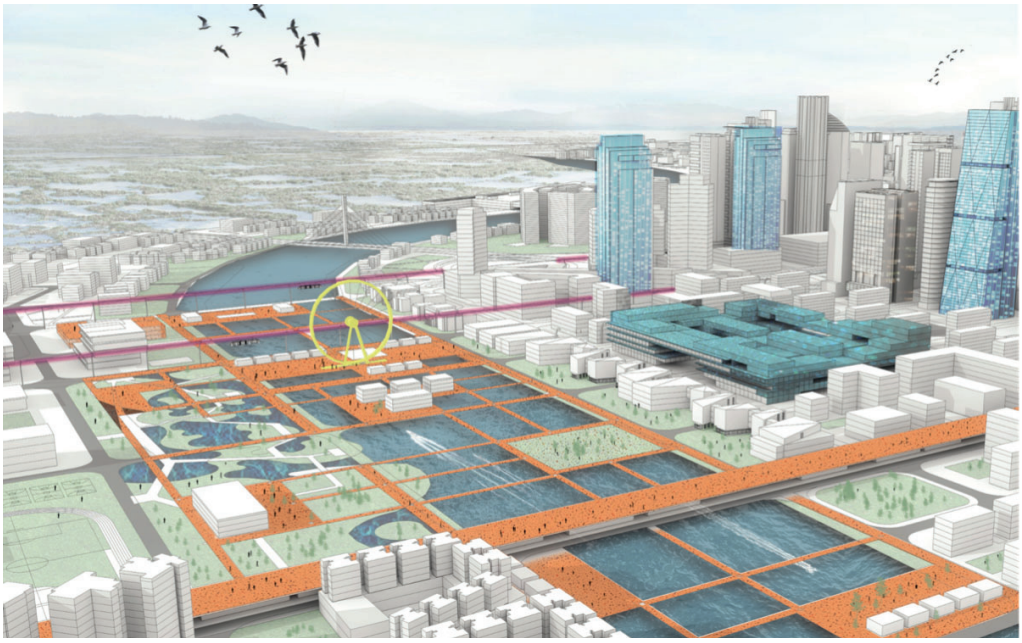

Figure 5. Speculative rendering of the new live+work environment

5. Conclusions

This study has explored the theoretical principles and precedents of Regional Innovation Systems, outlining how planning strategies, urban design measures, and supporting policies can nurture multi-stakeholder ecosystems that achieve innovation through collaboration. As Shenzhen and Hong Kong may see increased regulatory alignment and governmental cooperation in the future, the promotion of their technology and innovation sectors will be a strategically important collaborative opportunity. With the economic development of the Greater Bay Area, the expansion and evolution of knowledge and research-based enterprises requires support from Higher Educational Institutions and government initiatives. The border region, currently regarded as a 'back garden' by both Shenzhen and Hong Kong, is a place with high development potential. Attracting key new industries, research institutions, and talented people to this area could enhance the competitiveness of Hong Kong, Shenzhen, and the Greater Bay Area on the world stage.

From analysing international precedents of Regional Innovation Systems, it has become clear that successful examples of these systems involve leading institutions and companies, which are able to drive policy and development decisions in close collaboration with local government bodies. Planning, urban design and architectural strategies for innovation areas should not only focus on quantitative goals and branding, but incorporate progressive attitudes towards creating human-centric, open urban environments that promote interaction between different stakeholders through shared spaces and facilities. A comprehensive and service-oriented government-led urban infrastructure system could form a 'framework' for adaptive stakeholder-led development over time, incorporating transport and business infrastructure, as well as social and recreational facilities.

When these principles distilled from international case studies are applied to the Shenzhen Hong Kong border region, several challenges and opportunities emerge. The cross-border nature of this area poses difficulties due to the regulatory differences, requiring high-level coordination or the creation of a new governing body dedicated to the new collaborative innovation and technology districts. This co-city management mechanism can establish a pro-active, expanded government role to boost the growth of new R&D innovation industries, and improve the flow of key resources such as personnel, capital, and technology between Hong Kong and Shenzhen. The geographic location of the border region offers key opportunities to develop a sustainable urban district that benefits from its valuable natural environment, to establish a highly liveable working and living

environment in contrast with the highly densified urban areas in Shenzhen and Hong Kong.

The literature on Regional Innovation Systems highlights the crucial importance of policies and initiatives to stimulate a local culture of open collaboration, public engagement, and promotion of technology and innovation within the wider society, establishing close feedback loops between enterprises and the evolving needs and aspirations of the community. When we translate these goals into an urban planning approach for the case study site at Lok Ma Chau, a comprehensive district with high-quality public spaces, facilities, and services is envisioned, and highly connected to the surrounding urban nodes within the polycentric urban region. At the same time, urban planning and design strategies should be calibrated toward establishing a vibrant and mixed-use urban district that can facilitate dynamic growth and change over time, prioritising the needs of the talented individuals who drive the future success of specialised enterprises, research institutions, and start-up companies with a wide range of requirements. A new district for boundary-breaking research and business initiatives warrants an equally innovative approach to urban planning, design, and management, maximising the potential of the cross-border area to become an important alternative place for living and working in-between Hong Kong and Shenzhen.

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Repurposing Peri-Urban Spaces in Delhi

Anam Husain [1], Nisar Khan, Iqtedar Alam and Intekhab Alam

[1] ar.anamhusain@gmail.com; https://orcid.org/0000-0002-3313-2291

Abstract: Sustainable development is linked with issues like inflexible land use, fragmentation, and deterioration of natural systems. Peri-urban regions have become a hotspot for hybrid economies, while on the same hand urban centres have put increasing pressure on natural resources of these areas. This study throws light on how indiscriminate land use conversions give rise to social exclusion. Social exclusion leads to environmental degradation, which in turn affects the livelihoods and resilience of communities. As a result, an argument is made if the same kind of master planning should be followed or a different purpose should be given to these lands? A proposal has been made as an amalgamation of the research and the technique of ecosystem services mapping. This approach consists of understanding the socio-economic relationship with the ecosystem, the trends and patterns, the study of ecological layers, and cluster network analysis. Through this, an alternative zonal plan is created with ecosystem services as the base layer, which supports agricultural services based on alternative economies. The conceptualisation of this research takes root from the possibilities of giving an enhanced meaning to the peri-urban areas of cities and the inclusion of ecosystem services within city planning.

Keywords: Ecosystem services, Urban Rural Linkages, Social inclusion, resilient communities, Peri-Urban

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1. Introduction

Delhi's growth trajectory is a result of liberalisation in economic policies (1991). With this came land acquisition and privatisation trends that shifted the city's poor to the peripheries. The population density per hectare in 1991 was the lowest in the peripheral areas. Land Use Land Cover was also predominantly agricultural and had very little residential density. However, in the past two decades, the peripheral regions have shown a great trajectory in the growth rate without the provision of supporting infrastructures (Koshy, 2018). The hierarchy of governance indicates the presence of urban governance only at higher levels. This top-down decision-making process neglects the needs of local actors and a participatory democratic process concerning spatial decisions, thus showing fragmentation in governance, as well (Koshy, 2018).

Satellite cities lead to fragmentation at a regional scale because the in-between areas are neglected, as they do not serve any benefit except linking places. On the city scale, there are factors like economic nodes, mobility infrastructure, and social segregation based on caste and income groups (Koshy, 2018). This is why the multi-directional sprawl of Delhi has led to its ecological degeneration and underutilisation of natural sources and knowledge. On a peri-urban scale, there is more fragmentation. For instance, accommodation of diverse income groups, a hybrid lifestyle, the maintenance of green belts, and urban development are at conflict with each other (Koshy, 2018). All the trends are creating a state of differentiation and segregation which affects the marginalised and lower-income groups. There is a need to repurpose these regions for better linking of urban and rural to combat fragmentation.

The provisions in Master Plan 2021 are in favour of private developers. Farmhouses have been termed as 'low-density housing' and permitted in the green belt, which will hurt any long-term strategy. The whole model is reactive planning, i.e. to the urgent requirement rather than long-term vision. The zonal plans are also made according to the citywide infrastructure (transport) plans and do not reflect the context of locals. Zonal Development Plan 2021 shows zonal planning of the peripheries in a similar grid system of neighbouring cities like Noida and Gurgaon. The zonal plan disregards the existing agrarian landscape, the livelihoods of the natives, and the ecological services (provisional and regulatory) provided by the region. City expansion and a lack of delineation of specific functions led to the disappearance of the green belt. The green belt protects Delhi from harsh winds and is the major provider of food, reduces the heat island effect, and contributes to the precipitation of Delhi. The Master Plan mentions the preservation of a green belt around the boundary of Delhi, but does not discuss the ecological importance or the services it can provide. It also does not incorporate the existing villages in the green belt. The Green Development Area proposal has been passed by the government which allows development in the green belt like small industries, ring roads, concert areas, interpretation centres, etc. The proposal only aims to look for the benefit of Low-Density Residential Area (LDRA) in the green belt and gives the term "green development" to any construction which has a GRIHA certificate (the Indian Equivalent to LEED certification). The perception of the city as being separate from natural processes that support life is a long-standing misconception.

The sectors of Narela and Rohini in Delhi were once agrarian lands and acquired in the same manner. In the last 15 years, the occupancy rate varied from 10 to 40 per cent. The expected urban growth of Delhi has never been transected with reality. These prime agrarian lands now bear ghost towns with decreasing land value every year. So, do we really need more land? Similarly, Noida was divided and given to private developers on the basis of land pooling. It is being used to construct housing with no consideration for economically weaker sections. Most of the societies are still unoccupied as the growth expected for Noida was not met in reality, and also because all the housing facilities are only for one section of society. The social and economic indiscrimination is remarkably visible in Noida. This exclusion has turned people from primary to tertiary occupations, and has also led to a loss in ecosystem values as well as a skilled work force. The proposed Zonal plan for Delhi's L-zone follows the same trajectory as Noida and will soon face similar issues.

This study aims at the application of ecological principles to develop an integrated urban land-use planning for Delhi's L-zone case that could optimise the urban ecosystem, enable socio-economic sustainability, and also create an alternative model for the fragmented peri-urban regions.

2. Theories and Methods

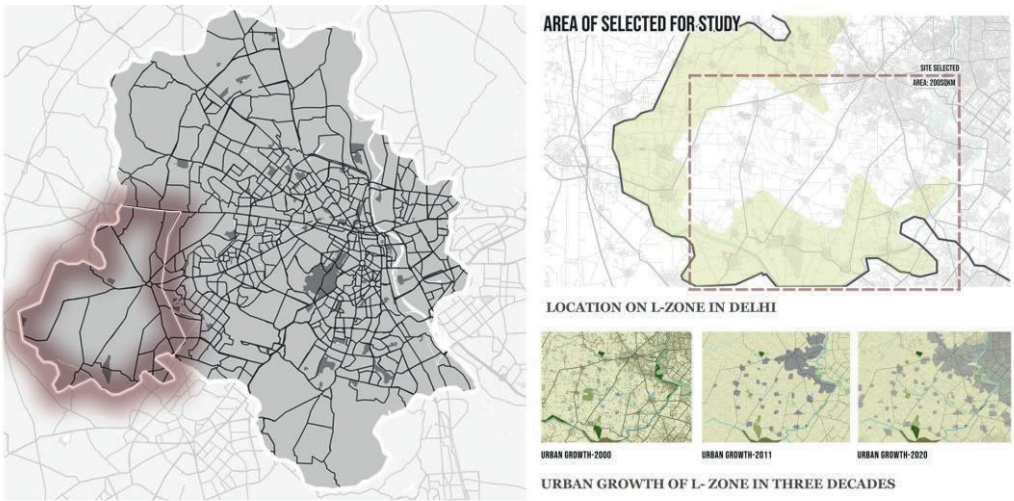

Figure 1: Location of L-zone in Delhi and the urban growth in L zone as compared to agriculture and forests in the last three decades.

The case: With each development plan, our cities are moving from agrarian landscapes to suburbia. The non-inclusivity of such hybrid landscapes in our planning is increasing regional inequalities, and is also making the peri-urban areas susceptible to customary land rights disputes. The elaboration of the same is situated in the peri-urban regions of Delhi, where rural communities surrounded by fertile landscapes constitute an instance of fragmentation. Delhi's L zone reflects the interface between the rural and urban. Despite the fact that it is surrounded by urban expansion, this region is still used for agriculture. The type and scale of this agriculture, on the other hand, have altered dramatically. The L-zone is now experiencing a property boom and has been a victim of persistent agricultural land invasion.

According to the DSPIR model of human environment systems, ecosystem values can be evaluated and monetised. This table shows the Ecosystem Services Value (ESV) of L zone and its degrading value from 2005–2016. Mostly, the forest, river, and streams have decreased which will directly affect the services. So, when we compare the Land-Use Land-Cover and the economic value given to each typology we see that even though the area has not degraded much in the trends, it's actually the least urbanised area of Delhi. Even so, we have lost 10.23 crore rupees in a decade. The calculation in Figure 2 was made for Delhi and L-zone. All these are impacted by the pressure of certain drivers like production systems, socio-political, socio-economic, demographic, technological, cultural, etc. on the site. These drivers create pressures like change in land use, spatial changes, and changes in intensity (functional). The monetised evaluation becomes a source of tangible proof to understand the driver's effect on ecology. It is also important to understand the pattern through which all these issues are arising. Then ratings can be given to each ecosystem type in the area according to the type of services it is providing in quantity.

Year	Value	Urban	Rural	Inland Wetland	Fallow Land	Cropland	Plantation	Waterbodies	Canal/ River	Scrub Land	Forest Plantn	Total Value
2005	SqKM	27.51	16.46	0.1	33.36	137.55	0.26	0.26	3.77	0.17	0.56	220
	Hectares	2751	1646	10	3336	13755	26	26	377	17	56	22000
	US$	0	0	84980	306912	1265460	6032	220948	3203746	0	54264	[illegible]
2016	SqKM	33.03	9.71	0.01	4.26	168.77	0.16	0.16	2.34	1.56	0	220
	Hectares	3303	971	1	426	16877	16	16	234	156	0	22000
	US$	0	0	8498	39192	1552684	3712	135968	1988532	0	0	3728586

Ecology System Valuation	2005	Value US$ Million	Value ₹ Rs. Crores	2016	Value US$ Million	Value ₹ Rs. Crores	Change in Value over the Decade:	Value US$ Million	Value ₹ Rs. Crores
		5.142342	37.5390966		3.728586	27.2186778		-1.413756	-10.3204188

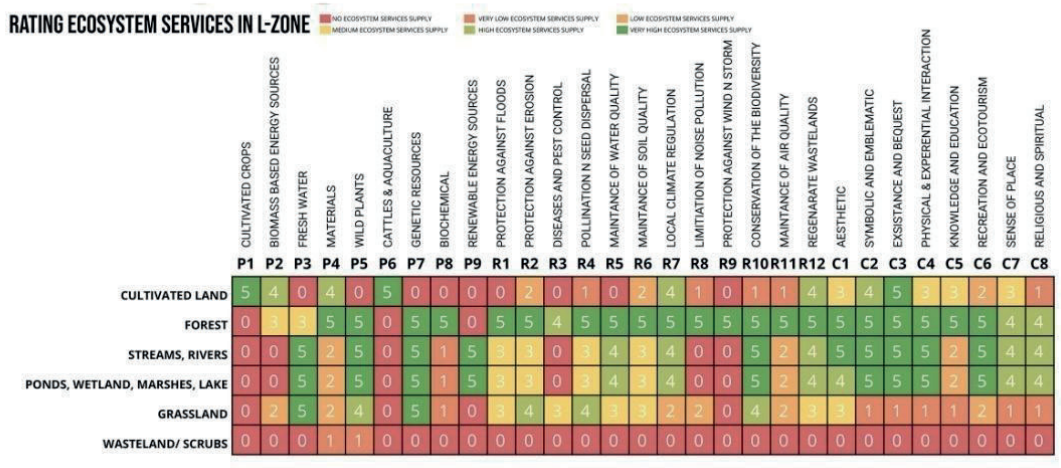

Figure 2: Ecosystem Value Monetisation of L-zone and Rating of Ecosystem services in L-zone

The study is based on the example of Christopher Alexander's 'A Pattern Language,' which emphasises viewing a city as a pattern and the trends of drivers like socio-political and past structural designing. A pattern language entails patterns that describe a problem which reoccurs in our environment and then further provides a solution that can be used to tackle several problems. Similarly, in our study we see that a particular issue raises several problems which are linked, and that by finding solutions to some core issues we can resolve many problems. A Pattern language explains how adapting our solutions to local circumstances and creating pilot projects by studying the local patterns might be able to help us create solutions for larger contexts. Pattern language sets the first base for this

study as it helps us to understand how our planning is affecting the environment and creating a pattern of its own. So, the study is conducted by mapping the trends in social, economic, and ecological layers. These layers (Figure 3) are mapped to show the socio-ecological pattern that is present in the region, which goes hand in hand with socio-political issues in Figure 5.

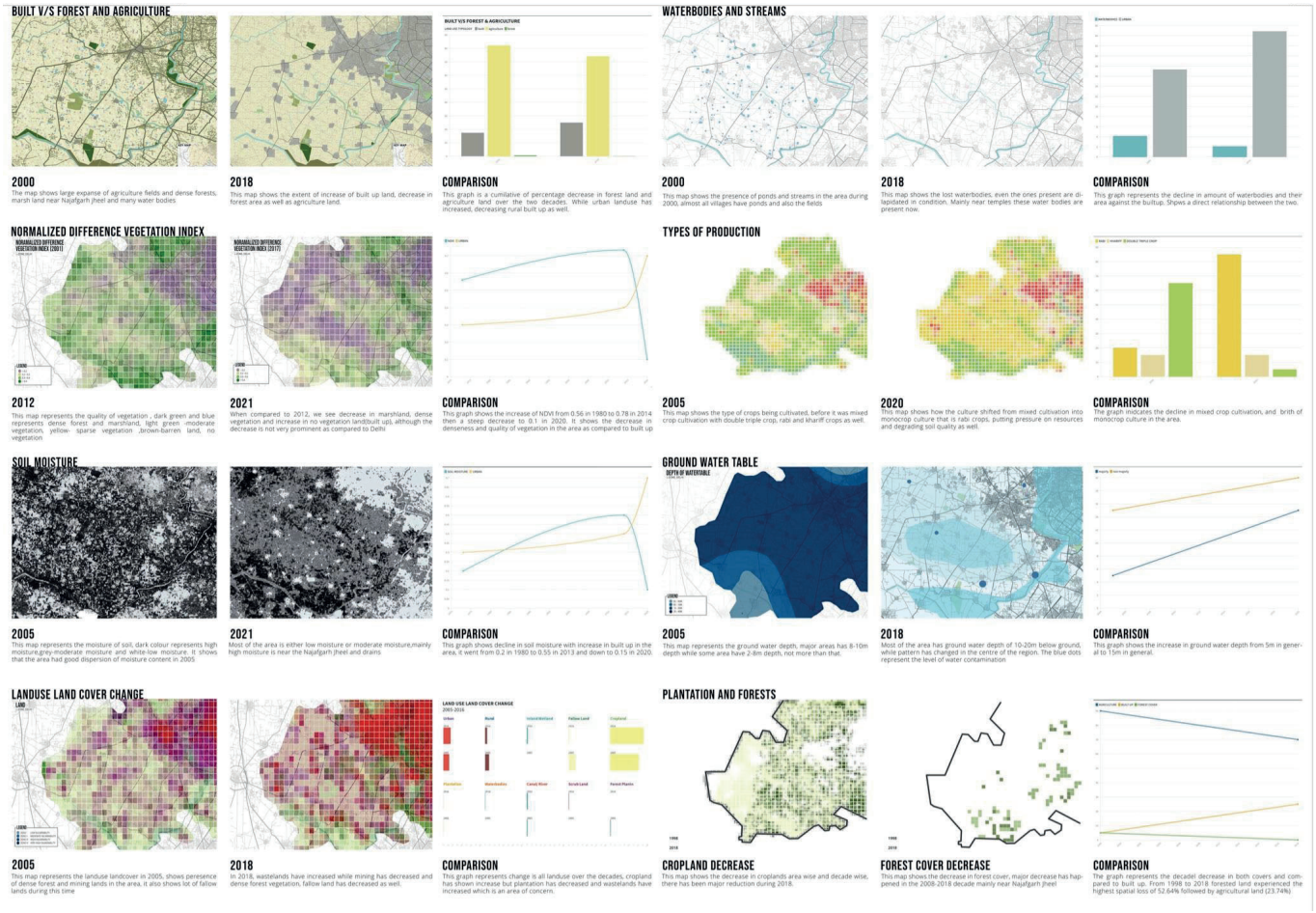

Figure 3: Various layers used to understand the socio ecological pattern in L-zone (Source: Author)

- Built v/s forest and agricultural trend: The map of year 2000 shows a large expanse of agriculture fields in dense forests, the marshland near Najafgarh Jheel, and many water bodies. The map of 2018 shows the extent of increase of built-up land, the decrease in forest area, as well as agriculture land. The graph is a cumulative percentage decrease in forest land and agricultural land over the two decades.
- Normalized difference vegetation index trend: The map of 2012 represents the quality of vegetation, where dark green and blue represent dense forest and marshland, light green represents moderate vegetation, yellow is sparse vegetation, and brown-barren land, no vegetation. When compared to 2020, we see a decrease in marshland, dense vegetation, and an increase in no vegetation land (built-up), although the decrease is not very prominent when compared to Delhi. The graph shows the increase of NDVI from 0.56 in 1980 to 0.78 in 2014, then followed by a steep decrease to 0.1 in 2020.
- Soil Moisture trend: This map represents the moisture of soil. It shows that the area had good dispersion of moisture content in 2005. In 2021, most of the area is either low moisture or moderate moisture, and the mostly high moisture is near the Najafgarh Jheel and drains. The graph shows a decline in soil moisture, with an increase in built up in the area, and it went from 0.2 in 1980 to 0.55 in 2013, and then down to 0.15 in 2020.
- Land Use Land Cover trend: The LULC map of 2005 shows the presence of dense forest and mining lands in the area, and it also shows a lot of fallow lands during this time. In 2018, wastelands increased while mining decreased, and dense forest

vegetation and fallow land have decreased as well. The graph represents the change in all land use over the decades, and cropland has shown increase, but planting decreased and wastelands increased – which is an area of concern.

- Built v/s water body trend: The map of 2000 shows the presence of ponds and streams in the area during 2000, almost all villages have ponds, as well as the fields. The map of 2018 shows the lost water bodies, even the ones present are dilapidated in condition. These water bodies are present now mainly near temples.
- Built v/s type of production trend: The map of 2005 shows that there was a mixed crop cultivation with double triple crop typologies. While the map of 2020 shows how the culture shifted to mono-crop (Rabi crops), hence putting pressure on resources and degrading the soil quality.
- Built v/s Cropland and Forest Cover Decrease Trend: From 1998 to 2018 forested land experienced the highest spatial loss of 52.64% followed by agricultural land (23.74%).

The layers (morphological, social, and ecological) also help in understanding the best use of the land, for instance, through the surface forms and soil typology layers, land suitability can be mapped out. All the trends and layers are marked and compared to the built-up within the region. In the primary survey, it was observed that there are issues like '*karkat colonies*' (temporary shelters set up by contractors for labourers), that start developing into dormitories or pave the way for new construction (Bhatla, 2019), eventually leading to a reduction in grasslands/green belt and agriculture land. Another issue is constricting the villages through a peripheral road called 'the *Phirni road*,' villages are not allowed to expand any further even though they own these lands and so the villagers start building over the ponds.

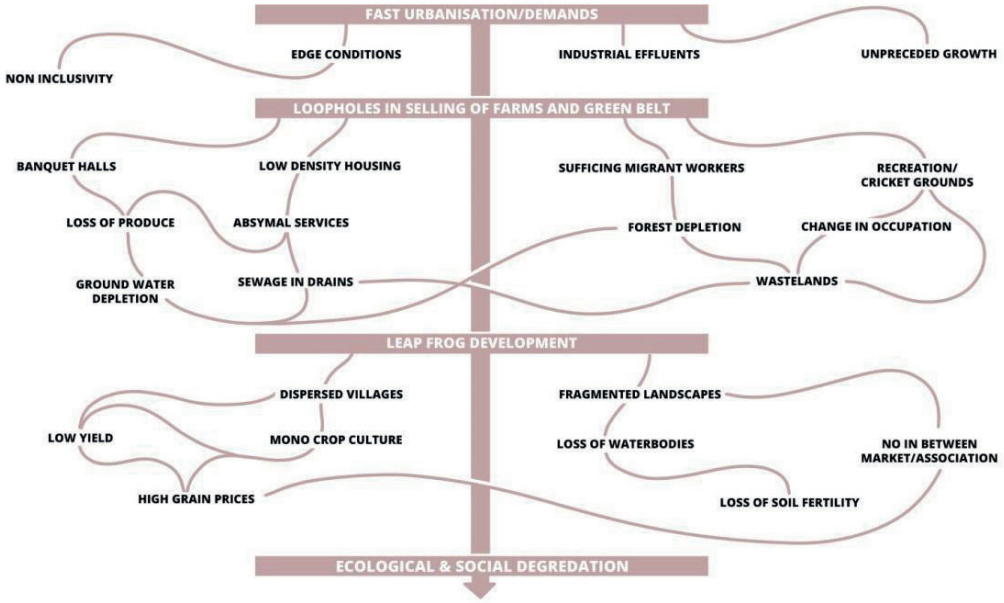

Figure 4: Pattern of Social and Ecological degradation in L-zone, Delhi.

Analysis of trends and patterns of the region gives an interrelation between problems of the area. Haphazard urbanisation or indiscriminate land-use conversions have been divided into three phases: fast urbanisation demands, loopholes in the selling of farms and green belt, and leapfrog development. Through the trigger of fast urbanisation, problems like the non-inclusivity of natives, unsafe edges, industrial effluent accumulation in water bodies/soil, and unprecedented growth occur. The most common loopholes for selling land in the green belt is by the construction of Banquet halls, *'Karkat Colonies*' which start turning into permanent housings now these conditions give rise to loss of food production, abysmal services, sewage in the drain, groundwater depletion and contamination, forest depletion, increase in wastelands, and a change in occupation and demography. Leapfrog development gives rise to dispersed villages and fragmented landscapes; these issues give rise to mono-crop cultures, low yield, poor market linkage, loss of soil fertility, loss of water bodies, and high grain prices. The above analysis in Figure 4 proves that social exclusion

in spatial planning and policies give rise to ecological degradation and loss of ecosystem values of a place.

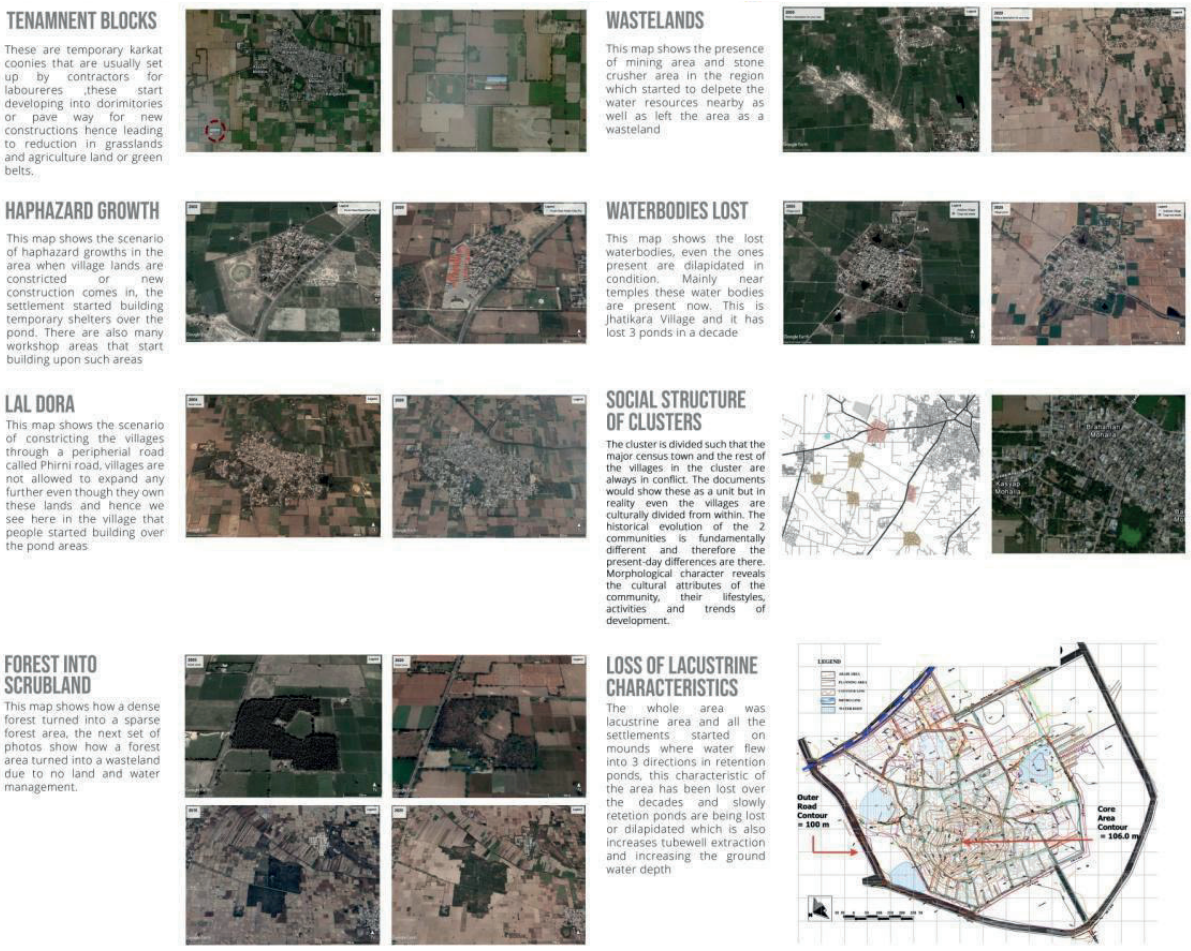

Figure 5: Satellite images of the present issues in L-zone

The larger issue that would occur due to these patterns is food insecurity. The Agenda 21 Document strongly advocates for the urban-rural continuum and food security. There should be an attempt to translate the ideas into spatial guidelines, as it is observed that often the intentions of a project or the cause is lost in translation from text to space.

3. Results

The thought behind the approach is to use ecosystem services for the basis of the land development strategies. Here the services provided by the ecosystem are translated into development plans. The study takes the examples of MacKaye and McHarg of informing settlement patterns according to ecosystem services. Similarly, Christopher Alexander's 'A pattern language' talks about recurrent design patterns that planners use. It elaborates that one should see evolution and design as patterns and trends to understand the depth of the issues. Each trend contributes to an issue that gives rise to multiple problems, hence if we are able to identify the trend we will be able to tackle many problems. This book becomes a guidebook to understand our cities as it helps us interlink various layers. This ideology has been used as the basis of understanding the L- zone. The author in the book 'Village Swaraj' talks about how villages should work on their strengths. He also talks about how villages should work together in clusters to strengthen their livelihood opportunities. This ideology has been further used in the cluster network analysis in this paper. Theories of these works have been used to demonstrate a multidisciplinary approach for planning. The collected data on trends of social, ecological, and economical layers are used in reference to these theories to establish the development indicators.

3.1 Implementing the Knowledge of Ecosystem Services Mapping

Ecosystem services can be utilised for their regulatory benefits, provisional benefits, and their benefit of providing alternate economies to the peri-urban areas. Ecosystem services are often translated to land uses for the purpose of mapping. Here the same is applied, and it demonstrated that different land uses can support more than one ecosystem service, and vice-versa that some ecosystem services can be found in more than one land use (King, 2017). This is important for compatibility and multi-functionality.

3.1.1 Regulatory Benefits: Ecological infrastructures provide regulatory benefits like flood resilience, air quality, etc. Each ecological infrastructure provides supporting benefits to the natives and their livelihood. All ecological structures should be mapped and quantified for their suitability.

3.1.2 Provision Benefits: Secondly, through provision level; certain ecosystem services are demand-related, e.g. food, energy, crops, etc. The suitability of land to provide these services can be mapped. According to the required services, a land use plan can be planned denoting proficiency of the services.

3.1.3 Livelihood Benefit: By understanding the nature of labor associated with the service provision, we can understand where inhibition can occur to support the provision of services. This can strengthen the existing community by providing local economy, increase social interaction and enhance the working/living environment (King, 2017).

3.2 Peri-urban economy in relation to services

There has been a stark decrease in agrarian employment in Delhi which can be mainly attributed to indiscriminate land use conversions. This has led to social discrimination and further ecological degradation of lands, this pattern is decreasing the livelihood and economy of marginalised farmers. Hence, new economies should be brought in for peri-urban lands according to land suitability. These alternative economies will support their existing native livelihood (farming). These new economies can both support the peri-urban communities financially and socially, and would also keep down the trips to further city cores for livelihood.

3.2.1 Settlement analysis for cluster development:

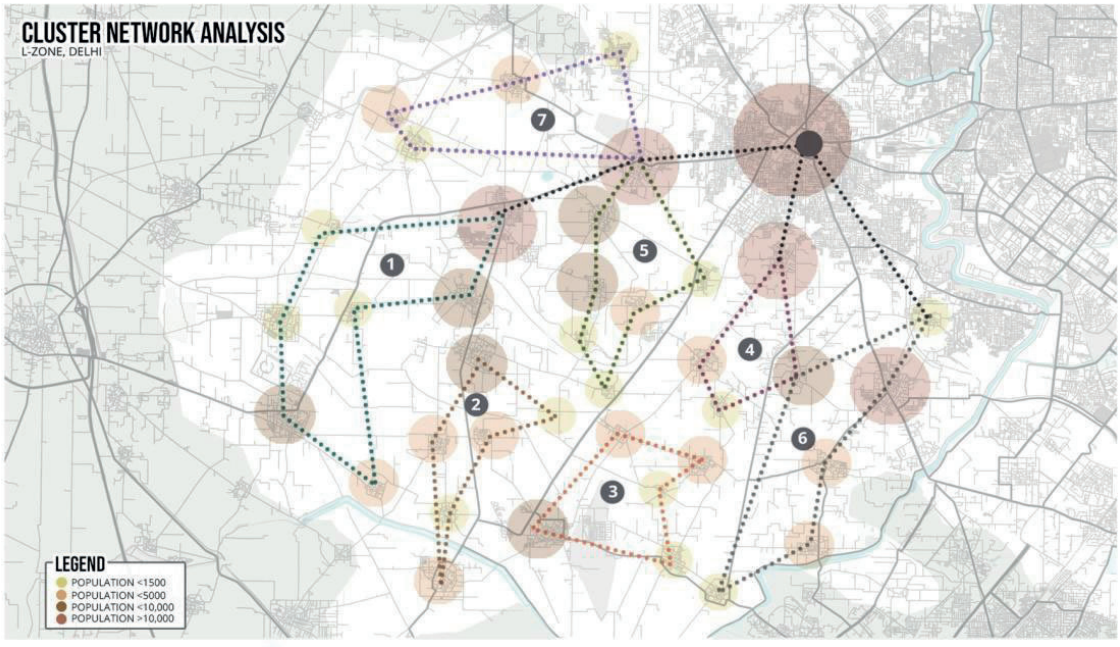

Figure 6: Hierarchy of Clusters based on their densities

Firstly, density analysis was done for each settlement cluster. Based on this analysis, villages were divided into four hierarchies to classify their typology and their compatibility for alternative economies.

3.2.2 Mapping Ecosystem Services

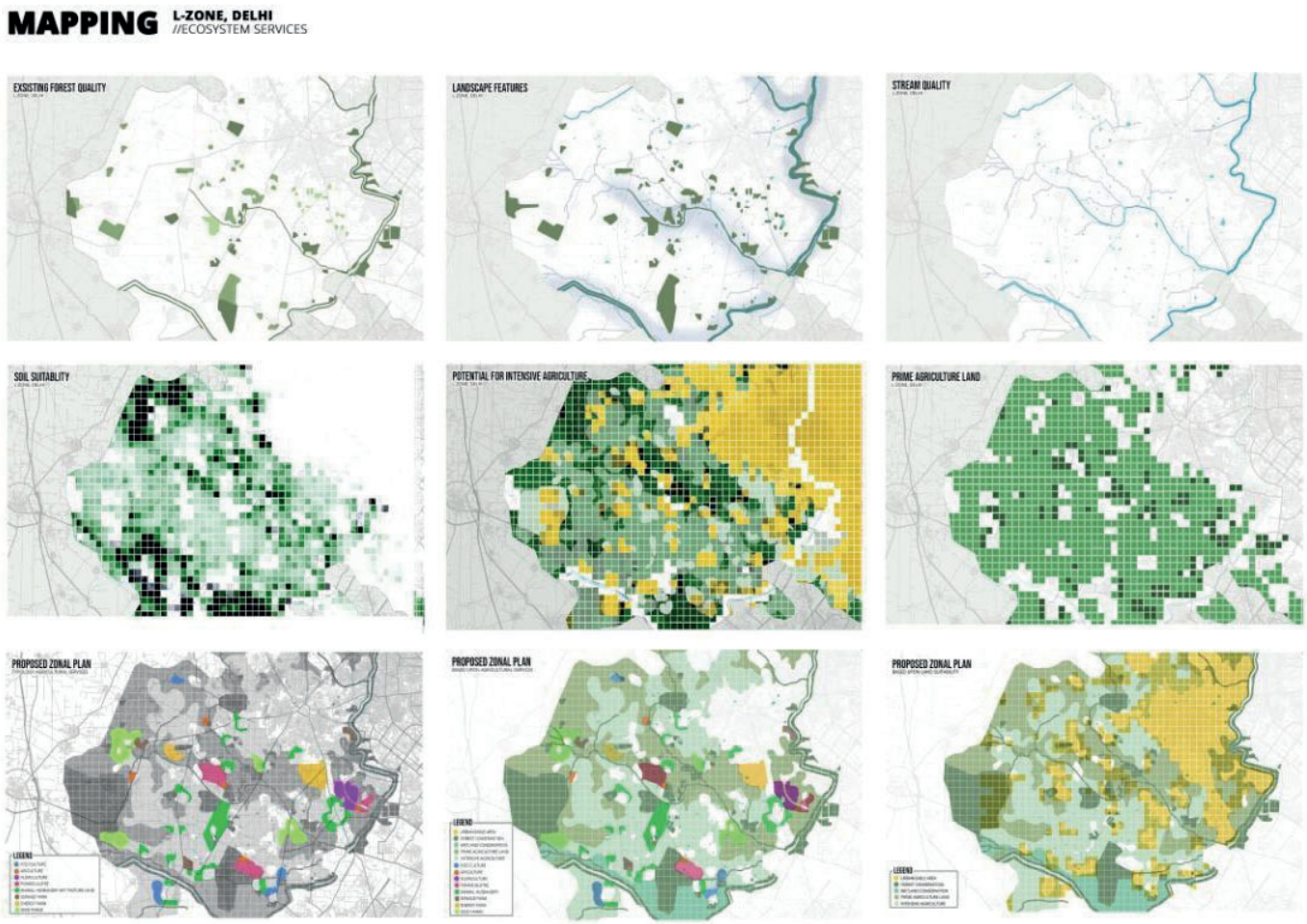

Figure 7: Mapping of Ecosystem Services: Conservation layer, prime and intensive agriculture layers, soil suitability, suitability map, alternative economies map (pisciculture, api culture, poma culture, etc.)

- Conservation Layer: These areas will be left for conservation to provide ecosystem services to the peri-urban agricultural lands.
- Ecosystem Services: Base Layers: water body, forests, streams, and marshlands. These layers will form the basis of the services provision in our zoning plan.
- Prime Agriculture Layer: This layer marks the land which is most suitable for agriculture and does not require many resources, these are lands with good soil fertility, adequate ground water potential and required soil moisture levels.
- Intensive Agriculture Layer: This mapping is done to understand which lands are arable and has the potential for intensive farming. Areas that are unsuitable for this are forests, marshlands, prime agriculture lands and water bodies. This is also based on high labor presence.
- Soil Suitability: The remaining lands with very low soil fertility can be utilised for village expansion as well as livestock areas.
- Landscape Amenity: This mapping is done to identify which areas have a high potential for landscape amenities or eco-tourism. This mapping is done to understand which lands are arable and has the potential for intensive farming. Areas that are unsuitable for this are forests, marshlands, prime agriculture lands and water bodies.

- Alternative Agro Economies: By overlapping the intensive agricultural zones with cluster analysis and suitability of each service we can obtain this map.

3.2.3 Suitability Mapping: In this step, the prime agriculture layer, the intensive agriculture layer, conservation and soil suitability layer are merged to get a suitability plan. The Land Suitability map will prove very efficient as a planning tool for such regions.

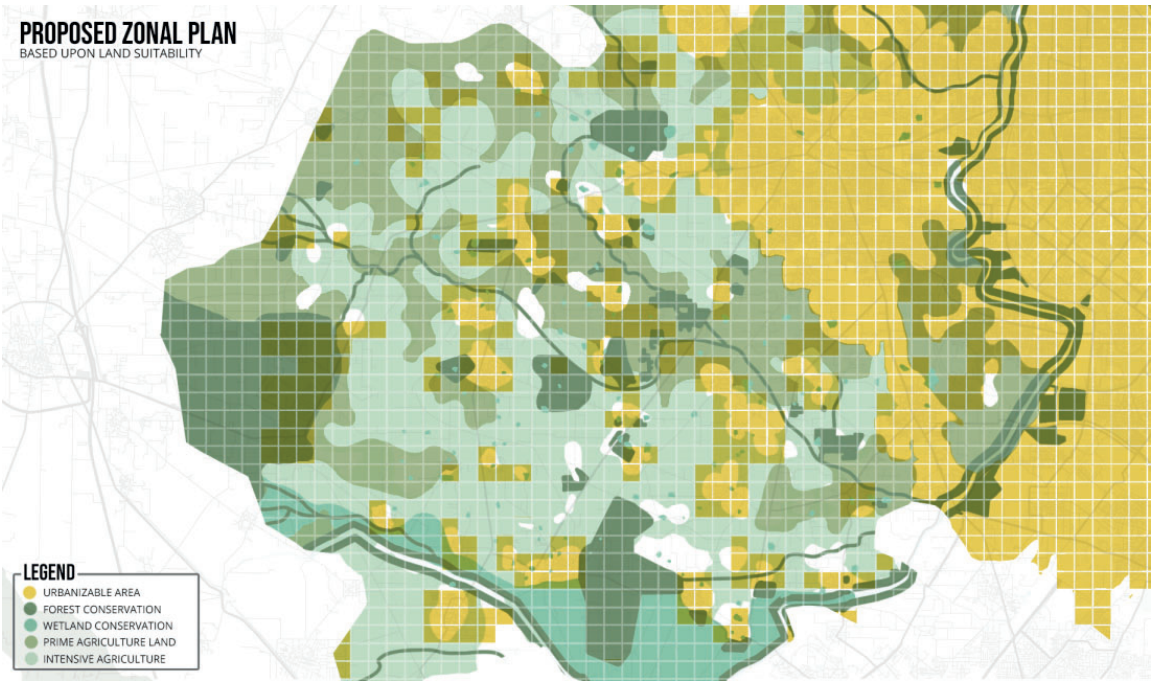

Figure 8: Proposed Land Suitability Map for L zone

3.2.4 Cluster Network and Suitability Map: Settlements are developed. These supporting livelihoods are based upon their requirements in spatial and land suitability terms. The cluster network is further developed and overlaid on the economies will strengthen their existing livelihood, i.e. agriculture.

3.2.5: Structural Plan: This map is derived by overlaying/overlapping the land suitability map, cluster network analysis, and agro-services map. This structural plan is divided into a prime agriculture zone, intensive agriculture zone, conservation zone, seed farms, energy farms, sewage farm, riparian zone, existing built up, built up spillover, agro services, johads and e-rickshaw routes. The circles indicate the clusters according to hierarchies. This forms the backbone of the type of development that would happen in the peri-urban zone. This map gives the alternative model for peri-urban lands that hinges on multiple scales and multi-functionality. This structural plan is further developed from the zonal plans into the vision plan with a list of projects that can strengthen the urban-rural linkage. The vision of this plan is to inform pragmatic strategies and propose a Framework for Action to build an enabling environment for more inclusive and functional urban-rural linkages This plan focuses on opportunities regarding the urban-rural continuum: rural urbanisation, strengthening small and intermediate towns, increasing the livelihood in rural areas, and reducing the development gap.

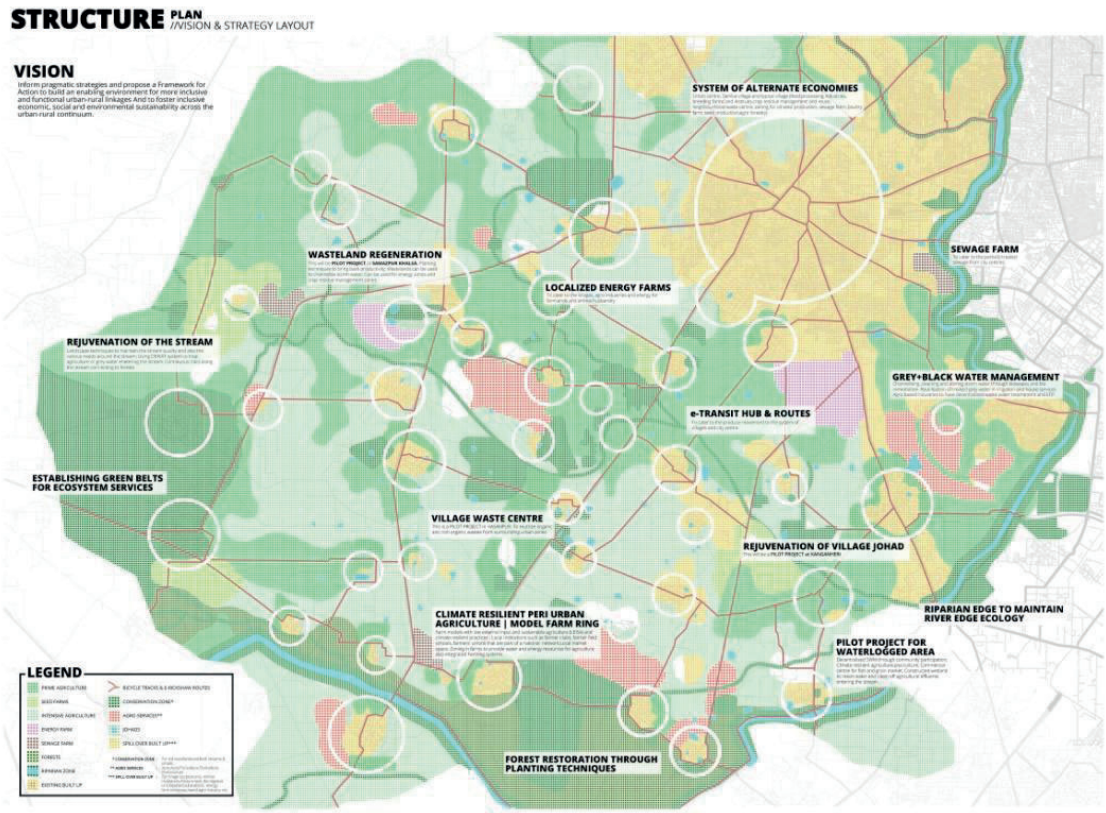

Figure 9: Proposed structural plan for L zone along with pilot projects list to fulfil the vision.

3.2.6 Development Possibilities:

Through the structural plan, it is evident that economies of agriculture, forestry, and tourism interrelate to benefit each other. Further development possibilities can be explained through two projects from the structural plan, i.e. System of Alternative Economies and Climate Resilient Peri-Urban agriculture.

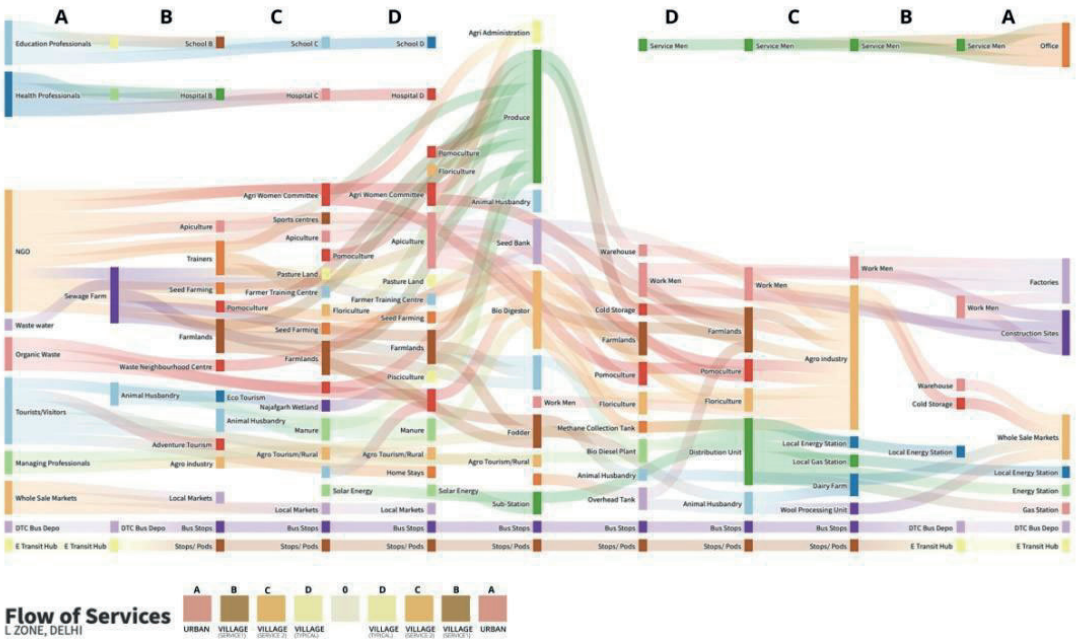

Figure 10: Flow of services of L zone from urban to peri-urban and back to urban.

- System of Alternative Economies

This study of clusters according to population densities and characteristics can give the kind of alternative and supporting economies these clusters can perform. The cluster hierarchy map illustrates rings of villages that can work together and support each other. It is divided into four categories, i.e. an urban centre, Service village 1, Service village 2, and a typical village. An integrated approach is proposed for Administration: a Women-led Agro committee at typical village, which will have members from NGO and Municipalities to ensure implementation and monitoring. Working: All villages are included in this with a different type of activities according to the land suitability map, Services: Each cluster provide certain services to another, but service villages are places where intermediate services are provided for intensive and prime agriculture This analysis is done to create a system of hierarchy for the flow of services. It starts from the level: A(urban) goes to O(peri-urban) and then comes back to A(urban).

- "The reciprocal and repetitive flow of people, goods, and financial and environmental services (defining urban-rural linkages) between specific rural, peri-urban and urban locations are interdependent; they are the reality of socio-spatial arrangements, creating places with distinct yet interwoven, socially constructed identities" (Sietchiping, Loose, Forster, & Githiri, 2019). Through this flow, Peri-urban landscapes are seen as a complement to the city rather than a fringe land.

4. Discussion

With each development plan, our cities are moving from agrarian landscapes to suburbia. Planning of satellite cities and increase in conurbations will put increasing pressure on the ecosystem services provided by the peri-urban regions. Repurposing the peri-urban areas will contribute to long-term strategies for sustainable development. The study determined opportunities regarding the urban-rural continuum: rural urbanisation while strengthening small and intermediate towns, increasing the livelihood in rural areas and reducing the development gap. Analysis of the trends in socio-ecological layers and planning pattern of a city can be used to create an approach that would optimise natural resources while evolving with the peri-urban dynamics. The research uses ecosystem services and application of ecological principles to develop an integrated urban land-use planning for Delhi's L zone case that could optimise the urban ecosystem. Frameworks for design and planning must be created to factor in new narratives that are specific to the local context so that ecology and biodiversity, therefore sustainability of the region at large is made possible. Although one of the main challenges of such a framework is to defy problems created by people in power, for instance, a doughnut strategy that forces people to sell their land even when they do not wish to. The only way this framework could be successful is if it's seen as an idea propagation rather than an enforcement in terms of planning. As seen through several case studies, people in developing countries are attached to their land. Once a framework is developed that keeps in mind the main stakeholders and the land suitability, a management framework could help to propagate the initiatives among the community. With the help of cluster analysis of settlements, a system of alternative economies can be created to provide new economies and diversification.

5. Conclusions

The paper discusses the notion that urban and rural communities do not function in isolation, there's always a circular flow of resources and people that makes this urban rural continuum. It creates a linkage which is greater than administrative boundaries/functions and leads to integrated and functional regional territories. The proposed structural plan is further developed from the zonal plans into the vision plan with a list of projects that can strengthen the urban-rural linkage. An alternative land use plan is developed with the objective of utilising ecosystem services. Peri-urban landscapes are given a purpose through land suitability mapping. Settlements are analysed according to their potentials to create a system of economies which ensures the urban rural linkage. The cluster hierarchy map illustrates rings of villages that can work together and support each other. The vision fosters inclusive economic, social, and environmental sustainability across the urban-rural continuum. Hence, by the above analysis and proposals, the full potential of peri-urban areas can be achieved.

Data Availability Statement

Raw data regarding the trends and patterns of L zone were generated from CGWB documents, Census of India. 1991, National Bureau of Soil Survey & Land Use Planning (Indian Council of Agricultural Research). Derived data supporting the findings (Trends and Patterns) of this study are available in Science data Bank at 10.11922/sciencedb.01165, reference number [31253.11.sciencedb.01165].

Contributor statement

Anam Husain: Conceptualisation, data curation, formal analysis, investigation, methodology, writing – original draft. Nisar Khan: Supervision, review of results. Iqtedar Alam: Supervision, review of results. Intekhab Alam: Supervison, review of results.

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NO-CITY: Designing across the Urban Pluriverse

Marco Ranzato [1], Davide Cauciello [2] and Federica Fava [3]

[1] Department of Architecture, Roma Tre University; marco.ranzato@uniroma3.it
[2] Department of Architecture, Roma Tre University; davide.cauciello@uniroma3.it
[3] Department of Architecture, Roma Tre University; federica.fava@uniroma3.it

Abstract: This paper presents some of the results of *NO-CITY SALARIA*, part of an interuniversity research and educational programme between Roma Tre University, the University of Camerino (UNICAM), and IUAV University of Venice. The programme was launched to explore the urban-rural dichotomy in three different territories of the Italian peninsula. Each area cuts through a particular urban condition up until the most peripheral regional areas of the country, namely the so-called "inner areas," identified by the 2014 National Strategy of the same name (SNAI). Challenging city-centric or urban-centric visions, today reinforced by the SNAI, this contribution presents some exercises of imagination that show possible ways to overcome dual territorial approaches. Methodologically, the study adopts the transect as a conceptual and practical tool that serves to address the territorial dialectic in a novel way. Fluctuating along the transect, the onward-backward movement blurs the imaginary line that profoundly limits a more complex urban discourse. Affirming the interchangeable and intrinsic value of both urban and rural realities, i.e. of each gradient of today's urban condition, the design speculations thus show the potential of the pluriverse of forms emerging from this continuous exchange.

Keywords: planetary urbanisation; transect; inner areas; human agency

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1. Beyond the urban-rural dichotomy

From its early days, the COVID-19 pandemic has brought the city-countryside debate and the consequences of all-encompassing urbanisation to the forefront (Boeri, 2020). Having forced many people to stay locked in their homes, the pandemic has strongly affected our cities and profoundly modified the discourse about density and dispersion, serendipity and tranquillity, and consumption and responsible production. Among those citizens who were in a position to choose if moving from or staying in the city, concerns about density and densification (Florida et al., 2020) has provoked anti-urban behaviours and a movement toward not only the suburbs, where a dwelling can include at least one garden, but also toward more peripheral regional areas, where it is possible to feel some distance from everyone.

Yet in Italy, a country that has been deeply affected by the pandemic (Amante & Balmer, 2020), the debate on the urban-rural dichotomy has been revived since 2014, when the National Strategy on Inner Areas (SNAI) policy was approved in order to re-balance the inequalities in access to services (education, health, public transport) that affect 60% of the territory (Agenzia per la Coesione Territoriale, 2012). Controversially, the policy redraws the country's boundaries between urban and rural, while promoting the implementation of typically urban services in the inner areas, defined in relation to their distance from "poles" (20>40 mins, 40>75 mins, >75 mins), which are areas that offer basic services in terms of education, health, and public transport. In other words, the difference

between the city and the so-called "inner areas" is marked by reference to the remoteness of these territorial portions to urban infrastructures. The SNAI attempts to shorten (at least partially) this gap through the injection of a series of initiatives and services into the inner areas.

The dichotomy which the SNAI affirms is deeply rooted in the history of the country and its physiography. From the Po Valley in the North down to Sicily in the South, the Italian peninsula is crossed by the Apennines, a mountain range that divides the coastal urbanisation of the Adriatic Coast in the East – with Ancona, Pescara, and Bari as the main poles – from that of the Tyrrhenian Coast in the West – with central poles in Genova, Rome, Naples, and Messina. As early as 1958 (although with reference to the South of Italy), Rossi Doria (1958) called the abovementioned Apennine territories the "bone lands" to denounce the socio-economic gulf that was emerging between the many inland areas of the interior and the plain areas along the coasts. The bone lands have not only been a reservoir of laborers and workers (for the industries of northern Italy and elsewhere, such as the mines of Belgium), but also of essential resources such as water, timber, and food. To a certain extent, because of their mix of environment, culture, production, and landscape, they can be seen as the backbone of the country (Pazzagli 2017, 20).

In 2020, in the midst of the pandemic, reflecting on the Italian urban-rural dichotomy and its socio-physical and political conditions seemed naturally relevant. With a critical perspective, 'NO-CITY,' an interuniversity research and educational programme between the Roma Tre University (Rome), the University of Camerino (UNICAM, Ascoli Piceno), Iuav University of Venice (Venice), and other national and international universities and research groups, was launched in an attempt to question the urban-rural dichotomy by investigating it along three transects of the Italian peninsula, each of which cuts through a given urban condition up until an inner area. The research question posed through NO-CITY is, "How can we best tackle the urban-rural dichotomy, reinforced by the SNAI policy, at a time of planetary urbanisation (Brenner & Schmid, 2011)?" By building on the complex cross-scaling convergency concerning all territories now entangled in the ever-present urban (Friedmann, 2002), the main objective of NO-CITY is to analyse and design urbanised territories by thinking about and building upon the relationships between urban assemblages of different and dynamic natures instead of their alleged boundaries (Balducci et al., 2016, 16).

To this end, the transect is adopted as conceptual and practical methodological tool that serves to address the urban-rural dialectic in a novel way. Fluctuating along the transect, it is possible to activate a rhythm that contrasts urban- or rural-centric positions, blurring that imaginary line that profoundly limits a more complex urban discourse. From the Geddesian "section" stretching the understanding of the city from the "tower of the centre" toward the valley-region and the universe, to the botanical perspective capable of holding the complexity of life, the transect offers itself as *space* for creative territorial exploration. In contrast, it allows the civic dimension of the area to be explored, which functions as entry point to the understanding of the local context and its inner dynamics.

By building on this tradition, NO-CITY SALARIA (the part of the programme that deals with the territory of Rome) investigated the transect that runs along the Roman road, via Salaria, which connects Rome on the Tyrrhenian coast to the Adriatic by traversing the mountain range of the Apennines. Drawing on the results of the first year of the programme experimentation (par. 3), this paper presents some reflections on the potential of a fluctuant or transient methodological approach (par. 2) toward and opposed to urban conditions that are still identified with the city. Moving along this trajectory, categories of analysis, spatialities, and types of urbanisation emerge in contrast to overly sharpen conceptual boundaries. The results show how the transect is a tool for detecting and, via the project, manipulating the relationships by holding together place and "region" (as Geddes would put it). At the same time, the transect shows its limits of spatial determination in the face of relationships that are discontinuous in space and uncontainable because planetary (par. 4).

2. The Transect and the Civics

Over the past 150 years, many pages have been devoted to the dissolution of the city. Already at the beginning of the second half of the nineteenth century, at the height of the industrialisation that was raging in Europe and beyond, Ildefons Cerdà spoke about urbanisation (Cerdà, 1867). Cerdà's intuition was that the "the city, as an entity differentiated from the territory, should cease to exist" and be "replaced by a dislocated system,

potentially extendible to infinity, whose function is no longer to produce a form, but to be a process" (Campani 2021, 254). In 2002, 140 years later, John Friedmann claimed that the city is dead and that what remains is *the urban* (Friedmann, 2002). Just 30 years before that, Henry Lefebvre spoke of the appearance of an *urbanised society*, a reflection that, not long ago, brought Neil Brenner and others to forge the hypothesis of a *planetary urbanisation* (e.g., Brenner, 2014). Needless to say, these cutting-edge understandings would deserve additional explanations, while several others would merit being mentioned and further explored. However, for what might concern the NO-CITY project, it is important to recall the common malaise expressed by these studies, namely, the trouble of dealing with the uncontainable transformations of the city, then of the territory. Periphery, dispersion, sprawl, conurbations, etc., are all notions abundantly used throughout the twentieth century to mark the disintegration of the urban-non-urban distinction, and, by extension, of the city-countryside binomial.

A few decades after Cerdà's theories on urbanisation, Patrick Geddes produced a series of hypotheses and theorizations about the city and the territory at large. They were all oriented towards a great cultural and social renewal in the face of "the narrow utilitarianism that characterised the industrial revolution" (Mazza, 2008, 1). Geddes' proposals were reactionary and, to a certain extent, city-centric. However, they were all oriented toward the reintegration of the urban within a wider territory in the belief that social processes and spatial form are intimately related. The famous Valley Section renders Geddes' thoughtful cross-scaling and territorial understanding apparent: the entire valley region is a region-city, an ideal type of city "modelled on the valley region with its network of settlements of various sizes and one large city as its centre" (Welter, 2001). The territory is reclaimed as an inhabited space and town and country are not set against each other. In this line, Geddes also highlighted the relevance of the knowledge of places – be they cities, towns, or any other form of settlement – via the practice of the survey, a true carrier for acquiring an active citizenship. This is what makes the Civics, i.e. associations of citizens that are able to search for the common good (Mazza, 2008).

The complex morphologies and interdependencies of planetary urbanisation disrupt Geddes's vision of a hierarchical and evolutionary town-city relation. Moreover, the current (and increasing) plurality of realities claiming different ways-of-being in the world describes a "pluriverse," i.e. "a world where many worlds fit" (Escobar 2018, 21). Although the Valley Section and the Civics localism and regionalism are relevant in describing territorial nexus, more recent developments thus suggest the urgency to explore other, non-hierarchical approaches to design or, in Escobar's words, a new "design imagination" (ibid).

Similarly to the Geddesian Valley Section, the transect promises to be a means of holding together the many assemblages of different and dynamic natures that characterise today's urbanisation and of understanding their complex relationships. According to Gandy (2020, 161), the transect is a botanical walk, "one of the most familiar methods used in conducting ecological surveys." In botany, the transect has the capacity to record variations, i.e., it allows one to overcome binary visions by recording transitions together with counterpoints. Herbert Sukopp (1990, quoted in Gandy 2020, 164) himself referred to the transect also as "a schematic approach adopted in order to provide a cross-sectional representation of the urban-rural gradient in terms of variations in the built environment and its characteristic vegetation." The very fact that the transect has so much in common with the Valley Section can be traced back to the fact that Geddes himself was a biologist.[1]

By building on these two traditions for its investigations, the NO-CITY programme adopts the idea of travelling along a line and stumbling into places. Those places are a sort of "accidental" situations along the way in order to make them every time vantage points for observation.

The investigation conducted in the frame of NO-CITY and presented below adopted a five-step (Figure 1) approach, described as follows:

1. territorial crossing: analysis of the entire transect by mapping and survey;
2. diagnosis of urban practices: selection and analysis of associations – intended as civics – carrying social and cultural values connected to the territorial specificities;
3. research by design: definition of a design proposal related to a portion of the territory narrowly related to the selected urban practices;
4. re-composition: assemblage of the different portions of the territory during both the analysis and design phases (1 and 3) in order to reconnect the study with the

1 "Although the term transect only begins to appear in botanical literature in the early twentieth century, its practical roots can be traced back to the Humboldtian scientific tradition, the mania for measurements, and methodologies of imperial prospection." (Gandy, 2020, 163)

different urban conditions that exist beyond the territorial unit by moving once again along the transect;

5. finalisation: definition of the final proposal by including additional elements that have emerged in the re-composition phase.

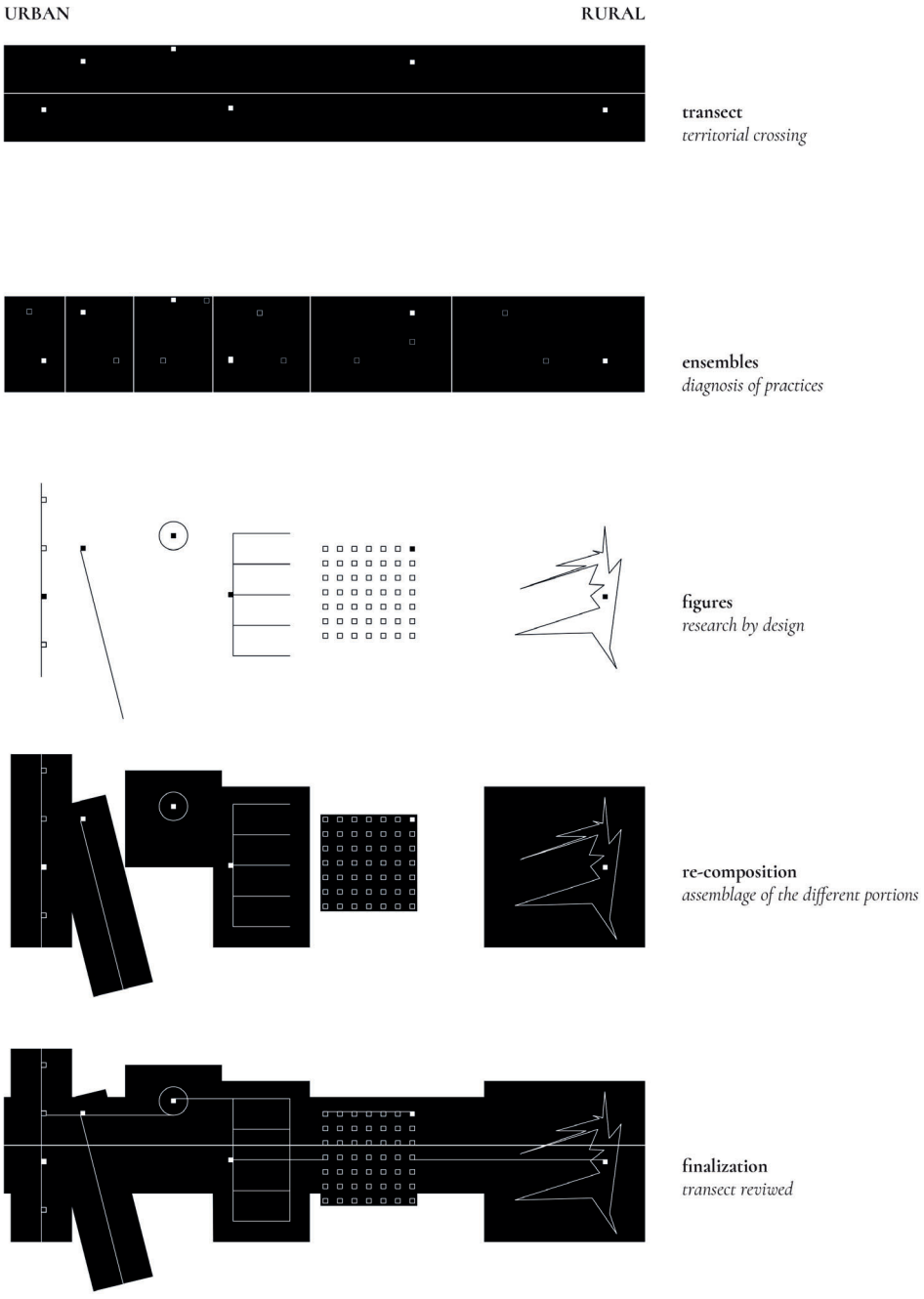

Figure 1. The Transect and the Civics.

For NO-CITY SALARIA (Rome), this five-step process was applied by following the consular Roman road Salaria that cuts through the identifiable urban condition at the centre of ancient Rome up until the countryside of the Monti Reatini Inner Area (Figure 2). The transect longitudinal development is of about 70 km; its altitude varies from 20 metres up to 800 metres above sea level.

Along the Salaria road, a series of associations or human practices were identified as the vantage point for observation and design (Table 1). Each association is understood as a rhizomatic figure standing out against a background or a portion of the territory that speaks about a specific urban/rural condition. As for the Civics of Geddes, each association operates projecting on a certain situation within the urban/rural gradient a supposed common good in terms of "living together," "living with the environment" and "tangible and intangible heritage."

Figure 2. NO-CITY SALARIA transect. (source: Riccardo Ruggeri)

Table 1. Selected associations along the NO-CITY SALARIA transect.

Practice	Location	Mission
1. Retake Roma	Trieste-Africano, Rome (RM)	Urban regeneration and valorization of public goods
2. Pedro Arrupe Centre	Roma Smistamento, Rome (RM)	Centre of hospitality for migrant families, women and childrens
3. Cooperativa sociale Folias	Monterotondo Scalo (RM)	Training opportunities for disadvantaged people
4. Accademia del Tempo Libero	Passo Corese (RI)	Development of cultural and sport activities
5. Associazione RIetica, Casa famiglia Il Seme	Toffia (RI)	Defense of public water and centre of hospitality for childrens
6. Gruppo Jobel	Torricella in Sabina (RI)	Artistic residencies for artists and for young people

The background on which the human practices operate was analysed by looking at land use and land cover, urbanisation patterns, services, mobility, and public transport, and environmental threats (step 1). The diagnosis included a campaign of interviews that enabled the researchers to get acquainted with the associations and begin the collaboration (step 2). For each association, a portrayal was developed integrating architectural artefacts, related networks, and societal values. The re-composition, a sort of collage of the associations and their features within the overall transect, was a fundamental move that offered the opportunity to reactivate its original dynamic (step 4). This concerned both the analysis and design phase, the latter intended as an exploration to expand the action of the associations, multiplying their relations with the places and thus with the different urban-rural gradients of the transect (step 3 and 5).

3. The region and the localities

Using the *Transect* as an epistemological tool and the *Civics* as agents of the common good, the Salaria stretch of territory, a portion of the complex urban realm, was reviewed by juxtaposing the issues of a given place with those of other places and urban gradients falling within the same stretch (Figure 3). A selection of the resulting design explorations is described below in order to show how the fluctuation within the transect supports a synergic approach among parts, enhancing their material and immaterial relationships toward a socio-spatial whole.

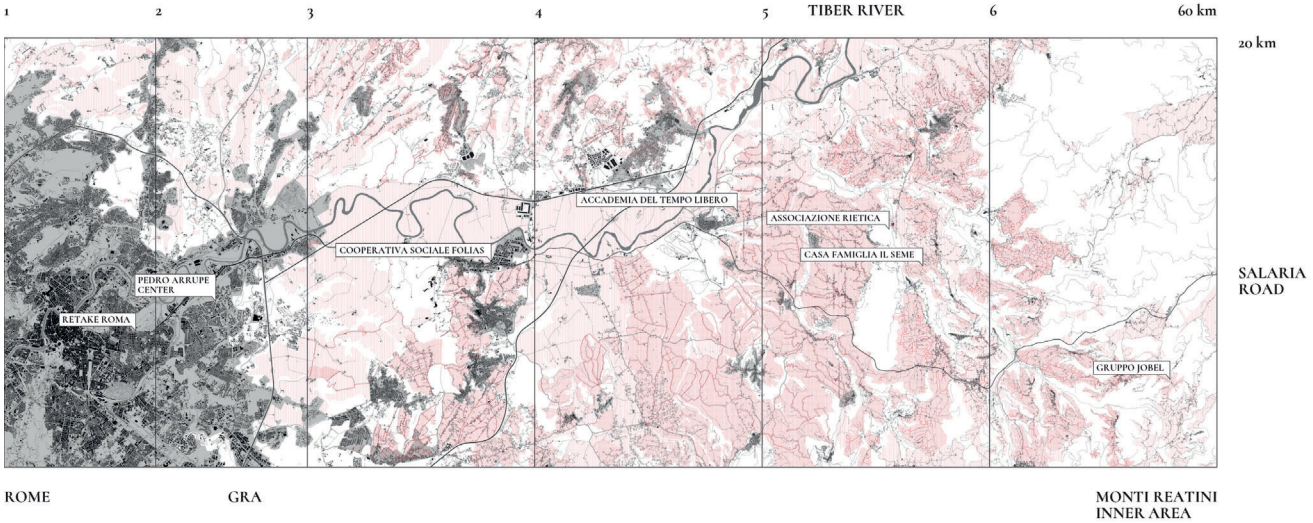

Figure 3. The NO-CITY SALARIA transect with its different urban gradients: urbanisation (grey), agriculture (red lines), olive orchards (red dots), dirt roads (red lines), Tiber river (grey thick line). (source: Lucrezia Alaimo, Marzia Carosi, Michela Di Seri, Matteo Durante)

Multiple agents, inverted public spaces

In Passo Corese, a small town located midway along the transect and where many workers from Rome reside, the association Accademia del Tempo Libero, whose work is all about making up for the place's lack of leisure activities, recognises the lack of cultural dynamics connected to insufficient and poor public spaces. At the same time, the territorial analysis highlights important agricultural resources; beyond production, the olive orchards scattered all around the village describe also heritage patterns, both natural and cultural, which present themselves as potential public ground for socialising activities.

Building on the inversion of the materialities characterising urban and rural public spaces, the design proposal involves the Accademia del Tempo Libero engaging local farms in organising an annual festival that attracts audiences from Rome and nearby Rieti. The festival is based upon the natural rhythms of the olive trees, altering the common urban hierarchy of the cityscape. Local residents who are interested may decide to participate in activities distributed throughout the year and all oriented towards the preparation of the festival (Figure 4). By looking at the transect from the vantage point of the Accademia del Tempo Libero, local leisure activities could make a space of specialised production a potential place for both local and supra-local publics to be involved at different times of the year.

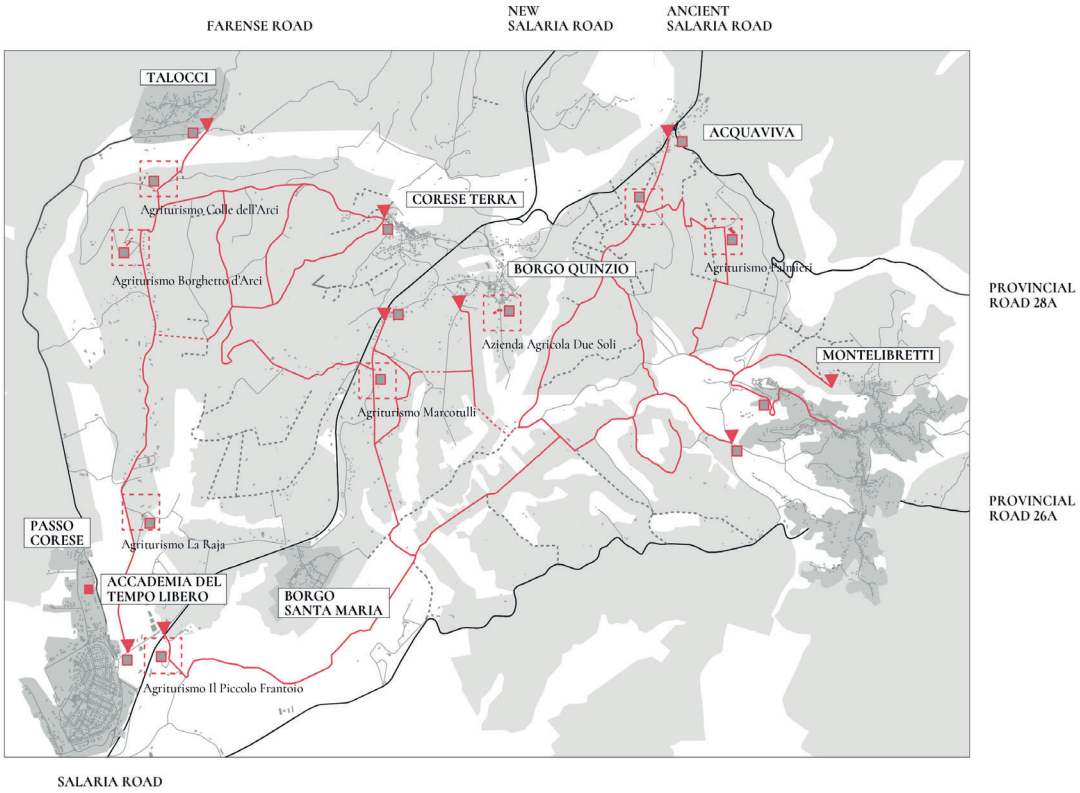

Figure 4. The olive orchards area as leisure facility for NO-CITY SALARIA: olive orchards (grey pattern), urbanisation (dark grey areas), existing pedestrian paths (red lines), new pedestrian paths (dashed red lines), dirt roads (dashed grey lines), intervention sites (dashed red squares), parkings (grey squares), starting point of the pedestrian path (red triangle). (source: Lucrezia Alaimo, Marzia Carosi, Michela Di Seri, Matteo Durante)

Hospitality beyond common hierarchic

In the very proximity of the GRA, i.e., the Rome metropolitan highway ring, between the big blocks of the public housing district of Serpentara and the industrial plots bordering the left bank of the River Tiber, the Pedro Arrupe Centre (PAC) hosts refugees in the railway enclave of the so-called 'Roma Smistamento.' The analysis of the surrounding context highlights the value of an informal, non-institutional approach to inclusion (Figure 5); this is something that characterises more rural realities, often strongly grounded on proximity and relational bonds, than urban ones. Moreover, the "protectiveness" assured by the figure of the *enclave* suggests the possibility of creating different logics of publicness.

According to the design proposal, the PAC would first expand its social and cultural activities in the abandoned spaces within the enclave, right next to the existing accommodation facility. In addition, two parallel possibilities of hospitality and integration would be explored by working on different forms of abandonment: 1) revitalising one of the General Markets of Rome, and 2) opening uninhabited houses in the small village of Montelibretti in the Apennines. In order for inclusive dynamics to be activated, the first proposal defines an enclosed system of public and private spaces, occasionally open to the outside world. Conversely, the natural isolation of the Montelibretti village creates the conditions for integration to happen directly in the public spaces and the surrounding open landscape, reversing the spatial qualities of what can be described as intimate and free space.

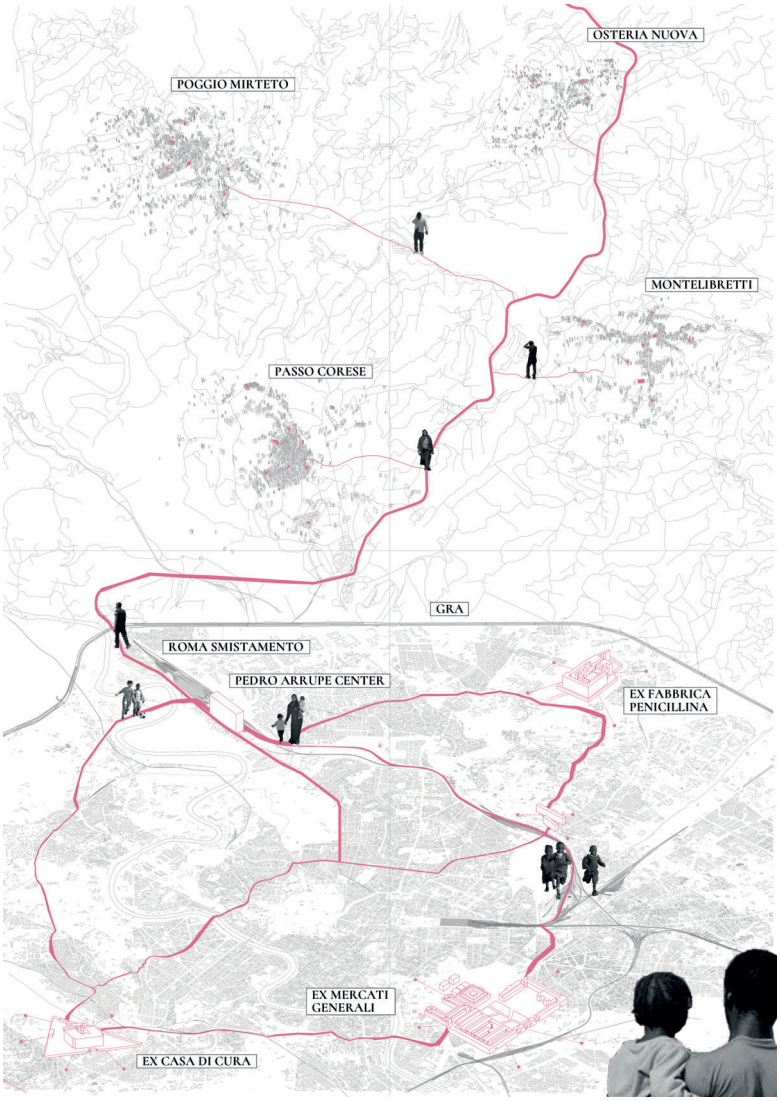

Figure 5. The hospitality spread throughout the NO-CITY SALARIA transect. (source: Valeria Barghiglioni, Ester Teresa Castillo Anis, Martina Lena De Gregorio, Benedetta Ventriglia)

4. The uncontainable pluriverse

The project's speculations on the Salaria transect have brought forth some early results that have much in common with those of studies focused on the world urbanisation phenomena. Although further studies are undoubtedly needed, some elements of interest can be read in the pluriverse of forms emerging from the continuous onward-backward movement created within the transect.

The urban/rural dichotomy thus becomes a *creative devise* to pinpoint and investigate the relational and synergic capacity of gradients of urbanity (Levy and Lussault, 2003) at all the points on the planet: the interaction of urban logics with rural materiality and heritage manifests other ways to inhabit a small town such as Passo Corese, designing new and specific scenarios of autonomy. The "ruralisation" of relationships that happens in certain public spaces of the city, along with the need to recreate a sort of "urban village" to assure conditions of hospitality, blur the line between the rural and the urban, reversing hierarchical orders and redefining territorial figures.

Although these evidences witness the imaginative potential of those relationalities activated within the transect, it must be noted that NO-CITY observations yet have a methodological limit. The transect and the civics continue to show a fixity, a definition, and a

measure, from which the implosions and explosions of urbanisation seem to escape. For instance, a design speculation that tackles the issue of hospitality within localities and planetary perspectives together may question where hospitality begins and what generates migration flows. However, despite this, what NO-CITY exercises of imagination show are possible ways to overcome city-centric and rural-centric visions, affirming the interchangeable and intrinsic value of both the urban and the rural, namely, of each gradient of today's urban condition.

Acknowledgments

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The Java Model: A Time-weighted Network Analysis of the Desakota

Neville Mars [1], Fabien Pfaender [2]

[1] Dynamic City Foundation / Mars Architects, Shanghai, China; nevillemars@me.com
[2] UTSEUS, Shanghai University / Costech EA2223 Université de Technologie de Compiègne; fabien.pfaender@utc.fr; 0000-0001-6338-9058

Names of the track editors:
Alexander Wandl
Rodrigo Cardoso

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Alexander Wandl
Machiel van Dorst

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Abstract: Peri-urban landscapes present a growing challenge for urban planners. Vast territories that comprise high population densities but few clear centralities erode the epistemological integrity of popular planning models. Meanwhile, as *in situ* urban-industrial development and top-down planned infrastructures transform these intricate landscapes, both the conceptual and practical challenges augment. Here, geospatial data can provide valuable insights. Network analyses can visualise the transformations within the peri-urban morphology. However, common 'unweighted' network graphs don't reflect operational realities on the ground and thus fail to inform planning strategies. This paper explores combining distance and travel speeds to develop a 'time-weighted' network model of the desakotas of Central Java. A one-hour travel boundary is introduced to demarcate the study area. Inadvertently, this reveals a regional loop that follows the expanding highway system, which suggests a limited efficacy of toll road developments. In response, this model lays the groundwork to evaluate a typical planning scenario: to build, or not to build a new toll road. The paper concludes that, the complexity of the impact on local communities, landscapes, and the regional 'accessibility profile' demands multi-scalar, multifaceted impact analyses to apprise strategic planning.

Keywords: Rural-urban integration, network analysis, Java, GIS, desakota, Indonesia

1. Introduction – data and the desakota

Gliding over the digital map, Java's density spikes merge to form a thick cloud [Fig. 1]. This abstraction refutes any hard distinctions between city and countryside. Observing the desakota,[1] which is Java's version of a peri-urban landscape, contemporary urbanity reveals itself as simultaneously dispersed and increasingly tightly networked together. used into a paradoxical rural-urban continuum of global and local systems of urbanisation,

[1] Desakota is a peri-urban landscape typology of Java Island. The term, coined by Terrence McGee, is an agglutination of the words 'desa' (village) and 'kota' (city) used to describe the growth and features of areas of mixed urban and agricultural activities that characterise the previously rural hinterlands of many of the rapidly expanding urban centers of the developing world in a new era of 'planetary urbanization.' " McGee T.G. (2017) The Sustainability of Extended Urban Spaces in Asia in the Twenty-First Century: Policy and Research Challenges. [In: Yokohari M., Murakami A., Hara Y., Tsuchiya K. (eds) Sustainable Landscape Planning in Selected Urban Regions. Science for Sustainable Societies. Springer, Tokyo.]

Java's data topography reaffirms the socioeconomic and ontological end of discrete urban nodes on a Cartesian plane, or what used to be simply known as 'the city.'[2]

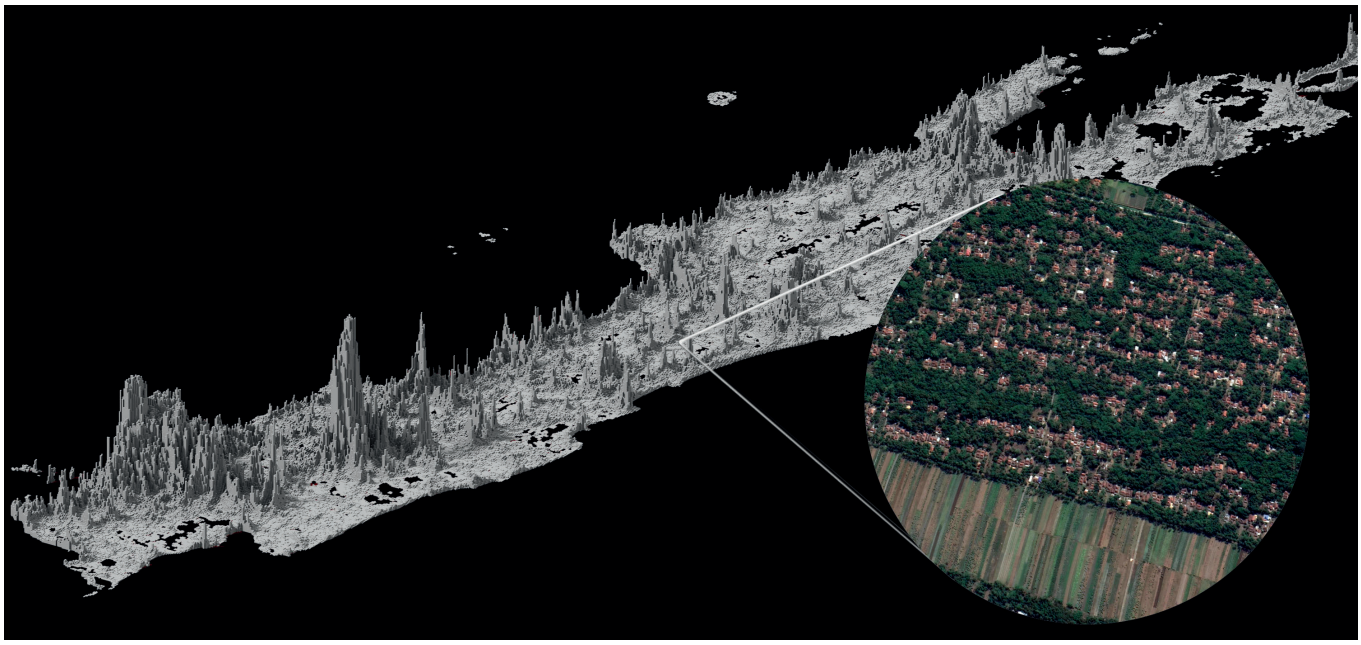

Figure 1.0 Population density map of Java Island. Census 2020. Circle insert: typical desakota striation, north of YIA airport, Central Java.

The concept of the city as a 'seamless whole,' has expired (DeLanda 2006: 10). As unsurprising as the conceptual death of the city would be to urban theorists, going back to Deleuze, Alexander, and Bateson in the seventies, in recent decades this notion has become dramatically more relevant, notably across Asia's peri-urban landscapes. This makes Deleuze's reconceptualisation of the city as an 'assemblage' acutely pertinent in its urban fringes, notably of 'Metro Java,' i.e. the city cores and 'extended metro regions.'[3] Where metropolitan intensities merge with the rhizomatous settlements of the hinterland, the last vestiges of a binary ideology – of urban versus non-urban – are under attack. Rather than urban densities seeping into the spatial void of the city's imagined counterpart, the countryside, in populated agrarian societies, built-up and densely populated areas invariably merge with the spatial multiplicities of productive landscapes.

Java's hinterland was never an urban void, not even a casual assemblage. The configurations of the desakota landscape have formed over centuries to systematically follow the variations within the natural geography. A lattice of rural communities continuously interweaves with the topographies of fertile land, fresh water, and forest. Resultant settlement patterns occurred in direct correlation to resource availability. The smallest unit of resource independence can be defined as a landscape 'module.'[4] Occurring in a range of different forms, they are the building blocks of Java's rural habitation. Innumerable modules link together to generate the desakota. In Deleuzian terms, this is a prime example of a "smooth space,"[5] i.e. flexible, generative, and decentralised. Yet, ironically, the resulting morphology that the desakota land use module delivers, visually resembles its counterpart: the "striated space," characterised by central control, intent, and hierarchy. (Deleuze & Guattari, 1980). The strands of land use types within each module link up to form a striated system of extended functional bands, which, we will argue, are critical to the suc-

[2] Vast territories notably in India, China, and Indonesia that constitute a hybrid landscape typology characterised by (fragments of) urbanisation dominating vast rural settings. Here it spawns urban functions and micro centralities, without clear dependencies to nearby urban cores. Lacking contiguity, urban density, and centrality, yet integrated with the urban economies that surround it, the rural//urban field defies common notions of city. The Chinese Dream – a society under construction. Lexicon. N. Mars, A. Hornsby. 010 Publishers, Rotterdam 2008.
[3] EMRs, or mega urban regions, such as JABOTABEK are driving much of Java's urban development (T. Firman et al., 2008).
[4] A second paper of Metro Java 2045 charts these land use modules. "A Cluster-based Land Use Taxonomy for Central Java." Boo Y., Mars, N.
[5] A Thousand Plateaus: Capitalism and Schizophrenia, p. 474, Gilles Deleuze, Félix Guattari, "Mille Plateaux," Les Éditions de Minuit, 1980.

cess of the desakota. Today, however, actual Deleuzian striation is looming large, as nationwide public works are rapidly (and at times crudely) projected across the landscape to reveal a modern, globalised Indonesia by 2045.

These systems of urbanisation, their scales, ideologies, and socio-spatial realities, are polar opposites and their assimilation is often irreconcilable. In light of Indonesia's rapid transformations, preserving and restoring its rural fabric is a core objective of the "Metro Java 2045"[6] planning project of which this study is a part. The underlying premise is that the desakota's uninterrupted land use striation can be equated with land use efficiency, sustainability, and even resilience, as defined in Indonesia's Climate Roadmap (ICCSR).

2. Time-based network analysis

2.1. minute cities

Without significant hierarchies or centralities within its spatial networks, the desakota defies conventional planning logic built around the centre/periphery dichotomy. Yet the planning disciplines still hinge on this withering spatial construct, which in turn underpins other fundamental, yet increasingly contrived, planning polarities: urban/rural, planned/generated, top-down/bottom-up, formal/informal, productive/stagnant, accessible/isolated, development/preservation, and notably, global/local.

As the desakota absorbs all the generic components of a global, neoliberal urbanism, its 'smooth spaces' give way to disruptions and emergent hierarchies. Yet, while planning conventions collapse within the sphere of the desakota's spatial transformations, maturing data technology brings its geospatial analysis within reach.

Spatial datasets allow us to map and analyse Java's topological landscape within a rural-urban continuum. As the desakota's spatial structure shifts from a predominantly horizontal 'field condition' to incorporate growing spatial hierarchies, its performance remains tied to the topology of mobility corridors and their ensuing land use patterns. Geospatial data allows its network structures to be modelled across scales (i.e., foot and bike paths (1.5m), single lane, and 'one and a half lane' roads (3m to 4.5m), trunk roads, and (planned) tollways.

According to Waldo Tobler's First Law of Geography "everything is related to everything else, but near things are more related than distant things." Within the socio-spatial and technological context of an urban assemblage, proximity is as much defined by time as it is by distance. 'Spacetime' is as much a reality for urbanists, as it is for theoretical physicists. To this end, the network analysis presented in this paper moves beyond common 'unweighted' graphs to include parameters of distance and travel speed, from which, in turn, a system of travel times can be deduced.

While in recent years time-based planning strategies have become commonplace, in daily practice few models seem to be backed by empirical evidence. Concepts such as the 5/15/30/60-minute city models hold promise to bring critical amenities within (walkable) reach of residential communities. The objective to concentrate urban functions, people and mobility echoes other sustainable planning tropes, such as Transit Oriented Development (TOD), and the 'compact city' writ large. As an umbrella model, the compact city is one of the theoretical cornerstones of sustainable planning. Its premise is that more condensed populations provide support for high-end public transit, services, and amenities, which in turn shorten commute times, frequency, and trip length, and thus lower energy demand. However, a discipline-wide accepted definition is still lacking (Neuman 2005), while its agenda of 'ecological development' perpetuates 'inherent contradictions' (Redclift 1987) at the heart of the planning discipline.

Hong Kong is the prototype compact city. It has expanded through hyper compact transit hubs that have kept commuting times reasonable. The desakota's density (close to 1000 p/km2) is sufficiently high, but Java's population of around 147.8 million (2020) is too finely dispersed to make the comparison meaningful. Despite this and the persistent epistemological contradictions, the compact city model has, arguably, performed as an ecological imaginary, streamlining efforts across the spectrum of planning specialisms and regions. This imaginary has given rise to a plethora of time-based planning concepts that

[6] www.MetroJava2045.org

aim for shared goals of mixed and intensified land use. But for the moment, these concepts, too, lack conceptual coherence and empirical foundation – specifically when applied outside of the West, and within the dispersed conditions of a rural-urban field.

The 15-minute city applies compact city logic to urban renewal. As such, it is reminiscent of 90s "village-in-city" schemes that aimed to disperse the programme throughout the city in order to limit suburb-to-centre mobility needs. As renowned urban planner Alain Bertaud has abundantly argued, this would subvert the very "reason d'être"[7] of the city as a place for a large mobile labor force to congregate, thus improving its citizens' ability to seek employment and housing opportunities. Edward Glaeser, shares a similar sentiment for the contemporary 15-minute city, calling it "an enclave – a ghetto – a subdivision,"[8] which, he argues, undercuts the city as an archipelago of neighbourhoods, which should foster links between different social territories, as much as within them. But within the context of Java's desakota, such criticism isn't quite so obvious. Planned centralities could offer vital amenities and economic opportunity, whilst preventing ribbon developments and pressure on ecologies and intricate road systems.

Accessibility and transit solutions are site-specific. They have to be observed over the long-term and within the local context, through a lens of culture, scale, form, morphology, density, climate, etc. Yet, surprisingly, many global institutions and thought leaders (ADB, WB, Brookings Institution, Joan Close[9], Parag Khanna[10]) still tend to uncritically equate economic development with road construction. This foregoes the precarious progress/preservation balance that emerging, tropical economies face. The traditional desakota communities were highly autonomous and localised. Their growing dependence on urban economies, tourism, and adoption of urban lifestyles, draws in components of a supra-regional reach. Expansion of infrastructural networks both supports and fuels this trend. In turn, this augments *in situ* urbanisation and socio-ecological fragmentation.[11] Without significant rural industrialisation or population growth,[12] the force driving land use changes and mobility needs isn't urbanization, but globalisation.

Roads intersect as much as they connect. Crudely planned infra-corridors vitiate the desakota's unique landscape striation. The desakota's relative isolation is both its weakness and its strength. Yet, current development models reveal a bias for highway expansion. Densely populated productive landscapes, typically in monsoon regions, are the world's dominant form of habitation. Intersecting these rice baskets with highways often presents an obvious choice for policymakers and market actors alike. The boost it gives local economies can be quick and construction easy and profitable. But at a time when grassroots activism has forced inner-city highways to be repurposed, demolished, and their construction blocked, in France, Korea, and India, respectively, investigating viable alternatives for the desakota and other peri-urban landscapes, reflects a global urgency.

2.2. Arborescence

Java's island-wide tollway construction is part of a national planning project. Their accelerated emergence, driven by an unofficial objective to match Western level road densities by 2045, could be interpreted as Indonesia merely 'catching up with the world' – infrastructurally and, consequently, economically. For the study area, this presents a total road surface of 873 km² and a relatively high land coverage of 5%. Distribution by road level is, however, unequal, with residential and tertiary roads accounting for 806 km², while secondary and primary roads account for only 35 km², and 13 km² for trunk and highways.[13] The bulk are municipal level roads (11% national, 11% provincial, 78% municipal, as of 2001) and of relatively poor condition.[14] However, we aim to illustrate that in order to make such comparisons, the morphology of the network is a paramount consideration. Java's developmental pathway is unlike western European countries, and cer-

[7] How Markets Shape Cities. Bertaud, A. 2018 MIT Press.
[8] The 15-minute city is a dead end — cities must be places of opportunity for everyone. LSE conference: The 15-Minute City. May 28th, 2021. https://blogs.lse.ac.uk/covid19/2021/05/28/the-15-minute-city-is-a-dead-end-cities-must-be-places-of-opportunity-for-everyone/
[9] As Former Executive Director of the United Nations Human Settlements Programme Dr. Joan Clos argues at UNH III, Quito, 2016.
[10] Connectography – Mapping the Future of Global Civilisation. Khanna, P. 2016 Penguin Random House.
[11] Meijer JR, Huijbregts MAJ, Schotten KCGJ, and Schipper AM. 2018. Global Patterns of Current and Future Road Infrastructure. *Environmental Research Letters* 13**:** 064006. http://www.globio.info/download-grip-dataset
[12] BPS Kabupaten Magelang. 2020. Kabupaten Magelang Dalam Angka 2020. Magelang
[13] For reference, France and the USA have built 0.017 ha/capita road surface (1.9% of its land surface) and 0.057 ha/capita road surface (1.7% of its land surface), respectively.
[14] Indonesia Road Sector Development. Junoasmono T. Deputy Director of Planning Integration and Network System Directorate General of Highways, 2015

tainly unlike today's juggernaut of highway construction, China. In general terms, the former gradually strengthened their historical trade routes to connect Europe's compact urban cores with bundled transit corridors, while the latter is well underway to project a universal road grid onto its landscape. They represent two extremes of highway development: the arborescent structure of a gradually maturing transit plexus, versus the uniform lattice of a built-from-scratch grid system.

It seems unreasonable, however, to categorise Java's road-network-in-transition as either one. The filigrain system of foot- and motorbike paths have served the desakota for decennia. Despite its high population densities, the homogeneous dispersion and localisation of activities allowed the network to function without forging much hierarchy. The desakota's landscape modules tessellate across the plane in an organic tiling, incorporating connections where needed. In this system, a tollroad is neither an upgrade nor an emergent system, but a wholly novel entity, comprised of its own scale, speed, and space, which will induce its own socioeconomic, ecological, and network dynamics.

Figure 2.0 Study area of 130 x 130 km (red), and the one-hour travel envelope (black).

3. The one-hour city: framing a network analysis of Central Java

3.1. Green edge

Data-driven analyses have begun to unveil the innate complexities of peri-urban landscapes. However, operating within the vast expanse of Central Java's hinterland presents a technical challenge: how can the boundaries of its geospatial analysis be demarcated? This question echoes the predicaments planners face when setting urban growth boundaries within the context of scattered and evolving cityscapes. From a performance and user perspective, Bertaud argues, one hour is a cut-off point for a "reasonable" commute. However, applied to large urban regions, with many inaccessible pockets, this presents a muddled accessibility profile. Conversely, we have contended that precisely within vast, decentralised urban networks, a 'one-hour city' concept can offer clarity as to where – and where not – to develop (Mars, Hornsby 2008), delineating a mobility based 'green edge,' instead of an arbitrary urban growth boundary. We've applied a similar time-based constraint to delineate our analysis of Central Java's rural road system.

3.2. Polar opposite

Within the 130 x 130 km Central Java study area [Figure 2.0] two main urban centres cast their influence over the hinterland[15]. A green edge can be simulated that encapsulates the polar structure of the regional corridors. Steadily, the national roads are upgraded to form a loop of tollways, with the volcano of Merapi Mountain at their centre. This simple structure offers an ideal framework to observe the transitions of the region's accessibility profile, i.e. the impact of new toll roads on travel times, which can inform planning decisions. However, the model's simplicity proved misleading, as it obscures the study area's complex internal organisation, while proving technically challenging, as it seems this approaches the largest area current data analysis can adequately sustain before upsetting viability thresholds.

3.4. Describing the one-hour corridor

The one-hour city model simulates a space of 30-minute access on either side of the national highway and tollway loop. The resultant envelope is a single, undifferentiated entity of a one-hour commute from edge to nearest edge, perpendicular to the highways at its centre [figure 2.0]. This envelope can be defined using a precise geospatial methodology. The raw data is derived from OpenStreetMap (OSM). Cropped to our 130 x 130 km frame, this dataset of 2gb, provides the basis of a 4-steps adjustment process that ultimately yields the one-hour envelope.

Value of the highway tag	level
services, bus, busway, bus_guideway, access, bus_stop, via_ferrata, access_ramp, emergency_access_point, emergency_bay, service, footway, traffic_island, virtual, cyleway, cycleway, byway, path, track, pedestrian, steps, platform, bridleway, rest_area, escape, footway	2
residential, yes, unclassified, crossing, unknown, bridge, lane, ford, psv, living_street, alley	3
tertiary, tertiary_link, turning_circle, road, roundabout, ice_road	4
secondary, secondary_link	5
primary, primary_link	6
trunk, trunk_link	7
motorway, motorway_link, ramp	8

Table 1.0 Overview of road levels 2 to 8 and the descriptions of the types they contain.

The first transformation distills the roads from the OSM map dataset, which include a variety of other geographic qualifiers not applicable to this analysis. However, currently only a few distillation tools can handle the large size of this dataset. We've applied the

[15] In the north, Semarang, tethered to the east-west trans-Java expressway (AH2), and in the south, Yogyakarta, with the new airport (YIA) and ancient Borobudur as major anchor points. On the east side the National toll road 14 (Jalan Tol Ciledug — Pejagan), and on west side the National Road 15 (Jalan Jogja - Solo).

parser library policosm[16] in Python language, developed specifically for such an operation. It does so by scanning the map and selecting connections with the tag 'highway.' This tag can be associated with a multitude of values, so we have introduced a system to reduce this variety to seven grades, as defined in Reference Table 1.

From here, the algorithm builds the network out, translating each point along the way as two vertices joined by an edge. At this stage, the roads are represented in a uniform graph. The second transformation is to refine the road network. However, the network contains too many vertices and edges for standard network algorithms to perform operations, such as a routing or centralities assessment, in a finite time. Therefore, simplifying the network while retaining its spatial information is critical in this process.

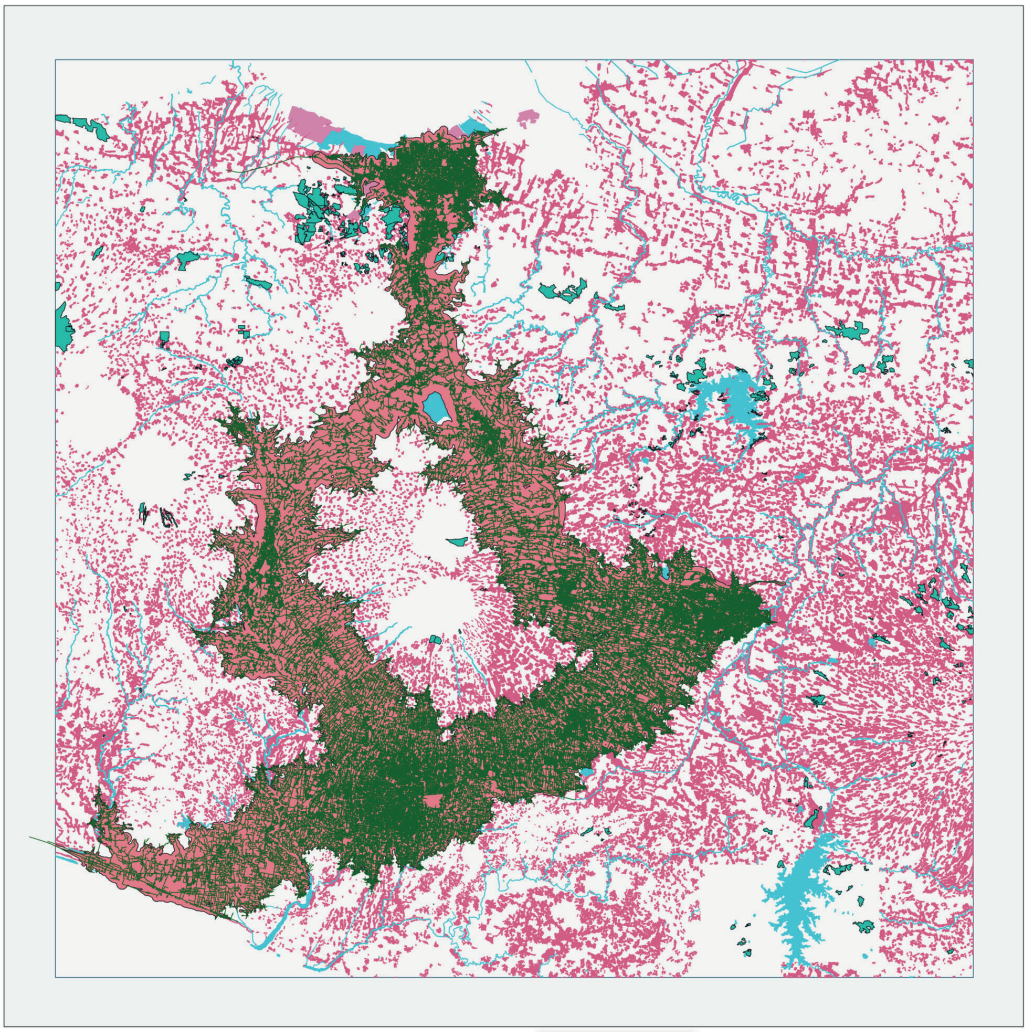

Figure 3.0 One-hour envelope projected onto settlement patterns of Central Java

The third transformation is to crop the 130 x 130 km area to create the corridor, or spatial envelope. This operation starts with establishing a series of anchor points throughout the area running from Semarang to Yogyakarta airport, in a loop encircling the volcano. [Figure 3.0] The anchor points are geographic tethers; once attached, the set of 17 anchors points are joined using a routing shortest path search weighed in time.

The time factor itself is a specific feature added to every edge corresponding to its geographical length (in metres, projection UTM zone 49S), multiplied by the speed observed on such edges, effectively ranging from 10KPH to 38KPH (Munawar 2011). The routing algorithm then generates a path that minimises the commute between each pair

[16] https://zenodo.org/record/1478235

of successive anchor points. This delivers the basic network skeleton. From this skeleton, the one-hour corridor is simulated. The routing algorithm is employed once again, now weighted for time. For the corridor, the idea is to create a sub-network, or 'isochrone tree,' from each of the 812 vertices of the backbone expending a maximal 30 min. travel time. These 812 branches create the time threshold, which are merged within a global network. This produces the final network dataset. The fourth transformation attributes an envelope to this one-hour corridor. It does so by creating a concave hull around each of the 812 tree-shaped networks and performing a 'unary union' at each of them.

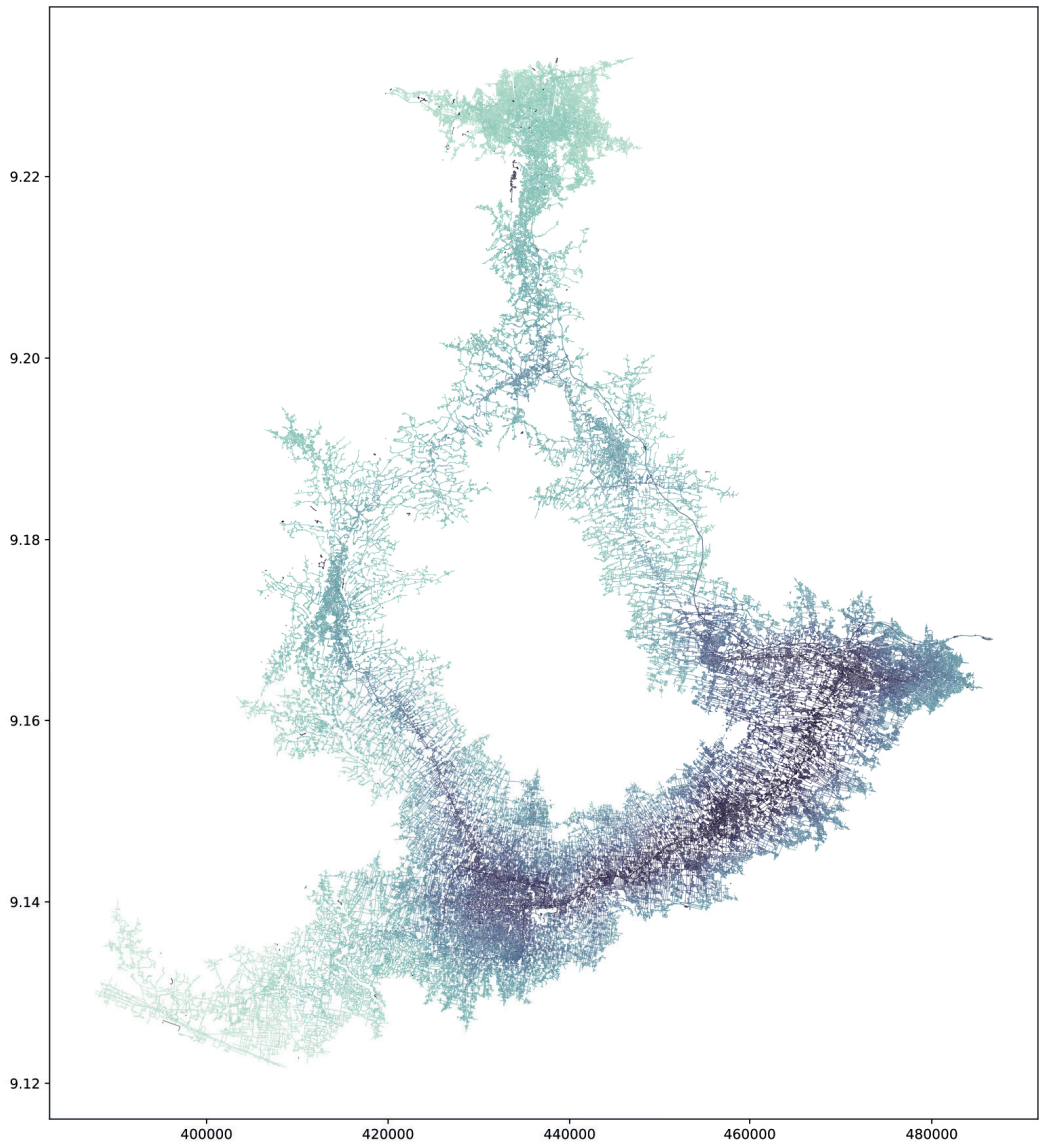

Figure 4.0 Closeness centrality ranging from 0 light blue to 1 dark purple.

4. Exploratory interpretation of the network data

This arduous process allows us to observe a more complete picture of the dense, singular network serving the desakota. Comparisons between travel time and travel distance, either using or avoiding the highway corridor, can now be made for the commute between any two points within the one-hour city loop.

The particularities embedded within the desakota, as described in the introduction, begin to reveal themselves – specifically its decentralised and dispersed structure. The visualisation itself validates our initial assumption that data analysis can offer a means to

collaborate on conceptual problems, such as time-based planning models, and assess concrete spatial strategies.

As an initial stress-test of the intended cross-disciplinary dialogue, we have performed two simple experiments using two centrality measures commonly used in graph theory (Porta 2010). Both centralities are based on 'shortest path' computation on the 367,000 edges within this network, which in this model is computationally intensive for the graph-tool library (Peixoto 2014). The shortest path minimises the sum of the weight (in our case, time-distance) between two vertices, calculated for the centrality measure for every pair on the graph.

4.1. Closeness centrality

Closeness centrality reflects how close a vertex is to all the other vertices on the graph, i.e. the sum of the distance weight of all the shortest paths between one vertex and all the other vertices on the graph. The rendered outcome is presented in Figure 4.0

The higher (darker) values of the closeness centralities appear on the south east side of the network, with the exception of the backbone, i.e. the highways and tollways. This centrality is sensitive to how many vertices are in close vicinity with one another; in our one-hour model, this is highlighted in the south-east region. All vertices in this area are close to each other, forming an almost 'optimal' lattice. In norther part of Semarang, the network is also dense, so closeness centrality is expected to be higher. However, this is not the case as transit systems within the city are more hierarchical, thus, closeness reveals that only a few corridors connect many destinations. Conversely, a lattice-like network with few hierarchies brings all vertices close to each other in a non-hierarchical manner. This reveals that multiple destinations can be reached via multiple connectors without a significant drop in travel time. This rendering suggests that the villages can exchange across this vast area time efficiently, without relying on one specific set of connections where traffic would subsequently concentrate.

4.2. Betweenness centrality

To build on this idea, we have chosen to implement a 'betweenness centrality' algorithm, weighted again with distance as a factor of travel time between vertices A and B. This centrality is different from proximity, as instead of measuring how close each vertex is to all the others, it measures how many of the shortest paths from all vertices to all other vertices pass through each edge. The edges with a high betweenness score are more likely to get traffic. In a hierarchical city, the betweenness is usually found at cities' main arteries, such as trunk or primary roads, or bridges. The outcome of betweenness centrality is visualised in Figure 5.0.

The betweenness in the figure has been filtered from the highest values. The reason for this is that the edges from the backbone have been obtained using the shortest path method, so their betweenness score eclipses the complexity of the underlying lower betweenness values. To remove the higher values, we simply remove one per thousand of the highest values. The betweenness values in the network highlight a distinct difference between the urban city situation, where the edges are very dense, and the desakota, where edges are less dense.

In cities, this centrality is not very helpful as they are more hierarchical structures. Removing the main travel routes result in tiny sparks of high betweenness on secondary and tertiary roads that hold no real value. The desakota structure, on the other hand, shows longer paths of high betweenness, spread among its vicinity, indicating a village-to-village favoured path with fewer low values (in yellow and green in Figure 5.0).

The combination of fewer low values and a high closeness indicates an optimisation of the land, where each connection is valuable, serving as a support for traffic with fewer additional options. The optimal network centralities observed here are a good indication of the practical benefits of the desakota in this specific rural-urban structure that may hold the key to sustainable densification.

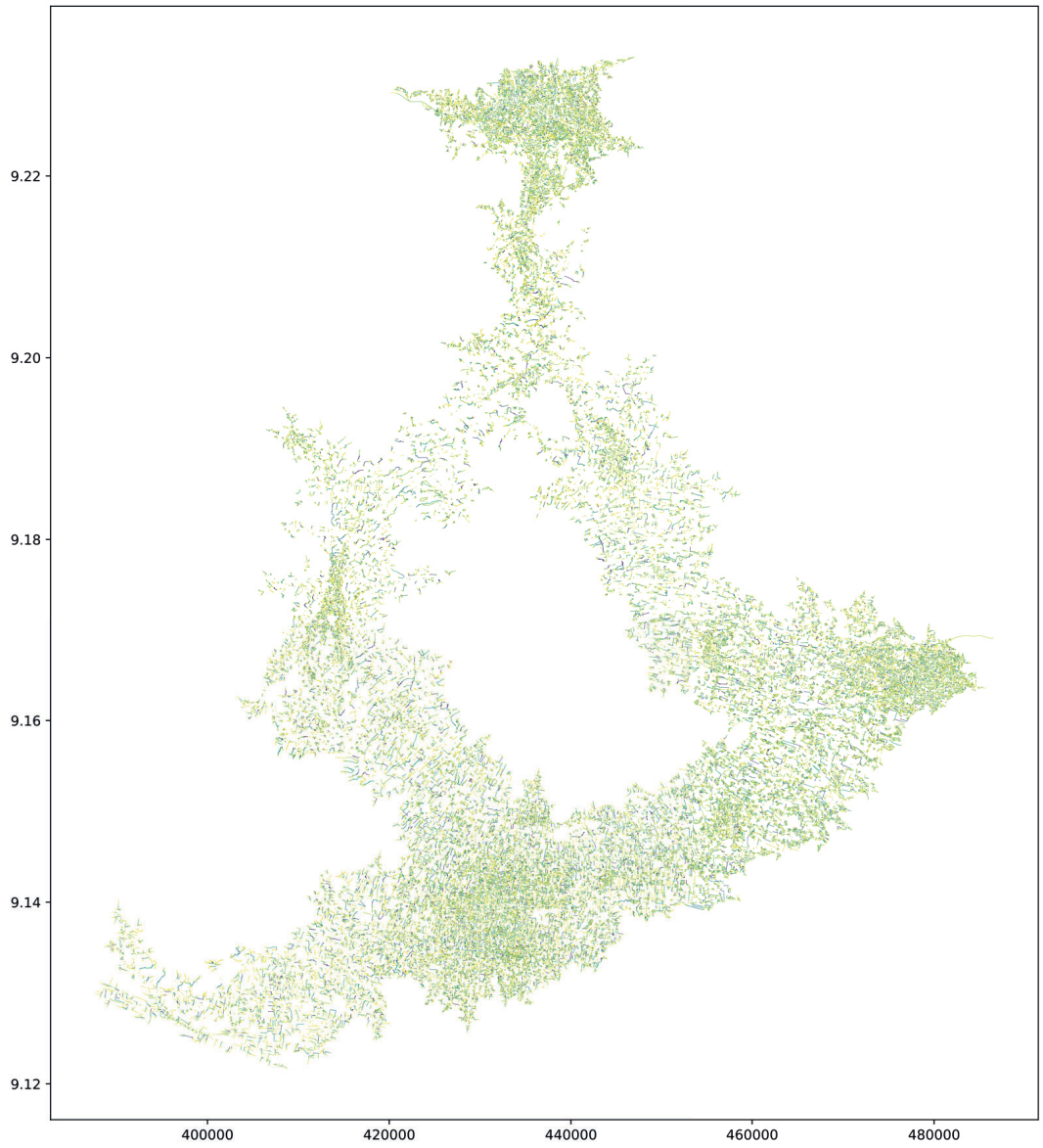

Figure 5.0 Betweenness centrality of the network edges are thresholded for the highest values as to let the lower structure appear. (Yellow is low, Blue is high).

5. Planning scenario and dialogue

5.1. Fait accompli

A reflexive process is elementary to urban planning. Feedback should be garnered at all stages of a project, and from all stakeholders. Though this principle isn't really disputed, it is not often implemented. Precisely in regions where planning conditions are most challenging, and development projects would benefit most from critical evaluation, time and resources tend to fall short. In large countries with complex power structures such as Indonesia, implementing a long-term supra-regional planning vision is a particularly painstaking and largely opaque process. Decisions that have been made will, therefore, not soon be overturned, or indeed critically discussed in the public domain. Tollway expansions in Central Java that have received a green light, are in effect a *fait accompli*.

Nevertheless, with thousands of kilometres of new infrastructure on the agenda nationwide for 2045, the transformations of Central Java should serve as a valuable case study. As its highways are rolled out to create better access for tourism in culturally significant locations, such as to the Borobudur, there seems to be a broad consensus among local experts[17] that this must be done sensibly. What this means, however, or how to achieve this – i.e. building elevated highways, fewer on and off ramps, tunnelling – remains to be seen. What is clear, as many have argued before us,[18] is that the desakota is foremost a fragile heritage landscape. The success of the region will be rooted in the success of its rural communities, which in turn remains reliant on the integrity of the village-landscape modules linking up to form the desakota. This underscores that spatial visions for the region cannot be orchestrated through central planning alone. Decisions on highway development should be based on an holistic assessment, informed by a combination of observation, local input, and objective data points. Herein lies a challenge.

Operating with the luxury of a long-term perspective – anticipating the advent of new technologies and other societal shifts – allows us to believe alternative development models are feasible. Such models localise resource flows (i.e., smart grids), and will allow remote communities to virtually tap into global information flows (i.e., e-learning, e-healthcare, e-commerce), but also new agro-logistic hubs and other design initiatives, to be developed in the next phase of the Metro Java 2045 project. These are regional planning projects which do not put further strain on existing road networks.

6. Conclusions

In contrast to the radial accessibility profiles that form around public transit nodes, the one-hour envelope we have modelled, portrays the desakotas of Central Java as a single ~250km long linear city. The operational direction of this loop, however, functions as much along the highways, as it does perpendicular to them. The tollways within the envelope represent progress and, as the simulations indicate, a new centrality. Yet, this is a centrality that is paradoxically void of urban programme. This contrast suggests that the emergent hybrid landscape of this region is a product of the collisions between two urban configurations: tree and tessellation – the respective products of two disparates forms of urbanism, local and global. The models suggest there is no significant difference in accessibility between sections with national roads or tollways. It can be deduced, however, that cross-regional movement is more efficient along newer highways, at least where there is quick access to on and off ramps. Conversely, the models suggest that if new tollways dissect local networks, this can greatly impede local movements, or village-to-village connectivity. Where this may happen precisely requires more research. Ultimately, however, the long-term mobility needs (of people and goods) must be better understood in order to optimise the efficacy of Central Java's emergent hybrid network. This requires a deeper understanding of the conflict between ideologies representing progress and preservation, of global and local systems of urbanisation and how these dichotomies are exacerbated by a gap between urban theory and planning practice.

[17] http://metrojava2045.org/roadmap-borobudur/
[18] http://jogjaheritagesociety.org

Data Availability Statement

Global Land Analysis & Discovery (https://glad.umd.edu/dataset/global-2010-tree-cover-30-m) (Hansen et al., 2013)

OCHA Services (https://data.humdata.org/dataset/worldpop-population-counts-for-indonesia)

EEA (https://www.eea.europa.eu/data-and-maps/data/world-digital-elevation-model-etopo5)

Contributor statement

Initiator: Neville Mars

Data Curation: Fabien Pfaender

Formal Analysis: Fabien Pfaender

Investigation: Fabien Pfaender, Yeeun Boo, Harshitha Mruthyunjaya, Neville Mars

Methodology: Fabien Pfaender, Neville Mars

Visualization: Fabien Pfaender

Writing: Neville Mars, Fabien Pfaender

Editing: Eva-Mae Brazil

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China's Urban Growth Boundaries: Towards a Context-Responsive Method

Christian Nolf [2], Yuting Xie [1,*] and Weishun Xu [3]

[1] Institute of Landscape Architecture, College of Agriculture and Biotechnology, Zhejiang University, Hangzhou, China; xieyuting@zju.edu.cn; ORCID ID: 0000-0002-6379-8908, * (corresponding author)
[2] Group Landscape Architecture and Spatial Planning, Wageningen University, The Netherlands; christian.nolf@wur.nl ; ORCID ID: 0000-0003-4304-2107
[3] Department of Architecture, Zhejiang University, Hangzhou, China; xuweishun@zju.edu.cn

Abstract: After four decades of fierce urban growth driven by economic development, China recently adopted a 'three red lines' policy to protect its permanent farmland, vital ecosystems, and to contain urban expansion. To delineate urban growth boundaries (UGBs), current methods all employ quantitative land-use suitability indicators to define a compromise between competing spatial claims. However, ignoring site characteristics and underpinned by an increasingly dualistic concep-tion of the urban and the rural realms, these methods often result in divisive UGBs devoid of any spatial quality. This paper explores how UGBs, rather than passive borders, can be designed as con-text-responsive and integrative urban-rural interfaces. A brief description of the urban growth phe-nomenon and the authorities' responses at the national level is followed by more specific investiga-tions in the Yangtze River Delta (YRD) region. Six representative urban-rural edges are examined in terms of historical development, planning, policies, current challenges, and opportunities. Based on the analysis, alternative design strategies are proposed to refine the definition of UGBs from a per-spective of spatial quality and programmatic innovation. A final part discusses how the design ex-plorations in the YRD can be systematized as a qualitative context-responsive method for UGB plan-ning in China.

Keywords: Urban Containment; Urban Growth Boundary; Three Red Lines Policy; Chinese Plan-ning; Research-Through-Design.

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1. Introduction: Containing Chinese cities

China's recent urbanisation is unprecedented in human history. Since the economic reform of 1978, the rate of urban population has increased from 17.9% to over 60% in 2020 (National Bureau of Statistics of PRC, 2020). This massive human wave, which saw 774 million people migrate to cities, was accompanied by a fourfold increase in urban land on the national average, and up to 11-fold increase in some megacity regions (Kuang, 2020; Liu et al., 2015). Encouraged by the authorities as an engine of economic development, the creation of urban land has been officially guided by urban masterplans (Deng et al., 2010; Hsing, 2010; Chen, 2016).

However, on the ground, urban expansion has also occurred less formally. Due to a lack of coordination between administrative levels and between sectoral agencies, the creation of urban land has often exceeded actual market demand (Long et al., 2013). In particular, many speculative urban developments have been initiated by rural communes on

the outskirts of cities to inflate their economic performance artificially (Verdini et al., 2016).

As a result, in most parts of China, the physical growth of cities has preceded, if not denied, official town planning. A retrospective of the successive master plans of cities like Hangzhou, Nanjing, Shanghai, and Beijing shows how the green belts supposed to contain urbanisation have each time been ignored by the voracious appetite of developers (Yang & Jinxing, 2007; Zhao, 2011; Yue et al., 2013; Wang et al., 2014; Tian et al., 2017; Shao et al., 2020).

In this hyperdynamic and semi-controlled context, the very idea of an urban edge has long been an abstract and unstable notion. Rather than a space, the urban edge in China was more synonymous with an ephemeral condition awaiting hypothetical development. Due to its inherently transient nature, China's urban edge has until recently not been considered in terms of spatial quality.

Recently, however, the tide has turned. Several studies have highlighted the negative environmental impact of urban land expansion (He et al., 2017), as well as its predominant contribution to the dramatic loss of agricultural land. It has been estimated that the destruction of farmland has accounted for 55% of the newly-expanded urban areas in China (Liu et al., 2019). In addition, research has shown that despite national land use plans and policies promoting compact forms of development, the average intensity of urban land uses in China has steadily declined over the past decades (Chen et al., 2016).

In response to these environmental, food security, and inefficient land use issues, China adopted in 2018 a strict 'three red lines' policy for the protection of vital ecosystems, permanent farmland, and the containment of cities (Xu et al., 2018; Jiang et al., 2019). Framed by the national strategy of "Ecological Civilization Construction," the three red lines policy is supported by a new integrated "territorial planning system." It is steered by a new "super" Ministry of Natural Resources, which merges the formerly competing sectors of land resources and spatial planning (Ma & Liu, 2018; Jiao, 2019; Nolf & Xie, 2020; Liu & Zhou, 2021).

In addition, massive investments in regional transport networks have completely reconfigured the spatiotemporal relationship between cities (Chen, 2020). In the Yangtze River Delta (YRD) megacity region, it now takes less time to reach the center of Shanghai from Hangzhou by high-speed train (196 km in 50 minutes) than from Shanghai's outer periphery by metro (42 km in 1h21). In these hyper-connected urban constellations, it is now possible and realistic to prevent peri-urban growth around certain cities and redistribute development pressure at a regional scale, in existing or new satellite towns (Mao et al., 2020).

2. Theories and Methods: re(de)fining urban growth boundaries

Containing urban growth is an old and global problem. As a country still undergoing a process of urbanisation, China has the opportunity to learn from previous experiences in other contexts. A substantial body of international literature examines and occasionally compares urban containment approaches in terms of objectives, methods, performance, and impact (Dawkins & Nelson, 2004; Millward, 2006). It shows that while most containment approaches aim to protect natural areas and farmland, and to promote compact forms of developments, they differ in the method adopted. The diversity of methods reflects the different institutional structures, planning systems, and spatial conditions specific to each context. Containment strategies obviously cannot be the same for addressing centralised metropolitan areas in the USA and Japan, or for addressing the polycentric constellation of mid-size cities and "territories-in-between" found in Western Europe (Wandl et al., 2014).

Among international precedents, the UK's approach to urban containment is of particular interest to China. The UK not only pioneered the concept of 'green belt' that strongly influenced the Chinese planning system (Yang et al., 2007; Wang et al., 2014). The UK also founds its containment strategy on a strong countryside protection paradigm, and supports it with strict land-use control instruments coordinated at the national level. This approach echoes the centralised structure of Chinese planning and its new priorities

for environmental protection. In this regard, the work of Nick Gallent and his colleagues on urban peripheries is worth examining: questioning the strict classification of urban and rural categories in the UK planning system, it seeks to recognise the specific value of urban-rural fringes as multifunctional areas that perform vital functions for both the city and the countryside (Gallent et al., 2004; Gallent & Shaw, 2007).

While most of the literature on urban containment focuses on land-use policies, a few precedents also address the question of UGBs in spatial and programmatic terms. Among these, the 'Transect' model championed by New Urbanism conceptualises the transition from the city to the countryside as a gradient in six distinct T-zones characterised by a decreasingly dense urban fabric (Duany & Talen, 2002). Used both as an analytical tool and as a code-based prescriptive planning instrument, the T-zones transect model nonetheless assumes a radio-concentric layout of the city, which only rarely corresponds to the complex reality of polycentric metropolitan peripheries.

Other spatial strategies for urban-rural boundaries have emerged through design competitions and calls for ideas. Among the most influential, the winning entry for the Dutch Green Heart by Harrison Studio in the mid-1990s imagines the urban-rural interface as a chain of wetlands to store freshwater while spatially marking the boundary (Harrison & Harrison, 1997; Tjallingii, 2000). Although not implemented, this vision inspired, in subsequent plans, the concept of an active ecological buffer zone at the edge of the Green Heart.

In 2008–2009, the international consultation for the future of the Grand Pari(s) highlighted the need to requalify the contours of the metropolitan area. Pointing out the lack of urban-rural dialogues on the outskirts of Paris, the multidisciplinary team involving Jean Nouvel and Michel Desvigne proposed widening and upgrading the urban growth boundary into an agro-urban ribbon combining small-scale agricultural programs (orchards, vegetable gardens, greenhouses) with public facilities (parcs, trails, public spaces) so that "*the urban and rural worlds can benefit from (...) the qualities of the other*" (Desvigne, 2009).

In any case, however, the literal transfer of urban containment models and strategies from one context to another is neither relevant nor desirable. Observing the challenges in Chinese urban-rural edges, Verdini et al. (2016) recall the importance of considering the specific institutional, cultural, and spatial conditions of each context: not only China's dual land tenure system that governs urban and rural land fundamentally distinctly (note 1), but also the great diversity of spatial patterns found across the country.

Recently, several sophisticated methods have been elaborated and tested to define UGBs in the specific context of China. Based on indicators of land-use efficiency, connectivity, carrying capacity, ecological security pattern, and ecosystem services, these methods provide scientific support for determining the spatial needs of different functions and defining their most reasonable locations (Long et al., 2010; Zhou et al., 2014; Jiao, 2015; Ma et al., 2017, Mao et al., 2020; Wang et al., 2020). However, the outcomes of these methods remain a quantitative compromise between competing land claims. Ignoring site characteristics and underpinned by an increasingly dualistic conception of the urban and the rural realms, these methods often result in generic and inert UGBs that don't respond to their context.

Aiming to maintain and consolidate urban-rural dialogues, our research enriches the outline of the UGBs with a perspective of spatial quality and programmatic innovation. It investigates how UGBs, rather than passive boundaries, can be conceived as context-sensitive and integrative urban-rural interfaces (Fig. 1). This objective is broken down into three sub-questions related to the past, present, and future of urban edges:

- How can the historical development pattern of urbanisation explain the current conditions of city edges?
- What specific spatial features and activities can currently be observed in urban-rural edges?
- Based on existing local resources and needs, which alternative UGBs could be imagined in the future?

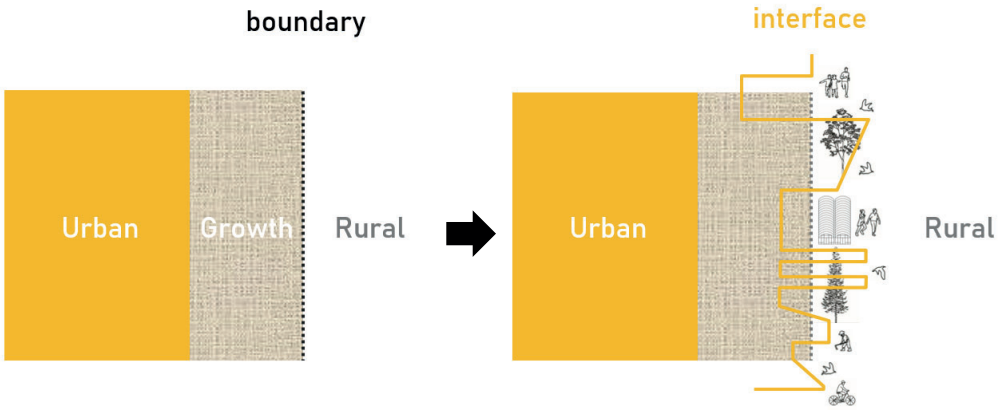

Figure 1. Urban Growth Boundary: from a passive border to an active interface

To address these questions, we examined the urban edges surrounding the vast green heart of the YRD megacity region. Developed on the deltaic plain south of the Yangtze River, the YRD megacity is an extraordinarily densely populated region comprising the cities of Shanghai, Suzhou, Jiaxing, and Hangzhou (Nolf et al., 2021). Subject to an ambitious Integration Plan since 2019, the YRD is a vivid example of the urgent need to protect open spaces and contain urbanisation. Next to objectives of economic, transportation, energy, and service integration, the YRD plan also includes strict quotas for permanent farmlands, preservation of ecological space, and a vast demonstration zone for integrated ecological and green development (CPG, 2019; NDRC, 2019; DNRZP, 2020).

We sampled six study areas along the UGBs recently planned to frame this demonstration zone (Fig. 2). All study areas have the same dimensions: 20 km in length to cover diverse edge conditions; 6 km transversely to provide an in-depth overview of the urban-rural transition. The study areas are nevertheless differentiated by their urban fabric and their landscape morphology. Furthermore, study areas located near major urban centres (edges 2, 5, 6) are subject to more intense development pressure than less central areas.

For each study area, a historical analysis, a critical review of successive master plans and policies, and a field survey on foot and with aerial views by drone were carried out to define local resources, current challenges, and future opportunities. Particular attention was devoted to identifying, through interpretive mapping and modelling, the spatial characteristics of the infrastructural and landscape systems framing each study area (Fig. 3).

This diagnosis in turn inspired context-responsive strategies for the (re)definition of the UGB in each study area. The strategies consist of a vision for the 20 km-long edge and of a detailed spatial design project materialising the vision in a representative 1 x 1 km2 site (see Table 1).

Figure 2. Study areas: 6 samples (20 km x 6 km) of urban edges were selected along the most recently planned UGBs surrounding the green heart of the YRD megacity region.

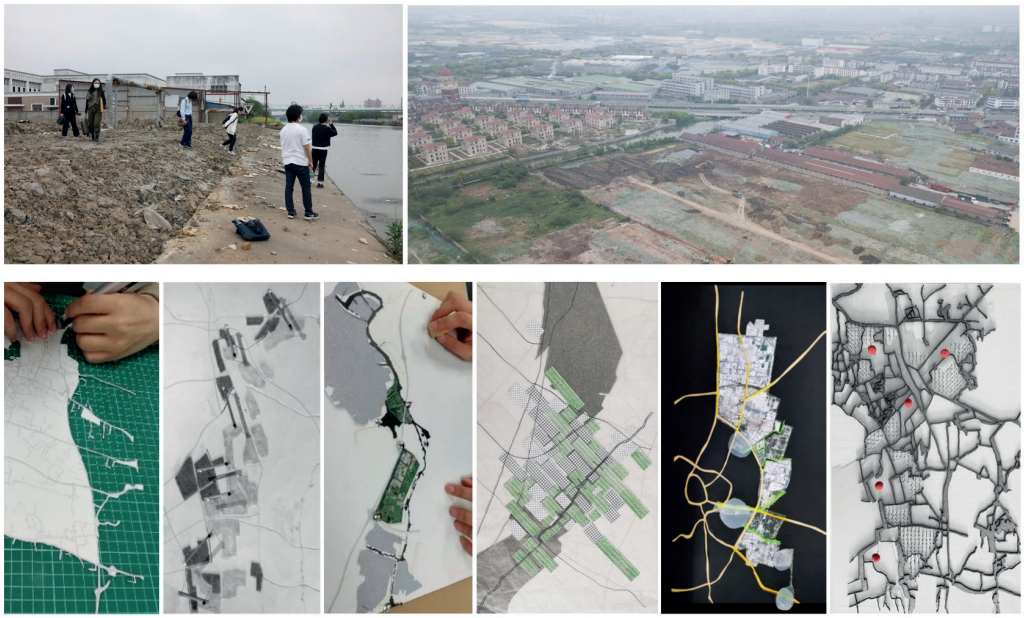

Figure 3. Methods: A set of techniques was used to identify the origin, condition, challenges, and resources of each of the six urban-rural edges in the YRD: historical analysis, field survey (pictures above), and interpretative mapping and modelling (pictures below).

3. Results

The examination of the six sample areas in the YRD generates insights on the past, present, and potential future of its urban-rural edges:

3.1. PAST: three identified types of edges

A first lesson relates to how the historical development patterns of urbanisation have conditioned the current edges. In all sites, the urbanisation process has involved a rapid and profound transformation of a preexisting rural landscape, with a peak period in 2000–2015. Three types of edges can be distinguished according to the intensity of the transformation (see Table 1, left column):

- First, sharp edges. Observed near the most densely populated areas, this type of edge results from the strict and rapid implementation of an urban masterplan. Replacing the original landscape entirely with a new grid of roads and canals, this type of edge features an hermetic urban-rural relationship;

- Second, hybrid edges. This type results from the superposition of a grid of roads on top of the original hydrological landscape. It is found in areas with less development pressure, where the means to reconfigure the water system were more limited. The combination of the road grid and the winding course of the rivers creates interesting variations within the blocks, but also more porous and diversified borders on the urban-rural edge;

- Third, organic edges. This type results from in-situ, unplanned, and incremental urban growth within the preexisting landscape structure. Observed in the least connected places, this type of urban-rural edge manifests itself through a gradual intensification of urban functions.

3.2. PRESENT: status quo and current activities

The observation of urban edges today reveals contrasting conditions. In several sites, the actual urban footprint occupies only a fraction of an overly ambitious old masterplan that has not been followed up by development (see Fig. 4). In other sites (including edge 2 and 4), a recent process of deindustrialization for integrated ecological and green development has dismantled the crown of old factories and workshops that occupied the peripheries. The result is a discontinuous and heterogeneous edge, an amalgamation of productive activities, residential functions, and large-scale urban facilities.

This environment is nonetheless the scene of various activities that opportunistically take advantage of the proximity of both the rural and the urban realms. Somehow echoing the notion of multifunctional fringe described by Gallent et al. (2004), the YRD's urban-rural edge today features, among others++, informal vegetable gardens managed by the local communities, ancient villages transformed into affordable dormitories for the "floating population" of migrant workers, or abandoned industrial estates temporarily occupied by small businesses.

In contrast to the rich diversity of elements and emerging practices encountered on the edge today, the official plans for the future urban-rural boundaries are strikingly rigid. Guided by top-down quantitative prescriptions and ignoring local specificities, the projected UGBs of masterplans draw a strict line between monofunctional urban blocks on the one hand, and a deeply rationalised agricultural landscape on the other. As such, the planned urban-rural boundaries annihilate all possibilities for urban-rural dialogue in the future.

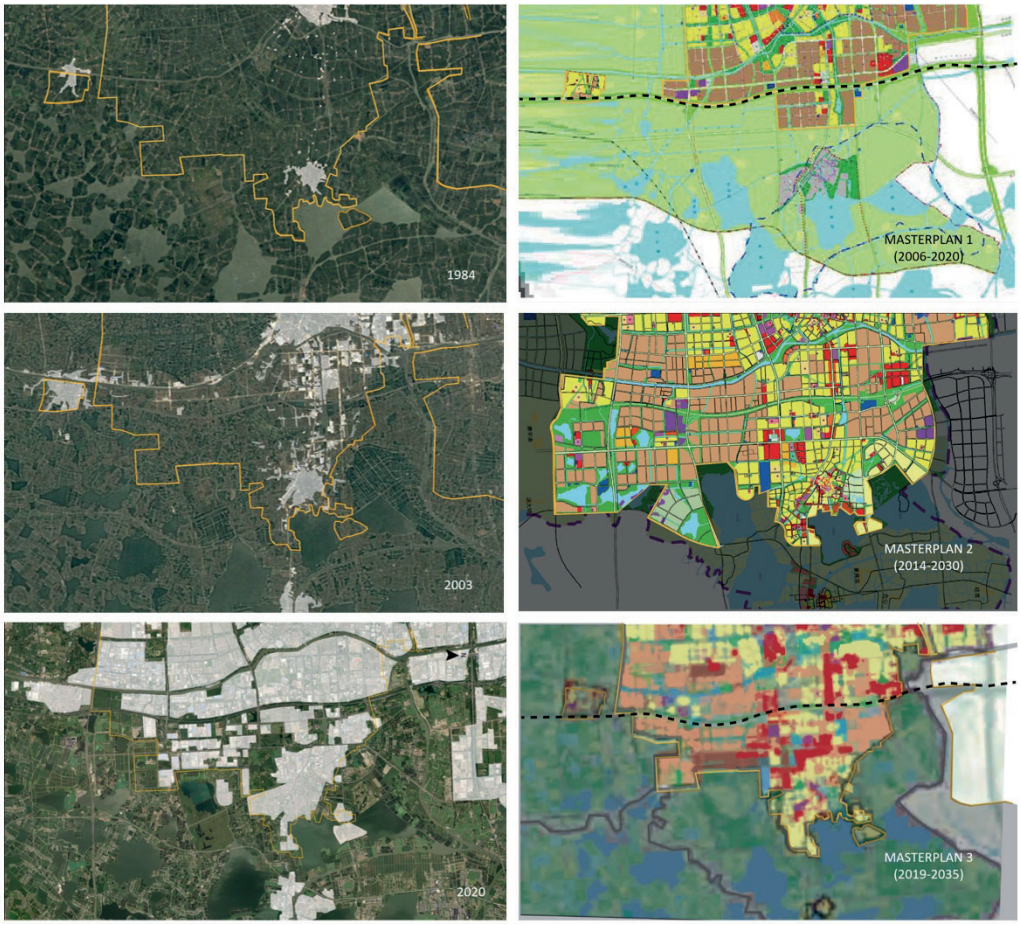

Figure 4. Plans vs. Reality: the historical review of the urban development in the different edges (here: edge 1) explains the persistence of some landscape features within the urban fabric but also shows how over-ambitious masterplans of the 2010s have been only partially occupied and recently motivated a retracted version of UGB.

3.3. FUTURE: alternative strategies for context-responsive UGBs

Based on the analysis of the six study areas, a total of 18 design projects reimagined UGBs as active urban-rural interfaces. Out of these 18 projects, three distinct but complementary contextual strategies can be synthesized (Table 1):

a) Performative landscape fringes

A first strategy is to reconcile the urban edge with its bordering landscape. In all of the studied sites, the official UGB has been defined from a purely urban perspective: it determines the legal limit up to which the grid carpet of urban blocks can be unrolled. However, in several sites, this edge is bordered by a characteristic and significant landscape structure, such as the famous Wusong River (edge 2), the World-Heritage listed Grand Canal (edges 5 and 6), or the centuries-old cultural landscape of the Jiangnan polders (edges 1, 3, 4) (Vannoorbeeck et al., 2019; Wang & Nolf, 2020; Xie & Nolf, 2020).

Rather than conceiving the UGB as a dividing line, the strategy is to address the entire urban-rural fringe as a significant space in its own right. Inspired by Desvigne's approach to "widen the edge" (2009), the purpose is to identify and select landscape or infrastructural structures capable of framing the urban border in resonance with its wider context.

Mediating between the city and the countryside, the landscape fringes can be particularly suitable for hosting large-scale environmental and recreational programs such as constructed wetlands, water storage, urban agriculture, windfarms, or riverfront parks.

The projects “Farm as Frame” (edge 1) or “Wusong River Wetland Park” (edge 2) exemplify, in their own distinct way, how a performative landscape fringe can become a unifying and meaningful envelope through which city and countryside dialogue.

b) Found Objects

A second principle is to take advantage of the resources and elements present on the boundary. As mentioned above, urban edges generally align functions which, due to their size or the nuisances they cause, do not fit in the heart of the city: power and waste treatments plants, logistic platforms, and industrial estates. Still in operation, underused, or decommissioned, these elements are nevertheless an integral part of the edge’s plural identity and offer multiple opportunities for (re)uses (Wood & Ravetz, 2000).

The “Found Objects” strategy consists of a selection and adaptive reuse of these unique items. Because of their history or their unconventional spatial qualities, these found objects can inspire original reconversion programs linked to education, culture, or events. Locally, they can contribute to preserving the memory and identity of the places to be urbanized, but also become a constituent element of new narratives along the future UGBs.

The project “Jiangnan Villages Cultural Route” along edge 3 proposes, for instance, to maintain and revitalise the ancient villages located on the edge and to interconnect them as relays between famous water towns. Gaining new significance as a thematic heritage route, the UGB can become a vivid linear place where old and new, big and small, and urban and rural values dialogue and interplay.

c) Transverses

A third principle takes a lateral view of the urban-rural edge. It investigates the elements and structures that cross the boundary transversally: the rivers that penetrate the urban grid and the streets that end up on the rural edge. The identification, selection, and enhancement of these transverse structures – both natural and artificial– is a way to maintain a visual, functional, and symbolic link between the city and its surrounding rural landscape.

The (re)qualification of transverses offers an alternative to the current model of hermetic urban carpet that ignores the adjacent rural landscape. As carriers of ecological corridors, soft mobility networks, or articulating public spaces programs, the activation of transverses maintains the possibilities of in-depth urban-rural exchanges.

Two complementary projects for edge 1 illustrate how a transversal approach can be applied in both directions: “Intermediary Rivers” rearticulates in a blue-green network the residual spaces found along the creeks crossing the boundary. Conversely, the “Urban Balconies” project focuses on dead-end streets abutting the urban-rural boundary and magnifies them as public gateways to nature. Together, these projects form a transversal armature that enlivens the UGB as a place of dialogue between city and countryside.

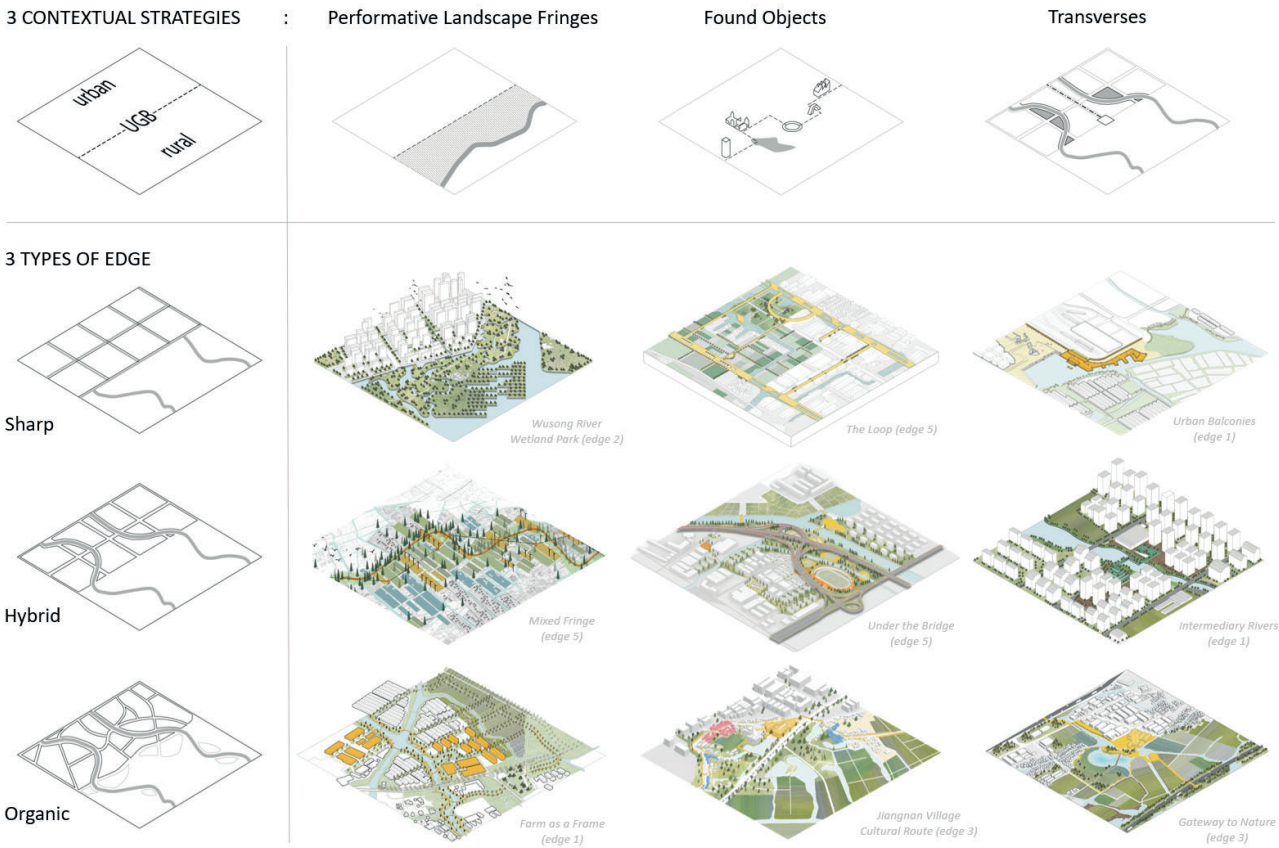

Table 1: Strategic matrix: three distinct, but complementary strategies are proposed to draw context-responsive UGBs: Performative Landscape Fringes; Found Objects; Transverses. A selection of nine design projects on 1 x 1 km2 sites illustrates how each strategy can be declined in the different edge conditions.

4. Discussion: towards a qualitative method for context-responsive UGBs

The implementation of China's three redline policy is not only a land-use planning matter. Involving the delineation of permanent UGBs, it is also a landscape and urban design assignment that will determine for a long time how cities interact with their rural counterparts. In this regard, our research does not pretend to replace existing quantitative land-use suitability methods, but to enrich them with spatial quality and programmatic perspectives. Drawing lessons both from exemplary international precedents and from our exploration of urban-rural fringes in the YRD, three suggestions can be made for a contextual approach to UGBs:

First, to work across the scales. Most current methods proceed from the general to the local: they assess how general quantitative objectives can be implemented in local conditions. In contrast, a cross-scalar method that combines the analysis of large scale landscape systems with a sampling of typical edge conditions helps grasping how local specificities can inductively inform the definition of genuinely contextual boundaries.

Second, to inform planning with historical analysis. Current methods evaluate from today's situation how expansion needs can be met in the future. A retrospective analysis of border areas can, additionally, elucidate their origin and development: it assesses the capacity of a site to be transformed and densified, but also identifies historic landscape features or elements that have the potential to guide site-specific developments.

Third, to think inclusively. Unlike land-use based methods that conceive UGBs in exclusive and divisive functional terms, an inclusive approach values the capacity of urban-rural fringes to accommodate a multiplicity of functions. To this end, onsite fieldwork is essential to capture the unique hybridization of activities found in fringe areas and to collect the local intelligence of stakeholders and interest groups. These insights can, in turn, inspire innovative programs for future developments.

5. Conclusions

The containment of urbanisation is a global issue that has preoccupied the discipline of spatial planning since its creation. Even more today, the demographic pressure, the environmental crises and the climate emergency urgently demand to reinvent the way we inhabit the earth while preserving its resources. In that regard, China's ambitious three red lines policy is a milestone from which other countries can learn.

To this end, this paper reviews the phenomenon of massive urbanisation that has transfigured China in recent decades and the current policy response. Focusing on its urban containment strategy, it points out the limitations of existing quantitative land-use methodologies to generate context-responsive UGBs. By exploring the past, present, and alternative futures of representative urban-rural edges in the YRD megacity region, this study suggests three methodological shifts to guide more contextual approaches to the definition of UGBs.

As pioneering research on the spatial and programmatic quality of UGBs in China, this study nevertheless presents the limitations of empirical, site-specific, and design-led explorations. In order to validate its potential as a qualitative method applicable to other contexts, we recommend future research directions to investigate how the proposed cross-scalar, historical, and inclusive approach can be supported by, respectively, typological classifications, site character assessment, and measurable indicators of functional integration.

Notes

Note 1: "In the Chinese land tenure system, urban land belongs to the state and is given in concession to urban households for a limited period of time, according to prevalent land use; the rural land is collectively owned, belonging to the rural communes, who allocate land among the members of the community based on egalitarian principles" (Hsing, 2010; cited in: Verdini, 2016).

Contributors statement

The three authors elaborated together the present research's concept, methodology, and development through an interdisciplinary joint studio in the Spring semester of 2020–2021. The original draft of the paper was written by Christian Nolf and amended by Yuting Xie and Weishun Xu. The figures were selected out of the studio outcomes and edited by the authors.

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Track 2

The City is an Object & A City is in Transition

Track editors:

Dipl. Ing. Birgit Hausleitner
Ir. Leo van den Burg
Dr. Akkelies van Nes

Cities are dynamic places in constant transition. The main elements of urban morphology, buildings, parcels and streets, landscape, open spaces and technical infrastructures form urban configurations shaped by local production of space. The configurations they build on multiple scales form, together with social, ecological and economic processes, complex systems. The adaptivity of these elements depends on their scale and related speed of change. An analytical and designerly approach to urban form acknowledges this complexity in the tension between object and process. This dialogue will question what spatial qualities will form the durability of place, what qualities contribute to its adaptivity and what disruptive transitions are necessary for our cities to afford eventual adaptations necessary to deal with current and futures crises.

Characterising Centre-Hinterlands:
Transition Design as a Framework for the Assessment of Urban Futures

Michael Louw [1], Daniel Elkin [2] and Gerhard Bruyns [3]

1 The University of Cape Town; Michael.Louw@uct.ac.za; ORCID ID 0000-0002-7137-3643
2 The Hong Kong Polytechnic University; dkelkin@polyu.edu.hk; ORCID ID 0000-0003-3295-6552
3 The Hong Kong Polytechnic University; Gerhard.bruyns@polyu.edu.hk; ORCID ID 0000-0002-4468-6505

Abstract: This article discusses recent urban development in two cases, Imizamo Yethu, South Africa, and Tai O Village, Hong Kong, within transition design frameworks. The article builds on contemporary theories that suggest categorical distinctions between urban population centres and that less dense hinterlands support adverse normative relationships in the context of continuous economic, administrative, political, and other transitions. It introduces the premise of "centre-hinterlands," to describe conditions where hinterland conditions are found within the centre and where researchers can construct provisional, administrative, and economic difference as inequity. The article presents research in Imizamo Yethu and Tai O that elaborates this description. The main methods applied in Imizamo Yethu include a morphological study and field observation, and the key findings in Imizamo Yethu include the gradual loss of distinction between "formally and informally" developed parts of the settlement in morphological character, developmental model, and administration. The main methods applied in Tai O Village include stakeholder workshopping, conducting a survey and interview, and a short-term pedestrian traffic monitoring project. The key findings in Tai O include economic and behavioural patterns that economically and socially entangle the village with the surrounding region. The article concludes with a discussion of transition design frameworks' relationship to potential for radical change in each development case.

Keywords: Centre-hinterlands; Transition Design; Cape Town; Hong Kong

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1. Introduction

Cities' development is not limited to the expansion or contraction of urban edges of peripheries (Brenner, 2016). Cities within cities and places nested within larger settings exhibit different realities and, as such, conflicting rationalities (de Satgé & Watson, 2018; Watson, 2003). These manifest radical differences in urban morphology, ecological processes, financial cycles, and politics surrounding the former.

Such "nested sites of difference" challenge environmental and spatial discourse in two ways. First, they disrupt the methods and registers through which we assess the environment, as applicable rationalities transition at territorial boundaries, leaving contextualised decision-making and administrative processes to compensate. Second, socio-technical processes blur the territorial discreteness of a city's material and spatial conditions, meaning researchers must appraise material locality within radically transformative frameworks. This may highlight the importance of mechanising a transition design framework based on vision, theories of change, mindset and posture, and new ways of designing (Irwin, 2015). According to Swilling and Annecke (2012), adversity produces localised

shifts and innovations that can contribute to what they call *just* transitions. These require acknowledgement that local action interrelates to global change.

To position transitional frameworks' impact upon design implementation in the built environment, this paper compares two transitional development settings, Imizamo Yethu in Cape Town and Tai O Village in Hong Kong, by discussing how each site has dealt with transitional drivers, in spatial, social, and material senses. By seeking links and differences between African and Asian approaches from both these highly distinct socio-spatial place-characteristics throughout disruptive moments, the paper explores the theme of the city as a transitional object. It suggests transition design as a framework for assessing responses to the future challenges of urban environments in the global South.

2. Theories and Methods

Urbanisation cannot be regarded solely through the delineation of geospatial agglomeration, and contemporary frameworks contest generalisations of urbanity as a universal type (Brenner, 2016; Brenner & Schmid, 2015). Vast differentials in terms of measurement data, morphology, demographics, and scale challenge descriptions of "the city," when defined in comparison to hinterlands as separate entities. By disputing the binary conception of traditional classifications of urban and rural, Brenner argues that the hinterland should be part of our understanding of the urban. However, this paper shows that the inverse is also true where areas within territories classified as urban are, through differentiated access to resources and opportunities, assigned place-definitions under categorial norms. The inversions of meta-categories, e.g., center-periphery, exterior-interior, or global-local (Bruyns & Read, 2006), compound urbanisation models and expose hinterlands within the centre. Differential urbanisation means areas like Imizamo Yethu in Cape Town and Tai O Village in Hong Kong, in stark contrast to their surroundings, can be regarded as *centre-hinterlands*. These areas, like other hinterlands, have been operationalised for exploitation as labour pools, tourist attractions as political objects, and in some instances, for 'shackfarming' and other politically complicated commercialisations. In contrast to their surroundings, they have significantly lower property sizes and values, there is tenure insecurity, there are substantially lower service levels, there is poorer transport connectivity, more unemployment, less opportunity, and higher vulnerability to natural disasters, amongst other issues.

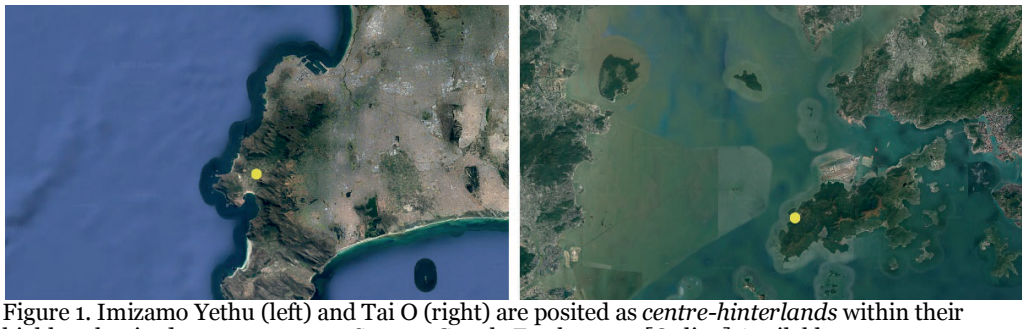

Figure 1. Imizamo Yethu (left) and Tai O (right) are posited as *centre-hinterlands* within their highly urbanised macro-contexts. Source: Google Earth, 2021. [Online] Available: https://earth.google.com/web

This type of uneven spatial development is a macro-trend of urbanisation, which is "emerging through a contradictory interplay between rapid, explosive processes of urbanisation, and various forms of stagnation, shrinkage, and marginalisation, often in close proximity to one another" (Brenner & Schmid, 2015: 152). As a spatial legacy of apartheid, Imizamo Yethu is a clear manifestation of uneven development as Figure 2 demonstrates. But this condition is by no means unique: Tai O is also an example of this trend, although perhaps less starkly visible in terms of physical proximity. However, it exhibits another macro trend identified by Brenner and Schmid, namely the mutation of capitalist urbanisation geographies where governments "prioritise economic growth, property-led investment in flagship mega-projects, urban renewal and gentrification over job creation, social distribution, equity, and participation" (2015: 153). This raises several ethical questions that are rooted in conflicting rationalities (de Satgé & Watson, 2018; Watson, 2003), especially where governments attempt to insert regulated larger-scale development into what is referred to as "informal" development.

Figure 2. The change in morphology between Imizamo Yethu and the neighbouring suburb of Tierboskloof in Hout Bay. Source: Johnny Miller, 2016. [Online] Available: https://unequalscenes.com/hout-bay-imizamo-yethu. Used with permission.

Figure 3. Tai O Village as seen in the 1972 aerial census, showing the stilt house districts and nearby shop houses. Source: Hong Kong Government Information Resources Department. Used with permission.

Brenner and Schmid (2015) note that these types of conditions make it exceedingly difficult for agencies and actors to influence space and policy. They go on to say that the methodological positions of postcolonial urbanism might be most productive if they are seen as "interim moves" in anticipation of more long-term visions for the urban conditions in the global South. This paper argues that transition design can be implemented in the global South to facilitate long-term visions that acknowledge the natural environment as a broader context, are place-based, and are oriented towards the quality of life of

communities. Further, transition design frameworks' radicality may be a key characteristic of response to stasis conditions emerging from categorising normative policies. Irwin positions transition design where "speculative, long-term visions of sustainable lifestyles fundamentally challenge existing paradigms and serve to inspire and inform the design of short- and mid-term solutions" (2015: 231). These solutions are influenced by a wider and perhaps more radical socio-ecological transition, differentiated from the social innovation (social design) approach that is centered on solutions for emerging paradigms (ibid.). Within the brief synopsis possible here, transitional design engages directly with wicked or seemingly non-solvable and fluid problems. Wicked problems present challenges that require a move away from a mechanistic approach to design and spatial planning, as a linear process to both assess, as well as develop, viable outcomes to complex issues. Application of a transitional design framework allows for the cross comparison between seemingly similar settings through different means, or strategy formation. The influence of spatial, socio-political, and environmental dynamics become emergent possibilities to a range of interventions, that may account for circularity linked to health issues or spatial challenges linked exclusively to agency.

Transition design may, in the context of centre-hinterlands or landscapes deeply nested in environmental settings that are captured by globalisation and neoliberal processes, deliver a differentiated take on the normative stances of 'static' design methods. In our view, prioritising socio-economic development and forms of agent-agency for change may present greater opportunities for long-term future-oriented outcomes. When considered in the contexts of the global South, transition design frameworks should prioritise equity and social impact to work towards *just* transitions (Swilling & Annecke, 2012).

To explore these theories, the paper presents case studies in Imizamo Yethu and Tai O Village, each investigating the relationship between these centre-hinterlands and surrounding population centres. The following section explores the hypothesis that each setting is historically and/or politically differentiated from its surroundings, while still exhibiting economic and social entanglements. In addition, our motivation for choosing both sites is based on the sharing of behavioural and built environment entanglement traits, with less distinct edge conditions and environmental integration. These entanglements allow us to construct difference in administrative power, infrastructural resources, or development opportunities as inequities. As surrounding or nested administrative bodies manipulate these locales as political objects, we discuss how change in each development market relates to categorical and policy norms that support strategy and administration. First-principle methods for investigating this hypothesis in Imizamo Yethu include a literature review, interviews with community stakeholders, long-term *in situ* observation, and morphological study from aerial photography. We present historical literature, results from stakeholder workshops, and results of an electronic monitoring project to discuss Tai O Village's case.

Although both cases share operational qualities, nestedness, and transformational traits, the postulation of a single methodology remains impractical. Instead, situating the question of agency as driver in both settings opens other potential for environmental change. The differentiation between environmental stasis and action of stakeholders, the manifestation of different agendas in both settings through leaders and role players, linked to the distinct use of interior (Tai O) and exterior (Imizamo Yethu) spaces to facilitate changes renders the uniqueness of transitional design in centre-hinterlands. Still using the first-principle materials (morphological footprints, social ethnographic compositions, and intervention assessment), the linking of these factors to agency shifts attention to different rationales. Through these studies we suggest that, first, urban conditions complicating container categories separating urban and rural, or formal and informal, exist; second, that these conditions display economic and political entanglement with population centres presented in contrast such that difference can be termed inequity-dependent upon historically-present normative categorisation; and, third, that despite inequity, stakeholders and actors in these conditions present contextualised rationalities which transition-oriented design research works to support or represent.

3. Results

The urban condition is interconnected, and boundaries are ambiguous. However, the methods and registers of spatial assessment are disturbed at the physical edges of centre-

hinterlands like Imizamo Yethu and Tai O. This section will explore how these nested sites of difference have dealt with transitional drivers, in spatial, social, and material ways.

3.1. Imizamo Yethu, Cape Town

Imizamo Yethu (IY) means "Our collective struggle" in IsiXhosa and was established in the early 1990s with the provision of serviced sites for approximately 450 families. In contrast with the wealthier, predominantly White, neighbourhoods surrounding it, IY is inhabited mostly by poorer, predominantly Black, residents and according to a 2012 report (CoCT, 2012) it was, along with Monwabisi, one of the two most poorly serviced neighbourhoods in the City of Cape Town at that time.

Morphological analysis of IY over a period of 20 years using drawings based on aerial photography, supported by input from local community members and NGOs, desktop research, and Author 1's own observations through involvement in IY for the past 10 years, shows alternating conditions of change and stasis. Intermittent aerial photography renders certain transitions invisible unless their existence is familiar to the observer, and is informed by knowledge about key transitional drivers over time.

Table 1 shows morphological transitions across several registers over five specific years that highlight the effects of specific transitional drivers: 1. In 2003, the Niall Mellon Trust built 150 houses that resulted in a substantial shift in the "formal" register; 2. 2010 marks the commencement of the Imizamo Yethu water platform project by the University of Cape Town as described by Louw (2016); 3. IY is regularly affected by fires, but the 2017 fire influenced a number of registers and had a devastating effect on the community; 4. At least four "formal" structures are destroyed because of arson attacks; and 5. The last four years mark the construction of several schools and a new ring road, which will lead to further transitions over the next years.

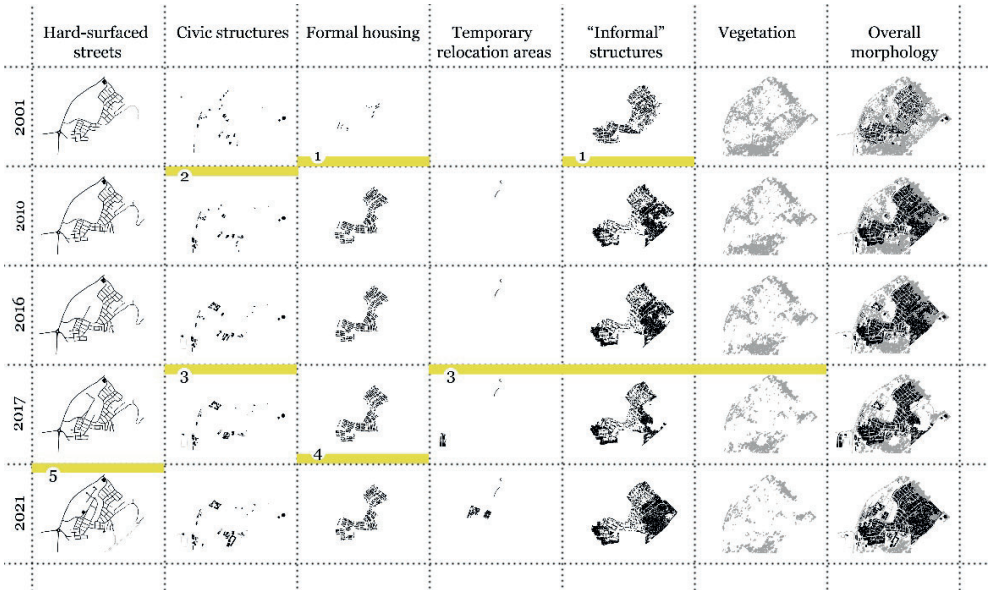

Table 1. The intermittent morphological changes in Imizamo Yethu over 20 years with a few key transitional drivers as highlighted in yellow (1. Houses built by the Niall Mellon Township Trust in 2002; 2. The beginning of the Imizamo Yethu water platform project; 3. The fire in 2017 which influenced all the categories; 4. Arson attacks on three community leaders' houses and local ANC offices; 5. Construction of a new ring road and the completion of several schools and day-care facilities). Source: Michael Louw, 2021, with base information from Google Earth.

The devastating fire of 2017 caused a sudden rupture that set off a series of events and agency conflicts. Figure 4 shows the condition of the "informal" portion of IY two days after the fire swept through the area. At least three people were killed, 3,500 homes were destroyed, and from 6,100 to over 15,000 people were affected or left homeless according to various sources that cite governmental spokespeople (De Villiers, 2017; Evans, 2017; Mafolo, 2020). The City of Cape Town established a temporary relocation area on the IY sports fields and initiated a re-blocking process together with nonprofit organisations and

the private sector. Local residents began rebuilding their homes on their own at a rapid pace shortly after the fire, while re-blocking proceeded on the lower parts of IY. Conflict ensued between various parties, including residents who supported the re-blocking and residents who did not, which led to arson attacks on local political offices and the houses of community leaders in support. These conflicting rationalities are often based on 'fundamentally different worldviews and different value-systems' (Watson, 2003: 396), and are not made visible on individual maps. Assessing the morphology before and after 2017 in isolation belies the major upheavals during that period.

Figure 4. The devastation recorded two days after the 2017 fire in Imizamo Yethu. Parts of the mountain are still smouldering in the background, while residents are already rebuilding their homes in the foreground amidst the rubble and salvaged material. Source: Michael Louw, 2017.

By crafting an overlay of the 'informal' register in Table 1, subtle changes in the footprints of dwellings in the upper portion of IY can be seen. Regular fires, rebuilding, densification, government interventions and other drivers cause regular shifts, but there is often a return to the status quo despite attempts at so-called 'regularisation.' Space is contested and negotiated and interestingly, key routes and circulation patterns remain over time. In contrast, "formal" areas within IY, besides eventual vertical extensions, are rapidly densified through the introduction of backyard dwellings and other "informal" additions. These tendencies challenge binary categorisation of the *formal* and *informal*.

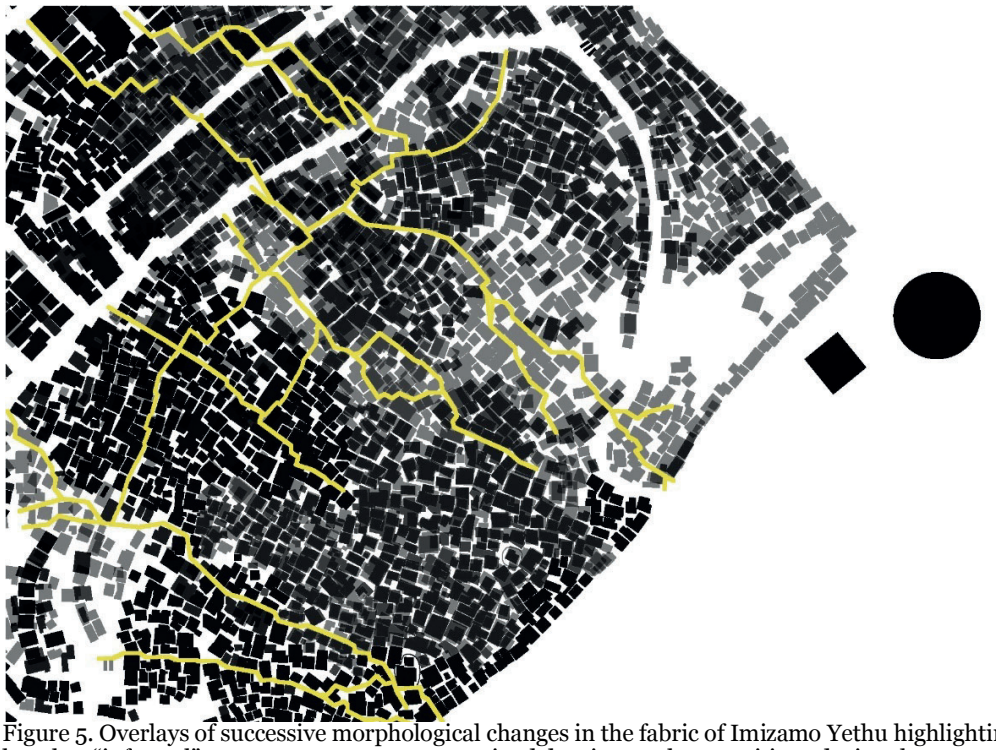

Figure 5. Overlays of successive morphological changes in the fabric of Imizamo Yethu highlighting how key "informal" movement patterns are retained despite regular transitions during the 20-year period of analysis. Source: Michael Louw, 2021.

3.2 Tai O Village, Hong Kong

Tai O Village is a historically *Tanka* ethnicity fishing settlement in Hong Kong. It was established prior to the Qing Dynasty period and persisted through the Colonial and Post-War periods as a salt-production, commercial fishing, and marine policing outpost

(Wong, 2000). In the early 21st Century Tai O took on an increasing role in regional tourism, especially after a regional ban on trawl fishing in 2012 (Cheung, 2012). Tai O's agglomeration of *pang uk* stilt house architecture has seen increased visibility to regional and international tourism audiences.

The Government of the Hong Kong Special Administrative Region codified this attention, and associated incentives for related commercial development, into planning strategy in 2017 with the Sustainable Lantau Blueprint (SLB). This document designates Tai O as an ecological and cultural tourism centre (Civil Engineering and Development Department, 2017). Coupled with Government Department constraints on development in stilt house districts (Lands Department, 2021), this document arguably places Tai O in a manipulable position as a resort, categorised as a 'rural idyll.' As discussed in Brenner and Schmid (2015), the strategic and media promotion positioning Tai O as a rural setting belie interrelationships on behavioural, infrastructural, and administrative levels, and more closely position Tai O as *peri-urban* or, as with IY, a centre-hinterland. Workshops and survey with stakeholders in Tai O indicated high incidences of commuter work between Tai O Village and nearby transit centres in Tung Chung and Hong Kong's central business district. Stakeholders' voiced frustration with insufficient bus and other transit services points to the fluidity of Tai O's boundaries, as Village residents are liable to forthcoming tourism development strategy, but perceive its benefits as slow in coming, especially through requested investment in leisure space and a sports facility development.

Furthermore, stakeholders voiced concern regarding increases in Village traffic due to tourist attention. They were unable to substantiate this perceived trend as bus and ferry companies were unwilling to share ridership data. A researcher-initiated pedestrian traffic monitoring project in Tai O quantified this tourism strategy impact as shown in Figure 6 and Table 2. Traffic monitoring reported average passages on weekend days, and days closest to weekends, at increased standard deviations from combined averages. This statistically proves the perceived increase in traffic on weekends during the monitoring period, and suggests that Tai O's economy remains entangled with surrounding population centres.

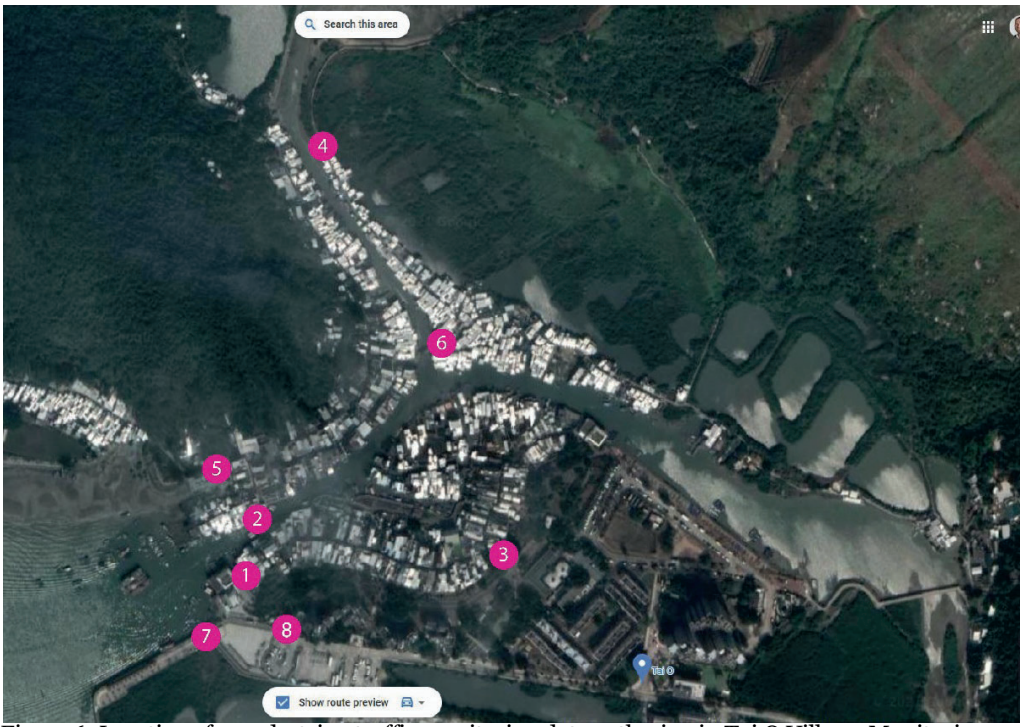

Figure 6. Locations for pedestrian traffic monitoring data gathering in Tai O Village. Monitoring location numbers correspond to data in Table 2. Source: Daniel Elkin with background aerial photography by Google Maps.

Monitoring Location	1. Tai O Rural Committee Showroom	2. Tai Chung Bridge	3. Near Lung Tin Estate	4. Tung O Ancient Trail Entrance	5. At Shek Tsai Po	6. Sun Ki Bridge	7. Ferry Pier to Wing On Street	8. Tai O Entrance Plaza Stairs
Total Passages Recorded	647,237	924,902	449,570	114,682	645,962	420,216	340,017	119,278
Daily Average Passages Recorded (# Std. Dev. From Mean Across all Days)								
Monday	1967 (.221)	3176 (.321)	1199 (.422)	170 (.292)	1851 (.136)	846 (.244)	729 (.157)	977 (.407)
Tuesday	1676 (.599)	3043 (.450)	1231 (.322)	159 (.351)	1653 (.348)	693 (.466)	584 (.391)	936 (.468)
Wednesday	1792 (.448)	3101 (.394)	1290 (.143)	225 (.014)	1705 (.293)	767 (.358)	680 (.237)	1127 (.183)
Thursday	1960 (.230)	3094 (.401)	1306 (.094)	193 (.178)	1666 (.333)	820 (.281)	670 (.252)	1078 (.256)
Friday	1914 (.289)	3355 (.146)	1326 (.032)	169 (.297)	1869 (.116)	970 (.062)	664 (.262)	1187 (.094)
Saturday	2611 (.615)	4247 (.725)	1513 (.543)	330 (.523)	2468 (.525)	1554 (.789)	1093 (.432)	1672 (.626)
Sunday	2875.5 (1.117)	4518 (.989)	1489 (.470)	347 (.611)	2633 (.702)	1440 (.623)	1363 (.869)	1778 (.783)
Std. Dev. Of Recorded Passages	769	1023	325	195	932	685	617	672

Table 2. Pedestrian traffic monitoring data from monitored locations in Tai O Village. Source: Daniel Elkin.

The Government's acquiescence of stilt houses to "natural wastage" (The Government of the Hong Kong Special Administrative Region, 2019), gives background on these demographic and economic impacts of its strategy, despite concurrent acknowledgement of pang uk districts as significant historical and cultural resources, as well as functioning housing stock. Whether this continues the patterns of, "tolerance, neglect, and resumption" Alan Smart (2001) documented is discussed among stakeholders surveyed. There is evidence of recent investment in Tai O that is arguably tourism related. Researchers have documented new investment in cafes, restaurants, and souvenir shops, along with renovations to some stilt houses occuring during the pandemic. This may indicate local response to increased tourism development orientation in Tai O in spite of COVID-19. As discussed below, we suggest this implies commercial rationalities in Tai O that contest the Government's casting of Tai O as a rural idyll, a construction which continues based on categories established in the colonial period. Instead, Tai O is more characteristically an urban settlement, in which we can construct the slow pace of provisioning and response to stakeholder concerns as inequitable provision and administration.

4. Discussion

The urban is not only about form, type, or boundedness. Instead, the urban is a *process*, and urban configurations are prone to "relentless churning" (Brenner & Schmid, 2015: 165). Brenner and Schmid observe how "Apparently stabilised urban sites are in fact merely temporary materialisations of ongoing socio-spatial transformations." This is clearly demonstrated in IY where singular mapping or aerial views do not register change unless local conditions are understood, monitored over time, and where this knowledge informs overlaid morphological studies that can surface transitions that are invisible to some. IY reflects relationships between the legacy of apartheid, current land use policy, government, nonprofit organisations, and the community. It is bounded by lower-density high-end residential fabric and Table Mountain National Park, but it is socially and politically entangled with these surroundings and while community-driven socio-spatial transformations within IY are sometimes rapid, the longer-term socio-spatial transformation of IY is agonisingly slow.

In Tai O, we can argue that the exoticising preservation narrative around the village reflects relationships between colonial history and land policy, survey, and censuses through power. Policies that regulate development in Tai O's stilt house districts descend from the Crown Lands and 1890 Squatters Ordinance. The British Colonial Government enacted this policy through census and survey to, we suggest, fix the territory as a static object, delineated by racial and political boundaries. The 1972 aerial survey and Squatter Structure and Occupancy Surveys in 1982 and '84 reinforced these policies, which transitioned into the contemporary period through the Government Lands Department. Despite the Government's efforts to cast stilt houses and their owners as static cultural artefacts, thereby subject to strategy, research respondents in Tai O evidence acutely responsive decision-making by capitalising their space. Entangled as Tai O is with surrounding urbanity, these investments, sometimes statutorily prohibited, serve as a form of social adaptability. In the absence of radical decision-making to untangle colonial anachronisms, this remains an arguably conservative, if significant, permutation within the Region's political economic, "hegemony," (Lee & Tang, 2016).

IY and Tai O, despite clear contextual differences, exhibit similarities in their rate of response to change. Communities in both are able to react quickly to sudden disturbances, and while government responses have been efficient in some instances, ineffective or conflictual policy and localised conflicts tend to result in long-term stasis. Change in these spaces cannot be traditionally controlled in a top-down manner, but can be catalysed. It is clear that more effective and longer-term transitional pathways are required in territories such as these. This paper posits a transition design framework to address visions for transition, theories of change, mindset and posture, and new ways of designing (Irwin, 2015).

5. Conclusions

Centre-hinterlands like IY and Tai O Village arguably demonstrate conditions where provisionally driven models for science and management of cities fall short, due to normative categorisations that support them, as well as logistical and operational demands. First, in both cases, development conditions which seem contradictory under dichotomies between urban and rural, formal and informal, or contemporary and vernacular, emerge from the rational decision-making of actors responding to their immediate contexts. The implicit necessity for provisional techniques to scale and to universally suit conditions within an administrative boundary arguably depends on categorical distinctions of this type, and therefore must face shortfalls in their comprehension of urban conditions and responsiveness of its administration. Second, we suggest that Brenner, Schmid, and Irwin's framework for evaluating such conditions depends on radicality because its alternative, often resulting in stasis conditions like IY and Tai O, relies upon normative categorical relationships. To varying degrees, these normative conditions can have ethical implications such that just transitions may necessitate radical change in the same way that difference may imply inequity. Centre-hinterlands, therefore, may emerge in cases where the categorisations used to distinguish these settlements effectively evolve into normative assertions against equitable inhabitation of the city.

In IY, as a centre-hinterland that emerged out of apartheid, rapid community-driven transitions based on immediate need often create an illusion of stasis. At the same time, government- and NGO-driven interventions are able to generate visible transitions, but they are often forced into stasis by localised conflicts. In Tai O, the collaborative monitoring research detailed above arguably emerges from shortfalls in administrative resources

applied to this centre-hinterland. This is despite the Hong Kong Government's evidencable enthusiasm for monitoring and other Smart City initiatives. The stasis persisting since the 1970's will, we argue, require administrative and ownership structures that acknowledge stilt house owners' desire to participate in the highly commercialised property market of Hong Kong, of which Tai O is a part. The emergence of differentiated types of spatial, social, and economic agencies renders both IY and Tai O as transitional spaces marked by internal and external conflicts. The contextualised rationalities suggest that engagements with these spaces require more radical approaches, moving away from normative or expected outcomes (spaces, infrastructure or economic integration). Moreover, change facilitators may reside in the premise of multiplicities of groups, collectives or individuals that exert change as they see fit, either through a range of technologies or actions, requiring the coordination of – rather than structuring of – such initiatives. This paper argues that using transition design frameworks in centre-hinterlands like these could foreground issues of social justice and equity to contribute towards just transitions.

Contributor statement

Conceptualisation: Authors 1, 2, and 3

Data curation: Authors 1 and 2

Investigation: Authors 1 and 2

Writing – original draft: Authors 1, 2, and 3

Writing – review and editing: Authors 1, 2, and 3

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Research on Urban Plot Openness Measurement and Influencing Factors: A Case Study of Downtown Nanjing

Linghao Wang [1,*], Jie Liu [2]

[1] Graduate student, School of architecture, Southeast University; Linghao.wang1016@gmail.com; 0000-0001-9349-2929

[2] Associate Professor, School of architecture, Southeast University; 101010513@seu.edu.cn

* Corresponding author

Abstract: The area inside the property boundary of a plot is often considered privately owned. However, resulting from the complexity of urban form transformation and urban planning regulations, the area within a plot boundary can also have public or semi-public attribution. The accessibility of the internal area of a plot is defined as the 'plot openness' in this paper. The openness of plots affects the spatial continuity in a city and reflects the mode of land development and urban planning. At present, the evaluation and analysis of urban public space have always been a hot research direction. But the openness of plots, the basic unit of urban forms, and its influencing factors have seldom been considered. This research aims at presenting a quantitative assessment framework to measure plot openness, and explore the potential factors including built density (FAR) and construction time that may affect the transformation of China's urban plot openness. Taking Nanjing's downtown as a case, this paper employs mapping to present the openness condition of the selected plots based on access and control type. Then, it proposes indicators including public space density (PSD), quasi-public space density (QSD), and depth of plot space (D) to quantitatively assess plot openness. At last, the regression analysis result reveals no strong linear relationship between plot openness and corresponding built density (FAR) in Nanjing's downtown, whilst the descriptive statistic base on the development period shows that the transformation of plot openness is indirectly influenced by the land-use policy and urban planning regulations enacted in different periods.

Keywords: plot openness; urban form; public space; statistical analysis; Nanjing

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1. Introduction

Accessible and shareable public spaces facilitate positive social interaction and diversity (Jacobs, 1961; Gehl, 1971), and bring a wide range of environmental and economic benefits (Sharifi, 2019). The description and analysis of urban public space is the most heavily researched topic. Researchers have explored various methods to delineate and evaluate public spaces. Focusing on linear public spaces in a city, the Space Syntax theory provides a configurational method to measure street spaces (Hillier and Hanson, 1984). In addition to the geometric attributes of public space itself, Urban Network Analysis (UNA) introduces the attributes of buildings into a weighted representation of spatial networks (Sevtsuk and Mekonnen, 2012). At present, researchers employ GIS, big data, and machine learning to analyse public space spatial distribution and accessibility (Biernacka and Kronenberg, 2018), public activities, and vitality (Zhang et al., 2018; Shen and Wu, 2021). So far, however, very few efforts have been devoted to quantifying and analysing the public space within plots, the basic unit of urban form.

The definition of public spaces can be classified in terms of ownership, access, control, and use (Lynch, 1981; Carmona, 2010; Németh and Schmidt, 2011). Following previous definitions, this research is mainly based on the access and control type of areas within plots. In general, the area inside the property boundaries of a plot belongs to the owner personally. Nevertheless, because of the transformation of land-use policy and the constraints of urban planning regulations, the area inside plots often presents diversified openness attributes. In this light, areas in privately owned plots that are accessible to the public will be defined as public spaces, whereas spaces in publicly owned plots that are not open to the public or controlled will not be defined as public spaces. Thus, this paper defines plot openness as the accessibility of the internal area of a plot.

The study of plot openness, especially to make it descriptive and figure out the factors that influence plot openness, is of great value. On the one hand, the public spaces inside the plot combine with streets, squares, and other urban public spaces constitute the urban open space system. On the other hand, in China, the public property land system and urban planning laws and regulations are closely linked. The evolution of plot openness is accompanied by the development and regeneration of urban space.

This research aims at presenting a quantitative assessment framework to measure plot openness based on evaluating the accessibility and configuration of areas within plot boundaries. And through statistical analysis, this research qualitatively interprets the mechanism that promotes the transformation of urban plot openness. In response to the aim of this research, the following questions will be answered: (1) How should plot openness in China's cities be defined, and what indicators can be used to measure plot openness? (2) What factors can affect plot openness transformation in Nanjing downtown?

2. Theories and Methods

2.1. Literature review

2.1.1. Concept of plot and plot configuration

The plot is the tract of land with property boundaries on which buildings locate and present the land development pattern. It is identified as one of the plan element complexes (street system, plot pattern, and building pattern) by M.R.G. Conzen (1960). Kropf (2014) develops a generic multilevel diagram of urban form that systematically articulates and explains the hierarchical relations among buildings, plots, streets, and other form elements at different scales. Acting as the fundamental unit of urban forms, plots link micro-scale (buildings) and macro-scale (simple tissue and urban tissue) of urban forms. Song (2021) proposes the *access structure* which further develops Kropf's theory to make it fit with China's urban form. Song points out the complexity of plot configuration in China, and he introduces *embedding* to describe the morphological composition that a plot is not directly bound by any street spaces, and as a result, its area is enclosed by the area of a neighboring plot.

In the preliminary definition, a plot can be broken down into the buildings and attached areas (gardens or courtyards) (Kropf, 2014) which indicate the areas within the property boundary of a plot are privately owned (Figure 1 (a)). However, this definition is derived from traditional European cities, which is different from the urban form of China's cities. The previous research findings of Song provide a typical case of the complexity of urban plot composition in China. Diagram (b) in Figure 1 illustrates the access order of embedded plots that one must cross the area of the neighboring plot before entering embedded plots. This plot configuration case implies the areas within the neighboring plot are public or semi-public rather than private. In current Chinese urban planning, the areas between plot boundaries and building redlines usually serve as pavement or street-front commercial spaces, which are accessible to the public. Areas within the building redline can also be public or semi-public corresponding to the plot function such as commercial (Figure 1 (c)).

According to previous research and the characteristics of plots in China, this paper tentatively proposes new layers of the hierarchical structure (Figure 2) by dividing the *Areas* in a plot into public space, semi-public space, and private space according to the management. Based on this definition, this paper will further introduce the *plot openness* concept.

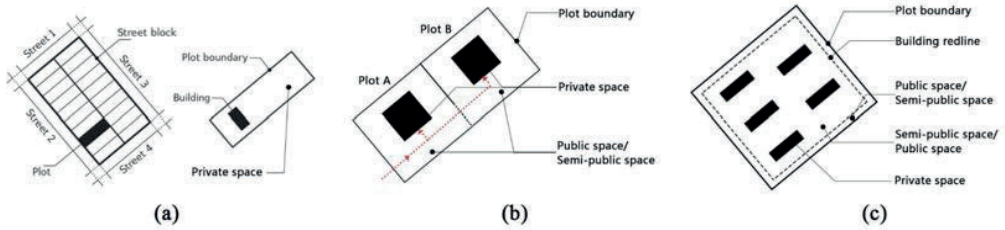


Figure 1 The characteristic of China's plot configuration is different from traditional European plot configuration proposed by Conzen: (a) Areas in the traditional European plot are privately owned; (b) Areas in embedded plots are public or semi-public; and (c) Areas in contemporary Chinese urban plots are public or semi-public (Source: Author)

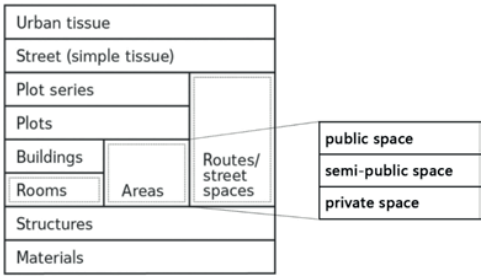


Figure 2 The subdivision of *Areas* within a plot based on the diagram proposed by Kropf.

2.1.2 Plot transformation and socio-economy factors

Plots provide a basic research scope to analyse urban physical form, and interpret the social and economic mechanism of the urban form transformation. Nanjing has experienced 70 years of urbanisation since 1949, it has undergone dramatic changes in physical form. Nanjing's downtown embeds rich urban morphologies that exist as diversified urban blocks built in different periods including the Republic of China (1927–1937), the planned economy period of the People's Republic of China (1949–1978), and the socialistic market-oriented economy period following the opening-up policy (1978-). This process of urban development has brought about great changes for the transformation of the openness of plots (Zhang and Ding, 2013). Land policies in different historical periods have influenced how developers use the land, including the management and control methods of areas inside plots. That is, the change of policies indirectly affects the transformation of plot openness. Moreover, the plot is both the unit of urban form structure and the control unit in urban planning regulations in China. The analysis of urban space openness based on the plot can connect with the control system of planning regulations, which facilitates the cognition of plot openness transformation (Zhang and Ding, 2018; Tang, 2017).

2.1.3. Openness measurement methods

Mapping is a fundamental and effective method to illustrate the openness of urban space. The method of mapping urban public space is not new. The Nolli map (1748) shows private spaces in black and public spaces in white (Verstegen and Ceen, 2013), and presents a graphic of urban public space form which reveals the ability of cities to act as a network of accessible public spaces. Based on field research, scholars further develop this mapping method to illustrate diversified public, semi-public, and private spaces in contemporary cities (Dovey, 2020; Ji & Ding, 2021). However, these mapping methods ignore proposing the basic research unit, making it difficult to present a systematic quantitative research method. Thus, this paper proposes to use plots as the basic mapping unit of openness research and introduces feasible quantitative analysis methods.

Current quantitative research methods on plot openness are inadequate, while the existing analysis methods for urban open space can provide some reference. Ji (2019) proposes methods of evaluating spatial openness, by using indicators of *the number of openings* and *the sum of angles of the openings*. Marchall (2017) demonstrates indexes of *perimeter enclosure* and *surface enclosure* to evaluate the enclosed form of open space. Yan (2017) employs indicators of *public space density*, *public space ratio*, and *public space ratio of the interior and exterior* to evaluate the coefficient and efficiency of open space in railway transit station blocks. Nevertheless, previous quantitative researches were mostly

focused on describing physical form and geometry features of open space, rather than investigating the public attribute of areas in plot property boundaries. Since some open spaces, though physically open, are not open to the public because of management.

By summarising the existing literature, this paper introduces a new concept namely *plot openness*. It aims to describe the accessibility of areas within a plot property boundary. This case has not been widely discussed in existing studies of urban morphology. However, it can be frequently observed in many contemporary China's cities, that have undergone rapid urbanisation and drastic transformation.

2.2. Research method

This study adopts both qualitative and quantitative methods. On one hand, quantitatively, this paper will establish an assessment framework for plot openness by proposing four morphological indicators. On the other hand, qualitatively, it will discuss the evolution of plot openness in Nanjing and interpret the factors that drive the transformation.

2.2.1. Case selection

This research studies two districts in downtown Nanjing, namely the old city and Hexi new district. These were selected to reflect varying plot openness during urbanisation in different historical contexts. The old city represents the urban development model of natural growth, its urban structure is mainly derived from the original urban fabric formed in the 1970s. Hexi new district is a completely new city area with orderly road grids constructed after 2000, which is the creation of a new city in non-urbanised areas. Fifteen sample blocks[1] (Figure 3) are selected which contain 197 plots with residential, commercial, and office functions.

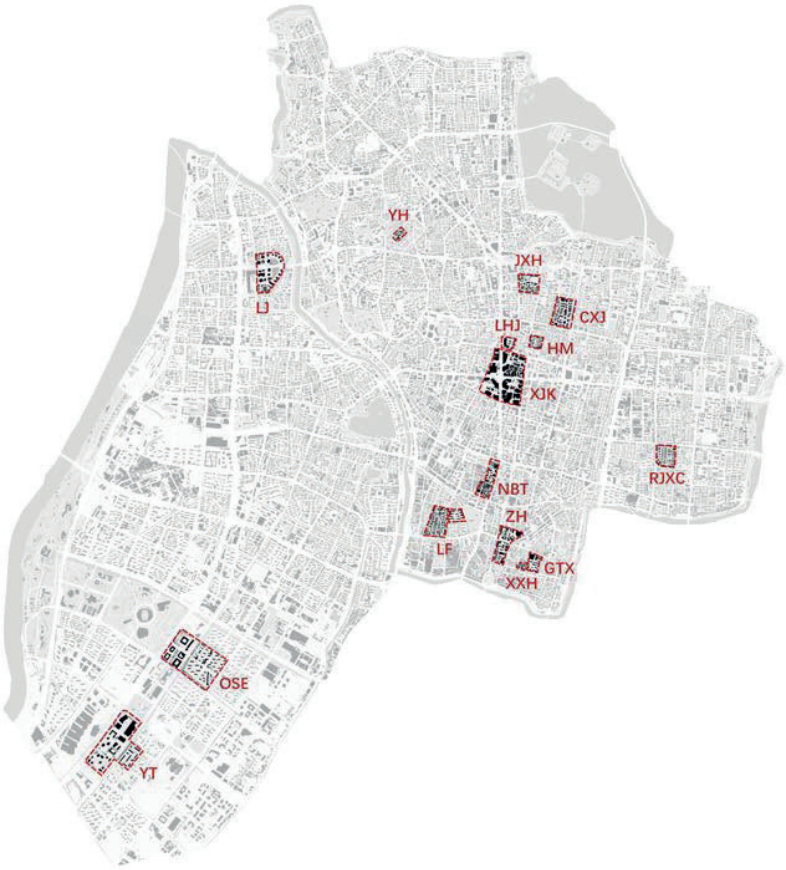
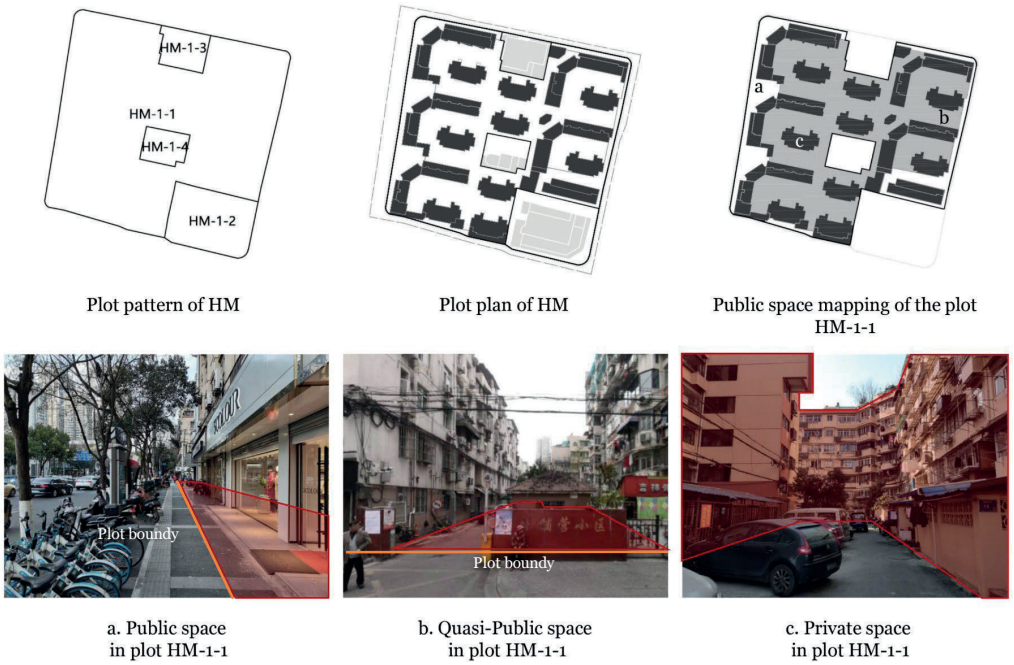


Figure 3. Research samples selected in Nanjing downtown (Source: Author)

[1] Samples includes Xinjiekou (XJK), Hongmiao (HM), Langhoujie (LHJ), Chengxianjie (CXJ), Jinxianghe (JXH), Nanbuting (NBT), Zhonghua road (ZHL), Gutongxiang (GTX), Xiaoxihu (XXH), Laifeng residential district (LF), Ruijinxincun residential district (RJXC), Yihe road (YHL), Longjiang (LJ), Olympic stadium east (OSE), and Yuantong (YT)

2.2.2. Mapping and plot openness indicators

The measurement of plot openness is divided into multiple phases. Firstly, mapping and field investigation are employed to figure out the accessibility of area in plots, and classify spaces in plots into public space, quasi-public space, and private space. which respectively represent the area in a plot that is completely accessible, under management, and inaccessible. For instance, spaces in the plot HM-1-1 are mapped as Figure 4. The area along the boundary (the white area) is commercial space on the ground floor of residential buildings, which is public and served as pedestrian sidewalks. The area occupying most of the plot (the grey area) is living space which is controlled by an entrance guard and is open only to residents who live in the residential district. The grey area is a quasi-public space that is not completely accessible to the public. Residential buildings are in black color, which represents they are private territories.



Plot pattern of HM | Plot plan of HM | Public space mapping of the plot HM-1-1

a. Public space in plot HM-1-1 | b. Quasi-Public space in plot HM-1-1 | c. Private space in plot HM-1-1

Figure 4. Classify and mapping areas in the plot HM-1-1 (Source: Author)

Secondly, plot openness indicators are proposed in this study (

Table 1 and Figure 5). Public space density (PSD) and quasi-public space density (QSD) are the ratios of public space area and quasi-public space area to plot gross area respectively, which represent the proportion of accessible area in plots. The plot depth expresses the complexity of space configuration in a plot, which refers to the *access structure*[2] (Song, Zhang, and Han, 2021). This research transforms the *access structure* to represent the access order of areas in a plot defined in the mapping phase. For example, Figure 5 (d) illustrates the calculation of plot depth. Before entering the grey area (quasi-public space) from streets, one should cross the white area (public space). Thus, the depth level of the white area and the grey area in plot HM-1-1 is *1* and *2*, respectively, and the depth of plot HM-1-1 is the average depth of these two areas, that is, *1.5*. In a similar way, the depth of plot HM-1-4 is *3*.

[2] The "access structure" demonstrates the hierarchical spatial order of access from streets to plots and buildings in China's cities.

Table 1. Definition and calculation formula of plot openness indicators (Source: Author)

Indicators	Definition	Calculation Formula
Public space density (PSD)	The proportion of public space in plots	$PSD=A_{public}/A_{plot}$
Quasi-public space density (QSD)	The proportion of quasi-public space in plots	$QSD=A_{quasi\text{-}public}/A_{plot}$
Depth (D)	The complexity of area subdivision in a plot, indicating the accessibility from streets to a certain space in a plot.	$D=\sum_n n\delta_n/\sum_n \delta_n$ (δn indicates the number of areas in the plot with depth level N)

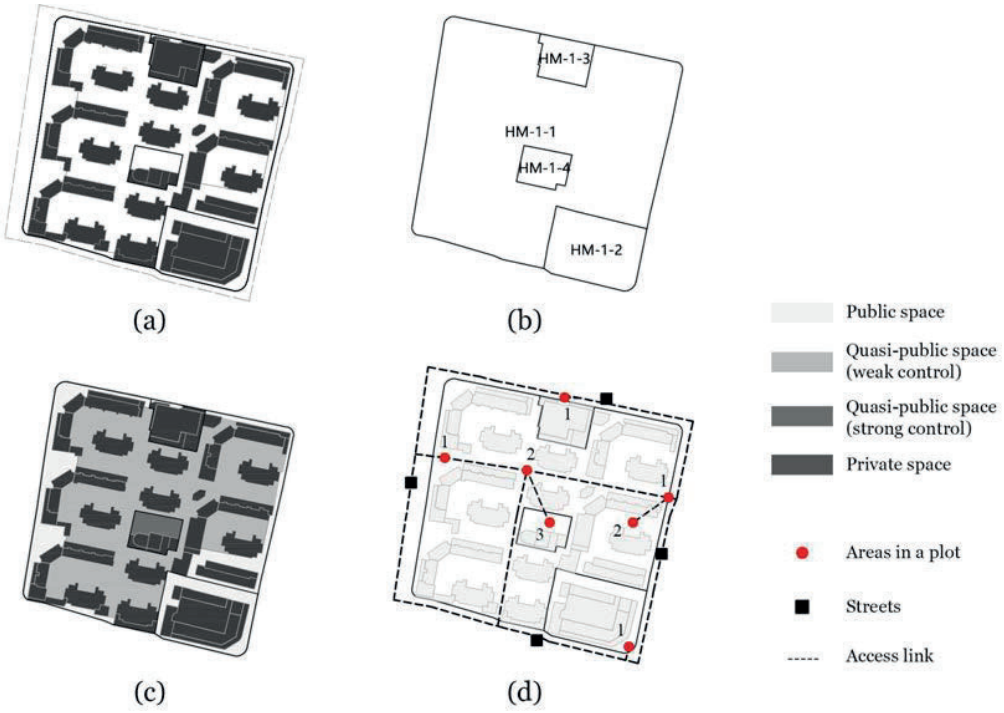


Figure 5. Plot openness indicators measurement illustration of Hongmiao: (a) plot plan; (b) plot pattern; (c) public space mapping; and (d) plot depth. (Source: Author)

2.2.3. Data collection and analysis

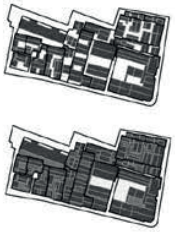
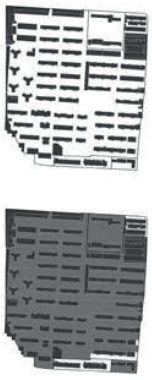
This study mainly obtains the plot data through planning administration in Nanjing and field investigation, which includes plot patterns and three-dimensional forms of buildings. Field investigation is an important process because the accessibility and access order of areas in a plot cannot be obtained directly, only field research can accurately recognize these characteristics. Then, online maps and Google Earth are used to revise the datum. In the data analysis phase, this study employs statistical analysis by using SPSS software. Regression analysis and box charts are used to demonstrate the drive factors of plot openness differentiation.

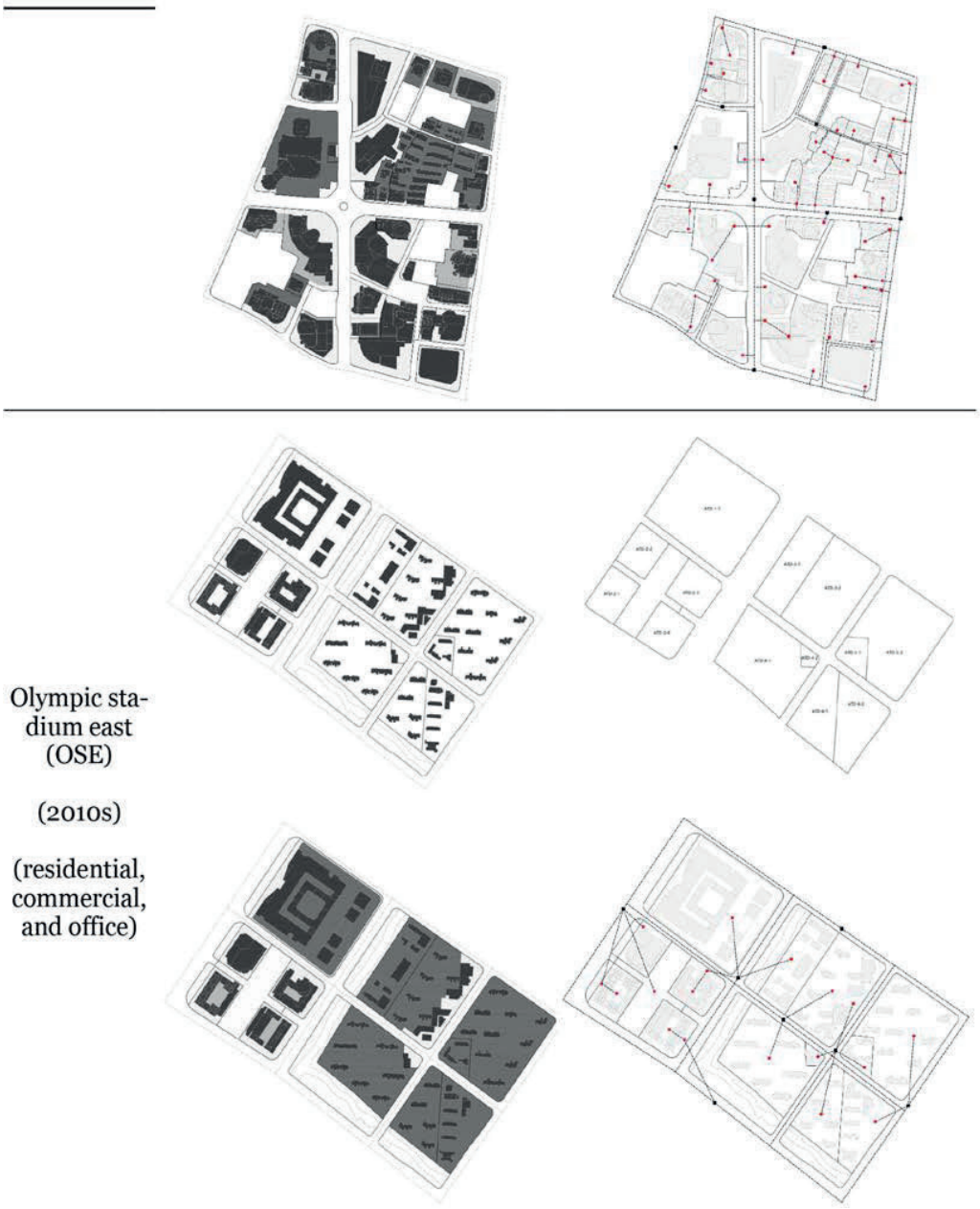
3. Results

3.1. The morphological features and plot openness of sample plots

Table 2. shows five samples development in the 1930s, 1980s, 1990s, 2000s, and 2010s, respectively, which are different in morphological features and plot openness.

Table 2. Morphological features and plot openness comparison of the selected samples: four diagrams in the table illustrate plot plan, plot pattern, public space mapping, and plot depth (Source: Author)

Plot	Morphological feature and plot openness diagrams	
Xiaoxihu (-1949) (residential)		
Ruijinxincun (RJXC) (1980s-1990s) (residential)		
Chengxianjie (CXJ) (1950s-2000s) (residential, commercial, and office)		
Xinjiekou (XJK) (1950s-2010s) (residential, commercial, and office)		



3.2. The effect of built density (FAR) on plot openness

Firstly, this paper will analyse whether built density is the potential factor that fosters the differentiation of plot openness. Since, it would be expected that the higher the built density of a plot, the higher openness of the plot. This paper mainly employs FAR (floor area ratio) to represent built density. The relation of built density and plot openness expresses the service capacity of public spaces in a plot, which reflects the quality of urban physical space. However, the regression analysis result shows that built density is not a strong factor that influences plot openness in downtown Nanjing (Figure 6). In residential plots, no strong linear relationship is shown between FAR and PSD (R^2=0.0681) and QSD (R^2=0.0202), indicating that the residential plot with higher density does not accommodate more public space or quasi-public space. The linear relationship between FAR and PSD (R^2=0.0156) and QSD (R^2=0.0017) of commercial plots is weaker. However, linear regression can explain the office plots better, the explanation coefficient for FAR and PSD, FAR and QSD explains roughly 30% and 45% of the variation, respectively (R^2=0.2996, R^2=0.4426). It indicates that built density affects the openness of office plots. The higher the built density of an office plot, the more the proportion of public space and less the proportion of quasi-public space in the plot area.

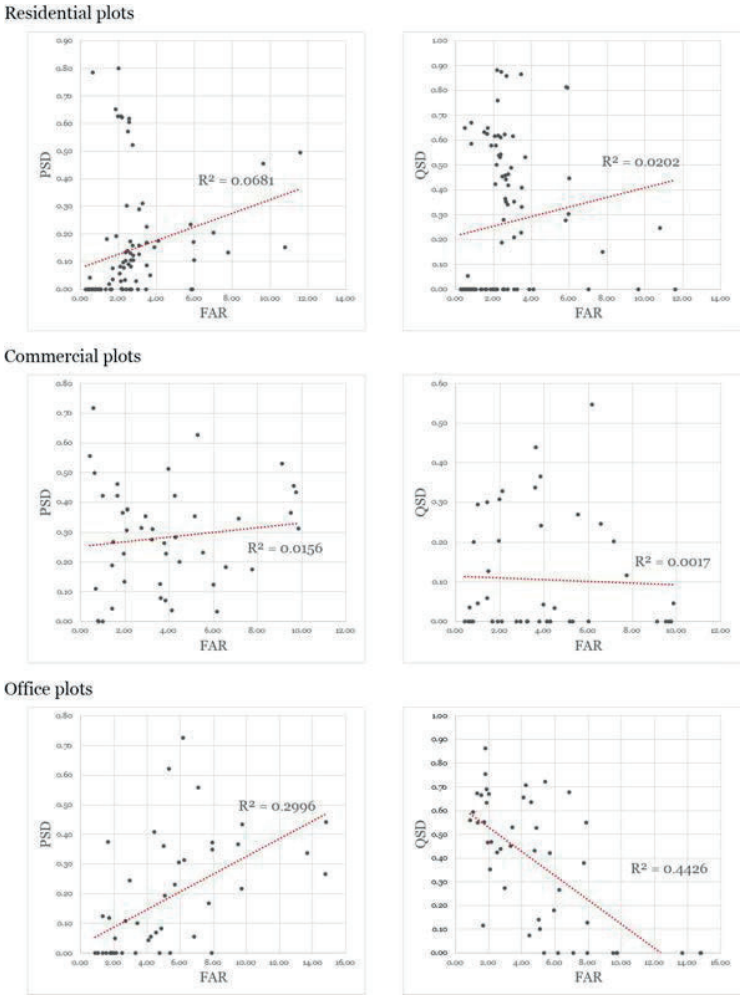


Figure 6. The regression analysis of plot density (FAR) and plot openness (PSD and QSD) in residential, commercial and office plots (Source: Author)

3.3. The effect of construction time on plot openness

Secondly, the factor of construction time of plots will be tested through statistical analysis. The construction time of the samples is divided into six phases: 1950s, 1980s, 1990s, 2000s, and 2010s. These periods are linked with the critical juncture of China's land system reform. Figure 7 presents the transformation of plot openness in three functional plots. In residential plots, the proportion of public space of the plot is in an evolutionary trend of rising, falling, and rising with two turning points in 1980 and 2000. The proportion of quasi-public space has been on the rise, especially since 1990, indicating that residential plots tend to strengthen the control and management of areas in plots. In commercial plots, the proportion of public space has been increasing and is in a high proportion, while the proportion of quasi-public space is relatively low, indicating that the commercial plot has been inclined to open the space in plots to the public for commercial value. In office plots, the proportion of public space in the plots increased significantly after 2010. The plot depth of the three functions is roughly in the range of 1.0–2.0. Compared with residential plots, the plot depth of the commercial and office plots is lower, indicating that the space in commercial and office plots has a more direct connection with the surrounding streets with better accessibility. The plot depth of residential plots is relatively high from the 1980s to the 2000s, representing a complex plot space configuration. While in recent years, the space in newly built residential areas is usually directly connected with the surrounding streets.

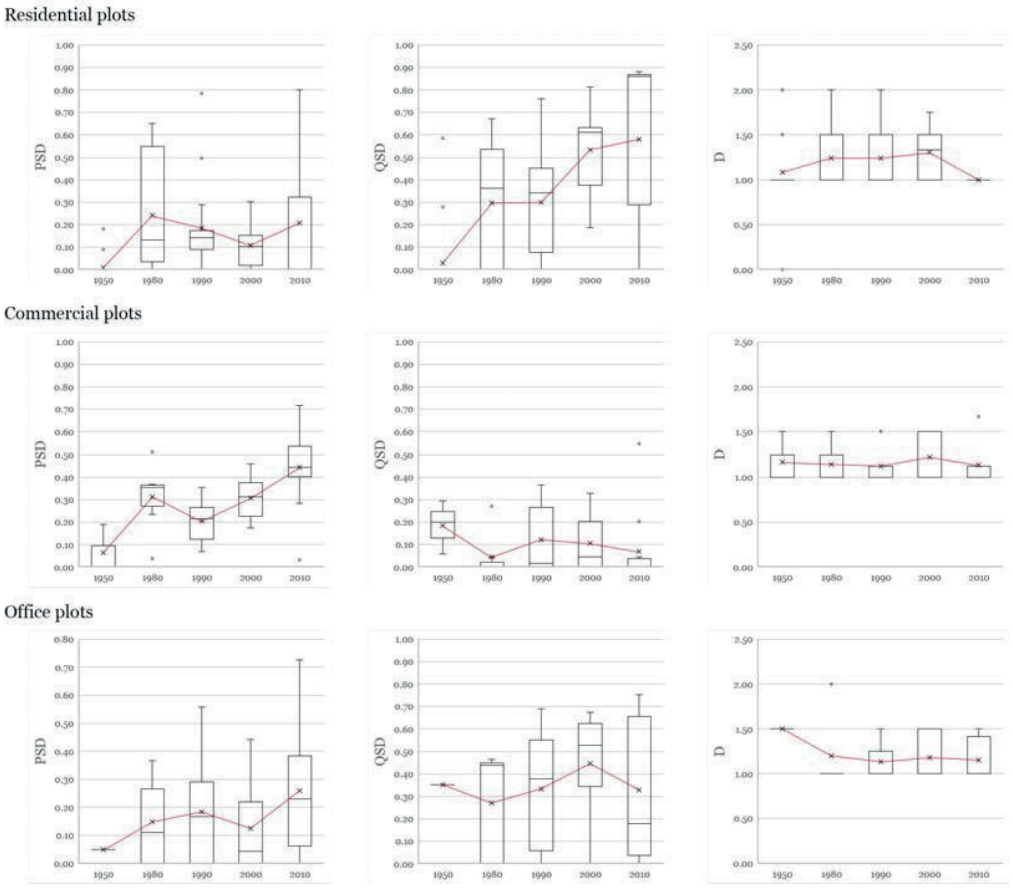


Figure 7. Boxplot diagram of plot openness transformation (Source: Author)

4. Discussion

4.1 Sociao-economy factors driven plot openness transformation

Previous statistical analyses show that the construction time is the main factor influencing the plot openness. The underlying reason lies in that plot openness is subject to the land development mode and the way of controlling public spaces in plots, which are affected by land-use policy and urban planning regulations enacted in different historical periods.

Before the founding of the People's Republic of China (1949), lands were privately owned. Traditional courtyard dwellings often occupied a whole plot, leading to low plot openness, such as Xiaoxihu traditional block and Yi he road residence districts. Since the beginning of the 1950s, China has gone through a period of planned economy. The land ownership was fully transformed to state-owned, and the administrative allocation was mainly adopted in the land-use model. The work unit compounds (Danwei) system is an important national strategy and administrative tool for promoting urbanisation during this period (Zhang and Ding, 2018). All living needs of its members are supported by Danwei, such as working place, apartments, canteens, schools, hospitals, etc. The development of a Danwei occupies an independent large-scale plot bounded by walls, which is an introverted and self-sufficient urban unit. Thus, the plot openness is relatively low in China's planned economy period.

In 1978, the urban economic structure began to adjust with the reform and opening-up, and the land market gradually formed. In the 1980s, the plot openness improved significantly, but there are differences among individual cases. During this period, the Danwei system led by a planned economy gradually came to an end, while the residential mode was still affected by the thought of a collective system. Most residential areas were welfare houses developed by the government. The phased development method often leads to complex plot morphological structures, and the boundary of some welfare housing plots

has transformed complicated in nearly 40 years development. Nowadays, many residential plots developed in the 1980s have conducted self-organised renewal such as opening internal roads and opening storefronts in residences, which contributes to the improvement of plot openness in the 1980s.

After the reform of the housing system in 1992, commercial residences developed by real estate emerged. The property and construction boundary of plots has been clearly delineated in urban planning. In this case, developers usually choose to control the area inside the plot only for private use. Especially in the 2000s, the rapid urbanisation of Nanjing's downtown facilitates the emergence of gated residential plots in the Hexi new district, which again led to the decline of the plot openness. Residential plots developed around 2010 still adopt a gated management mode, but community-supporting commercial spaces improve the plot openness to a certain extent. In terms of the plot depth, the newly built residence in this period often occupies a plot independently. Compared with the complex plot configuration in the old city generated by the incremental urban renewal process, the plot depth is relatively low with high accessibility in the new city. Moreover, the plot openness of commercial and office plots has been at a high level and gradually improved. Transforming from the introverted state-owned buildings to the modern commercial and office complexes, the areas in these plots are opened up and become part of the urban public space system.

Furthermore, Chinese urban planning regulations have been established and gradually completed since the 1980s. The open space along streets in a plot is mainly determined by the setback distance from plot boundaries required by urban planning regulations (Gao, 2017). Currently, detailed plot internal area design is regulated by urban design guidelines, such as regulating the major pedestrian access, public pedestrian corridor, public green space, sunken plaza, etc. inside plots. Therefore, mandatory planning regulations affect the openness of the areas within plot boundaries.

Table 3. Comparison of plot openness under the influence of land policies in different periods (Source: Author)

Periods	-1949	1949-1978	1978-1992	1992-2002	2002-
Land ownership	Privately-owned	State-owned	State-owned	Land Use Right system	Land Use Right system
Land development mode	Independent development	Administrative allocation and Project-based development	Administrative allocation and comprehensive development	Negotiation and project-based development	Government-led development plan
Critical juncture	—	Land nationalisation (1956)	Reform and opening-up policy (1978) Land Use Right system (1988)	Housing system reform (1992)	Land banking system (2002)
Urban planning regulation on plot openness	No requirement	No requirement	Requirement	Detailed requirement	Detailed requirement
Plot space accessibility	Low	Low	Low	High	High
Plot depth	Low	High	High	Low	Low
Plot openness	Low	Low	Low	High	High
Samples	Xiaoxihu; Yihe Road	Jinxinghe	Laifeng and Ruijinxincun residential district	Xinjiekou; Zhonghua road; Hongmiao	Xinjiekou; Longjiang; Olympic stadium east; Yuantong

5. Conclusions

This study is beneficial to prove the following contribution and conclusion.

First, it presents a quantitative assessment framework to measure plot openness based on evaluating the accessibility and configuration of spaces within plots. Combining field investigation and mapping methods, indicators of public space density (PSD) and quasi-public space density (QSD) reflect the proportion of accessible space area in a plot. Indicator of plot depth (D) expresses the complexity of plot configuration which explains the complexity of access links from streets to the subdivided areas within a plot.

Second, this study argues that the built density of plots has no strong linear relation with plot openness, which indicates built density is not the key factor that fosters the differentiation of plot openness. The regression analysis indicates that residential and commercial plots with high built density do not guarantee high plot openness, while the explanation coefficient for built density and plot openness could explain approximately 30% of the variation in office plots.

Third, the major difference in plot openness appears in the construction time of the plot. In the planned economy period (1949–1978), China's urban plots are introverted and self-sufficient urban units. After the reform and opening-up policy (1978–), the structure of areas inside plots has become complicated which leads to diversified plot openness. China's contemporary urban plots have relatively high plot openness, especially in terms of commercial and office plots. This transformation is mainly derived from the development of land-use policy and urban planning regulations.

As this research is still in its initial stage, some problems need to be solved and there is much work to be done. Due to the lack of sufficient historical data, this paper collects samples in different construction times for synchronic analysis instead of analysing the diachronic morphological evolution of the same plot. Besides, this paper adopts the analysis method of field investigation, it only chooses 197 plot samples in Nanjing's downtown, more experiments are needed to verify this method. Future studies can improve the research method and accommodate more analysis samples.

Contributor statement

Linghao Wang: conceptualisation, methodology, writing-original draft; Jie Liu: conceptualisation, writing-review, and editing

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An Emergency Evacuation Assessment of Community Public Open Space in View of the Community Life Circle

Xiaoyan Mi [1,*], Yumeng Wang [2], Ruiman Wang [3] and Delong Sun [4,]

[1] Assistant professor, School of Architecture, Tianjin University, Tianjin, China; xiaoyan_mi@tju.edu.cn
[2] Undergraduate student, School of Architecture, Tianjin University, Tianjin, China; 857227170@qq.com
[3] Undergraduate student, School of Architecture, Tianjin University, Tianjin, China; 708908011@qq.com
[4] Assistant professor, School of Architecture, Tianjin University, Tianjin, China; xslx2005@126.com
* Corresponding author.

Abstract: Seismic hazards, being the main natural disaster in cities, severely damages urban space. In addition, the current pandemic, as well as the concept of the community-life loop, necessitate a shift in urban space management to a more detailed and systematic assessment. From the perspective of community-life circles, this study assesses the evacuation capacity of open areas in Tianjin during earthquake disasters. It also considers the importance of open spaces for isolation and protection in major public health emergencies. Firstly, spatial analysis is done to locate open spaces that may be used for evacuation and to build urban community-life circles. Second, the open space evacuation capacity is computed, and the characteristics of the community-life circles are categorised and assessed as a unit. Finally, community-life rings are chosen depending on isolation and protection requirements. As a result, the evacuation map of community-life circles may be shown. The spatial properties of community-life circles are summarised in the fourth section. The findings show that open spaces located within the community with easy access to transportation and near the river system can better meet disaster prevention and evacuation requirements, whereas the closer the open spaces are to commercial facilities, the more difficult it is to meet the requirements.

Keywords: community-life circle; emergency evacuation; spatial analysis of isolation and protection; evacuation characteristics of open space; spatial characteristics of community-life circles

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1. Introduction

Open spaces have an essential role in earthquake and pandemic prevention, among other things, as an integral component of comprehensive urban disaster prevention. Since 2000, earthquake disaster deaths have accounted for over 70% of all deaths from all natural disasters worldwide, with China accounting for more than half of all earthquake-related deaths. Seismic dangers not only endanger people's lives, but they also cause major disruptions in metropolitan areas. The novel coronavirus that is currently sweeping the globe has resulted in substantial human and property losses, as well as a lot of thought about urban open space planning. China's first specific proposal to establish community-life circles was made in 2018, with a hierarchy of "15-minute, 5-10-minute" community-life circles and the creation of a community evaluation system.

This paper determines the carrying capacity of evacuation sites by studying the location of evacuation sites and escape routes in the event of disasters to evaluate the evacuation capacity of open spaces during earthquake disasters in six districts within Tianjin from the perspective of community-life circles. Then, based on the isolation and protection ability under major public health crises, it screens community-life circles and builds an evaluation system for community-life circles in Tianjin.

For emergency shelters, specific criteria must be met in terms of siting principles and design methodologies. Almeida et al., studied the site selection for temporary shelters through a multi-objective planning model (Alcada-Almeida et al., 2009), Saadatseresht et al., studied the problem of staff allocation in shelter planning using a multi-objective evolutionary algorithm (Saadatseresht et al., 2009), Wu et al., optimised the number of required shelters, site selection, and service areas in cities through a multi-objective planning model (Jianhong & Wenguo, 2011). In this paper, open spaces that meet evacuation requirements, and isolation and protection requirements are screened by combining the relevant codes for emergency shelters in China.

The escape route during a disaster is the passage through which people escape and eventually reach the destination evacuation point, which has both spatial and social attributes. Korhonen. T.'s agent model (Korhonen et al., 2008) and Wood. N.J.'s minimum cost distance model, among others, plan suitable evacuation routes and calculate evacuation time and cost (Wood & Schmidtlein, 2012). Manley et al., simulated the process of evacuation and escape of vulnerable groups during a disaster (Manley & Kim, 2012). Zhou et al., proposed a network optimisation model and planned a general route for evacuation. In this paper, we consider both the spatial property conditions of alternative paths and the influence of the domain and privacy of closed communities on people's psychological conditions and personal preferences to develop more scientific escape routes when studying the evacuation value of open spaces.

The carrying capacity of a refuge site is the ability to provide residents with the ability to conduct shelter, evacuation, and rescue. Zhu et al., calculated the carrying capacity of park green space based on the current situation of park green space and population distribution in Zhengzhou City (Zhenxing & Lijuan, 2011), and Zhang Haibo et al., calculated the medium- and long-term carrying capacity of emergency shelter places in Nanjing City by establishing a carrying capacity evaluation model (Haibo et al., 2019). From the perspective of population carrying capacity, we focus on the accommodative demand of open spaces and calculate the carrying capacity of open spaces inside and outside the community by constructing an open space evacuation value assessment system.

The isolation and protection value of open space means the role of open space emergency isolation and protection from viruses in the event of a major public health event. In the siting perspective of open space, Cai et al., constructed a model for siting disaster prevention and avoidance green spaces from an epidemic prevention perspective, incorporating three aspects of health and epidemic prevention needs (Yiran & Xi, 2020); In the management perspective of open space, Sun Li et al., construct a community public space resilience evaluation index system oriented to emergency management (LI & Yue, 2020); Wang Shifu et al., suggest incorporating health impact assessment in the whole planning process, taking into account the epidemic prevention measures of various countries in the COVID-19 (Shifu et al., 2021).

Based on the principles of personnel allocation and shortest evacuation distance, this study synthesizes existing research results and uses the six districts of Tianjin as the research object to calculate the evacuation capacity of open space by calculating the accessibility and carrying capacity of open space. The idea of community-life circles has been included. By integrating the impact of the New Crown pandemic on the community, the community-life circles that fulfil the requirements of evacuation and isolation protection are filtered out, and proposals are provided for the future building of life circles and open spaces.

2. Construction of urban open space based on community-life circles

2.1 Delineation of community-life circles

The research object is a densely populated city, and the analysis region is Tianjin's centre city, which has a total size of 181.12 square kilometers.

The first step was to split the community-life rings in Tianjin's six inner districts. According to Google Earth, the road network data is crawled to map the boundaries of residential communities and open spaces, of which there are 1851 residential communities and 1838 open spaces. POI data was obtained using Baidu Map to collect existing public facility point data. To build a network dataset and assess the 15-minute service area range of commercial, primary school, medical, and open spaces, the road data were defined with attributes and allocated to pedestrian speed. The preliminary living circle range is then calculated by superimposing the service area range. Finally, limiting elements such as rivers, roads, and railways are eliminated, and the population number and density data are checked for accuracy using the life circle. Tianjin is divided into six districts, each of which is divided into 90 15-minute community-life circles.

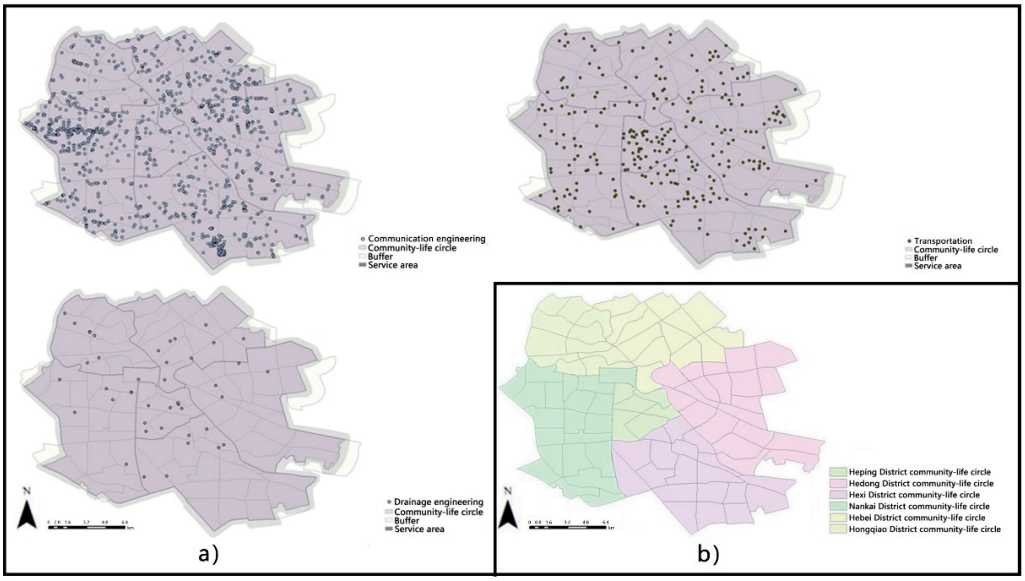

Figure 1. Division of community-life circle. a) Public facilities in six districts of Tianjin. b) Community-life circles of six districts in Tianjin (Source: Self-painted by the author)

2.2 Screening of open spaces

In this paper, 'open space' refers to the open space that exists outside of the constructed environment in the built-up region of the city, and includes both natural and artificial places such as parks and green areas within the urban area. The open spaces within existing community-life circles are screened using Chinese emergency shelter selection criteria in this study (Construction standard of community emergency shelters, JB180-2017).

1. Total open space area more than 1000m2.

2. The selected open space is not a disaster area.

3. The slope of the open space shall be no greater than 7°.

4. There is a roadway within the open space that is greater than 12m in width.

5. The shortest distance between the open space and the surrounding building should not be less than the height of that building.

6. Gas stations, gas facilities, and hazardous chemical enterprises should not be located within 1km of each other.

A total of 1295 open spaces eligible for emergency sheltering were screened for the study.

3. Construction of a system for assessing the value of disaster prevention and risk avoidance

3.1 Method of evacuation value assessment

In this section, the evacuation capacity of open spaces in six Tianjin districts are calculated, as well as the evacuation accessibility of open spaces and the carrying capacity of accessible open spaces within 90 seconds, in order to obtain open spaces that meet the requirements for both accessibility and carrying capacity. The following are the specific steps:

1) The community and open space scopes were both imported at the same time to separate communities with and without open space, as well as open space within and outside the community.

2) To find the open space outside the community that the community without open space can reach in 90 seconds, it shows that only 45.4 percent of the community without open space can successfully escape.

3) The results of the two calculations were combined to determine the amount of open space that could be reached in 90 seconds in each of the city's six districts, as well as the number of people that the accessible open space could accommodate by overlaying all of the open space with the community's connectivity.

Figure 2. Evacuation value evaluation of open space. a) Bearing capacity of open space. b) Open space meeting evacuation requirements (Source: Self-painted by the author)

Calculating the carrying capacity of the accessible open space (*B*) requires calculating the number of evacuees each open space needs to carry (*P*) and the number of evacuees it can carry (*C*).

Firstly, we view the number of open spaces (*w*) that can be reached in 90 seconds in a community, and then allocate the total population (*p*) of the community to the open spaces that can be reached in proportion to the area (*S*). So, the number of evacuated population (*p'*) of the community that needs to be covered by the open space is obtained. If the open space has only one community's evacuation population to bear, then *p'* is the total number of evacuation population (*P*) that the open space needs to bear; if the open space needs to bear more than one community's evacuation population, then we need to check the number of communities (*m*) that can reach the open space and add up the number of people that can be reached by each community to get the total number of people (P) that each open space needs to bear. The total number of people (P) in each open space.

$$pi'=p1\text{-}S/\ i$$

$$P=I'$$

A review of the code shows that the area per person for disaster prevention and shelter is 2 m², which gives the number of people (C) that each open space can take.

$$C=S/2$$

Calculating the ratio of the number of people that the open space needs to carry (*P*) to the number of people that it can carry (*C*) gives the carrying capacity of each open space (*B*).

$$B=P/C$$

The calculated carrying capacity index (*B*) is classified with a cut-off of 1. Open spaces with $B > 1$ are those that have the capacity to carry the evacuated population of the surrounding community, and vice versa for $B < 1$.

3.2 Method of isolation protection value assessment

The following steps will be taken in this section: calculate the isolation and protection capacity of open spaces that meet evacuation requirements, and obtain community-life circles that meet both evacuation, and isolation and protection requirements, and screen out life circles that do not meet disaster protection requirements.

1)At least two emergency evacuation and shelter areas should be provided in the life circle, according to the Technical Guidelines for Community Life Circle Planning, resulting in community-life circles that meet evacuation standards within each district.

2)Because many communities are being segregated as a result of the present pandemic, the next study will look into whether these living circles can meet the needs for isolation and protection. For the isolation and protection function, 363 open areas in the neighborhood were screened as study items. Then, using an OD cost matrix, compute the open places that can be reached by motor vehicles within the 3-minute ideal rescue time from logistic facility points. A total of 280 open areas, representing 218 villages, were reviewed in under three minutes.

These towns' open space area per capita is assessed, and those that are bigger than the 3m² minimum open space area per capita required for isolation and protection are designated open spaces that meet the isolation and protection standards.

Figure 3. Evaluation of isolation and protection value of open space. a) Community-life circle meeting evacuation requirements. b) Open space meeting evacuation and isolation protection requirements. c) Six differentiation of community-life circle meeting the requirements of evacuation and isolation protection (Source: Self-painted by the author)

Loading open spaces that fulfill isolation and protection requirements, screening out community-life circles that meet both evacuation and isolation and protection requirements, and examining the disparities among the city's six districts. Overall, the

Nankai District has the best comprehensive disaster prevention capabilities for community-life circles, while the Hebei and Heping Districts have the worst.

4. Tianjin City Community-Life Circle Assessment

4.1 Analysis of the evacuation value of community open space in Tianjin

The above calculations and analyses are being used to investigate the relationship between the distribution of open space that meets evacuation requirements and administrative zoning, communities, road networks, river systems, commercial facilities, tourism resources, and other factors.

1) When comparing the carrying coefficients of open space in the brownfield areas of Hongqiao District and the northern part of Hedong District, it can be concluded that the carrying coefficients of open space in the brownfield areas of Hongqiao District and the northern part of Hedong District are higher, and the open space meeting evacuation requirements are more densely distributed.

When the location of open space points that meet evacuation requirements is compared to community boundaries, it is discovered that 48.6% of open spaces within the community can meet evacuation requirements, while only 32.4 percent of open spaces outside the community can, indicating that open spaces within the community are more likely to meet evacuation requirements than open spaces outside the community.

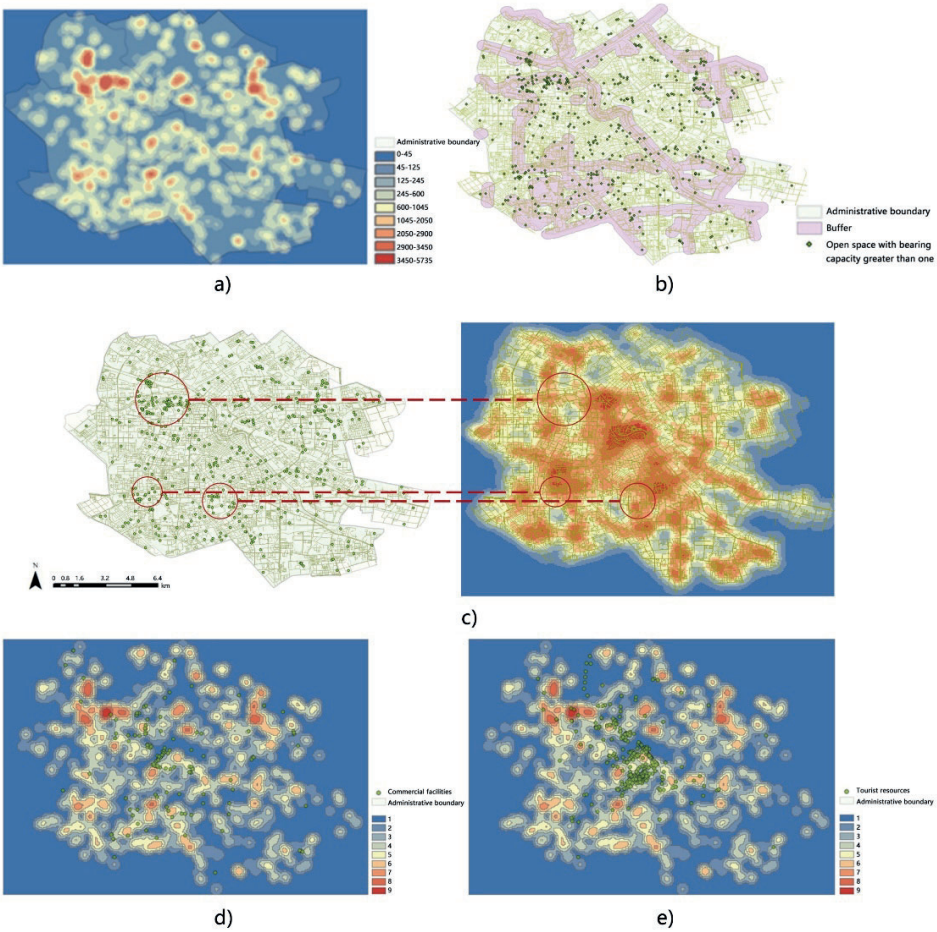

Figure 4. Induction of open space characteristics meeting requirements: a) Relationship between open space and administrative regions; b) Buffer zone of river system; c) Relationship between open space and road network; d) Relationship between open space and commercial facilities; e) Relationship between open space and tourism resources (Source: Self-painted by the author).

2) It can be seen that many open spaces that meet the evacuation conditions are located within the buffer zone, especially in several areas where the open spaces that meet the conditions are concentrated and contiguous, such as the Hongqiao and Nankai Districts, by creating a 300m buffer zone outward from the river system in the six districts of the city. There are 418 open space points in the buffer zone and 215 open space points in the optimal location, accounting for 51.4 percent of all open space points. It signifies that the river system's open space evacuation capacity is strong.

3) A comparison of the relationship between open space points that meet evacuation requirements and the traffic road network reveals that some open spaces have more evacuation options available to the communities surrounding them and have a higher carrying factor due to the higher density of the road network around them, as well as good traffic accessibility, which requires fewer people to be transported.

4) When we look at the relationship between open space locations that meet evacuation requirements and commercial facilities, we can see that places with a lot of commercial facilities have less open space that meets the standards, which is a generally negative association. The main reasons for this are the high intensity and density of growth in commercial areas, as well as the challenge of meeting catastrophe preventive and evacuation criteria with the limited available open space.

5) A study of the relationship between open space locations that meet evacuation standards and tourism resources found that places with a high concentration of commercial facilities had less open space that fits the requirements, with a positive and then negative correlation. Higher building densities in locations with more tourism resources in the city's six districts, such as around the modest foreign building blocks of the Five Avenues, are the main causes for this.

Table 1. Relationship between open space and commercial facilities

Nuclear density of commercial facilities	1	2	3	4	5	6	7	8	9
Number of optimal location points	28	27	24	27	13	6	0	1	0

Table 2. Relationship between open space and tourism resources

Nuclear density of tourism resources	1	2	3	4	5	6	7	8	9
Number of optimal location points	48	49	95	79	31	12	4	1	1

4.2 Analysis of community-life circles that do not have the required evacuation capacity and isolation protection

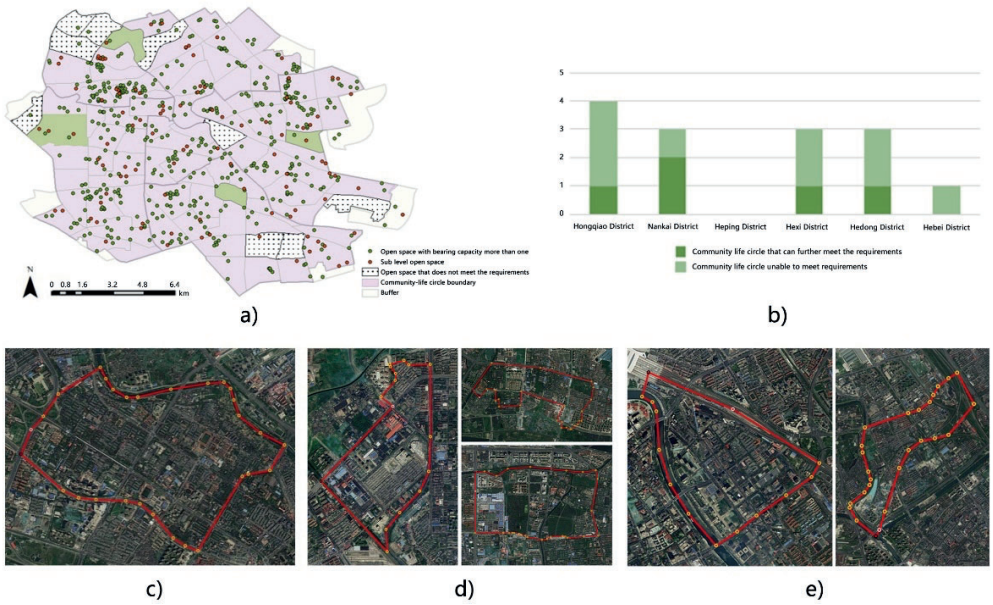

Figure 5. Unsatisfactory community-life circle: a) Community-life circle meeting requirements and sub level community life circle; b) Community-life circle that still does not meet the requirements after supplement; c) community-life circle Ⅰ; d) community-life circle Ⅱ; e) community-life circle Ⅲ (Source: Google Earth and Self-painted by the author)

Four community-life circles in the Hongqiao District, three in the Nankai District, three in the Hedong District, three in the Hexi District, one in the Hebei District, and zero in the Heping District were screened out because they did not meet the disaster preventive and avoidance requirements. Open spaces with *B* less than one were given a spacing of 0.2, 1, 3, 5, 7, and 9, while those with *B* more than one were given a consistent value of 11. The additional open spaces with sub-evacuation levels of 7 and 9 were chosen as open spaces that might still be used to meet evacuation standards with some optimisation and modification. After supplementing, it was discovered that certain community-life circles still lacked appropriate open spaces.

Dingzigu Street in the northwestern portion of the Hongqiao District, which is one of the last communities in Tianjin to undergo shantytown restoration, is one of the three community-life circles in the city's six districts. The life circles are primarily residential zones with densely built-up areas and limited open space. Large open spaces, most of which are closed playgrounds on campus, are inaccessible and unevenly distributed. To allow evacuation of residents, safe and regulated open spaces should be established within residential zones, while open spaces within the campus might be opened at different times to improve utilisation efficiency.

The Nankai, Hedong, and Hexi Districts, respectively, have community-life circles in the western and eastern regions of the city's six districts. The life circles are largely industrial parks and hardware markets, with high building density and a lack of open space, and open space in residential neighborhoods is limited and does not meet evacuation criteria, posing significant dangers of safe evacuation. Efforts should be made in future building to improve the quality of public open space in residential areas and to establish emergency shelters in industrial zones.

The two community-life circles in the Hedong and Hebei Districts, respectively, are inconvenient for residents to evacuate due to the numerous railways, viaducts, expressways, and main roads in the vicinity; there are many demolition plots and abandoned sites in the life circles, which cannot be used as evacuation places; and there

are many old residential areas with a small nucleus. Demolition plots and abandoned sites should be turned to a central location in the future, while old residential districts should be revitalised.

5. Discussion and Conclusions

The suitability of open space as an evacuation site distribution is usually calculated by analysing criteria such as open space accessibility, disaster frequency, evacuation area per capita, or by constructing evacuation models during disasters. Most studies, on the other hand, only address one objective function: the shortest total evacuation distance of residents as the goal of evacuation sites, ignoring community-living circles, diseases, and open spaces.

The following are the paper's main contributions: (1) This study investigates open space from the standpoint of a community-living circle, taking into account the influence of the New Crown epidemic, as well as the isolation and protective value of open space; (2) The fact that communities, as zones where populations live together, are inherently separated and blocked, while public attributes are weak, is taken into account in this research; and (3) The proportionate balance of personnel allocation is innovatively considered when calculating the carrying capacity of open space, and the number of people to be carried in each open space is calculated more precisely by calculating the area proportion and accessibility of open space.

From the perspective of community-life circles, this paper estimates the carrying capacity of evacuation sites by examining the location of evacuation sites and the escape routes in case of disasters, analyses the evacuation capacity of open spaces under earthquake disasters in six districts within Tianjin, screens community living circles, and sets the assessment system of community living circles in Tianjin by considering the isolation and protection capability. The following findings were made:

(1) While 85 percent of community-life circles can meet evacuation requirements, only about 30 percent of living circles can meet both evacuation and disaster prevention and avoidance requirements, and the majority of community-life circles struggle to meet isolation and protection requirements and do not account for major public-health emergencies;

(2) The open spaces meeting the requirements are densely distributed in the middle and southeast of the Hongqiao District and north of the Hedong District, which is related to the more open spaces in the waterfront area and the better environmental quality of the new community;

(3) Open spaces within the community, with high traffic access and near the river system, can better satisfy disaster prevention and avoidance needs, however the closer open spaces are to commercial facilities, the more difficult it is to fulfil disaster prevention and avoidance criteria;

(4) In the assessment of open space evacuation value, this study incorporates the steps of spatial screening, people allocation, and minimal time measurement, and extends to the community-life circle and epidemic prevention sectors. From the standpoint of urban planning specialty, these findings have theoretical and practical implications for partitioning community-life circles and building catastrophe prevention and evacuation zones in dwelling circles.

Data Availability Statement

Central urban area of Tianjin, such as water system and roads, was from the open data source of Amap API platform.

Tianjin high resolution remote sensing image data was from GL - 1 satellite

(https://mall.charmingglobe.com/BaseMap).

Contributor statement

Xiaoyan Mi is in charge of conceptualisation, funding acquisition, methodology, project administration, supervision and writing - review & editing. Yumeng Wang and Ruiman Wang are in

charge of data curation, formal analysis, investigation, visualization, and writing – original draft. Delong Sun is in charge of conceptualisation, investigation, supervision, resources, and validation.

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Land Use Indexed Mobility Changes' Impact on Urban Crimes in Metropolitan Cities

Yijing Li [1,*], Ivan Y. Sun[2], Yan Zhang[3] and Yuying Wu[1]

[1] Department of Informatics, King's College London, the United Kingdom; yijing.li@kcl.ac.uk; ORCID ID 0000-0002-9831-0298
[2] Department of Sociology & Criminal Justice, University of Delaware, US
[3] School of Regulation and Global Governance (RegNet), Australian National University, Canberra, Australia; ian.zhang@anu.edu.au
* Corresponding author.

Abstract: Social distancing and lockdown measures have been widely deployed in urban areas worldwide to restrict citizens' movement to help contain the COVID-19 pandemic. This resulted in dramatic changes in people's daily mobility, as well as the criminality and delinquency in cities. Drawing on crime data in London, Sydney, and New York in 2020, this study attempts the first one-year "look back" on the impact of massive lockdowns on crime trends in the assistance of two classic criminological theories, routine activity, and general strain, as well as cutting-edge machine learning techniques on relating the community-level geodemographics, socio-economic profiles, and mobility changes to changes in crime. The research findings suggest a general crime reduction upon mobility changes during lockdowns among the metropolitan cities, but some city-featured prominent crime types had an eye-catching increase during the period. Holistic mobility change was found to be the most crime-influential factor rather than any fine-scaled residents' geodemographic characteristics, echoing commonly offsite criminal behaviors rather than committing crimes locally; the data-driven evidence could be further utilised for city-wide crime prediction and prevention strategies towards post-pandemic recovery.

Keywords: crime change; lockdown; mobility change; routine activity; land use

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1. Introduction

The COVID-19 pandemic has been wreaking havoc on human well-being, economics, crime, government administration, and social interactions within global cities, resulting in irreversible impacts throughout 2020, and will continue to do so into the foreseeable future (Clemens, 2020; Liu et al., 2021; Stickle and Felson, 2020). In response to the pandemic – and to contain the rapid spread of the virus – governments around the world began to impose policies and measures like lockdowns, social distancing, and stay-at-home mechanisms to demobilize people's activities, especially in metropolitan cities. Understandably, this simultaneously affects the daily routines and the social interactions of millions of people, making 2020 the largest experiment of criminological changes in human history (Liu et al., 2021; Stickle and Felson, 2020). This is evidenced by: the decrease in residential burglary and theft thanks to guardianship strengthened by stay-at-home directives (Ashby, 2020; Campedelli et al., 2020; Halford et al., 2020); the substantial decline in violent crimes against persons immediately following the COVID-19 containment measures (Abrams, 2021; Langton et al., 2021; Payne et al., 2020); the unprecedented

surge of domestic violence after the deployment of lockdowns (Dai et al., 2021; Mohler et al.,2020; Boserup et al., 2020; Krishnakumar and Verma, 2021; Piquero et al., 2020, 2021; Zhang, 2020); the significant increase of illegal drug abuse during the COVID-19 lockdowns (Balmori de la Miyar et al., 2020; Rashid, 2021; Niles et al., 2021; Zaami et al., 2020); and the increase in reports of cyber victimisation during the lockdowns with the internet as the main source for social interactions of millions of people (Chang et al., 2021; Buil-Gil et al., 2020; Buil-Gil and Zeng, 2021). However, most of the empirical studies in the field mainly focused on one city or one country (e.g., Hodgkinson and Andresen, 2020; Mccarthy et al., 2021; Rashid, 2021); or the only observed crime trends over a short period, ranging from several weeks (see, e.g., Balmori de la Miyar et al., 2020; Felson et al., 2020; Kim and Phillips, 2021), to three months (see, e.g. Mccarthy et al., 2021; Mohler et al., 2020), up to a maximum of six months (see, e.g. Langton et al., 2021; Nivette et al., 2021; Rashid, 2021).

This article tried to draw on the data from three international metropolises, London, New York, and Sydney to explore how the widespread lockdowns have impacted major types of crime in an urban context, and which areas were the main hotspot regions in order to advance our understanding of the unprecedented crime situations imposed by COVID-19 in a comparative way. This study aims to contribute to the field in three different aspects:

(1) To deliver more comparative insights and solid evidence to the existing literature, by observing crime patterns in three cities, over a one-year period;

(2) To apply classic criminological theories – routine activity and general strain – onto different cities, to identify whether some urban areas have been disproportionately affected by mobility change during lockdowns;

(3) To explore how the trends and patterns in urban crimes will develop in the future, assisted by machine learning techniques and spatial predictive models. And, as a result, to provide references for efficient crime prevention and policing strategies.

2. Theories and Methods

The magnitude of the COVID-19 pandemic has manifested in the dramatic changes of social orders and controls (Liu et al., 2021; Stickle and Felson, 2020), during which the period dramatic changes in crime had been evidenced, especially in property crime. With the introduction of COVID-19 containment measures, people have had to stay at home and so strengthened the guardianship over personal property and space, resulting in a significant decrease in residential burglary and theft (Ashby, 2020; Campedelli et al., 2020; Halford et al., 2020). Whereas a substantial level of decline in violent crimes and crimes against persons was found by researchers immediately following COVID-19 containment measures (Abrams, 2021; Langton et al., 2021; Payne et al., 2020), except for domestic violence surges (Dai et al., 2021; Mohler et al., 2020; Boserup et al., 2020; Krishnakumar and Verma, 2021; Piquero et al., 2020, 2021; Zhang, 2020) upon the measures. Besides such conventional crimes, the COVID-19 pandemic has also given rise to other types of crime and delinquencies including, the rise in activity of drug lords in Mexico City despite the stay-at-home order (Balmori de la Miyar et al., 2020); the steep increase of illegal drug trafficking in Dhaka, Bangladesh by 75% (Rashid, 2021), and the significant increase of illegal drug abuse (Niles et al., 2021; Zaami et al., 2020); the skyrocketing number of hate crimes towards different ethnicities or religions (Gover et al., 2020; Xu et al., 2021); as well as the eye-catching increase of cyber victimization reports (e.g., online romance fraud) (Buil-Gil et al., 2020; Buil-Gil and Zeng, 2021) ever since the internet has become a primary source of social interaction during lockdown.

In the hope of containing the outbreak of the contagion, governments around the world have deployed NPI strategies of social distancing and mandatory lockdowns to restrict citizen activities. The changing organisation of individuals' routine activities is best situated to account for inclinations, patterns, distributions, and trends in criminal activities amid lockdowns; in together with the intensified social isolation, the worsening financial conditions, and the uncertainty and anxiety caused by a lockdown towards aggregated general strain (Agnew, 1992) for committing crimes. Two prominent criminological theories are routine activity theory (RAT) and general strain theory (GST), and so combined to provide useful theoretical supports for understanding crime changes throughout the pandemic.

The RAT theory (Cohen and Felson, 1979) sets up a key foundation to the situation facilitating criminal acts: a motivated offender, suitable target, and capable guardianship, hence focuses on how a social context influences people's vulnerability to crime (Dugan and Apel, 2005; Xu, 2009), and had been widely tested out on domestic violence research

in recent decade (Hayes, 2018; Boman and Gallupe, 2020; Mohler et al., 2020; Piquero et al., 2021), which supports the hypothesis that, stay-at-home measures have extended the periods of contact between the vulnerable victims and potential motivated abusers for such type of crime. On the other hand, the rollout of massive containment measures has changed people's routine activities dramatically, decreasing their time spent at public venues. Instead, people's time spent in residential areas increased, hence contributing to the plummeting crime rates. GST theory explains that people undergo certain strains or stressors would engage in criminal behaviours (Agnew, 1992, 2002, 2010, 2015), which fits for the potential psychological impacts from extensive lockdowns by COVID-19 pandemic. The pandemic not only significantly boosted the number of unemployed people (Goolsbee and Syverson, 2021; Lemieux et al., 2020), inducing financial stress and substantial inequality, but, violence and property crimes were found concentrated in socio-economically disadvantaged regions (Hipp and Yates, 2011; Hooghe et al., 2011; Hulme et al., 2019; Payne et al., 2020). This also exaggerated the potential range of negative psychological impacts on citizens due to the constrained freedom of movement and changed stress. The lockdown resulting loneliness, anxiety, and depression can all be triggers for a delinquent coping mechanism (Niles et al., 2021), leading to escalating anger and potential violence in the home (Piquero et al., 2021). In line with GST, we can understand how the risk of domestic violence may have been magnified, especially in conjunction with the prevalent abuse of alcohol and drugs during the isolation periods (Piquero et al., 2020).

To reduce the transmission rates and impacts of COVID-19 in target cities in 2020, several non-pharmaceutical intervention (NPI) strategies, most prevalently, the national lockdowns, had been set in place in line with respective national public health policies and guidelines. The COVID-19 lockdown timelines in London, New York, and Sydney are depicted in Fig.1, demonstrating the first lockdown from late March until mid-to-late May 2020, and the second lockdown in November and December 2020.

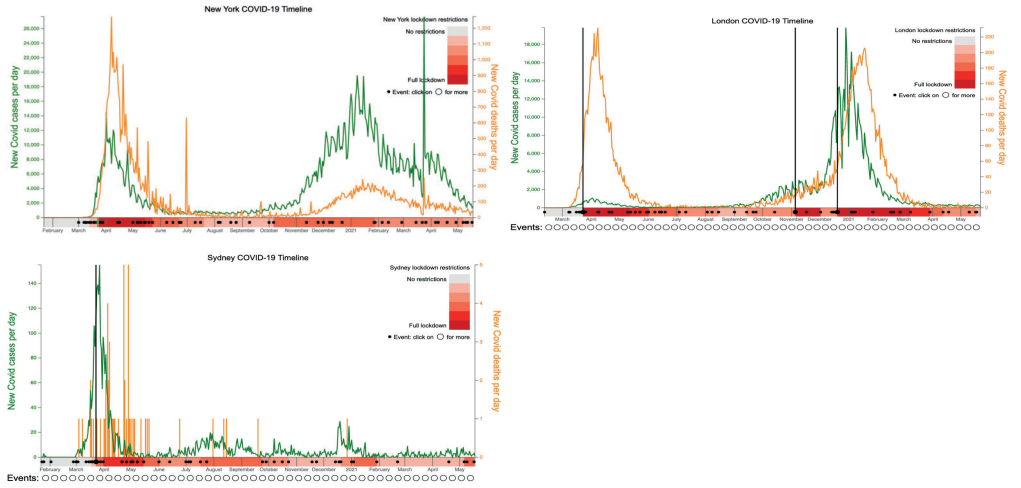


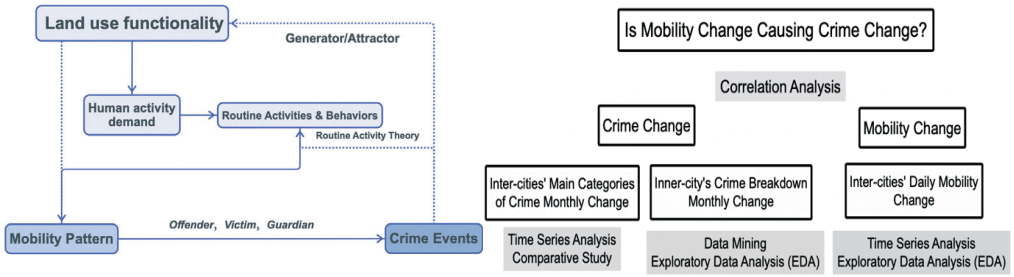
Fig. 1 COVID-19 Lockdowns in London and Sydney
Interactive details can be found via the project website at:
https://comparecitycrime.com/london/london_timeline.html;
https://comparecitycrime.com/sydney/sydney_timeline.html;
https://comparecitycrime.com/newyork/newyork_timeline.html

Haug et al., (2020) assessed the effectiveness of lockdowns depending on cities' local context, with an emphasis on the corresponding impacts on local mobility. Halford et al., (2020) theorised that such mobility changes were the primary causes to crime rate changes in UK cities during the pandemic. In view of these insights, this study will take the lockdown milestone events as the temporal benchmarks, utilise city-wide land use functioning data derived from Open Street Map on six land use categories – recreation, grocery, work, transit, residential, and parks – this data is used to calculate monthly average mobility change in space (see detailed animation visualised on the project website http://www.comparecitycome.com) further relating to inner-city crime changes on monthly basis (Equation 1).

$$Mob_{ik} = \sum_{j=1}^{6} Mob_{jk} * \left(\frac{Area_{ij}}{Area_i}\right) \quad \ldots\ldots \quad (1)$$

where *i* is the index for fine geographical unit (i.e., i=1,2,3, …, 4835 LSOA in London, *i* =1,2,3, …, 312 SA2 in Sydney, *i*=1,2,3,…,2195 TRACT in New York City), *j* is the land use category (*j* =1,2,3,4,5,6), and *k* is the index for consecutive dates (15th February 2020 – 31st December 2020) or months (February to December 2020).

Against the context of each target city, this study will investigate the correlation between land use-related mobility change and crime change, following the workflow as depicted in Fig.2: (1) time series analyses on monthly crime rate change and mobility change in each city, in the finest geographical scale; (2) spatially exploratory data analysis of inner-city hot spots during lockdowns; and (3) spatial regression analysis considering socio-economic contextual features' influence, to address the starting question.



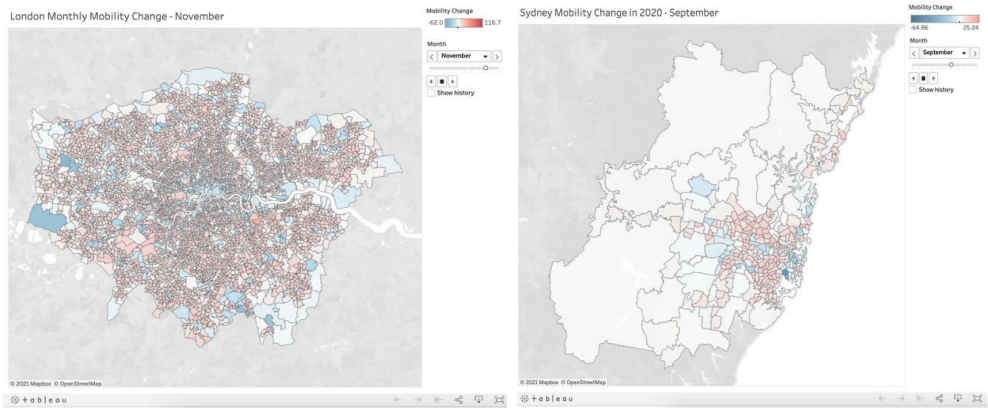
(a) (b)

Fig.2 Research design and workflow

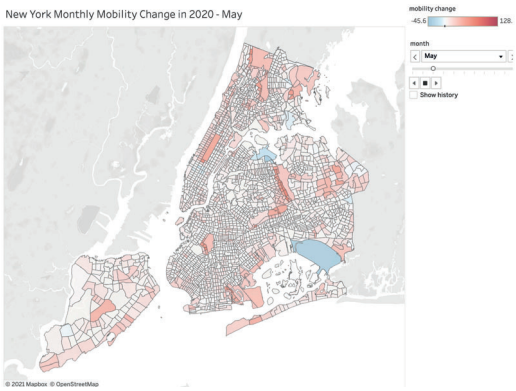
Among all three target cities, significant crime rate drops had been witnessed in 2020 compared to 2019 over the national pandemic incurred changes. In acknowledgement of the different crime classifications among the cities, major crime types will be analysed in this study. Alongside the data, the socio-economic status (SES) data for each city was derived from the latest corresponding census sources. This data was clustered by the machine learning KMeans algorithm to provide contextual clusters, and further fit into the spatial regression models for the purpose of predicting crime and providing evidence for crime prevention priority strategies.

3. Results

Taking the mobility index of 13th January 2020 as the benchmark for each city, it was obvious that mobility dropped significantly during each lockdown, especially during the early stages of each. This same trend is noticeable regardless of the mobility mode or the city. To get a vivid impression of the mobility change in the context of each city specifically, spatial exploration of at the finest geographical scale could be realised in an interactive way. For example, the monthly mobility change data extracted are in Fig.3 with the relevant hyperlinks.



https://comparecitycrime.com/london/ldn_monthly_mobility.html https://comparecitycrime.com/sydney/sydney_month_mobility.html



https://comparecitycrime.com/newyork/newyork_month_mobility.html

Fig. 3 Monthly Mobility Change in Geographical units in London, New York City, and Sydney in 2020

In Fig.4, monthly crime changes of the main crime categories – property crime and violent crime, in 2020, can be seen alongside year-on-year crime rates in 2019, to compare the impact of lockdowns on crime changes by main category, where the lockdown periods were highlighted in light yellow rectangular frames.

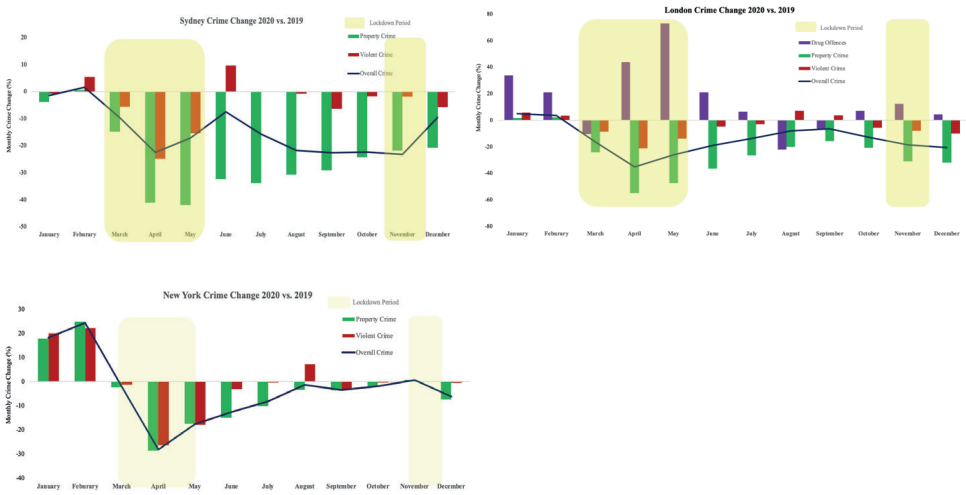


Fig.4 Monthly Crime Changes by Category

It is clear that the monthly changes in overall crime rate witnessed a cliff-drop reduction for all target cities during their first lockdowns (i.e., March to May), in comparison with previous year; for a majority part of their second lockdowns (i.e., November to December), the property crime rate shared similar impacts as overall crimes in response to the lockdown due to its bearing the largest proportion: a general decreasing trend in the property crime rate. However, there was an exceptional case in Sydney during the second lockdown with a relatively mild change. Violent crimes across all cities shared similar dramatic drops during the first lockdown when compared to 2019, but unlike property crime rates, they remained steady in the second lockdown. To further investigate the year-on-year variance in crime rate according to crime type across the lockdown months, results in Sydney (Fig.5 and Fig.6), London (Fig.7 and Fig.8), and New York City (Fig.9 and Fig.10) are presented below:

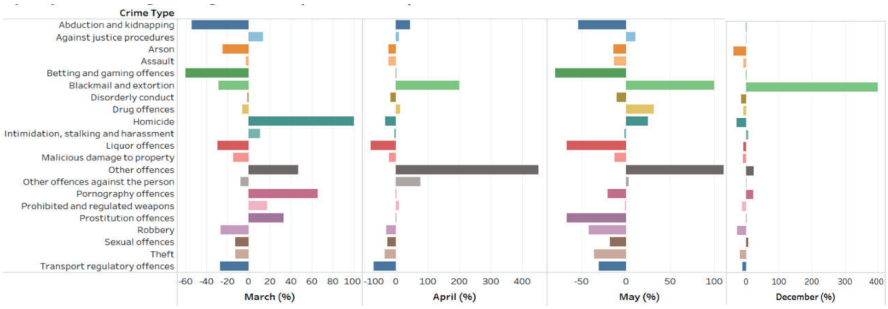


Fig. 5 Sydney Crime Change (%) during Lockdowns (2020 vs. 2019) by Category

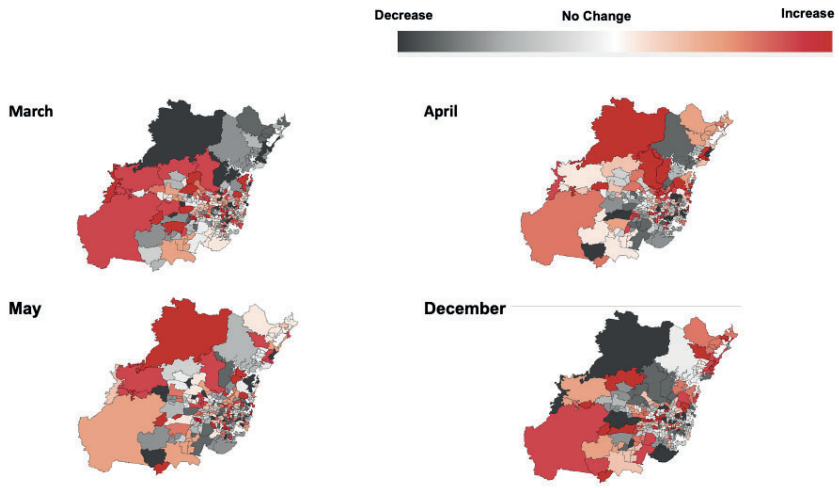


Fig. 6 Sydney Crime Change (%) during Lockdowns (2020 vs. 2019) by SA2 Units

In Sydney, there were significant increases in violent crimes like homicide. The data also shows increased crime rates for several types of offences, including pornography, prostitution, and owning weapons in the March. During the same period, there were obvious year-on-year decreases in gaming offences, kidnapping, liquor offences, and robbery. Similar crime change impacts were reflected in April and May, and even in December, during the second lockdown. Blackmail and extortion became the dominating category to experience increased crime rates, quadrupling by the end of the year. Theft, as the main crime type, didn't experience much change during the lockdown; there was a slight decrease in the number of theft cases during the lockdown first period. This trend for theft can be seen in parallel with another type of crime: transport regulatory offences. These findings are consistent with the mobility change trends seen upon implementation of NPI measures under the lockdown policy.

London witnessed the most significant crime rate drop during the first lockdown, especially for crime types like theft, burglary, and robbery. These categories saw an average decrease of more than 50% year-on-year, dropping most dramatically in April. There were comparable decreases in Violence Against the Person cases in April (down 30%), and Possession of Weapons dropped in March (by over 30%).

However, some other crimes – such as Domestic Abuse and Anti-Social Behaviour – saw large increases during the lockdown period when compared to 2019. For example, Drug Offences increased by over 50% in May compared to 2019 and continued increasing into the second lockdown in November.

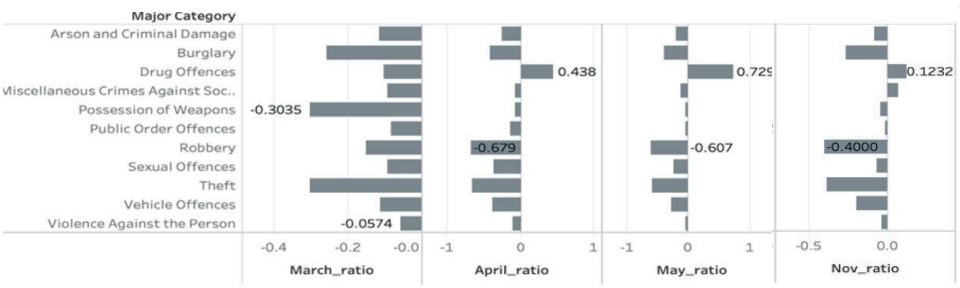


Fig. 7 London Crime Change (%) during Lockdowns (2020 vs. 2019) by Category

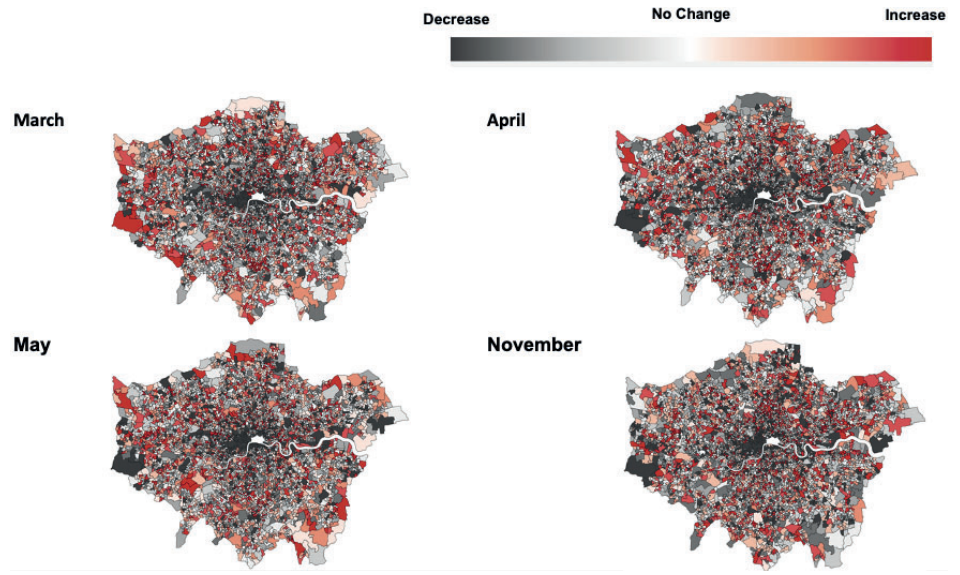


Fig. 8 London Crime Change (%) During Lockdowns (2020 vs. 2019) by LSOAs

New York City had exhibited abnormal pattern to the other two cities, in seeing significant crime increases in burglary, grand larceny of motor wehicle, and Murders throughout the lockdown months; but experienced cliff drops of Grand Larceny, Rape, Robbery and Felony assaults in the first lockdown (April and May). It indicated a stronger impact on local crime from the first lockdown, but severer crime recoveries in the second lockdown, making property crimes prominent for the city.

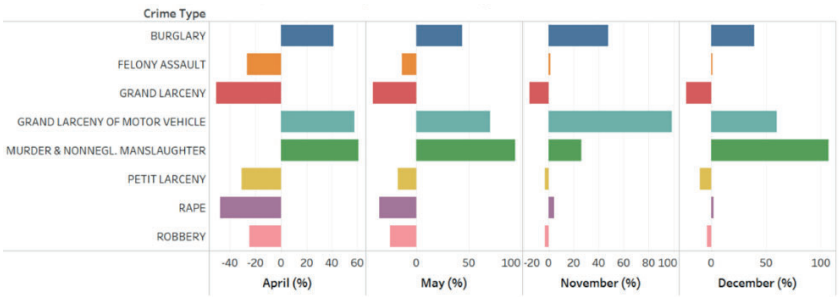


Fig. 9 New York City Crime Change (%) during Lockdowns (2020 vs. 2019) by Category

The spatial distribution of crime change hot spots in New York City was consistent with the other cities in that, the downtown of Manhattan saw the most crime decreases or fewer changes in the city, whilst the outskirt Staten Island and the Queens districts which had long been bearing higher crime rates in the city, saw most of the “parceled” crime increases during lockdowns.

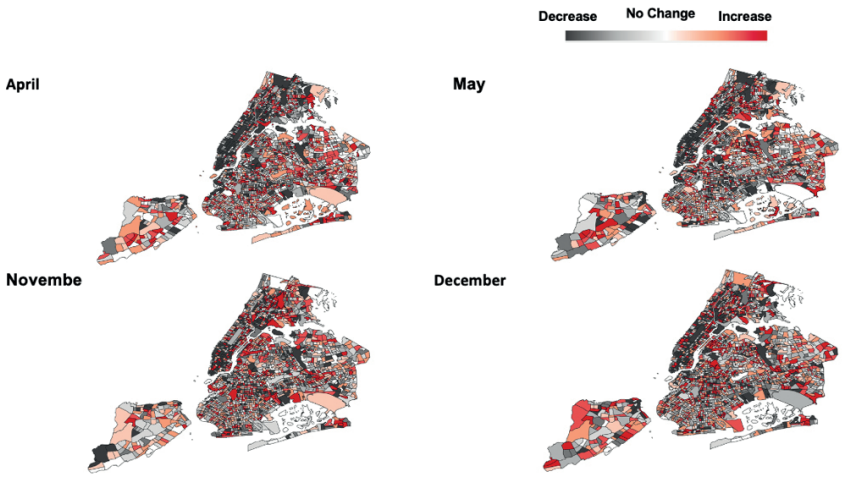


Fig. 10 New York City Crime Change (%) during Lockdowns (2020 vs. 2019) by Tracts

The visualisation of results identified hot spots in these cities where the crime rate had dropped significantly. These areas with the greatest reduction in crime centred around transportation hubs and city centre areas, which is consistent with the hypothesis that mobility-related crime decreases during periods of national lockdown. It also demonstrates increasing crime rates in parks and other outdoor leisure spaces, in line with the RAT hypothesis that a lack of surveillance, or guardianship, results in increased delinquency. Alongside the overarching trends, the results depict an emerging increase of certain crimes, i.e. cybercrime, and a rocketing increase in drug-dealing over the lockdown periods. These crimes were found to occur in rural areas and parks in the city outskirts, possibly related to tension as defined in the GST model.

Upon applying the K-Means clustering technique on selected demographical, social, and economic status (SES) variables at the finest geographical scale, it was found in both target cities an optimal six (or five in New York City) clusters as depicted in Fig.11. The clustering features were included in a spatially weighted regression model on crime change and mobility change, for prediction purposes.

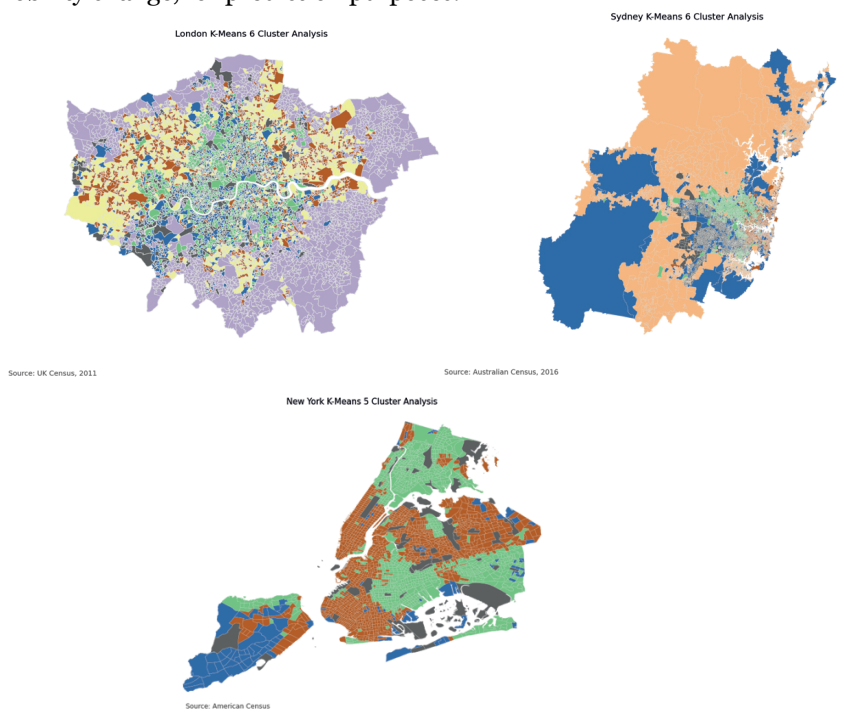


Fig.11 K-Means Clustering of SES features in the cities

To reflect the neighbouring regions' influences on crime change against lockdowns, i.e., regional SES profiling, and impacts from mobility changes, the spatial lag model (SLM) and spatial error model (SEM) had been utilised to identify the most influential factors in Table 1. In London, mobility change and neighbouring regions' crime change had exhibited significant positive influences on crime change; in exception with the insignificant relation between crime change and local SES features. However, Sydney's crime change had been identified as only affected by its neighbouring areas' crime changes, rather than the mobility change throughout lockdowns. New York City had been found to be influenced significantly by not only the neightbouring crime rates over the lockdowns, but also in the SEM model to have positive associations with mobility change and negative relation with contextual profiling during the 2nd lockdown.

Table 1 Spatial Regressions among London, Sydney and New York City

		London		**Sydney**		**New York City**	
		SLM	*SEM*	*SLM*	*SEM*	*SLM*	*SEM*
1st Lockdown (i.e., April)	R-squared	0.553	0.068	0.198	0.002	*0.169*	*0.0008*
	Mobility Change	0.304***	0.342***	0.011	-0.118	*0.014*	*0.0002*
	SES Cluster	0.178	0.129	-1.351	-0.821	*0.162*	*0.149*
	Neighbours' Crime Change	0.127***	0.130***	0.087***	0.091***	*0.479****	*-0.236****
2nd Lockdown (i.e., November /December)	R-squared	0.534	0.062	0.005	0.002	*0.055*	*0.0018*
	Mobility Change	0.375***	0.397***	0.273	0.349	*0.091*	*0.201****
	SES Cluster	0.149	0.118	0.399	-0.241	*-0.079*	*-0.303****
	Neighbours' Crime Change	0.125***	0.127***	0.082***	0.084***	*0.293****	*-0.236****

***p<0.01, **p<0.05, *p<0.1

4. Conclusions

The study had compared lockdown impacts in 2020 in London, New York City, and Sydney, to relate the mobility changes with crime changes on a monthly basis in order to capture the city profiled features of crime changes in both type and spatio-temporal patterns. It had been recognised as a natural experiment of two prominent criminological theories: RAT and GST, in the conclusions that: (1) the impacts of the Covid-19 pandemic on the cliff-drops of most crimes greatly rest on RAT, as people's mobility is constrained by lockdowns; while the emerging rise of particular crimes, such as domestic violence and drug abuse, which could be a result of people's coping mechanisms to escape from the mental and emotional pressure caused by lockdowns are thus supported by GST; (2) identified hot spot regions experiencing most eye-catching cliff crime drops during lockdowns were mostly in transit hubs, city centres, etc., where the human mobility decreased significantly from the series NPI measures during lockdown; (3) those abnormal increases of city-characterised types of crime (e.g., blackmail in Sydney, drug offences in London, vechicle larceny in New York) may due to being lack of surveillance (e.g., national parks, public venues, etc.), with some seeing crimes bouncing back right upon the lifting of NPI measures considering tension resenting or strain expression. (4) It highlighted the driving effect from mobility change to crime change during lockdown periods in London and New York, but not the case in Sydney.

The work is expected to not only generate some comparative data-driven evidence for city policymakers, on crime prevention strategies and efficient policing, but also build up a replicable workflow/model based on the identified similarities among target cities, and to expand further to a broader range of cities. In future studies, wider variables would be considered, such as the variable measuring people's actual strain levels or the changes of citizens' routine activities to fit for more optimal model configurations.

Acknowledgments

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GreenWithGrey: Actions and Dialogues for a Transitioning Productive Landscape

Andrea Aragone [1], Marco Ranzato [2] and Chiara Cavalieri [3]

[1] LATITUDE Platform for Urban Research and Design (Belgium), Université Catholique de Louvain (Belgium), IUAV University of Venice (Italy); a.aragone@latitude-platform.eu; 0000-0003-0072-5709
[2] Roma Tre University (Italy), LATITUDE Platform for Urban Research and Design (Belgium); marco.ranzato@uniroma3.it; 0000-0002-9637-110
[3] Catholic University of Louvain, UCLouvain. SST/LAB: Louvain Research Institute pour Landscape, Architecture and Built Environment (Belgium); chiara.cavalieri@uclouvain.be; 0000-0002-7023-6516

Names of the track editors:
Birgit Hausleitner
Leo van den Burg
Akkelies van Nes

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Abstract: Flanders is one of the best-known productive regions of Europe. Concentrating the majority of the Belgian industry and workforce, the Region features a continuous and dense infrastructure throughout its landscape: slabs of asphalt and concrete, tiles, sheds, wide roads, unused vegetated remnants of space, and industrial platforms. These elements cover approximately 4.5% of the urbanisation of the region and 15% of its overall *land take*, becoming a major question when it comes to the soil impermeabilization and water management question. This work looks at industrial platforms as umbrellas spread right across the Flemish territory. Umbrellas that every year repel approximately millions of m³ of rainwater. What if this water were retained instead? GreenWithGrey is one of the strategic projects of the "*Proeftuinen Ontharding,*" a programme aiming at tackling the very diffuse – and land consuming – urbanisation of Flanders through strategic desealing actions. Within this framework, GreenWithGrey explores possibilities for desealing Flemish industrial platforms to tackle questions such as providing more room for water and strengthening the regional water cycle. GreenWithGrey achieves the ongoing transition through a mix of doing and undoing, of actions and policies, of top down and bottom-up strategies.

Keywords: desealing; transition; water management; experiment; policy implementation strategies

1. Introduction

Flanders is historically one of the best-known productive regions in Europe. Today, it counts about 1,356 industrial platforms.[1] Large impermeable surfaces made of slabs of asphalt, concrete paving, tiles, sheds, wide roads, unused vegetated remnants of space, and industrial platforms cover approximately 60,000 ha – that corresponds to a square of 25 x 25 km – that is to say the 4.5% of the regional footprint and the 15% of its overall land take. If observed within a regional gaze, industrial platforms reveal two different logics of distribution: they not only concentrate mostly along main mobility infrastructures, such as waterways, highways, and railways, but they are also mainly placed near primary or secondary watercourses. Here we could imagine them as a potential intersection between mobility and ecological networks. Historically, these industrial sites depended on the watercourses for transport, water provision, and discharge. Today, having lost this historical dependency, they are rather constituted by umbrellas spread right across the Flemish territory. Umbrellas that every year intercept approximately 450 million m³ of rainwater that is more than 200 million m³ of runoff a year.[2] This is equal to an amount of water that could fit in 1,356 water towers, 250 m in height and with a footprint of 25 x 25 m each.

Instead, most of the water runs off directly into the sewer system or into surface water. What is remarkable is that of this, 40% is roof runoff, which means 72 million m³ of good quality water.[3] This is plenty of water that, if it does not generate floods, vanishes after each rainfall. What if this water were to be used instead?

The project exploring this question – GreenWithGrey – is one of the strategic projects of the "*Proeftuinen Ontharding*" (Living Lab Desealing), coordinated by the non-profit organisation LATITUDE Platform for Urban Research and Design, together with two Belgian universities UCLouvain and KULeuven.[4] GreenWithGrey explores possibilities for desealing the industrial platforms of Flanders in order to give more room for water and so strengthen the regional water cycle. In 2011, the European Union defined the EU Roadmap to Resource Efficient Europe which "outlines how we can transform Europe's economy into a sustainable one by 2050." According to the roadmap, NO NET LAND TAKE is one of the main goals to be achieved by 2050. In the same spirit, in 2018, the Department of Environment and Urban Development (*Departement Omgeving*, Flemish Government) started "*Proeftuinen Ontharding*," aiming at tackling the very diffuse – and land consuming – urbanisation of the region through desealing actions. "Desealing for more space for water" is among the three main axes of the initiative, together with "desealing for more qualitative school environments," and "desealing for more mobility with fewer roads."

The research project starts from the general hypothesis that optimising water management in industrial platforms can, via desealing actions, be strategic to counteract regional water dysfunction. As part of a systemic reflection, this hypothesis not only stimulates the physical transformation of the industrial platforms, but it also investigates new forms of coalitions between local and regional stakeholders, while broadening to ecological and societal scopes. Furthermore, GreenWithGrey acknowledges that rainwater has to be considered an opportunity and that industrial platforms could be seen as water towers. This article focuses on the relationship between the industrial platforms of Flanders and the water management of the territory they are part of.

2. Theories and Methods

Water management strategies such as desealing offer potentials for other actions that support the sustainable redevelopment of the industrial platforms. These strategies include the strategic reuse of runoff water (a potential resource) generated by industrial platforms, and the development of ecological (green-blue) networks (whose continuity and connectivity has often been compromised by the development of these platforms). The above-mentioned strategies are aligned with the Flemish Regional Strategic Vision (Departement Omgeving, 2018) that sets the objective of a sustainable transition for Flanders. Within this framework, GreenWithGrey discloses the complexity of a multi-level and polycentric stakeholder structure of water management (Knieper & Pahl-Wostl, 2016). Existing forms of management, coalitions, and policy frameworks are not currently adapted to today's challenges and should be reconsidered in order to bring about a change in the management of water and to reach the regional objectives.

According to the World Resource Institute, by 2040 water stress in Belgium will be extremely high when compared to global geographies. Moreover, in Flanders one in every six jobs is related to the subject of water (Vlaanderen Circulair, 2017). By contextualising these figures, especially in relation to the most recent extreme events – be they floods and droughts – that have occurred in the region, the unfolding of water management complexity becomes not only a fundamental but also an urgent subject. Moreover, the specific urbanisation of the territory as a diffuse and dense infrastructural network causes frequent overflows of wastewater into surface water. As it is commonly known, this specific runoff flooding is caused by the lack of sewer capacity, so that rainwater cannot be drained during extreme events. As a result, because of the untreated wastewater, it occurs that the quality of surface water falls below the accepted European standard, while rainwater continues to be considered a threat (in terms of flooding), rather than representing a resource (for recycling and combating drought), or offering an independent and unitary water system (Cavalieri & Vanin, 2019).

GreenWithGrey provides the foundations for turning to the *Thousand Flanders Water Towers* scheme. All tools, methods, and actions which are part of the project aim to demonstrate that industrial platforms can detain, infiltrate, and reuse rainwater in order to counter the current cultural dimension of its wastage. The shifting consideration of the existing industrial platforms as a source flow instead of the cause of overflow requires the

overall motion of legislators, institutions, and industry players in the years to come. To understand the complexity of Flanders industrial platforms, GreenWithGrey first looks at how they are organised and what are the basic determinants to be considered when transforming them from an overflow problem into a resource. But the making of the *Thousand Flanders Water* scheme is not a unitary project: it implies not only the reconceptualisation of surfaces, infrastructures, and flows but also an understanding of the hundreds of thousands of actors, activities, and situations. Hence, industrial platforms are revealed as the strategic potential space many initiatives can be experimented, from the convergence of the will and action of many institutional and private actors, to the testing of specific implementation for specific conditions of water dysfunction, or ultimately the disclosure of new opportunities in combining local and regional regulations.

Throughout the spatial analysis, in-depth interviews, stakeholders' workshops, policy analysis, and design exploration, GreenWithGrey displays how to operationally and spatially transform industrial platforms into *detainment, infiltration, or retainment devices*. These new devices transform industrial platforms from umbrellas to water towers, that intelligently reuse roof runoff water via a set of physical transformations, tested both on ideal-types and on two case studies.[5] Further on, GreenWithGrey goes on to propose a trajectory of policy implementation addressed to the regional decision-makers. This is identified at supporting the regional objective to accelerate the process that will lead to resorting to the Flanders water towers. GreenWithGrey's outputs serve as the basic inspiration tools for the various actors to be able to start developing an integrated water management of the industrial platforms both on their own and also in concert. In addition to these desktop research methods, GreenWithGrey recognises that experiments and collaborations between actors are an essential part of the process of investigation (Köhler et al., 2019). In this respect, GreenWithGrey opened up with the Asiat DePave Summer School (August–September 2019): about 10 days in the field to sample materials of the industrial platform of Cargovil in Vilvoorde, the municipality north of the Brussels-Capital Region. Students, local stakeholders, academics, designers, and local politicians were involved to discuss the first ideas about desealing industrial platforms. Afterwards, GreenWithGrey organised a series of (online) bilateral meetings to allow experts, representatives of different regional and local institutions, managers, and users of industrial platforms to explain their perspective on the subject and react on the research hypothesis and findings (June-November 2020). Finally, a roundtable with key Flemish institutions provided the momentum to take stock of research outcomes and the project communication (December 2020).

3. Results

In 2018, when the programme *Proeftuinen Ontharding* (Living Lab Desealing) was launched, the Flemish Government decided to explore the potential of desealing on two scales of investigation, which also refer to different actions of exploration: desealing tests on small-scale interventions (e.g., schools, roads, or parcels) and the desealing strategic regional projects. GreenWithGrey is part of the second line of action. The call for setting up pioneering actions within Flanders is also a call to install roots for a future necessary cultural shift (Architecture Workroom Brussels and Departement Omgeving, 2021), featuring the urge to physically and strategically anchor the projects to the territory in the short term by working with design tests and policy adaptations at the same time. To keep this interaction between the two levels, GreenWithGrey based its processes and results by setting up continued exchanges with local and regional actors (of change), be they industrialists, public and private developers, policymakers, and infrastructure managers. But how does one allow the discussion to continue once the project has finished, to attain the activation of *A Thousand Flanders Water Towers*? To do so, GreenWithGrey has compiled the research into five different booklets to inform a larger public of the possibilities of desealing industrial platforms, and primarily to nourish the transition debate and stimulate the interactions with the actors of change.

1. Seize the opportunity and understand where you are: The GreenWithGrey diagnosis

To find its way around the world of Flanders industrial platforms, GreenWithGrey first had to understand how they are organised and what the basic determinants to be considered were when transforming them from an overflow problem into a resource. The discovery is by no means obvious. There are organisational patterns and it is possible to build a taxonomy, but when looking at water logics, each platform is different in itself,

with not a single block having a unified water functioning/system. Any industrial platform is a kaleidoscope. If the permeability conditions of infiltration or detention prone soil is often a unitary issue for an industrial platform, things change when we look at the second determinant, i.e. the existing drainage system. It could be a combined wastewater, a separated system with stormwater pipes or a separated stormwater with open air ditches. GreenWithGrey shows how this condition often changes within the same industrial platform.

2. Figure out with whom: GreenWithGrey coalitions

Building on experience in the field, exchange with the various cross-fertilised actors, GreenWithGrey elaborated a compilation of potential coalitions. They are plausible situations that can be encountered in the variegated landscape of the Flanders industrial platforms. Depending on who one decides to work with, GreenWithGrey designs initiatives such as *neighbours*, when it is among different industrial entities, *districts*, among industrial and one or more public institutions, and *parks*, when the initiative is led by one or more public institutions.

3. Find what to do: The GreenWithGrey design toolkit

By taking into account the abovementioned determinants – infiltration-prone/detention-prone soil conditions and the sort of existing drainage – GreenWithGrey displays how to make the industrial platforms to detain, infiltrate and, in case, reuse roof runoff water. The toolkit is a set of ideal-types or possible, desirable water flow configurations, one for each of the most recurrent industrial platforms clusters, chosen among many others because they are more widely distributed, easier to implement and have greater impact on the landscape. The ideal-types altogether make the water-flow industrial clusters working parts that turn the platform into a water tower serving the territory of Flanders.

4. Get support: GreenWithGrey policy instruments

GreenWithGrey identifies a series of policy instruments or mechanisms that could be embedded within the existing set of regional policies in order to push the GreenWithGrey change. The main objective of the GreenWithGrey policy instruments is to make the upgrading process of the existing stock of industrial platforms possible. An *open water database* makes the water balance available, accounting for both the consumption of water, but also the production of water resulting from the interception of rainwater.

The fees paid by industrial entities according to their water consumption and production patterns go to feed a *common fund* for the GreenWithGrey change. Supported by the common fund, *ecologically sound projects* and *systemic water projects* increase the ecological performance and societal features of the industrial platforms.

5. Go and test: GreenWithGrey design projects

Two design projects show the feasibility of turning on *A Thousand Flanders Water Towers*. Inspired by the GreenWithGrey coalitions, fostered by the GreenWithGrey design toolkit, and supported by the GreenWithGrey policy instruments, two industrial platforms of Flanders are loaded with devices for water flow infiltration, retention, detention, and reuse. The design speculations are peppered with hydro-figures, a.k.a. what the GreenWithGrey shift would mean in terms water reuse and recycling, flood risk reduction, landscape restoration, and opportunities for recreation. They are there to trigger the imagination and arouse popular interest in the possibility.

The five GreenWithGrey booklets represent the results of the research project. They put together the complexity that has emerged throughout the entire exploration. They are defined according to the principle that they have to promote the discussion about the opportunity to activate desealing operations in existing industrial platforms in support of a better water management of Flanders. By the GreenWithGrey booklets, the aim is clearly to travel among many desks and to enrich the dialogue between technicians, politicians, and industrials in order to turn on *A Thousand Flanders Water Towers* one after the other.

4. Discussion

Since the beginning of the '90s, the Flemish government started to implement the Flemish environmental permit decree (*Vlaamse milieuvergunningsdecreet*, 1985) with environmental standards regulations for reducing water pollution (VLAREM – *Vlaams Reglement betreffende de Milieuvergunning*). VLAREM II made it mandatory to build

separate stormwater and wastewater drainage systems when a public sewage system is built or renewed. It is also mandatory for private owners to split up the sewage on their terrain, although only during renovation or new constructions. At the same time, the Flemish spatial planning framework (rainwater ordinance – *Hemelwaterverordening*) defines high standards for the water management at the parcel level – infiltration, reuse and buffering rainwater – again only via renovation and new constructions. When considering droughts, policy is a step behind. It was only after the extreme water scarcity occurred during the summer 2018, that the Flemish Government stepped up efforts in the fight against drought and water scarcity by drafting the *Actieplan Droogte* (2019–2021) and the Blue Deal part of the *Vlaams Klimaat Adaptatieplan* 2021–2030. This process of implementation illustrates that the Flemish government is not only seeking a circular water cycle, but that it also already tackles water dysfunction via policy revision. Although policy implementations are thus currently under development, the struggle for allowing the intended ecological transition to take off is already evident. The gap between territorial process and policy is still too big, making it impossible to anchor the former to the latter. In this line of thinking, it is important to notice that one of the main current hurdles is the fact that legislations are not retroactive and applicable to the existing built-up tissue. In other words, the legislation wishes to implement the new, but does not embrace the idea of restoration of existing built stock; in fact every year, only less than 1% of buildings request a renovation permit (Vlaamse Regering, 2020). Considering that to enable transition a cultural shift is needed (Grin, 2010), Flemish governmental agencies are still seeking for innovative solution able to combine spatial transformation, environmental thinking, and policymaking.

Within this context, we could enlarge the purpose of "*Proeftuinen Ontharding*." If desealing is the main objective of the program, it could be said that another primary objective for the Flemish Department of Environment and Urban Development is to reduce the noticeable gap between policies and socio-ecological processes occurring in Flanders. The quest for establishing coalitions of actors through design processes is a key part of the living labs. Design becomes a means for negotiation between actors that operate on different scales (Manzini, 2015) and take a central role for enabling innovation systems (Lawhon & Murphy, 2011). In particular, the Flemish territorial agencies understood the importance of testing the design to stimulate collaboration and exploration. Design experiments, pilot projects, and living labs – that are all onsite actions – are taken as opportunities for learning and for exchanging between local knowledge and regional strategies (Dobre et al., 2018). The will to reduce the dichotomy between regional planning and local practices is addressed through the means of design. This is also to say: design, as a means to settle coalitions, has a relevant role in the process to achieve the sustainable transition of Flanders. Learning opportunities multiply. Possibilities of onsite testing of the hypothesis, on which territorial policy is based, are first discussed and oriented. By funding projects such as GreenWithGrey, the governmental agencies are exploring the objects of investigations – i.e. industrial platforms and rainwater management – in order to better orientate the acceleration in the coming years. Concurrently, and not less relevant, tables are being set up to discuss a shared and common vision between local and regional operators.

From its beginning, GreenWithGrey has been a process of collaboration between the research group, the governmental agency, and local and regional actors. Focusing on industrial platforms and their water management revealed the huge complexity of the actors involved. Industrialists, industrial platform managers, public and private developers, sewer and water distribution managers, surface water and waterways agencies and institutional representatives (municipal, provincial, regional) represent a part of the stakeholders that deal with GreenWithGrey. The complexity was disclosed through design – thus possible transformations of the rainwater management of industrial platform – which serves as the tool for debate and learning opportunity. The three main collaborative actions – the Summer School, bilateral interviews, and the roundtable – have been important favourable circumstances during which multi-scalar actors could freely negotiate among each other to transform the regional water management.

Following this line of thinking GreenWithGrey could be seen as one piece of experimental transition strategies directed by the Flemish government. As scholars investigated in-depth, experiments are today a specific approach to understanding how to govern transition (Matschoss, & Repo, 2018) and they pointed out how there has been an increase, especially in funding and testing them, in the recent years in many urban territories (Broto

et al., 2013). As an experiment, GreenWithGrey attempts to explore and trigger regional transition by producing design explorations negotiated with strategic multi-scalar stakeholders, this in order to deepen the role of the designers as mediators for change (Köhler et al., 2019).

5. Conclusions

GreenWithGrey, in this sense acting as a living lab, is an active experiment, and is merely one part of the difficult path towards the Flemish ecological transition. Through the whole research process, the continued re-conceptualization of water as an active design device for transforming industrial platforms has been continuously intertwined with a parallel discussion about existing and possible forms of better water management policies. More in particular, the tension between these two dimensions relies on the constant discussion carried on by the research team with the involved stakeholders. The aim of enabling *A Thousand Flanders Water Towers* is not only a mere speculation on design and actor coalitions, nor does it only aim at initiating local stakeholders in water desealing processes. It is also, and most importantly, the design of a process able to enhance a large-scale discussion on the need for a cultural shift in respect with soil and water.

In addition, one could consider GreenWithGrey as fertile ground for ecological transition in order to: (1) further deepen the role of design within a complex and multi-level process for drafting policies; (2) understand and redesign the different roles of the actors involved; and (3) foresee a further role for water within a framework of innovative climate strategies for a specific territorial pattern, such as that of Flemish diffusion.

Notes

[1] This work refers to industrial platforms as clusters of industrial companies – mainly placed on artificial topographies – with a surface of 5 ha or more. The geographic database produced by Agentschap Informatie Vlaanderen presents about 6,000 industrial platforms (bedrijventerreinen). 1,356 industrial platforms have a surface of 5 ha or more and are equal to 92% of the total industrial platform surface.

[2] These numbers are calculated taking into account a runoff coefficient of about 0.8 for sealed surfaces and 0.2 for soft surfaces.

[3] The runoff generated by the roof generally has a good quality and, although not drinkable, it is usable for many needs without having to be processed.

[4] LATITUDE Platform (coordination): Marco Ranzato, Andrea Aragone, Federico Broggini, Alexander Colson, Federico Gobbato; UCLouvain: Chiara Cavalieri, Daniela Perrotti, Daniel Otero Pena; KULeuven: Bruno Notteboom, Ciel Grommen. Since 2020 Marco Ranzato is involved as Roma Tre University.

[5] The two case studies are located within the same watershed of the Maelbeek. It is located in the northern proximity of the Brussels-Capital Region. The two case studies are two industrial platforms. One platform, namely Asse-Zellik Industriezone, is located in the upstream part of the watershed, immediately above one of the sources of the Maelbeek river, within the municipality of Asse. It lays on mainly high infiltration soil. The second case study is Cargovil, which is located in the downstream part of the watershed at the intersection of the Maelbeek river with the Senne river and facing the canal Antwerp-Brussels. The platform is within the municipality of Vilvoorde. It is located on low infiltration prone soil.

Contributor statement

Conceptualisation: Author 2, Author 1

Methodology: Author 2, Author 1, Author 3

Writing – Original Draft: Author 2

Writing – Review & Editing: Author 1, Author 3

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Integrated Coastal Flood Design: Changing the Paradigm in Flood Risk Management

Luca Iuorio [1], Andrea Bortolotti [2]

[1] TU Delft, Department of Urbanism; l.iuorio@tudelft.nl
[2] TU Delft, Department of Urbanism; a.bortolotti@tudelft.nl

Abstract: The relationship between the design of the flood protection infrastructure and the design of the urbanscape is the focus of this paper, and asks the question how these two types of design can consciously affect each other? The text presents the preliminary result of an interdisciplinary research conducted by a team of urban designers and hydraulic engineers on two pilot projects of coastal adaptation to extreme sea level rise on the North Sea: Vlissingen (NL) and Southend-on-Sea (UK). Spatial measures to accept the flood, land use change, water-proof housing developments, and the use of nature-based solutions are described in relation to the urban fabric. The aim is to discuss models of flood risk reduction which are alternatives to the more conventional coastal flood protection strategies. A different "designer" way of thinking and great effort to describe and analyse the two cases have been utilised to enlighten the spatial qualities of the urban form and its long-term adaptability.

Keywords: coastal flood; water infrastructure; integrated design; risk management; living with water

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1. Introduction

In recent decades, global warming has increasingly challenged hydraulic engineers and urban designers to reshape and adapt coastal cities to sea level rise and intensifying storm events. (Davoudi, Crawford & Mehmood, 2009). The current flood risk-related challenges induced by climate change place pressure on designing urban areas in which both natural and man-made conditions can be out of balance. Flood risk is mostly oriented towards reducing the probability of flood events. Also, due to the changing hydrological cycle, exceptional river discharge, heavy rainfall, erosion, sedimentation, and subsidence, grey infrastructures (dykes, seawalls, dams, etc.) are constantly being built. But, the hard-engineered approach to flood risk management does not always work: especially in floodplain and coastal areas, these infrastructures have a significant growing impact on the (urban) landscape (Van Loon-Steensma & Kok, 2016).

Knowledge about the design of the urban fabric of the protected areas in relation to the overall risk reduction by the flood defense system is still limited (Nillesen & Kok, 2015), but growing. A separation between flood management and urban planning has been perpetuated over time by the idea that flood defence offers the primary condition for urban development. In the Netherlands, for example, technical interventions have made the territory livable, and the government has a strong and coordinated responsibility for both safety and spatial planning (Hooimeijer, 2014). Flood risk management, indeed, is considered the "*conditio sine qua non*" (Van der Woud, 1987) for urban development in the sense that without dykes there is no possible spatial order.

However, a new awareness – also in the field of engineering – is growing, especially in the Dutch context. In recent decades, this has triggered several experimental programmes in which the flood infrastructures have been approaching the water-space involved in the large span design of urban, rural, or natural lands. Examples such as the "Room for River" programme in the Netherlands, new dyke concepts (e.g., double dyke, wide green dyke), the use of nature-based solutions (e.g., marshlands, the Sand Engine, reconstruction of dunes, etc.) demonstrate that water protection infrastructure may have larger spatial footprint than the one that traditional dykes used to have in the past (Van Loon-Steensma & Vellinga, 2019). Nevertheless, accepting water, implementing nature-based solutions, improving emergency and evacuation plans, etc., all those measures demand overcoming the division and practical silos between urban planning and flood management.

Making space for water has become the hallmark of a new generation of flood management plans and strategies (Foster, Hudson, Bray & Nicholls, 2013; Thomas, 2014) that address a renovated attitude in living closer with it. Living with water includes the discipline of spatial design more than the current dominant engineering-based flood risk management paradigm. It overturns the hydraulic design approach – according to which there is no spatial order without flood defence (Van der Woud, 1987) – reclaiming the need to think of water protection systems any more as a line, but as a space. Spatial design is part of flood risk management and hydraulic engineering is part of spatial design. In this perspective, urbanised areas are intended as a historized, dynamic, and transitional objects that can adapt to climate change and environmental hazards through the means of integrated spatial and infrastructural design.

This paper discusses the preliminary result of an interdisciplinary research conducted on two middle-sized cities on the North Sea: Vlissingen, in the Netherlands; and Southend-on-Sea, in England. The case studies are part of the Interreg - Sustainable and Resilient Coastal Cities (SARCC) project, which gathers a number of municipalities across four European countries (France, United Kingdom, Belgium, Netherlands) willing to implement the transition of historical grey water defense infrastructure towards the development of more sustainable seafronts projects through the implementation of pilot projects (coordinated by the municipality of Southend-On-Sea in partnership with other public agencies and institutes among which TU Delft Department of Urbanism and of Hydraulic Engineering). The Vlissingen and Southend-on-sea pilot projects, discussed in this paper, were developed in collaboration by a team of urban designers, hydraulic engineers, and marine archaeologists.

Both projects reflect the broader scope of SARCC: the aim is to explore alternative models of coastal management and planning. Accepting water overtopping, using temporary dykes, and implementing changes in land use and building regulation are taken as main principles and translated into spatial actions to reduce overall flood risk in these cities. The intent is to expand the scope of the pilot design to include whole urban areas and establish more complex and resilient flood management in which several urban/spatial adaptation strategies are taken into account. The proposed spatial adaptation strategies are based on original hydrodynamic models which account for extreme storm surge and sea-level rise projections for the year 2100.

2. Vlissingen

Vlissingen is a medium-sized city (44,370 inhabitants) situated in the outlet of the Western Scheldt River on the North Sea coast. Thanks to this strategic geographical position, it has represented a crucial harbour since the XIV century. Its internal areas, as most of its province, are below annual flood events. Nevertheless, the area is protected both by a reinforced dyke, on top of which are built row buildings and towers (south) and sandy dunes (west) integrated to the regional blue and green network. Internal polders are drained by the Walcheren channel communicating with the sea through locks.

At present, Vlissingen's primary flood defense structure is composed by the following elements: (i) a reinforced concrete slope along the sandy coastline; (ii) storm walls with a bullnose,above which lays the waterfront boulevard; (iii) the first row of buildings made by a mix of traditional 3-storey row houses and towers of different heights with commercial activities on the ground floors (some of which are accessible from a raised plaza with underneath parking); and (iv) a raised dyke on the back of the buildings, in the western part of the main boulevard.

In the past, due to the projection of future sea level rise (IPCC, 2019), the Municipality of Vlissingen has promoted a strategy of urban development which integrates adaptation to forthcoming flood risk. The so-called 'Vlissings Model' (Vlissingen & Ma.an, 2010) aims to create a sea-barrier with buildings themselves: foundations and first floors of new developments must be designed to anticipate the future rising of the coastal dyke. Recently, several buildings on top of the primary defence line have already been built according to these principles: they have higher ceilings at the ground level in order to further incorporate the eventual raising of the dyke.

Today, the Municipality is also promoting an urban renewal plan (including commercial and residential functions) that aims to recover a former artificial basin located in a central area of the city, behind the main dyke, to serve as water reservoir in case of flooding. The project will impact an empty, but spontaneously vegetated area called "Spuikom," once connected with the nearby harbour that has been partially filled after the 1970s to allow the construction of new buildings and parking lots.

These two strategies have offered the opportunity to further investigate the spatial effects on the urban context. On the one hand, the Vlissings Model may require, in the long term, the entire demolition and reconstruction of the historical buildings along the seaside. On the other hand, the reactivation of the Spuikom requires the basin and its surrounding area (streets and buildings) to be redesigned to function as a buffer zone in order to give adequate space to excess water.

The TU Delft departments of Urbanism and Hydraulic Engineering have expanded the analysis for this second option. Building on original hydrodynamic models for storm events in the year 2100, it was possible to figure out most needed spatial adaptation measures in the historical urbanscape. In the suggested spatial vision, the Spuikom again becomes a basin to store water in the case of flood; the streetscape is designed with the scope of redirecting water into the reservoir; streets are equipped with movable barriers to divert the flood. In this "re-making space for water" approach the developments planned by the Municipality are taken into account and also create economic catalysts to feasibly transform the area.

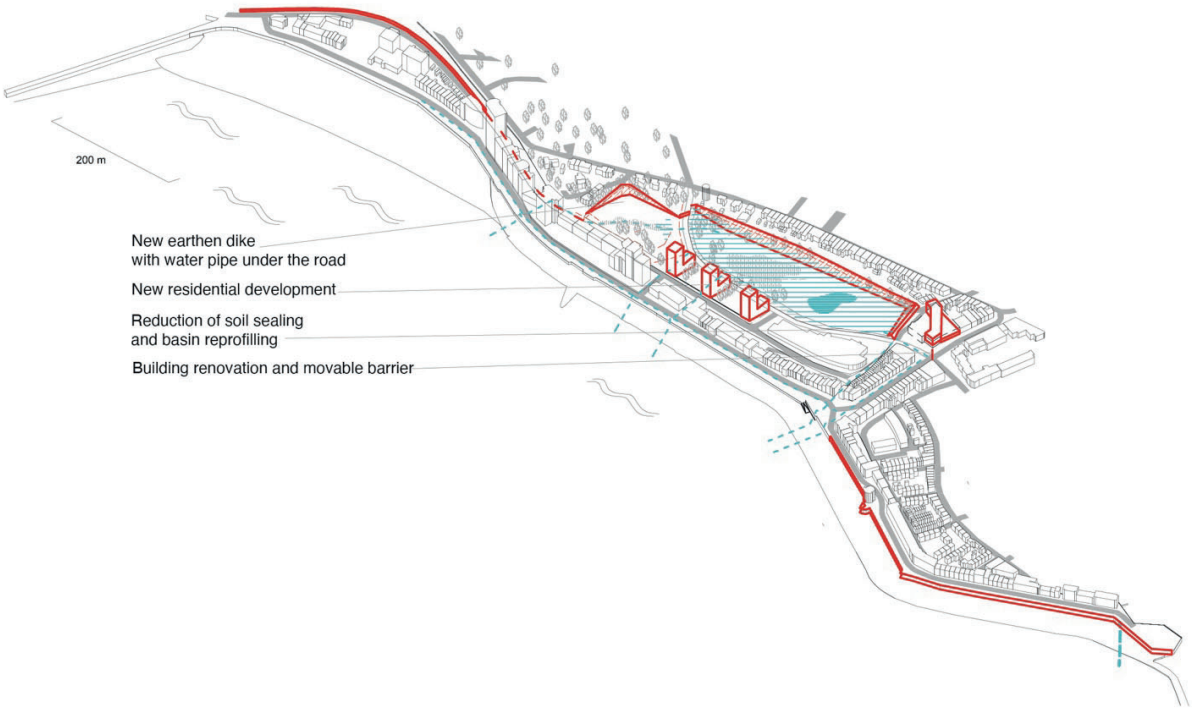

Figure 1. Making space for water. Spatial vision for Vlissingen. Drawn by A. Bortolotti. The strategy has been developed within the Sarcc project, TU Delft team: F. Hooimeijer, J. Bricker, A. Diaz, Q. Ke, A. Bortolotti.

3. Southend-on-sea

Southend is one of the most densely populated areas (181,800 inhabitants) outside London. It is located on the mouth of the Thames River and served by a capillary transport network which includes multiple train stations. Its waterfront has been, historically, an important leisure and recreational area. The urban structure is of sprawl-type dominated by single-family houses with gardens, whereas public and commercial services are concentrated along several high streets and recreational grounds (e.g., sports fields). Property development pressure is strong (Southend-on-sea, 2021), particularly along the seafront due to its high economic value.

From a geomorphological perspective, the municipality is divided into two parts: the town centre and western part are on high ground and not at risk from tidal flooding, while much of the sea front and the eastern part is on lowland and at risk of flooding.

The whole sea front is protected by hard defence structures including revetments, sea walls, and groynes to mitigate wave impact. Today, in coherence with the Thames Estuary action plan for 2100, the Southend-on-Sea Borough Council is promoting rebuilding and refurbishment works of the defences as they come to the end of their lifespan. Reinforcing the defence line may affect the link with the sea, whereas the aim is to minimise the visual impact on the historical area as much as possible. On this point, main policy lines have been established (i) "to integrate flood defence into developments – and ensure that the developments are designed with a proper understanding of the flood risk they face" (Thames Estuary 2100, 2012: 72) in the aim that (ii) "improvements to the flood risk management system should provide amenity, recreational, and environmental enhancement, and be designed to minimise any adverse impacts on the frontage" (Thames Estuary 2100, 2012: 214). Yet, responses for local flood risk management are still required to be designed or assessed in detail at the local scale.

In 2020, the Southend-on-Sea Borough Council appointed an engineering local firm for developing a set of nature-based solutions to protect the coast including vertipools, a climate garden, vegetated shingle, gabion baskets, and dune stabilisation. Vertipools are proposed for the old Leigh port and Westcliff Casino sites; installed on existing seawall, they are meant to provide space for the recreation of micro-habitat. A climate resistant garden which includes hard (boardwalks) and soft (pathways) standings and drought tolerant plant species (e.g., Sea Holly, Sea Kale, and Blue Fescue) is proposed for Jocelyn Beach. Like climate gardens, vegetated shingles are meant to dissipate wave energy and are proposed for Thorpe Bay beach. Finally, dune stabilisation and 150 m-long new gabion baskets are proposed for East Beach.

Whereas these interventions are punctual and targeted at specific areas, the TU Delft - Department of Urbanism team has proposed to develop a broader reflection on the long-term strategy of adaptation to rising seas. The TU Delft - Department of Hydraulic Engineering and the UK Maritime Archaeology Trust contributed content-wise.

Gunners Park and the contiguous Garrison development – located in the south-eastern borough of Shoeburyness – are two of the main flood risk areas of the low-lying Southend-on-Sea. For this reason, they are the object of the proposed design.

Four strategies are identified in the aim to meet some major urban challenges: (i) the *topo-strategy*, which focuses on place-specific water management strategies in relation to the inherited urban structure (density and typology) and soil type (e.g., rainwater infiltration in the high ground's permeable soils, seawater retention in the low-lying impervious soils); (ii) the *eco-strategy,* that relies on the existing blue and green networks to reinforce their role of landscape connections and improvement of water and soil quality; (iii) the *accessibility-strategy* that mainly focuses on giving priority to the active mobility (pedestrian and cycle) to provide widespread access to the seafront; and (iv) the *longue-durée-strategy* which places greater emphasis in research, protection, and preservation of the local cultural heritage.

In line with the work for the other project study of Vlissingen (NL), it is proposed to accept water overtopping and build a secondary defense line along the existing margin between the open and built-up areas. In such a way, the area is adapted to function as a retention basin for excess water in the case of extreme events, while the existing and enhanced

drainage network is used to drain the area at the end of the storm. At the basis of this idea is the principle of building a new embankment that can serve both as protection, leisure space, and connection, while the new urban development inside the area is designed to be flood-proofed (e.g., by being raised on piles, or by giving ground floors to functions such as car parks).

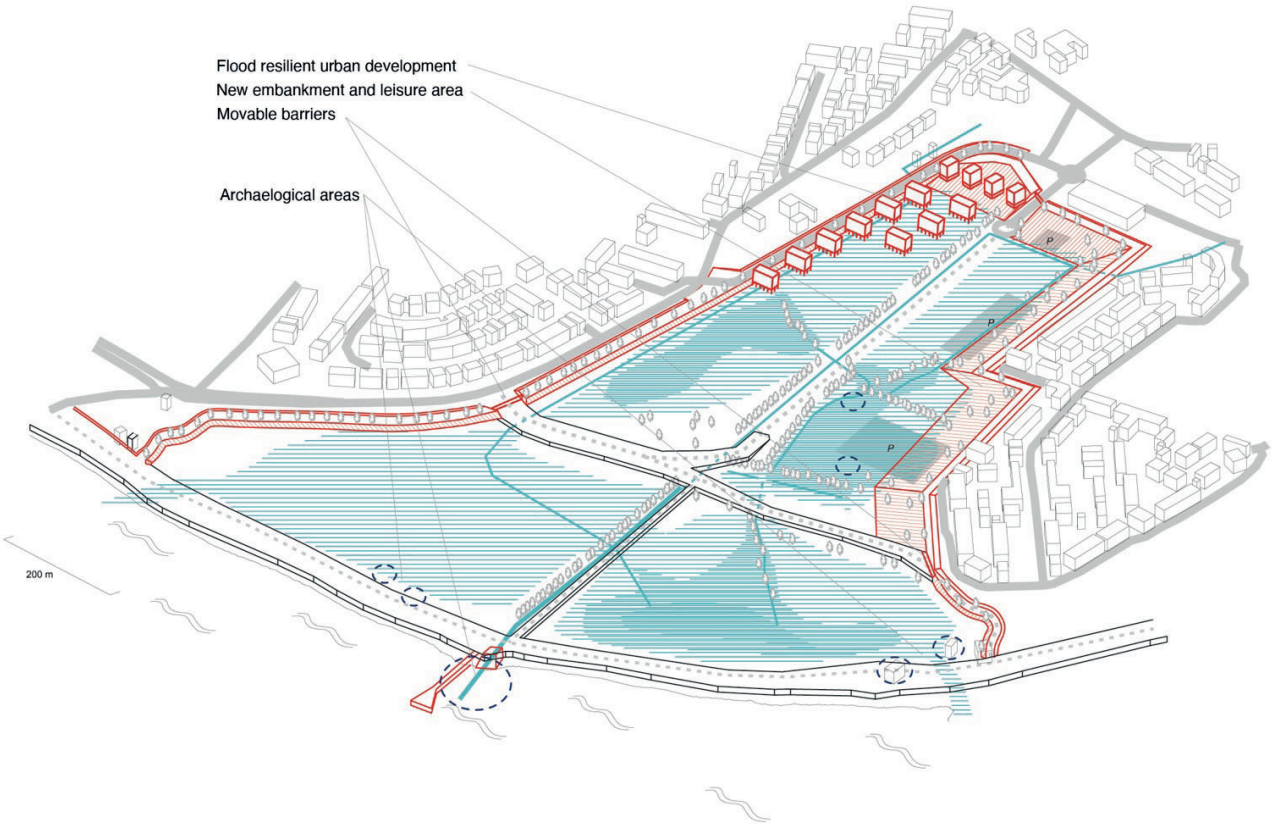

Figure 2. Making space for water. Spatial vision for Southend-on-sea. Drawn by A. Bortolotti and L. Iuorio. The strategy has been developed within the Sarcc project, TU Delft team: F. Hooimeijer, D. Wuthrich, Q. Ke, A. Bortolotti, L. Iuorio.

4. Discussion

Fitting into a 2 km by 2 km frame, we have expanded the analysis and developed a vision for these urban areas with the aim to meet the objective of better integrating flood defence with new developments, as well enhancing public spaces and recreational function. Instead of heightening the existing primary defense line, the resulting spatial scenarios recombine existing landscape features – dykes, embankments, ditches, new buildings and roads – in a way to make the pilots prone to stand a flood event in 2100 by reducing the consequences.

The two new waterfronts have many common aspects; in both cases, the dyke shapes the city as a fundamental part of it but represents only an element of the complex and broader territorial design. In contrast, the storage areas – where water, once overtopped the dyke, can be collected in – are an active part of the urban environment; the seasonal controlled floods change the configuration of the open spaces adapting urban fabric to the storm events. The design and realisation of floodable parks, moreover, give the opportunity to implement new leisure areas, public spaces, and waterproof housing developments. Coastal water infrastructures are not detached from the urban background and they are also the way to support the objective of making more space for water and living more closely with it.

In the last two centuries, dealing with water has meant “protection” (Priest et al., 2016) and so far the study concerning sea level rise has been confined to the point of view of the engineering domains. This attitude neglected the potential role of spatial design

disciplines (architecture, landscape, and urban design) and conceptualised the problem from a single perspective. The two project cases presented in this paper combine hydraulic, historical, and spatial knowledge to support the need for a paradigm shift in the engineering-based probability approach to flood risk management. Designing with water also comes to terms with the spatial form of the cultural landscapes and the technical construction of urbanised areas. Innovation is achieved not only in reducing the probabilities, but also the consequences of flood risk. Working on the consequences of the risk means to involve the spatial dimension of territory as a palimpsest (Corboz, 1985) and rearticulate the relation between hydraulic engineering and urban planning to better design its transformation.

In both cases, the historized urban landscape has played a pivotal role to further design – through an interdisciplinary lens – the water defense system. Indeed, the projects deal with the big physical inheritance of the coastal built environment demonstrating how changes in building and planning infrastructures by specialists may also impact the attitude of perceiving and experiencing cities, landscape, and places by citizens.

The Vlissingen and Southend-on-sea cases show that flood defense infrastructures can be imagined and developed within a spatial approach, that they can be physical manufactures integrated into landscape and they qualitatively affect urban development also the way people interact with water through them.

5. Conclusion

This paper aims to enlighten new possible synergies between scientific domains through the role of integrated design. Many authors have pointed out the potential role of integrated and systemic design to explore and tackle the spatial challenge of climate change in its complexity (Berger, 2009; Belanger, 2016; Corner, 2006 & 2014).

Spatial design integrates social, cultural, economic, and political perspectives with natural site conditions and man-made construction to plan for sustainable urban development. Historically, the role of the designer has been related to the capacity of handling multifaceted and complex problems; today, in the light of the multiple and transcalar issues posed by climate change, there is the need to restore and reclaim this peculiar expertise.

Urban design, water management, and hydraulic engineering are the disciplines which perform as the main drivers to look at the coastal urbanisation in relation to the sea level rise challenges in its multilayered aspects, both technical and conceptual. In the aim to develop an innovative systemic awareness, a shift of the way we do research and projects on water seems to be crucial. Specific attention should be paid to the integrated design process; integrated design is a comprehensive and holistic approach to the design which brings together specialisms usually considered separately. New research may establish experimental methodologies, as well as new conceptual frameworks and innovative design approaches to find a common fertile ground and push forward the research of spatial solutions for climate adaptation.

Contributor statement

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The TU Delft team: F. Hooimeijer, D. Wuthrich, J. Bricker, A. Diaz, Q. Ke, A. Bortolotti, L. Iuorio.

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The Special Economic Zone: The Catalytic Effect of Governmental Support, Technology Innovation, and Spatial Factors in Shenzhen

Danyang Lei [1*] and Jeroen van Ameijde [2]

[1] School of Architecture, The Chinese University of Hong Kong; dannieleihk@gmail.com
[2] School of Architecture, The Chinese University of Hong Kong; jeroen.vanameijde@cuhk.edu.hk, 0000-0002-3635-3305
* Corresponding author.

Research highlights

1) Shenzhen is still characterised by its special zone function and fast development.

2) Shenzhen's pillar industry – the technology industry – has been making breakthroughs while exposing bottlenecks in recent years.

3) While a supportive political environment and timely adjusted master plans have played crucial roles in the constant transition of urban growth, liveability should not be segregated from economic development.

4) The living and working environment qualities and the connection between regions are increasingly important in attracting talents and stimulating technology innovation.

Keywords: Shenzhen Special Economic Zone; urban economic development; urban planning; technology innovation

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1. Introduction

The Shenzhen Special Economic Zone (SSEZ), viewed as China's Silicon Valley, is regarded as a miracle of economic success (Du, 2020). In the 1980s, as part of the policy to reform and internationalise, the SSEZ was established by the central government as one of China's first pilot areas to embrace a market-driven and global economy. Over the past 40 years, the SSEZ has developed rapidly, from a border town to a global hub for technology companies. During its extraordinary growth, Shenzhen's urban form has changed in parallel with the evolution of its political, economic, and social structures.

Shenzhen's rapid growth has been the subject of many studies in the period from 1980–2010. Research on its economy shows that the SSEZ has benefitted from high levels of exchange with its surrounding territory, compared to other international examples of special zones (Farole et al., 2011). Studies on policy highlight how the central government has delegated power to local government, enabling local policies to follow market demand (Jian, 2008).

As Shenzhen's model has now been replicated throughout China and its "special zone" character has become less unique, discussions about the SSEZ have decreased. However, apart from its administrative model, Shenzhen is still characterised by its special functions, enabled by the SSEZ. Shenzhen's pillar technology industry has continued to evolve, making breakthroughs while exposing bottlenecks in recent years. Therefore, studying Shenzhen's current status is still relevant for other cities that aim to replicate their successes. Moreover, most research on the SSEZ focuses on politics, economics, and business administration, while there are limited studies on the role of spatial factors in the growth

of Shenzhen (Ng & Tang, 2004). The rapid development of four successive urban planning strategies suggests that the SSEZ has been strongly supported by spatial planning in its transition towards a global city (Ng, 2011).

This study presented in this paper explores the catalytic relationships amongst governmental support, technology innovation, and spatial factors. The term "governmental support" in this study refers to the policy, planning, and other acts of the local or central government. "Technology innovation" here means the introduction of new technology in manufacturing, information services, and other high-tech related industries. The term "spatial factors" refers to both urban layout on a city or regional scale and the citizen's daily living environment on a neighbourhood scale. The study focuses on the following questions:

1) In different historical stages, did the government lead or follow technology innovation?
2) How has Shenzhen's urban layout and the living environment changed in relation to policy reforms?
3) Which types of spatial environments enhance or hinder technology innovation?

The study concludes with insights about the political and spatial qualities that contribute to the adaptivity of the city, as well as what role the planning department could play in stimulating future technology innovation and liveability.

2. Theories and Methods

Thomas Farole and Gokhan Akinci's book *Special Economic Zones: Progress, Emerging Challenges, and Future Directions* provides a fundamental framework for understanding special economic zone development processes. The book describes how special economic zones usually start by attracting investment and creating jobs, and then "move from static to dynamic gains" (Farole et al., 2011, p. 20). Based on this theory, our study has divided the SSEZ's historical stages according to several milestone events. The authors also argue that special economic zones should consider social and environmental sustainability to achieve long-term development.

To evaluate how spatial factors in Shenzhen's planning have interacted with the government policy and industry, we refer to DeLanda's notions of "planned and the organic processes of urban growth," as well as "energy flow intensification" which causes the transformation in the urban form (DeLanda, 1997, pp. 21, 35). These theories have provided perspectives for data collection (including government reports, research articles, news, and reviews on Shenzhen's policy, technology industry and space) and discussion. To investigate which specific spatial factors could intensify the "energy flows" that facilitate the city's development, we refer to Richard Sennett's "open city" theory, which describes three spatial principles related to an open system: passage territories, incomplete form, and development narratives (Sennett, 2006). These principles have provided a reference for the review of Shenzhen's spatial factors in our study.

3. Results

Summarising the key stages in the historic development of Shenzhen, we have attempted to map the nature of the relationships and catalytic effects between policy, technology and spatial factors for each distinct stage (Figure 1). Some of the key observations derived from this exercise are summarised below.

3.1. Policy and Technology Innovation

The relationships between policy and innovation, described in the upper section of each diagram in Figure 1, show how the Shenzhen government has attracted private enterprises by creating a liberal and supportive regulatory environment. Throughout the different stages, it has aimed to create a symbiotic relationship between the government, technology innovation and economic development. Since 1992, the government also introduced policies to guide private companies, in particular stimulate copyright protection and locally driven innovation, and to prioritise environmental sustainability. A key observation is that private industry has been dependent on government policy support to attract and retain talent to the city.

3.2. Policy and Spatial Factors

The evaluation of relationships between policy and spatial factors (shown on the left side of each diagram in Figure 1), shows that the government's construction of transportation infrastructure and the favourable population influx and trade policies have facilitated the rapid urban growth of Shenzhen. In Shenzhen's short history, four master plans were implemented, achieving a decentralized layout and strong transport connections between the centre and outskirts of the city. Only in the recent stage since 2012, do we see policy and planning strategies aimed at improving liveability and social sustainability, aspects which have received less attention in earlier phases of rapid growth.

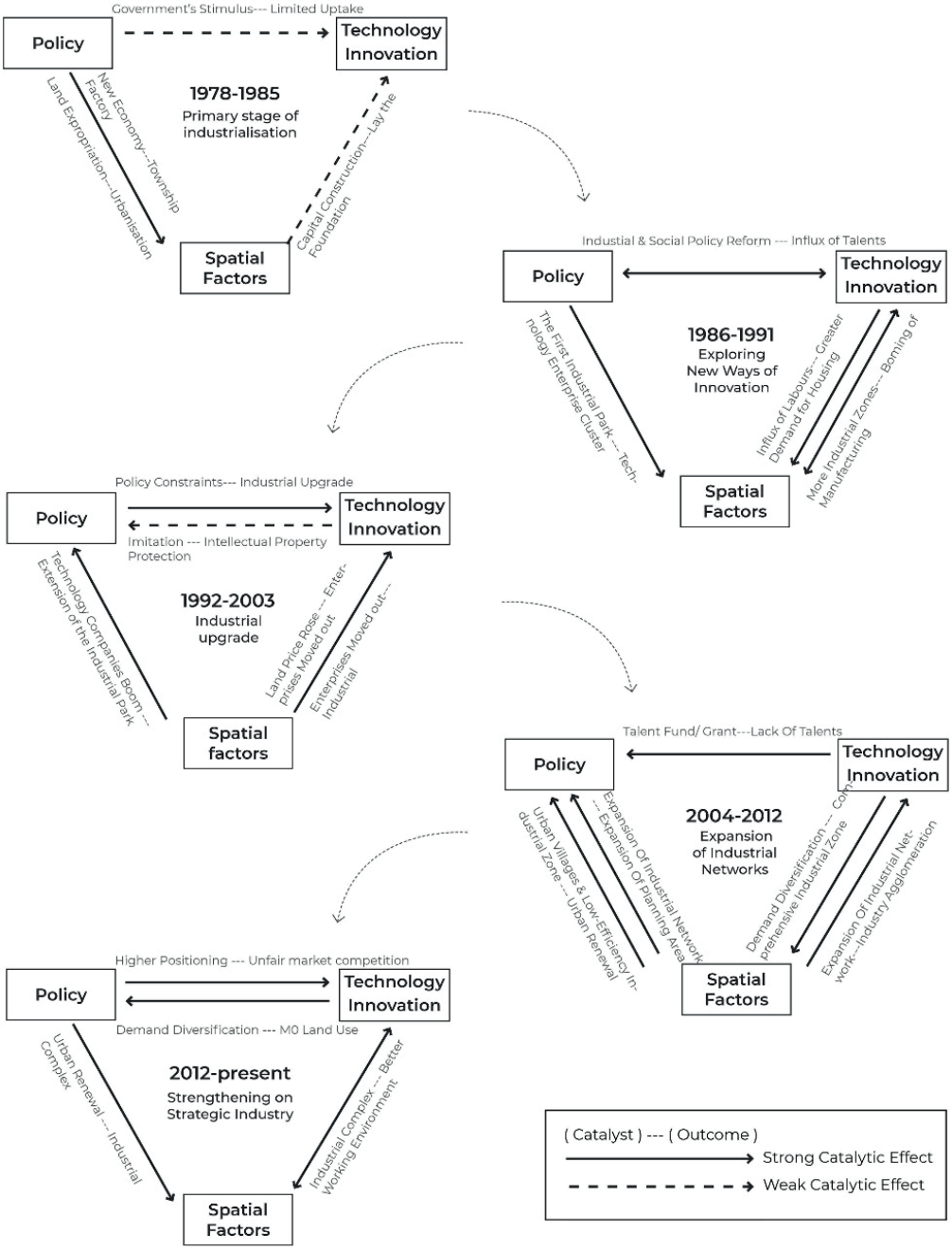

Figure 1. Summary of the relationships among policy, technology innovation and spatial factors in the different periods of Shenzhen's urban development.

3.3. Technology Innovation and Spatial Factors

Our review of the relationships between technology innovation and spatial factors (on the right side of each diagram) shows that the spatial factors that enhance or hinder innovation at different stages of technology development could be different. Specialised industrial parks have been suitable for labour-intensive manufacturing in the early stages. However, as the industry has upgraded towards a knowledge-intensive model, enterprises have started to prefer mix-used complexes that provide flexible R&D space and better spatial quality. As Shenzhen's industrial development has caused an expansion of entrepreneurial hubs towards new urban areas, connectivity between urban districts has been a key factor in supporting continued technology innovation.

4. Discussion and conclusions

4.1. Policy and Technology Innovation

Our review of the relationships between policy and technology innovation has revealed that private industries and market forces have been the driving factor in the rapid growth of Shenzhen's technology industry. Researchers have found that technology innovation in Shenzhen is driven by dynamic small and medium-sized enterprises (SMEs) (Lundberg, 2019). SMEs are more risk-taking and have a more flexible production model than established large enterprises. While the initial growth in Shenzhen's technology sector has been driven by imported technological innovations, the later stages of technology innovation have been led by local SMEs. The continued support of local and independent innovation is of great importance in the context of reduced global collaboration and increasing international competition in the technology sector.

While there may be strong expectations for Shenzhen's continued progress in the high-tech and innovation industries, it is important to acknowledge the time and costs that are required for the incubation of new initiatives in this field. SMEs may face difficulties in getting funding, as they are less attractive to invest in compared to mature enterprises (Wang, 2014). Government programmes may be needed to provide a support system for the incubation of SMEs, and their research and development, which would also counter potential threats to the sector such as monopolisation and the outflow of talents.

4.2. Policy and Spatial Factors

Our review indicates that the timely adjustment of Shenzhen's master plans has provided the necessary support for the rapid transformation of its urban areas and society. According to analysts, Shenzhen's planning strategies have already incorporated considerations around spatial qualities and quality of life, and the planning process is participatory by engaging both experts and ordinary citizens (Ng, 2011). However, achieving liveability is still a challenge for Shenzhen. In the Economist Intelligence Unit's "World's Best Liveable Cities" ranking in 2018, Shenzhen ranks 85th, behind Hong Kong, Taipei, Suzhou, and Beijing (Tang, 2020). Specifically, a shortage of affordable housing has emerged since the great population influx of the 1980s, which is especially challenging for young migrants, who form a critical component in the technology industry. According to a report, about 70% of Shenzhen's floating population live in urban villages, where most people live in small and substandard apartments (Liang, 2020). However, demolition of the urban villages should be avoided, as they form a crucial infrastructure for migrants and low-skilled workers within easy commuting distance to the capital-intensive and resource-rich areas of the city centre. It is suggested that gradual improvements, updates, and rent controls are more sustainable and prevent social segregation.

Our research has also highlighted a very high concentration of industry and population in the southern part of Shenzhen (Nanshan, Futian, Luohu), which indicates an imbalance of land use. According to a study, due to the advantage in location and public services, 80% of the enterprises hope to set their headquarters in the city centre (Wang, 2012), while the northern part of Shenzhen, where many industrial parks and high-tech zones are located, is underused. To achieve a better job-housing balance, the government should guide enterprise's site selection according to the composition characteristics of different industrial networks, creating a balanced distribution of employment locations in relation to affordable housing within short commuting distances.

4.3. Technology Innovation and Spatial Factors

Our finding suggest that Shenzhen's spatial planning framework should be updated in line with the upgrading of its industries. For example, along with the introduction of mixed land-use modes, some specialised industrial zones have transformed into comprehensive areas with complexes that contain flexible spaces for R&D, as well as various commercial and public services. According to Sennett's spatial design principles for 'open systems', fine-grained mixed-use conditions create multiple "passage territories" by mixing different production and consumption activities, as well as a porous border that integrates innovation districts within the city. The principles of "incomplete form" and "development narrative" might be interpreted into strategies for the industrial transformation, adaptive reuse and upgrading of existing complexes, inserting new functions in its buildings and street networks. These types of transformations could strengthen Shenzhen's attractiveness for national and international talent in the technology sector, whose presence would be a key factor in any future successes (Lundberg, 2019).

Studies have shown how in the early stages of Shenzhen's industrialisation, the factors involved in setting up local production processes (labour, land, materials, etc.) were cheap and widely distributed, and therefore have led to the rapid growth and development of the city. However, in the middle and later stages of industrialisation, the nature of production processes has evolved to high-end technology. The workforce associated with this is much more selective about choosing where to gather and live (Ye & Tang, 2011), as the qualities of the urban environment are known to impact quality of life, well-being and the fulfilment of individual and community aspirations (De Haan et al., 2014). This makes clear that better living and working environments for high-tech industry professionals could support innovation.

Our findings also reveal the trends for further expansion of industrial networks around Shenzhen, especially considering the establishment of the Greater Bay Area. Shenzhen's industrial upgrade has already resulted in the migration of low-tech manufacturing to other areas in the region. Scholars have argued that when all elements of a production process are connected within one-hour travel distances, an integrated industrial network can still function efficiently (Teng, 2021). This brings us to conclude that the notion of the Special Economic Zone could retain its relevance for Shenzhen, despite drastic changes in its modes of production, if it is reconsidered towards the integrated, polycentric meshwork urban region of the Greater Bay Area. Key priorities for future development would be to improve the spatial qualities of living and working environments, to attract and retain talent. As multiple urban nodes within a larger urban region will collaborate to provide different employment opportunities, living qualities, and lifestyle choices, the connectivity within the region should be further enhanced through transport and social infrastructure provision.

This study has revealed several insights around the catalytic effects between Shenzhen's policy, technology innovation and spatial factors, in the context of its status as a Special Economic Zone. As part of the links between policy and technology innovation, we have shown how a supportive political environment plays a crucial role in encouraging technology innovation and industry upgrading. Around policy and space, we have discussed how the timely adjustment of master plans enable strategic transitions within the guidance of urban growth, in which liveability should not be segregated from the urban development. In relation to technology and space, we conclude that the urban environmental qualities for living and working, as well as the connection between urban areas, are increasingly important in stimulating sustainable forms of technology development.

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The Tension between Object and Process: Three Spatial Planning Meta-Theories

Andreas Faludi [1,*]

[1] Professor emeritus and Guest researcher, Delft University of Technology

Research highlights

For an analytical and designerly approach, read spatial planning.

Spatial planning invokes, not one but three irreconcilable meta-theories making it complex, particularly so in urban areas.

Each meta-theory makes assumptions as to its object – be it a territory, a place, or a functional area – and how to handle it: by applying statutory powers, through tailor-made initiatives or by invoking relevant requirements.

Meta-theories of spatial planning are not reducible to one overall theory.

Which is why an integrated approach always and necessarily remains a distant ideal.

Keywords: Place-based Planning; Functional planning; Neo-medievalism

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1. Introduction

For what the Call for Papers calls the '. . . analytical and designerly approach to urban form . . .' I say spatial planning and identify three underlying 'meta-theories.' Each makes its own assumptions as to the object of spatial planning and how to handle it.

(1) If that object is an administrative territory, then spatial planning is, strictly within its borders, about invoking whatever statutory powers are available.
(2) If it is a place identified as such by concerned actors, then planning is tailor-made to suit their aspirations.
(3) If it is about a functional area, then planning follows relevant requirements.

Each invokes its own meta-theory and adds to the complexity referred to by the Call for Papers as a characteristic of – but not exclusive to – urban planning. After all, each makes its own assumptions as to its object and how to deal with it. This is like what Thomas Kuhn (1960) says about scientific paradigms defining research issues and their resolutions in sometimes incompatible ways.

First, I discuss the above, also recalling my critique of the first meta-theory for the 'territorialism' leading to it, wrongly as it happens, and claiming supremacy. Then, I refer to Delft showing the three forms of spatial planning operating side-by-side, thereby demonstrating the '. . . complexity in the tension between object and process . . .' referred to in the Call for Papers. Lastly, I invoke my own research on European spatial planning to show it to be similarly – and irreducibly – complex.

2. Meta-spatial planning theories

The Call for Papers claims that cities are in permanent transition. This is said to add to the complexity of an urban morphology witnessing overlapping and competing interests. The first to experience difficulties are city authorities: their borders define their reach and depend on voter consent. With its apparatus, each city forms a 'territorial-

administrative complex' (Faludi (2016). The complex is wedded to the first conventional spatial planning meta-theory. The assumption is that as territorial authorities, cities exercise overall responsibility over, and possess the requisite powers subject only to those of higher authorities for dealing with their territories for the best of their citizens.

Under this meta-theory, the local production of space is thus thought to be a privilege – and a responsibility – of the 'local state.' But, note that like with the 'military-administrative complex' which in Faludi (2016) I invoke by way of comparison, the relevant administrations mix genuine concerns with a wish to hold on to, and if possible extend their powers. They assume that – much as their own – the interests of voters, too, are circumscribed by the borders that bind them together. In Faludi (2020), I argue that external effects are considered only insofar as they concern voters.

But this is an overtly simplistic view of the concerns and aspirations of voters. They are not only citizens of their local state. Some of their concerns are more immediate or, indeed, wider. They may concern a local landmark, a hang out, a regional park, an outside source of employment or of pollution, a national park, or a world heritage site. So, they may be prepared to take relevant initiatives. For the relevant areas, Healey (2010) has coined the term 'places.' Being *ad hoc* and depending on circumstances, places are the objects of spontaneously formed coalitions. See here the second meta-theory.

There are no claims made to sovereignty. The groups simply wish that someone takes care of their concerns. They may be willing to take some relevant actions and/or to enjoin others to do their bidding. Compared to local administrations, the collectives of concerned actors are fluid, depending on the campaigns for establishing and enhancing places as the objects of attention and action. Such places are not normally owned by any one authority either. And even if they were, the role of the authority is more that of a custodian than of a landlord disposing over his or her property. In Faludi (2015), I describe places as 'no-man's lands.'

One more alternative to administrative territories being the objects of concern are functional areas. Unlike places, they are not *ad hoc* formations, but reflect permanent needs like the provision of schools, water supplies, transport, and so forth, each with a public or private providers. Frey and Eichenberger (1999) have coined the term 'Functional Overlapping Competing Jurisdictions' (FOCJ): functional because they claim no general, but only a specific responsibility; overlapping because their areas of concern may crisscross administrative boundaries; competing because there can be alternative providers; jurisdictions because they exercise, albeit limited powers over their clients (who according to these authors could – indeed should, but this is a different matter – share in their administration). See here the third meta-theory as identified.

The two alternatives to the conventional spatial planning meta-theory which in Faludi (2018) I have described – and criticized – as 'territorialism' thus identify, either fleeting places as the objects, and *ad hoc* coalitions as the subjects, or functional areas as the objects, and the providers of services as the subjects of planning. Dealing with urban morphology, planners thus deal, not only with fixed territories but also *ad hoc* places and functional areas. They must do so in various combinations and sometimes all at once and without any presumption of one of the spatial planning meta-theories taking precedence over the others.

In terms of the Call for Papers, there is more than one way, therefore, of dealing with the tension between object and process. The ensuing complexity of having to deal with three types of spatial configurations and three meta-planning theories needs to be acknowledged. Well-ordered, 'Euclidean' (Davoudi, Strange 2009) planning already being recognised as illusionary gives credence to the claim that the future will be unlike the neat order which planners love and which territorialism conjures up. Nonetheless, terrorism is derived from the idea – itself a fiction – of an international order of sovereign states. It applies this order down to the level of cities and towns. Commonly associated with the Peace of Westphalia, this order is being replaced, however, by one more like in the Middle-Ages with their complex territorial arrangements. Complex, 'neo-medieval' planning is a better paradigm for dealing with urban form than is the assumption of relevant territorial authority exercising responsibility.

3. Case study Delft

Here I illustrate the three spatial planning meta-theories at work in my home town, Delft, based on the observations of a resident of close to 50 years.

Identifying myself as such, what do I mean in terms of the three meta-spatial planning theories? Firstly, that I am registered as a citizen with an abode in Delft appearing as such in the population register. So, the administration provides me with my

passport, driver's license, and other documentation. Also, it invites me to vote in European, national, provincial, and of course local elections. In addition, I of course pay my local taxes and can approach the municipal authorities on various other matters. I can for instance comment on plans and regulations and apply for, or objecting to permits relating to the built and natural environment under the statutes and building codes. By voting, petitioning and/or campaigning, albeit indirectly, I can influence the making and administration of a veritable plethora of measures. Hopefully, they make the 'territorial-administrative complex' – Delft politicians and their administrators – responsive to my needs, in exchange for which I may give them my vote.

But none of this applies to citizens of neighbouring, let alone far-away municipalities. My representatives and I are bound to and bonded by the territorial borders of Delft. But, honestly, I do not care quite as much for what happens in areas beyond the historic centre, surrounded as it is by a major canal, remnants of the ancient city's walls, some city gates preserved, if sometimes only by the names of streets. This old town is my habitat, the rest being merely a supply base, one that may, or may not end at the boundaries of Delft.

Even within the historic centre, because of its shape my interest is more in the northern part. So, I am a member – not an active one, I admit – of a citizen group called 'Binnenstad Noord' (Town Centre North) monitoring developments where local interest are at stake and raising issues with the city authorities. A recent issue concerns, for instance, the conversion of a water tower, being a landmark, into a restaurant. Owing to its location near a tram stop in a small park where in days gone by the steam tram from The Hague arrived, this is a prominent landmark. There is a small café in the park frequented itself by locals, the place being somewhat notorious because of a deadly shooting there not long ago.

Why and how the conversion of the water tower with buildings attached has come to the attention of my semi-institutionalised citizen group I do not know. It may have been the watchful eyes of members noting that the existing statutory plan seems not to foresee the water tower becoming a restaurant. Anyhow, even if this has not yet become an issue, it has the making of one. Many like this at Delft and other historic cities have the habit of becoming one that could lead to an action group for maintaining the place in its present form, or at least for modifying the proposal to become more respectful of the plan. In other words: an example the more of, in a manner of speaking self-defined places – or perhaps one had better say: places defined by the perception of affected and/or concerned people – becoming the object of an *ad hoc* form of spatial planning.

Lastly, the tram stop itself is part of a large network. It is served by a couple of tramlines and a bus, all linking Delft to The Hague. After their pleasant entry, they go on to Delft Central and in one case beyond to huge new housing and commercial developments at the other end of town. It is clear that the planning of these functional areas answers concerns that include, but also extend beyond the areas it serves in Delft. Their planning and management also connect more institutions than those responsible for the territorial development of Delft, including the bus company, Dutch Railways (now going underground), with Delft Central a prominent new station around which there is a cluster of modern development with repercussions for the whole city and beyond. This latter development has been negotiated and re-negotiated over the best part of 20 years, with not only territorial, but also functional authorities playing their part. So, this has not been within the purview of Delft, but Delft has suffered, also financially, from some of the setbacks the development has experienced. But now the city seems to be set to profit from what is becoming a success story, with functional authorities playing a prominent role and Delft deriving some of the benefits.

See here the three regimes, each representing a meta-theory of spatial planning. They cannot be reduced to one. Between them, they shape my hometown in sometimes unpredictable, perhaps even contradictory ways. Thus, the administration is doing land-use planning invoking fixed rules, but of course with an eye also on the property market and public finances. Action groups occasionally raise issues that concern them and service providers answering to functional imperatives, and in so doing crisscrossing territorial boundaries. Between them, their actions make for the complexity of urban areas and of the spatial planning referred to above.

4. Conclusions

The complex arrangement above is unlike the picture conjured up by the idea of Delft, or indeed any other such entity being self-referential. However, this is the idea behind the division of land and people into supposedly self-contained communities subject only to national law. The suggestion has its roots in the Peace of Westphalia, which is where and

when states were defined as sovereign. The idea has taken root over the centuries, trickling down to where they exist, regions and, pretty universally, local communities.

The idea of sovereign states with clearly marked territories thus comes from international relations theory. Without going into detail, this is evident in the European Union (EU). Which is why there seems to exist only two ways of imagining what it is: either a federal union, and thus with qualities of a state, or a construct which is ultimately at the mercy of its members. European spatial planning, such as it is, shows this clearly (Faludi 2021a). It has been – in fact is being – wrongly understood as the making of an EU masterplan. But, Zielonka (2014) amongst others has offered an alternative perspective: an EU like in the Middle Ages, with multiple, overlapping, and loose forms of interaction. In terms of planning, the picture that I have conjured up using Delft by way of illustration is reminiscent of this neo-medievalism. Which is not meant to be an argument against integration, spatial or otherwise. It is merely to point out that such integration is, and will remain what in Faludi (2021b) I describe as a complex matter.

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Field-Urbanism: Reconstructing Agency of Architecture in Milan's *Coree*

Elettra Carnelli [1]

1 Research and Teaching Associate, Technical University of Munich, Germany; elettra.carnelli@tum.de; https://orcid.org/0000-0002-0259-580

Research highlights

- The majority of buildings are not designed by architects, but are the result of processes and decisions that involve multiple actors (construction regulations, technical and industrial innovations, social norms, and practices).
- Does that mean that building practices without architects are more successful in satisfying the needs of users? What are the reasons for their success? Could architects learn from these alternative approaches to building design?
- This paper addresses these questions by examining the case study of *coree*, self-constructed settlements built on the outskirts of Milan between the 1950s and 1960s, focusing on the *corea* of Cerchiarello in Pero.
- By analysing the formal and spatial features of Cerchiarello, contextualised in the historical, economic, and social frameworks that generated it, the qualities of *coree* building practices will be examined. Accordingly, the working methods and the protagonists behind the genesis, consolidation, and evolution of the *corea* of Cerchiarello will be reconstructed and examined.
- The hypothesis of this study is that architectural research and practice should consider non-authorial and co-produced architecture as relevant as "high" architecture because it has its own methods and characteristics, whereby it can adapt to the changing needs of its inhabitants and thus reinvent itself. Therefore, the investigation of the methods and processes of *coree* should increase understanding of post-World War II Milanese architecture, and contribute to the development of practices aimed at making the urban fabric adaptable.

Keywords: field-urbanism, everyday architecture, *coree*, post-World War II Italy, Milan

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1. Introduction

Cities are complex structures undergoing constant change, where different actors and users engage in shaping the environment according to their needs and desires. In this process, architects are not always involved, especially in everyday architecture: "Most architecture . . . is by non-architects, or at least the result of larger processes that are, artistically speaking, unselfconscious: building regulations, governmental acts, the vernacular, planning laws, mass housing, the mallification of the suburbs, and inventions in the technical/industrial sphere" (Jencks, 2000, n.p.). In this respect, one might ask why the work of an architect represents a small portion of the building activity: are non-authorial and co-produced building practices more adept at satisfying the needs and desires of users? What are the reasons for their success? Can such practices contribute to the debate on the resilience and adaptivity of the urban fabric?

This paper addresses these questions by examining the case-study of *coree*,[1] self-constructed settlements that proliferated on the outskirts of Milan throughout the 1950s and

[1] These settlements were known as *coree* because of their similarity to images appearing from the Korean War in the media in that period.

early 1960s. Despite their bad reputation at the time, *coree* provided quality housing for migrants from different parts of Italy, and represented a family-based and collective response to the problems caused by immigration and rapid urbanisation in Milan during the post-War World II period, often helping integration. *Coree* self-constructors were often the elite within the immigrant world, and able to invest money and resources in construction, for whom *ad hoc* networks and processes formed. Indeed, realising *coree* involved many actors and much expertise, including surveyors, entrepreneurs, and technicians (Foot, 2004). *Coree* settlements consist mainly of single-family houses, whose design contains typical features of the dwellers' region of origin, such as flat roofs (South of Italy) or pitched roofs (Veneto region), carefully differentiated to provide privacy and identity (Diena, 1963). Furthermore, the original buildings were continually modified and extended, to meet the needs of the occupants or to accommodate tenants. Additional stories and annexes were therefore part of the *coree* morphology, a permanent *non-finito* state resulting from an additive and contextual design method.

As a social and historical phenomenon, *coree* were investigated in two main moments in the 1970s and 1980s.[2] However, this unique and dynamic housing system has not yet been fully studied with regard to its crucial architectural and urban features: *coree* have been considered architectural by-products of post-World War II Milan, built and designed according to conceptions different from those valued and practiced in the "high" and authorial architecture of the time.

This paper examines the formal and spatial features of the *corea* of Cerchiarello[3] in the historical, economic, and social frameworks that generated it. This investigation focuses on Cerchiarello's urban structure, its construction process, and those involved. Thus, the crucial features and qualities of non-authorial and co-produced building processes are examined as a basis for a broader discussion of contemporary design practices. I hypothesize that architectural research and practice should examine non-authorial and co-produced architecture, as in the example of *coree*, as "high" architecture: thanks to additive design methods, pragmatic approaches, stylistic syncretism, and shared authorship, *coree*'s architecture is able to adapt to the changing needs of users and thus to reinvent itself. In this sense, it can be considered as a modern form of vernacular, where traditional elements were adopted and re-interpreted by a network of professional builders, surveyors, technicians, and users. On an urban level, *coree* settlements can be seen from the perspective of the "field" as "coherent and enduring physical entities because they are inhabited, subject to, and continuously reshaped by the undending actions and interventions of the people who live within the material fabric" (Habraken, 2005, p. 31). So, examining the methods and processes of *coree* should help to understand post-World War II Milanese society better, and shed light on adaptive co-produced design approaches.

2. Theories and Methods

Examining the methods and processes of *coree* means focusing on how they were designed and constructed, i.e. on the mode underlying these architectural practices. The notion of mode, from modus operandi, is still marginal in architectural-historical approaches, even if it is crucial for a deeper understanding of the built environment (Boucsein, 2021). According to Yaneva, "if we consider architecture as a mode of activity, we cannot divide and subdivide its objects in styles, design principles, and architectural languages. We can only follow the differentiation of the activity into different modes as it impinges on different materials and employs different media." (Yaneva, 2012, p. 108) From an analysis of *coree,* many external conditions that influenced their construction can be identified: economy (industrialisation, land ownership), society (networks, immigration), legislation (building regulations), and technology (infrastructure, building technology). These conditions show that, as Till argues, "architecture is [...] shaped more by external conditions than by the internal processes of the architect." (Till, 2009, p. 1)

The architect's reactions to these external conditions correspond to precise modes: the authors of "high" architecture often see external influences as obstacles to be overcome through the power of design; therefore, they strive to react to them with appropriate design methods (Banham, 1996). In contrast, those involved in non-authorial architecture, and in *coree* in particular, work with external conditions, translating them directly into

[2] The first documents, including the works by of F. Alasia, D. Montaldi, L. Diena, and the research promoted by the Istituto Lombardo di Scienze Economiche e Sociali (ILSES), were produced during the 1970s and are distinguished by a clear political position, according to which the data and phenomena described are interpreted. During the 1980s, there was an attempt to draw up a historiography of the *coree*, which culminated in the work of John Foot, who described the phenomenon starting from the case study of the municipality of Pero.

[3] Cerchiarello is a district of Pero, north-east of Milan, where the population grew dramatically, from 2,000 inhabitants in the 1950s to 10,000 by the early 1970s due to large scale industrialisation and the resulting migration (Foot, 2004).

architecture since they do not have the resources and the ambition to oppose these conditions. Through the perspective of mode, *coree* can be best understood and analysed as the product of specific post-war conditions reflected in built form, and as the result of the needs and desires of a precise group of users, for whom *ad hoc* networks and processes formed. In this sense, *coree* can be considered as a modern form of vernacular since migrants from all over Italy were constructing and employing their (building) traditions in a new context. When reading the characteristics of vernacular architecture according to A. Rapaport, similarities with the *coree*'s mode of designing and building can be recognized: "lack of theoretical or aesthetic pretensions; working with the site and micro-climate; respect for other people and their houses and hence for the total environment . . .; and working within an idiom with variations within a given order. . . Another characteristic of vernacular is its additive quality, its unspecialized, open-ended nature, so different from the closed, final form typical of most high-style design." (Rapaport, 1969, pp. 5–6).

A combination of historical, architectural, and sociological approaches was chosen to identify the *coree*'s mode and to reconstruct their genesis. These approaches were implemented in two moments: firstly, the genesis of the *corea* of Cerchiarello was reconstructed through a formal-spatial analysis from archival files such as plans, official documents, and correspondence between surveyors, builders, authorities, and owners. The design processes and decisions were examined through the archival material and by comparing building files on selected houses in the same neighbourhood. Parallel to this formal-spatial analysis, qualitative research based on historical data (primary and secondary sources such as archive material, interviews, published work) was conducted, in order to identify the actors involved and the conditions incorporating the corresponding social and spatial changes. The methodological framework of Situational Analysis (Clarke, 2005) assisted in understanding the context and mapping the actors and conditions of the genesis of *coree*, together with the resulting networks (Zwangsleitner, 2017). In this way, situational maps supported the formal-spatial analysis, shedding light on the genesis, consolidation, and evolution of the *corea* of Cerchiarello (Fig.1).

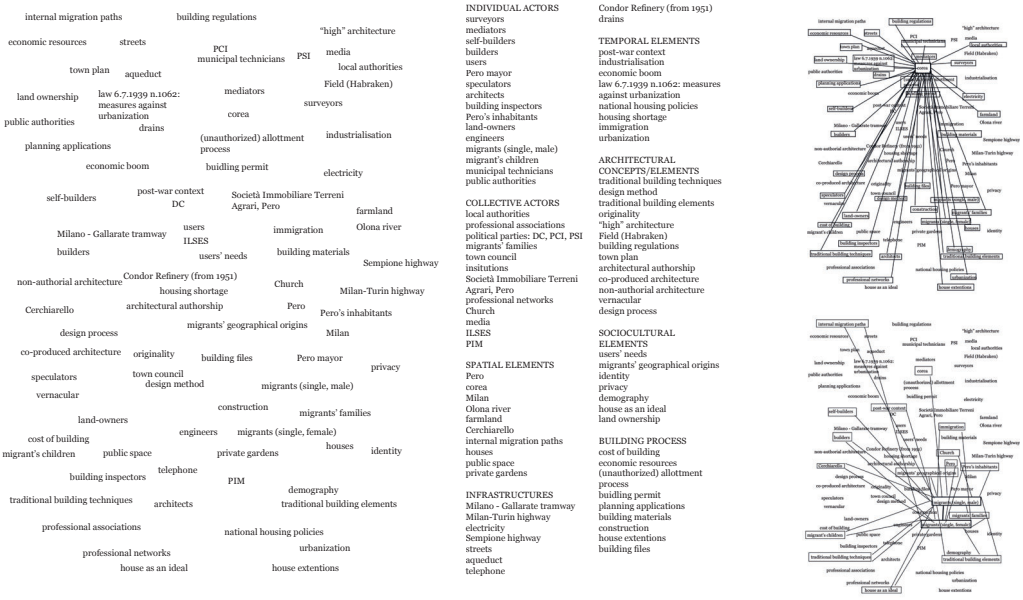

Fig.1 Examples of the maps used for the analysis of Cerchiarello's *corea*. Situational Analysis (Clarke, 2005) entails the creation of maps and analysis that, when applied to architectural research, can facilitate the identification of interdependencies or relations that might otherwise remain hidden or overshadowed by more obvious and representative argumentation strands (Zwangsleitner, 2017).
Left: Unordered Situational Map, depicting the elements and actors involved in a certain situation, in this case the formation of the *corea* of Cerchiarello.
Middle: Ordered Situational Map.
Right: Relational Analysis using Situational Maps. Focus on *coree*'s construction and single migrants.
For privacy reasons, the names of the involved actors have been removed.

3. Results

This section presents a first reconstruction of the design process and the networks involved in the building of Cerchiarello's *corea* from 1951 to 1959. The analysis was developed by studying archival material in the municipal archive of Pero. The files consist mainly of planning applications, which include building permits, certificates of occupancy, drawings, and correspondence between owners, technicians, and the municipality. Situational maps were employed to identify the relations between the actors involved. Simultaneously, a formal-spatial analysis on the plans of selected houses was conducted to reconstruct the building and design processes.

The archival material reveals valuable information about the origin of the *corea* of Cerchiarello and its corresponding design and construction mode. Note that the existence of such material demonstrates that the *corea* of Cerchiarello was not illegal – even though Pero did not have a proper town plan until 1961 (Centro Studi PIM, 1963), planning applications were required to build. These applications were submitted by owners to the municipality, sometimes with the technical support of surveyors. However, even during construction, changes to the approved project were made. Evidence was found in the reports of municipal technicians, who often stepped in indicating necessary adjustments, such as the alignment with existing buildings or the position of the bathrooms, stairways, and windows. Building files reveal that owners, self-builders, surveyors, municipal technicians, and local authorities were key figures in the *corea* construction network. With regard to the surveyors, the same names recur in the building files: some of them appeared to have worked exclusively on *coree*, guiding owners, and self-builders through design and construction, as Foot also observed (2002, 2004).

Based on the municipal annual lists of new buildings, the first *corea*-houses in Cerchiarello date back to 1951. At the time, the process of allotting previous farmland had already started: the plots were sold to migrants, who sometimes further subdivided them. "Visually, we can imagine this early *corea* as a real village, isolated in the countryside . . ." (Foot, 2004, 56). Basic infrastructure and services, such as roads, electricity, and drains, were lacking (Foot, 2002) (see Fig.2). The 1:100 plans included in planning applications depict simple layouts of 2–3 room one-story houses, which provided space for one or two households (Fig.4). Two-story buildings were less frequent and were often the result of later extensions (Fig.3). Examples of this continuous construction can be found in the municipal archives: from 1954 on, many building permits were submitted for additional stories and extensions (Fig.4). The authors of these changes were surveyors or the users themselves, who modified the original design following a contextual approach, "most of the authors of this architecture [...] viewed their work as pragmatic and provisional responses to a state of emergency after the war, and [...] usually did not attach importance to notions of authorship." (Boucsein 2021, p. 170)

Reading through building files, a pragmatic and additive approach to construction and design emerges. The morphology of Cerchiarello was influenced by this co-produced and non-authorial mode: the result is a variegated urban landscape, structured by small houses progressively extended with new and improved features (Fig.5). Therefore, the originality of Cerchiarello, and generally of *coree*, lies in their origins, as low-rise, urban village-shaped settlements, progressively evolving according to the needs of the inhabitants.

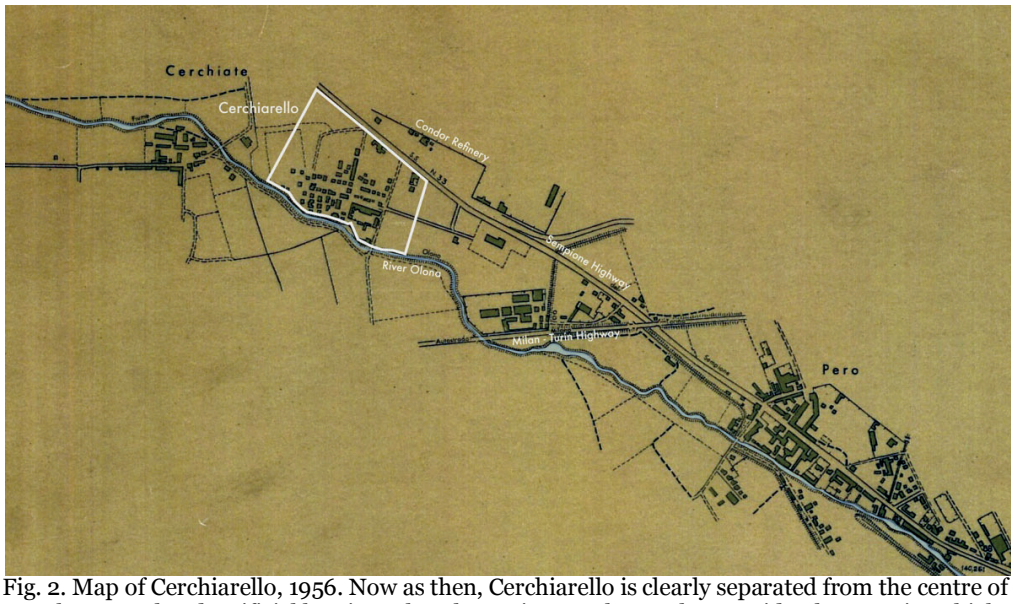

Fig. 2. Map of Cerchiarello, 1956. Now as then, Cerchiarello is clearly separated from the centre of Pero by natural and artificial barriers: the Olona River on the south-west side, the Sempione highway and the Condor refinery on the north-east side, and the Milan-Turin highway south. The map shows the urban structure of Cerchiarello's *corea*, comprised of almost only single-family houses, with the exception of an older farmstead, arranged according to a compact and grid-like scheme. Cerchiarello was built on farmland that was subdivided and sold in the early 1950s. As in most other *coree*, the houses were built in open countryside, without proper roads or infrastructure.
Courtesy of GeoPortale – Comune di Milano

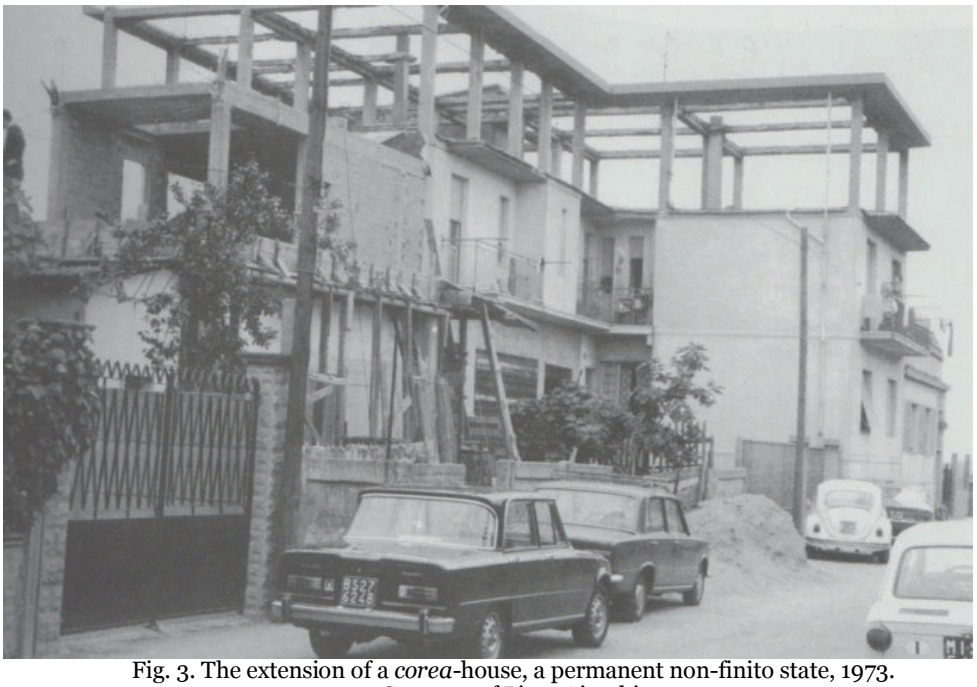
Fig. 3. The extension of a *corea*-house, a permanent non-finito state, 1973.
Courtesy of Piero Airaghi.

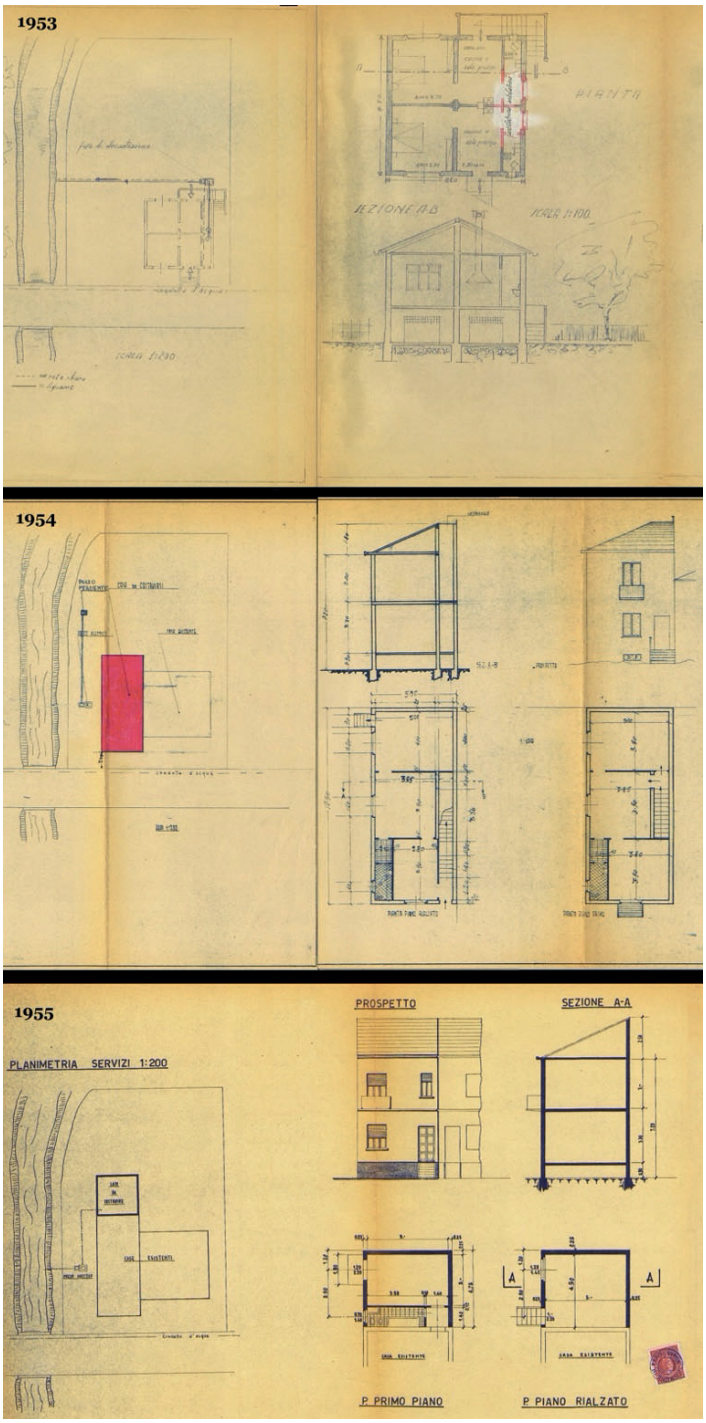

Fig. 4. The evolution of a house in Cerchiarello as an example of the design process in *corea*.
Top: The 1953 plans depict a simple layout of two apartments with two rooms each, providing space for two households. In the process of approval, municipal technicians often stepped in, indicating necessary adjustments. In this case, we can see that the configuration of the bathroom was changed at a later date (red marked walls).
Middle: In 1954, the building application for a first extension was submitted. The file is in the name of the same owner and his brother, who most likely moved to Cerchiarello looking for better opportunities, following a common pattern. This project has been signed by a surveyor, but often the changes were carried out by the users themselves.
Bottom: In 1955, the files for another extension were submitted. A new volume is designed on the back of the first extension, providing storage space on the ground floor and an additional room with a bathroom on the first floor, connected to the existing building.
Courtesy of Archivio Storico del Comune di Pero (archivio aggregato ex Comune di Cerchiate, files 8/1953, 39/1954, 2/1955)

Fig. 5. The two houses from Fig. 3 today. Author photo.

4. Discussion and conclusions

After this initial analysis, *coree* emerge as complex and multifaceted urban structures, continually modified by different actors and processes. As argued by Latour and Yaneva, "architectural design embraces a complex conglomerate of many surprising agencies that are rarely taken into account by architectural theory" (Latour and Yaneva, 2008, p. 86) and practice. Indeed, *coree* were built under the extreme pressure of external circumstances (housing shortages, large scale immigration, loose construction regulations, among others), and their authors deliberately and consciously worked with the external conditions they encountered, translating them directly into architecture. In this light, *coree* can be understood as a modern form of vernacular through their mode, i.e. as the product of users' expectations, of their expertise, and more generally of the unique conditions of post-World War II Milan, which were reflected in the built environment. The *coree*'s methods (additive, pragmatic, and non-authorial) were fundamentally different from those of "high" architecture: it was possible to continually modify these buildings even after "completion," making the notion of authorship or originality secondary, as in vernacular architecture. Consequently, *coree* were adept in satisfying the evolving needs and desires of the users, creating unique "fields" of village-like neighbourhoods, homogenous yet differentiated (Foot, 2004).

This study identifies the qualities and highlights of non-authorial and co-produced architecture, using the example of *coree*. The investigation of their modes and characteristics can contribute to the development of practices aimed at making the urban fabric adaptable. Therefore, *coree* are worth further study, especially focusing on the influence of external factors, such traditions, building cultures, and the geographical origin of migrants, on design and construction, while extending the analysis temporally, from the 1960s to the present. In this way, the results of this research could provide a productive basis for discussions of contemporary architectural and urban practice and inspire greater appreciation of non-authorial architecture's adaptive design methods.

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Supervision: Dr. Benedikt Boucsein
Resources: Patrizia Angelone, Piero Airaghi
Writing – Review & Editing: Stephen Starck

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Standing the Test of Time: Urban Heritage for Resilient Communities

Ann Sandra Godly [1] and Eingeel Jafar Khan [2]

[1] University of Waterloo, Canada; annsandragodly@gmail.com
[2] National University of Singapore, Singapore; eingeelkhan@u.nus.edu;

Research highlights

1) Does the conservation of urban heritage encourage resilient communities?

2) A critical analysis into the pros and cons of popular conservation strategies as implemented in two globally removed cases

Keywords: urban resilience, heritage conservation and planning, dynamic communities, cultural landscapes, public space

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1. Introduction

Renowned planner Geddes (1916) championed placing local communities and their intangible place attachments at the heart of urban heritage conservation and planning in a landscape-based approach. Meanwhile, Daher (1996) understood heritage conservation as a "complex activity aimed at revitalisation, reuse, and reinsertion in the society of national and local identity with a sense of belonging to a shared place." As cultural tourism, it brings revenue, civic pride, and fosters better understanding of cultures (Assi, 2000).

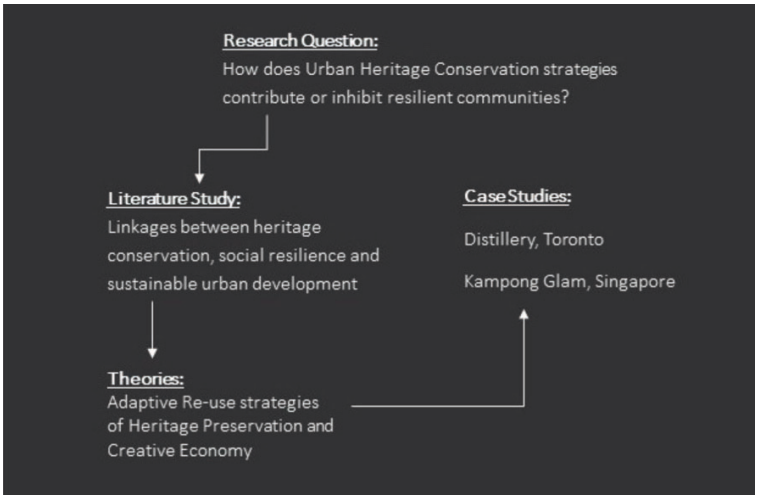
Thus, place, heritage, and identity are closely interconnected in the urban context with the representation of heritage having social implications for individual and ethno-collective identity (Moore 2007, Shaw 2007, Waitt 2000). While conserving the interdependent tangible and intangible heritage is ideal (Powell, 1987), rather than enforcing the outmoded lifestyles of the past, it is necessary to instill new life to old districts and facilitate the adoption of new activities relevant to the globalising world. Unfortunately, on the flip side, such intervention often alienates local communities with a deep connection to the past (Kong and Yeoh, 1994).

Can urban heritage enrich the lives of communities in the throes of rapid urbanisation, growth, and unprecedented stress? Can they be transformed from derelict structures to spaces of meaningful social engagement? These are questions heritage conservationists have been trying to answer for decades. In response, they have come up with some ingenious ways to bring new relevance to these relics, but the long-term ripple effects of their implementation towards the people they serve is a subject that begs greater research.

This paper investigates the efficacy of two popular, globally recognised conservation strategies by comparing intent with outcome. In particular, it explores the effect they have had towards creating sustainable, resilient communities.

2. Theories and Methods

A systematic literature review and case study methodology was adopted to identify and synthesize the relevant research linking urban heritage with social resilience. Based on the methodology advocated by Flyybjerg (2006), who believed in using examples in the social sciences to help understand realities and devise explanatory theories, the paper analyses two case studies. Further employing his classification of cases, both the Distillery and Kampong Glam might be deemed 'critical' for their capacity to generate generally applicable principles, but are also 'deviant' in the light of particularities likely to produce rich knowledge (Henderson, 2015).



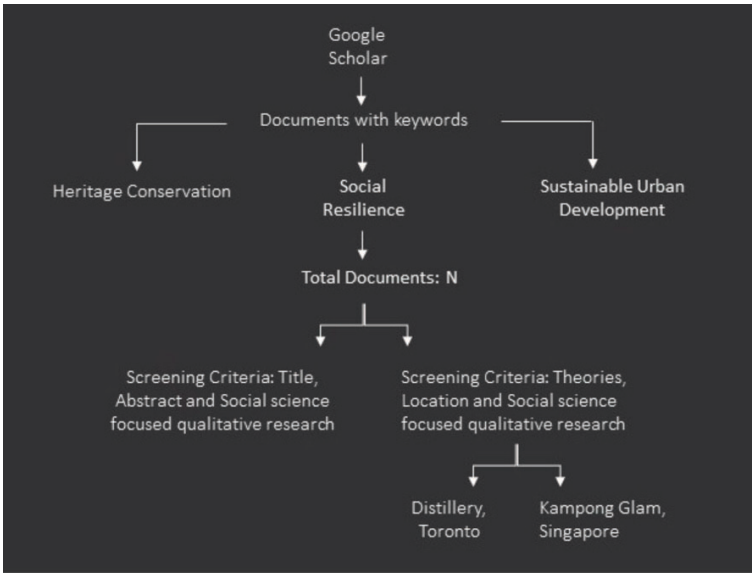


Figure 1 and 2. Research Framework and Methodology Flow Chart, respectively.

On the surface, Toronto's Distillery District and Singapore's Kampong Glam could not be more different as case studies for this treatise, being so geographically removed, culturally contrasting, and contextually varied. However, a closer look reveals that they are connected by more than just their colonial past – both are textbook examples of the use of the increasingly popular, globally favored strategies of "**heritage preservation**" and **"creative economies"** as a way to breathe new life into decaying socio-spatial manifestations. Indeed, this two-pronged approach can be seen practically everywhere – from Hauz Khas in New Delhi to the Grand Bazaar in Istanbul, and 22@ in Barcelona. But, is this universal appeal justified? Kampong Glam and Distillery District give us a glimpse into the eastern and western context, providing generic lessons that can be applied to other locations, as well.

3. Results

Case Studies:

The Gooderham and Worts Brewery in Toronto began as an alcohol factory in 1832, but was briefly repurposed to produce acetone in 1916, during Prohibition. However, its Victorian era and early 20th century structures caught the eye of film directors, who saw the site as a backdrop for their movies, connecting this landmark to art, media, and pop culture. By the 1990s, even though the Distillery's future as an industrial complex was shrouded in doubt, forces like the Parks Canada's Commercial Heritage Property Incentive Fund, Toronto Historical Board and the Ontario Heritage Act pushed for its preservation as a site of historic import and architectural heritage (Mathews, 2010).

Ever since its establishment, the Distillery has always remained privately owned. This ownership model continued even after the City Council approved a mixed-use redevelopment masterplan in 1994, when Cityscape Holdings made an investment, promising to transform the place into an entertainment, arts, and culture district (Mathews, 2010). This proposal came at a time when the global west was seeing a marked change in urban leisure. With city folk finding themselves with increased disposable incomes, public space began to become more consumer-oriented, and entertainment began to be commoditized. Shopping malls, theatres, amusement parks, museums, galleries, and night clubs raked in large profits, pointing to promising returns for the Cityscape venture (Kohn, 2010). To further incentivize landmark preservation, the city permitted the construction of three 40-storey residential towers. And so, the newly reinvented "Distillery District" first opened its doors to the masses in 2003 (Mathews 2010).

The adaptive reuse of this brownfield development was conceived as a celebration of Canadian culture; the past – preserved in the heritage structures, the present – reflected in local goods, food, and entertainment, and the future – embodied in the expression of local artisans. Indeed, today, the Distillery District is Toronto's iconic festive marketplace, home to the city's most widely anticipated pop-up galleries, food fairs, and seasonal bazaars.

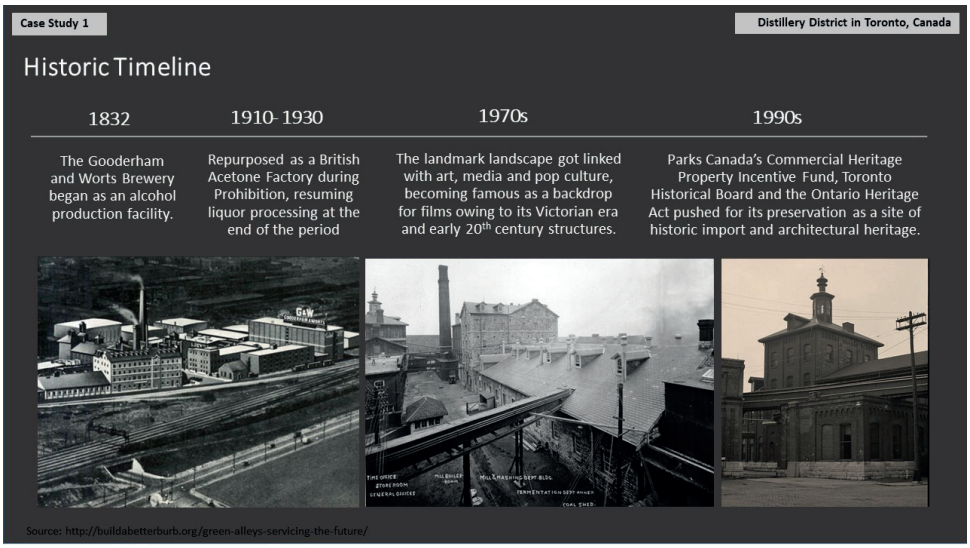


Figure 3. Historic timeline of Case Study 1: Distillery District in Toronto, Canada.

In contrast, the Kampong Glam district in Singapore was demarcated by Sir Raffles in the early nineteenth century for a Malay settlement as part of his masterplan's spatial and economic rationalisation process. It became a popular stop for Islamic settlers and merchants from the Indo-Malay Archipelago and beyond. The impacts of such a settlement manifested considerably on the physical and economic landscape of the neighborhood, imbuing the space with both a distinct identity and spirituality. The Sultan Mosque became a landmark, supported by other cultural symbols such as the Royal House of Istana, Gedung Kuning (the chief minister's house), Islamic schools, royal burial grounds, and a concentration of trade-related activities catering to the social and religious needs of the community. Once the major transit point for East Asian Muslim pilgrims on their way

to Mecca, the Kampong Glam district became a hub for business, travel arrangements, temporary lodgings, and other religious preparations. This legacy continues today, with pilgrimage-related services available across the street from the local mosque.

During the 1980s, the Singaporean Government conserved nine hectares of Kampong Glam to curb excessive, unchecked urban redevelopment and bolster tourism (Henderson 2012, Yeoh 2005). The following decades saw many smaller conservation efforts like the conversion of residential shophouses to commercial businesses, the creation of the Bussorah Street pedestrian mall, and the conversion of an area near Sultan Mosque into a thriving food paradise. Today, Kampong Glam is a bustling commercial area, frequented by shopping enthusiasts, food lovers, entertainment seekers, and tourists. The Urban Redevelopment Authority also commissioned artists to create street murals and graffiti in an attempt to attract more tourism to the area (Chang and Huang 2011).

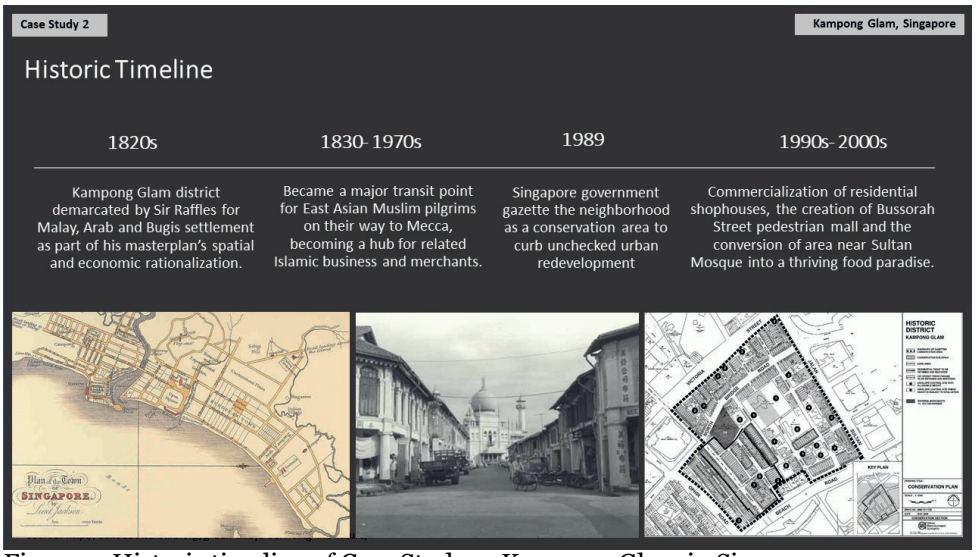


Figure 4. Historic timeline of Case Study 2: Kampong Glam in Singapore

Findings:

Both The Distillery District and Kampong Glam owe their dramatic transformation to the popular two-pronged adaptive reuse approach of "historic preservation" and "creative economies." Following is a brief description of how these strategies were used in both cases:

- Heritage Preservation

". . . marketplaces are particularly manipulative heritage commodifiers, selectively capitalizing on whatever heritage spin has most appeal to their clientele, fundamentally in the values of a market and reclaimed urbanity but also in their buildings where possible, and in ornamentation, association, and environs." (Tunbridge, 2001)

Central to The Distillery District's redevelopment strategy is its identity as an industrial relic. Its unique architectural vocabulary has been retained with money dedicated to its restoration. However, creating an educational, historical narrative is limited to plaques, signage, and an official website alone (Mathews, 2010). Instead, the developers market the site's heritage through artful imagery and scene-setting. Objects like barrels, millstones, and heavy machinery exploit nostalgia by providing the consumer the experience of stepping into a bygone era (Kohn, 2010). Like actors in a performance, these spatial reconstructions create a dialogue between the people and the past.

This commodification of culture is not unique to Toronto alone. Although Kampong Glam boasts of a proud and rich Malay heritage, it underwent a massive makeover to cater to more popular tastes. The palm-lined paths, onion domes, and arches echo a more Middle-Eastern than Malay vibe. Although this exoticisation has proven to be a tourist-

pleaser, it comes at a cost, as seen in the case of Bussorah street – a vista to the Sultan Mosque, the original site of the "seasonal space" of Ramadan food bazaar for decades. The Ramadan Bazaar was (and still is) an integral part of the Singapore Muslim culture with intangible historic value. The "living heritage" affirms the community's identity while providing a "sense of place." However, the street's redevelopment into a pedestrianised mall pushed gentrification, leading to an erasure of local culture, and evoking a deep sense of loss among the Malay-Muslim community (Ismail 2006).

- Creative Economies

"*[Creative economies arise when], in order to create spaces conducive for the creative class, officials use zoning variances and tax incentive schemes to convert older manufacturing sites into mixed-use projects, reconfigure the transportation system to promote public transport, cycling, and walking, encourage environmental-friendly urban design and architecture, and/or create spaces that facilitate cultural events like shows, concerts, and festivals . . .*" (Hague 2017).

It is no secret that public art drives placemaking, employment, social engagement, and change, strengthening community ties and disseminating ideas. At the Distillery District, arts-led regeneration is key to its creative economy strategy. The abundance of free and unordered space onsite makes it the perfect venue for improvisational, flexible, and transitional use (Wung, 2007). Artists, designers, craftspeople, and performance groups can use the Distillery's ephemeral quality of space as a stage to showcase their talents. In addition to this, the non-profit organisation Artscape signed a 20-year lease with Cityscape in 2002 to provide offices and studios for the "long-term residency and protection" of around 60 members of the arts community (Mathews, 2010).

Meanwhile, in Kampong Glam, the government has adopted the creative economy strategy through the adaptive reuse of shophouses along the periphery of the Central Business District. Bustling cafes, boutiques, and nightclubs instill new life into the western part of the district. State institutions and local stakeholders encourage diversity of occupants and usage. Having learnt from past mistakes, they prevented it from becoming an exclusive tourist hub that has no relevance to the resident population (Kumar, 2020). The emergence of a mixed cluster typology in the northern part of the district promises a neighborhood steeped in culture and diversity.

4. Discussion and conclusions

Once decaying and on the cusp of being obsolete, the twin strategies of "heritage preservation" and "creative economies" have, no doubt, brought the Victorian-era Distillery and Malay-Muslim ghetto of Kampong Glam into 21st century relevance. Today, these are thriving landmarks that form an integral part of their city's identity, drawing flocks of locals and tourists alike. Communities can now experience a connection to their roots while simultaneously celebrating the evolution of their own modern culture and lifestyles. The tourism and leisure industry has contributed to positive economic growth, and by providing employment, livelihoods have improved and set people on the path to becoming self-sufficient. As centers for civic engagement and a forum for unfettered creative expression, both cases have played a pivotal role in uplifting society.

These are giant strides towards the goal of urban resilience, and their accomplishments must be applauded. It is no wonder that adaptive reuse projects across the globe constantly champion heritage preservation alongside creative economies as the solution to the issue of dynamic, sprawling cities outgrowing the use of their tangible, architectural history. However, this dual-pronged regeneration strategy is not without its flaws:

- The inauthentic representation of history: In both the cases of Kampong Glam and the Distillery District, heritage is used as a marketing tool to attract people and generate revenue. The Distillery does little more than the bare minimum to weave historical narrative. More time, effort, and resources have gone into creating an experience that has visitors reaching for their wallets.

  "Visual theming" for the consumer's sake and the inaccurate depiction of history is better explained in Kampong Glam, whose leisure and amusement infrastructure reflect a distinct Arab aesthetic, capitalising on the fact that this was once a

stopping point for devout Muslims on pilgrimage to Mecca. Shisha bars and middle eastern restaurants are a far departure from the Malay-Muslim society that once thrived here (Tantow, 2012). Nevertheless, this deliberate appropriation of a foreign, exotic culture has proven seductive. With these half-hearted and even untruthful portrayals of the past, one must ask if the term "heritage preservation" is gradually becoming a misnomer.

- The alienation of local communities: In the case of Kampong Glam, ongoing gentrification has drastically hampered representation of the region's Malay population. The convenient side-stepping of its roots in favour of appropriating Arab culture is a snub to the indigenous way of life. Furthermore, certain youth-centric activities such as bars and nightclubs, which reflect an excessive, consumerist outlook is frowned upon by the traditionalists, who value a quiet, moral, and spiritual life (Imran, 2007).

  Meanwhile, the Distillery's private ownership has limited the city to the role of a facilitator – providing guidelines and building codes, grants, and easements (Abusada, 2015. Mathews & Picton, 2013). The discussion around privately-owned public space has been hotly debated, and it is no secret that entrenchment of private interest in the public realm is gaining momentum. Cityscape Holdings has been the true force behind the direction of the precinct's redevelopment. While the Distillery's adaptive reuse has already led to a wave of gentrification, further developments like the high-rise residential towers are feared to exclude weaker sections of society (Mathews, 2010). The lack of public engagement and consultation in the planning process is worrying, as it means that the Distillery District will cater to the masses only as long as it remains profitable (Mathews, 2014).

For urban heritage to speak to the needs of an ever-evolving city, the growing disconnect between the past, space and user must be mended. The sanitization of histories and consumer-driven leisure will only stunt true cultural, social, political, and economic progress. The question is, in the pursuit of urban resilience, can planners and developers resist the temptation of short-term gain of commercial success and turn their attention to what truly matters – the people?

Contributor statement

Ann Sandra Godly: Validation, Writing – Distillery case, Original Draft, Review & Editing. **Eingeel Jafar Khan:** Conceptualization, Methodology, Writing – Kampong Glam case, Original Draft, Review & Editing.

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Diversity of Built Form: Is It and Its Relations with Other Dimensions of Diversity Well-Measured?

Zhuoshu He [1]*, Ye Zhang [2]

[1] National University of Singapore; zhuoshuhe@u.nus.edu; https://orcid.org/0000-0003-0499-7111
[2] National University of Singapore; akizy@nus.edu.sg
* Corresponding author

Research highlights

1) Conduct a literature review to evaluate the current status in quantifying diversity of urban form.

2) Summarize multidisciplinary definition and measurements of diversity, setting a triple-concept framework comprising variety, balance and disparity for evaluating existing studies.

3) Layout existing studies about measuring built-form diversity and assessing its relations with other socio-spatial factors.

4) Results show that no study measures built-form diversity considering the comprehensive diversity definition, and overall weak and inconsistent associations between built-form diversity and other socio-spatial factors.

Keywords: urban diversity; urban form; urban morphology; measurement; literature review

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Leo van den Burg
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1. Introduction

Diversity is one of the most essential values in contemporary urban planning. It is able to enhance place vitality and social equity, especially for many regions suffered from separation for decades (Talen & Lee, 2018). Urban diversity is generally regarded as having physical and social dimensions. The former is various physical design, mixes of uses, and the expanded public realm, while the latter consists of mixes of multiple class, ethnic, and cultural groups exercising their rights (Bobkova, Marcus, & Berghauser Pont, 2017; Fainstein, 2005; Jacobs, 1961; Talen, 2006b). Physical diversity does not directly generate social diversity, but it does provide spatial conditions for social diversity to thrive and sustain (Talen, 2006b). Some researchers even believe that given the fluid nature of social diversity, providing diverse forms in the built environment may be more successful than policies directly aim at integration (Stanley, 2012).

Measuring the diversity of built form is crucial for resolving the above debates about the effects of physical diversity on the overall urban diversity. In addition, it is important to distinguish which spatial variables are important for socioeconomic diversity and in what combinations (Bobkova et al., 2017). The prerequisite is properly measuring physical diversity properly. Secondly, a diverse built environment is a common goal in urban design. The plot, street, block, etc. are fundamental components that urban designers work on. Currently, existing urban design protocols and guidelines (e.g., ASBEC, 2017) are too general in providing guidance for these components. Better measurement and assessment will provide stronger references to inform urban design guidelines. Thirdly, urban forms can be studied independently by studying the mathematical relationships between the characteristics of form (Vialard, 2013). It helps enhance knowledge on urban spatial structure and develop methods that adapt urban analytics better.

Scholars pointed out that methods and techniques for measuring diversity of built form are not sophisticated and need to be investigated in more detail (Marcus, 2010; Talen, 2006c; Talen & Lee, 2018). Compared to built-form measurements on dimension, intensity, and connectivity, diversity is underrepresented (Fleischmann, Romice, & Porta, 2020). Additionally, existing diversity measures originate from multiple subjects (e.g., ecology, economics, and psychology). Whether and how they could be applicable to urban analytics require more exploration (Salat, Bourdic, & Nowacki, 2010).

Nonetheless, what is the current status on research about measuring built-form diversity and assessing its relations with other socio-spatial factors? Comprehensive review on this topic is still rare, which obstructs further discussion and exploration on this topic. Therefore, we conduct a literature review in order to: 1) summarise a multidisciplinary definition and measures of diversity to set a framework for filtering existing quantitative research about built-form diversity; and 2) layout measurements of built-form diversity, and assessments of relations between built-form diversity and other socio-spatial factors.

2. Methods of Review

Our review starts with technical definitions and measures on diversity. Here we do not confine the scope in urban morphology or urban studies, but include multidisciplinary literature. It is for setting a framework for filtering relevant literature.

Because the terminology in research about both diversity and urban form are inconsistent and loose, directly identifying literature by keywords seems difficult. We apply an iterative snowball approach combining backward and forward traces of reference. One starting point is a most recent review about built-form measurements (Fleischmann et al., 2020), which summarises four quantitative measurements on diversity of urban form (Bobkova et al., 2017; Feliciotti, 2018; Louf & Barthelemy, 2014; Song, Gordon-Larsen, & Popkin, 2013). Another starting point is literature citing a classic work about urban diversity by Talen (2008). Whenever we find literature related to measuring built-form diversity, it is included in the database, and its reference is screened. Correspond to Fleischmann et al. (2020), for studies about non-morphological elements (housing, land use, and transportation), we note them but do not include them in this review.

Then we extract measurements on diversity of built form, which include the following contents. 1) Element: the spatial unit (or grain) whose features are measured, including building, plot, street and block. 2) Feature: a characteristic of the element that is measured (e.g., area). 3) Extent: the aggregated area in which a diversity measurement is computed and the spatial unit that diversity value is assigned (e.g., 500 m network accessible district of Census Tracts). 4) Measure: the formula or desiderata to compute diversity (e.g., Simpson index).

3. Results

3.1. Multidisciplinary definitions and measures of diversity

The definitions of diversity are manifold and ambiguous (Bobkova et al., 2017; Talen, 2006a). Many urban studies do not specify a definition of diversity, but take it as a notion instead. Some researchers define it through how it is intrinsically produced, like Page (2010)'s diversity "of types," "within a type," and "of composition," and Salat et al. (2010)'s diversity in "similar objects," "spatial distribution," and "objects of different scales."

We highlight diversity definitions that describe the performance and lead to measures. It is assumed that a system encompasses plenty of objects, and can be partitioned into categories according to attributes. The most popular definition relates to ecology and combines two concepts, richness and evenness (Magurran, 2005; McGarigal, Cushman, Neel, & Ene, 2002). Richness is the number of categories, while evenness is their relative abundance. However, Junge (1994) and Stirling (2007) advocate a more comprehensive definition, comprising variety, balance, and disparity. Variety is the synonym of richness. Balance is the apportionment across categories, capturing both

evenness in ecology and concentration in economy. Variety and balance are characterised by categories. Disparity refers to the manner and degree in which objects are distinguished. It is on this basis that a taxonomy of objects is defined and partitioned, hence, it could also represent inter-categorial heterogeneity.

Related measures can be placed in the above three concepts. Variety can be simply measured by categorial count. It can be further expressed as joint or non-overlapping types (Page, 2010). Measures of balance are mainly Shannon Entropy and Simpson Index. There are some variants, including the Herfindahl–Hirschman Index, Gini Index, etc. The weakness is that they treat all categories as equal (Page, 2010). Usually, even distribution is not the reality nor the optimum (Salat et al., 2010). Some researchers instead compare categorial percentages between sub-district and entire areas, which imply some kinds of weighting, like the Dissimilarity Index and Neighborhood Diversity Index (Maly, 2000; Song, Merlin, & Rodriguez, 2013). For disparity, the simplest measures are variation measures, like standard deviation (SD) and coefficient of variation (CV) (Junge, 1991). Balance measures fail to take into account the extent of differences between categories, which could be addressed by distance measures. Weitzman (1992) used a set of pairwise distances of objects to perform desiderata of taxonomy. However, distance measures rely on the sample – when more objects are added, the distances are likely to change (Page, 2010). For some attributes, distance may not exist between objects (Page, 2010). Additionally, Junge (1991; 1994) used projection models to measure similarity/dissimilarity (homogeneity/heterogeneity) of objects and apportionment between categories.

3.2. Existing studies measuring diversity of built form

Based on the triple-concept framework, we select and summarise built-form measurements that measure variety, balance, or disparity. A few studies claim that they intend to quantify built-form diversity, and often take SD, CV, Simpson index, or Shannon entropy as proxies for diversity. More studies rarely mention diversity, but measure variety, balance, or disparity of built form to some extent, so they are also included (Table 1). Throughout both kinds of studies, no one covers variety, balance, and disparity at the same time, let alone integrating them.

Within studies measuring variety and balance, Bobkova et al. (2017) and Martino, Girling, and Lu (2021) emphasize diversity the most. For Bobkova et al. (2017), diversity is a starting point and is linked to the plot system based on the Spatial Capacity, so the aim is shifted to morphological measures for the plot. The only measurement that directly measures diversity is Simpson Index of plot area within a 500 m network accessible district (the value is assigned to the plot). They infer that diverse plot area is important for a fertile ground with high plot accessibility when it scales up from a local center to a more globally performing center. They replace this measurement with number of accessible plots in the subsequent research (Bobkova, Berghauser Pont, & Marcus, 2019). Similarly, in Martino et al. (2021), variables measuring diversity of built form are Simpson index of building age, plot area, and dwelling type.

Those measuring disparity often employ clustering and multivariate analysis for the following aims. Some studies aim to classify built-form elements into typologies. For example, Bobkova et al. (2019) explore plot typologies based on three attributes. Some aim to classify cities or districts through clustering. For instance, Boeing (2019) classifies 100 cities based on eight attributes on street configuration. Here, cities are the elements and their pairwise distances or disparity are measured. Some other studies aim to simplify built-form criteria applying multivariate analysis, where clustering of studied districts plays as validation of the reduced set of variables (Dibble et al., 2017; Song, Gordon-Larsen, et al., 2013). It is claimed to be measuring diversity by Salazar-Llano (2019). However, in all these situations, the balance of elements and features within certain extents (e.g., neighborhoods) is missing to measure diversity comprehensively.

Besides, most frequent elements and features are building age and plot area, as what Jacobs (1961) advocates. There are two ways to catch the extent – using exclusive

boundary (e.g., census district, sanctuary area and grids), or taking into account surrounding area (e.g., buffer, accessible network district). Most studies set the extent on the neighborhood or equivalent scale, corresponding to the argument that district (neighborhood) scale enables examination of diversity and social mixing (Bourdic, Salat, & Nowacki, 2012; Talen & Lee, 2018). Only Martino et al. (2021) compare different scales using five-radius network accessible districts of the census dissemination area.

Table 1. Measurements on diversity of built form

Element	Measurements of Variety, Balance	Measurements of Disparity
Building	• Simpson Index of building age within 400 m, 800 m, 1600 m, 3200 m and 4800 m network accessible districts of the census district (Martino et al., 2021) • Shannon Entropy of building floor area within all plots abutting street segment (Ewing & Clemente, 2013) • Shannon Entropy of building height within town (Salazar-Llano, 2019)	• SD (Z score) of building age within 200m*200m grid (Powe, Mabry, Talen, & Mahmoudi, 2016; Preservation Green Lab, 2014), 100m*100m grid (Delclòs-Alió & Miralles-Guasch, 2018) or census district (Rosner & Curtin, 2015; Sung, Lee, & Cheon, 2015) • K-means cluster of buildings within 5 cities based on floor area ratio and building density in 500 m network accessible district (Berghauser Pont, Stavroulaki, Bobkova, et al., 2019)
Plot	• Simpson index of plot area within 500m network accessible district (Bobkova et al., 2017; Feliciotti, 2018) or 400 m, 800 m, 1600 m, 3200 m, 4800 m network accessible districts of census district (Martino et al., 2021)	• K-means cluster of plots within five cities based on average plot area, average ratio of plot area, and minimum bounding rectangle area and average ratio of plot frontage and perimeter in 500 m network accessible district (Bobkova et al., 2019) • SD of land patch area within 1 km, 3 km, 5 km, 8 km buffer (Song, Gordon-Larsen, et al., 2013)
Block	-	• CV of block area, ratio of same-size-circle diameter and circumscribed-circle diameter, and ratio of block perimeter and same-size-square perimeter within adjacent blocks (Vialard, 2013) • Hierarchical cluster of 131 cities based on block area and ratio of block area and circumscribed circle area (Louf & Barthelemy, 2014)
Street	• Shannon entropy of street length and street orientation within town (Salazar-Llano, 2019) or city (Boeing, 2019)	• K-means cluster of streets within five cities based on angular betweenness (Berghauser Pont, Stavroulaki, Bobkova, et al., 2019) • Hierarchical cluster of 100 cities based on street orientation, length, circuity, and proportion of different nodes (Boeing, 2019)
Mixed elements	-	• Hierarchical cluster of 45 sanctuary areas based on 207 attributes and a subset of nine attributes on building, plot, and block, which are derived from multivariate analysis (Dibble et al., 2017) • Hierarchical cluster of 20,467 neighborhoods based on 27 attributes on land patch and street and subsets of attributes that are highest loading on factors within 1 km, 3 km, 5 km, 8 km buffer (Song, Gordon-Larsen, et al., 2013)

3.3. Quantitative evidence relating built-form diversity with other factors

Within quantitative studies about built-form diversity, evaluation of its relations with functional or social diversity is rare, so we also include other socio-spatial factors (Table 2). While putting them together, many mixed and inconsistent results can be found. For example, Powe et al. (2016) find that SD of building age has significantly positive relations with Simpson Index of race in Seattle, but no significant relation is found in San Francisco, Washington DC, and Tucson. Relations between SD of building age and percentage of small economy are also mixed among four cities.

Many results show the role of built-form diversity is minor or even inverse with expectation. For example, Martino et al. (2021) find that diversity variables are less important than intensity and centrality variables, and Simpson index of building age is inversely related to Shannon entropy of socioeconomic variables and affordability variables. Powe et al. (2016) find that SD of building age has a significantly negative association with Herfindahl–Hirschman Index of occupation.

Quantitative evidence examining built-form diversity and other socio-spatial factors are insufficient to get rigorous conclusions. Complex socio-spatial relation is the nature, so we need more quantitative evidence that systematically examines the effect of built-form diversity, especially in different regions and urban contexts. Previous studies find that fine grain, well connectivity, and mid to high density may host socioeconomic diversity. But how diverse grain sizes, connectivity, and densities are related to functional and socioeconomic diversity? The effects of built-form diversity are underexplored comparing to other built-form measures (e.g., density, connectivity) and other built-environment sectors (e.g., land use, housing).

Table 2. Quantitative evidence relating built-form diversity with other factors.

Element	Quantitative evidence
Building	• SD of building age has significantly negative association with median resident age, Simpson Index of resident age (Powe et al., 2016); no significant relation with walking activities (Sung et al., 2015) • Shannon entropy of building age has positive correlation with Shannon entropy of local economic type and education attainment (Carlucci, Zambon, & Salvati, 2020). • Simpson index of building age is negatively related to the sum of Shannon entropy of education attainment, income, and race, and affordability index (Martino et al., 2021) • Entropy of building floor area approaches significance with pedestrian count (Ewing & Clemente, 2013) • Building typologies have significant variation in pedestrian flow (Berghauser Pont, Stavroulaki, & Marcus, 2019).
Plot	• Simpson index of plot area positively relates to affordability index (Martino et al., 2021) • SD of land patch area is highly correlated with land-use diversity, and it is among highest loading variables of factors (Song, Gordon-Larsen, et al., 2013)
Street	• Shannon entropy of street orientation relates to higher node degree (ways per intersection), more 4-way intersections, fewer dead ends, and average circuity (Boeing, 2019)

4. Discussion and conclusions:

In this paper, we summarize multidisciplinary definitions of diversity and existing studies measuring built-form diversity. A comprehensive definition of diversity deals with both category and object, which leads to three concepts – Variety, Balance, and Disparity. Within quantitative studies about built-form diversity, few measure diversity considering the three concepts at the same time. For those who claim to measure diversity, SD, CV, Simpson Index, or Shannon Entropy are taken as proxies for diversity measurement. More other studies do not aim for diversity, thus do not intend to develop comprehensive diversity measurement. Building age and plot area are the most common elements and

features that are measured. There are some quantitative evaluations on associations between built-form diversity and other socio-spatial factors, but they are still limited, comparing to other built-form measures and other built-environment sectors. The effects of built-form diversity shown in current results are somewhat weak or inconsistent.

Several unsolved questions are worth to be explored in future research. Firstly, current evidence shows overall weak associations between built-form diversity and other socio-spatial factors. However, are their associations well examined, given that measurements on built-form diversity are not comprehensive? Secondly, such a situation calls for integration of measurements on Variety, Balance, and Disparity, and application on different built-form elements and features. Although existing measurements seems complementary, there are challenges in integrating them. That is to say, how distance measures, which yield typologies, could be better integrated with measures transforming entities into numbers? Thirdly, although most existing studies focus on the neighborhood scale, there are debates on which scale of diversity we should pursue (Stanley, 2012; Talen, 2006b). Cross-scale comparison on associations between different dimensions of diversity is meaningful. Additionally, measurement on built-form diversity and other dimensions of diversity (e.g., land use mix) can provide methodological reference for each other.

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From Border to Interface: Evaluating the Design Strategies in the Regeneration of Industrial Heritage Projects in Shanghai from the Perspective of Public Space - Public Life

Yifan Dong [1], Jingwen Gan [2] and Huaqing Huang [3,*]

[1] Nanjing University; yetfundong@gmail.com
[2] Nanjing University; hriegan@gmail.com
[3] Shanghai Jiao Tong University; huanghq@sjtu.edu.cn

Research highlights

1) Diagrammatic analysis is used to reveal certain invisible pattern between pedestrian's behaviors and architectural interfaces.

2) Tracking study based on Public Space – Public Life theory is adopted as the main research method.

3) Effective design guidelines of architectural interface are concluded as reference for future projects of industrial heritage regeneration.

Keywords: urban renewal; regeneration of industrial heritage; architectural interface; public space – public life

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1. Introduction

Since the 1990s, Chinese cities have entered a phase dominated by regeneration and redevelopment (Wang, & Jiang, 2006). With the gradual decline of traditional industries and the ongoing socio-economic transformation, the regeneration of industrial heritages has been increasingly recognised as a significant and urgent topic in the agenda of urban renewal, especially in a modernist functional mega-city with a strong industrial background like Shanghai. Since 2002, Shanghai has started the regeneration of historical industrial areas alongside the Huangpu River with the goal of transforming the closed river banks into open public space by 2035 (Zhang, & Zhang, & Zhang, Qin, 2019). The industrial buildings in these areas, on the one hand, recall the old industrial memory of the city, while on the other hand, act as heterogeneous and isolative patches in the waterfront urban fabric due to their oversized volumes and rigidly closed borders. As Christopher Alexander believes – "The machine-like building is cut off from its surroundings, isolated, an island. The building with a lively building edge is connected, part of the social fabric, part of the town, part of the lives of all the people who live and move around it . . ." (Alexander, 1979, p.754). In the case of the regeneration of industrial heritages, in order to turn the enclosed objects into open space without altering their distinctive monolithic volumes, the design strategy of border space is especially worth concerning.

By the end of 2017, 45km of waterfront public space on both sides of the Huangpu River had been connected, and a significant portion of the waterfront industrial heritages have been renovated at both architectural and functional levels. They provide numerous cases for evaluating the effectiveness of interface design strategies. Based on Jan Gehl's Public Space – Public Life (PSPL) research method, this paper uses the classic tracking

study in the PSPL tools to survey the selected cases. Furthermore, new analysis and representation methods are proposed to reveal the patterns between the interface of the renovated building and the pedestrians' behavior. In conclusion, effective design guidelines of transforming "border to interface" on an urban scale are summarised as reference for future projects of industrial heritage regeneration.

2. Theories and Methods

2.1. Research method: Public Space – Public Life (PSPL)

Classic PSPL tools focus on direct observation, and the survey data are suggested to be presented and interpreted as simple charts & graphs (Gehl Institute, 2020). For example, in the study of public life along different ground floor facades in Copenhagen, a bar chart was presented to compare the frequency of spontaneous behaviors of pedestrians through different types of facades, which leads to research conclusions (Gehl, & Kaefer, & Reigstad, 2006). Without a systematic approach to analysis, such a PSPL survey does not allow for a more comprehensive analysis of a larger sample size.

In the evaluation of the prototype toolkit of observation, the Gehl Institute looks to the next step of "correlating public life data with other qualitative place-data such as public space quality criteria" (Gehl Institute, 2016), bringing inspiration for the methodological improvements in this paper: a new analytical method, the point-line-plane framework, systematically expands the scope of the subject in the PSPL from a planar mapping to a three-dimensional space, and is directly related to the evaluation criteria for the architectural interfaces; a new representation method, the behavioral heat map, improves the presentation of public life data by processing the data in a computerised way. Complemented by these two, the PSPL method can facilitate researchers to visually establish the interrelations between the physical environment and behavioral data.

PSPL includes "contemporary tools that can be applied analytically to once again forge an alliance between life and space in cities" (Gehl, & Svarre, 2013). There are tools such as counting, mapping, tracking, etc. In this research, in view of the rambling nature of the Three Belt (Zhang, & Zhang, & Zhang, Qin, 2019) in which selected cases located, a tracking study in the PSPL toolbox is used.

According to Jan Gehl, in low-quality outdoor space, only necessary activities take place, but in high-quality outdoor space, despite the probability of necessary activity is unchanged in general, the duration of them has a tendency to extend and spontaneous behaviors ensue (Gehl, 1987). Thus, the walking speed is taken as the indicator of the overall effectiveness of the interface and spontaneous behaviors including turning head to look at the building, heading up to look at the building, staying somewhere near the architectural interface, and taking photos are recorded to reflect the quality of the interface more subtly.

2.2. Analytical method: point-line-plane framework

In order to analyse the relationship between the interface and the behavioral data, the interface need to be extracted into architectural components. Referring to the idea of imageability proposed by Kevin Lynch – the "quality in a physical object which gives it a high probability of evoking a strong image in any given observer" (Lynch, 1964), we extracted five components from the perspective of ordinary pedestrians' observation. Furthermore, these components are classified into three geometric categories – point, line, and plane (Table 1).

Table 1. Components of architectural interface

Category	Components	Description
Point	Landmark	Extremely prominent object, especially the exposed old industrial mechanical construction
	Entrance	Entrance for the public
Line	Transparent enclosure	-
	Opaque enclosure	-
Plane	Semi-outdoor space	-
	Slope	Ramps and grand stairs that open to the public

2.3. Representation method: behavioral heat map

After the tracking study, the spots where different spontaneous behaviors take place are overlaid on the masterplan of selected cases, and according to the density of the spots, heat maps of pedestrian behaviors are obtained.

With the abstract model of interface based on the point-line-plane framework, the heat maps can thus reveal certain invisible patterns between pedestrian behaviors and the architectural interface. As a result, effective strategies of interface design are concluded at the morphological level.

3. Results

3.1. Case study

This paper conducts detailed field research on three projects, namely Yicang Modern Art Museum (MAM), 1862 Old Shipyard (Mifa), and Green Hill (GH), which all share the problems of oversized volumes and closed borders commonly found in industrial buildings (Figure 1).

The tracking studies were carried out between 4pm and 6pm on fine autumn days. For each building interface in the selected cases, 200 pedestrians were randomly followed, whose behaviors were recorded on their path and walking speed was measured (Table 2). In addition, a section of the waterfront walkway connecting the building interface was selected to measure the pedestrian's walking speed as a comparison.

Table 2. Pedestrians' average walking speed of passing through different interfaces

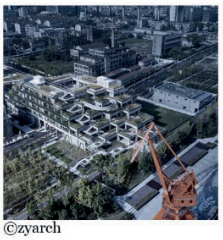
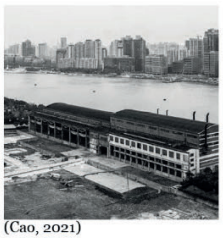
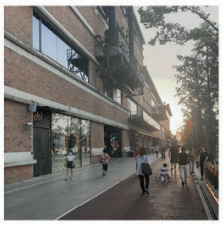
	MAM		**Mifa**		**GH**	
	Length/ m	**Average Speed/m*s^{-1}**	Length/ m	**Average Speed/m*s^{-1}**	Length/ m	**Average Speed/m*s^{-1}**
Interface connected to the waterfront walkway	93.0	**0.978**	200.0	**0.913**	46.8	**0.919**
Interface perpendicular to the waterfront walkway	38.4	**0.959**	44.5	**0.915**	36.6	**1.027**
Interface facing the city	112.3	**1.039**	200.0	**1.172**	36.6	**1.148**
Comparison section	54.4	**1.114**	45.5	**1.088**	27.8	**0.996**

3.2. Result analysis

Based on the point-line-plane framework, abstract composition models of the three cases are extracted (Figure 2). Meanwhile, behavioral heat maps were made based on four types of pedestrian behaviors on passing through the building interfaces (Figure 3). Combining the heat maps, the walking speed data and the interface composition, some patterns between the interface components and the impact of the interface were summarised.

- **The influence of point-like elements is closely linked to a comfortable field of vision.**

  "Our sense of sight is well developed straight ahead and to the sides . . . But of the world above us, we see very little." (Gehl, 2006, p.32). The heat map of Mifa confirms this. Comparing Figure 3. b-2 with Figure 3. c-2, when walking on the waterfront walkway adjacent to the building interface, people are more interested in the first level of the interface, especially the entrances, than the industrial-looking landmark high above them. For GH, comparing Figure 3. b-3 with Figure 3. c-3, the landmark on the higher level is also attractive as the ground floor interface due to the receding building form (Figure 2. c) which makes it visible to pedestrians when approaching the interface by raising their eyes slightly along the building setback.

	Modern Art Musem (MAM)	**Mifa 1862** (Mifa)	**Green Hill** (GH)
Condition after regeneration	 ©Tian Fangfang	 ©Eiichi Kano	 ©zyarch
Original condition	 (Liu, 2021)	 (Cao, 2021)	 (Zhang, & Zhang, & Zhang, Qin, 2019)
Public life along the interfaces			
Typology	Art museum	Community center	Public service
Original Typology	coal bunkers and loading docks	Shanghai Shipyard (Pudong)	maintainance warehouse of a tobacco company
Architectural design	Atelier Deshaus	Kengo Kuma and Associates	Original Design Studio of TJAD
Year of completion	2016	2016	2018
Total built-up area	9180 sqm	31626 sqm	17678 sqm
Pedestrain flow rate * (along the riverbank)	13.8 ped/min	10.3 ped/min	9.4 ped/min
Pedestrain flow rate (facing the urban space)	7.3 ped/min	3.5 ped/min	4.2 ped/min

Examples of interface elements extracted from selected cases

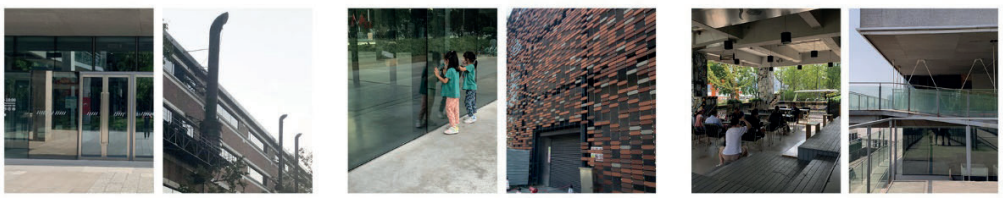


Figure 1. Basic information of selected cases

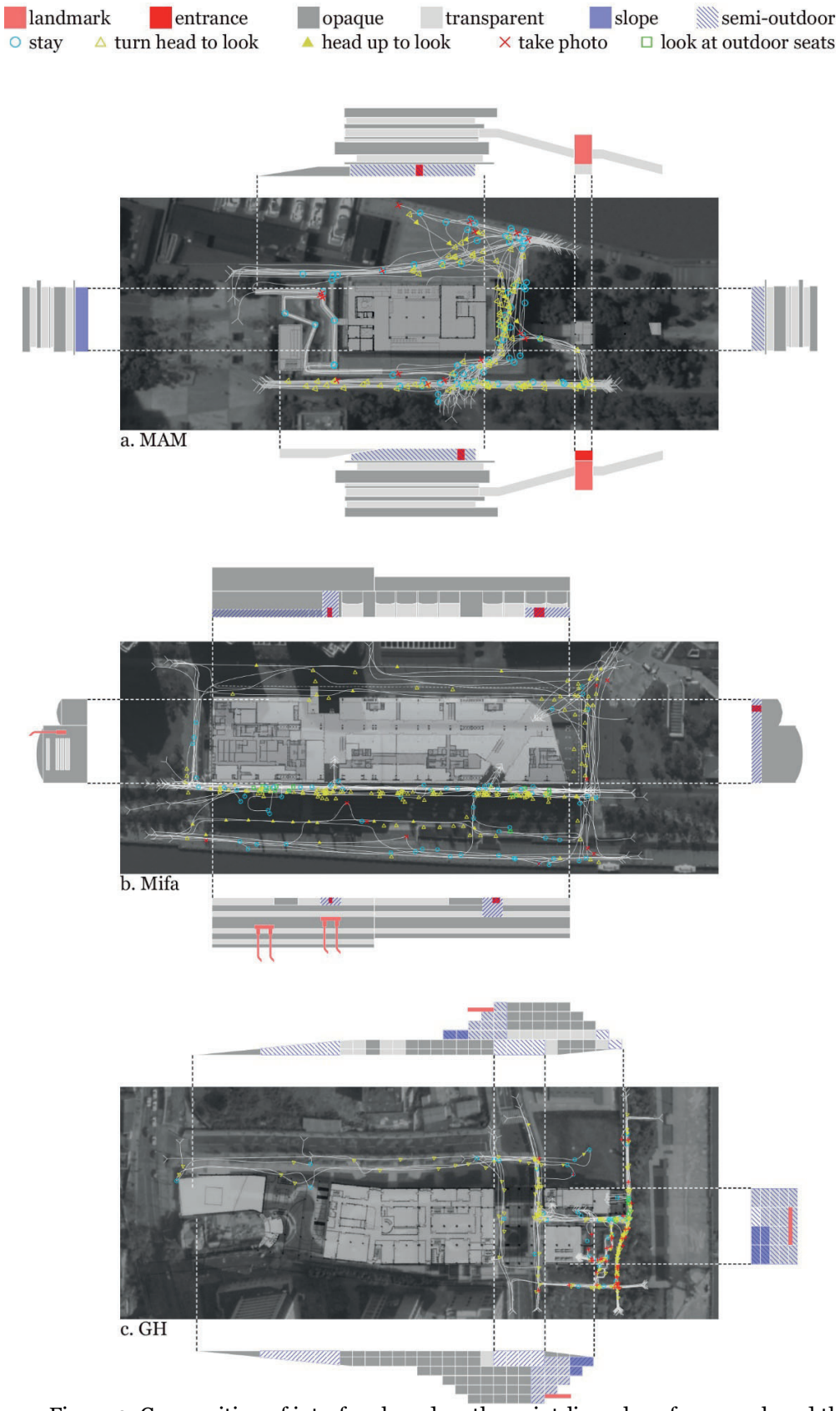


Figure 2. Composition of interface based on the point-line-plane framework and the path of pedestrians

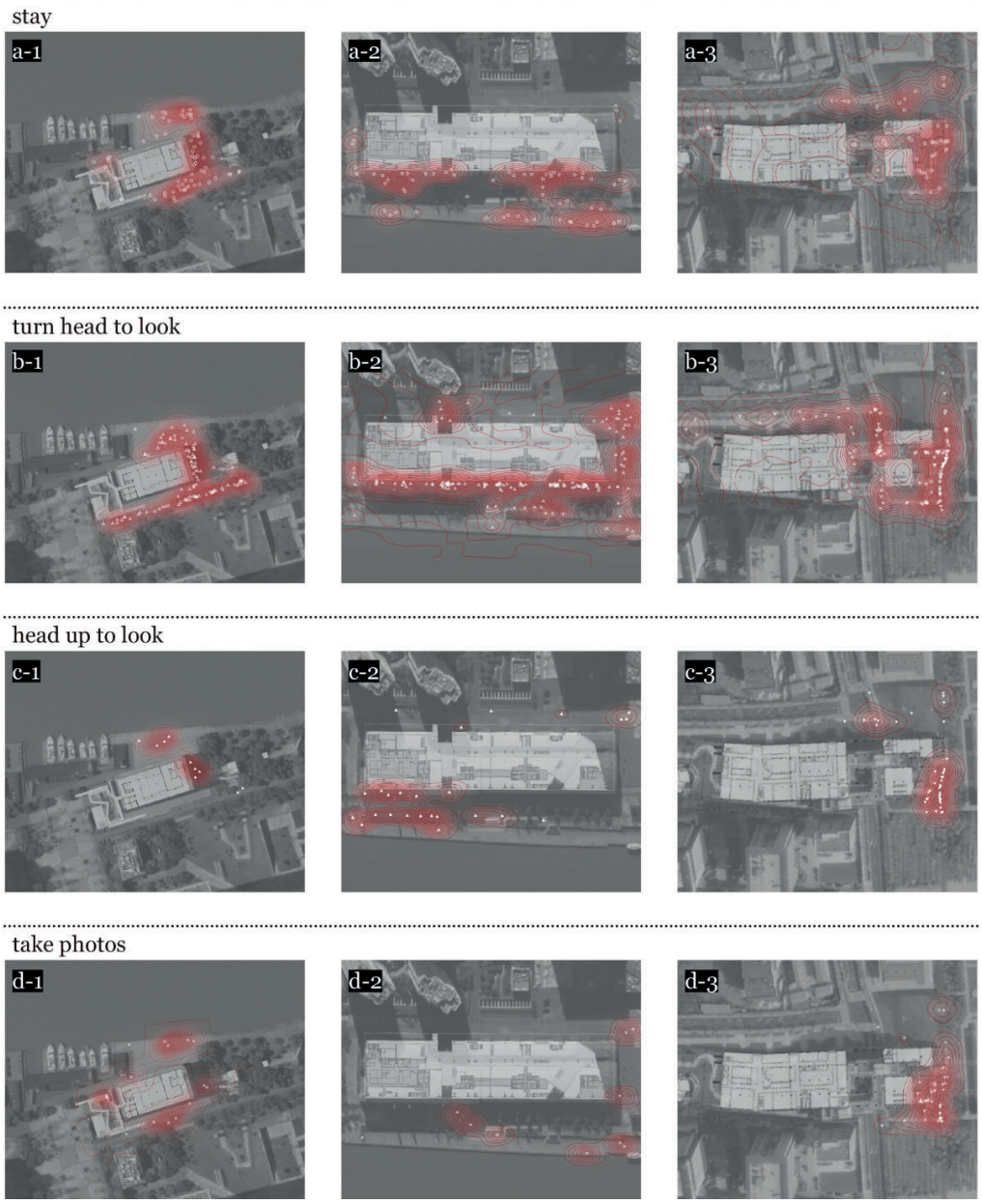


Figure 3. Behavioral heat map of selected cases

- **The properties of the linear elements are most relevant to the linear roaming path of pedestrians. Therefore, the quality of the linear elements determines the pedestrians' interaction with the interfaces and also influences their walking speed.**

In general, open and transparent linear interfaces are more vibrant. All the three buildings have a commercial program of restaurants or cafes on the ground floor, creating rich interactions with pedestrians. For example, most of the restaurants in Mifa beside the waterfront have permeable curtain walls with outdoor cafes, effectively attracting views and stays (Figure 3. a-2, Figure 3. b-2). On the contrary, the side closer to the city retains more of the factory's original trusses and displays a non-transparent façade with some mostly specialised retails, so the interaction with pedestrians is less frequent and the average speed of pedestrians is much higher (Table 2). It is worth noting that the ground floor interface of MAM is mostly glazed with highly reflective glass, which reduces internal and external permeability, but increases its attractiveness to interactions due to its mirrored effect, especially on the

short side of the building (Figure 3. a-1, Figure 3. b-1). It also slows down the pedestrians' walking speed (Table 2).

- **Plane-like elements are important in stimulating activities, but only their combination with linear or point-like elements is a guarantee of their attractiveness.**

The combination of a flat linear interface and recessed semi-outdoor space creates a sense of rhythm that is highly attractive to the pedestrians, such as the two recessed entrances with semi-outdoor space on the waterfront interface of Mifa (Figure 3. b-2) and the passage through the street in GH (Figure 3. b-3); whereas the relatively homogeneous and continuous under-corridor space lacks objects to make people stop and gaze, as in the case of the MAM. Whether or not the architects intended it to be, this interface, with its sculptural form, discreetly gives way to the riverfront plaza, which is a lively sightseeing space rich in activities and high pedestrian flow in the evening.

The combination of the slope and the landmark brings a strong dynamic to the riverside frontage of GH. The slope and the stairs provide a clear path to the landmark, and the attractiveness of the landmark creates an incentive for pedestrians to climb the slope. Therefore, lots of pedestrians tend to gather here, stop, and take photographs (Figure 3. a-3, Figure 3. d-3). However, the grass slope facing the city is significantly less vibrant because it is blocked by the fence. The architect's intention to extend the public life of the city to the riverfront is not fully realized. Interestingly, at its interface facing the urban streets, the number of people coming specifically by taxi is literally higher than those directly attracted from streets, reflecting that the status of GH is considered more a landmark than a public space of neighborhood to some extent. There is also a similar pity for MAM. Although many visitors were attracted to the waterfront ramp to roam and take photographs (Figure 3. d-1), the connection between the ramp and the upper corridor was locked for management reasons, so the intention to connect the upper levels to the waterfront was not realised.

4. Discussion and conclusions:

The walking speed of people rambling along the riverside slows down to varying degrees as they pass through the architectural interface of regenerated industrial heritage (Table 2). Although walking speeds show a numerically insignificant difference, this data does contain a degree of value given the sufficient sample size. From a general perspective, slower walking speed proves that all the three cases have positive influences on the spatial quality of the riverside. From a closer perspective, some of the patterns summarised above may provide effective design strategies for other regeneration projects of industrial heritage in the future. Admittedly, some of these design strategies overlap with well-established European design experience, but in other words, they are justified by the data- and graph-based analysis presented in this study.

- The retention of industrial elements in some industrial heritage requires consideration as to whether there are suitable viewing points and whether they are in a comfortable visual range of pedestrians due to the relation with visual attractiveness.
- A transparent interface on the ground floor, like the glass curtain wall, is an effective strategy of slowing pedestrian walking speed and promoting public activity around it.
- Compared to setting the entrance on a flat interface, the rhythmic variation of the interface created by placing the entrance in a concave semi-outdoor space on a flat interface generates more attractions.
- People are likely to have an inclination to view the river from a higher place. The slope is therefore a natural attraction for people strolling along the river.
- Combining landmark and slope is a strong and valid gesture to attract people to explore the building.
- The gap between architectural design and operational management should not be neglected, which may prevent the design intention from being fully realised.

From the dichotomy between the industrial heritage and the waterfront space, to the lively social activities taking place around the regenerated heritage on the riverside, the importance and potential of the regeneration of industrial heritages is self-evident. From the perspective of PSPL, this study analyses the regenerated industrial projects that have

already been put into use, and draws out certain patterns between the architectural interface and pedestrian behavior, providing a micro-scale perspective for the design and evaluation of buildings and their public realms.

Undoubtedly, the PSPL research method can reflect the public life of urban spaces truly and vividly, and it is also a compensate for the distortion of big data urban analytical method at the microscopic scale. However, as the study is mainly based on the direct observation of the researcher, it is difficult to eradicate the researcher's subjective judgement. Therefore, to obtain valid analysis data, the researcher needs to have as much experience as possible in public life observation. As for the analysis of data collected by PSPL survey, other than the behavioral heat map proposed here by using the density of behaviors to simulate a heat map through geometrical fitting, future research may also be based on computational analytical methods such as numerical fitting and machine learning.

Contributor statement

Yifan Dong: Conceptualization, Methodology, Investigation, Visualization, Writing – Original Draft

Jingwen Gan: Conceptualization, Formal analysis, Investigation, Visualization, Writing – Original Draft

Huaqing Huang: Conceptualization, Supervision, Writing – Review & Editing

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Public Spatialisation in China: Rethinking the Interface in Industrial Building Renovations by Local and Transnational Design Firms

Jiawen Han [1], and Wenya Xue [2,*]

[1] Xi'an Jiaotong-Liverpool University; Jiawen Han@xjtlu.edu.cn; 0000-0002-6528-6404
[2] Xi'an Jiaotong-Liverpool University; wenyaxuexwy@gmail.com

Research highlights

1) This research critically analyses different firms' design strategies regarding interface and the new social and spatial dynamics they have been bringing to the city.

2) This research investigates how the educational, social, and cultural differences embedded in Chinese and Western architects have created subtle differences in their understanding and interface strategies towards publicness of space.

3) This research highlights multiple approaches to interface intention in China's urban regeneration and their various impacts on the adaptability of building for new social activities.

Keywords: Interface; Building Renovation; Public Space

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Birgit Hausleitner
Leo van den Burg
Akkelies van Nes

Names of the reviewers:
Birgit Hausleitner
Henco Bekkering

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1. Introduction

Many industrial buildings from the last century remaining in the city centres of post-industrial Chinese cities have been transformed to adopt new functions and new relationships with the urban area. The transition has impacted the shift toward Chinese cities as more public and dynamic places. However, the interface between industrial buildings and their surrounding streets/open space, which has played a key role in this transition, has been overlooked. This study attempts to rethink interfaces in renovation by mapping the three perspectives of permeability, transparency, and interstitiality.

2. Theories and Methods

Public space is inherently contradictory. Madanipour (2010) argues that the involvement of different powers are important for the making of public space. Public spaces are shaped both by "claims" and "the absence of claims"; by open to the public and by withdrawal from the public sphere (Madanipour, 2010). Due to the constraints of traditional Chinese Confucianism and the social hierarchy, many public spaces were in a subordinate position in the ancient Chinese cities. It was not until the entry of Western culture that the idea of urban public space began to be debated and changes were strategically implemented. In other words, public space as one of the most important social and spatial concepts in China since the early 1900s has arisen from the closer contact between the East and the West. From the 1910s, Chinese planners began to borrow Western urban planning concepts and applied them to urban parks, urban squares, and other spaces. From the mid-1950s, Chinese cities began to replicate the Soviet model in which industrial buildings dominated the location of the residential compounds. This gradual implementation from the West redefined the urban form for many Chinese cities within a century, so the theoretical framing of Western analysis of the urban form, especially for industrial areas, has a strong morphological significance for reference.

The industrial survivals in Chinese cities show a strong sense of boundaries and rarely have a positive relationship with the current city. Interfaces are vital in the transformation of the publicness of a space, since the access to the exterior influences the publicness of the space. Therefore, this article focuses on the interface of the industrial heritage and how it has enhanced the continuity of the industrial past and the present city. Interfaces have different evaluation criteria in mapping under different contexts. Typological research by Dovey and Wood (2015) distinguishes the interfaces in modern suburbs of three cities by accessibility, setback, transparency, and mode of access, in which permeability and transparency are crucial factors, and which are also included in the interface mapping in this research. However, the transformation of the industrial heritage in the West is freer in breaking their original spatial form and interface, while China's industrial heritage projects normally choose a relatively implicit way to eliminate its sense of closure. Therefore, this paper also further selects interstitiality, namely the articulation of interfaces in transitional zones between public spaces as proposed by Mehta (2009) as an important aspect for reviewing industrial buildings' publicization in the Chinese context. New spaces created during the renovation, often the interstitial spaces between new additions and the preserved old structures, to some extent articulate the publicness of the interface transitions. This article uses interface mapping, which visualises the documentation on building entrances, glazing, and interstitial spaces. Mapping in this paper is not simply a means of documenting the design of interfaces in the urban heritage, but also for interpreting notions of public spatialisation in renovations among architects by visualising the design of interfaces.

Therefore, this research analyses the interfaces in terms of permeability, transparency, and interstitiality. Permeability means the accessibility of the building interface. The autonomous access of pedestrians to a building requires a large and noticeable entrance. The larger the area of entrance, the higher the permeability, and the more contribution to improve the publicness of the building. For instance, industrial buildings for mass production had few entrances because interior space is for manufacturing instead of attracting people from surrounding communities.

Transparency in this research is not related to the scale of windows nor the transparency of light to interior space. It relates to the visibility of people both inside and outside the building. The more visual contact generated by the building interface between interior space and the exterior street, the higher the transparency of the interface. For example, the transparency is high when the building interface shows dynamic activities or distinctive spatial experiences of the interior space through openings such as glazing. When windows on building interface cannot bring visual contact between inside and outside people, such as when windows are higher than human eye-level or when glazing is intended to reduce the visibility of interior space, the transparency of the building is low. Interface with high transparency will contribute to the publicness of the space.

Interstitiality targeting on space between interior and exterior streets stimulates social activities. Framed by multiple layers of materials, interstitial space is the space between a building façade and its surrounding streets. The volume of space framed by old and new materials is an important factor in stimulating social activities on the building interface. Larger interstitial space between the building façade and the street provides more space for pedestrians and has more possibilities to generate autonomous social gathering.

The existing literature observes strategies to expand the publicness of interface and often interprets social factors instead of completing sufficient analysis on physical space. Social factors in this discourse are difficult to capture, such as space configuration, ownership (private or public), and management of public interest (collective memory and cultural character) (Varna and Tiesdell, 2010, Leclercq et al., 2020), which often leads to a lack of project-based details and evidence of how the publicness is transformed. Nevertheless, when interpreting this discourse using the interface as the perspective to observe physical spaces and then relates them to social impacts, seemingly parallel factors such as the revitalisation of culture, governmental management, and ownership become related. Hence, the role of the interface in the transformation of publicness in public space, though overlooked by existing literature, becomes the viewpoint of this research for targeting the discourse. This research investigates three cases including the revitalization of the entrance to the M Woods Museum by a Chinese firm, Vector Architects, the Garage by Neri&Hu, and the Kunming Rubber Factory by Kokaistudios. Kokaistudios and Neri&Hu

are both international design firms based in China. The legend for permeability, transparency, and interstitially is analysed on how much they contribute to the publicness of a building interface. This study critically analyses each firm's design strategies regarding interface and the new social and spatial dynamics they have been bringing to the city.

3. Results

3.1. Case studies of the permeability, transparency, and interstitiality of interfaces

In terms of permeability, the three cases have all been improved through various methods. The M Woods entrance revitalisation changed the position of entrances, both for guiding interior and exterior circulations and improving accessibility on another side of the building. The Kunming Rubber Factory Renovation did not change the number of entrances, but opened spaces between industrial buildings as public space and moved entrances from one side of the building to the other, which is close to external pedestrian pathways. The Garage by Neri&Hu reduced the number of entrances. However, their design strategies emphasised entrances through an extrusion of materials and signals illustrating the function of interior space. Comparing the three cases on their designs in relation to the improvement of permeability, it is evident that Kokaistudios consider the permeability important for generating public activities. Their approach, which removed the building entrances, is concise. Differing from Kokaistudios, Vector Architects removed entrances intentionally, not only to improve the permeability of the building interface, but also to design the circulation of the public from exterior streets to the interior gallery, and from interior space to exterior streets. Permeability for Vector Architects is related to a continual pathway linking interior and exterior spaces. The Garage by Neri&Hu focuses more on visual attraction instead of physical accessibility. Their approach to permeability is achieved by emphasising the existence of entrances through design instead of positioning entrances close to pedestrians.

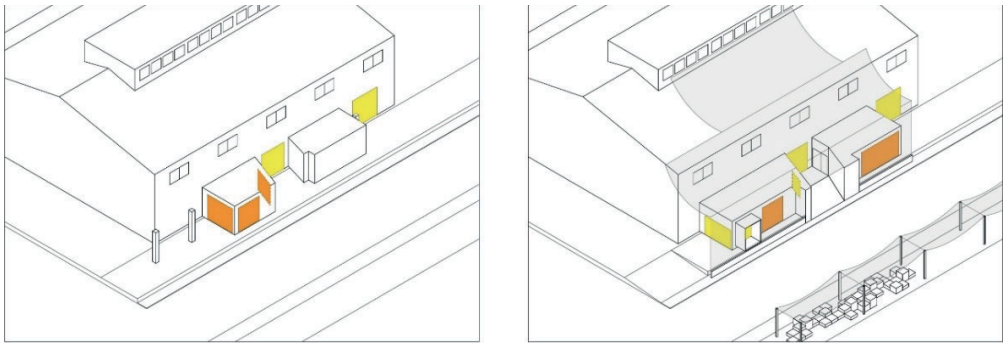

Figure 1. Revitalization of the entrance to the M Woods Museum by Vector Architects

The impacts of design strategies to transparency in these three case studies are different. However, the transparency of the building facades was improved by different extents. The M Woods entrance renovation changed the orientation of windows from parallel to the street to facing the street. The glazing before renovation allowed people in the interior space to see exterior activity. The renovation changed the visibility and allows visual contact between inside and outside people (Figure 1). Except for glazing, the architects applied semi-transparent materials for generating ambiguity. Although the interior space is not clearly shown, the semi-transparent layer improved transparency of the façade. Differing from Vector Architects, the approach by Kokaistudios has limited changes on the ground floor glazing, but improved visibility on the floors above (Figure 2). Although the orientation of the windows did not change during renovation, visual contact between the inside and outside is achieved on the industrial building. The mapping on the transparency of the Garage shows that visual contact from both sides is not as important to Neri&Hu as expressing the industrial memory of the building.

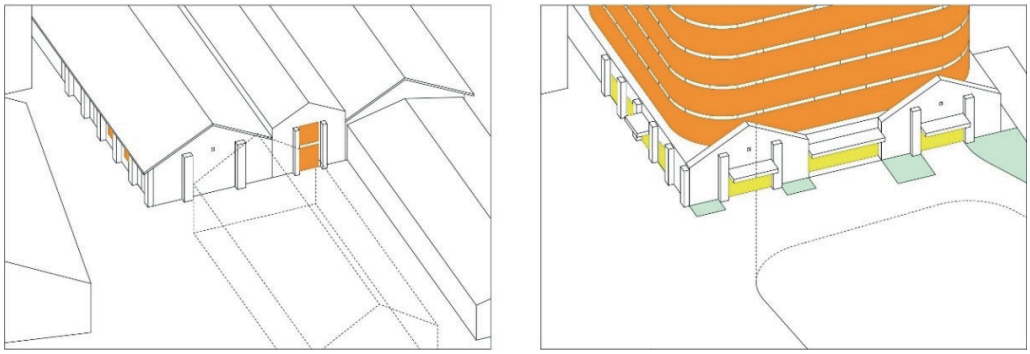

Figure 2. Renovation of Kunming Rubber Factory

The interstitiality of the M Woods Entrance Revitalization was improved on spaces in front of two building entrances and the space under a semi-transparent shelter opposite the main entrance. In this case, interstitial spaces built during renovation are intended to bring visual contact between people. In the revitalisation of the entrance to the M Woods Museum, changes to the permeability and transparency supplemented the creation of an interstitial space. The changes to the three aspects all aimed at stimulating visual contact of the people with the different spaces. The video on the official web page of Vector Architects (Vector architects) shows how the entrance is used by pedestrians. People sit under the semi-transparent shelter, observing others in the gallery, and on the exterior street. Although these autonomous activities are common in many other public spaces, the diversity demonstrates the success of the building interface and its catalytic effect on autonomous social activities.

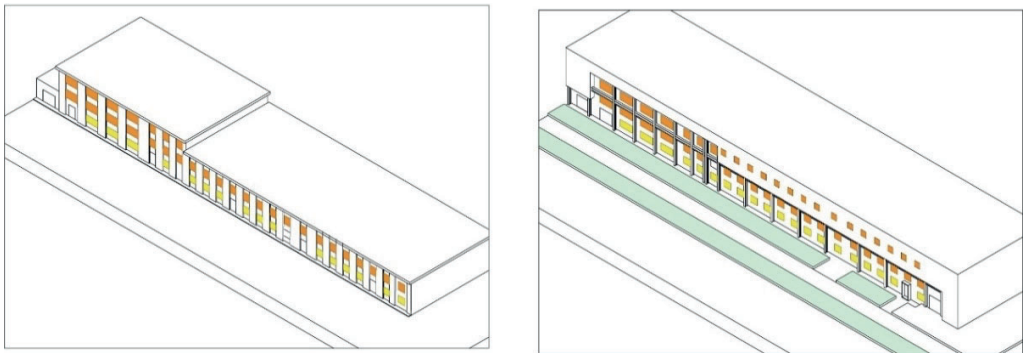

Figure 3. Windows emphasised in the building interface of the Garage

To see and to be seen is the dominant method for stimulating publicness of space in this case. The interstitial space in the Kunming Rubber Factory renovation refers to spaces in front of building entrances which are under cantilevers and framed by landscape. Interstitial spaces by Kokaistudios are not intended to stimulate public activities through public gaze, but to be open to all activities that may autonomously happen. Designs during renovation by Neri&Hu dramatically changed the building interface on its spatial experience (Figure 3). The interstitial space is framed by a brick building façade and steel support added during renovation. Interstitiality in this project is improved through the distinctiveness of the space instead of the temporary human activities that happen in the space.

3.2. Public spaces shaped in different projects by different architects

The design strategies in the three cases led to different results for the permeability, transparency, and interstitiality of the building interfaces, and consequently led to differences in the publicness of the spaces. The entrance of the M Woods Museum creates a public space that stimulates social activities. The renovation of the rubber factory created a public space that citizens can use in multiple ways. The Garage has a public space that evokes citizens' shared memory of its industrial history, which generates an ideological publicness for citizens. The architects' approaches to the building interfaces contributed to the subtle differences manifest in the projects. The three cases selected are in post-in-

dustrial Chinese cities. The projects were undertaken when renovating industrial buildings became an important part of the urban regeneration process. The architects' differing education and practices shaped their understanding of industrial buildings and public spaces, resulting in their different approaches on how to integrate the industrial buildings into the post-industrial urban context.

This research is not intended to justify the connection between their diverse approaches and their cultural and educational backgrounds. Instead, it aims only to raise awareness of the possible differences in the publicness of the spaces due to various potential factors, so that the final spatial outcomes act as different forms of catalyst in the renovation projects and later, affected in different ways the transformation of the cities in China. Among these projects, Vector Architects as Chinese architects blurred the boundary between the old and new structures so that they serve the present usage of people and gave the building and space a new identity, rather than reiterating the building's collective memory. Neri&Hu's chief architects were educated in America, and they tended to emphasize the industrial characteristics. They transformed the building into a city landmark that attracted public attention. In contrast, the architects from Kokaistudios, who came from Italy, tended to minimise the integration of a new addition to an old structure, distinguishing the two clearly in physical space, whilst integrating them by function and using spatial integration for social activities. These strategies have inevitably been adapted to the different projects' requirement and the local contexts. However, the hidden understanding of an industrial building, industrial heritage, public space, and publicness of the local Chinese architects and the transnational firms impacted their strategies and the final spatial configurations.

4. Discussion and conclusions:

Architects' approaches to building interfaces generate different types of public space in Chinese cities. By analysing a building's interface with regard to permeability, transparency, and interstitiality, the impact of design strategies on creating public space has been demonstrated. Although such architects did not explain their design strategies in relation to the public transformation of building interfaces in their design briefings, this research explicitly unfolded these underlying design strategies, which have cast subtle, different aspects of openness during and after renovations had taken place. This has shed light on the spatial design's impact on how the public space can be received by the wider public. It also shows how the educational, social, and cultural differences embedded in Chinese and Western architects have created subtle differences in their understanding and interface strategies towards the publicness of space. It further highlights these approaches to interface intention in China's urban regeneration and their various impacts on the adaptability of building for new social activities. This study enhances the understanding of strategies for interfaces and public spatialisation in the discourse of renovating industrial buildings in China.

Public spaces should be shared by all citizens, enabling public activities to take place and strengthening relationships between people. This type of public space with its openness was rare in traditional Chinese cities, which mainly consisted of enclosed and private family courtyards. However, as it is imperative in a rapidly globalising world to move toward a more-open society and more-inclusive cities, the adaptive reuse of these abandoned industrial buildings provides opportunities to generate usable public space that can be shared by all citizens, thereby revitalising their collective memory of the height of the industrialisation period.

Contributor statement

The authors confirm contribution to the paper as follows: research conception and design: Jiawen Han. Wenya Xue; data collection: Wenya Xue; analysis and interpretation of results: Wenya Xue, Jiawen Han; revision and paper preparation: Jiawen Han. All authors reviewed the results and approved the final version of the paper.

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Track 3

Political Ecology & Adaptive and Transformative Framework

Track editors:

Dr. Diego Andres Sepulveda Carmona
Dr. Fransje Hooimeijer
Dr. Taneha Kuzniecow Bacchin

Change came into its own. Today we experience and acknowledge the nexus of ecology, culture and politics as a moving objective, defined by local realities placed within global developments. Large-scale change is no longer a distant probability but an approaching condition, which forces us to accept instability and envision sustainability transitions as the ground of future inhabitation. When looking closer into atmospheric, water (riverine, maritime, deltaic), and land systems and their inherent uncertainties we realize the agency that local sensitivities, culture and planning regimes have in defining the success or failure of sustainable development. This dialogue will question what the real ground of present and future urbanization is, imagining adaptive and transformative change as material and ecologically sensitive practices to site, context and culture.

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Limited Development in the Shenzhen Bay Area: A Future Model for Coordinated Development of Urbanisation and Eco-Conservation

XING Jiao [1,*], Nai-Huei Casey WANG [2] and Jeroen VAN AMEIJDE [3]

[1,*] School of Architecture, The Chinese University of Hong Kong, 1155155069@link.cuhk.edu.hk; 0000-0001-9874-8866
[2] School of Architecture, The Chinese University of Hong Kong, Casey Nai-Huei Wang, casey_wang@blend-arch.com
[3] School of Architecture, The Chinese University of Hong Kong, jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305;

Abstract: From 1980 to 2018, the urban area of the Greater Bay Area increased from 2607 to 8243 km². Rapid urbanisation has brought a series of ecological damages. Against a background of global sustainable development, future urban planning models for the region should seek a balance between urbanisation and ecology. This study examines current theories for sustainable urban development and the conceptual models for it: Compact City, Eco-City, and Blue Urbanism. It describes a comprehensive model based on the theories and analysis of several model precedents. These include Gothenburg and Helsingborg as examples of compact cities, Stockholm and Malmö as eco-cities, and Toronto and Perth as blue urbanism. The core strategies found were synthesized into a combined model for evaluating future development proposals in Shenzhen. Using Shenzhen Bay as a case study location, the effectiveness of the comprehensive model was evaluated from the perspective of sustainable urban development. While there is no ideal model for the balance of urbanisation and ecology, the comprehensive model provides a method and theoretical basis to control urban sprawl and guide a balanced development of future cities.

Keywords: Urban expansion; Eco-conservation; Eco-cities; Compact City; Blue Urbanism; Shenzhen Bay

Names of the track editors:
Diego Sepulveda
Fransje Hooimeijer
Taneha Bacchin

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Diego Sepulveda

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1. Introduction

The population concentration and the expansion of built-up areas caused by urbanisation greatly affects the function of ecosystems (Wenjing et al., 2020) and has impacted ecological corridors (Deng et al., 2017), bird migration paths, natural habitats (Paker et al., 2014), vegetation cover (González-García et al., 2014), photochemical pollution, and noise pollution (Kempenaers et al., 2014). The goal of sustainable urban development is to achieve a balance among environmental, economic, and social sustainability (Mensah, 2018). This will make the city greener, fairer, and profitable for all the stakeholders (Figure 1). The key conceptual principles of sustainable urbanism include:

- Core values (Stevens et al., 2010): compactness (density), and biophilia (human access to nature);
- Core factors (Schwartz, 2013): urban transportation, energy efficient built environment, carbon measurement and planning, air quality, green energy, sustainable communities, adaptation and resilience, waste management, intelligent city infrastructure, finance, and economic development;

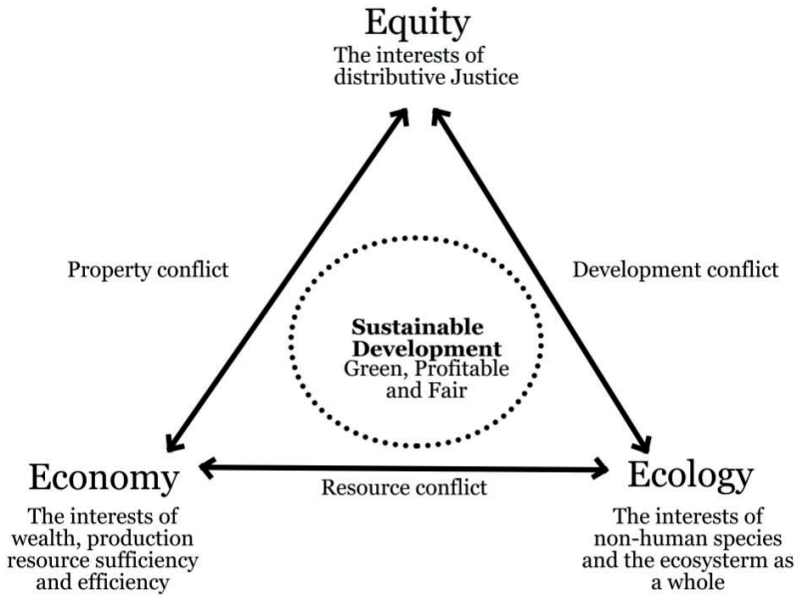

Figure 1. Conflict between key contributors (Moore, 2007).

As the coastal zone of the Greater Bay Area consists of spaces where water and land meet and interact, it is also a zone where urban areas coexist with natural elements, marine life and terrestrial vegetation and species. As any new urban developments in these areas is adapted to topography, water bodies, and shorelines, the urban and natural environment are impacted by new flows of people and resources. It is crucial to consider the balance between urbanisation and ecology, and the impact on local climate, human and ecological health, and sustainable development goals for the urban communities.

Different models have informed the general rubric of sustainability. The Compact City focuses on sustainable development, urban transportation, urban density, and quality of life (Gang et al., 2008), but it's environmental benefits are disputed (Breheny, 1997). The Eco-city model takes the environmental aspects of sustainability as its primary goal while neglecting the economic effect (Hodson & Marvin, 2010). The Blue Urbanism concept proposes the sustainable development of cities and oceans, however, there are still few practical examples of this approach, and the theoretical basis is not fully developed (Beatley, 2014). As the reality of urban development is a complex process involving many parameters and stakeholders, Therefore, extracting positive benefit elements from a single model and using it to synthesize a comprehensive model can achieve the goal of sustainable development in an all-round way and achieve the balanced development of urbanisation and ecology.

The goal of this article is to propose a new comprehensive model that balances between urbanisation and ecology, and test how it applies to the Shenzhen Bay area. The new model could serve as a reference for other development locations, and promote the sustainable development of the many coastal cities in the Greater Bay Area. The paper reviews the existing theories found within related literature, and discusses the rationality of the theories and their arguments. It then analyses case studies that demonstrate and put forward several strategies for sustainable urban development. Based on these findings, a comprehensive model is formulated and tested on the case study site, to explore its applicability and validity.

2. Theories and Methods

2.1. Compact city

The 'compact city' was first proposed in 1973, with its capacity to achieve more efficiency, space, convenience, and accessibility (Dantzig, 1973). The compact city is characterised by high density, and a "pleasant scale and complex functions" (European Commission, 1990). The typical characteristics of this urban model are: promoting urban renewal, preserving farmland, using mixed-use land layout, prioritising public

transportation, and promoting concentrated development of urban nodes (Breheny, 1997). It proposes the formation of urban forms using the principle of "decentralised centralization," relying on good connectivity between urban nodes through transportation and communication technologies (Thomas & Cousins, 1996). In recent decades, the focus of the compact city has shifted from "proximity" to "accessibility" (Zonneveld, 2005). The five spatial principles, related to urban planning include: high density, urban centres at different levels, curbing urban sprawl, reducing the use of car traffic, improving the use of green space and open space, and connecting the urban region by public transport (Kiyonobu, 2011). The impact on lowering emissions and conservation of the countryside are the reasons why the compact city model has been advocated as sustainable (Westerink et al., 2013), and it has been proposed that the sustainability of cities in developing countries can be measured by evaluating their density, land-use mix, transportation networks, accessibility, and shape dimensions (Kotharkar et al., 2014).

The compact city model is considered to be an effective solution to improve urban efficiencies when a city prepares strategic planning and urban design policies (Bibri, 2020). Otherwise, the model may produce adverse effects such as the exposure to pollution by a concentrated population, which affects health (Neuman, 2005). It may also lead to increased housing prices, traffic congestion, and social exclusion (Bramley & Power, 2009), increased crime rates (Burton, 2001), an increased income gap, and a lack of green space accessibility (Burton, 2001). High-density is associated with crowding, leading to reduced amounts of public open space and urban green space per person (Breheny, 1996). The main arguments around the compact city model focus on the environmental benefits, but the social and community sustainability aspects need to be further researched.

Sweden is one of the countries with the highest levels of sustainable development practices (Dryzek, 2021, p. 166). Both Gothenburg and Helsingborg deploy the compact city model towards their urban planning practices and strategies to achieve sustainable development (Bibri et al., 2020). Table 2 gives an overview of their various detailed planning strategies towards a sustainable compact city, organised according to the categories of Compactness, Density, Mixed Land Use, Sustainable Transportation, and Green Structure.

Table 1. Figures of the precedent cities, summarised from (Bibri et al., 2020; Bibri & Krogstie, 2020b; Lau et al., 2008)

	Gothenburg (Bibri et al., 2020)	Helsingborg (Bibri et al., 2020)	Stockholm (Bibri & Krogstie, 2020b)	Malmö (Bibri & Krogstie, 2020b)	Shenzhen (Zhou & Karlskrona, 2010)	Hong Kong (Lau et al., 2008)
Land area (km^2)	447.8	346	5400	159	1997.80	1110.78
Population	599,000	135,300	806,000	344,100	17,560,000	7,500,700
Average age	39	40	39.8	37.9	34	85
Issues	Urban sprawl; High immigration; Density of built areas	Urban sprawl; Density of built areas	Urban sprawl; Restore brownfield areas; Traffic congestion;	Loss of green space; Restore brownfield areas; Traffic congestion	Lack of land resource; Unbalanced development; Car-oriented situation;	Loss of green space; Urban development; Traffic congestion
Policies	Compact city comprehensive planning	Compact city eco-city	Eco-city;	Eco-city	Compact city	Vertical city Compact city Sky city

Table 2. Strategies from precedent cities to achieve sustainability goals, summarized from (Bibri et al., 2020; Bibri & Krogstie, 2020b; Beatley, 2014)

Design principles	Strategies for environmental, economic, and social sustainability
Compact City strategies : Gothenburg and Helsingborg (Bibri et al., 2020)	
Compactness	• Build and develop centrally • Concentrate on strategic nodes • Complement and mix • Reserve outer city areas for future development
Density	• High density of built objects in designed and emergent compact urban form • Diverse scales of built objects • Distribution of building footprints with frequent larger buildings • Greater density in strategic nodes • Prioritization of density close to the central points of strategic nodes • High density combined with multidimensional mixed land use
Mixed Land Use	• Physical land use mix (business activity, production, consumption, etc.) • Social mix (housing, demography, lifestyles, etc.) • Greater mix of housing, business, and facilities in strategic nodes • Multidimensional mixed land use combined with sustainable transportation
Sustainable Transportation	• Cycling and walking • Public transport (metro, buses, tram, etc.) • To improve mobility management infrastructure • Cooperate with sustainable transportation, multidimensional mixed land use and high density • Network structure of link areas to connect the major nodes of the transport system • Separate lanes for the public transport • time and a punctual and reliable system • More services along the main corridors • An easy to understand, safe, and secure system for guaranteeing quality and service • Multi-model travelling in strategic nodes to support their dense, mixed use central points
Green Structure	• Green areas and parks • Green areas hand in hand with density • Protection and integration of natural, agricultural, and cultural areas through intensification
Intensification	• Increase in population • Increase in redevelopment of previously developed sites, subdivisions and conversions, and additions and extensions • Increase in development of previously undeveloped urban land and buildings • Increase in density and diversity of sub-centres • Investment in and improvement of transport infrastructure and services
Eco-city strategies: Stockholm and Malmö (Bibri & Krogstie, 2020b)	
Sustainable energy systems	• Local production of electricity – solar energy • 100% locally renewable energy – sun, wind, and water • Passive houses • A large-scale smart grid
Sustainable waste management	• Smart waste collecting system • Vacuum waste chutes system • Food waste disposers • Wastewater and sewage treatment system • Behavioural change
Sustainable materials	• Recycled and reused materials

	• High performance and resource – effective materials
Sustainable transportation	• Cycling and walking • Public transport • Car-pooling (biogas and electric) • Mobility management • Behavioural change
Green and blue infrastructure	• Greening • Rainwater harvesting • Ecological diversity • Green factor supplemented with green points • Green parks • Green streets and alleys • Green roofs • Rain gardens • Bioswales • Permeable pavements
Mixed land use	• Physical land use mix (horizontal/spread of facilities, vertical mix of uses, amenity, public space, etc.) • Economic mix (business activity, production, consumption, etc.) • Some aspects of social mix (housing, demography, lifestyles, visitors, etc.)
Economic growth and business development	• Green-tech innovation • Green-tech production and export • Entrepreneurial and innovation-based start-ups • Industrial and technological investment • Job creation and skill development • Government, industry, and academia collaboration • International cooperation
Social equity	• Social integration • Flexible design of housing in terms of types and forms • Affordable housing by means of an efficient, careful process • Greater accessibility to facilities and services
The quality of life	• Meeting places for social interaction • Ready access to recreational and green areas • Natural surveillance: safety and security • The whole stage of housing design
Social cohesion	• Citizen participation and consultation • Multi-stakeholder cooperation • Well-being of all inhabitants
Blue Urbanism strategies : Toronto and Perth (Beatley, 2014)	
Raise citizens' awareness	• Cultivate empathy for Marine life • Encourage students and residents to participate in conservation efforts
Waterfront redevelopment	• Diversified coastline functions • Hydrophilic facilities • Oyster breeding plan • Contact with water • Greenway access to river • Water trip • Buildings connect to the Marine realm
Urban Planning to protect the ocean	• Set aside protective zone • Assess the impact of development on the ocean • Floating cities
Reduce city pollution emissions	• Blue roofs blue urbanism

From analysis these case studies, we can summarise some key aspects of the compact city principles, which include nearness, connectedness, and accumulation (Bibri et al., 2020). The Comprehensive Plan for Gothenburg and The Master Plan for Helsingborg

focus on three aspects of implement compactness (Helsingborg, 2010a; Gothenburg City Council, 2014a):

- For the central area and the surrounding areas: a combination of concentrated and high-density developments of commercial functions, providing intensive employment and family housing;
- Concentrating on Strategic Nodes, intermediate city: focuses on developing mixed-function buildings, public transportation systems, and enhancing connectivity and accessibility to centrally located areas;
- At the urban boundaries area: designate natural green spaces for their ecological value and future protection.

As a result of these policies, the scope and influence of the central urban area has been expanded, densified, and been made more accessible and attractive. Expanding outwards from its historic centre location, the central district supports the needs of commercial premises and services, provides shorter travel distances, gives more people the opportunity to walk or cycle, and accommodates housing and employment growth within the perimeter of the existing urban area.

As Shenzhen Bay experiences population growth, urban sprawl, and a reduction of ecological land, the areas face questions such as how to reduce land-use intensity, improve living quality, provide affordable housing, education, and employment (Feng et al., 2016). The compact city model could provide solutions to these challenges: employing strategies of 'build and develop centrally' and 'concentrate on strategic nodes,' to protect ecological habitats, bird migration corridors, and other ecological benefits through intensive land-use and containment of urban expansion. And the principles of 'density' and 'mixed land use' can provide more people with employment opportunities, reducing commuting and related emissions, improving the efficiency of land. Finally, strategies for sustainable transportation can alleviate traffic congestion, reduce traffic pollution, improve accessibility, and connect strategic nodes, so as to promote border fusion and improve the quality of life.

2.2. Eco-city Theories

In 1898, Ebenezer Howard proposed a new social city model, the "Garden City" to alleviate urban overcrowding and environmental degradation, and make cities self-sufficient. Howard also envisaged polycentric urban agglomerations, with larger cities connected to multiple satellite cities through roads and railways (Howard, 1898). In 1971, the concept of "eco-city" was first put forward (UNESCO, 1971). Since the 1990s, the eco-city concept has become diversified because of global awareness of climate change. Some focus on walking, biking and mass transit for everyday mobility to reduce environmental impacts (Engwicht, 1992). Others focus on measures to restore urban ecosystems at brownfield sites, improve air quality and make better use of water resources (White, 2002). The evolution of "eco-city" concepts is summarised in Table 3.

Table 3. The evolution of the "eco-city" concept

Theory	Author	Time	Theme
Garden city (Howard, 1902)(Howard, 1902)(Howard, 1902)(Howard, 1902)	Ebenezer Howard	1902	To balance the proportion of residential, industrial, and agricultural areas from thinking about public service, facilities and green belts, social opportunities, gardens, urban planning
Cities in Evolution	Patrick Geddes	1915	Human society should achieve a balance between supply, demand and with the natural environment
The culture of cities (Lewis, 1938)(Lewis,	Lewis Mumford	1938	Human society is to keep balance with the natural environment and social conditions

1938)(Lewis, 1938)(Lewis, 1938)			
Design with nature	Lan Lennox McHarg	1969	Geography, topography, groundwater, land use, climate, plants and wildlife are integrated into the basis of regional landscape and urban planning
Eco-city	UNESCO	1971	Strengthen circulation and optimisation of urban systems, to efficiently utilise resources and energy
Calming the traffic	David Engwicht	1992	Public transportation should be the main form of mobility in cities
The essence of eco-city	Mark Roseland	1997	Eco-city planning, greening city, green economic development, and ecological community design
Transport dimensions (Kenworthy, 2006)(Kenworthy, 2006)(Kenworthy, 2006)(Kenworthy, 2006)	Jeffrey R Kenworthy	2006	Ten key transport dimensions for sustainable city development: compact, mixed-use urban form, well-defined higher-density, human-oriented centres, priority to the development of superior public transport systems and conditions for non-motorized modes, with minimal road capacity increases, and protection of the city's natural areas and food-producing capacity.
Biophilic cities (Beatley, 2011)(Beatley, 2011)(Beatley, 2011)(Beatley, 2011)	Timothy Beatley	2011	A city that puts nature first in its design, planning, and management
Eco-urbanism (Kenworthy, 2019)(Kenworthy, 2019)(Kenworthy, 2019)(Kenworthy, 2019)	Jeffrey R Kenworthy	2019	Mobility patterns: Discusses the strengths and weaknesses of public transport, walking, and cycling patterns of urban regions in Southern Sweden, and the key policy directions for improvement.

The Eco-city concept aims to achieve a healthy and liveable environment for human beings through low resource consumption and low environmental intervention (Bibri & Krogstie, 2020a). However, 'ecology' is a broad concept, and it is difficult to judge whether each eco-city application achieves sustainable effects (Bibri & Krogstie, 2020b). Until now, although there have been many practical eco-city initiatives, no unified definition of the concept has been agreed upon (Holmstedt et al., 2016). Scholars argue that there are deficiencies in the formulation of intelligent solutions, relevant to urban processes and practices (Bibri, 2019). It is felt that the eco-city concept focuses too singularly on the construction of ecological environments, while not fully considering the economic and social impacts or benefits.

The city of Stockholm, with its strong environmental policies and focus on improving the quality of life of its citizens, has been at the forefront of ecological thinking (Lindström & Eriksson, 1993). Meanwhile, municipalities in Stockholm and Malmö have incorporated "green structures" into their masterplans (Bibri & Krogstie, 2020b). Table 2 lists the eco-city related planning principles, organised within the categories of: sustainable energy systems, sustainable waste management, green and blue infrastructure, mixed land use, economic growth and business development, social equity, quality of life, and social cohesion.

The Stockholm Royal Seaport (SRS), located between the inner city and the nature, is a brownfield area of 236 hectares that is being redeveloped. Through the construction of a new bio-fuel cogeneration plant in the SRS district, Stockholm can reduce CO_2 emissions by generating 10% of its electricity demand and 25% of its district heating needs (Stockholm city, 2009). The Western Harbour district in Malmo has implemented solar panels for heat and power production on buildings to reduce the use of energy resources. Both SRS and Western Harbour used recycled materials in the construction of streets and alleys, and created resilient areas with flood control, recreation, and biodiversity through new parks, courtyards, and green roofs in the community. In relation of general environmental sustainability, the two urban districts save energy and reduce energy demand through renewable resources (solar, wind, and water, bio-fuel thermoelectric systems, passive solar houses); reduce material resources through sustainable building materials; and reduced pressure on green spaces, ecosystem, and biodiversity through green structures and green factor planning tools (Bibri & Krogstie, 2020a).

Shenzhen Bay is a large ecological and natural area with nearly 100,000 migratory birds using it as a refuelling station every year. During further development of the area, it is crucial to consider how to minimise human intervention in this ecological environment, while also providing healthy and liveable districts for human populations. The eco-city concept provides several strategies to balance these contradictory requirements. Additional policies to minimise resource consumption, reduce environmental intervention, and introduce "green structures" can reduce marine pollution, expand the range of birds' activities, and enrich biological species.

2.3. 'Blue Urbanism'

Before the 1980s, the research focus of waterfront cities was port development, urban expansion, industrial development, and the interaction with regional development (Hoyle & Hilling, 1984). Since the 1980s, the spatial utilisation and spatial diversification of the port city interface has attracted widespread attention (Jolliffe, 1990). In the 21st century, since the impact of urbanisation on the environment and ecology has gained awareness, more scholars have begun to focus on the relationship between port city development and the environment (Ruiming, 2014).

In 2011, the concept of Blue Urbanism was first proposed, addressing city-ocean relations and proposing relevant strategies from the perspective of urban design (Beatley, 2014). As the relationship between cities and oceans has changed from development and demand to interdependence, several strategies such as port-city interaction, marine conservation, waterfront revitalisation, and public participation have been introduced as part of a balanced development approach. The goal of Blue Urbanism is to raise awareness of marine protection and balance the development of cities and oceans: to assess the impact of urban construction on the ocean, and rationally plan the expansion of human settlements in relation to water (Beatley, 2014). In the context of land use rights and recreational use, more attention has been paid to the fairness of water use rights (Dahmann et al., 2010), the importance of water bodies and how they are affecting human health (White et al., 2016). Between experts different definitions on what is included in the term 'Blue Infrastructure' (Scholz et al., 2013) and recent scholars have argued that the definition should more closely match how ordinary citizens appreciate and use water features and area (Preller et al., 2016). Blue Infrastructure is now defined as "all designated physical and technological entities related to water bodies and flows," and forms the basis for the definition of Blue Urbanism (Falkenmark & Rockström, 2010).

Lake Ontario, Toronto, shows the transformation and ecological restoration of a hydrophilic and diversified waterfront. Perth's example shows how buildings can connect to the Marine Realm and the benefits (Beatley, 2014). Table 2 lists the principles for the blue urbanism: raising citizens' awareness of the ocean and its life, urban planning around waterfront redevelopment, reducing city pollution emissions into the ocean. The Toronto waterfront project creates possibilities for people to have different levels of contact with the waterfront, and a diversified experience of coastal space functions. The total amount of pollutants in Perth's streets flowing into the sea has been greatly reduced with the implementation of the 'Blue Roof' initiative; the roof was designed to detain stormwater and provides sustainability benefit through rooftop cooling. Although the solutions demonstrated would need to be adjusted to fit other locations, the principles shown in the

two precedents could help provide a basis for guiding aspects of the further urbanisation of the Shenzhen Bay waterfront areas.

3. Proposition of a Synthesis Model

As part of this study, a new comprehensive model, which is suitable for urban developments in coastal regions for balanced ecological and urban development, was formulated based on three dimensions: urban planning and layout, community environment shaping, and urban waterfront shaping and marine conservation. The new integrated urban development model is as follows:

- From the perspective of planning and layout, strategies to achieve sustainability are deduced from the Compact City theories, and the precedents of Gothenburg and Helsingborg: compactness, density, mixed land use, sustainable transportation, green structure, intensification;
- From the perspective of community environment-shaping, the extracted strategies of ecology and social sustainability are: sustainable energy systems, sustainable waste management, green and blue infrastructure, mixed land use, and economic growth and business;
- Based on the theory of Blue Urbanism and the case studies, the selected strategies to achieve sustainable waterfront space modelling and marine conservation include: raising citizens' awareness of the ocean and its life, waterfront redevelopment planning, and reducing city pollution emissions into the ocean.

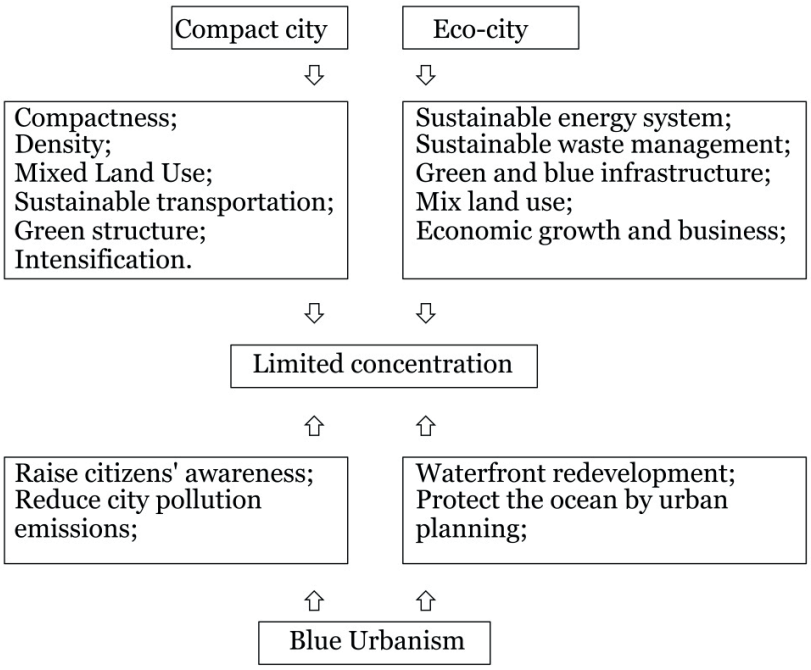

Figure 2. The synthesis model for Shenzhen Bay

The integrated model includes strategies and principles for 'urban planning and layout,' 'environment shaping and micro-intervention within the community,' and 'waterfront space-shaping and Marine conservation at the city boundary.'

4. Case study testing

The final stage of the study involved testing the comprehensive framework on the Shenzhen Bay site location. This stage included analysing the current conditions in the area. Then, the existing conditions were compared with the comprehensive model to

identify issues for improvement in relation to urban development and environmental sustainability. Based on these findings, a future development strategy was formulated.

4.1. Site Context

Due to its economic success and rapid urban development, Shenzhen has in recent decades accumulated a highly concentrated population and features a dense traffic network, high density housing, and relative low proportions of public green space. Hong Kong, in contrast, has large areas of green space, and a more dispersed population agglomeration clustered in high-density urban nodes. Its traffic network mostly covers the urban areas. The strict security at the Shenzhen-Hong Kong border and the different modes of urban development and positioning on the two sides, result in relatively limited cross-border exchanges. Around the case study area of Shenzhen Bay, access to and utilisation of waterfront areas is contrasting: the north side features many connections and dense functional areas, while the south side only has a few residential villages near the waterfront, connected by a limited number of transport links (Figure 3).

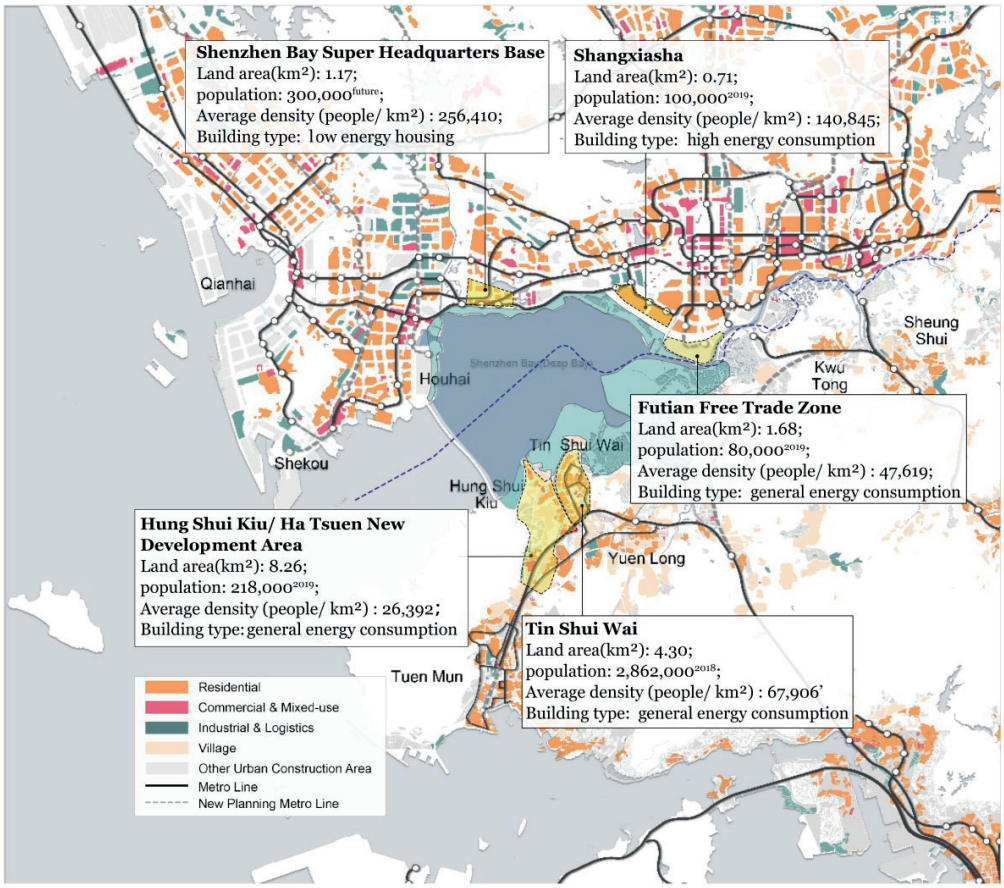

Figure 3. The property of land-use around Shenzhen Bay (Source: OpenStreetMap)

The area has seen extensive land reclamation to address the shortage of land for urban development. From 1980 to 2005, 1963 ha of coastal land has been added through reclamation (Jianfang, 2013). After 2005, the reclamation activities have reduced, but the ecological environment of the bay has deteriorated further, resulting in reduced coastal tidal flats and wetlands, a decline in marine biodiversity, and impacts on fish habitats and bird migration routes (Lijuan, 2007). Large-scale construction areas have not effectively dealt with, and sewage and pollutants are directly discharged into the sea, causing marine pollution and seriously affecting the survival of sea life and biological systems. The rapid land expansion and transformation has compressed coastal areas and reduced natural ecological green spaces. The damage and reduction of ecological areas has also reduced their potential contribution to human quality of life and well-being.

Shenzhen's urban areas feature highly intensive land-use, while there is almost no ecological public green space. Surrounding ecological areas are under pressure to provide more land for construction. The sprawling urban clusters across the region have resulted in uneven access to public transportation and some areas have low land utilisation rates. Land function consolidation and waterfront space remodelling can be considered to improve transport and land-use efficiency, liveability, and interconnectivity in the region (Figure 4).

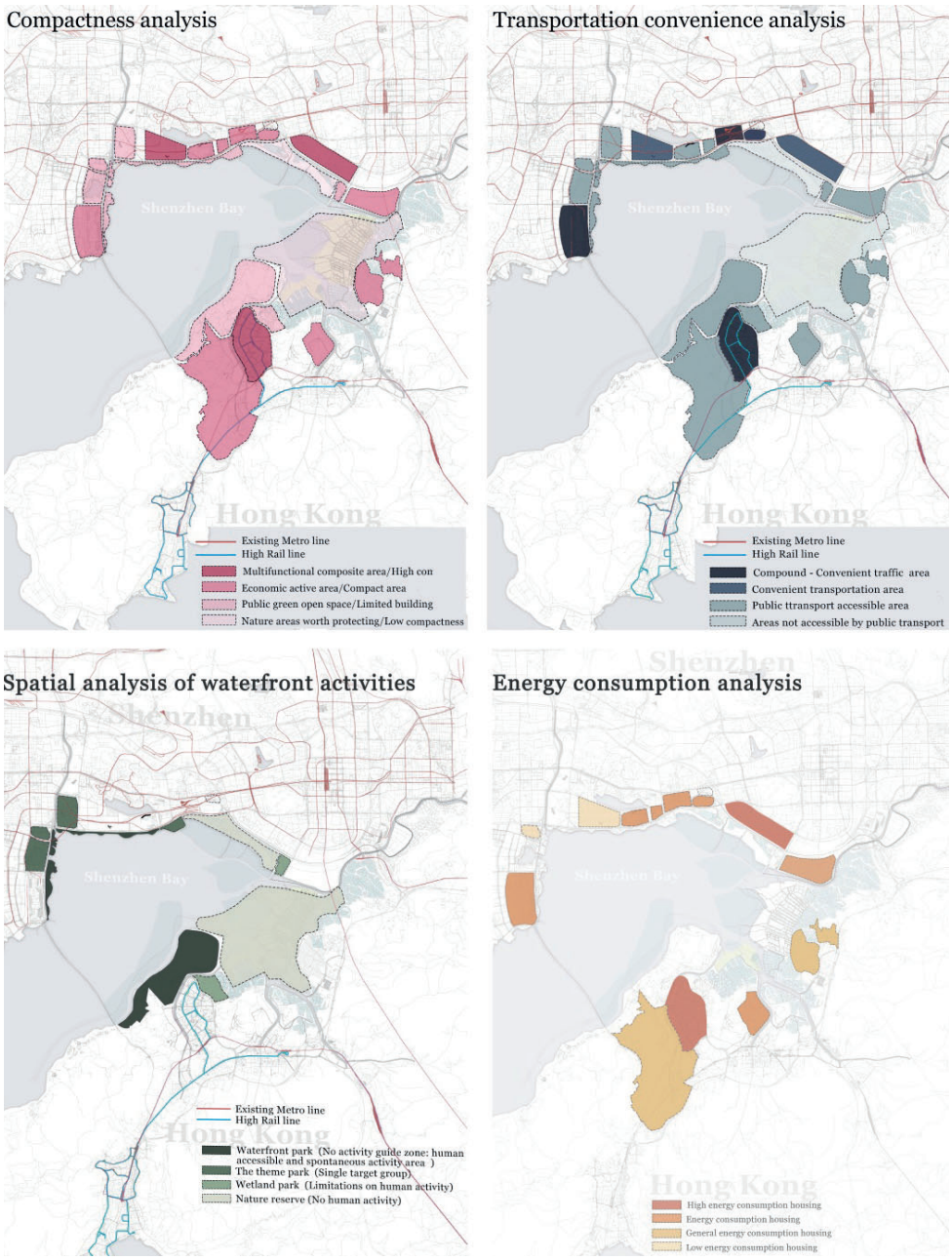

Figure 4. Spatial analyses of Shenzhen Bay (Source: author).

4.2. Site Analysis and Intervention Strategies

With the high demand for urban development land, cultivated land, and ecological green space have been repurposed, and the ecologies at the regions urban boundaries have become fragile. As the decrease in ecological green space affects the urban micro-climate, air quality, and possibilities for recreation; the sea area reduction and seawater pollution have reduced the Bay Area's capacity for seawater purification. To alleviate the

contradiction in land demand for urban development and green spaces, the area could benefit greatly from a comprehensive and sustainable urban development strategy, incorporating economic aims as well as steps towards the improvement of the natural environment to benefit the health of residents. After comparing the Shenzhen Bay area and the comprehensive model, a selection of corresponding strategies was identified to be applicable to be translated to the case study site (Table 4).

Table 4. Design strategies for Shenzhen Bay

Recommendations	Principles	Strategies
Areas	Shenzhen Bay	• Polycentric-compact urban layout • Increase the release of ecological green space • Redevelopment waterfront space • Sustainable cross-boundary transport system • To reduce pollution.
	Hong Kong Side	• Diversified coastline functions • Sustainable transport • Waterfront accessibility.
	Shenzhen Side	• Polycentric-compact urban layout • Greater density in strategic nodes • Mix-land used • Releases an ecological corridor • Continue green loop system • Green streets and alleys
Layers	Urban planning	• Polycentric-compact urban layout • Sustainable transportation • Releases buffers of green public space set aside protective zone
	Building technology	• Convenient and smart waste treatment system • 100% locally general renewable energy • Green and blue roof • High performance materials • Apply the Application of Solar Energy Technology in buildings
	Mixed use	• High density combined with multidimensional mixed land use • Community supporting centralized layout • Composite building functions
	Infrastructure construction	• Efficient access to facilities, public space, safety, affordable housing，jobs, and education • Hydrophilic facilities

		• More services along the main corridors for greater frequency • Network structure of link areas to connect the major nodes of the transport system • implement the policy of 'low energy consumption – recycling' in the community
Policies	Urban design that preserves the possibility of future development	• Implement the planning policy of compact, land saving, balanced development of natural excessive zone and considering the reservation of future urban development space • Promulgate uniform development indicators and monitoring standards • Green street and green alley in the planning.
	Energy consumption and construction process	• No food waste policy • Solar Energy Technology in the building • 'Low energy consumption – recycling' in the community • High performance and resource materials
	Government decision-making and public participation	• Assess the impact of development on the ocean • Multi-stakeholder cooperation • Encourage Social integration policy: Set up Bay Area Common protection centre, no regional restrictions on jobs.

4.3. Site Transformation

Some places do not meet the desirable sustainability criteria by comparing the case study area with the comprehensive model. This highlights how urban sprawl interferes with ecology, and what specific intervention strategies could be implemented to improve conditions as specified in the comprehensive model.

Less Compactness

Firstly, the urban form of Shenzhen Bay does not fully match the planning model of 'Central Core + Strategic Nodes.' Secondly, the urban plots and buildings are lacking a diverse function mix, or the mixing degree is low. Thirdly, the city's sustainable mobility networks are not fully developed. Although the coverage rate of the subway system in the north of Shenzhen is relatively high, the coverage rates of cycling and walking networks are low, and the accessibility to the waterfront and public green space can be improved (Figure 3). Finally, the Shenzhen Bay area has an imbalance in regional development. For the Shenzhen side, the large-scale, homogeneous, and medium density plot layouts encroach on the original ecological landscapes, while on the Hong Kong side it's just the opposite with wild Green Space and centralised construction nodes.

In conclusion, at the planning level of Shenzhen Bay, a lack of compactness, squeezing of natural ecological space, a discontinuity of transportation networks, and an imbalance of development between Shenzhen and Hong Kong can be observed.

High energy consumption and impacts on the environment

For the northern and western areas around Shenzhen Bay, the frequent land reclamation and construction activities have decreased the ecological environment (Figure 4). There Are low-density buildings along Shenzhen Bay, using older types of construction and materials, and long-distance commuting results in higher energy use.

Waterfront renewal and marine conservation need to be optimized

Due to land reclamation and urban construction in Shenzhen Bay, the degree of sea water pollution is the highest across the entire Greater Bay Area (EPD, 2019), the waterfront accessibility along Shenzhen Bay is poor, and lacks spatial diversity (Figure 4). As a result of previous stages of rapid urban development, the area features disorderly construction based on short-term economic pursuits. Many parts of the waterfront space are inaccessible to the public, which is desirable in protected ecological areas, but undesirable in other sites where the coastal areas could be more effectively used for recreational or limited urban development.

Intervention strategies for future transformation

To create a Bay Area in which urban development is balanced with ecology, the study explores several speculative policy interventions:

- The urban planning strategy should identify and intensify different urban centres, connected to a network of sub-centres to form a polycentric urban region. The main urban centres can be strengthened by high-density, mixed-use developments, following the Compact City model arranged around sustainable transportation nodes and lines, forming a compact city region: innovation centre, cultural centre, live+work centre, regional integration, eco-new town, and a new city centre. The urban space released between the compact centres can be used for ecological restoration and reserved for future urban spatial development. This is to restore ecology and achieve sustainable urban development.

- Around the Shenzhen Bay area, new public transport links and recreational routes can be constructed to facilitate regional exchange (Figure 5). This loop system can feature a light rail route and several fast ferry connections to link the different urban centres. Recreational routes and new diverse public spaces and landscapes can be created around the coastline to achieve waterfront renewal and accessibility. At the Shenzhen-Hong Kong boundary, a cross-border exchange area can be established to promote collaborative innovation and technology enterprises.

- Inside the urban areas, policies aimed at lowering energy consumption, pollution and increasing recycling can be implemented in communities. Buildings and urban spaces can be transformed through policies that promote the use of solar energy technology, green streets, and green alleys.

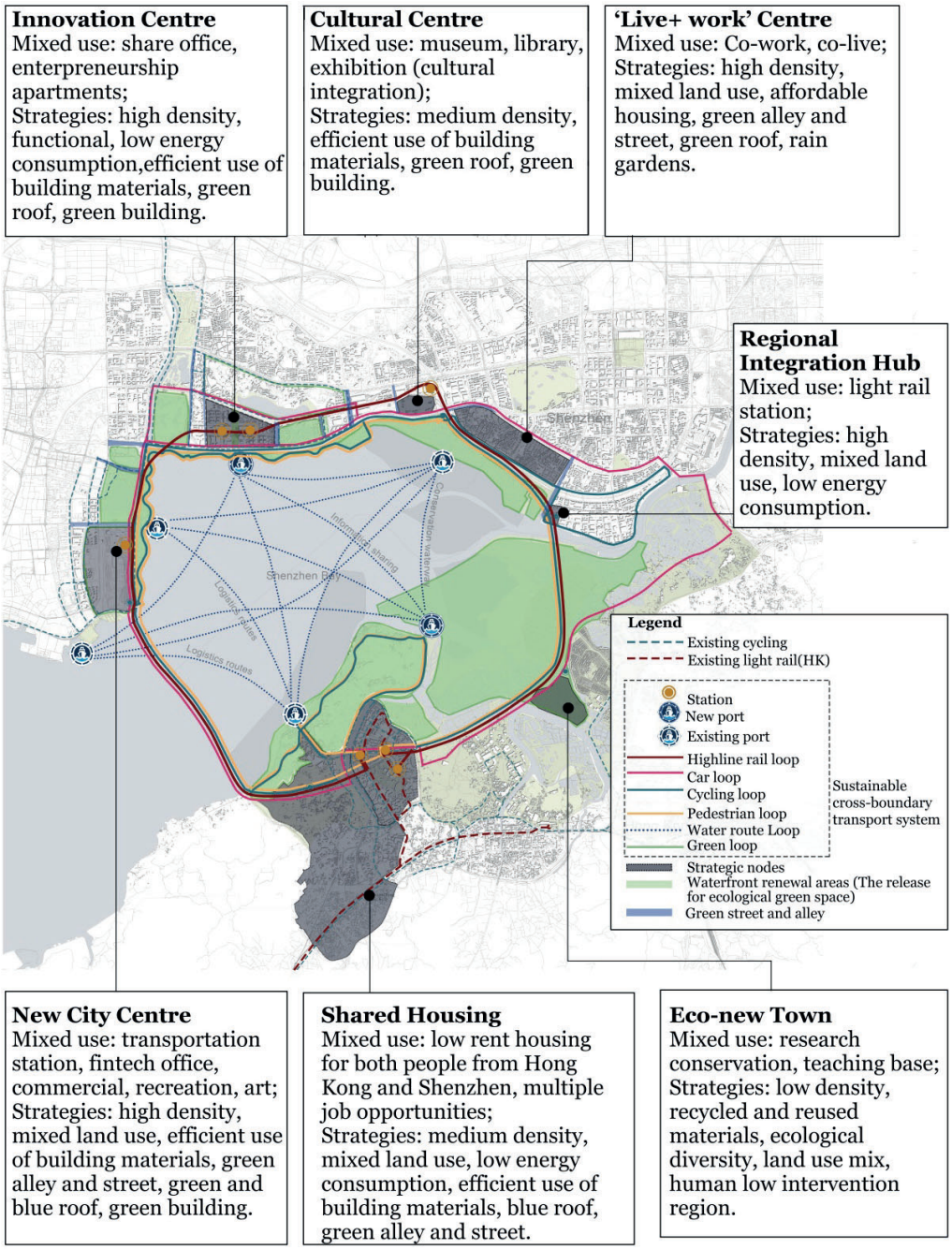

Figure 5. Speculative eco-urban development scenario for Shenzhen Bay (Source: author).

The future scenario visualised here would enable shorter and faster connections between different urban communities and provide better access to nature and recreation. The regional urban and ecological development strategy would improve the quality of life, urban micro-climates, and support mental, physical, and community health. It would stimulate new urban development in selected areas, while maintaining and strengthening sites of ecological importance.

5. Discussion

The boundary of a waterfront city is a sensitive and multi-dimensional space involving urbanisation, natural ecology, and the ocean. Current urban development theories often consider only one dimension, such as ecological restoration, waterfront space development, or transport system efficiencies. A more comprehensive and

integrated approach is needed for coastal cities, to guide the strategic development of urban construction, infrastructure, and public spaces in relation to the surrounding natural environment, resources, and ecosystems.

The 'limited development' model explored in this study aims to achieve a compact urban layout, liveable high-density and mixed-use areas, sustainable transportation, and integrated green networks and spaces. The coastal location of many urban centres in the Greater Bay Area implies that a more developed waterfront renewal and ocean conservation policy is needed to achieve a balance between urban development, human health, and healthy natural systems, species, and climates.

Compactness is at the core of the comprehensive model developed in this study. At the regional level, concentrated urban development means that space can be reserved for nature, agriculture, and species, while allocating strategic locations for compact future urban development. The compact city strategy needs to be combined with urban design strategies to safeguard liveability: considering urban ventilation and pollution dispersion, maintaining affordable housing and social inclusion, comprehensive traffic and public transport solutions, and the provision of safe and green public spaces. A lack of strategic regional planning and compact city policies may result in the inefficient use of limited land resources and the damaging or eradication of ecosystems, therefore the development of urban and natural areas should be considered in relation to one another.

6. Conclusions

This paper has presented a strategy for urban expansion and ecologically balanced development in the Shenzhen Bay area, consisting of three dimensions. Firstly, considering Bay area as a whole and based on the concept of a polycentric-compact urban layout, it has been proposed that the Shenzhen side could focus on the strengthening of polycentric urban nodes, and on the expansion of green spaces for natural habitats, while the Hong Kong side should focus on ecological conservation and waterfront space activation. Secondly, at the level of the urban communities, sustainable processes should be promoted such as reduced energy consumption and pollution, by improvements in construction technology, building materials, urban function mixing, and public transport enhancement. Finally, from the perspective of local policies, sustainable lifestyle changes should be promoted, and public participation in collaborative environmental improvement projects should be encouraged.

In this study, a comprehensive model for 'limited urban development' was developed based on the theories of the Compact City, Eco-City, and Blue Urbanism. This model provides a theoretical basis for how to improve sustainability, efficiency, resilience, equity, and quality of life, as well as integrating the consideration of ecological systems and marine conservation in the analysis and planning of cities. While it gives a general framework for evaluating future planning strategies, the effectiveness of its implementation depends on detailed further application. As the 'limited development' model tested in the Shenzhen Bay area shows, by analysing existing urban densities and identifying areas for further intensification, it is possible to provide more housing and work with convenient commuting distances, while maintaining green spaces and waterfront areas that balance the needs for animal habitats and human recreation.

Either high urban density or urban sprawl models are the type that can affect people's physical and mental health and reduce the quality of life of the community. Therefore, there is no ideal single model for the most sustainable or liveable form of urban development. The key insights produced with the comprehensive model presented in this paper are that a balanced approach to urban and ecological development requires collaboration across different disciplines and decision-making bodies. Planners and urban designers can adopt methods and strategies developed in theory and in practice, to approach the measurement and implementation of sustainable urban practices in a comprehensive manner. The balanced development of future cities involves a careful planning of density, liveability, and mobility in relation to the natural surroundings which sustain and enrich urban life.

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Potential Dimensions of Socio-Environmental Approaches as a Platform for Local Co-Development under Climate Change Variability

Diego Sepulveda-Carmona [1,*]

[1] Delft University of Technology, Faculty of Architecture and the Built Environment, Department of Urbanism, Section of Spatial Planning and Strategy; d.a.sepulvedacarmona@tudelft.nl; https://orvid.org/0000-0002-7491-8629

* Corresponding author[1]

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Diego Sepulveda
Fransje Hooimeijer
Taneha Bacchin

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Taneha Bacchin
Carmen Mendoza Arroyo

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Abstract: The governance of urban processes, in the face of the effects of variability and extremes of climate change, determines the complex approach to address them – especially because of their inherent uncertainty and the high infrastructure cost that their solving entails. The urgency of the responses and actions imposed by extreme weather events transfers additional complexity to less developed societies, given the drift towards sectoral responses and the structural lack of financing at the municipal level. This article proposes a two-pronged approach, linking climate adaptation processes and strategies to local development. This double effect would facilitate the process of adaptation to climate change through the active integration of a wider range of actors in local development, integrating agendas and actions of greater complexity, ensuring a long-term perspective of evolutionary change. The article is defined from a theoretical framework with a transdisciplinary perspective to validate the link between climate change strategies and local development. It is presented through a case study, establishing a framework for possible interventions with integrated objectives, in order to determine policy recommendations and local development strategies within the characteristics and conditions recognised in the case study, and pays special attention to the high level of informal settlements in abandoned areas and the limited economic capacity of the municipality to cope with their needs.

Keywords: Climate Change Adaptation; Transdisciplinarity; Local Development

Contextualising climate change variability and local development through adaptation

The literature on adaptation to climate change has its basis for discussion in risk management, expanded in the recognition of the levels of vulnerability (social, economic, and environmental) present in each place and defined in its specific conditions. The assessment of these conditions is the fundamental factor in implementing the necessary socio-environmental change. This is more evident in locations that have asymmetric responses to the satisfaction of basic needs, such as the main urban localities of the Reconquista river basin in the Greater Buenos Aires area, considered here as a case study.

[1] This study considers transdisciplinarity from the perspective of D.J. Lang et al., (2012) as a reflective, integrative scientific principle articulated by co-participatory methods that aims to solve or transition social problems and, at the same time, related scientific problems by differentiating and integrating knowledge from various scientific and social disciplines.

One the one hand, the historical socio-cultural conditions of the main inhabitants of the intervened area, shows high levels of poverty, and on the other hand the deviation of responsibilities to the local municipal levels do not match the institutional technical and financial capacities needed to respond to the increased complexity of the urban context. In line with the risk described by Fratini et al. (2012) of the socio-economic decay that characterised the informal areas and its associated municipal governance, there is a recognised gradual loss of tacit knowledge and decreasing social awareness which at the same time are leading to inadequate choices with respect to urban flood risk management and the capacities needed to activate proper strategies to counteract the growing risk of climate change variability.

Recognition of the causes and effects of climate change variability is defined in the complex interrelationships of diverse systems (ecological, social, and physical components under a common decision-making system), so the approach to understanding it is framed as that of a 'complex system.' This is based on the dynamic coexistence of natural and anthropogenic processes in a context of continuous change (Meyer, 2009). The locations of the selected cases are within the Reconquista River basin system and could be conceptualised as part (a subsystem of) an urban delta system (the Paraná delta), which in turn is considered as a complex adaptive system (Dammers et al., 2014) given its dynamic interrelationships between the water system, soil characteristics, its level of urbanisation, its socio-economic conditions, and its production systems, among others.

This article defines a 'systemic interrelationship' as ". . . a complex whole, a set of interconnected things or parts, an organised body of tangible or intangible things that interact to form a whole" (McLoughlin,1969). The city is also understood as a complex system, composed of subsystems, encouraged by general systems theory (McLoughlin, 1969). From the point of view of complexity theory, cities can be understood as open systems because they exchange information with their environment (Portugali, 2006), as well as complex, because they are made up of numerous components or actors with interdependent behaviours, resulting in varied effects (Durlauf, 2005; Portugali, 2006; Zagare, 2018). In this article, the socio-ecological approach is proposed to reveal the interactions of the systems considered and, through it, to define the main challenges to be addressed.

Interrelationships between systems and sub-systems intersect within a non-static equilibrium (Pelling and High 2005; Johnson, 2012), i.e. one that is continuously changing and produces uncertain effects. Even a small change can trigger a qualitative impact on the whole system and thus requires an adaptation process to reach a new equilibrium (Pelling and High 2005). Continuous interactions take place in a non-linear and unpredictable way, so it is necessary for the system to adjust to these changes to reach a non-static equilibrium.

Given that climate change variability has its most critical expressions on the local level, the main issues to counteract its effects lie in the capacity of territorial decision-making at the municipal level. In particular, those issues that make it possible to deal with adaptive dynamics, (necessary to manage the associated risks and embedded in a longer-term resilience strategy), are the development perspectives, challenges, and actions to address the specific risks associated with the effects of flooding (also considering the lack of water during certain periods of the year).

This article argues that complex adaptive systems are defined by the resilience of the system, which implies its ability to absorb disturbances without being weakened or unable to adapt and learn. Some natural and social systems have the built-in capacity to recover from adverse circumstances, while others have to learn to be resilient.

The article focuses on the role of networks as an interrelated support system and the role of institutions in building resilience in social and ecological systems under a framework of joint municipal territorial management, and relies on their national actors and policies.

Resilience as adaptive capacity

The term 'resilience' is based on three main perspectives: engineering, ecological, and evolutionary. Engineering resilience refers to the ability of a system to return to an equilibrium or steady state after a disturbance (Holling, 2001). Ecological resilience refers to

"the ability of these systems to absorb change [...] and still persist" (Holling, 1973). The main distinction between the two definitions referred to is the maintained efficiency of the function, versus the maintained existence of the function (Schulze, 1996). In the proposed framework, which links territorial decisions with mandatory actions to cope with the effects of climate change, the concept of resilience needs to be broadened in order to apply it appropriately to local development conditions and thus target the necessary change-oriented adaptation. Evolutionary resilience (Davoudi et al., 2013) extends the description of resilience from the engineering and ecological viewpoints of restoring and enhancing, also considering the capacity of complex social-ecological systems to change, adapt, or transform in response to stresses and disturbances (Carpenter and Westley, 2005). The concept of resilience is thus established by thinking about local conditions and enabling the activation of an integrated process of change that integrates local development and adaptation to climate change. This study requires the consideration of local, biophysical, and social conditions, proposing to define as a basis the scalar level of vulnerability of the main system at stake, in this case the water structure, and from there to define the risks associated with other vulnerabilities (social, physical, and economic).

Wisner et al. (2004) define social vulnerability to climate change as "the characteristics of an individual or group and their situation that influence their ability to anticipate, cope with, resist, and recover from the impact of a natural hazard" (an extreme natural event or process). Anderson and Woodrow (1998) expand it to: "long-term factors that affect a community's ability to respond to events or make it susceptible to calamities." It goes on to distinguish between material, physical, social, organisational, motivational, and attitudinal vulnerabilities. According to the latter definition, the appropriate framework for integrating local development into climate change adaptation strategies requires the assessment of existing socio-environmental conditions including the need for forecasting and planning. Furthermore, the proposed theoretical framework seeks to clarify that territorial decision-making, as a vulnerable system, should also be considered within the requested action of change, considering Cutter and Finch's (2008) contribution on defining vulnerability as "the potential damage incurred by a person, asset, activity, or set of elements that are at risk. Risk is driven by natural, technological, social, intentional, or complex hazards with the potential outcome being disaster. In our approach, risk expands to social, economic, political, and cultural conditions and factors in decision-making, i.e. vulnerability is socially constructed."

Returning to Adaptive Capacity

Under the theoretical re-conceptualisation of risk and vulnerability detailed in the previous paragraph, this paragraph seeks to define the next step: adaptation, defined as the actions people take in response to, or in anticipation of, anticipated or actual changes and risks, to reduce adverse impacts or take advantage of opportunities presented by climate change or other recognised risks.

Adaptation is not about returning to an earlier state, because all social and natural systems evolve and, in some respects, co-evolve with each other over time. This is the basis of evolutionary resilience (Davoudi et al., 2013). Evolutionary resilience extends the description of resilience from engineering and ecological views of restoration and enhancement to the capacity of complex social-ecological systems to change, adapt, or transform in response to stresses and strains (Carpenter, 2005), and thus responds to our proposal to link local adaptation strategies with local development. Therefore, the social conditions within resilience can be framed to consider the following:

- Social resilience is often used to describe the capacity to adapt positively despite adversity (Luthar and Cicchetti 2000).
- Social resilience is the ability of groups or communities to adapt in the face of external social, political, or environmental stresses and disturbances (Adger 2000).

This defines the basic conditions to which a social group needs to respond in order to be resilient.

The components of the applied approach

The theoretical approach presented in this study of modelling adaptive resilience, strategically aligning the management of climate change effects and local development, began by proposing the necessary assessment of the biophysical systems involved (local conditions within various interrelated systems), defining environmental resilience in its main line of argument and revealing its own limitations. It can be agreed that it depends on the capacity of natural systems to absorb change [...] and still persist, "functioning, maintaining its existence, and maintaining a certain level of efficiency of its recovery functions" (Holling, 1973; Schulze, 1996) as a result of which we conclude that the proposed system can be induced by design. To do so, engineering and social aspects must be aligned with biophysical conditions and recognise existing social conditions to trigger change through an institutional perspective. This is proposed by defining an iterative process of opportunities, designed through co-evaluations and strategic alignments over time.

Adaptation to present and future risks is increasingly understood as an integrative process precipitated by the need to cope with extremes, within gradually changing average climatic parameters (Kelly and Adger 2000, Jones 2001).

Current adaptation strategies have recognised in the dynamics of biophysical systems, as well as in green spaces and urban water systems, potentials for enhancing biodiversity conservation and contributing to the solution of societal challenges (Goddard et al., 2010, Cohen Shacham, 2016). Along these lines, the European Community has recognised the functioning of ecosystems as fundamental pillars for the mitigation of and adaptation to climate change (European Commission, 2015). While aligned to local development objectives and recognising their economic and operational constraints, these strategies can generate exponentially expanding environmental resources, economic benefits, and social benefits (Kabish et al., 2015).

Within these strategies, which promote the maintenance, enhancement, and systemic restoration of biodiversity by expanding urban eco-systemic capacity are Nature-based solutions, as well as actions based on "ecosystem-based adaptation," "green infrastructure," "ecosystem-based disaster risk reduction" and "natural water retention measures." All are defined around the search for answers to the various complexities that climate adaptation and local development demand today. These strategies and the concepts that validate them are mostly complementary, and can be and are used in both urban and non-urban contexts. It is important to consider that both nature-based strategies and their associated potential strategies are highly complex to study and evaluate, due to the multi-scalar nature of the dynamics of bio-physical systems, both in their spatial and temporal scales. As they are associated with territorial decision-making systems for its applicability, they require the intervention of various levels of governance, from the purely local to the transnational territory. The local context and its particularities must always be distinguished for their possible implementation, hence the proposal described here is structured on a concrete experience that evaluates and correlates them.

This article argues that adaptive management processes informed by iterative learning about the ecosystem and through a systemic evaluation of the successes and failures of previous management, increases current resilience, which in turn can increase the capacity to respond to climate change threats in the long term.

Thus, a second concept is proposed: the necessary activation of an adaptive management process, where the evaluation of past actions and the level of constraints considered in each time period need to be assessed and revealed in order to define a cumulative knowledge to guide an evolutionary process of change, in the various pathways taken under different levels of risk in order to improve their performance. Again, this is a request for external input.

This type of adaptive management (Lee, 1999) can be used to pursue the objectives of:

- Greater ecological stability;
- More flexible institutions/structures for resource management;
- Recognising and activating the adaptive cycle (Holling, 2001).

As such, evolutionary resilience, understood as a process of cumulative/reflective knowledge, is proposed here precisely to emphasise that the system goes through different stages of change to become adaptive (Schulze, 1996), and that each decision and its context

are important elements to consider in the more holistic decision-making processes proposed as a model of associated objectives.

To fulfil the integration of these objectives, from the environmental to the social sphere at local level, it is necessary to implement a clear organisational structure under the recognised capacities of local government bodies, so the process proposes to include the resources and skills of external bodies, as in this case, academic support for systemic assessments, which are already defined from a socio-environmental perspective.

This would result in a call for a transdisciplinary research approach, where possible changes can be jointly assessed by the various actors involved, at each step of the process, from the main biophysical assessments to the social demands and the various capacities of the local government bodies involved.

The concept of adaptive capacity relates to the potential of a social-ecological system to reduce its vulnerability (the level at which a system is unable to cope with adverse effects) and minimise the risks associated with a specific threat (Adger, Huq, &. Brown, 2003; Adger, 2006; Smit and Wandel, 2006). According to Folke (2005), adaptability is a prerequisite for the resilience of a system, which can be defined as "the ability of a system to absorb disturbances" by reorganising itself to maintain its identity (Folke et al., 2010) before shifting to a radical state. The proposed path for change therefore requires a high level of flexibility and territorial action defined by a constant assessment of the various conditions considered in each system and through their interactions.

The complex interrelationship of the dynamics of the natural and built environment is constantly adapting, which means that the whole process must always be cyclical and evolutionary (depending on gradual changes).

Adaptations depend on each system and its interactions (positive and negative), so the proposed transdisciplinary approach considers the co-evaluation from a scientific perspective of local conditions (including the human and economic municipal resources to support this process).

The adaptations can be seen as opportunities to improve each system and its interrelationships, so the active transdisciplinary approach that proposes various possibilities for change, co-defines its main objectives and scope, needing to align with local governance capacities to result in concrete and feasible strategies (in line with the municipality's development goals) and to effectively integrate local stakeholders in their evaluation.

Following the proposed domains upon which a transdisciplinary approach acts (Fratini et al., 2012), we highlight some essential aspects valued by different stakeholders which come into play when implementing a transdisciplinary approach, linking climate change adaptation to the local development: (1) technical optimisation, dealing with standards and guidelines for urban drainage systems, based on the knowledge transfer that includes different disciplines and local technical knowledge; (2) spatial planning, making the urban area more resilient to future changing conditions, by also including strategic municipal plans; and (3) day-to-day values, enhancing awareness, acceptance, and participation among stakeholders, also within an evolutionary integration within the process and setting the conditions for an active and long-term participation of different stakeholders, with an emphasis on the role of the local inhabitants.

Transdisciplinary process for a new vision of local adaptability - the Arroyo Morón Case

Transdisciplinarity for climate change and local development

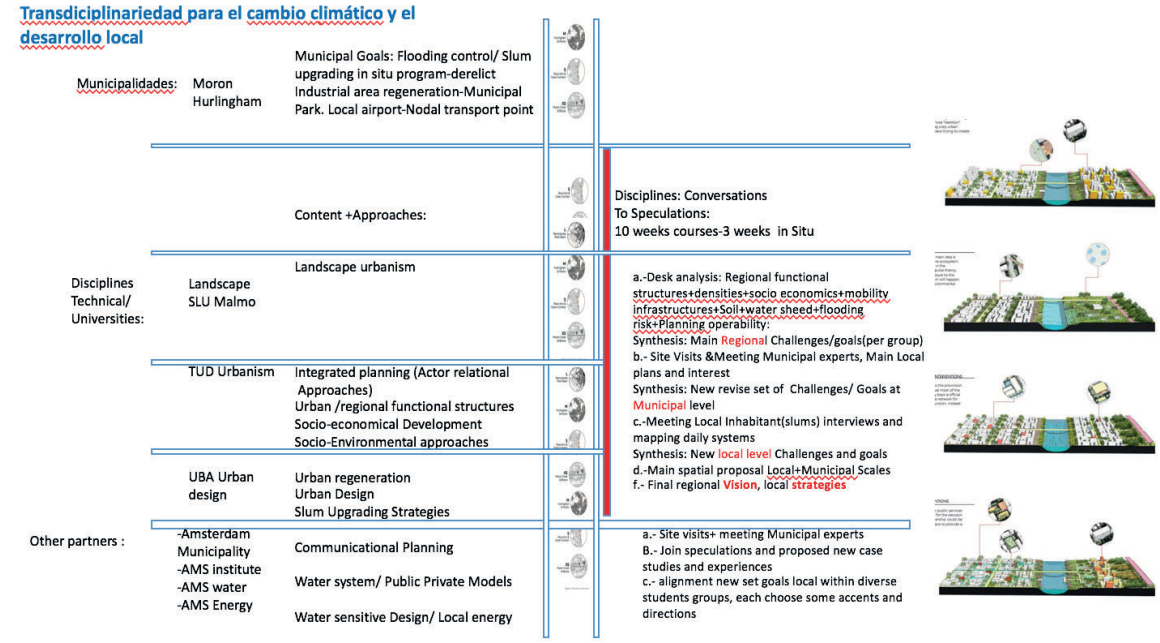

Image 1: Actors and roles in the transdisciplinary programme of the Arroyo Morón case. Authors: Diedrich, Janches and Sepulveda 2018.

This study is based on joint research between different institutions that bring together various disciplines with the aim of improving local development, coordinating agendas and actors to respond to the effects of climate change, and the environmental crisis on the local scale. This is in addition to the concepts of evolutionary adaptation activated by participatory processes, those that integrate local, public, and private actors, academia and various disciplines to facilitate the processes of evaluation, implementation, and monitoring of alternatives for institutional, social, and environmental change. These are recognised as systems whose effects must be assessed in their interrelationships, interdependencies and capacities, in order to define a plan of integrated actions in sustainable processes that increase their local impact.

From this perspective, during two three-month periods in 2018 and 2019, a research consortium called "transdisciplinarity for climate change in complex areas" was formed, which offered the municipalities of Hurlingham and Morón in the periphery of Greater Buenos Aires to jointly define a possible framework of ideas for a strategic action plan towards climate change.[2] This exercise was carried out as part of the activities of the Master's degree courses in urban and landscape architecture from three universities: Master of Landscape Architecture (SLU Malmo, Sweden), Master of Urban Design (University of Buenos Aires), and Master of Urban Planning (Delft University of Technology).

The basic local conditioning factors of these two municipalities were evaluated from the disciplines of urban planning, ecology, landscape, anthropology, and governance, recognising that: 1) the natural features present in both territories are part of the Reconquista River basin, a tributary of the Paraná River and interrelated with its deltaic dynamics, and 2) that the quality of the local tributaries combined in the Arroyo Morón reveals high levels of pollution, and that flood control infrastructure is urgently needed. At the same time, the social conditions of the area were considered, which feature a large number of informal settlements in flood-prone and polluted areas where the poverty rate is high, and informal employment is the main source of income for most of the population located in irrigated areas.

[2] The full study forms a part of the research project "Tactics and Strategies for the Integral Improvement of the Urban-Water Landscape in the Area of the Reconquista River Basin, Flavio Janches and Juan Carlos Angelomé [authors]." Strategic Development Project 2018/2019, University of Buenos Aires, Department of Science and Technology, Faculty of Architecture, Design and Urban Planning, Higher Institute of Urban Planning.

In addition, the good level of connectivity and mobility at metropolitan level was recognised, allowing for the possibility of growth and densification, so that in a first meeting the guidelines for the development of the project were agreed. In this way, the operational framework of a support agreement was followed that sought to bring together strategies for local adaptation in response to climate change and local inter-municipal development possibilities, enhancing the objectives of local development plans, while recognising the functional interrelationships at the scales of intervention (spatial and temporal).

The operational framework of this exercise was defined as transdisciplinary and structured according to the process defined by Diedrich, Khan, and Lindholm (2015) as "beyond best practices" as a participatory dialogue, involving inhabitants, municipal specialists, and academic disciplines of landscape/ecology, urbanism/urban design/governance, anthropology, and urban design as a platform for co-evaluation and participatory design, in order to facilitate, understand, and coordinate the complexities of climate change and spatial planning at the local level.

The design of this interdisciplinary activation framework was defined as a speculative process that coordinated a way of creating, of deliberation, and possible decision-making as a testing ground for the definition of critical responses and evolution of the knowledge framework, particularly adapted to the strategic guidelines of climate adaptation, environmental improvement, and socio-spatial integration.

Through the results obtained in each phase of the exercise and from the re-evaluation of the processes and projects developed, it would be possible to redefine the framework of theoretical, technical, and methodological reflection, in order to promote new integrative proposals and provide specific disciplinary responses to each systemic feature to be considered. This is essential because of the complexity of the problems to be tackled, which require new approaches to help transform complex urban landscapes into more sustainable environments (F. Janches et al., 2019).

The exercise described here is structured within this design in a non-linear and interactive process of agreements, proposals, co-evaluations, measurements, and adjustments, concluding with concrete possibilities, to discuss possible development strategies with multiple actors, and thereby define the specific strategies to follow, improving and expanding the objectives of existing strategic plans, from a process that is not linear, but instead iterative and incremental.

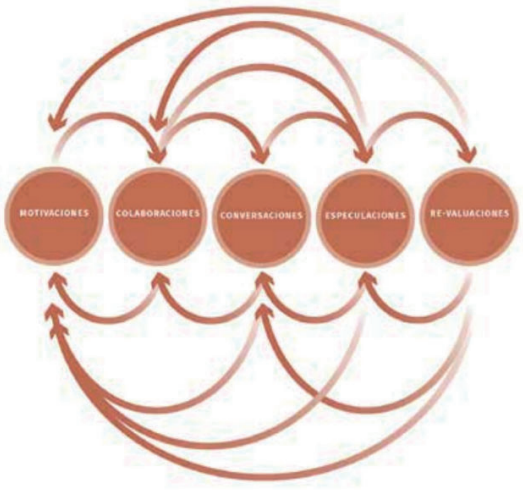

Image 2: Iterative process that structures and defines the transdisciplinary methodology implemented in the Arroyo Morón project. Author: Lisa Diedrich 2018

We now go on to describe the phases of the exercise, its actions, and the actors involved in the transdisciplinary process. These defined the operational framework of the

exercise, the systems considered, and the possible interrelationships between them. Through their spatial definition, possible potentials were detected, which in turn revealed possible paths, which were re-evaluated by the local actors involved, from the economic and technical capacities of the municipalities, to the possible spheres of participation of private actors, among other issues:

Phase 0: Systemic (prior) analysis and background review.
Strategic guidelines predefined by both municipalities:
Short-term objectives: Flood control/Formalisation of marginal areas, industrial regeneration and activation programme, urban regeneration programme-Municipal park.
Medium-term objectives: Co-evaluation of strategic guidelines for the reconversion of a disused airport into a regional airport focused on the development of a multimodal metropolitan transport hub.
Actors: Academics, municipal officials, inhabitants, and non-governmental organisations.
Actions: At the invitation of the municipalities, the strategic guidelines are jointly reviewed through discussions/interviews with the different stakeholders, the areas, the systems to be considered, and their levels of risk and urgency are co-defined.
Product: The framework programme of the challenges to be considered, the map of actors and the urgent needs to be considered.

Phase 1: Categorisation and prototypical proposal (integrating systems)
Objective: To define the systems at stake, their possible interrelationships and to determine a prototypical synthesis of possible local solutions before approved and similar constraints.
Actors: Academics, municipal officials,
Actions: Re-evaluation of the system and its environmental impact, rainwater and sewerage management, socio-economic mapping, and integrated re-mapping. Speculations from possible solutions based on the study of past actions and impact assessment.
Output: Prototypical proposal of integrated local solutions.

Phase 2: Presentation of prototype proposal (integrating systems) to local stakeholders. Selection and review of technical feasibility, decision-making, and management capacity.
Objective: To evaluate the potentialities and limitations of the "speculations" presented as tools or previous solutions from the economic and technical capacities of the municipalities and local actors involved.
Actors: Academics, municipal officials, inhabitants, and non-governmental organisations.
Actions: Implementation of three discussion tables, coordinated according to urgent problems, where prototypes of possible solutions are presented and discussed by each group of actors, to later define the possible frameworks and their limitations.
Product: Definition of possible solutions from concrete strategies aligning the diverse interests of the stakeholders involved.

Phase 3: Adjustment of the prototypical proposal recognising technical feasibility and decision and management capacity.
Objective: Detailed review of the technical feasibility required by the proposals and joint review of the institutional support system (financial and programmatic).
Actors: Academics, municipal officials.
Actions: Presentation of detailed reports of the proposals, evaluation, and discussion of their possible operability.
Output: Assessment of possible actions, potentials, and constraints, both operational and in terms of decision-making and competence.

Phase 4: Spatial contextualisation and co-selection of possible strategic actions.
Objective: Quantification of possible actions, spatial expression, special impact, and co-definition of strategic actions.
Actors: Academics, municipal officials, inhabitants, and non-governmental organisations.

Actions: Implementation of three discussion tables coordinated by actions, where prototype strategies are presented and discussed by each stakeholder group, and then hierarchies of interests are defined by possible agreements of their impacts.
Output: Selection of local strategic plans in stages.

Phase 5: Final selection according to technical feasibility, decision-making, and management capacity.
Objective: Definition of the local strategic plan for the specific framework of the transdisciplinary plan to be developed.
Actors: Academics, municipal officials, non-governmental organisations.
Actions: Summary report of the actions to be developed, possible impacts, cost, and time.
Product: Full report of the local strategic plan to be developed.

Phase 6: Co-evaluation of socio-environmental impact.
Objective: the implementation of a Socio-environmental Impact Co-evaluation System.
Actors: Academics, municipal officials, non-governmental organisations.
Actions: Implementation through participatory scenario system of the co-evaluations, from the more technical framework to the social impact.
Product: Socio-environmental co-evaluation report.

Phase 7: Co-definition of strategic actions in critical areas and possible phases of evolutionary change.
Objective: Once a local strategic plan has been defined and agreed upon, its stages are defined and agreements are made for specific goals over time.
Actors: Academics, municipal officials, non-governmental organisations.
Actions: Creation of two moderated discussion tables to jointly define the objectives by stages.
Product: Local strategic plan, stages, goals, and possible funding.

Phase 8: Detail of actions for cost definition.
Objective: To define the estimated costs of each stage, recognising possible governmental and cooperation agency plans for potential implementation.
Actors: Municipal officials.
Actions: Municipal, inter-municipal assessments and possible review at regional level.
Output: Cost plan by stages.

Phase 9: Local level, visualisations of integrated systems and their possibilities. Second presentation to the community.
Objective: To generate spatial visualisations of possible proposed changes and their spatial outcomes, as a means of communication and dissemination for discussion among various actors and strengthening of possible guidelines.
Actors: Academics, municipal officials, non-governmental organisations.
Actions: Iterative process of visualisation, understanding and detailing.
Product: visualisations and systemic-functional details of selected actions.

Phase 10: Speculations. Detailed strategic adaptive proposal.
Objective: From the definition and detail of the possible local strategic plans presented as opportunities, determining the territorial changes linked to the socio-technical capacities of the actors, defining from the operative limitations possible strategic adaptations.
Actors: Academics, municipal officials, non-governmental organisations.
Actions: Two evaluation roundtables.
Product: Final report of possibilities and adaptations of the decision framed with possible financing.

In each phase, the proposed processes were defined as “conversations” where the framework consisted of proposals executed by the students, discussed/evaluated by the

municipal experts and enriched by discussions with the different parties, from the inhabitants to the different stakeholders within the river area between the two municipalities. It culminated in a revised and delimited proposal of possible evolutionary plans for the implementation of an inter-municipal development framework.

Some final observations

The possibilities proposed in this study link local adaptation strategies with local development strategies, which responds to the strategic adaptation platform and its specific theoretical foundations. The implementation possibilities of the case study are reinforced by the values of empowering local capacities and co-assessing the main causes and effects of an aligned two-pronged strategy.

The role of a more academic environment in facilitating systems assessments has been established to validate the need for a transdisciplinary research approach while offering different development alternatives. This is a crucial enabling role in the local adaptation process that aims at a long-term perspective and meets the definitions of the abovementioned socio-environmental theories and approaches. The demands of flexible regulatory systems and the inclusive perspective of stakeholders, aligned on their shared development objectives, are fundamental to visualise co-defined assessments and opportunities.

The presented study case experiences, in particular reveals two main critical points to consider, the necessity to incorporate the spatial planning perspective within, so as to be able to project and embed the local strategies for climate change adaptation within a broader developing perspectives, under the specific capacities and vision of the local governance body. So, with this, the possible expansion to new and more powerful actors on the development should be included. In contrast, the activations of a more socio-cultural recognition on the process of local actors' awareness towards active involvement need to recognised on the transdisciplinary process steps, so to be able to keep the people's attention and through that facilitate the evolutionary involvement and validation of the inhabitant voices and engagement within.

Active strategies of co-definition, co-evaluation and co-design to face complex and highly uncertain problems appear as a significant milestone for water management and local development. The challenges are open and the possible activation for change from different concrete and evaluated development possibilities is clearly a new opportunity for municipalities in delta conditions with a development that is conditioned by a lack of resources.

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Challenges and Opportunities in Upscaling Room for the River: A Conversation about Large-scale Change through Small-scale Interventions

Isabel Recubenis Sanchis [1,2,*], Geert J.M. van der Meulen [1,3]

[1] Delft University of Technology, Faculty of Architecture and the Built Environment, Department of Urbanism, Section of Urban Design
[2] isabelrecubenis@gmail.com; https://orcid.org/0000-0001-6681-489X
[3] https://orcid.org/0000-0002-0705-5763
[*] Corresponding author

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Diego Sepulveda
Fransje Hooimeijer
Taneha Bacchin

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Abstract: Highlighted by the recent 2021 flood events in Europe, this research takes the momentum to underline the necessity for radical solutions that embrace uncertain and extreme discharges at the core of planning and design frameworks. Building upon existing Adaptive Management practices in the Netherlands, this research takes the experience of the Room for the River programme to discuss the challenges and opportunities arising from its (eventually inevitable) upscaling in the context of the Netherlands. It does so by means of two spatial and two managerial inquiries to draw conclusions on the complexities and entry points to shift towards large-scale change through small-scale interventions.

Keywords: design-thinking, climate adaptation, flood risk management, Room for the River

1. Introduction

In July 2021, Europe experienced floods caused by extreme rainfall events and consequential rapidly fluctuating stormwater discharges. Rising climate change awareness and the preceding occurrence of similar flood incidents globally underline the necessity for the (continuation of the) advancement of flood risk management. For the affected area, such catastrophes can, in fact, provide the decisive tipping points prompting adaptation, whereas outside of this area, the catastrophe regularly serves merely as a reality check, commonly insufficiently capable of (re-)generating the need for adaptation (Rosenzweig & Solecki, 2014; Van der Meulen, 2018).

While the repercussions of the July 2021 floods were most devastating in German and Belgian lands in the Rhine-Meuse watershed, in 1993 and 1995, the same watershed was the stage of similar high discharge volumes in the Netherlands. Despite repercussions then being limited to large-scale evacuations, the near flood, together with an increased concern with the environment and a better understanding of the effects of climate change, triggered a transition in flood risk management (Portugali et al., 2016). With the conviction of improving water safety and robustness alongside spatial and environmental qualities, this transition was translated, in 2005, in the national planning policy project "Room for the River" (RfR) (Portugali et al., 2016).

In light of recent events, this paper takes the successful RfR to discuss the challenges and opportunities arising from its (eventually inevitable) upscaling in the context of the Netherlands. It does so by means of two spatial and two managerial inquiries to draw conclusions on the complexities and entry points to shift towards large-scale change through small-scale interventions.

2. Theories and Methods

Room for the River is an exemplary programme and stepping stone in Adaptive Management, an approach that integrates scientific knowledge into environmental decision-making by adopting cycles of improvement, understanding, and management (Armitage et al., 2008; Zevenbergen et al., 2015). As such, the programme is guided by the adoption of a systems approach, participatory decision-making, learning, and experimentation (Zevenbergen et al., 2015). Both from a narrative point of view – accommodating water and living with water – and from a policy approach point of view – multi-actor network governance, the programme signifies the end of an era of battling against water in an authoritarian government style (Roth et al., 2021).

In this sense, RfR is considered a solid foundation upon which to build the necessary upscaling of flood risk management. On the bases of recent RfR experience review (Roth et al., 2021; den Boer et al., 2019; Edelenbos et al., 2017), the paper synthesizes (and updates) some of the conclusions of a year-long thesis on the Dutch Upper Delta (or Waterschap Rivierenland) (Recubenis Sanchis, 2020). To do so, it takes four spatial and managerial lines of inquiry targeting key aspects in dealing with flood dynamicity and extremes, time-pressure, preparedness, and uncertainty, namely: floodplain area, size, and number of interventions, social engagement, and long-term goals. As seen in Table 1, each spatial and managerial aspect is supported by theory notions and/or reported experience, being, in order: flood robustness (Klijn et al., 2018), implementability and citizen involvement (by Roth et al., 2021; Forrest et al., 2020; Den Boer et al., 2019; Edelenbos et al., 2016), flood preparedness (Davoudi et al., (2013), spatial redundancy (Roggema, 2021), and dynamic adaptive policy pathways (Haasnoot et al., 2012).

Table 1. Supporting theory notions and research.

Critical conditions	Spatial inquiry	Managerial inquiry	Supporting research
Flood dynamicity and extremes	Floodplain area	-	Flood robustness, Klijn et al., (2018)
Time-pressure	Size and number of interventions	-	(Reported) implementability, Roth et al., (2021), Forrest et al., (2020), den Boer et al., (2019), Edelenbos et al., (2016)
Flood preparedness	-	Stakeholder engagement	(Reported) citizen involvement, Roth et al., (2021), Forrest et al., (2020), den Boer et al., (2019), Edelenbos et al., (2016),
Uncertainty	-	Long-term goals	spatial redundancy, Roggema, (2021) & Dynamic Adaptive Policy Pathways, Haasnot et al., (2012)

By means of *what if* questions and scenario-building, a process of design-thinking is activated, enabling the start of an inventory of challenges and opportunities in moving towards an upscaling of RfR's scope.

- In light of extreme events, how to increase the robustness of the system? What if the full urbanized delta could be, by design, floodable?
- In light of accelerated climate change, how to accelerate the pace of implementation? What if flood risk management was implemented by means of an increased number of small transformations?
- In light of the inevitable floods, how can flood preparedness be drastically increased? What if flood risk management was implemented by means of a cooperation of top-down and self-organised initiatives?
- In light of highly dynamic and uncertain discharges and weather-events, how can a a system be delivered that is adaptable to future demands? What if the proposal could embrace a water-accommodation capacity that could adapt and evolve in time?

3. Results

With a recurrent structure, each line of inquiry guides an alternative perspective (line of opportunity) and subsequent cultural and managerial premises for the implementation of a more radical approach to give room to rivers.

3.1. Upscaling the scope of RfR by increasing the floodplain area

The first inquiry revolves around the current meaning – in spatial and managerial terms – of floodplains. In RfR, 34 projects increase room for the river by effectively executing a new, confined wider and deeper floodplain. In this sense, the management of floods is restricted to the areas outside the relocated, improved and/or heightened dykes, whereas the urbanised floodplain within dykes is meant to remain dry, unchanged, and unaware. The physical definition (or confinement) of floodplains has a strong management implication, namely, the existence of protecting/active areas – outside dykes – and protected/passive areas – inside dikes. However, given the recognised dynamicity of river discharges and extreme weather events, the costs of keeping this assumption can be very high, including: risk of critical damage if the dykes were to break (Klijn et al., 2018); unprepared inhabitants within the so-called "safe and dry areas" (De Bruijn et al., 2017; Terpstra, 2010).

In light of extreme events, how can the robustness of the system be increased? What if the full urbanised delta could be, by design, floodable?

Envision a river with a multitude of ramifications, a network of floodable pathways and depressed areas designed to be flooded when needed and an urbanised delta designed to respond collectively during extreme river discharges (see Figure 1).

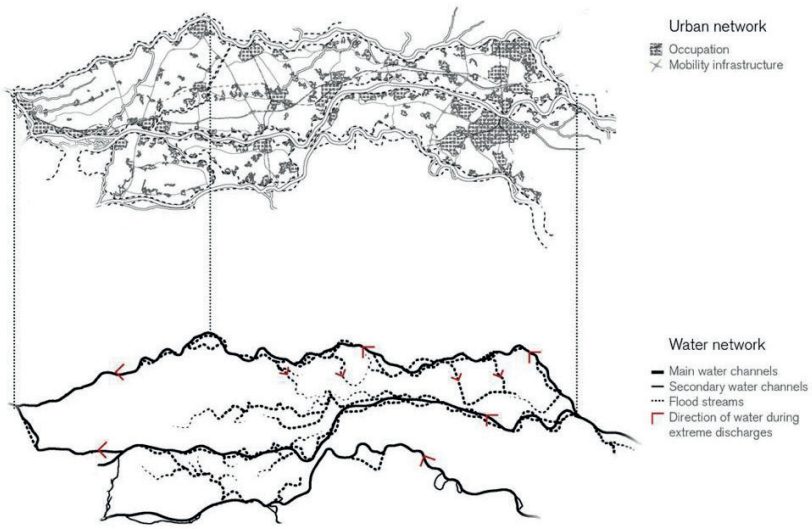

Figure 1. Rivierenland flood network

This vision would work along with:

- A shift of agricultural land values focused on soil health. The inquiry would require moving away from intensive agricultural practices, crop "efficiency," and "productivity" responsible for the critical soil state (Orgiazzi et al., 2016), and instead transitioning towards the notion of crop resilience. In this sense, the eventual flood of agricultural land would be seen as part of a process of soil renewal with the associated lateral exchange of nutrients and organisms – flood pulse (Junk et al., 1989; Tockner et al., 2000) – which, together with the adoption of regenerative practices (Murakami, 1991), would improve soil health, ensuring crop resilience against extreme weather events, pests, and pathogens (Moebius-Clune et al., 2016);
- The cultural acceptance of small floods. According to Klijn et al., (2018) people value large consequences as more important than frequency of occurrence. Therefore,

despite psychological limitations in climate change mitigation and adaptation which decelerate the cultural process of acceptance (Scheffer & Wesley, 2007), the initial unwillingness to accept small floods could, in time, be reversed, as means to avoid major disasters.

3.2. Upscaling the scope of RfR by downscaling the scale of interventions

Continuing with the previous vision, namely, unlocking the full urbanised delta extension as floodplain, the second inquiry discusses the road to its spatial (and managerial) implementation. In RfR, the enlargement of the floodplains takes place through the development of a few big projects. This *modus operandi* involves a series of challenges, namely: an uneven distribution of affected people and municipalities (Edelenbos, 2017; Roth et al., 2021); and a valuable amount of time in executing big projects which are not performative/operative until completion.

In light of accelerated climate change, how can the pace of implementation be accelerated? What if flood risk management was implemented by means of an increased number of small transformations?

I a series of small patches of lowered land spread throughout the agricultural land. In a cumulative process of transformation, the aggregation of patches would form regional clusters, eventually taking part of the river system as a ramified flood network (see Figure 2). In this sense, the interventions could be performative from the beginning, moving from a water storage function during extreme weather-related events, to a buffer function during extreme river discharges as the network increased (in flood capacity). From an executional point of view, this approach would entail a series of small investments spread throughout the territory, shortening implementation times. From a financial point of view, the investment dedicated to the implementation of the programme interventions could be redirected directly to the affected farmers, now also executioners of the programme.

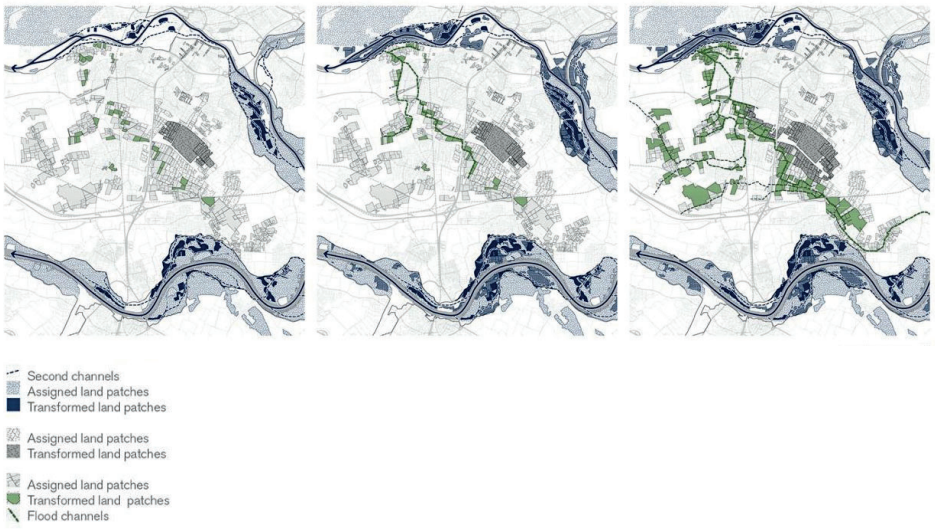

Figure 2. Flood network implementation example between Arnhem and Nijmegen.

This vision would work along with:

- A widespread landowner engagement to execute and maintain floodable patches of land. From a cultural perspective, the Dutch have a strong tradition in taking issues into their own hands, even when it comes to flood risk management. Looking at the RfR experience review, both Edelenbos et al., (2016) and Roth et al., (2021) report stakeholder/citizen initiative, self-organisation, and local self-responsibility, especially when reacting to proposed government policies. The resources needed to support this motivation and engagement could be monetary (economic incentives), but also as internal knowledge and expertise in the areas of safety (see the Kampen case in Roth et al., 2021).

- Unlocking the need to fully control a growing network, changing in size and shape and involving an incremental number of stakeholders and available land (see following section).

3.3. Upscaling the scope of RfR by increasing stakeholder engagement

Inquiries 1 and 2 imply the key role of stakeholder and social engagement, both for citizens with and without land ownership, participating in the transformation. In RfR, social engagement happens through participatory decision-making. However, according to Roth et al., (2021), experts determine which risks are acceptable and, therefore the decision-making remains basically top-down and technocratic, highlighting a desynchronisation between breakthrough policy narrative and the necessary but non-sufficient flood risk awareness; the lack of clarity regarding citizens' responsibilities and scope of action; a governance arena increasingly difficult to grasp for citizens; and the co-optation of critical citizens for an orchestrated participation that conceals rather than deals with conflicts (e.g., citizens as a powerless "sounding-board" council). All of which demonstrate an increasing gap between climate action and citizen involvement, the distancing of citizens from an active involvement (and understanding) of future challenges; and the non-involvement of citizens in deciding which risks are acceptable to them. In this way, the inquiry hints at the close interconnection between social engagement and flood-preparedness, which, as explored by Davouidi et al., (2013), is key in tying together persistence, transformability, and adaptability to Climate Adaptation.

In light of the inevitable floods, how can flood preparedness be drastically increased? What if flood risk management was implemented by means of a cooperation of top-down and self-organised initiatives?

Imagine the partial lowering of fields to start as a self-organised, self-served initiative where regional and national bodies take their part by connecting the dispersed patches into a regional network (see Figure 2). In this vision, order is enabled by the articulatory role of these entities, setting guidelines in designing and executing regional corridors connecting the (already) executed patches to an upgraded network with the river system.

This vision would work along with:

- A coordination of formal and self-organised initiatives through communication, monitoring, and reassessment. In this sense, the experience of RfR with the Programme Directorate (PDR) and the nomination of an external team for the assessment and monitoring (Q-TEAM) (Van Twist et al., 2011), could be directly transposable. The continuous monitoring and reassessment of the transformation would, on the one hand, serve as means to maintain the incentives system, while at the same time be used to adopt cycles of improvement (Armitage et al., 2008). In practice, Forrest et al., (2020) has recently reported the emergence of citizen contribution and interactions with public authorities in Dutch pluvial flood risk management in Arnhem.
- An advancement of societal limits to adaptation (Adger et al., 2008). Adaptation is commonly confined by economic, ecological, physical, and technological limits, beyond which it is considered impossible. Adger et al. (2008), however, argue that adaptation is confined by a society's attitude to ethics, culture, knowledge, and risk, which means limits are society-dependent and therefore mutable. This implies that adaptive capacity can be enhanced by increased citizen involvement and awareness, changing a society's perception.

3.4. Upscaling the scope of RfR by enabling an evolutionary water-accommodation capacity

As a result of the previously discussed inquiries, this one comes as the ultimate consequence (or goal, depending on the perspective), of the envisioned upscaling. The inquiry challenges the RfR long term adaptability through fixed long-term goals, namely, a water safety objective of 16,000 m3/s in 2018 (Van Twist et al., 2011; Klijn et al., 2018), and proposes to reach similar future goals with a sequence of short-term perspectives.

In light of highly dynamic and uncertain discharges and weather-events, how can a system that is adaptable to future demands be delivered? What if the proposal could embrace a water-accommodation capacity that could adapt and evolve in time?

Considering the aforementioned vision (previous inquiries), imagine the upscaling of the flood network to occur progressively, as new land patches were to become available and added into the network. The existence of multipurpose "voids" would enable the accommodation of different needs, turning the Rivierenland landscape into different degrees of a "water world" according to the level of discharge, intensity, and the amount of precipitation.

This vision would work along with:

- Redundancy, a defining feature of all metabolic networks (Sambamoorthy et al., 2019). As a design principle, it has been used to enhance the adaptive capacity of urban environments, as seen in the water square project(s) in Rotterdam or the "Floodable Eemsdelta" project in the northern part of the Netherlands, where parts of the urban and agricultural landscape were made redundant to accommodate different uses according to the type of emergency (see Roggema, 2021). In this case, the multiple available/pre-prepared floodable land patches, could be activated as water-accomodation ponds, allowing for the necessary space for adaptation.
- Dynamic adaptive policy pathways (DAPP) (Haasnoot et al., 2012), a method favored by policy advisors and policymakers (EEA, 2012) and key to major flood risk management programmes (e.g., Dutch Delta Programme (Haasnoot, 2013), the New York metropolitan region (Rosenzweig & Solecki, 2010), and Thames's estuary (Reeder & Ranger, 2011)). DAPP presents all possible scenario-specific flood risk management actions and interventions in parallel, as a road map following tipping points, continuously scoping, and anticipating possible options for change and efficiency as future development unrolls. By doing so, DAPP allows the consideration of both transitional and long-term, and short-term and incremental interventions side by side.

Table 2 summarizes the key points of the results section.

Table 2. Summary of research results.

Inquiries	RfR	Opportunity	Premises	Supporting research
Flood plain area	confined	*Extremely robust system?* Unconfined floodplain	• Shift of agricultural land values focused on soil health; • Cultural acceptance of small floods	• Flood of agricultural land as a process of soil renewal (Junk et al., 1989; Tockner et al., 2000) Crop resilience through soil health (Moebius-Clune, 2016); • Willingness to accept small floods as means to avoid major disasters (Klijn et al., 2018)
Size and number of projects	Few, big projects	*Quicker to implement?* Many, small projects	• Widespread landowner engagement to execute and maintain floodable patches of land; • Let go of need to fully control a growing network	• RfR reported stakeholder initiative, self-organization and local self-responsibility in flood risk management (Roth et al., 2021; Edelenbos et al., 2016) • RfR experience in monitoring and reassessment (Van Twist et al., 2011)

Stakeholder engagement	Local stakeholders as 'sounding-board'	*Universal flood preparedness?* Local stakeholders as actors of change	• Coordination of top-down and self-organised initiatives; • Advancement of societal limits to adaptation	• RfR experience of emerging citizen contribution, roles and interactions with public authorities in Dutch pluvial flood risk management (Forrest et al., 2020) • The adaptive capacity can be enhanced by increased citizen involvement and awareness since limits to adaptation are society-dependent and mutable (Adger et al., 2008)
Long-term goals	fixed	*Adaptable to future demands?* Open-evolutionary	• Spatial Redundancy • Short-term and incremental interventions together with transitional long-term change	• Dutch experience with spatial redundancy shows it as a strategy to accommodate emergencies (Roggema, 2021) • Dynamic adaptive policy pathways as a favored policy method to adapt to uncertainty (Hassnoot et al., 2012)

4. Discussion

To enable the reflection on the potential of the radical upscaling of Dutch flood risk management, design, and planning practice, this paper uses abstraction as a way of design thinking to address the highly complex, multi-scalar (spatially and temporally), and multidisciplinary challenge. Abstraction can, however, provoke oversimplification and both over- and underestimation of future conditions (Stolk, 2015). The authors therefore acknowledge the limitations of the reflection and the disregard of topics of relevance to the lines of inquiry. Such topics include the current and future influence of political and economic stability and the compartmentalisation of flood risk management bodies and responsibilities, among others.

By means of a framework of open questions that follow the current state of affairs and state of the art, the paper initiates and unlocks a discussion on the implementability and operationalisation, and challenges and opportunities of upscaling in line with the conference format "from dichotomies to dialogues." Ultimately, this exploratory and design-thinking nature of the paper allows us to question and reflect on the validity of prior assumptions (such as the meaning of "floodplain" in the Dutch Delta). As such, it taps into the strength of design to initiate collective behavioral change (Brugmans, 2018) and accelerate the necessity of change by mobilising a longing for change (Alkemade et al., 2018). The paper sets the arena to address the present state of Crisis as the passage from one particular mode of functioning to another (Valery, 1925), as part of the evolutionary cycles of adaptation, as a moment of deconstruction and disassembly of meanings and values to enable the construction of new ones (Holling, 1995).

5. Conclusion

Learning from Dutch history, different trends in flood risk management have been accompanied by different forms of governance, citizen involvement, policy narratives, and spatial interventions (Roth et al., 2021; Hooimeijer, 2014). In the need to continue upscaling flood risk management, the Netherlands is, from a policy, narrative, and even a technological point of view, at the forefront. However, as discussed in the paper, a technocratic definition of adaptation limits and risk, and the confinement of flood risk management to the areas outside the dykes, are some of the barriers that have been containing a more radical approach to the upscaling task, effectively containing the co-production of nature and society.

In addressing flood dynamicity and extremes, time-pressure, preparedness, and uncertainty, the proposed lines of inquiry target: floodplain area, size, and the number of interventions, social engagement, and long-term goals. By looking into them, the paper questions the aforementioned spatial, cultural, and policy assumptions and guides the collective imagination of a vision in which large-scale change (the increased room for rivers) is designed to unfold through small-scale interventions (repurposed agricultural land patches).

While the paper's aim is not solution-driven, the vision exercise highlights key aspects and principles for the upscaling, namely: interconnectedness among political and ecological change and non-hierarchy among spatial and managerial takes of the issue. As seen in Table 2, a decentralised network of localised floodable ponds spread throughout the watershed goes hand in hand with a widespread landowner engagement, the cultural acceptance of small floods, and, ultimately, flood preparedness. At the same time, by means of widespread stakeholder engagement, increasing parts of the territory can be activated, enlarging the flood network while making it adaptable to uncertainty and extremes through spatial redundancy. By being interconnected and non-hierarchical, the explored spatial and managerial inquiries act, in fact, as four different entry points to trigger the upscaling task.

In this sense, from a political ecology perspective, the paper highlights the fundamental nature-society dialectic to upscale room for rivers, where: the cultural take (acceptance of small floods) enables (or is enabled by) the spatial take (decentralized flood network), which triggers (or is triggered by) a managerial take (stakeholder engagement), and a policy take (society-dependent adaptation limits).

Contributor statement

Conceptualization: Author 1, Author 2
Resources: Author 1, Author 2
Visualization: Author 1
Writing - Original Draft: Author 1
Writing - Review & Editing: Author 1, Author 2

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Promoting Green Street Networks: Synergies of Active Mobility Urban Projects and Nature-based Solutions

Prof. Dr. Ernesto Philibert-Petit [1]

[1] Tecnológico de Monterrey, Mexico. Escuela de Arquitectura, Arte y Diseño; ernesto.philibert@tec.mx; ORCID ID 0000-0001-8444-3172

Abstract:

This paper discusses a strategy for promoting green streets with synergies of active mobility projects and Nature-based Solutions (NbS) as efficient and effective resources for urban resilience in a Latin American context, specifically studying the case of an upgradable urban project in Mexico City.

The case study 'Urban Project,' a green street network, was originally conceptualized in 2008 with criteria based on the promotion of accessibility and active mobility (i.e., pedestrian and bicyclist) and connectivity to other modes of mobility.

Doing research by design, slight modifications to the original programme are proposed, incorporating NbS, with a minimum cost and a maximum benefit increase. The upgraded project's compliance with urban resilience policies is analysed confronting its probable impacts with Mexico City's recently issued *Local Strategy of Climate Action 2021–2050* (LSCA) and the *Programme of Climate Action of Mexico City 2021–2030* (PCAMC) (CDMX, 2021). A qualitative preliminary assessment of the probable impact of the upgraded project in relation to the 12 societal challenge areas of the NbS framework (Raymond et al., 2017, European Commission, 2021) is presented. Preliminary conclusions of a positive policy compliance and political viability of the upgraded project can be inferred. However, important contradictions appear when considering Mexico's current federal energy political agenda.

Keywords: Urban resilience, Nature-based Solutions, Green street networks, Political viability

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1. Introduction

Green streets

Rethinking the role of streets in creating resilient, low-carbon communities and potential space for additional green and blue infrastructure is emerging. Rethinking street space offers an opportunity to tie climate mitigation and climate adaptation together to accomplish multiple community goals (Fields & Renne, 2021).

The most current defined concept of "green streets" incorporates a wide variety of design elements including street trees, permeable pavements, bio-retention, rain gardens, and swales. Although the design and appearance of green streets will vary, the functional goals are the same: to provide source control of stormwater, limit its transport and pollutant conveyance to the collection system, restore redevelopment hydrology to the extent possible, and to provide environmentally enhanced roads. Successful application of green

techniques will encourage soil and vegetation contact and infiltration and retention of stormwater (Lukes, Kloss, & Low Impact Development Center, 2008, in Im, 2019).

Active mobility projects

Efforts to reduce private car mobility and increase active mobility in cities have been made globally in an effort to reduce emissions and sedentarism, and to increase pedestrian accessibility to the public space, especially to green areas, a social asset growing in importance in a COVID-19 era.

Active mobility urban projects have been slowly but steadily growing in presence and acceptance in Latin American cities in recent years. However, the participation of active mobility in the total modal split remains low. A recent mobility modal split count of Mexico City reports that walking has a 26% share, cycling 1%, public transport 50%, and personal cars 23% (ICLEI, 2021).

To advance in their promotion, policymakers need to understand the advantages of active mobility projects and interventions in favour of society by quantifying their costs and benefits. Carrying out cost-benefit analyses (CBAs) can provide policymakers with valuable information for making investment decisions in the sector. In Latin America and the Caribbean, CBAs of walking and cycling projects are not widespread, but recently their use has increased (Rivas & Serebrisky, 2020).

Active mobility urban projects can significantly improve its cost-benefit ratio by incorporating the benefits of Nature-based Solutions in their programme, resulting in important synergies with a minimum-cost with maximum-benefit increases.

Nature-based Solutions

Are defined as solutions that are "inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits, and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes, and seascapes through locally adapted, resource-efficient, and systemic interventions" (European Commission, 2021). In short, NbS provide integrated, multifunctional solutions to many of our current urban and rural challenges through the use of nature and natural processes (European Commission, 2021).

The European Union has led an important effort to achieve resilience from climate change and has developed a robust framework of policies and financing of research, implementation and evaluation of plans, programmes and projects under the umbrella concept of Nature-based Solutions. This framework has identified 12 societal challenge areas related to urban resilience that can potentially be addressed by NbS (Raymond et al., 2017; European Commission, 2021).

The aim of this paper

This paper discusses how, by incorporating minor design adjustments with a probable marginal cost increase, a demonstrative urban project originally conceptualized in 2008, could achieve accessibility and promote active mobility in a central *alcaldía (*mayoralty, a figure similar to a municipality) part of Mexico City, a green street network, and could now in addition, report significant contributions to urban resilience, and positive impacts in the societal challenge areas identified by the NbS framework.

Moreover, the 2021 version of the urban project has much better compliance with current urban resilience policies at the state-level (Mexico City is nowadays one of the 32 federated states constituting Mexico as a nation), making the project even more politically viable. This upgrading by adding Nature-based Solutions can be an example of strategic synergies to promote active mobility and Nature-based Solutions in green street projects.

A political dichotomy note is presented.

2. Theories and Methods

Urban projects can bridge the urban resilience knowledge gap

Urban projects, as an inductive form of city making are here considered as a feasible tool for achieving sustainable urban development. Urban projects appear now as an instrument in the city's local realm to connect the needs and aspirations of its citizens with attention and resources from global networks, and which generally operate under their own norms and codes (Philibert Petit, 2006). Moreover, in its design stage, urban projects are a concretion-providing instrument by visualising the possible future qualitatively, as well as quantitatively, and even more they can be established as objective targets to place resources to achieve policy goals such as urban resilience.

Research by design

Research by design is a method of exploration of possibilities that are improbable if we do not take action (De Jong, 2001). Research by design allows us to give form to a programme and/or a project of a given solution in order to visualize and communicate it more accurately to the stakeholders and to be able to assess the given solution *ex ante*. Research by design is a reliable method of quantification of materials, visualizing procedures and calculating costs and benefits of a given project, to assess its viability. A project may act as a hypothesis in a scientific method. It is an assumption of what we think can be the solution of the problem stated in advance.

An active mobility urban project upgraded by nature-based solutions

An active mobility urban project of networked green streets was devised in 2008, aiming to enhance pedestrian and bicyclist mobility by redesigning sidewalks, bike lanes, crossings, and other public spaces in a central sector of Mexico City. The network intends to connect all the urban parks within the sector, has interfaces at the intersections with transit networks, reduces vehicular speeds at the crossings, and effectively separates cars, pedestrians, and bicycles by means of corner sidewalk extensions and sidewalk gardens. Construction of the network's first stage was completed successfully in 2009 as a demonstrative project, linking the two-largest urban parks in the sector with 3km of green corridor with accessible sidewalks, protected crossings, a bike lane, and sidewalk gardens. The completion of the network proposed in the sector studied and even in other sectors of Mexico City should have a better political viability when incorporating nature-based solutions in the program.

The programme can be upgraded by incorporating only two additional design strategies:

- Planting additional urban trees to increase canopy cover;
- Using rain gardens for stormwater runoff mitigation.

The components to be upgraded with such strategies are:

Sidewalk gardens

The typical sidewalk gardens can be modified to perform as rain gardens by designing a concave garden surface instead of the typical convex one, making depressions of different shapes and dimensions that drain surface water run-off and encourage its infiltration into the soil. Where the natural soil is impervious, an engineered sandy or gritty soil may be substituted (Dunnet & Clay, 2007). In some cases, additional space for new trees can be provided.

Corner sidewalk extensions

Areas were devised primarily for pedestrian protection that can also perform as rain gardens like the sidewalk gardens. There are three extensions per corner and four corners

per crossing and each of the 12 extensions in a crossing can provide space for planting at least one tree.

Bikeway separators

Can be integral parts of the street as a longitudinal planter and also perform as rain gardens (Massachusetts Department of Transportation, 2015).

Pavement at the crossings

The pavement can be modified in order to be permeable at the crossings, since the intervention would imply demolishing part of the existing pavement at the crossings.

Policy compliance

Political viability results from the alignment of at least six factors: policy compliance, fundability, technical viability that is related to fulfillment of design standards and regulatory pathways, including support from a legal framework and stakeholder engagement (Zúñiga-Terán, 2020). In this paper we analyse the first factor, policy compliance. Policy compliance is assessed by comparing the 2008 urban project's programme as a baseline, versus the 2021 NBS upgraded program, confronting both with Mexico City's recently issued *Local Strategy of Climate Action 2021–2050* (LSCA) and the *Programme of Climate Action of Mexico City 2021–2030* (PCAMC) (CDMX, 2021).

Additionally, a qualitative preliminary assessment of the project is also done versus its probable impact, before and after the upgrade on the NbS 12 societal challenge areas identified by Raymond et al. (2017) and the European Commission (2021).

3. Results

Project upgrading results

Our case study, the *alcaldía* has the lowest potential area for planting new trees in Mexico City, calculated in about only 6% of the total area already planted with trees (Bravo-Bello, 2020). In a typical street segment in the area studied, there is a count of approximately 12 street trees per every 350m of street length. The project's upgrade allows planting 12 additional trees per crossing, duplicating the tree count along the segment. Over time, the tree canopy surface would also probably duplicate. The upgraded project would result in a substantial increase in the total canopy area.

In the same 350m typical street segment, sidewalk gardens currently provide approximately 100 m^2 of planting area that can easily be converted in rain garden surface. An additional rain garden area can be provided by the corner sidewalk extensions and has approximately 50 m^2. Bikeway separators can provide another 80m^2 of rain garden area for a total of 230m^2 of rain garden area per every 350m street segment.

Policy compliance results

The *Programme of Climate Action of Mexico City 2021–2030* (PCAMC) (CDMX, 2021) has eight general axes: 1) Integrated and sustainable mobility, 2) Solar city, 3) Zero waste, 4) Sustainable water management and rescue of rivers and water bodies, 5) Afforestation of country and city, 6) Adaptive capacity and resilience, 7) Air Quality, and 8) Climate culture. Table 1 shows the comparison of the 2008 and 2021 urban project's versions by confronting them qualitatively with the PCAMC (CDMX, 2021). The 2008 version of the project studied is coherent with only 1 out of the 8 axes (axis number 1), while the 2021 version is coherent with six out of the eight axes (axes numbers 1, 4, 5, 6, 7, and 8).By analysing the PCAMC's 23 action lines and their specific actions, the 2008 version complies with only two out of 23: 1.1.1 Increase the use of bicycle in the mobility system and 1.3.2 Impulse neighborhood-scale mobility with low-emission transport. The 2021 version would comply with six additional specific actions: 4.2.1 Aquifer recharge by green and blue infrastructure, 4.3.1 Reduction of hydric risks, 5.3.1 Impulse green infra-

structure, 6.2.1 Foster integral risk management, 6.3.1 Adopt and transversalize principles of adaptive capacity and resilience and 7.1.1 Follow up of measures of climate action by means of the *Environmental Management of Air Quality of the Metropolitan Area of Mexico City 2021–2030*.

The 2008 project complies with only 9% of the specific actions designated in the PCAMC, while the 2021 version complies with 35% of them, quadrupling the number of policy actions that the baseline 2008 project does.

Table 1. Project versions' compliance with specific actions established by the Programme of Climate Action of Mexico City.

Axis	Action line	Specific action	Description	Project Version 2008	Project Version 2021
1	Integrated and Sustainable Mobility				
	1.1	Promote modal transport change to clean, active and public modes			
		1.1.1	Increase the use of bicycle in the mobility system	✔	✔
		1.3.2	Impulse neighborhood-scale mobility with low emission transport	✔	✔
2	Solar city				
3	Zero waste				
4	Sustainable water management and rescue of rivers and water bodies				
	4.2	Promote aquifer's recharge			
		4.2.1	Aquifer recharge by green and blue infrastructure		✔
	4.3	Reduction of hydric risks associated to climate change			
		4.3.1	Reduction of hydric risks		✔
5	Afforestation of country and city				
	5.3	Afforestation of urban areas by promotion of green infrastructure			
		5.3.1	Impulse green infrastructure		✔
6	Adaptive capacity and resilience				
	6.2	Develop a strategy at risks, impacts and vulnerabilities by climate change			
		6.2.1	Foster integral risk management		✔
		6.3.1	Adopt and transversalize principles of adaptive capacity and resilience		✔
7	Air Quality				
	7.1	Design and execute joint actions to maximize synergism of climate change, air quality and health			
		7.1.1	Follow-up of measures of climate change action by means of the Environmental Management of Air Quality of the Metropolitan Area of Mexico City 2021-2030		✔
8	Climate culture				

Probable impacts on the 12 NbS framework societal challenge areas

An analysis of the probable impacts that the two versions of the proposed green streets on the 12 societal challenge areas identified by the NbS framework, shows (see Table 2) that the 2008 version could directly impact on three out of 12 areas (25%): Green space management, Place regeneration and Health and Well-being. The 2021-upgraded programme would have direct impact on five additional areas for a total of eight out of 12 areas impacted (67%). The additional five areas being: Climate resilience, Water management, Natural and Climate Hazards, Biodiversity enhancement, and Air quality.

When considering also the probable indirect impacts of both projects, the 2008 version impacts on 42% of the societal challenge areas while the 2021 version in 100%.

Table 2. Probable impacts of the 2008 baseline programme compared to the 2021 upgraded programme on 12 Societal Challenge Areas identified by the Nature-based Solutions' Framework.

	Description	Project version 2008	Project version 2021
1	Climate resilience		✔
2	Water management		✔
3	Natural and climate hazards		✔
4	Green space management	✔	✔
5	Biodiversity enhancement		✔
6	Air quality		✔
7	Place regeneration	✔	✔
8	Knowledge and social capability for sustainable urban transformation	i	i
9	Participatory planning and governance	i	i
10	Social justice and social cohesion		i
11	Health and wellbeing	✔	✔
12	New economic opportunities and green jobs		i
	Probable direct impact	25%	67%
	Probable direct and indirect impact	42%	100%
✔	Direct impact		
i	Indirect impact		

4. Discussion

Urban resilience policy compliance

In the Latin American region, cities have experienced environmental adversities, persistent urban violence, massive immigration flows, and weakening economic crises and a growing concern for urban resilience policy frameworks is observable. (Ardila, 2020).

Mexico City's *Programme of Climate Action* can be a good example of urban resilience policy development in the recent years in an emblematic Latin America capital city. Local policies of cities can be aligned to a global quest for reducing carbon and other GHG emissions and to achieve resilience from imminent effects of global warming and negative externalities of fragmented urban tissues. Five out of eight (62.5%) specific areas addressed in the PCAMC correspond conceptually to societal challenge areas defined by the NbS framework (see Table 3).

Table 3. Conceptual correspondence between impact areas of the Nature-based Solutions' Framework and areas addressed by the Programme of Climate Action of Mexico City 2021–2030.

NbS Framework		PCAMC 2021-2030	
1	Climate resilience	6	Adaptive capacity and resilience
		8	Climate culture
2	Water management	4	Sustainable water management
3	Natural and climate hazards	6	Adaptive capacity and resilience
4	Green space management	5	Afforestation of country and city
5	Biodiversity enhancement		
6	Air quality	7	Air quality
7	Place regeneration		
8	Knowledge and social capability building for sustainable transformation	8	Climate culture
9	Participatory planning and governance		
10	Social justice and social cohesion		
11	Health and wellbeing		
12	New economic opportunities and green jobs		

The other three out of eight areas addressed by the PCMAC (37.5%) correspond to urban mobility, energy, and waste management, areas that are also related to urban sustainability and resilience.

Likewise urban policies that have been upgraded to match global or international policies, ongoing urban projects can be upgraded, by sometimes-minor adjustments, as in our case study, to be more corresponding to upgraded urban resilience policies, as demonstrated in this exercise. This upgrading does not represent a significant increase in costs but can report a very significant increase in benefits.

Impacts on societal challenge areas

In our case study, a full direct and indirect match with societal challenge areas defined by the Nbs framework could be feasible only by making minor adjustments in the programme (and in the consequent project). By incorporating NbS such as rain gardens and planting trees, the number of areas impacted by the probable intervention was increased from 25% to 67% and when considering the probable indirect impacts, the number increases from 42% to 100%. Quantitative studies of efficiency and effectiveness should be realised of course, however, a qualitative preliminary assessment is quite positive.

Political dichotomies

Mexico City used to be an important city-state in Mesoamerica since some years after its foundation in 1325 until 1521. In many ways, Mexico City remained a city-state during the colonial period from 1521 to 1821; the city concentrated most of the political power in the Viceroyalty of New Spain. Since Mexico's independence from Spain, centralism has been a distinctive political feature of the new nation, even though a federal republic was established as a form of government in 1823 for the first time and in 1846 for the second in the 19th Century, which ended with a 30-year term of a centralist regime in the *Porfiriato*. After the Mexican Revolution, another strong centralist regime took power in Mexico for nearly 70 years, having in Mexico City an emblematic and politically subordinated capital city. The year 1997 marked the first moment in the 20th Century when, as a somehow independent *state* of the union, Mexico City elected a government from a different political party from that of the federation. There was a short period of nearly 20 years of political diverseness of the City and the Federation, with a climax in 2016 when the political entity *Distrito Federal* was finally recognised as the 32nd political entity of the nation, as *Ciudad de México*. The political diverseness and independence of Mexico City from the Federation, apparently ended in 2018 with the rise of a political movement that governs the Federation and the City once again with a subordinate relationship of the latter to the former.

During the short period of political diverseness (1997–2018), Mexico City advanced substantially in the global agenda for sustainability and produced a number of political initiatives in the fields of ecology, sustainability, and urban resilience. In 2013, Mexico City was selected to be part of the 100 resilient Cities Initiative by the Rockefeller Foundation. The City developed a comprehensive public policy designed to counter the effects of climate change in the Mexico City Climate Action Programme 2014–2020 (PACCM), then the City government issued, *A 2025 Vision for Mexico City on Climate Change* (2015), which includes international, domestic, and local climate policies as of 2015. Mexico City then produced the document *CDMX Resilience Strategy* (2016). This trajectory and impulse to advanced urban resilience policies resulted in the most current political instrument, the recently issued *Local Strategy of Climate Action 2021–2050* (LSCA), and the *Programme of Climate Action of Mexico City 2021–2030* (PCAMC) (CDMX 2021).

At least three political dichotomies: Solar city, Air quality, and Climate culture

Most of the World's climate-change resilience efforts are directed to counteract the effects of GHG emissions. Global aims have been set by the Paris agreement since 2016. Mexico endorsed and signed the agreement on time. However, the present Mexican federal government abruptly veered in 2018 and returned to favor oil and carbon as preferred means of producing electricity, and opposed new hurdles to private investments in clean energy (solar and wind generated energy). This outdated policy stands as the first and foremost dichotomy appearing when Mexico City is striving to be a *solar city,* combat air pollution, and embed a climate culture. A federal thermo-electrical plant in Tula, some 40 km North of Mexico City's megalopolis diffuse limits, has been reconverted to operate with fuel oil, with the corresponding exacerbation in sulfur dioxide levels in the atmosphere, directly affecting inhabitants in Mexico City and its well-intentioned *Solar city,* Air *quality*, and *Climate culture* urban resilience policies.

Future research highlights

There is a trend to enrich the already robust framework of Nature-based Solutions and within it, there is an important research and development line to be discovered, tested, and escalated: the synergism of NbS and Sustainable Urban Design. In particular, we have found out a great opportunity in the exploration of synergies of NbS and Active Mobility Urban Projects. Moreover we have been able to find out that there is also a great opportunity in the exploration of the synergies of Smart City Technologies and NbS, and incrementally in these areas of knowledge with Urban Design. We have to point out that there is also a great opportunity in developing research by design in Architecture, at the scale of the architectural object and its immediate context. Architectural objects might as well perform as NbS: "inspired and supported by nature, designed to address societal challenges which are cost-effective, simultaneously provide environmental, social, and economic benefits, and help build resilience."

5. Conclusions

Given three recurrent conditions, we can observe in many cities nowadays regarding climate warming or even climate emergency, misalignments in resilient policies and particular political agendas, and scarcity of economic resources, finding synergies can be an important strategy for urban resilience.

In particular, this paper proposes, as a design principle, the use of green street networks as a feasible means of finding those synergies, in this case, of active mobility urban projects, which are growing in frequency and acceptance, with Nature-based Solutions.

We found out that upgrading urban projects with NbS is a viable and worthy strategy in a Latin American context where some cities are still starting to fight fragmentation with accessibility and mobility – especially active mobility – projects, and in addition they now have to deal with evident vulnerability to climate change-detonated phenomena.

While alignment and agreement can be reached in a relatively smooth fashion regarding urban resilience policies when only one or two entities of the same level of government

are involved, differences and misalignment happen when there are more than two or three entities involved (e.g., on the metropolitan scale).

There is still a big dependence on alignment of policies and agendas with cities at the local level with those at the federal or even global level. This is the case of Mexico City, where political alignment is needed.

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Governance Frameworks towards Sustainable Infrastructure Transformation – Overcoming Deadlocks, Resistance and Uncertainty through Multi-level Dialogue

Dan Teodorovici [1]*, Sigrid Busch [2] Raphael Dietz [3] and Frieder Hartung [4]

[1] Chair of International Urbanism, Institute of Urban Planning and Design, University of Stuttgart, Germany; dan.teodorovici@si.uni-stuttgart.de; ORCID ID 0000-0002-3918-9635
[2] Chair of International Urbanism, Institute of Urban Planning and Design, University of Stuttgart, Germany; sigrid.busch@si.uni-stuttgart.de; ORCID ID 0000-0002-6647-8782
[3] asp Architekten GmbH; raphael.dietz@asp-stuttgat.de; ORCID ID 0000-0002-0025-3038
[4] Unit of Urban Development, Department of Housing and Urban Planning, City of Stuttgart; Frieder.Hartung@stuttgart.de

* the corresponding author.

Abstract: The transformation towards climate neutrality is a central topic of sustainable urban development and an essential goal of global and national policies. However, the implementation of these policies has so far been insufficient, as they are characterised by dichotomies of responsibilities and interests. This is particularly evident in the transformation of urban infrastructures, characterised by a high complexity of involved stakeholders and planning levels. This paper argues that infrastructure projects are in specific need for inter- and transdisciplinary approaches based on inclusive governance formats. Reflecting on two case studies in the context of sustainable infrastructure transformation from Stuttgart, Germany, this article unravels problems within constellations of stakeholders and planning levels, focusing on the analysis of framework conditions (i.e., spatial, functional, and institutional conditions) and governance levels (i.e., strategic, tactical, operational, and reflexive levels). This case study research and comparative analysis offers transferable suggestions for conceiving a more inclusive governance framework for sustainable infrastructure transformation. This framework aims to enable a vertical and horizontal dialogue between political entities and stakeholders on different spatial levels to overcome the dichotomy between ambitious programs and local concerns, considering the complex systemic networks and socio-cultural conditions involved in transforming urban infrastructures.

Keywords: governance for sustainable transformation; energy transition; integrated urban development; stakeholder-involvement

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1. Introduction

For many years now, global and national climate protection policies have tried to reduce the causes and effects of climate change ("Bundes-Klimaschutzgesetz" 2019; United Nations 2017; WBGU - German Advisory Council on Global Change 2016). However, the results of these efforts are hardly effective, since the implementation of these policies is complex, characterised by dichotomies of responsibilities and interests, and requires an inter- and transdisciplinary planning culture. This paper addresses such dichotomies evident in two case studies from Stuttgart: (1) Stuttgart 21, and (2) the inter- and transdisci-

plinary research project WECHSEL. While Stuttgart 21 gained prominence as one of Germany's most significant and most contested railways infrastructure modernisation and urban development projects since its kick-off in the 1990s, WECHSEL investigated how the German Energy Transition could be used for a sustainable transformation of the Neckar Valley in Stuttgart. WECHSEL explored reconfiguring the existing energy infrastructure to promote an inclusive and resilient development alongside the river bank. Although the Stuttgart Neckar Valley has been the subject of numerous urban design projects since the 1990s (s.e.g. Hartung et al., 2021, 8–9, 17–18; Landeshauptstadt Stuttgart 2017; Landeshauptstadt Stuttgart 2014), WECHSEL and its subsequent Urban Concept "Stuttgart am Neckar" (2021) form the first concept to link existing and new urban development and landscape projects along the entire Stuttgart Neckar Valley. It offers an integrative approach that: (1) brings together historical context and current infrastructural framework conditions, and (2) is embedded in a dialogue process with experts from energy system analysis, urban planning, and sociology, the municipal government, and civil society. Based on the dichotomies apparent from both case studies, this paper first addresses the framework conditions of the German planning system and its governance levels. It then argues that an intermediary and integrative level of governance for sustainable transformation is needed that closes the gap between European Union programs and national programs on the one hand, and municipal planning sovereignty on the other. This gap is particularly evident in the lack of programs and consistent governance frameworks at the regional level and is therefore addressed and reflected on in the course of this article. Finally, suggestions and requirements for such a governance level are outlined with the aim of overcoming deadlocks, resistance, and uncertainty through multi-level dialogue.

2. Theories and Methods

The challenges of transformation management in the area of infrastructures such as mobility and energy require cross-border projects and programs as well as cross-cutting governance structures. Within the EU, joint programs such as the European Green Deal (European Commission 2019) form the basis for advancing the energy and mobility transition. However, the legislative and executive implementation of these supranational policies is based on national planning systems and governance modes, which in turn represent highly differentiated legal and administrative structures (Reimer and Bloetevogel 2012, 14).

2.1 Theoretical framework:

Spatial planning systems and governance – adjusting to new challenges

Although comparative planning research has highlighted the diversity of the different models of current planning systems in European countries (Reimer, Getimis, and Bloetevogel 2013, 5), common strands of development can be identified (Cotella and Stead 2011, 13). Embracing the challenges of sustainable development, the rationale for planning is redefining the role of the institutionalised planning bodies from authoritarian decision-making towards strategic and proactive planning modes. This development is accompanied by the strengthening of lower levels of government. This calls for a higher degree of responsibility especially for the municipal level, i.e. a higher degree of power and of decision-making, based on direct access to higher financial funds, and on a higher degree of democratic accountability to the electorate as to decision-making, based on participation, and as to public expenditure on large projects. This requires the higher levels of government to cede a higher amount of power, along with funds to lower governmental levels than at present. Such empowerment also touches upon legislative aspects: the lower levels of government should be in the position to interpret and adjust EU and national laws according to the concrete local or municipal reality. So, the states and federal states delegate planning tasks to new regional units founded to enhance cooperation between municipalities. On these lower levels of self-government, multi-actor and multi-level territorial governance arrangements are seen as a means to open up spaces of negotiation with public and private stakeholders (Reimer, Getimis, and Bloetevogel 2013, 285).

Sustainable urban infrastructure transformation – conceptualising spatial change management

While these changes in the planning systems should generally facilitate the path to more inclusive forms of planning, there are still challenges in the area of sustainable urban

transformation concerning: (1) spatial, (2) functional, and (3) institutional framework conditions (Wiehe et al., 2020). This is particularly evident in urban infrastructure transformation. Here the spatial scope of projects usually exceeds the boundaries of responsibilities (e.g., of one municipality). Additionally, the functional conditions depend on complex external factors, and the institutional settings most often do not mirror the variety of stakeholders (Gustafsson et al., 2015/ Knieling and Lange 2018/Renn et al., 2020/Fischer et al., 2020).

A change in these framework conditions has to be discussed in relation to transition theory, which argues that transitions are characterised by a shift from established processes and instruments to new models including multi-actor processes which are cross-cutting jurisdictional and functional boundaries (Knieling and Lange 2018, 514). Although transition towards sustainability follows a collective goal, Geels (2011, 25) emphasizes that some actors might have limited stakes in and enthusiasm for the transition processes, leading to "free-rider problems and prisoners dilemma" (Geels 2011, 25). Furthermore, Leas et al., (2014, 1130) argue that transition processes are prone to facing resistances from actors whose interests might be marginalised or neglected, leading to deadlocks within the transformation process.

These problems highlight the relevance of a suitable transition management based on a governance framework to integrate public and private stakeholders (vertically) as well as administrative units and decision-makers (both horizontally and vertically). Leas et al., (2014, 1133) describe the following four governance levels as fundamental for this framework: (1) a strategic level focusing on socio-cultural debate and long-term visioning, (2) a tactical level to transfer the strategic visions into "transition paths" and "agendas," (3) an operational level to implement "transition experiments," and (4) a reflexive level to monitor and evaluate the transition process. The goal of this framework should be to overcome the spatial, functional, and institutional limitations within sustainable transformation projects and to set up a "broad collaborative innovation network, including representatives from business, government, science, and civil society" (Leas et al., 2014, 1133).

The German planning system in the light of sustainable infrastructure transformation – complexity of competencies and planning processes

These current debates and trends apply equally to the sustainable transition management and the spatial planning system in Germany, which is characterised by a decentralised, federal system with a multi-level organisation consisting of four spatial levels coordinated by a mutual feedback principle (Blotevogel, Danielzyk, and Münter 2013, 84ff). The lowest level consists of cities and municipalities that have been assigned planning autonomy, provided that the planning is approved by the higher authority of the federal states. Playing an intermediary role between the federal states and the municipalities, the superordinate level of the regions sets the framework for coordinating and moderating the respective interests of the municipalities, as well as the sectoral planning of the federal states (Figure 1). As mentioned previously, the regional planning level is not consistently institutionalised, though. There is also a diversity as to how this level is designed in the different federal states and with which competencies it is endowed. With the 2006 reform of federalism, the federal states level has acquired legislative authority to set frameworks for spatial planning within their states, mainly focusing on sectoral planning and public measures affecting spatial development (Henckel and Pahl-Weber 2008). With this reform, the superordinate federal level focuses on devising policies and guidelines for development, as well as the exchange of information and coordination between the federal states.

In planning practice, the structure of the German planning system presents challenges: The fragmentation of responsibilities through the respective municipal planning autonomy can only be partially absorbed through the superordinate levels of the regions and federal states. Furthermore, the principle of mutual feedback is mainly shared between the levels of government within states or regions and with the immediate superior or subordinate level. As a consequence, conflicts might occur between the top planning levels and the municipal level, and also between non-institutionalised project partners or stakeholders. In addition, despite efforts to strengthen comprehensive spatial planning, the coordination of sectoral planning (horizontally) and multi-level planning (vertically) is still

a challenge for which informal instruments are becoming increasingly important (Blotevogel, Danielzyk, and Münter 2013, 103). In the same way, the active involvement of civil society and private sector actors requires informal planning instruments. While successful informal instruments and governance models are existing for planning tasks at the neighborhood and municipal levels, these must first be established for projects that go beyond the area of responsibility of individual municipalities – as this is the case for most infrastructure transformation projects. Therefore, a fundamental governance discussion for overarching (and often contested) infrastructure transformation is necessary with the aim of avoiding deadlocks in favor of developing coordinated and integrated solutions.

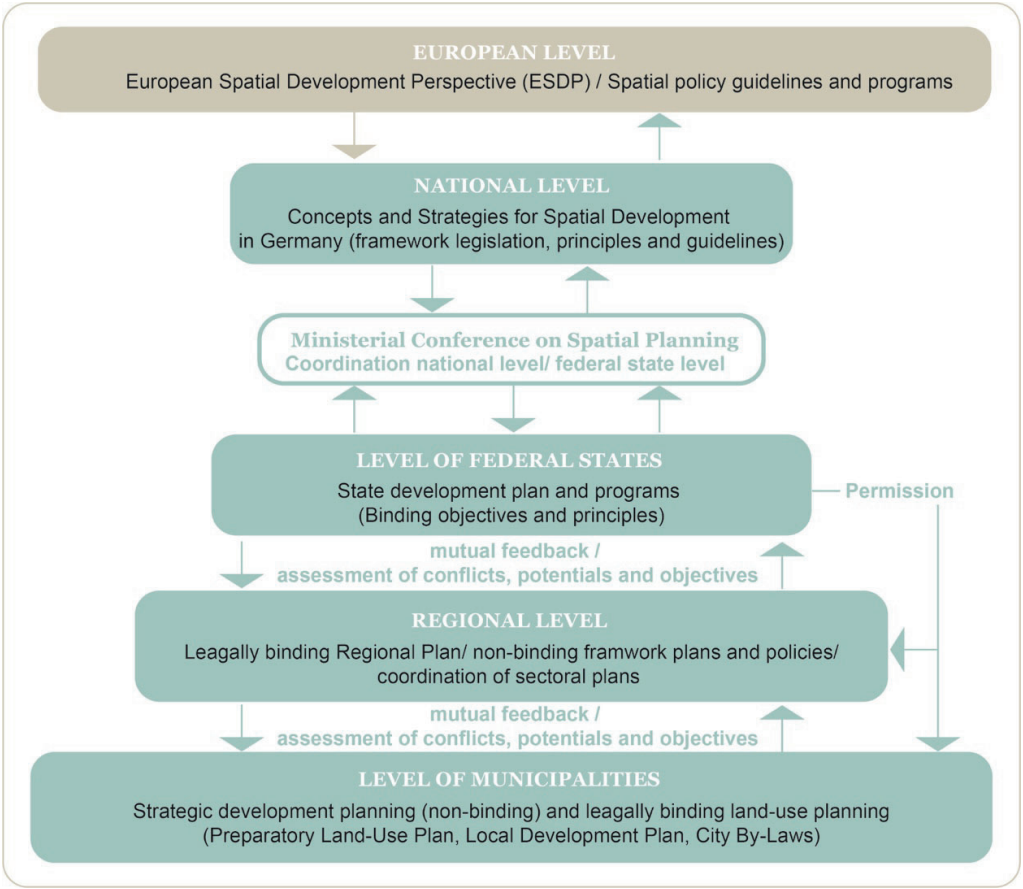

Figure 1. System of Spatial Planning in Germany, source: modified from Blotevogel et al., (2013, 86) and LHS (2007, 6)

2.2 Research Methods – case study research and comparative analysis

The empirical research of this paper refers to the previously mentioned theoretical discourse and governance gap through a comparative case study research of two infrastructure projects characterised by stagnation and resistance.

The case study research is based on the active participation of the authors in the projects as part of a research project. In addition, some of the authors were involved in the participation processes as part of their individual civic and professional engagement. To objectify this experience, the authors also evaluated additional primary and secondary sources (literature, workshop documentations, and planning documents). Both projects are located in Stuttgart, Germany and its region, which enables an in-depth analysis of the underlying municipal and regional planning practice and the shortcomings of the existing

governance framework. Furthermore, they are both based on implementing supra-national transformation policies on the local level (sustainable mobility networks, sustainable energy transition).

The two case studies form a starting point for revealing inherent problems and limitations of policy implementation within the existing planning and governance framework and aim to provide suggestions for a debate about improving these framework conditions. In what follows, the projects and the core issues of the planning processes are presented and reflected upon, and the transferability of findings from these processes is discussed.

3. Results

The two case studies chosen for this contribution are: (1) the transformation of Stuttgart's integration into the European high-speed railway system, which is to be realised by the project "Stuttgart 21," and (2) the transformation of Stuttgart's energy infrastructures and the sustainable urban development along the Neckar River resulting from this transformation, as investigated by the WECHSEL research project (Brodecki et al., 2020).

Stuttgart 21 (subsequently named 'S21') is already far advanced in this respect and looks back on a project history of more than 30 years. The desire to bring Stuttgart closer to the Neckar has been nurtured for just as long, but for a long time it did not get beyond ideas and studies. A prospect of a real transformation has occurred only thanks to the recently started redefinition of the energy infrastructure triggered by the energy transition. Compared to Stuttgart 21, it is still in its infancy of a development planned for decades.

3.1. Stuttgart 21

S21 is part of Magistrale 17 of the Trans-European Networks, a high-speed connection via Paris-Strasbourg-Stuttgart-Vienna-Bratislava, which aims at modernizing the infrastructural connection of the Eastern European EU member states (Eisenkopf, 2007). The project is integrated into the "Stuttgart - Ulm railway project" and is divided into two subprojects, the "new Wendlingen - Ulm line" and the "reorganisation of the railway junction" (S21) (Helmholz, 2013). This reorganisation comprises several sub-projects, such as the construction of the new main railway station in central Stuttgart, the new airport railway station, as well as numerous tunnel constructions under the city. The following partners are involved in the project:

- EU within the framework of the Trans-European Networks Programme, Magistrale 17;
- The German Federal Government – represented by the Federal Ministry of Transport and Digital Infrastructure (BMVI) – finances the part that would have been necessary for the integration of the new line into the Stuttgart node even without the realisation of S21 and ensures the overall financing of the new line Wendlingen - Ulm;
- The state of Baden-Württemberg subsidizes the project in order to achieve an earlier completion;
- The Verband Region Stuttgart (Regional Assembly) contributes financially to the expansion of regional transport;
- Deutsche Bahn is the project promoter;
- The city of Stuttgart supports the project in order to benefit from the connection to the main line and improved regional transport (Bahnprojekt Stuttgart Ulm). In addition, the project will free up about 100 ha of inner-city railway areas for urban development. In addition to the transport aspect, S21 will thus become a project with enormous urban development dimensions called the 'Rosenstein Project' (see Fig. 2).

The project gained international prominence, especially in 2010, when it reached an impasse. The planning had been pushed forward for years, fulfilling the formally required

public participation specifications, which proved to be unsuitable to sufficiently inform about the dimension of the project and to actively involve the public. The construction start and tree felling provoked massive protests. The state government put down these protests, sometimes violently – a circumstance that contributed to their being voted out of office shortly afterwards – leading to a deadlock and a temporary construction halt. A mediation process resulted in partial concessions to the opponents (e.g., preservation of the historic post office at the main station). Then the people of Baden-Württemberg backed S21 to go ahead in a referendum in 2011 (on the evolution of S21 from the start to 2016 see e.g. Stuckenbrock 2016).

One central point of criticism was not addressed, though: The new station capacity was deemed too small to handle increasing future traffic. The Deutsche Bahn rejected the idea to build the station directly with 10 tracks instead of eight as too expensive. Today, this has proved to be a mistake and may be heading towards another deadlock. While the City of Stuttgart is pushing ahead with the S21-Rosenstein urban development, the state's transport ministry is considering building a complementary underground station perpendicular to the new main station (Obermeyer Infrastruktur GmbH & Co. KG, 2021). This would make much of the city's previous planning obsolete and would result in large-scale new planning and further exploding costs, setting it back by years or even decades. This development is a result of uncoordinated planning between the city and regional levels.

3.2. WECHSEL

The WECHSEL research project (2017–2019) investigated the urban planning potential that may result from the sustainable transformation of Stuttgart's energy infrastructure. This infrastructure accumulates in the Neckar valley, mostly denying public access to the river. In the course of the energy transformation, the opportunity arises here to reconfigure large areas along the river and, for example, to establish new sustainable urban quarters or open spaces (on WECHSEL see Hartung et al., 2021; Brodecki et al., 2020).

The project is the first to address the entire Stuttgart part of the Neckar Valley (see Fig. 3). It focused mainly on the areas of the waterworks, gasworks, the Gaisburg coal-fired power plant, and the Münster waste-to-energy plant, which also burns coal. All plants and areas are owned by EnBW, one of Germany's largest energy supply companies. The waterworks have been shut down for years, and the EnBW already questions the use of the gasworks as an inner-city gas storage facility. The Gaisburg power station has already been converted from coal to gas, freeing up the land of the former coal dump for future development. Additionally, other factors stand in the way of large-scale urban development on the sites, which are not solely in the hands of the city and EnBW:

- The river itself is a federal waterway and thus subject to management by the Federal Ministry of Transport and Digital Infrastructure (BMVI).
- The federal road running parallel to the river blocks access to the river and cuts off the development areas from it. It is also under the authority of the BMVI.
- The current energy infrastructure is interconnected by a widely ramified underground pipeline network. In addition to electricity, the power plants also supply the city with district heating. As it is utopian to expect Stuttgart to become energy self-sufficient, the city will have to rely on regional interconnections for its renewable energy supply if it does not want to import a large part of its energy needs from further afield. Then there are also other coal-fired power plants in the region that will have to be shut down or converted in the future. These sites have the potential to be activated for Stuttgart's energy supply. However, this requires a regional approach.
- One proposal of the WECHSEL project for the use of renewable energies was the installation of two large river heat pumps. This also requires a regional approach to avoid that other river riparians also install such systems without coordination, which could lead to a loss of efficiency of the systems and weaken the river's ecology.

Figure 2. Urban Concept Plan, Rosenstein Quarter Stuttgart, International Urban Planning Competition Rosenstein, winning entry of asp Architects and Urban Planners Stuttgart/Berlin, source: asp Architekten GmbH (2018)

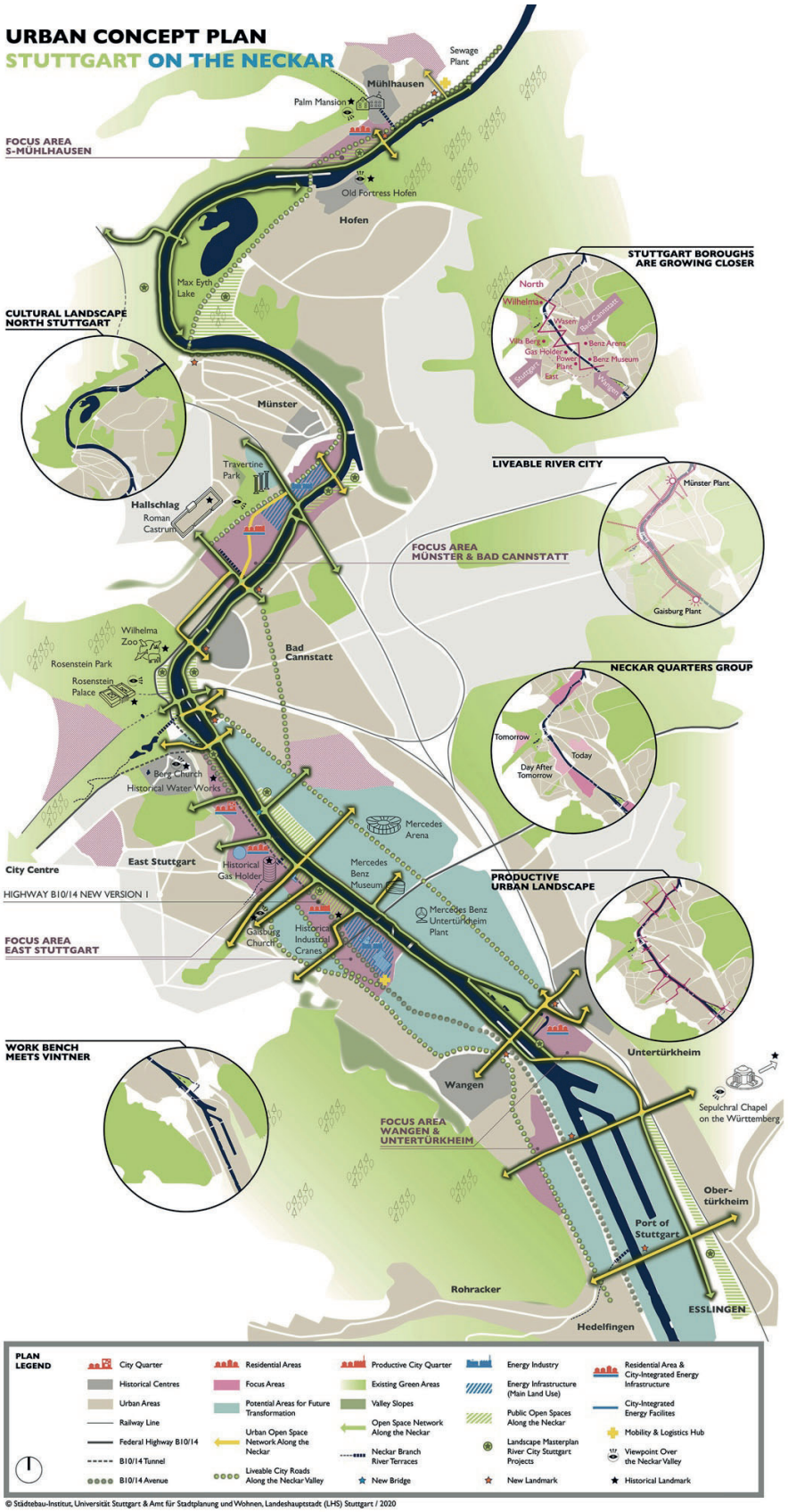

Figure 3. Urban Concept Plan, "Stuttgart on the Neckar," source: Department of Housing and Urban Planning, City of Stuttgart, & Chair of International Urbanism, University of Stuttgart (2021)

4. Discussion

The discussion proceeds along aspects of framework conditions and governance levels mentioned in chapter 2. Both projects have in common that they exceed the (1) spatial and (2) functional framework conditions mentioned by Wiehe et al., (2020). In particular, the complex functional framework conditions of infrastructure projects make thorough and forward-looking coordination necessary, as S21 has shown regarding the train station capacity. To the same extent, the future energy supply and the networking of different energy sources must be coordinated, taking into account the interplay of space reserves and energy infrastructures in the greater Stuttgart region.

Besides these scale problems, the case studies showed that the (3) institutional framework conditions need to include an extended range of stakeholders. Both projects have in common that they serve the implementation of (inter)national requirements at the local level. It can be seen that these requirements affect regional, as well as local concerns and, in addition to their actual goals (transport/energy), influence other local goals, namely those of Stuttgart's urban development. These in turn require the involvement of other actors at national level (federal waterway, federal highway, federal railways), but also at the regional (supply infrastructure) and public-private sector levels (railway/EnBW), as well as civil society.

Based on the experiences from S21, the involvement of these actors needs to take place on the (1) the strategic level, (2) the tactical level, (3) the operational level mentioned by Leas et al., (2014). At the start of S21, a process of negotiating and defining long-term visions for a sustainable transformation of the rail system could have taken place. Since civil society was not involved in this first strategic governance level, overall acceptance for S21 was not achieved. This problem continued at the tactical level, in which the transition agenda for railway infrastructures was defined, and at the operational level it escalated to the deadlock of the project that could only be overcome through arbitration. Now that the process is already well advanced, attempts have been made to include a (4) reflexive level to learn from previous mistakes, and to include civil society initiatives for sub-areas, such as the initiative to preserve the historic railway infrastructural constructions and to integrate them into a public park.

With the sustainable transformation of the Stuttgart Neckar Valley being still in its early stages, lessons learned from the reflective level of S21 can provide for an inclusive process from the start. On the strategic level, an attempt has been made with WECHSEL and the integrated urban concept "Stuttgart am Neckar" ("Stuttgart on the Neckar") to open up a dialogue between civil society, local political parties, planning departments, and key stakeholders such as the EnBW. This strategic governance level was facilitated through an inter- and transdisciplinary research project funded by the Ministry of Education and Research which provided the framework for an informal exchange outside of the institutionalised routines of municipal and regional planning bodies. However, it remains an open question how this dialogue process might be perpetuated after the end of the research project and transferred into the operational and reflexive levels. It also became clear that the project stakeholders did not address the complexity of the transformation process, which led to the question of how an adequate stakeholder constellation could be achieved.

5. Conclusions

Based on these findings and questions, in the concluding chapter we would like to give food for thought towards inclusive governance structures that might promote the implementation of sustainable infrastructure projects. These thoughts and considerations are aimed at the multitude of cities and regions that are currently working on infrastructure projects e.g. in the field of energy and mobility transition and could therefore contribute to an upscaling effect of new governance schemes.

Due to the scale problems that are inherent in infrastructure projects, it is of specific importance to transcend the formal procedures and levels of municipal planning and develop

flexible governance frameworks which allow for multi-actor and multi-level governance arrangements.

These arrangements might be initiated by (a group of) actors operating as project patron with the aim of establishing a long-term dialogue platform for all relevant stakeholders. Depending on each project and the needs arising in the project, these stakeholders would include members from different realms (politics, industry, science, planning, administration, civil society, etc.) and levels – from the local and municipal level over the regional one to the state or federal level. The purpose of such a first multilateral dialogue platform is to create a long-term monitoring or steering group (a regular round table or a project company) that consolidates the governance arrangement. The management of this governance arrangement needs to be anchored in transparent participation formats with expert and public feedback to interim results. For the sake of the greatest possible inclusion, the participation process may need to conceive experimental formats that transcend the official steps required by the planning system. Dialogue is based on partnership and integrative approaches, as also outlined for instance by the New Leipzig Charter especially as to "[s]trengthening urban governance to ensure the common good" (s. European Commission 2020, p. 7).

The communication within these formats could focus on: (1) clarifying the overall project goals on the strategic level, (2) discerning the interests of all involved stakeholders, and (3) finding ways to attain fruitful compromises. Eventually, this communication needs to be based on partnership and aims at promoting an inclusive planning culture based on cooperation, integration, and a successful multi-level dialogue.

Data Availability Statement

https://international-urbanism.de/research/wechsel/

Contributor statement

Author 1: Conceptualisation, Writing Original Draft & Review and Editing, Resources, Supervision

Author 2: Conceptualisation, Writing Original Draft & Review and Editing, Methodology, Visualisation, Resources, Supervision

Author 3: Conceptualisation, Writing Original Draft & Review and Editing, Visualisation

Author 4: Conceptualisation, Resources, Visualisation

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Geographies of (Hydro)Power： Water Exploitation and Urbanisation Praxis across the Veneto Region

Elena Longhin

1 Università IUAV di Venezia; elonghin1@iuav.it; https://orcid.org/0000-0002-8573-6337

Abstract: Since the mid-20th century, fundamental shifts in the state and functioning of the Earth system have emerged through a multiplicity of socio-ecological crises triggered by ever-growing large-scale use of natural resources and the ever-greater scales of social and material exchange, and accelerated by climate change. Although over the time we have come to realise how the long-distance interactions between urban and non-urban territories, supporting vertically cities and their functioning, have increasingly altered ecosystems and established intensively operational landscapes, energy extractive production methods and their reciprocal counter-landscapes are rarely critically investigated as constitutive parts of the urbanisation process. Transcending binaries of urban/rural environments, this contribution describes larger research attempts to understand and question the social, political, and ecological dynamics deployed by the energy spatial project along the Piave River, the most engineered hydro basin in Europe. Whilst the exploration offered by the methodology of landscape urbanism pushes the focus beyond the urban realm, it makes use of urban political ecology's conceptual framework as a lens through which examining how urban metabolic processes entail urbanisation across scales. Engagements between urbanism research praxis and landscape political ecology additionally provide a productive method to frame and conceptualise extensive forms of urbanisation through the focus on critical landscapes. The research argues that by bringing upfront the anatomy of the riverine infra-natures is a way to question inherited and ongoing dynamics entailed across landscapes, as well providing as encompassing understanding of their intricate apparatuses' roles in forging the territorial palimpsest.

Keywords: operational landscapes; machinic territories; political ecology, resource extraction, hydro-power.

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1. Introduction

The acceleration of resources extraction, accumulation, and exhaustion along productive apparatuses has reached criticality. The recognition of capitalism, based on fossil fuel and natural resource exhaustion, as the upholder of the condensation of power, capital and nature, requires an intellectual state shift in order to revolutionise views and praxis. In fact, what the Anthropocene has shown ultimately with the year-long ongoing health crisis due to the COVID-19 pandemic is that we have come to a crucial threshold. During this time, we have come to realise that complex infrastructural systems triggering river and coastal ecologies, such as hydro-power infrastructures, have profoundly reshaped the built, as well as the non-built environments. Nevertheless, energy-related apparatuses, and their reciprocal counter-landscapes, are rarely investigated and considered as constitutive parts of the urbanisation process.

Transcending binaries of urban/rural environments, this contribution therefore aims to develop an understanding of the energy spatial project deployed along the most engineered hydro basin in Europe, the Piave River – the only alpine system that reached the Venice Lagoon – by exposing the role of a water apparatus within the urbanisation processes [Figure 1]. It aims at contributing to the Track n.3, and raises a series of questions stemming from the materiality of water and its political implications in the frame of the current climate regime. Furthermore, it argues that by bringing upfront the anatomy of the riverine infra-natures, and the interplay of socio-environmental conflicts with dams' economy of power, is a way to question both inherited and ongoing dynamics entailed by the machinic landscapes across the region, as well providing as encompassing understanding of their intricate apparatuses' roles in forging the territorial palimpsest.

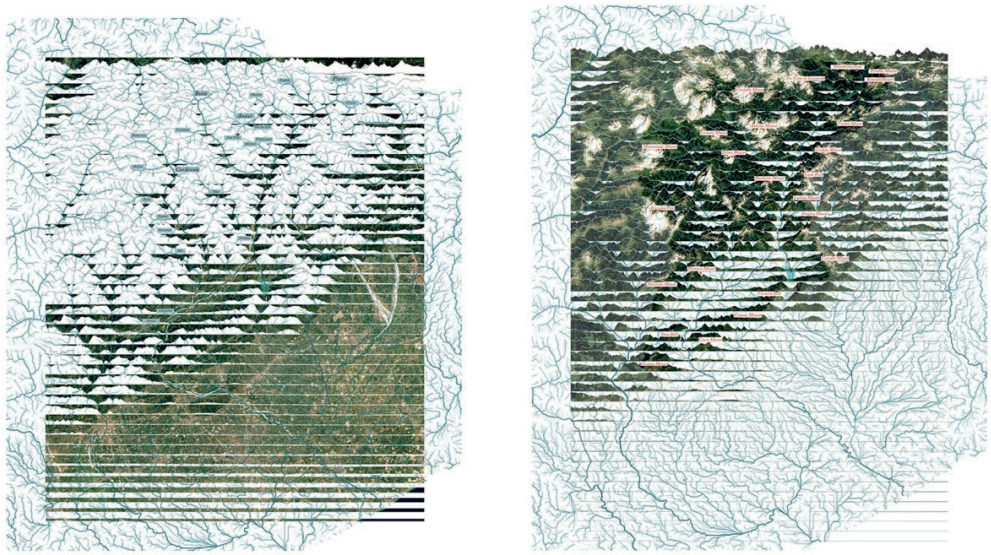

Figure 1. Cartographical and hydrological analyses of the mountain (right) – plain (left) morphological condition across the Piave river basin.

2. Theories and Methods

The idea that growth in its current resource-eager form is incompatible with environmental stability and recovery has been pushed forward since the 1972 Club of Rome's report over the limits to growth (Meadows, Meadows, Randers, & Behrens III, 1970) which outlined 13 scenarios for the future. Following two other ground-breaking publications, Osborne's *Our Plundered Planet* and Vogt's *Road to Survival* (Osborn, 1948; Vogt, 1948) that called for limiting the world's natural resource consumption, it highlighted the bio-physical limits of the planet, and classified pollution, lack of resources and overpopulation as the factors of 21st century industrialised society. Since the '60s, the idea of the Earth's fragility started to be widely acknowledged: the Moon landing in 1969 also contributed to conveying the idea of the planet as a fragile ecosystem, on April 22nd 1970 the first Earth Day was established, and even the detonation of the atomic bombs had instigated the notion of the Earth (Gaia) as something that could be destroyed.

At the same time, however, in the mid-1970s, the market economy was unleashed with devastating effects and what started to escalate was the emerging regime of "flexible accumulation," the real novelty and key feature across the following years (Harvey, 1989). In fact, out of the war came a number of new technologies which permitted a highly-promising recovery of resources that had been impossible or economically impractical to extract before. They were all means for both access and extraction of natural resources and crucial instruments for the development of rural and peri-urban areas into cities (Viallet, 2019).

The acknowledgment of the urgency to restrain growth was, however, rapidly swept under the carpet – as quickly as the affirmation of emerging of new renewables technics – overpowered by the perspective of growth, plenty, and freedom advancing new spatial dispositions for the city, as an unbounded and unlimited space in expansion, whether dense or scarce (Iturbe, 2021).

Processes of anthropization through urbanisation and agriculture more vastly contributed to the degradation of the Earth's living tissue. Although being recognised in twentieth-century urban studies, as territories that were qualitatively specific, "city-regions," "city-territories," and "conurbations" (Piccinato, Quilici, & Tafuri, 1962), were still considered separated from the earstwhile "non-urban" spaces lying beyond their boundaries (Brenner & Schmid, 2011). Given the interdependencies between the built and the natural environments, it is no longer possible to consider a clear division between what's city and what's rural, nor to ignore the spatial relations which ties these spaces to their distant places of production. In the last 40 years especially, we have, however, witnessed several far-reaching worldwide socio-spatial transformations among which the creation of new scales of urbanisation and the re-articulation of urban territories (Brenner & Schmid, 2011; Soja, 2000), that require us to acknowledge the inherent connections between the urban and non-urban spaces. The urbanisation process which has consolidated over time, beyond the politically constructed city-border, consolidated as well the spatial relationship between energy capitals and energy peripheries (Brosnan, 2002; Cronon, 1991; Melosi, 2014), however, the extractive tendencies of contemporary society are rarely viewed through the lens of energetic transformation (Iturbe, 2021).

If there is no doubt that the territory is the measurement of human phenomena, the case of Piave's geographies of power proves highly explicative of how resource extraction in the form of water technologies entwine ecology and society (Boelens, Hoogesteger, Swyngedouw, Vos, & Wester, 2016) in a distinctive mode of social-spatial organisation. This example has resulted across a century of radical territorial re-configuration of the north-Italian landscape (Bianchi, 1989; Elden, 2010). Spanning across the Alps to the Adriatic Sea, the Piave River is a 222 kilometre-long river which exemplifies a fundamental space-time continuum of the Italian identity (Marzo Magno, 2010). It is the only river that does not flow, nor gush, nor swell anymore, but completes a long other list of actions, with different tools and mechanisms across the territory it traverses [Figure 2]. In fact, uses of the river are multifunctional and, inevitably, management issues surrounding the river are complex. Major conflicts are directly related to water resource management, hazard mitigation, mineral extraction through gravel mining (with implications for the supply of sediments to the coast), flood defence, and environmental conservation. Water abstraction, from both the river and basin aquifers, for irrigation and domestic supply and hydroelectric power production constitute the main mechanisations the river endures.

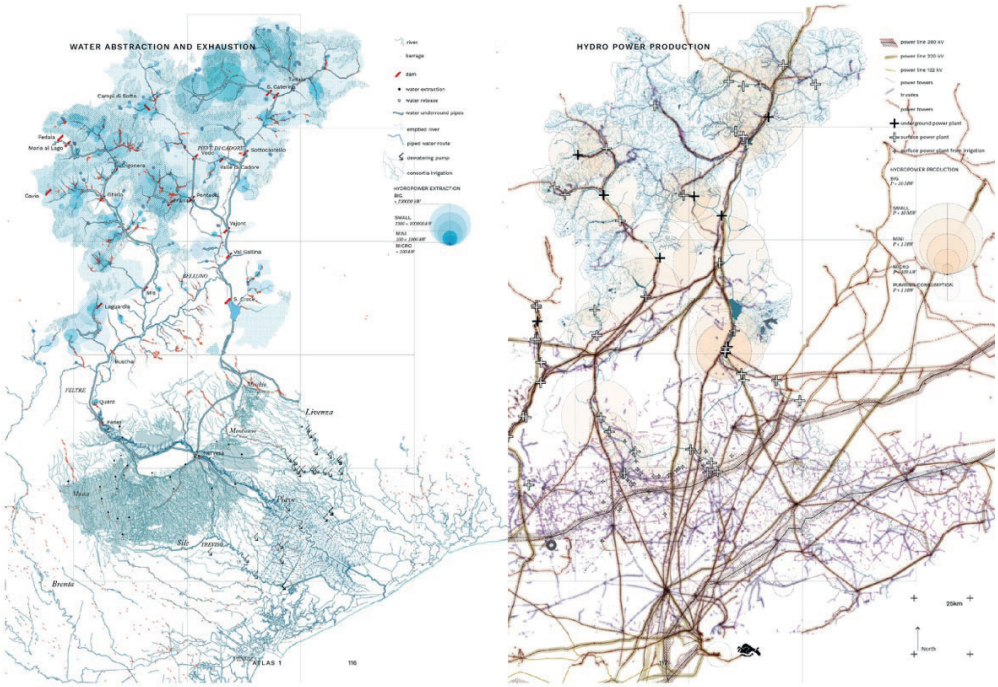

Figure 2. Maps of the water abstraction and exhaustion systems (left); map of the hydro-power grid of distribution (right), across the Veneto Region.

Inherited from the modern era, over 100 years of major alterations and modifications of its hydrological basin characterise a specific operational landscape with complex

contemporary territorial implications. The 'non-city' spaces within it inscribed have undergone internal political-economic operations and spatiotemporal dynamics entangled with the construction of the city environment whose ecologies are still systemically redesigned, dictating socio-ecological crises (Brenner & Katsikis, 2020). Above all, however, its waters served the most, as an indispensable nature capital, that once turned into energy boosted the expanding electric industry, enabled the establishment of the first relevant Italian industrial platform along the marshlands of Venice, and therefore contributed to the technological acceleration that sustained a territorial transformation and a radical social progress. The foundation of this new ground, and the exploitation of the Piave river are intertwined with one particular company since its foundation in 1905 up until the nationalisation of the entire electric industry in 1963. In fact, SADE (Società Adriatica di Energia), enabled the transformation of the socio-economic condition of the Veneto region in the span of just two decades across the 1940s and the 60s.

As the most engineered river in Europe, the Piave River has been turned into an intricate machine which regulates the 90% of its water. This technological apparatus (Erik Swyngedouw, 2015) generates the 6% of the Italian energy demand and the 60% of the Veneto region one. The remaining water quantity, which counts for the 10% of its original natural state, once reached the plain is eventually imbibed by cultivated fields at the rhythm of 99 cm/s. The apparatus responsible of this condition, which makes it the most engineered river in Europe, is an intricate system composed of 13 dams, 12 artificial lakes which hamper 160 millions of cubic meters of water, 335 intakes (barrages and weirs), 30 electric power plants, 200 km of underground or over ground pipes and an infinite number of other artificial barriers and embankments (Armiero, 2013; De Nato et al., 2014; Vallerani, 2006). This complex scheme of power production, entangled with a large-scale distribution pattern, composes an energy machine progressively layered across the territory in a close disguised relation to the agriculture one, eventually markedly defining the Veneto region spatial organisations since the beginning of the nineteenth century [Figure 3].

Stemming from the materiality of water, its role and value, a series of questions drives the research. It asks who has the power to accumulate it, to use and distribute it within a complex overlapping fragmented group of institutional bodies? Where do we draw the beneficial threshold of great works acceptance, with their considerable landscape alterations? Where and how the system is unresponsive or unproductive? Is it possible to imagine a structural modification of the machine which implies the fragmentation into individual collaborating sub-systems, therefore addressing the site-specific condition of their environmental and geo-spatial contexts? What are otherwise the consequential ecological costs of a consistent use of the same mechanism? To what extent can we reduce the energy demand and what other forms of development might we imagine?

The use of Urban Political Ecology (UPE)'s conceptual framework comes into help in trying to answer these questions, as a lens through which showing how the socio-natural metabolic flows originating 'elsewhere,' in the non-urban space, produce cities as much as their specific socio-political contexts (Connolly, 2019). It provides useful conceptual methodology for analysing processes surrounding the politics of distribution and the abstraction of water (Menga & Swyngedouw, 2018; Peet & Watts, 2004; E. Swyngedouw, 1997). The work of urban political ecologists, focusing on elements of nature which permeate cities shows – while perhaps focused on a particular urban site, as critically observed by Angelo, Wachsmuth, and Connolly – that the socio-natural flows and interactions taking place within the city are not bounded beyond the urban constructed inhabited space (Angelo & Wachsmuth, 2014; Connolly, 2019), helping to conceptualise the end of the urban-rural divide. As Bill Cronon observed, the "urban and rural landscapes . . . are not two places but one. They created each other, they transformed each other's environments and economies, and they now depend on each other for survival" (Cronon, 1991, p. 384). Within the same perspective, Henri Lefebvre understood places as multidimensional sites of processes of social construction, symbolic representation, and spatial practices, and argued that capitalist urbanisation had formed an uneven "mesh" of "varying density, thickness, and activity" that was now being stretched across the entire surface of the world (Lefebvre, 2003) (Brenner & Katsikis, 2013). The resulting spatial configurations have thus strong implications over the ways in which non-urban areas are actually urbanised. Lefebvre's understanding of urbanisation – and the significance of his legacy – was not only about the 'explosion' of urban societies, but also that it is a highly uneven and socially unjust process which reinforces class divides and power relations. This is very clear in the ways in which 'irreducibly complicitous' actors and processes occurs along the Piave hydro-basin.

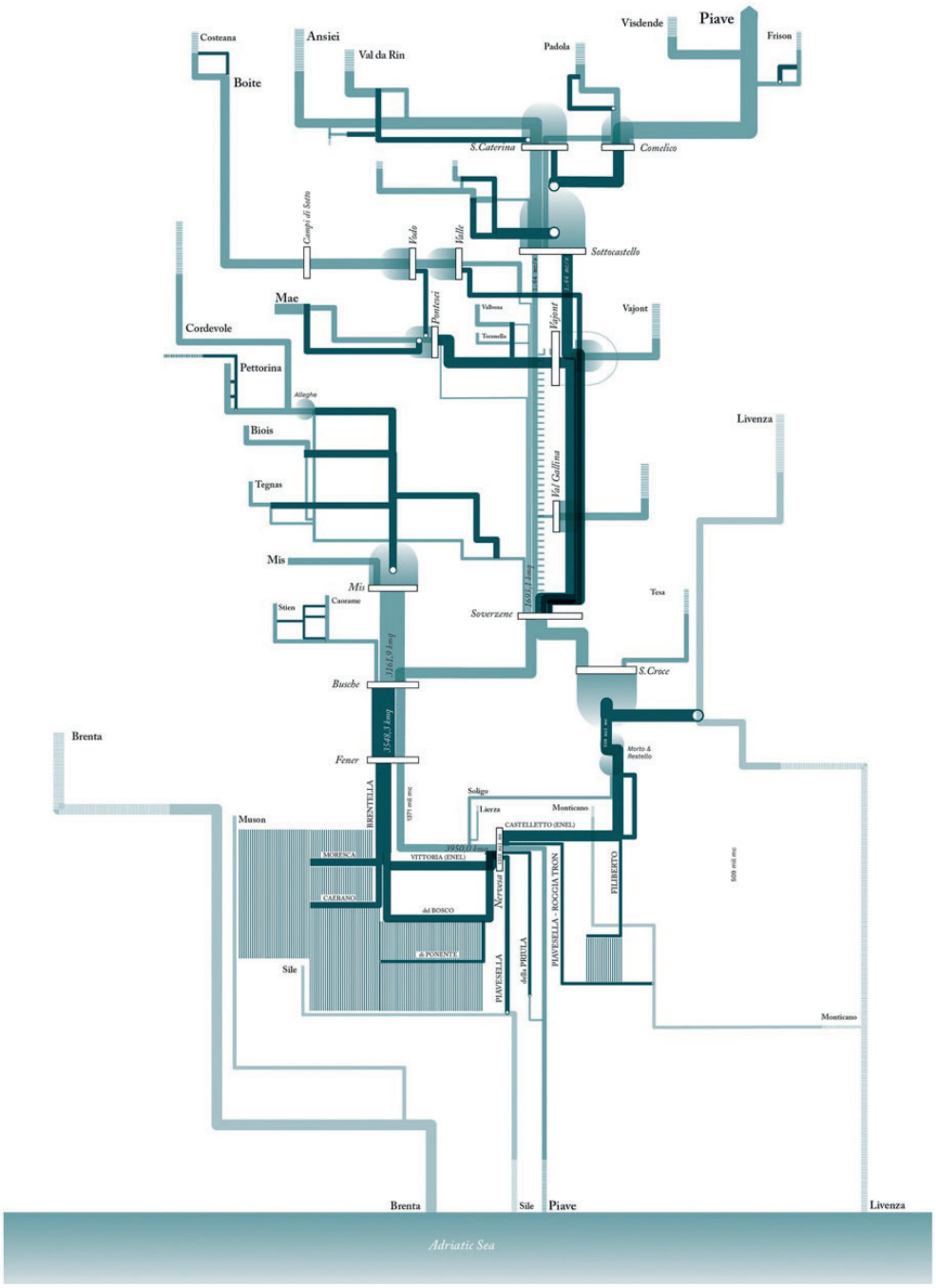

Figure 3. Diagram north-south of the hydro-power apparatus of water abstraction, accumulation, and distribution, from the Alps (top) to the Adriatic Sea (bottom).

Engagements of this methodology with landscape urbanism research praxis provides a productive method to frame and conceptualising extensive forms of urbanisation through the focus on critical landscapes. This draws from the understanding of landscape as a "machinic model" which requires a 'transdisciplinary praxis' (Spencer, 2012) and acknowledges critical agency as opposed to – as Grahame Shane argues (2003) – 'flexible,' 'sustainable,' or 'bottom-up' approaches in urban design. It elaborates on the concept of a produced, assembled, networked, or cyborg-ian nature as an internal-versus-external component of society in deep contact with capital, challenging the superficial idea of 'sustainability' and 'naturalism' inherent in many architectures and planning of the late 1900s and early 2000s especially (Gissen, 2019; Spencer, 2020). The methodological approach into *territory as a process*, is useful for the examination of dependencies,

responsibilities and inequalities of everyday diverse practices of urban phenomena and their more-than-urban connections. The understanding of their infrastructural assembly as supporting apparatuses through which material, social, and economic flows foster capitalism's dynamics in the globalised territory (Castro, Ramirez, Rico, & Spencer, 2012), is unfolded through the tracing of different related sites where flows are *de facto* captured, accumulated, exhausted, or distributed. The research has therefore made the first ever attempt to analyse – through advanced geospatial simulations – how and where water is abstracted or accumulated, it deviations through artificial paths, as well as its actual flows and natural accumaltion areas according to the geomorphy of the river basin. This analysis has been put in relation to the mapping of the energetic apparatuses and their network of distrubtion across the landscape into urbanised areas.

3. Results

From the appropriation of lands and water, the creation of reservoirs, the installation of industries, to the capacity to irrigate large scale of territories, dams have been part of a "political economy of power" (Swyngedouw, 2004) which consequences have spatially reshaped even the most remote landscapes. Their impacts radically have restructured the functioning of entire territories, established questionable processes of appropriation of spaces and resources, and triggered political power relationships both upstream and downstream rivers. In the riparian territories of the Veneto region social-economic conflicts still pervades issues around mountain water accumulation and plain replenishment. Whereas Swyngedown (2004) makes reference to a process of local waters being transformed into global money, through processes of privatisation around the world, this is occurring in the Veneto region as both the energy providers (accumulating water) and the irrigation consortia (exhausting water), making use of Piave, bolster the productive process of both the mountain and the plain. The conflict around the compatibility of these productive systems, in the frame of a necessary preservation of the mountain environment, burst into the debate of the raising requests for the creation of new hydro power plants and the necessity to make use of more water to irrigate soils.

In the past 10 years, a new scale of exploitation is pervading remaining pristine streams: with the establishment of monetary incentives, in the shape of "green certificates" (introduced in 1999 and confirmed with the law 99 of 23/07/2009, in transposition of the indications of the European Energy Directive no. 28/2009, issued following the Kyoto Protocol), a growing number of private companies have since financed the construction of 'mini and micro hydro-electric powerplants' (micro hydro-power plants P < 10 KW; mini hydro-power plants 100 < P <1.000 KW) and managed their waters. This method has consequentially accelerated a growing number of granted applications (1270 in 1999; 2536 in 2015), even though they contribute just 0.5% of the total energetic production, exemplifying the incoherence of their purposes. Whilst incentivising a proliferation of private governing bodies with different interests overlapping to the regional/provincial management of the river waters, their implementations do not follow even an economic logic, but a purely financial one. Their subsidies are re-funded by the public society through an imposed tax over the energy bill, whilst providers can decide to sell their energy at a price three times higher than the market value. The Piave River is currently exploited for the 80% of its course through a machinic apparatus made of 200 kilometres of pipes, a percentage that will reach 90%, plus other 200 kilometres, if the undergoing applications will be approved. This is made evident with a cartographical analysis of the recent intake points (between 2018–2020) [Figure 4], which intersected with previous analysis resulted in saturation map of the upper river basin (see right map), declaring the current exhaustion of Piave's water.

The floodplain area is instead where the system of hydropower production intersects the irrigation one, from which a dense web of channels and pipes depart to irrigate the plain fields by 1.6 millions of cubic metres per year. Currently, water concessions for irrigation practices exceed the river (remaining) capacity, raising conflicts between practises of accumulation and exhaustion. Water used to irrigate the high dry plain is partially returned to the river basin through soil infiltration, whilst the one abstracted for electric generation – instead of going back to the river – get distributed and exchanged through a complex entangled sub-system of distribution. An experimental phase over Piave and Sile Rivers (European Directive 2000/60/EC) held in 2018 have proven the dependent relation of the high plain with the artificial reservoirs, the important factor played by the conservation of the river flow against pollutants derived from urban waste and the contribution to recharge the underground water table. This makes evident the relevancy to recognise the larger set of values the river plays, its influences in the larger

web of human-environment interaction, and its role in the construction of a landscape which spans from the high plain until Venice Lagoon.

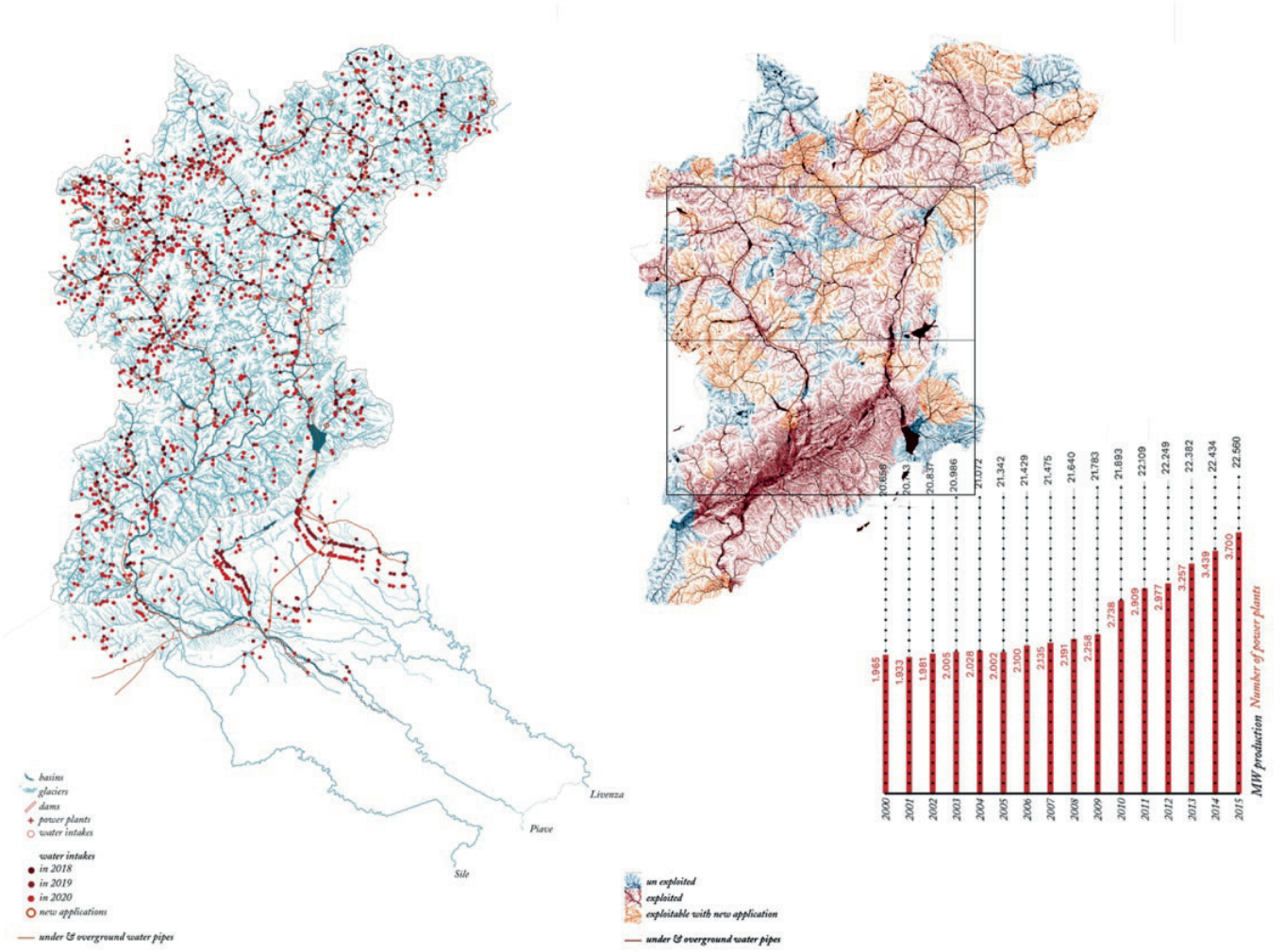

Figure 4. Map of the totality of the water intakes in 2020 (left); map of the resulted saturation of the waterscape of the Piave hydrological basin; diagram of the evolution of the hydro-power plants: increase of number of intakes between 2000 and 2015 and energy production.

In the low plain, consequential effects of both the restrained water and sediments stock behind dams are also visible, as well as of the progressive anthropization of the river course. The river flow rate and the sediment supply have been in fact considerably altered by hydroelectric dams, causing reduced meanderings, faster water velocity, and an increase in its kinetic energic deprived by lack of sediments (Surian, 1999). In addition, the economic drive and the simultaneous rush in building constructions, which have surged markedly since the 1970s, have induced a remarkable waterproofing of the soil, together with the spread of gravel mines, have compromised river capacity to cope with flooding and the capacity of the soil to absorb rainwaters, thus amplifying extreme consequential territorial events [Figure 5]. The dense network of rivers, canals, drainage channels, and ditches has been weakened by spreading urbanisation, their bed being buried, piped, or occupied by new roads, new cycling routes, or wild vegetation and threatened by a densification of the urban space.

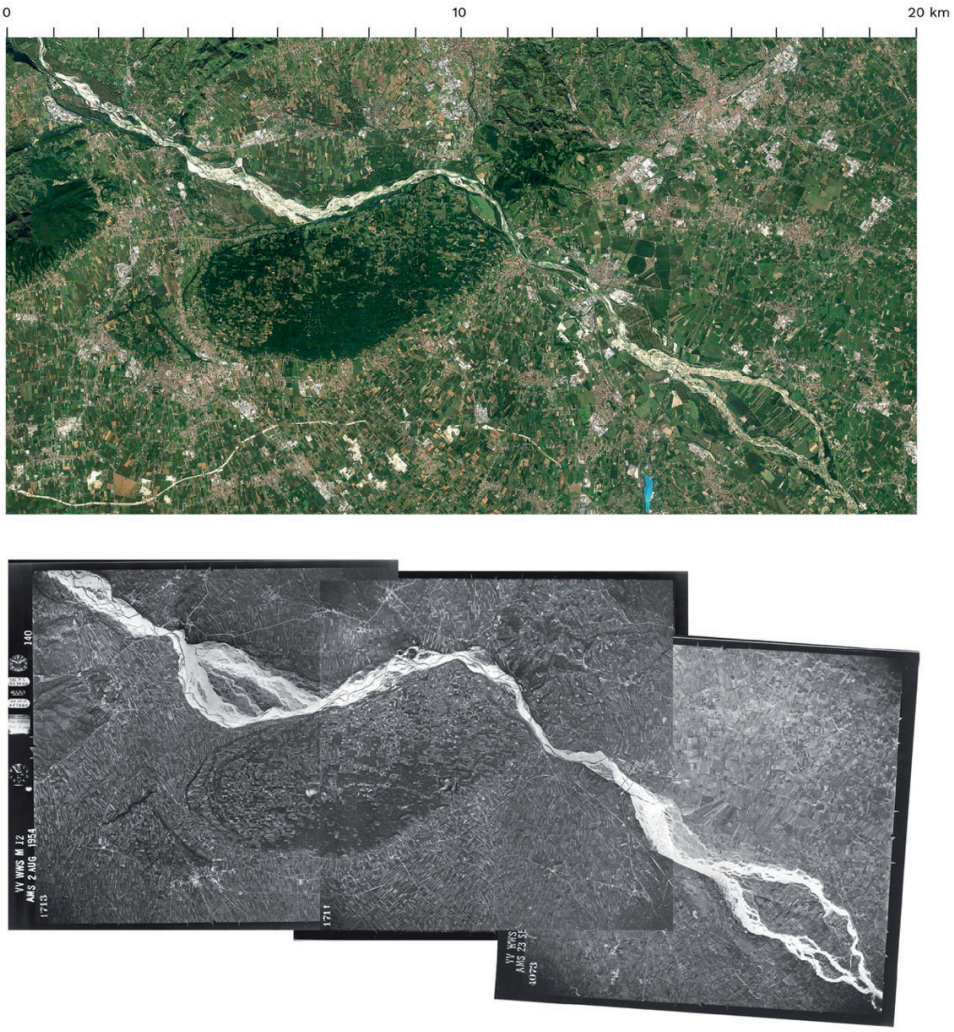

Figure 5. Comparison of the current occupation of the river course when it leaves the mountains and crosscut the high plain: above a 2020 aerial view, below a collage of photographs taken in 1954 during the flights of GAI-IGM Gruppo Aero Italiano – Instituto Geografico Militare (IUAV, CIRCE).

4. Discussion

Having for centuries encouraged human tinkering to exploit its inherent powers, the Piave vast hydrological basin has been exhausted as a hydro-electric laboratory. The long array of attempts to tame the river and transform its watershed into a tractable "organic machine," to use White's term (White, 1996, p. 112), had in fact played a contributing role in unleashing a far wider set of relations across the region, whose outcomes entangles the mountain-plain infrastructural flows in a diffused and complex system of territorial interactions. The plain is today one of the most extensive inhabited and economically competitive urban landscapes in Europe.

The uses of the river are about work and justice, electricity and ways of life, fish and irrigated fields, gravel and sand, and about "how these things are inseparable in our own tangled lives" (White, 1996, p. 112). In the ways in which users, power managers, utility operators, agro-industrial and construction industries have manipulated the river materiality, it comes clear how "capital realises its own agenda of "accumulation's sake, production for production's sake," against a background of the technological possibilities it has itself created" (Harvey, 1996, p. 158). All the actors involved in the exploitative processes occurring along the Piave claim their part of the machine: the production of energy and the irrigation dynamics commodify the river as a whole in an interdependent chain of processes. In point of fact, energy-related apparatuses and their reciprocal counter-landscapes are rarely critically investigated as constitutive parts of specific

urbanisation processes. Although the next energy transition – with its promising innovations characterised by larger uses of renewables forms of energy generation and technics – is yet to be implemented, we already recognise that they hardly support alternative patterns of energy consumption that have shaped the built environment for the past two centuries (Iturbe, 2021). For this reason, to come to terms with the river operationalisation within the urbanisation processes we need to come to terms with the palimpsest the basin has overlaid (Viganò, 2020), intercepting the dispossession and accumulation of physical materials, value systems, theories, and rationalities.

5. Conclusions

Through the lens of hydro-power, the research shows that along the Piave exists a long array of dynamics and arguments which are political and material at the same time. All the actors involved in different ways in the exploitative uses along its course, claiming their part, commodify the river in an interdependent chain of processes. Physical modifications to the river, praxes of water accumulation, extraction and exhaustion, the inhabitation of its spaces, together with polices, laws, and plans are all political technologies of this territory. With their own strategies, methods and approaches, they imply specific doings of power, which results in specific social and material consequences. Demonstrating their interdependent relationships, the work attests how the river mechanization is fundamental in sustaining urbanisation praxes.

Acknowledging the challenges of exploring and describing conditions which carry both spatial and temporal scales, the work claims cartography and the design of territory (considered as surveying and projecting) as instruments with the potential to expose and mediate among managerial, surveyance, and legal practices and fields. In doing so, it argues for a multidisciplinary approach which brings together urban and landscape studies with political ecology, science of technology, environmental, and society studies, from where inform alternative perspectives. In the case explored this has exposed criticalities, fragilities, as well as strengths and point of crises along the river course, from where an encompassing new territorial vision would have to be designed. By shifting urbanism focus into large 'operationalised landscapes,' through the lens of landscape as a 'way of seeing,' working and reconstituting knowledge, the approach aims at empowering territorial research as a design tool.

Data Availability Statement

A long series of geospatial datasets have been explored, juxtaposed, compared, and unified. Besides making use of the open datasets from European repositories (European Environmental Agency) and individual regional geo-portals (Veneto, Friuli Venezia Giulia, Trentino, Alto Adige), the cartographical representations were made possible through the retrieve of undisclosed (or unpublished) datasets belonging to the following companies and institutions: Consorzio Piave; Arpa Veneto; Province of Belluno; Glacier Inventory of the Alps from Sentinel-2 (2019); European Soil Data Center ESDAC; WWF EPO Brussels 2019 (Euronature, Geota, Fluvius); EU Horizon Amber 2020; Dam Removal European Project, River Watch; Balkan Rivers, WWF (European Policy Office); World Fish Migration Foundation.

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Mutual Adaptation: A Perspective for Analyzing the Urban Transitions of Modern China

Qi, Huiyang [1, *]

[1] National University of Singapore; Qihuiyang@u.nus.edu; 0000-0002-7748-2963.

Research highlights

1) The paper discusses a perspective for analyzing urban transitions of modern China.

2) The perspective focuses on the reconciliation process of bottom-up public needs and top-down politico-economic goals, and the process can be partially observed through the transformation of local economic organizations.

3) The perspective helps to understand how a particular city region has adapted to past transitions, which may help the city region in adapting to new development paradigms.

Keywords: Urban transition; Local adaptation trajectories; Economic organizations; Planning implementation.

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Diego Sepulveda
Fransje Hooimeijer
Taneha Bacchin

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1. Introduction

If modernity is considered as a moving target, then it opens up the present for a future that is expected to be different and requires active shaping, molding, and preparation (Schmidt, 2014). Conceptual dichotomies provide anchors in defining and achieving targets, allowing the unfavorable pole to catch up with the favorable pole on the trajectories that identified by the favorable pole. Under such a consideration, conceptual dichotomies pervade the practice of urban planning and urban governance. However, the actual implementation of the plan may be constrained by the dichotomies that crafted it, because the dichotomies themselves are questionable, questionable in the distinction of two poles, questionable in the generalizability of the trajectory.

Skinner (1977) questioned the dominating dichotomies (rural/urban, industrial/pre-industrial, and Occidental/Oriental). He contested that such constructed-types approach "assumes a coincidence in covariation among key variable that seldom obtains in the real world." (Skinner, 1977: p.5) Rowe (1989) questioned the dichotomy of Occidental/Oriental cities. By observing Hankow, Rowe pointed out that the "urban commune," the key variable for the modernisation of Occidental cities, was also observed in a typical migrant city in the late Imperial China. Robinson (2002) questioned the dichotomy of world cities/other cities, she contested that such an approach is at best irrelevant and at worst harmful to the poor cities. Therefore, though conceptual dichotomies help planners and policymakers to craft visions to "conjure" development; however, dialogues are needed to adjust the visions, and to facilitate more suitable trajectories for implementation.

In facilitating the dialogues to identify implementation trajectories, this paper discusses a perspective for analysing the past transitional adaptations' trajectories of particular cities. The perspective is termed as 'mutual adaptation.' The perspective focuses on the reconciliation processes of bottom-up public needs and top-down politico-economic goals. And such processes can be partially observed through the transformation of local economic organisations.

The paper first discusses the meaning of the perspective. Then the paper discusses the potentials of the perspective and gives a conclusion.

2. Meaning

"Mutual adaptation" was initially used to describe behaviors of compromising the interests of governance and the interests of private economic organisations in late Qing's Chinese cities (Willmott, 1972). Here, "interests of governance" and "interests of private economic organisations" include two sets of interests. One encompasses the scaling-down interests (from state to municipal government), while the other encompasses the scaling-up interests (from people to the organisation).

In the context of the Imperial China, the government's management on cities and villages heavily relied on local self-governance (Friedmann, 2005). In villages, the self-governance was mainly carried out by the clan heads and gentries through blood ties. In cities, the self-governance was mainly carried out by the private economic organisations that centered on subethnic ties (provincials associations or guilds). In this regard, "mutual adaptation" implies a process, of which the two sets of interests adjusting themselves to achieve reconciliation on operating and developing a city. The process resulted in flexible relationships between the administrative and economic activities, enabling city-region's daily operation and effective adaptation to emergencies (Metzger, 1972).

In the context of the Late Qing Dynasty and to the Republican China, the political authority was unstable. Cities, especially the treaty port cities were governed by multiple political powers, and the urban management relied more on the private economic organizations. Rowe (1984) studied on the transformation of guilds in Hankow in late Qing Dynasty. The Guilds were initially found based on the subethnic ties, absorbing individuals from common geographic origins, and were managed according to these subethnic ties. Because of the late development of Hankow and the decline of Qing's administrative power, there was a wide gap between *de jure* and *de facto* systems in Hankow. As a consequence, local government had to rely on guilds to manage economic activities, continuously devolving controls while retaining the prerogative of direct intervention. In such a situation, guilds continued to grow, merge, and extend functions to urban management. Commercial ties gradually rose as the primary management rules, while subethnic ties fell as secondary, but still essential. Similar transformation of guilds was observed in other treaty port cities with insufficient administrative capacity, such as Shanghai (Goodman, 1995). The transformation of guild in Hankow or Shanghai implies a reconciliation process to move the city forward, which supplemented the administrative capacity while helped people adapt to the urban life.

In the context of the early days of the founding of New China, the political authority was reestablished. And many private economic organisations were absorbed by the government as the government's intermediate organisation (work units). Work units were originally a top-down design for breaking subethnic ties and absorbing individuals into the urban administrative system (Liu, 2000). Such a design initially urged work unit to put top priority of fulfil politico-economic goals, thereby promoting the establishment of China's heavy industry. However, in the development process, work unit declined its efficiency in achieving goals while putting more attention in fulfilling its self-sufficiency. Such a tendency was driven by the hardship to achieve self-sufficiency with increasing number of employees and increasing needs of the members. Along the process, the work units stepped beyond the state redistribution system and formed black markets (Lu, 2005). And the work unit operation gradually evolved back towards the operation of a traditional family (Lü & Perry, 1997). Lu (2005) explained the process as struggles between obeying orders of government agencies and caring for members, which led the work unit to take the responsibility of working as a collective family. Lu's explanation reveals how the two sets of interests are reconciled through the transformation of work unit.

In short, "mutual adaptation" describes the behavior of constant reconciliation between scaling-down politico-economic goals and scaling-up public daily life's needs in the process of modern China's urbanisation, which can be partially observed through the transformation of local economic organisations.

3. Potentials

"Mutual adaptation" may continue to impact urbanisation in contemporary China, as what has been adapted may continue to impact the trajectories towards new adaptation. Based on Friedmann's (2005) and Read's (2012) observations in Beijing, Basic-level administrators (e.g., policeman and residents committee staff) served citizens in a paternalistic way, resolving minor disputes in citizens' everyday lives. In Luigi's (2014) observation in Shenyang, the laid-off staffs treated the Residents Committees as the only remaining institution protecting their entitlements to welfare, similar to their former work units.

Bray (2005) conducted a genealogical study on work units. Through the study, Bray linked the familism characteristics of work unit with that in republican guilds and corporations and pointed out that the origin of such characteristics come from the Confucian archetype family. Bray is certainly right on the connections of such familism characteristics; however, such characteristics might be practiced in distinct ways. The guilds were constantly recruiting external population to enlarge the "family" to obtain more resources. While the work units were constantly seeking self-sufficiency for the internal growing population of the "family." As a result, guild-families moved towards more open while work-unit-families moved towards more closed (Rowe, 1984; Liu, 2000).

Furthermore, though guilds and work units may have existed in the majorities of city-regions in modern China; however, the time of appearance and the maturity of development differ, and the subsequent impacts on local urbanisation also differ. Such differences resonate the "unique rhythm" of China's regional development cycle identified by Skinner (1977). As Skinner described:

"(Chinese) Regional social systems . . . developed first in smaller physiographic units, often the basins of short rivers or tributaries; such isolated systems were subsequently linked with others to form larger systems, again contained in and constrained by the hierarchical physiographic structure. The processes whereby subregional socioeconomic systems were integrated to from the great regional economies that eventually developed within macroregions were gradual and, for most of agrarian China, still very much underway in the nineteenth century." (Skinner, 1977: p.12)

Therefore, "mutual adaptation" helps to analyse a particular city's past urban transitions, and may help the city to adapt new transition. And in facilitating such a purpose, the focus should be put on the history of the particular city-region itself.

4. Discussion and conclusions:

Planning is a moving technique. What should be planned and what could be planned is always in debate, and which part gives to "urban planning" to manage is always changing. The dynamic rationales of planning come from what has been practiced successful around the world. Due to these characteristics, the image crafted by planning is both based-on and isolated-from the locality. The realisation of such an image requires mobilization of local publics. If the image is crafted with understandings on local adaptation trajectories, then the reconciliation process between top-down and bottom-up will be smoothed out, and the public mobilisation will be more efficient. Understanding the local adaptation trajectories and setting up engines that can mobilise the local, both require a *meso* perspective that focuses on past local reconciliation process, which is more practical and helpful.

In conclusion, planning city-regions is not only to define targets, but also to set up engines to mobilise the local in adjusting and achieving the targets. And the "mutual adaptation" perspective may help in setting up these engines.

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Track 4

Metropolization and the Right to the City

Track editors:

Dr. Caroline Newton
Dr. Lei Qu

While essential for the liveability and vibrant urban life that marketing and branding strategies seek to depict, our cities gradually lose their diversity and dynamism. The metropolises of the world are becoming more segregated by the year. They become more exclusive as people settle in, while in the past, they were melting pots of newcomers and the loci for challenging the status quo. The demonstrations in the 1960s were an effort to retake control of the governing of the city, illustrating the people's claim to the Right to the City. The renewed attention for this right (e.g. its appearance in the New Urban Agenda) emphasises the urgency for city planners and designers to act on their social responsibility. In this session, we explore this duty together with just and sustainable approaches to citification, in a time and age where economic performance, city branding, and segregation become more dominant. Together we will explore alternative urban scenarios and visions.

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Built Environment Age-Friendly Optimisation Strategies: Promoting the Elderly Food Market Usage as an Example

Wei Yue [1] and Yang Dongfeng [2,*]

1 Dalian University of Technology, China; weiyue03@mail.dlut.edu.cn
2 Dalian University of Technology, China; yangdongfeng@dlut.edu.cn
* Corresponding author

Abstract: City researchers support the elderly to actively enhance physical activities by intervening in built environments to benefit the healthy development of the elderly. The aim of this study is to propose built environment optimisation strategies to promote the physical activity level of the elderly. The research took the elderly food market usage in Dalian as an example, and divided the built environment into accessibility and attractiveness dimensions. The methods of combining the statistical quantitative analysis and qualitative comparative analysis were applied. We found that the spatial distribution density, the minimum distance of space, the type and the diversity of facility were key factors affecting usage frequency of the elderly food market. Furthermore, combinations of "the farmer market," and the "high spatial distribution densities and rich types" had the high possibility and applicability to enhance activities of buying food in the region. Based on this, four optimisation models of built environments were proposed for promoting usage levels in the elderly. The findings of this study could match urban supply with the elderly' s needs, and it is a feasible way to provide fine design strategies for realisation of age-friendly cities.

Keywords: age-friendly; physical activity; built environment; fine design

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Lei Qu

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1. Introduction

Regular participation in physical activity is an important contributor to healthy aging (Tan, Guo & Jiang, 2010, as cited in Dou, Pynoos & Feng, 2015). Through identification and combination of built environment elements, urban space can be created with practical optimisation strategies to meet the needs of the elderly, which can effectively promote their active participation physical activity (Yu, 2020). For the urban elderly population, daily physical activities can be divided into business, leisure, and sports. Among them, business activities led by food shopping provide regular opportunities for the elderly to travel (Cao & Chai, 2006). The elderly food market usage may be affected by the accessibility and attractiveness of the built environment, with accessibility providing opportunities for events and attractiveness providing motivation for events (Qin & Zhang, 2019). Overall, the relationship between physical activities and built environments is intricate. A few elements, independent qualitative or quantitative research cannot propose specific implementation content for construction of age-friendly built environments (Lee & Moudon, 2016), and this is precisely an important breakthrough that positively affects physical activities of the elderly.

In recent years, the impact of built environment on physical activities of the elderly has become a hot topic in the urban planning field. Specifically, research points out that factors such as travel distance (Ma et al., 2014), location, and spatial structure (Ding, Wei & Jiao, 2017), functional richness, and environmental quality will all affect physical activ-

ity patterns of the elderly (WHO, 2007). In addition, the location conditions and environmental quality of the food market directly affect the selection and use of the elderly activity venues (Wang & Zhang, 2016). In terms of improvement suggestions, design a community walking system that meets the travel needs of the elderly (Chai & Li, 2005, as cited in Wang et al., 2015), strengthen the walking connection between parks and the food market (Cao & Zhuo, 2017), and it is recommended to increase the functional richness of the food market and enhance the vitality of the space (Wu & Chen, 2017). These conclusions provide new ideas for urban built environment planning and regulation. However, when actual space cannot fully optimise fragmented elements, we still don't know what the key built environment elements are that influence the elderly food market usage. In the face of the differences and complexity of regional conditions, where the combination of influencing factors should be selected as the best to promote the improvement of conditions for physical activities of the elderly.

So, from the perspective of elderly-friendly planning, this study combines the advantages of quantitative analysis and qualitative analysis to find a combination of multiple elements of the built environment that promote the elderly food market usage frequency to guide the optimisation of the actual urban built environments. Specifically, this study selected spatial distribution density, minimum distance in space, actual travel distance, the number of intersections as the factors to measure accessibility, and selects type, land use nature, facilities diversity, street feature richness, and land use mix as measures of attractiveness. These elements are independent variables. Data on individual attributes and use frequency of the food market of 210 elderly over 60 years old living in Dalian, China were collected through a questionnaire survey as dependent variables. Correlation analysis and multiple regression analysis were used to identify key influencing factors. Qualitative comparative analysis was used to analyse the combined effect of influencing factors, and then summed up four built environment optimisation modes. This study could propose a way to construct built environment optimisation strategies to promote the physical activity level of the elderly, thereby providing a theoretical reference for the construction of age-friendly cities.

2. Methods and Data

2.1. Research methods

Aristotle (1962) proposed that similar people cannot allow cities to exist. Kevin Lynch (1960) pointed out that a region is a relatively large area of a city that observers can imagine entering, with some common characteristics. However, current research on built environments and elderly physical activities are lacking in combined individual and regional analyses. This study combines statistical quantitative analysis and qualitative comparative analysis of the research characteristics at the individual and regional levels, in order to provide new ideas for the planning field to promote physical activity of the elderly. The specific research method includes three steps.

Firstly, correlation and multiple regression analysis methods were used to analyse the correlation between built environment elements and the elderly food market usage frequency. The purpose is to screen out the built environment influencing factors of physical activity of the elderly, and eliminate irrelevant variables. Secondly, the qualitative comparative analysis (QCA) method was used for in-depth analysis of the relationship between the built environment factors and the elderly food market usage frequency. The independent variable in this step was the significant influencing factor screened in the previous step, and the dependent variable was the average use frequency of the elderly food market in different regions. The purpose is to explore the built environment impact effect at the regional level and verify the effect difference of the combination of influencing factors. Finally, we summarised the above analysis results, and found out the specific factors that have a negative impact on the elderly food market usage according to the current situation of the region to determine the improvement methods to form some environment optimisation models.

2.2. Measurement methods and data

We chose the Dalian urban area as our study area to examine the elderly food market usage in the Chinese context. At the built environment measurement level, a total of nine measurement elements were selected from the two dimensions of accessibility and attractiveness. Used points of interest and electronic maps to obtain data, and the specific measurement methods of the elements are shown in Table 1.

Table 1. Measurement method of built environment factors in food market

Dimensions	Elements	Measurement methods
accessibility	spatial distribution density	Draw a buffer zone with a radius of 500m from home, and count the number of food markets in the buffer zone.
	minimum distance in space	Measure the distance between the residential area of the research object and the nearest food market and classify them. It is stipulated that the distance level of individuals within 100 meters is *1*, the level of individuals within 100–300 meters is *2*, the level of individuals within 300–500 meters is *3*, and the level of individuals greater than 500 meters is *4*.
	actual travel distance	Measure the length of the walking route from the source of the individual trip to the destination.
	number of intersections	Calculate the number of road junctions in the active walking route.
attractiveness	type	With the business model and the form of place coverage as the classification elements, the food market is divided into five categories: wet market, supermarket, fruit and vegetable store, street market, and open market.
	land use nature	The food market is recorded as *0* if it is located on residential land, and it is recorded as *1* if it is located on non-residential land.
	facilities diversity	Select kindergartens, elementary schools, pharmacies, shopping malls, community activity centers, parks, squares in residential areas, and squares outside residential areas. Measure the number of types of facilities within 200 meters of the food market.
	street feature richness	The roads adjacent to the food market are divided into traffic streets, life service streets, and comprehensive streets. The traffic streets have the lowest functional mix and the comprehensive streets have the highest functional mix.
	land use mix	Count the number of land use types within 100 meters of the food market. A single sample of land use is recorded as *0*, two samples of land use are recorded as *1*, and so on.

At the elderly activities measurement level, the questionnaire survey collected 210 valid samples, including 102 males and 108 females, with an average age of 71 years. This study used random sampling methods, using a combination of questionnaires and structured interviews to ask elderly residents about their weekly food shopping activities, personal attributes, and home addresses. This study took the use frequency of the weekly food market as an indicator of individual food shopping activities for the elderly, and stipulates that 1–3 times a week were used as low frequency, 4-5 times were used as medium frequency, and 6 times and above were used as high frequency.

In addition, since the dependent variable in the QCA method is the average use frequency of the elderly food market in different regions, we grouped the survey subjects were grouped according to their residential addresses and the spatial distribution of food shopping activities, and the average food market usage frequency of the samples in the group was used as a measure of the elderly food shopping activity in the region. The borders of the area were all bounded by roads, natural mountains or water bodies. A total of 16 regions were divided into regions, and there was a significant gap in the activity of the elderly (Figure 1).

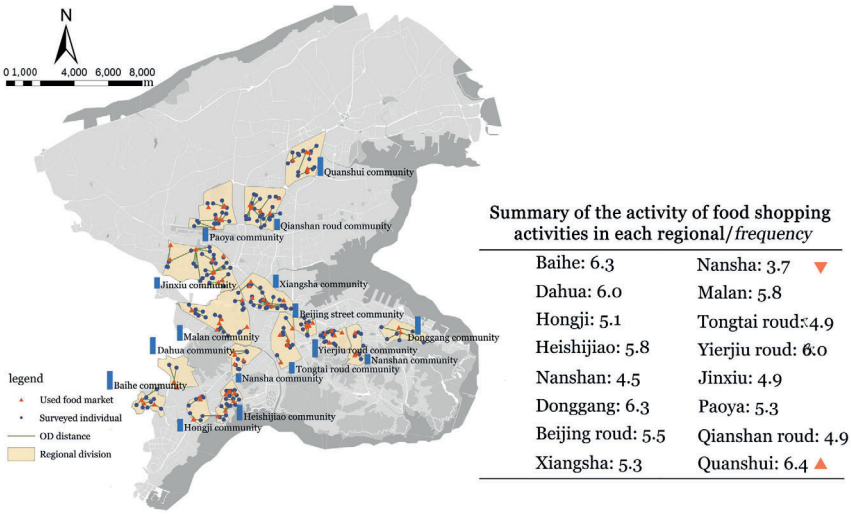


Figure 1. Spatial distribution, regional division, and activity result statistics of survey samples

3. Results

3.1. Identification of factors affecting the elderly food market usage

According to correlation analysis, in addition to the richness of street functions and the degree of land use mixing, there were a number of built environment factors that had significant correlations with the frequency of use of individual food markets. There was a high degree of positive correlation between the spatial distribution density and the elderly food market usage, and the impact of different types of food markets and land use on the elderly usage had significant differences (Table 2). The results indicated that the occurrence of physical activity in the elderly required the dual support of opportunity and motivation.

Table 2. Correlation between built environment elements and individual use frequency

Dimensions	Elements	Sig.(p)	Correlation coefficient (r)
accessibility	spatial distribution density	0.003	0.207**
	minimum distance in space	0.014	-0.169*
	actual travel distance	0.008	-0.182**
	number of intersection	0.019	-0.162*
attractiveness	type	0.033	——
	land use nature	0.034	——
	diversity of facility	0.011	0.176*
	street feature richness	0.881	-0.010
	land use mix	0.964	-0.004

According to multiple regression analysis, market variables had the highest explanatory power and reached a significant level, followed by the facility network diversity variable. In addition, from the variable standard coefficient, attractiveness had a stronger effect on the elderly food market usage frequency than accessibility (Table 3). This showed that for the elderly individuals, the street market had the strongest effect in promoting their food shopping activities, and the diversity of facilities and outlets was an important factor in the occurrence of their food shopping activities. The street market not only provided residents with fresh and cheap food, but also an important place for social interaction (Liu & Yang, 2016).

Table 3. Results of multiple regression analysis model between built environment factors and individual use frequency

Model				standardised coefficient	Sig.	Collinearity statistics	
		B	standard error			tolerance	VIF
R=0.361 R^2=0.130 Standard estimation error=2.041 p=0.002	(constant)	4.847	0.845		0.000		
	spatial distribution density	0.069	0.053	**0.104**	0.199	0.667	1.499
	minimum distance in space	-0.321	0.224	**-0.115**	0.156	0.671	1.490
	actual travel distance	0.000	0.000	-0.083	0.282	0.747	1.339
	number of intersection	-0.063	0.113	-0.041	0.590	0.766	1.305
	diversity of facility	0.475	0.226	**0.146**	**0.040**	0.875	1.143
	wet market virtual	0.727	0.487	**0.158**	0.138	0.387	2.581
	supermarket virtual	0.557	0.503	**0.120**	0.279	0.360	2.774
	fruit and vegetable	1.348	1.278	0.075	0.293	0.862	1.161
	Store virtual street market virtual	1.211	0.568	**0.231**	**0.035**	0.371	2.699
	Land use virtual	-0.093	0.323	-0.023	0.761	0.762	1.313

Note: Dependent variable = usage frequency.

3.2. Combination of factors affecting the regional food market average usage

The fuzzy-set QCA analysis found that for the 16 regions studied, 50% of the regions had a higher activity in buying food. The results could be explained by following three ways:

1. The spatial distribution density of the food market was high;
2. There was a street market;
3. The minimum space was close and there was a wet market.

The results showed that spatial distribution density represented potential selection opportunities of the food market in the region. The rich selection opportunities and the active business atmosphere had a positive effect on senior citizens' food shopping activities, thereby promoting the increase of regional activity. The presence of a street market in an area could greatly increase the activity of the elderly in buying food. The minimum distance in space reflected convenience of food market outlets in the area. Good convenience was one of the main conditions for promoting the elderly to travel (Qin & Zhang, 2019).

The multi-value QCA analysis found that there were 62.5% of regions where the activity of buying food is higher. The results could be explained by following three ways:

1. The spatial distribution density of the food market was high and there were rich type food markets.
2. The minimum space was close. There were supermarkets and street markets.
3. The minimum space was close and there was a wet market.

The results showed that the minimum space and type of the food market were the most effective built environment factors for promoting the activity of buying food in the area. This may be because the configuration and layout of commercial service facilities had greatly interfered with the mode of shopping and travel activities for the elderly (Huang &

Wu, 2015), and the type of food market directly affected their service methods and quality (Liu, Astrid & Harry, 2020), which was an important characteristics of space use.

3.3. Built environment optimisation

Through the screening of the built environment elements and the combination of the influencing factors, the internal connection between the built environment and the elderly food market usage was found. The analysis showed that the types of food markets, the density of food markets, and the minimum spatial distance had independent and combined effects on the elderly food market usage frequency and may be the key optimisation factors of built environments. Furthermore, we summarised the problems existing in built environments of Dalian food markets, and proposed four types of food market built environment optimisation models (Figure 4).

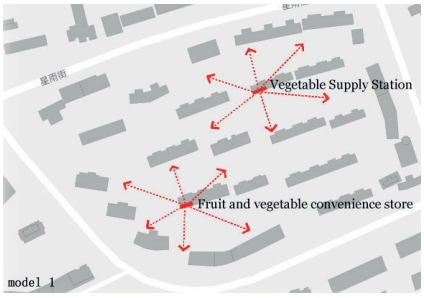
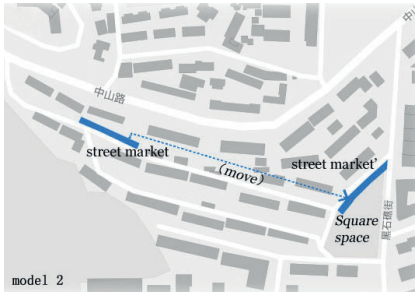
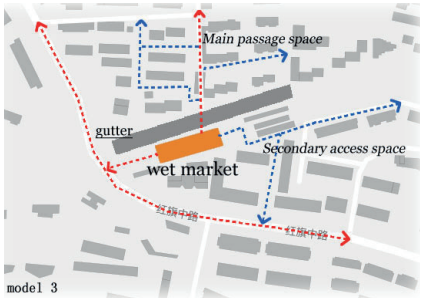
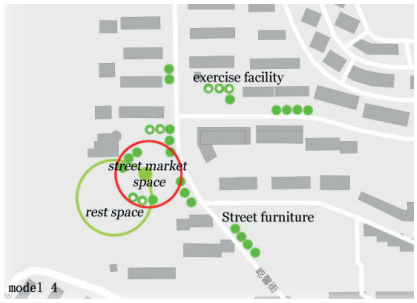
Optimisation icon		
Present situation	inadequate attractiveness of the elderly community	the environment of street market is not good
Strategy	pay attention to the diversification of food market types	reserve and optimise the street market space
Optimisation icon		
Present situation	missing street market, fewer food markets	the size and accessibility of the food market basically meet the demand, and it is difficult to improve
Strategy	add connecting roads to eliminate traffic barriers	set up leisure facilities and spaces

Figure 4. Optimisation model of food market built environment

First, for older communities with more elderly residents, not only the number of food markets must be ensured, but also the diversification of food market types to meet the needs of the elderly as much as possible. The ground floor of the building or the public space in the community provided the elderly with a place to buy food that met their preferences, made up for the disadvantages of the rigid planning of the food market, and enhanced the built environment promotion of the physical activities of the elderly. Second, for areas with the street market but poor environment, it should be approved space optimisation and management policy adjustments were used to retain fairgrounds and gave full play to their advantages in attractiveness to the elderly. Third, for areas where there was no market or the number of food markets was insufficient, the existing food markets (especially the wet market) accessibility and service quality to improve the occurrence of food shopping activities for the elderly. Fourth, for areas where the size and accessibility

of the food market basically met the elderly's needs, we could focus on the elderly's sense of place experience. For example, the existing recreational street furniture was arranged in appropriate spaces around the food market, and accessible design methods were used to provide older residents with leisure and resting spaces.

4. Discussion

From the above analysis results, it can be seen that the elderly food market usage frequency is affected by different elements of the built environment. As the physical condition of the elderly declines, their travel activities are more susceptible to disturbances by quality of the urban environment. A good built environment may promote the physical activity level of the elderly, but a poor built environment may be a barrier to the participation of the elderly. Possible reasons for this result are discussed below. On the one hand, the problem of population aging and unbalanced allocation of resources has become prominent. Existing service facilities and environmental conditions cannot meet the needs of health and equity and old-age care at home, which prevents the elderly from forming an active and healthy lifestyle. On the other hand, planning the policy transformation is in its infancy, and the current planning work is difficult to cope with the predicament of urban space optimisation implementation under stock planning, making it difficult to achieve the goal of building a friendly city for the elderly. Therefore, on the basis of in-depth understanding of the relationship between built environments and the physical activity of the elderly, we need to optimise existing built environments for the aging, and strive to promote the construction of elderly-friendly cities.

5. Conclusions

This study adopted multiple methods to explore the relationship between built environments and the elderly food market usage frequency, and tried to propose some optimization models for the specific built environment. The main conclusions are as follows. In terms of factor identification, the correlation analysis excluded the richness of street functions and the degree of land use mixing, and these two built environment factors had a weak impact on the elderly food market usage. The multiple regression model pointed out that the diversity of markets and facility outlets had a significant impact on the grocery shopping activities of the elderly. In terms of factor combination, qualitative comparative analysis preliminarily determined that the combination of "minimum spatial distance and farmer markets" had a higher possibility to improve the average usage frequency of the elderly in the area, and the combination of "high spatial distribution density and a variety of types of food markets" could have high applicability for promoting the occurrence of food shopping among the elderly. Finally, according to the data analysis results and the status quo of different regions in Dalian, four optimisation models for food market built environments were proposed. The optimisation content mainly included increasing the diversity of food market types, improving road smoothness, and improving environmental comfort, etc.

To sum up, the combination of statistical analysis and qualitative comparative analysis not only could accurately identify influencing factors, but also could explore the interactions between factors, and finally to clarify the intrinsic relationship between regional conditions and improvement approaches. According to the analysis results and the type of the built environment in the current area, selecting the corresponding optimisation model may improve the service quality of built environments to the elderly from the bottom up. The optimisation model may improve urban adaptability in the context of inventory planning, and may protect the elderly right to healthy living.

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Public Spaces as Community Hubs in High-Density Residential Areas: A Case Study of Tuen Mun, Hong Kong

Shuman RAO [1*], Nai Huei Casey WANG [2] and Jeroen VAN AMEIJDE [3]

1 School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; shuman@link.cuhk.edu.hk; 0000-0001-5481-6329
2 School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; casey_wang@blend-arch.com
3 School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305
* Corresponding author

Abstract: Hong Kong's residential neighbourhoods are characterised by high-rise, high density estates with limited public open spaces, as a result of limited regulation and land resources. Tuen Mun new town, due to its remote location and affordable housing, has a mixed demographic consisting in part of a range of immigrant families from different cultural and ethnic backgrounds. In the context of this social diversity, the lack of specifically designed public spaces suited to different cultural needs may decrease neighbourhood relations and a sense of belonging in the city. The study presented here analyses the characteristics of individual and group activities of Tuen Mun residents, documenting the composition of public space in residential areas. It employed field observations, questionnaires, and GIS mapping to map the shortest routes to desired locations. By correlating the cultural activities of diverse residents with physical characteristics of public space features, the study identifies elements and atmospheres that are conducive to spatial appropriation for cultural activities. The study produces insights about how to adapt existing or newly planned housing estates and neighbouring public spaces to better support diverse residents and promote social and cultural integration.

Keywords: High-density residential areas; public space; multi-cultural spaces; environmental behaviour.

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1. Introduction

Hong Kong has developed from a regional trade port to today's international financial centre, and a high-density megacity. Immigration, whether in the form of domestic flow from one city to another, or from one country to another, has become more and more common (Lou & Chan, 2003). The influx of people into the territory has brought about a sharp increase in housing demand, and building high-density housing has become an inevitable way to deal with this problem (Zou, 2016). The flat land available in Hong Kong is limited, and to reduce the cost of housing construction and maximise land use, residential high-rise blocks are combined into tightly arranged multi-tower estates. In these high-density communities, the resulting public outdoor space is limited, but the high density does not necessarily mean crowding (Lozano, 1990). The environmental quality and design of public space greatly affects people's perception of availability and accessibility to public space facilities. In the context of social diversity, a lack of public spaces suitable for different people's cultural needs can prevent residents from participating in cultural activities in public outdoor spaces.

Studies have shown that participating in community cultural life can help improve people's overall life satisfaction, making Hong Kong's new immigrants more likely to have a high level of subjective well-being (Lou & Chan, 2003). However, research has found that Hong Kong residents are less satisfied with community public spaces (Lai, 2018). Although the number of open spaces is limited, there is still room for improvement in quality. This paper presents a detailed study on community public space, to grasp residents' real needs for spatial activities and cultural participation. It aims to contribute insights in how to improve the quality and vitality of community spaces, and aims to provide new strategies for community development in urban renewal.

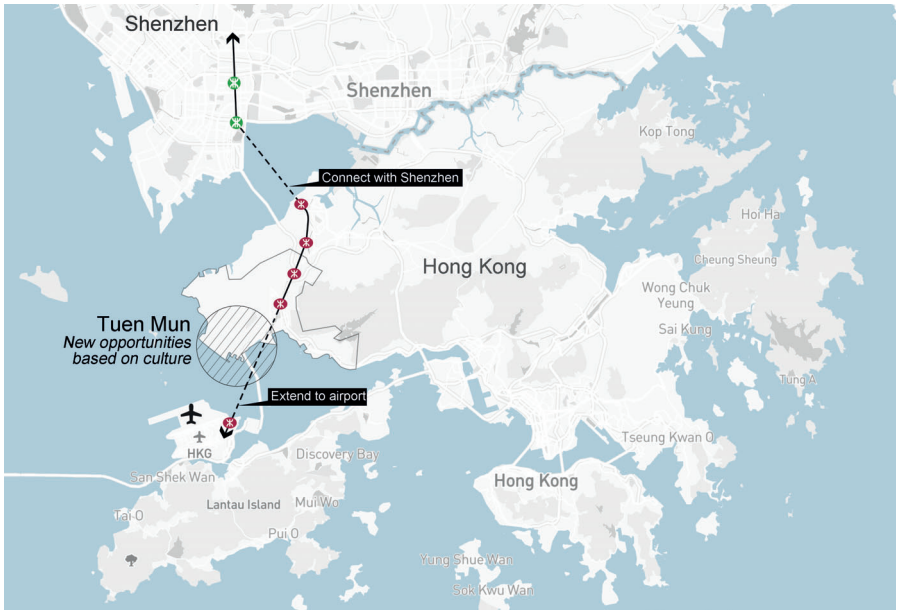


Figure 1. The map showing the location of the Tuen Mun along the "Western Economic Corridor" linking Hong Kong International Airport to Shenzhen.

As the new towns in Hong Kong are built to solve population and employment pressures, Tuen Mun (Figure 1) is a representative example of the decentralised urban expansion process of Hong Kong. The main attraction of the new towns lies in better access to public housing services (Wong & Towns, 1982). Among the non-local population in Hong Kong, about 5.5% of mainland Chinese and 3.5% of ethnic minorities choose to settle in Tuen Mun. Filipinos, Indonesians, and whites are the largest non-local groups (GovHK, 2020). The study presented here focuses on documenting the local cultural aspects and subjective experiences of diverse residents, to try and understand which kind of public spaces in high-density residential areas can meet their different cultural needs. It explores which spatial elements affect the vitality of the activity spaces in order to be able to propose design strategies for the upgrading of public spaces in existing housing estates.

The main objective of this study was to explore the impact of public space in high-rise residential areas on residents' cultural activities to understand how to improve cultural facilities that can enhance the vitality of the community and the cultural integration of residents. This paper is organised into four sections, starting with an overview of the research background and an introduction to the theoretical framework of cultural activities in public spaces. Secondly, it reports on methods used to evaluate the vitality of community spaces. Subsequently, the investigations of three communities in Tuen Mun were analysed. Finally, the design strategy and development direction of high-density residential areas are outlined and discussed.

The public space of residential areas has been researched by scholars in the fields of sociology, environmental psychology, and microclimate sciences. Most studies consider residents as a homogenous group and do not consider demographic differences in relation to different public space needs. Some recent studies have focused on the needs of elderly people in public housing estates (Mesthrige & Cheung, 2020), yet there is a lack of research into other vulnerable groups defined by low income, ethnicity, or culturally diverse

requirements. This paper focuses on the shift of community cultural space from material space to the cultural life and communication activities of different groups. It addresses the research gap around the relationships between spatial factors of public space design and planning, opportunities for cultivating community culture, and the capacity for housing estate spaces to contribute to the establishment of an identity and sense of belonging for diverse groups of residents belonging to minority cultures.

There are three main contributions presented in this paper. Firstly, we focus on analysing the public space of residential areas from the perspective of environmental psychology and the lifestyles of different groups; secondly, the research explores the specific the high-rise, high-density residential conditions in Hong Kong's new towns, a model which is increasingly replicated in other cities; and finally, we link public space studies to insights around the planning and design of public housing estates and their public spaces, discussing urban design from a humanistic and regionally-focused perspective.

2. Public Spaces and The Sense of Community

The sense of community is a multi-dimensional structure that incorporates the subjective sense of belonging to an organised collective, the community's expectation to meet individual needs, and the individual's psychological investment in the social system (Townley, 2011). The densely populated and urbanised environment of Hong Kong affects the sense of community of residents, as the high population density and crowded public spaces may cause weakened local community and social interactions with other residents (Mak, 2009). Moreover, the high proportion of people who have migrated to Hong Kong in recent decades has contributed to a flexible and changeable identity for the region (Cheng and Mak, 2008), which could make a sense of community harder to establish. Organising community activities, promoting residents' public participation, and strengthening residents' understanding of the community can enhance community awareness and cultivate residents' sense of community belonging (Cen, Ling, and Fang, 2003).

To understand the different ways in which urban environments can support different groups of people, we can classify human needs according to specific needs in relation to people for physiology, society, and the environment. The American psychologist Maslow (1943) believed that all behaviours are driven by underlying motivations. The classification of "Human Needs" by Maslow makes a hierarchy in which the needs are organised from external to internal, lower to higher, and material needs to spiritual needs. Marcus and Francis (1997) claimed that the most critical factor in the design of a successful urban space is that it can meet multiple needs. They proposed that the quality of space is defined according to human needs, and these needs can be reflected in the spatial design and quality of the space. Urban activities take place according to environmental needs and spiritual needs, such as the realisation of self-worth. Table 1 summarises the different categories of activities, which helps to translate Maslow's hierarchy into public space needs.

Table 1. Translation of the Human needs to the activities in multicultural public space

Human Needs	Spatial Activities condition & type
Self-Actualisation Needs	Community cultural activities
Esteem Needs	Racial harmony activities
Belonging Needs	Social Integration programs
Safety Needs	Secure and private environment
Physiological Needs	Sufficient activity spaces

The level of urban spatial vitality can be reflected in the strength of the residents' selective activities (Gehl, 1987). Urban design methods focused on residents' activities, can concentrate on community space vitality and urban vibrancy, which helps to implement the transformation from 'space-oriented' to 'people-oriented' research and design (Ye, Wei & Wang, 2014). Based on the activity characteristics of individual residents and the acquisition of spatial location data, we can effectively evaluate the community's vitality.

The interweaving process of people's activities and places in residential areas brings vitality to the city. Spatial qualities, activities, and behaviour influence each other and restrict each other. Therefore, improvement in public space facilities can be an effective means to promote the social integration of residents. To define a methodology for the analysis of public space vitality, several parameters of public space use can be measured, as outlined in Table 2.

Table 2. Evaluation criteria for public spaces in high-density communities

	Space vitality evaluation criteria
Users	User category Number of people passing through Number of people staying
Activities	Activity duration Activity type Diversity of cultural activities

3. Case Study Analysis: Tuen Mun new town, Hong Kong

For our study, the evaluation system formulated based on literature was applied to a case study area in Tuen Mun new town, analysing several public spaces in residential areas to study which elements were responsible for stimulating vitality and community activities. Three high-density residential areas were selected based on mutual proximity, scale and having a mixture of public rental, subsidised ownership, and private estates (respectively): Butterfly Estate, Siu Hei Court, and Yuet Wu Villa.

Table 3: The basic information summary of high-density communities

Community Name	Site interior	Spatial model	FAR
Butterfly Estate		Architectural strip layout +scattered outdoor space	3.0
Siu Hei Court		Architectural enclosing layout + public space single centre mode	4.37
Yuet Wu Villa		Architectural enclosing layout + public space double centre mode	7.35

From the perspective of non-spatial elements, the level of urban spatial vitality can be reflected in the strength of the residents' selective activities (Gehl, 2010). The evaluation of community space vitality from the perspective of residents' activities

provides new insights into urban spatial vitality, and to a certain extent, helps to implement the transformation from "space-oriented" to "people-oriented" urban design. Based on the activity characteristics of individual residents and the acquisition of spatial location data, we can effectively evaluate the community's vitality (Low, 2010). This vitality is an indication of social engagement amongst neighbours and is an effective means to promote the social integration of residents (Jacobs, 1961). The interweaving of people's activities and places brings vitality to the city, highlighting how the qualities of space are closely related to people and behaviour. As they influence each other and restrict each other, our study's evaluation of space vitality focuses primarily on the assessment of social activities, by analysing space users and activities.

Field observations were conducted to observe and count the activities of residents in the space, analysing the relationship between residents' behaviour and play. By using methods of onsite real-time annotation and intermittent fixed-point photography, the number of participants of different groups in different activity spaces was counted for different time periods, and measured for the indicators of 1) the number of passers-by, 2) the number of stays, and 3) the type of residents. Subsequently, a GIS mapping exercise was conducted to map the shortest routes between origin and destination points, to analyse how walking distance and time impact accessibility and to identify opportunities to improve cultural facilities and strengthen community vitality.

In parallel, a questionnaire survey was conducted amongst some of the residents, interviewing two elderly people, three children, and three Filipino domestic workers who were participating in activities in the community. The aim was to investigate the cultural needs of different types of residents and explore the needs of various community groups for cultural activities space. The questionnaire design was divided into three parts: 1) basic information of residents, 2) cultural activities, and 3) spatial experience.

The research conducted on working days and rest days, from 10:00–18:00, the public spaces investigated were Butterfly Estate (57 people were observed on Saturday, June 26, 2021), Siu Hei Court (65 people observed on Sunday, July 11, 2021), and Yuet Hu Villa (46 people observed on Thursday, July 15, 2021). In addition, the use conditions of different spaces were recorded.

Table 4. Questionnaire for investigating the needs of community groups

	Details of the questionnaire
Basic information	Age Education Length of residence
Cultural activities	Frequency Duration Types
Spatial experience	Degree of satisfaction Willingness to participate in activities Maximum acceptable distance

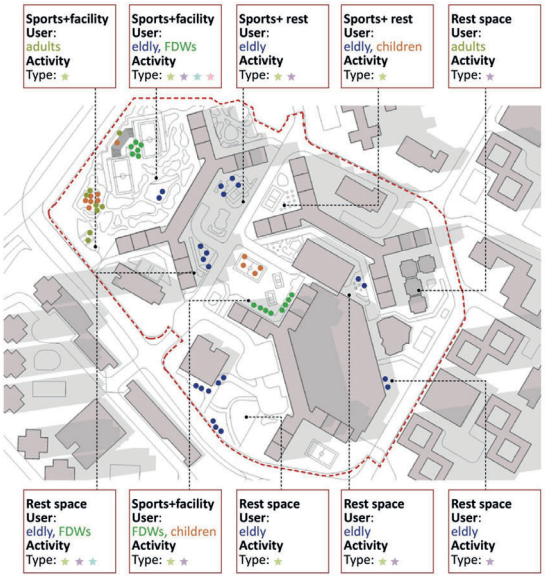
4. Findings

4.1. Activity location mapping

The following section combines the results from the field observations and GIS mapping of the selected case study sites. From the mapping of the locations, intensities, and types of activities that were observed, several insights can be formulated. Firstly, Butterfly Estate, which compared with the other two communities is more significant in scale, has more activity spaces and facilities (Figure 2). There are more cultural activities in this community, but these are affected by environmental factors such as a lack of shade

from sunlight. The space is lacking environmental comfort and facilities such as seating. The accessibility to the largest activity space in the estate is low, which leads to a low utilisation rate.

The second and third sites, Siu Hei Court and Yuet Wu Villa, are smaller in scale. Siu Hei Court has limited public open space and has a single cultural service function (Figure 3). In contrast, Yuet Wu Villa has higher accessibility and more varied activity spaces, providing residents with convenient leisure opportunities (Figure 4). The characteristics of different community spaces highlight the differences in cultural activity space provision across the Butterfly Bay area, due to the independent development of large-scale urban plots by separate developers or government bodies.



• Location and layout:
the space are distributed among the buildings or located on the edge, Decentralized layout.

• Service facilities:
the leisure square, the playground, the basketball court, tennis court, performance stage, chess and card leisure facilities.

• Spatial characteristics:
strong cultural atmosphere, long exposure time, relatively imbalance spatial ratio.

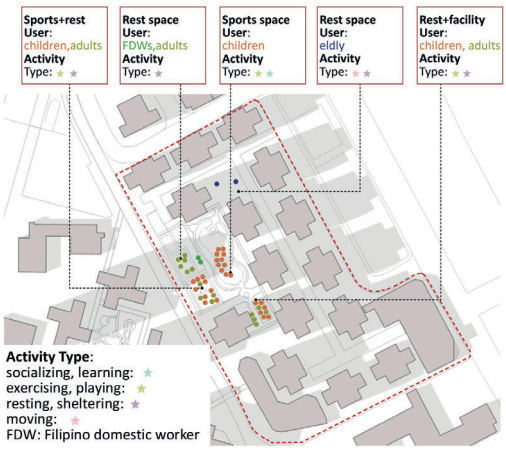
Figure 2. Analysis of the vitality of Butterfly Estate.

• Location and layout:
the activity space are concentrated on the roof of the parking lot, few ground facilities.

• Service facilities:
plant garden, playground, basketball court, children's facilities.

• Spatial characteristics:
Insufficient space type, large area of paved ground, high utilization of roof space.

Figure 3. Analysis of the vitality of Siu Hei Court.



• Location and layout:
public space located at the edge of the community, centralized layout.

• Service facilities:
badminton court, basketball court, skating rink, children's facilities.

• Spatial characteristics:
small areas but comfortable activity space, harmonious atmosphere.

Figure 4. Analysis of the vitality of Yuet Wu Villa.

Table 5. The proportion and behaviour of activities in different groups

	Elderly	Children	FDWs
Butterfly Estate	32% chess 45% rest 23% chat	78% games 22% rest	33% sing 52% rest 15% chat
Siu Hei Court	22% exercise 38% rest 40% chat	82% games 18% rest	26% dinner 61% rest 13% chat
Yuet Wu Villa	18% exercise 63% rest 19% chat	85% games 15% rest	33% dinner 45% rest 22% chat

Based on the behavioural observations of the three groups, it was found that the elderly are more inclined to cultural activities related to health interests, and the cultural activities of children are mainly small-scale simple outdoor games. The cultural needs of Filipino domestic workers seem related to the community rituals and activities experienced in their home country, using singing and dancing to connect within the Hong Kong-based Filipino community and enjoy leisure time. The group activities are not only determined by the cultural preferences of different groups, but also related to the social needs of each group and the inclusiveness of the spaces available in the neighbourhood.

The central community space in each estate is the most visited place within residents' daily lives. Compared with the other two communities, the Butterfly Estate is more significant in scale, with more activity space and facilities. There are more cultural activities in the community, but these are affected by environmental factors such as light and space ratio. The space is not comfortable enough, and the accessibility of the most significant activity space in the community is low (Figure 5.a), which leads to a low utilisation rate. Siu Hei Court and Yuet Wu Villa are small in scale; they are limited by space, and have a single cultural service function. In contrast, Yuet Wu Villa has higher accessibility (Figure 5.c) and more concentrated activity spaces, providing residents with convenient activity spaces. The characteristics of different community spaces indicate the diversified demographics and income levels across the different estates in Butterfly Bay.

Figure 5. a) shortest routes to public space in Butterfly Estate; b) shortest routes to public space in Siu Hei Court; c) shortest routes to public space in Yuet Wu Villa.

4.2. The characteristics of the three community spaces

Based on the comparison of the observational, analytical, and survey data obtained from the three different housing estates, several observations and insights can be formulated around the patterns and trends in public space use.

User diversity

Analysing the daily users of the community spaces, it was found that elderly and children are the main user groups; their space needs should be given a high priority. In addition, the main migrant population in the community, Filipino domestic helpers, usually spend more than 12 hours in the public spaces on Sundays. They are a group of users with unique and specific needs, as they socialise and rest during Sundays away from their employers' homes. Due to their limited financial means, they use public open spaces for congregation, socialising, having meals, and engaging in their own community culture. As these activities are typically not supported by specifically designed public space facilities, their comfort and sense of belonging could be greatly improved if their group activity characteristics would be considered in possible public space design improvement works. This could in turn stimulate community vitality, cultural exchange, and social integration.

Multi-cultural activity space

Instead of assuming that different cultural groups seek different spaces, this study found that the behaviour and activities of the groups are highly compatible. The survey found that the elderly prefer shaded spaces, and they also like to stay in spaces to observe people's behaviour or children's play. Children usually like exciting spaces, and Filipino domestic helpers like secluded spaces. While these preferences might differ slightly, they indicate the possibility for spatial connections and their combination into a single area which contains diverse public spaces. This notion of 'overlap' and diversity is a vital design concept to meet the complex needs of different people's activities; the diversity of spatial functions can lead to social engagement, which is an essential factor of spatial vitality.

Spatial accessibility

The analysis of circulation networks across the different housing estates has shown that many of the community spaces have poor accessibility and visibility from the building entrances and main pedestrian roads through the estates. Examples are the public space at the edge of the Butterfly Estate, and the roof space of Siu Hei Court, which have low accessibility and low utilisation rates. The access routes need a clear layout, a sense of

direction, and need to consist of comfortable and attractive pedestrian spaces. Improvements here could increase the engagement of residents with the community, and stimulate their regular participation in socialising, recreation, and exercise, which improves health and well-being.

5. Discussion

5.1. Differences in Cultural Activity Needs for Different Groups

From the results of the questionnaire survey, it can be found that the elderly are more inclined to participate in cultural activities as long as these are related to their interests. However, for the elderly to play and enjoy music, the environment is required to be free of other noise. This creates specific requirements for space scale and location. For example, as most of the available rest space in the Butterfly Estate is set up with children's play facilities, it is hard to provide the right conditions for elderly's playing of musical instruments or singing. If there are no shaded spaces in the main activity area, this also limits the possibilities for the elderly to engage in community activities.

The existing community spaces already seem to consider the needs of children, but the children's outdoor facilities are relatively simple. Due to the high-density housing, the shared activity spaces are small, and lack engaging, exciting, and creative play facilities. Especially for older children, possibilities for games and group play activities seem restricted.

As the main group of migrant workers in Hong Kong, Filipino domestic helpers are a key user group of public spaces, but their specific needs are significantly under addressed. The impression has been created that some public space regulations and facilities are designed to prohibit Filipino domestic workers from using community spaces. As a result of this perceived segregation, Filipino domestic workers will naturally keep their distance from other residents in the community. In the interviews, some Filipino domestic workers reflect that if the community would invite them to participate in any cultural activities, they would refuse. The cultural dilemma is that the helpers desire privacy and psychological distancing from their employers on their rest day, while at the same time their presence, culture, and contributions to Hong Kong deserve respect, engagement, and dedicated facilities. The differences in socio-economic conditions result in social segregation, making it difficult to establish a dialogue between these different communities.

Based on our observations and survey data, several improvement policies can be envisaged that would help social engagement for and between diverse user groups. The elderly like to engage in groups, such as chatting, playing cards, exercising, etc. The community can organise more cultural exchanges for the elderly and hold some chess and other games. For the elderly with hobbies such as calligraphy, music, etc., the community could provide indoor activity spaces to have a comfortable environment to develop their interests, which would enhance social interaction and the sense of belonging.

Children of different ages have specific differences in the types of outdoor activities. Children's activities in early childhood are mostly sand-playing, seesaws, and other more minor activities; children older than five are mostly running, jumping, and cycling. Physical activities with a wide range of activities such as pulleys, etc., are the main activities; adolescent children mainly focus on special sports activities such as basketball, table tennis, swimming, etc. The community could organise different games based on the existing space conditions. Activities stimulate their curiosity and interest and gradually raise their awareness of cultural participation.

Filipino domestic workers have different cultural backgrounds from Hong Kong Chinese residents. Through interviews and observations, it has become clear that they are passionate about the culture of their hometown and like cultural activities that are close to life and easy to understand, such as dancing, singing, and performances. The community can organise some characteristic cultural exchange activities that enable Filipino domestic helpers to feel welcome in the community.

5.2. Inclusiveness of Community Spaces

The elderly and children in the case study areas showed a high degree of community engagement, but there are no shared spaces for interaction between these separate groups. For example, the butterfly estate community space is relatively scattered and independent, resulting in each space having its fixed participation group. Siu Hei Court has fewer ground floor-based activities, and children's facilities are concentrated in the roof court of the parking lot. The elderly stay in the ground level gardens and other spaces. In addition, special groups such as Filipino domestic workers do not participate in the cultural services organised in the community space. Although the activities of various groups of people have brought vitality to the estate's public spaces, there is little interaction between the different groups.

The environmental design strategies for these residential estates seem mostly concerned with the visual and formal arrangement of form and composition. They feature large open spaces with green planting, but lack actual people-related activity facilities. As a result, there are many underused spaces in the external environment of these high-rise residential areas, which contribute negatively to the atmosphere, activities, and interactions between residents and can aggravated the feelings of indifference between neighbours, losing the sense of belonging that the environment outside the residential buildings should offer. We conclude that better urban design strategies could be implemented here, based on research and analysis of people's behaviours and communication.

5.3. Multi-space Development Needs besides Standard Facilities

Cultural facilities in public housing benefit from government, financial, and organisational support, like other social services in Hong Kong. The estates adhere to the Hong Kong Planning Standards and Guidelines, which already takes spaces for recreation and community development into account. In terms of land supply, facility allocation, environmental design, and service staff allocation, the government's contributions significantly facilitate the daily cultural life of the housing estate residents. However, it is clear from the survey that apart from enjoying the fixed places as part of the daily cultural activities of residents, there is a desire for irregular or self-organised activities and events. These might be facilitated on internal roads or neighbourhood open spaces between residences, temporarily placing furniture, event canopies, and equipment. It was also found that there is a need for more diverse playgrounds for children of different ages, with and without the supervision of their parents, and private spaces for Philippine domestic workers to organise cultural activities during public holidays. The true nature of community interaction is dynamic, and the supporting spaces should be flexible and changeable according to people's needs and desires. Therefore, it is essential to be able to adjust the functions and details of the public space design according to the community's wishes. The case study estate spaces seemed to lack a design awareness of the openness and inclusiveness that neighbourhood spaces could use to stimulate the sense of belonging that creates self-supportive communities. More capital investment at the community level, improvement of services and facilities, and community-oriented space management would be highly welcomed by some of the most vulnerable, and culturally and ethnically diverse groups of residents in Hong Kong.

6. Conclusions

This paper has explored some of the social public space conditions within the high-density, high-rise context of Hong Kong's residential estates. Three case study estates in Tuen Mun highlight the typical issues across Hong Kong's older and poorer districts, where a diverse mixture of lower income residents depend on public spaces for their everyday essential and recreational activities. Despite the pressures on public open spaces in the city, a range of underused public spaces was found, and it was found that several cultural groups' needs are not fully supported in the urban design of the spaces. To improve walkability, community interaction, comfort, and enjoyment in public spaces, pedestrian networks can be improved to achieve better orientation, visibility, and connectivity, so that all public spaces places have good accessibility and residents can reach each area of the community spaces conveniently. Better circulation and increased sociability would also improve the residents' sense of ownership and security in the estates. Internal roads and emergency vehicle access ways could be used more flexibly to support formal and informal community activities, events, and play. Urban design elements such as seating, shade, and play elements can be combined with improved

landscaping, designed around the different cultural and lifestyle needs of the various groups of local residents, acknowledging the different preferences and aspirations of people from different ages and backgrounds.

As Hong Kong is bound for continued urban development amongst the prospect of an improved post-pandemic regional connectivity, it is hoped that renewed economic progress can be paired with investment in the social infrastructures of the urban environment. Besides employing contemporary strategies for landscape and public design for the newest housing estates in the latest urban development areas, the large stock of Hong Kong's aging housing estates in the new towns deserve special attention, as simple upgrades of the public spaces could achieve significant social benefits for large proportions of the population. While the scope of the case study sites and public space parameters investigated in this study might be limited, a promising and important direction for further research is identified. Through the detailed studies of diverse social and cultural activities, in relation to the characteristics and features of public space, insights can be gathered to support a new form of human-centric, evidence-based urban design. Lessons from Hong Kong's high-density urbanism can be of significant value to other cities confronted with a need to provide high density and sustainable housing, designed around different public spaces that promote social and cultural integration.

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Collectivistic Culture and Civic Space as Urban Identity: A Theory-based and Human-centric Transformation Strategy for the Futian Central District, Shenzhen

Yajuan CHEN [1,*], Nai Hui Casey WANG [2] and Jeroen VAN AMEIJDE [3]

[1] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; 1155151589@link.cuhk.edu.hk; 0000-0003-1777-550
[2] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; casey_wang@blend-arch.com
[3] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305

Abstract: The city centre is the crucial epicentre of an urban agglomeration, drawing in opportunities from across a wide territory. Shenzhen is a plan-led polycentric city, but its commercially-driven development has resulted in a scattered series of city centres, and a fragmented urban identity. Culture-driven strategies have been used to strengthen urban identity, but cultural policies in Shenzhen are focused on the construction of cultural institutions, divorced from the urban design of public spaces or neighbourhoods. This paper explores the role of public space as a platform for culture, and the different roles of a 'centre' in large cities, outlining the economic, cultural, symbolic, and psychological values of important central spaces and events. It focuses on how cultural elements can be integrated with civic space in urban centres to improve the quality of life for residents, as well as their sense of community and identity. The paper presents an exploration of the needs of people for urban culture in Shenzhen, based on the urban theories and case studies, and field observations in Shenzhen. It finds that the sustainable development of urban centres can be realised through understanding and catering to the needs of different groups of residents, especially the activity patterns of young people and their daily collectivistic activities.

Keywords: Urban Identity; Urban Culture; Public Space; Urban Transformation; Shenzhen

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1. Introduction

The city centre is a crucial epicentre of an urban agglomeration, drawing in opportunities from across a wide territorial area and containing social, economic, cultural, and institutional functions (Rogerson & Giddings, 2020). Although some people desire to live in suburbs, many prefer a mixed community with central functions that can accommodate work, life, and entertainment activities (Mehta, 2014). As part of the rapid development and densification of cities, urban centres experience challenges such as a lack of public spaces, crowding, traffic congestion, and rising prices for goods and services. These challenges have caused the reputation of the city centre, historically the most representative of the city image, to become ambiguous with positive and negative associations. Several urbanists and scholars have discussed the notion of urban identity and the 'Right to the City.' Gehl (2010) posed that civic space is both the stage of culture and the symbol of identity. According to Harvey, the Right to the City is not merely a right of access to what already exists, but a right to change by creating a qualitatively different kind of urban sociality (Harvey, 2003).

Shenzhen is a plan-led polycentric city, and its 'cluster-belt' urban structure plays an important role in the city development and economy (Huang & Xie, 2012). However, the commercially-driven development of Shenzhen has resulted in a fragmented or scattered urban identity (Tang, 2020). Culture-driven urban and regional strategies have been used since the 1980s in Europe and beyond to unify and strengthen urban identity (Nuccio & Ponzini, 2017), but cultural policies in Shenzhen are often based around the construction of cultural institutions, divorced from the urban design of public spaces or neighbourhoods.

There are some voices in society claiming that public space is no longer needed by civil and political life, but many scholars have demonstrated the relationships between public space and society, and between social life and the sense of belonging in communities (Amin, 2008). Some sociologists have defined the notion of urban culture as the interaction between culture and urban space (Mehta, 2014). Few researchers have explored which kind of spatial qualities could produce specific public activities that affect urban culture and identity. The central aim of this research project is to explore how cultural elements can be integrated with civic space, and how a new urban centre can contribute to improvements in people's quality of life, their sense of community, and identity.

This study explores the role of public space as a platform for culture by analysing the concepts and relationships between collectivistic culture, civic space, and urban identity through literature review and field studies. It focuses on the principles of public space design from the perspective of humanization, and the relationships between public cultural life and public space. It uses the central area of Shenzhen as a case study to test how locally specific characteristics and cultural activities could influence the creation of civic space.

The hypothesis of this study is that urban identity depends on public culture and its visibility, which does not only appear in formal cultural institutions and spaces for cultural events, but also in casual activities in civic space. A deep human need exists for associations with significant places. The sustainable development of urban centres can be realised through understanding and catering to the needs of different groups of residents. Diverse activities by different groups make efficient use of urban space and create a diverse urban cultural landscape (Aelbrecht, 2017). A combination of fixed and spontaneous activities in public spaces can regulate the use of space and stimulate the generation of cultural activities.

To explore this hypothesis, this paper will present a review of relevant theories and publications around urban culture, space, and identity, and analyse the precedent case of London's South Bank Centre as an example of a concentration of open public spaces which are activated through formalised and informal cultural activities. It then discusses our research of Shenzhen's Futian Central District as a case study site, an example of the current limitations and opportunities around central urban spaces as a platform for collectivistic cultural participation. A series of renewal strategies for the site is presented based on site analysis and field studies to speculate how urban design measures can produce new cultural spaces, increase public participation and the sense of belonging, and help shape a new urban image representative of a collective cultural identity.

2. Urban theories of urban culture, space, and identity

Although the civic and political functions of public space are hybridised by new communication technologies, consumer venues and other media, public space is still the primary domain to guarantees citizens' political rights and the embodiment of civic culture and urban life (Amin, 2008). Civic spaces are an extension of the community, as the setting where celebrations are held, where social and economic exchanges take place, and cultures mix. Public spaces provide opportunities for humans and nature to interact, contain important spaces for circulation and activities, and lay the foundation for urban identity and city life (Mehta, 2007). Urban identity is an important aspect in achieving social sustainability during the development of cities, for it offers people a sense of belonging, responsibility, and connects with their desires for improved qualities of urban life. A deep human need exists for associations with significant places, and civic space forms a stage to forge these associations (Oktay, 2002). One of the dimensions of 'culture' is everyday life (Longhurst et al., 2008), and this materialises through the interactions between people

and their environment (Lin & Mele, 2012). With the increasing digitisation of urban life and urban culture, urban public space is becoming more integrated within the private domain (Mao, 2015). Amongst these changes in consumption habits and activity patterns, the role that urban identity plays within people's individual experiences is also changing.

2.1. Culture: The art of everyday life

Culture, or civilization, taken in its wider ethnographic sense, is "a complex whole which includes knowledge, beliefs, art, morals, laws, customs, and any other capabilities and habits acquired by man as a member of society" (Taylor, 1871). The notion of culture includes "art and art activities, the learned, primarily symbolic features of a particular way of life and its process of development" (Longhurst & Baldwin, 2008). It can refer to the highest achievements of society; represented in a museum, concert hall, and other cultural institutions, and it can also refer to everyday life types of activities and rituals.

Research into the manifestations of culture in public spaces focuses mainly on activities. As a central concept in anthropology, culture is closely related to the human environment. People's activities and behaviours in cities constitute social culture, and social culture will affect people's lives in every corner of the city (Low, 2010). Cultural activities can transport people from the daily mire into a sacred space with a sense of ritual (Zukin, 1995).

2.2. Identity: Distinguishing the city from others

Lynch (1964) defined urban identity as the extent to which a person can recognise or recall a place as being distinct from other places. It can be associated with the 'instinct' of a city, its culture, art, symbols, and way of life, forming an index to its urban characteristics, making the city stand out in the world (Oktay, 2002). Some scholars have defined culture as the medium that represent urban identity, as culture is a means to store the images and memories of a city, and fill every space in the city with activities (Zukin, 1995). In this definition, urban culture refers to the close interactions between humans and their environment, through which people change themselves when shaping cities (Harvey, 2003).

2.3. The role of civic space and the right to the city

The notion of Civic Space has been defined as space accompanied by a set of universally accepted rules that allow people to organise, participate, and communicate with each other freely and without hindrance, and in doing so, influence the political and social structures around them. Parks and other urban public spaces that have the potential to be "the stage upon which the drama of communal life unfolds" (Carr et al., 1992, pp. 3). Civic space is also the stage on which the Right to the City is exercised through cultural activities. The right to the city does not only imply free access to the city's spaces by all members of society, but also the right for all urban citizens to participate in the decision-making and co-creation of the future versions of the city (Harvey, 2003).

2.4. Human-centric design

Well known urbanists such as William H. Whyte, Jane Jacobs, Allan Jacobs, and Jan Gehl have since long advocated the need for urban designers to focus on the opportunities for supporting and creating public life, rather than being guided by the technical efficiencies or dogmas around urban design. The intrinsic driving forces behind public life are based on human behaviour, motivation, and activity demand (Zou, 2013). According to Maslow's hierarchy of needs, physiology and safety are basic needs and can be addressed through features in the physical environment; belonging and love and self-esteem are psychological needs that are achieved through social interaction; and self-realisation is a spiritual need and can be achieved through personal development in relation to an individual's context. When applying Maslow's concepts to the design of public spaces, this implies that they should provide physical safety, shelter and resting opportunities, provide space and facilities for the social activities of different groups of people, and enable each individual's ability to modify the space to create a collective culture. This comprehensive and human-centric approach to urban design assumes an alignment between the city's performance goals and its residents' life objectives.

2.5. Public space design

Carr et al. (1992) expressed the ideal that public space is responsive, democratic, and meaningful, and Gehl (2006) argued that successful public spaces contain a mixture of necessary, optional, and social functions and outdoor activities. Mehta (2014) summarised the five dimensions of public space design around the properties of usability, activity, physical environment, and perceptual atmosphere, with the keywords of Inclusiveness, Meaningful Activities, Safety, Comfort, and Pleasurability. Zou (2013) studied the organisation and design of the external spaces from a human perspective and provided solutions for the contradiction between urban image and humanized design. An overview of public space design objectivities is given in Table 1.

Table 1. Factors and characteristics of humanized public activity space design.

Scholars	Factors	Characteristics
Mehta (2014)	Usability	Inclusiveness: accessible and open, safe
	Activities	Meaningful activities
	Physical environment	Comfort: comfort and convenience
	Perceptual atmosphere	Pleasurability: changeable, pleasure
Carr et al. (1992)	Psychology	Responsive, democratic, and meaningful
Gehl (2006)	Activities	Necessary, optional, and social functions
Zou (2013)	Humanization	Domain sense, place sense, ecological sense, and harmony

The insights summarised in the sections above help us define the key characteristics of cultural urban spaces as platforms for civic participation, embracing the cultural everyday activities ordinary citizens. They inform the criteria through which precedents and case study sites can be analysed, to identify how urban design, public space facilities, and activities can help to create inclusive urban cultural centres.

3. Precedent: London's South Bank Centre

London's South Bank has been a place of significance for defining identity since the Festival of Britain in 1951, which aimed to strengthen Britain's outlook through introducing the latest technology, science, architecture, and arts in the aftermath of WW2. It has been transformed into an entertainment and commercial district, anchored around the Southbank centre and its artistic venues which attract millions of visitors every year (Figure 1).

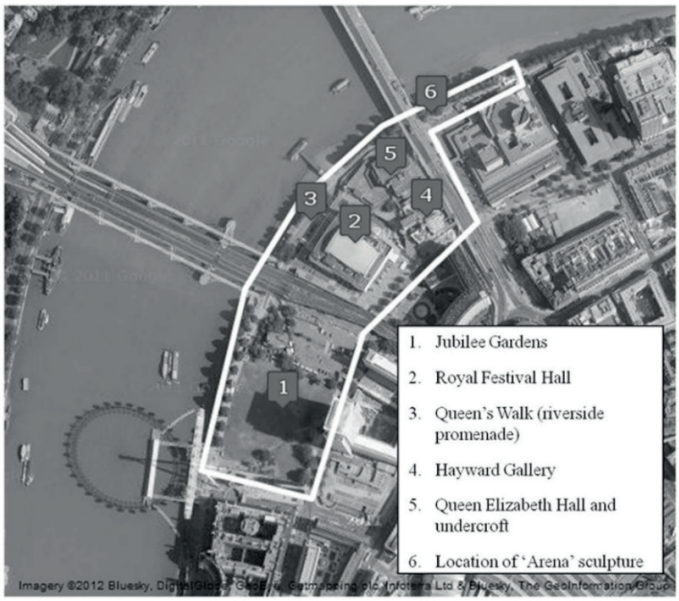

Figure 1. Aerial photograph of London's South Bank Centre (Adapted from Google Maps)

The South Bank is a hub of iconic, state-funded arts and entertainment venues and events, and one of the few places that is equally as popular with Londoners as with tourists. Public performances and festivals are held here regularly, some jointly organised by community members and non-governmental organisations to express the creativity of the community and provide free performances for local residents.

A combination of fixed and spontaneous events activates the main pedestrian routes and stimulate the vitality of public spaces. There are many cultural and art institutions and open-air spaces on the South Bank that showcase British cultural life. A book market and food market attract both residents and visitors, while street performers generate spontaneously formed audience circles, inviting passers-by to participate in the cultural life of the area.

The experience and production of space at London's South Bank is characterised by the term 'openness.' This openness allows for the generation of social processes, promoting the slowing down and inhabitation of the public space. The openness applies not only to the physical dimension, but to the psychological and regulatory levels, as the spaces are regularly used as 'play' and performance areas. A previously underused undercroft space has been a base for skateboarders since decades, and has become representative of the cultural characteristics and sense of belonging of the area, representing the memory of the community. Lefebvre (1991, pp. 286) argues that "space is permeated with social relations; it is not only supported by social relations, but it is also producing and produced by social relations."

Aelbrecht (2017) has analysed the social production of space at the South Bank as a process of the playful use of the site. 'Play' in South Bank is discussed in a threefold way: as explicit moments of playfulness, as plays on meaning in public space, and as playful projections of the self. Part of the qualitative 'value' of public space lies in its capacity to facilitate moments of play; it is from precisely the non-functional, 'open' status of the public space that its value is derived in this regard. The play function helps to explore the meaning of the individual in the public space, thereby enriching the meaning of the public space.

4. Case Study Analysis

As the analysis of London's South Bank area has highlighted the interplay between spatial conditions, management, and diverse public engagement, we apply our analytical framework to a case study research which focuses on one of Shenzhen's iconic urban centres.

4.1. Civic Space in Shenzhen's Futian Central District

The Futian Central District is the second constructed central district in Shenzhen, after the Luohu CBD. It incorporates administration, culture, commerce, and crucial intersections between several main subway lines. The area is home to the Shenzhen Stock Exchange and Futian Station, with new high speed rail connections to Hong Kong and the rest of China. At the end of 2015, 74 new buildings and a 7.04 million m^2 floor space had been completed for office buildings, accounting for 62% of the total built area (Chen, 2017). The central axis is the "backbone" of the public space and forms a three-dimensional axis with a length of 2km in the north-south direction and a width of 250m in the east-west direction. Elevated pedestrian walkways connect the six main buildings (Figure 2).

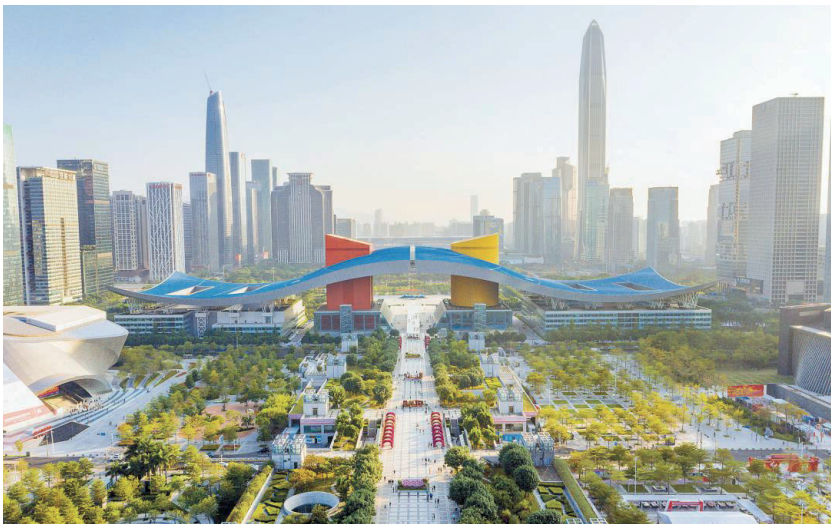

Figure 2. View of the central axis of the Futian Central District (http://www.sznews.com/news/content/2021-09/13/content_24564714.htm accessed on 27.09.2021.)

4.2. Public activities on the central axis

The central area houses Shenzhen's municipal level public offices, so that citizens can access various government services in the same place. The monumental central axis space can hold large-scale urban events, such as the Spring Festival Gala, the National Light show, etc. (Figure 3). These government-organised activities do not happen very often and are concentrated into a certain period of the year.

Figure 3. Light show on the central axis. (https://www.sohu.com/a/409080147_120755677?_trans_=000014_bdss2_dkgjgj accessed on 19.07.2021.)

During most other days of the year, spontaneous activities take place on the central axis such as skateboarding and square dancing. During our site observations, the most eye-catching public space activities were people skateboarding in the square in front of the municipal building (Figure 4), and people dancing under the canopy on the platform of the Civic Centre (Figure 5). Most of the skateboarders were students, and most of the dancers were retired women. They come here almost every day because the space is free and generous, and according to some interviewees, activities in the city centre make them feel happier and proud of their city.

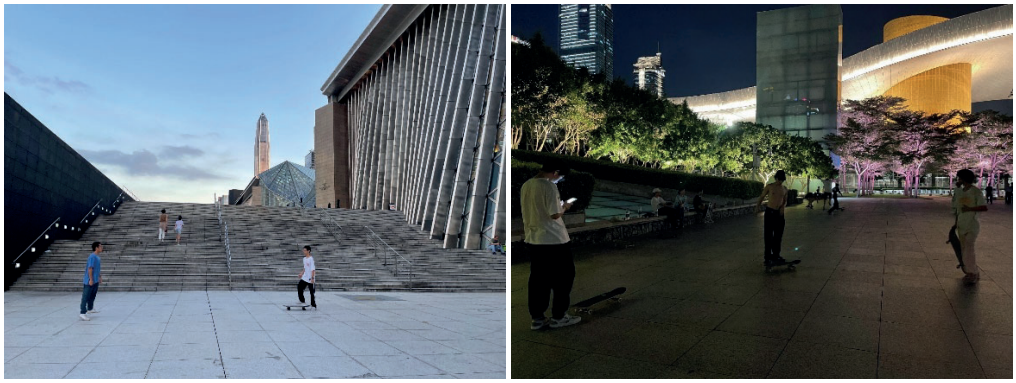

Figure 4. Skateboarding around the public buildings and the square day and night (photos by author)

Figure 5. Square dancing under the canopy of Civic Centre (photo by author)

Pedestrians are distributed across the entire area, but people gather more in the spacious places for group activities, such as playing, skateboarding, and square dancing. These collective activities form the core component of the cultural landscape of the central area.

Table 2. Public space and activities of the central axis during the site visit (time: Tue. July 14th, 2020, 7pm–9pm).

Types of public space	Location	Land-use	Owner-ship	Seats	Activities	Crowd density
Square	City Square	G4	Public	Flower bed seats	Sitting, riding, walking, skateboarding, jogging, playing football	□□
	South Square	G1	Public	Stone benches	Jogging, walking	□
Park	City Square Park	G1	Public	/	Walking	□
	Roof Garden	G1+C1	Private	Stone benches	Walking	□
	Around buildings	GIC2	Public	/	Sitting, skateboarding, playing a ball, picturing	□

Leisure Green Space	Playground	GIC1	Public	Stone seats	Playing with water	□□□
Arcade	Central Book City	G1+C1	Private	Private seats	Eating and drinking	□
	Civic Centre	GIC1	Public	/	Dancing, walking, playing	□□□□□

4.3 Public space characteristics and evaluation

Following a series of site visits, qualitative field observations and informal interviews, the following phenomena of the public space layout and activity patterns in the central area can be summarised:

- There are no signs or indications in the public spaces or public facilities in the central area. More than 90% of the public spaces of buildings are not equipped with public space signage;
- There is a lack of outdoor public seating in the public spaces. Most of the seating is around flower beds and people sit on the ground. More than 80% of the public spaces of buildings are not equipped with public seating;
- There are very few facilities in the public spaces. Besides some seating and greening there is a lack of outdoor facilities to support other activities. Most people just walk around without engaging in activities or resting;
- There is a low utilisation of public open space outside the buildings. For example, the stairs area at the entrance of the Children's Palace is dark and no one uses the stairs as seating;
- People tend to gather in free and playable spaces, utilising landscape features and gardens as places for children to play. The commercial areas are considered too expensive for ordinary people and lack vitality;
- People tend to use spacious areas to do collectivistic activities like skateboarding and square dancing.

With reference to our earlier research about the theoretical and pragmatic aspects of good public space design for the establishment of civic space, resident participation, and the forming of urban identity, a number of problems and opportunities for improvement can be identified around the studied area:

- Unclear public space management: the space lacks signage and guidelines to divide and navigate the space, and also lacks public space activity facilities and seating. The urban design is monofunctional, and lacks mechanisms for retaining people and generating activities, resulting in low space utilisation;
- A lack of support for organising activities. Most activities on the site are scattered and free, and fail to become regular fixtures of the site due a lack of support infrastructure. As a results, the site lacks the mutual stimulation between fixed activities and spontaneous activities as seen at London's South Bank. Exceptions are formed by the square dancing, which is organised without the need of any facilities, and which form a regular urban activity with strong appreciation;
- A lack of playability of the public spaces outside the buildings, and a lack of connections between different types of public spaces, result in a sense of isolation and emptiness amongst the featureless and the monotonously designed plazas;
- The central area has a high proportion of commercial offices, but the public spaces and facilities are not designed to support the office workers or residents from the surrounding neighbourhoods during their leisure time. This has led to many small and medium enterprises leaving the area for more vibrant, affordable and up and coming neighbourhoods.

5. Discussion

Chen (2017) has noted that after more than 20 years of rapid urban development, the Futian Central District has become the administrative, business, and transportation hub of Shenzhen. With the emergence of Shenzhen as a high-tech, Tier 1 metropolis competing

at the world stage, the Futian Central District is the city's symbolic centre of power, but at the same time, it also reveals some of the contemporary difficulties urban centres have in providing the city with an urban identity representative of collective urban culture. As Shenzhen has evolved rapidly along the linear shoreline of Shenzhen Bay, it now has multiple centres with varying identities and different function mixes. In the relentless pursuit of innovation and expansion, new epicentres of urban development, urban culture and vibrancy have emerged westwards, leaving the previous flagship districts behind in the regional competition for investment and renewal. Similar to London's South Bank area, which has experienced several rounds of large-scale redesign and reprogramming, the Futian Central District has the potential to become a true multi-faceted urban centre in the hearts of Shenzhen's citizens.

In line with our findings from the review of relevant urban theories and precedent analysis, combined with the evaluation of field observations during site visits to the case study area, a series of recommendations for the future transformation of the Futian Central District are listed below and illustrated in Figure 6.

A culture-driven urban development approach

Besides major governmental institutions and company headquarters, the Futian Central District already has several cultural institutions, including galleries, a major library, and museums. Expanding the relationships between these institutions and collaborating organisations, community initiatives, events and commercial programming can be employed to activate a wider area and its public spaces to form a dynamic cultural district. As outlined in our previous sections, culture should be defined as the combination and interplay between the institutions that represent the highest achievements of the society, and the rituals and activities of everyday urban life that contribute to a sense of identity and belonging for ordinary citizens.

Human-centric design

With reference to the South Bank's ability for the social production of space, linked to the psychological and spiritual human needs as outlined by Maslow, a true urban centre should align its ambitions with the people's aspirations in their pursuit of a better life. Infrastructure for socialising and collective experiences should be provided, in addition to fulfilling basic public space needs in the form of facilities for resting, consumption, and shelter from the environment. This can lead to individual and community development.

Mixed-use urban planning

The following insights promoted by urbanists such as Jane Jacobs and others, the area could benefit from a more fine-grain mixed-use programmatic distribution. Jacobs referred to the ecological principle of 'autocatalytic dynamics'; a condition where urban neighbourhoods 'come alive' through the self-reinforcing dynamic interactions between many different types of functions, people and activities (Jacobs, 1961). Reducing the proportion of commercial offices and developing buildings and urban spaces with composite and mixed functions, would add vibrancy to the area by attracting varied types of users during all times of the day and week.

Resilience

According to the human-centric design principles for public space design, the large plaza spaces of the Futian Central District are recommended to be redesigned in relation to the scale of human activities. Inclusion of the principles of openness in relation to urban morphology and management would result in accessible, inclusive, and flexible public spaces that form a platform for formal and informal activities, representing the institutional and local cultural characteristics of the area. Openness towards future changes in lifestyle and social gathering preferences ensures social, cultural, and economic resilience.

Design for collectivistic culture and civic appropriation

As a final point, the insights from the literature on collective identity, meaning and a sense of participation can be synthesized and applied towards the case study site. Relating in particular to the management and activation of public spaces, it is recommended to comprehensively plan yearlong calendars of collective activities such as sports, performing arts, exhibitions and shows, festivals, and markets. These regular fixtures as part of the

collective experience help build memories and anticipation and create a multi-faceted cultural urban landscape that triggers community-led activities in dialogue with the institutional cultural presences in the area.

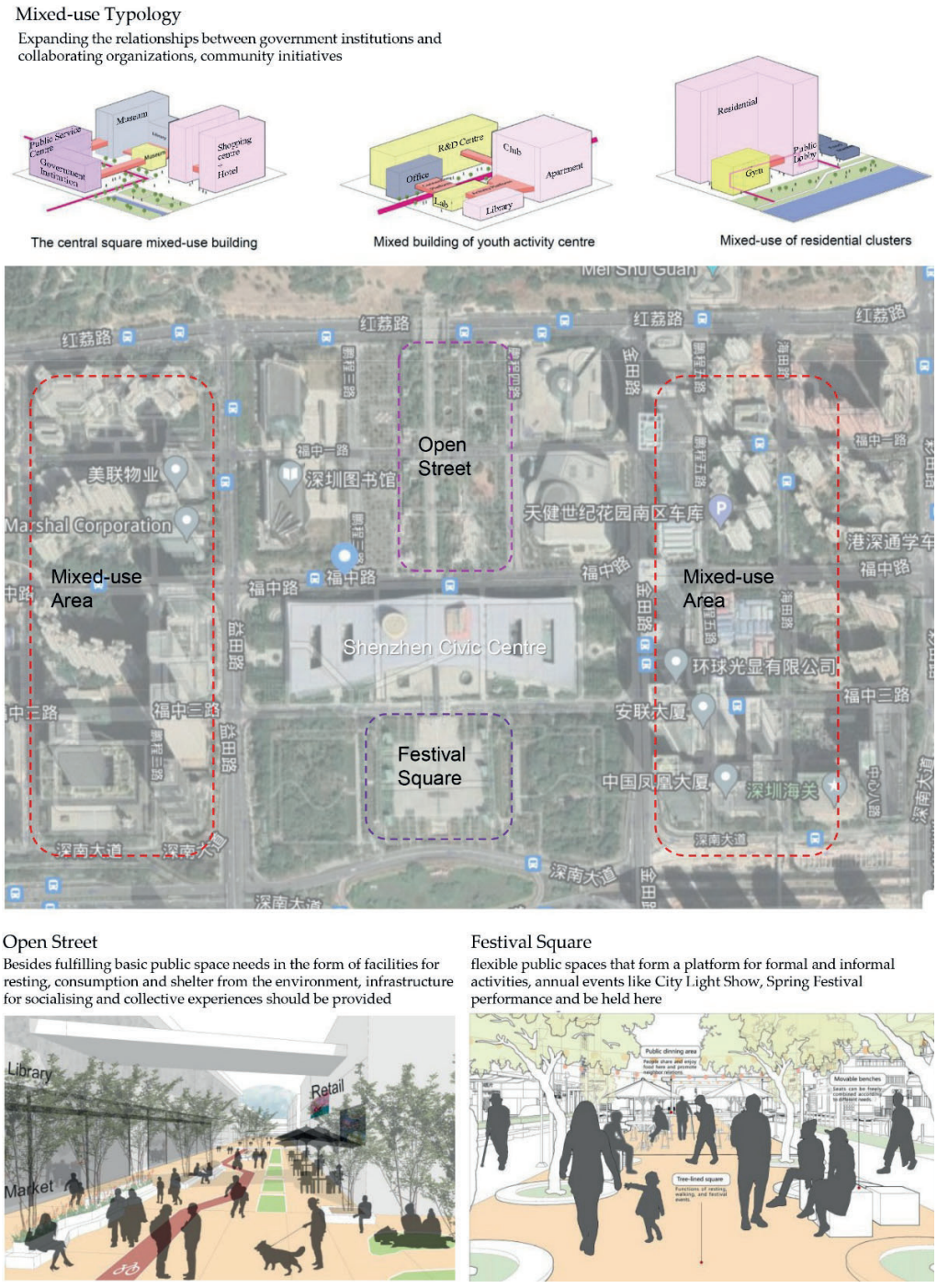

Figure 6. Potential future transformations in the Futian Central District

6. Conclusions

By discussing the conceptual and practical interactions between public space, urban culture and urban identity, this paper has explored the particularities of public space as a platform for culture and urban collectivistic activities, capable of representing a strengthening and evolving image of the city and its communities. Our analysis of London's South Bank Centre has identified the importance of human-centric urban space planning and management, to establish an open system of cultural institutions and spaces

for everyday life, establishing a synergy between planned and unplanned social experiences. The place identity and cultural production established at the site contribute to the collective appreciation and significance of this urban centre, and help establish an inclusive image of the city based on the participation of diverse groups of residents and visitors.

Our analysis of the case study site at Futian Central District in Shenzhen responds to the city's rapid transformation into an urban metropolis of global importance, which is increasingly focusing on liveability and urban renewal. As Shenzhen's intensive land development has led to the increase of privatised or highly regulated public spaces, it is of vital importance that renewal strategies for existing urban centres protect the notion of the Right to the City, facilitating participation and co-creation opportunities for diverse groups of residents. Our analysis of Futian Central District's public space users and activity patterns has highlighted how public open spaces are open to appropriation by ordinary citizens, but it has shown how a lack of facilities, urban function mixing, and event planning currently limits this potential. The Futian Central District, with its large-scale and underused spaces, shows the unique potential to incorporate additional urban cultural facilities and urban design measures to embrace a broader urban identity, representative of the aspirations and participation of all of Shenzhen's residents. A more active, inclusive and dynamic engagement of citizens, and their interaction with the new urban environment can help create collective experiences, strengthen the sense of belonging and forge a new image of the city based on the sophistication of its everyday life.

In this paper, we have outlined a series of theoretical and practical considerations that promote the implementation of truly public and open public spaces, deploying physical and social infrastructures to enable a wide range of cultural activities. Through a series of measures such as private-public synergies between institutions and the creative and cultural industries, combined with people-oriented public space design, function mixing and event planning strategies, we have shown how cultural mechanisms within public spaces could help establish urban centres with a broad popular appreciation.

Public spaces in the main central areas of large cities have the unique capacity to record collective urban history, culture and progress, through the layering and incremental development of its institutions, buildings, and landscapes. Rather than focusing on the reinvention of urban identity through the construction of brand-new symbols in isolated locations, cities can invest in the strategic upgrading of existing centres, introducing new stakeholders and activities in dialogue with the rich existing urban fabric.

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Parameters for Independent Living in Old Age in Terms of Urban Planning and Technology

Aglaée Degros [1], Nina Alisa Habe [2,*]

[1] TU Graz / 145 Institute of Urbanism; a.degros@tugraz.at
[2] TU Graz / 145 Institute of Urbanism; n.a.habe@student.tugraz.at *
* Corresponding author

Abstract: The concept of autonomy and self-determination in old age has taken on further meaning. Pushed by the social side effects of the corona crisis, the 65+ target age group has become more digitally fit and has tried technical applications such as video calls and delivery services. In the view of the demographic change and the ageing of the global population, there are various potentials for technology to support those aged 65+ in their independent lifestyle. To sound out urban planning potentials that can be used to support independent living in old age, a survey of ages 65+ was conducted. The survey asked about user acceptance and habits of the target group. The goals were to assess whether technology support could improve independent living in old age, and to investigate which technical application can be used in everyday life to support an age-appropriate urban living environment. The research has shown that technology is an important factor in many areas of urban and social life, and that urban design can have a supportive effect on the living conditions for the elderly, as well as providing them a meeting place.

Keywords: smart community; aging; independent living; old age; urban planning

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1. Introduction

Self-determined living in old age in combination with a supportive urban living environment is becoming more and more important for the increasingly ageing population. According to an analysis of the report "Europe's Demographic Future," the demographic development of the European population aged 65+ is calculated to average 55% by 2050 (Hergott, 2012, p. 8–11). The increasing ageing of the population is not only a European challenge, but a general challenge for the future. The challenges, such as ensuring social contact and a self-determined life in old age, need to be addressed. The limited mobility of the 65+ target age group not only affects autonomy and activity, but in combination with demographic change will change the parameters of urban design in the long term (Sölch, 2015, p. 35).

The desire for an independent, self-determined life can be supported by digitalisation and has a high impact on the satisfaction in the areas of housing and social integration. Digitalisation is omnipresent in various areas of life. The use of technology among the target group aged 65+ has been further established by the social restrictions and effects of the corona crisis since 2020, and has gained further importance under these circumstances. As a result, social participation and self-determination in old age became supported and recognisable through digitalisation and technology. Especially in times of lockdown and isolation, the 65+ target age group has had to become more digitally fit and has

tried out new technical applications such as video telephony and messaging services. Evaluations by Statistik Austria show that in 2020 there was a 10% growth of internet telephony and video calls among the 65+ target age group. Likewise, digital development has contributed to the automation of mobility in terms of consumer behaviour such as online shopping. According to statistics from Statistik Austria, around 22% of the 65+ target age group in Austria were already using online shopping services in 2020 (Statistik Austria, 2020). Also, technical assistance systems and applications like apps are in a process of constant development and are becoming increasingly important. In this way, an active leisure time, mental fitness, and social contacts in the familiar living environment can be digitally supported (Weiß et al., 2017, p. 9–10).

The paper tries to assess whether technological possibilities and their user acceptance can improve a self-determined life in old age. It provides firsthand data on user acceptance of available technologies in old age. First, the terms 'Smart City' and their associated accessibility are discussed, and then the starting point of the survey is described. Then, the evaluations of the survey in the areas of technology and its application, as well as the urban environment are discussed. Finally, the advantages and disadvantages of technological progress are discussed.

2. Theories and Methods

Digital applications are often associated with the term 'Smart City.' But what is the definition of a smart city? The term Smart City defines the development of promising urban planning programmes and strategies, in the form of networking, as well as innovative integration of different areas of a city. Smart City concepts should encompass technical, economic, social, and ecological developments (Dangschat/Jens, 2020, p. 148). 'Smart Living' encompasses services and applications from a wide range of actors in relation to the interests and needs of older people (Guggenbühl et al., 2018, p. 19). The aim is to increase safety and ease the daily lives of residents. These include fully automatic fall detection systems, mobile safety watches, light paths, and fall detection in the bathroom (Riedel/Hofer, 2018, p. 38). If used correctly, smart living technologies could have great potential for the future. In order to achieve broad acceptance among the population, operation and functionality must be adapted to the requirements of the target group. Smart City means participation, inclusivity, and support concepts, as well as digital and analogue offers for self-determined participation in social life (Günthner et al., 2017, p. 9).

To transform this need for autonomy and self-determination into fields of action, a survey of the 65+ target age group was conducted to identify the technical potential that can be used to support independent living in old age. A total of 307 people in the 65+ target age group living in Graz were asked over a period of four months, from August to November 2020. In total, 77 questions were asked in the areas of digitalisation, social life, mobility, and infrastructure in relation to relevance and habit. Figure 1 shows that the study participants are 38% men and 62% women. Of the respondents, 25.7% were 65–69 years old and 18.2% were 70–74. The percentage of respondents aged 75–79 was 26.4%, and for those aged 80–84 it was 16%. Participation of the target group aged between 85–89 years was 8.8%. The age group 90–94 was 4.6% at the time of the survey and participation 95+ was 0.3%. It should also be noted that 43.9% of the results relate to 65– 75 year olds, while even 70.3% of the evaluations concern the 65–80 year olds. The results of the survey in the areas of urban development and digitalisation show urban planning and digital potentials for supporting an age-appropriate urban living environment.

3. Results

First of all, the results of the survey make it clear that there is no desire to change the usual living situation. A total of 97.4% of the respondents state that they are satisfied to very satisfied with their living situation. Almost 85.7% are not willing to change their living situation. This suggests great potential for digitalisation in combination with housing and urban development, in which the physically existing environment is upgraded to new settlements through urban planning and digital measures in order to enable people to remain in their homes and familiar surroundings for as long as possible.

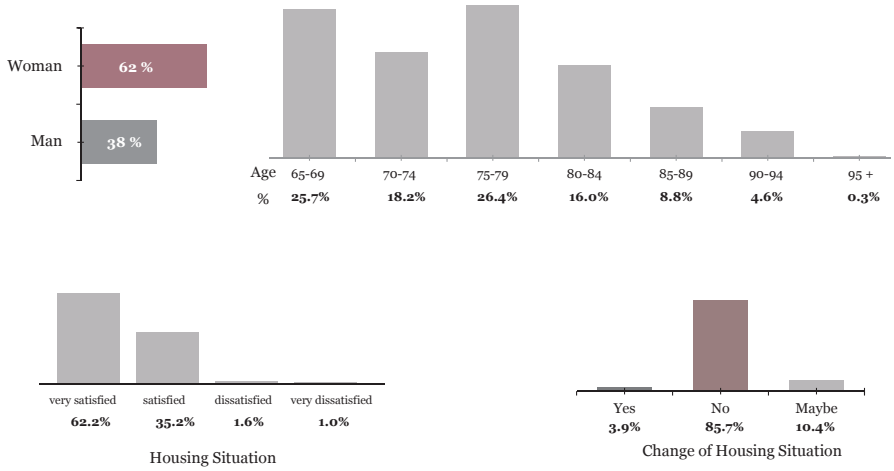

Figure 1. Core data of the respondents and their living situation

3.1.Senior-friendly technology

User acceptance is crucial for digitalisation to be used in the neighbourhood in the long term. In order to shape the digital transformation in an integrative way, the neighbourhood must become an actor in sustainable urban development and digitalisation (Günthner et al., 2017, p. 7). Extensive applications such as video telephony are also very positively received by the 65+ target age group if there is a clear added value for the user. With regard to whether modern information technologies and technology can support the 65+ target age group, the question is not "whether," but "how" they can be used. Digital precarity and exclusion is also an essential issue. To understand digitisation mentally, but also to access it physically, good vision and good motor skills are needed. One has to take into account the user-friendliness and the questions of the target group concerning the use of this technology. The focus is on developing new systems and adapting existing technologies to the needs of the 65+ target age group. This requires senior-friendly technology as a support for a self-determined life in old age with the involvement of the target group. For this, trainings and workshops with seniors are needed in order to learn together about wishes and ideas for intelligent use. Technical solutions are needed to improve the living conditions of the 65+ target age group in order to achieve broad user acceptance. The area of digital application in the age of the surveyed 65+ target age group has revealed a great willingness to use it. Messaging services such as WhatsApp are used by 55.4% and Facebook and Instagram by 14.3% daily. The mobile phone is even used daily by almost 93.5% of the respondents. The computer also finds popularity in use, with just under 51.8% using it daily. Newspapers are preferred to be read traditionally, online newspapers are read by only 18.2% daily. Online banking is used by 39% of respondents and public WiFi is found to be very important by 23.9%. The acceptance of the applications increases with involvement and knowledge. This is also well shown by the evaluation regarding the acceptance of technical applications to help people live independently in old age. Here, the acceptance of care robots and emergency bracelets was examined. As shown in Fig. 2. the emergency bracelet received an average rating of 4.2 stars out of a possible 5 stars. The care robot received an average of only 1.7 stars, as it entails uncertainty and distance. It should be noted that 5 stars is the best and 1 star the worst possible rating in the survey. The digital transformation must not lead to the exclusion of the 65+ target age group, but must promote participation, integration, and inclusion in social life. Digitalisation brings services and technical support, but also the danger of social isolation. There is a risk of social distancing through digital proximity. An important goal in the implementation of technology in old age is to support independence and autonomy, and to promote social closeness despite physical distance. This idea is important to keep in mind to be able to counteract loneliness through urban planning.

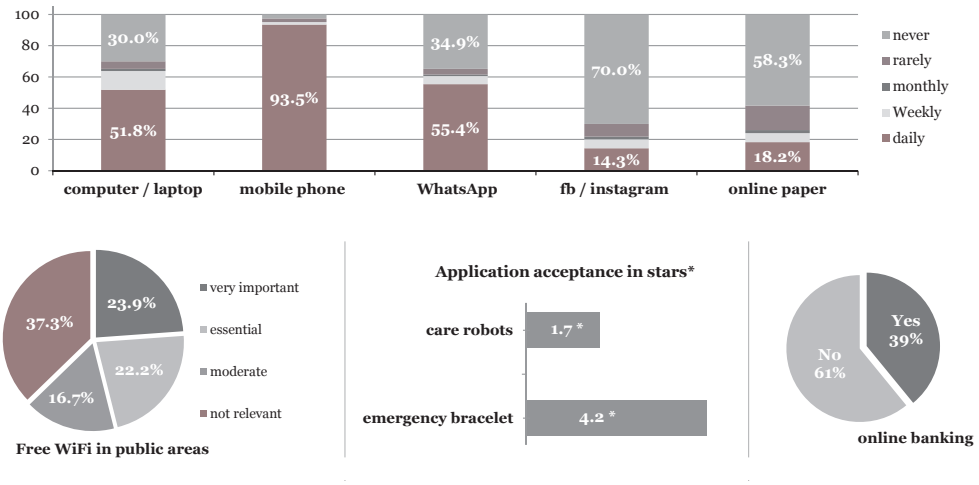

Figure 2. Digital behaviour of the respondents

3.2. Digital applications in urban environment

Digital applications can create and ensure healthy living conditions for the 65+ target group and enable participation in social life. Digitalisation and technological potential can be used to maintain mobility, safety, and independence (Zens et al., 2010, p. 474–477). For example, online shopping, delivery services, but also car sharing and waste management are seen as smart steps to support autonomous lifestyles in old age. There are various ways to establish the new applications and problem solvers in everyday life:

3.2.1. Delivery service

Mobility has changed due to digitalisation, as the pandemic also shows. The massive increase in online trade is promoting alternative solutions here (Riedel and Hofer, 2018, p. 45). The radius for the age-friendly space was identified in the survey as 500 m. For distances beyond this radius, a well-connected delivery service can provide service. The service needs to be adapted to the size of the city and to the neighbourhood. For supply that is not included in this radius, technical assistance such as digital service and delivery service can be offered.

The target group orders online very rarely and goes shopping regularly. A total of 93% of the respondents had never ordered groceries online at the time of the survey. Food has also never been ordered online by 87% of the target group. Online shopping is more popular here, with 44% having already ordered something via online retail. Many apps and tools are not yet sufficiently senior-friendly, so younger relatives often still order online for the 65+ target age group. Through coaching and training, these applications could find wider acceptance in the population. The target group rarely orders online but goes shopping regularly 77.5% of respondents go shopping at least two to three times a week. Also, 11.4% of the respondents even go shopping daily. Shopping is seen here as a social interaction, experience, and task. It is therefore important to maintain small-scale infrastructures and shops in the neighbourhood to strengthen social structures and prevent loneliness in old age.

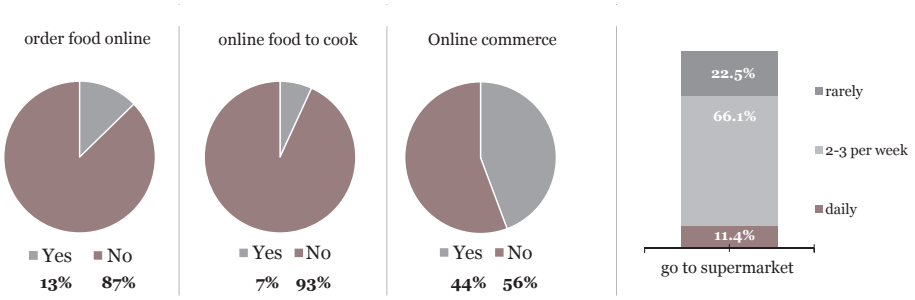

Figure 3. Shopping behaviour of the respondents

3.2.2. Car Sharing

Mobility stands for independence, quality of life, autonomy and freedom. In Austria, car sharing has been established since 1992 (Magistratsabteilung, 2015, p. 8). Car sharing reduces the number of vehicles and has a positive impact on the environment and urban mobility. Emission reduction and an increase in pedestrian traffic in urban neighbourhoods of short distances are positive effects of car sharing. As an example, based on 2015 data, approx. 7,000 tonnes of CO2 are saved annually in Vienna (Magistratsabteilung, 2015, p. 47). Car sharing systems are becoming more and more popular, especially in cities. (Stier/Berger, 2016, p. 144) Demand among the population is still low, as the 65+ target age group survey shows. Just 3.6% of the respondents use car sharing.

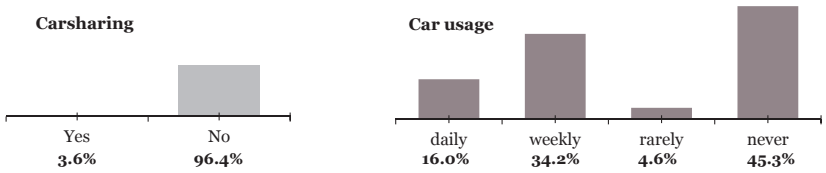

Figure 4. Car usage of the respondents

According to the survey, there is too little information and aversion to the unknown. Another problem is that the grid is not dense enough. Thus, urban planning of the future must adapt the car sharing tool so that it finds more application among the 65+ target age group. Special driving courses and training for the 65+ target age group, as well as information brochures could take away the fear of the unknown. Car sharing is the perfect solution for the older population as they rarely want to use their car. The survey showed that 50% use the car at least once a week. The question that needs to be addressed here is which car sharing model is appealing to the target group. Regardless of how the technology in car sharing systems will change, the public space around the system must also be adapted.

Contra Car Sharing
Not enough information
I do not (no longer) go by car/No need
Too cumbersome and not practicable
Would be spontaneous and independent
I prefer my own car

Table 1. Contra Car Sharing/survey 65+

3.2.3. “Waste management” by technology

The issue of waste disposal is also a problem for the 65+ target age group. Distance and non-accessible public spaces are obstacles to being able to cope with everyday life in an independent way. The survey showed that collection points are too far away. Access to waste collection points is also often not accessible or is overcrowded due to too much waste. Alternative solutions with digital support could promote independent living in the city. The waste management in the smart city district like Helsinki Kalasatama (Degros/Grabner/Rainer, 2019, p. 15) has a technological waste system. Environmental protection, noise reduction, and accessible access are associated with these deployed waste management systems. A specially developed pipe system generates negative pressure and a strong air flow. The waste is transported at up to 70 km/h through an underground suction system directly to the waste collection point. The air sucked in is thereby hygienically filtered against unpleasant odours. The pipes are laid directly during construction and are thus very well suited for city extension concepts (Hartmann, 2015). Energy can also be generated from the recycled waste to supply the neighbourhood. Essential for an intact application are small waste sizes and a functioning waste separation of the users (Wiesner, 2014). For the 65+ target age group, it is important to have a dense network of collection stations, the use of information brochures, and education, as well as accessible access.

4. Discussion

Interaction and communication possibilities support new forms of neighbourhoods, shaped by demographic change and digitalisation. The growing interest in sharing equipment and assistance is giving rise to more and more neighbourhood platforms. These include swap exchanges, as well as WhatsApp groups and Facebook communities. Despite the electronic basis of these neighbourhood forms, the increase in personal contacts is emphasised as positive by the users (Dangschat/Jens, 2020, p. 150). Through good networking in the neighbourhood local resources are used and synergies are exploited. Mutual help is provided in the community. This can be childcare, help with shopping, looking after community gardens or help with waste disposal. In the future, more importance will be attributed to personal non-family associations such as neighbourhood communities. The survey showed that 46.3% are very satisfied and 25.9% are satisfied with their neighbourhood relations. Almost 43.6% of the respondents would like to see more networking.

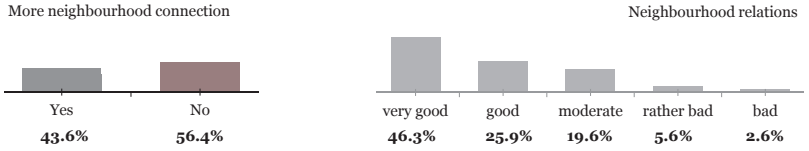

Figure 5 Neighbourhood connection the surveyed target group

Neighbourly help, as well as good networking with each other are an important attribute for independence, and independent living in old age – which is so important with regard to the quality of life of the 65+ target age group. Smart cities and smart neighbourhoods can support the community here. But does this smartness inevitably consist of technology and what risks does a smart city concept entail for the target group? The neighbourhood acts as a meeting place that expresses the quality of life and diversity of a city. The residents are at the centre. Smart is not tied to technology, but can be supported by it. As such, the social network and infrastructure are very important.

Smart city services can add value to the quality of life and facilitate everyday urban life through digital infrastructures. However, it is also very important to be aware of the possible negative aspect of control and surveillance by technology in private and public spaces through digital platforms (Bauriedl/Strüver, 2018, p. 18). Also, can socio-economic and socio-cultural inequality be reinforced by smart city concepts, which bring with them the risk of social and digital exclusion?

Furthermore, digital literacy is a prerequisite for participation as a smart citizen. Therefore, it is important for the community to consciously create access for all without exclusion (Bauriedl/Strüver, 2018, p. 24–25). There is a need for meeting points, community spaces, and public space. Car sharing needs a tighter network, easier use, as well as courses and coaching. Delivery service promotes dependency and independence at the same time. A delivery service provides the supply, but reduces social participation by preventing people from leaving their own homes (Kreuzer/Scholz, 2011, p. 13). In the future, delivery services could enter into a synergy with social services. For example, a delivery service for seniors that automatically includes a conversation. An added value in terms of quality of life to prevent the problem of loneliness would be an age-friendly app for the neighbourhood to strengthen the community. This should not take place exclusively on a digital level but invite people to meet physically. An age-friendly inclusive design is therefore based on cooperation and networking in the neighbourhood (Lobsinger et al., 2016, p.9–13). The spatial quality must therefore be improved through digital technologies to contribute to the creation of liveable urban spaces (Radulova-Stahmer, 2020, p. 756).

5. Conclusions

First of all, it can be concluded from the research that technology and its use in urban design can improve the possibilities for a self-determined life in old age, provided that the

important findings are taken into account. These are the need for user-friendly technologies and the need for training, as well as awareness-raising against loneliness through technology and isolation. Technologies must be used in a precise and stimulating way. For example, a neighbourhood app can isolate, but also have an integrative effect.

Secondly, it is it important to take the findings and experiences of the pandemic into account in future urban design development processes. Here, the city in combination with technical support can serve as a future key in terms of autonomous living in old age and independence of the 65+ target age group for a self-determined life. For this purpose, smart housing, as an application area for smart living technologies, must not only be considered as an inhabited house, but also as a lively neighbourhood in the context of the city. Infrastructure and public space play a major role here. There is a need for digital connection and real community spaces and community meeting places in the social neighbourhood.

Finally, in order to bring technological applications to the neighbourhood, it also needs a community that supports it. Thus, smart communities must become pioneers in urban development to ensure digital participation, integration, and inclusion of all generations an intelligent, future-oriented neighbourhood with a high quality of life and social help. Social relationships are key factors for autonomy, integration, and life satisfaction in the neighbourhood, therefore it is essential to promote community.

This research has shown that in the future, digital supplementary applications, and alternative forms of living in combination with an age-appropriate urban environment will represent an adequate solution for self-determined living in old age in the city. As the survey has shown, especially the 65+ target age group will benefit from these new technologies and digital applications and adaptations in urbanism in the course of demographic change.

Contributor statement

A.D. and N.H. conceived of the presented idea. N.H. has performed the survey. A.D. verified the analytical methods. A.D. supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

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COVID-19 and the Right to the City: Informal Settlements Learning and Mobilizing during a Pandemic

Daniela Beltrame [1], Joaquin Benitez [2], Karenna Groff [3], and Amelia Seabold [4,*]

[1] MCP, MIT DUSP; dcocco@mit.edu
[2] PhD, University of Buenos Aires; jbenitez@sociales.uba.ar; 0000-0001-7132-6639
[3] MIT; kgroff@mit.edu; 0000-0002-6725-094X
[4] MCP Candidate, MIT DUSP; aseabold@mit.edu; 0000-0001-8559-4239

Abstract: Deepening socio-economic inequalities, highlighted by the COVID-19 pandemic, make just and sustainable approaches to city-making that include different actors and value different types of knowledge have become even more urgent than before. Slums and informal settlements are loci of enunciation for these alternatives. Their already strained networks received additional pressure since the onset of COVID-19, but they also managed to remain sites of creativity and resourcefulness, where networks of kinship and solidarity foster alternative forms of "citification," and negotiate decision-making space to further realise their right to the city. The pandemic affected the right to the city agenda in different ways across the global South, and this project investigated which variables drove these differences. In-depth interviews about the COVID-19 response in slum communities in Buenos Aires, Argentina and Freetown, Sierra Leone were conducted, and three topics emerged that reportedly had an effect on the potential for forwarding the right to the city agenda during the pandemic: 1) previous situated knowledge and experience of community-based organisations (CBOs), as well as pre-existing socio-spatial infrastructure; 2) government agencies' political positioning and resource mobilisation capacity and; 3) CBOs built capacity to mobilize beyond crisis-specific issues and negotiate spaces of power in local governance structures.

Keywords: Right to the City; COVID-19; Informal Settlements; Urban governance; Community-Based Organisations

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1. Introduction

Slums and informal settlements have long been the self-provided housing alternative for populations historically marginalized by city officials and others in positions of power. In the context of a global pandemic, with policies and restrictions that have tended to exacerbate this marginalization, slum dwellers have continued to utilise their collectively gained experience, situated knowledge, and mobilization strategies to claim their agency and their right to the city.

This research attempts to understand how the right to the city agenda is advanced in informal settlements during a crisis. It considers which variables affect the advance of the right to the city agenda during a crisis and looks at slum communities in Buenos Aires and Freetown to understand what happened to this agenda during the COVID-19 pandemic.

Through semi-structured interviews with a variety of actors, this research found three emerging variables that have had an effect on the potential for advancing the right to the city agenda during the pandemic: 1) previous situated knowledge and the experience of community-based organisations (CBOs), as well as pre-existing socio-spatial infrastructure; 2) government agencies' political positioning and resource mobilization capacity, and; 3) CBOs accrued capacity to mobilize beyond crisis-specific issues and negotiate spaces of power in local governance structures.

This paper first describes the requisite literature on co-production of slum health and the right to the city agenda, followed by an explanation of the research methods used, including desk research and primary interviews. Next, an analysis of our data collection is presented, weaving quotes from interviews with a discussion to expand on the three emerging topics found. Finally, it concludes with a restatement of findings and a look toward the future.

2. Theories and Methods

2.1. The right to the city in a city in crisis: slum health co-production during COVID-19

Fifty years after its first formulation by Henri Lefebvre (1968), the right to the city has become a polysemic concept as a result of both theoretical reflection and political struggle (Marcuse, 2011; Costes, 2011). An important dimension of the right to the city involves collective decision-making and political leadership by urban dwellers, particularly against both global capital flows and local entrepreneurial governance that shape cities in undemocratic ways (Harvey, 2012). But the right to the city is more than a cry and demand for participation and consultation from local governments: it is about *autogestion*[1], radical democracy, and direct involvement of those who actually produce the city in everyday life (Brenner, 2008; Harvey, 2012). In some cities of the global south, social movements have struggled to make the right to the city formally enacted in urban legislation (Fajemirokun, 2010; Benitez, 2018), placing strong emphasis on "democratic management of the city and the territory," as well as "democratic production of the city and in the city" (Zárate, 2018: 25–27). This calls not only for policies like participatory budgets and urban planning, but for a radical acceptance and social integration of informal settlements and other forms of social production of habitat (Huchzermeyer, 2011). This paper frames these acts of leadership and protagonism in the COVID-19 response as part of a perennial struggle for the right to the city, as lockdowns, social distancing, and the distribution of foodstuff and basic goods shape the urban everyday life of informal communities. The right to the city is a cry and demand that unifies diverse urban claims and movements (Mayer, 2012), but even when some community-based organisations (CBOs) or urban movements do not explicitly frame their struggles in terms of a right to the city, it still can be traced and found as a structure of feeling (Williams, 1978), a pre-emergent cultural form in which the housing and urban environments are loosely claimed for in a language of rights (Benitez, 2018).

This is particularly important as local CBOs and informal actors bring forms of situated knowledge (Haraway, 1988): partial, located, and embodied forms of knowledge and experience that are collectively created and better account for particularities compared to both universal and relativistic epistemologies. When properly mobilized, these forms of situated knowledge make any social or health-related intervention in slums and informal settlements more democratic and medically effective (Lilford et al., 2017). In fact, health in slums and informal settlements is the result of a co-production of multiple economic, informal, medical, social, and state actors (Corburn and Lee, 2016).

In the context of the current COVID-19 global pandemic, where technological solutions tend to overshadow more socially-aware policies, fighting the pandemic requires behavioral changes on everyday practices (such as social distancing) that are not easy to impose from above (Gupte and Mitilin, 2020). Across the Global South, CBOs mobilized to enact these changes and ameliorate the economic, medical, and social crisis created by the COVID-19 pandemic in slums and informal settlements (Duque Franco et al., 2020; Auerbach and Tachil, 2021; Beltrame et al., forthcoming).

2.2. Methodology

As mentioned, slum communities and informal settlements are loci of enunciation for alternative endeavors to realise their right to the city. These stem from alternative sources of knowledge and power, with networks of kinship and solidarity that foster alternative forms of "citification," and negotiate decision-making space. To understand how the pandemic affected these endeavors to further the right to the city in different ways across the Global South, and what variables drove these differences, this project applied qualitative methodology, which has proved adequate for exploratory research aimed at understanding people's insights and perceptions.

[1] *Autogestion* can be loosely translated from French as self-management, self-determination, co-management, and/or mutual help. We keep the original French word as it has political connotations that the English word "management" cannot capture.

The analysis and arguments presented in this paper are based on data emerging from a combination of desk research, semi-structured interviews with development actors on the ground, and informal communications with members of research institutions both in Freetown and Buenos Aires.

First, we conducted a review of different pieces of public information about the COVID-19 response, aimed at identifying emerging themes in academic and gray literature that highlighted the situation in informal settlements, specifically in each location.

Primary data collection included semi-structured interviews and informal communications with slum settlement residents, local government representatives, officers of INGOs' local chapters, and members of research institutions. Topics covered in our interviews included understanding how the COVID-19 pandemic affected interviewees' and residents' daily lives, how they aided in the response, their perceptions about response success, factors that influenced their actions, and their overall mobilization capacity towards a broader right to the city agenda beyond their COVID-19 response, among others. In both cities, local organisations were key to articulate and tailor research questions, select settlements, decide on appropriate methodologies, and develop context-appropriate tools.

In terms of sampling, we agreed on including a diverse set of participants in terms of age and gender, as well as a specific group of settlements (Figure 1). In Freetown, we selected five settlements, responding to the local partner's interest to study both hillside and seaside locations, as well as including both a site with a high number of COVID-19 cases, and one with no cases, to understand the extent of other hardships (Table 1). While the formal interviews were conducted between June and September 2020, informal communications with residents were established as early as April 2020. We conducted a total of 19 interviews to 25 people in Freetown. Resident interviews were conducted in person by trained local resident researchers through partnerships with local organisations,[2] using the interviewees' language of choice (Spanish, English, or Krio) and following local safety guidelines. Non-resident interviews and all other communications were conducted remotely by the authors through Zoom and WhatsApp platforms. Non-resident interviews included representatives from the local chapters of Catholic Relief Services, CARE International, and GOAL, as well as local government officials from the Mayor's Delivery Unit, and members of the MIT GOV/LAB team that collaborated with the Institute for Governance Reform and the Government of Sierra Leone to implement a rapid survey to inform country-wide COVID-19 response policies in April/May 2020.

In Buenos Aires, we selected six settlements of different sizes and urban histories (Table 2). The cases included Barrio Padre Mugica (formerly known as 'Villa 31'), Rodrigo Bueno, Villa 20-Lugano, Villa 15-Ciudad Oculta, Barrio Padre Ricciardelli (formerly known as 'Villa 1-11-14'), and Villa Azul (in the Greater Buenos Aires area). Villa Azul was included despite being located outside of the core district of the city because the government's response included a unique form of community isolation that required cordoning off of the entire community. Three of these settlements are going through upgrading programs with heavy government presence deploying a broad range of urban interventions. The other three were selected to explore locations that did not have significant previous attention. We conducted 19 interviews to 24 people, between July 2020 and February 2021. We interviewed key political, social, and state actors. Even though part of our research team was located in Buenos Aires, all research was conducted remotely due to local stay-at-home COVID-19 response measures.

[2] The partner CBOs were: the Federation of the Urban and Rural Poor (FEDURP) with its professional support organisation the Centre of Dialogue on Human Settlements and Poverty Alleviation (CODOHSAPA), and Foundation for the Future Sierra Leone (FFF-SL). FEDURP is the Sierra Leone affiliate of Slum Dwellers International (SDI), a transnational network of the urban poor. The Foundation for the future Sierra Leone (FFF-SL) is an educational syndicate, non-profit, community-led organisation in Cockle Bay, Freetown whose mission is to support the education of vulnerable children and young adults.

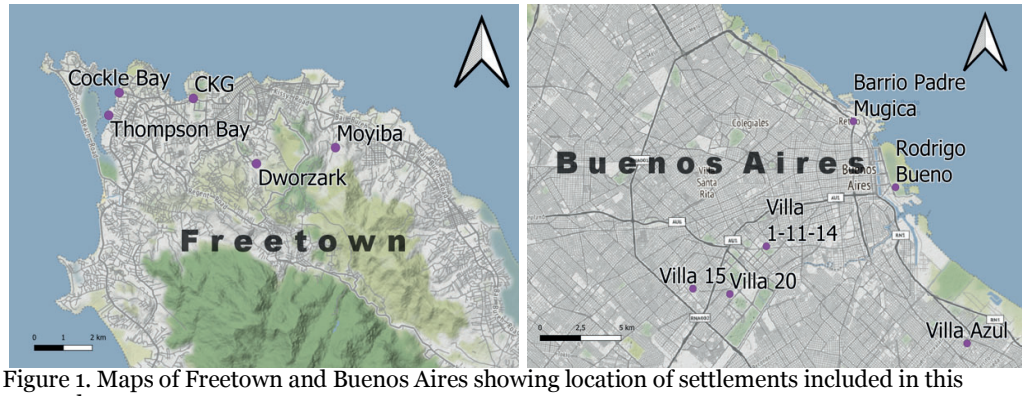

Figure 1. Maps of Freetown and Buenos Aires showing location of settlements included in this research.
Source: Prepared by the authors.

Table 1. Selected settlements in Freetown.
Source: Prepared by the authors.

Freetown, Sierra Leone		
Settlement name	**Population**	**Location**
Krab Town, Kolleh Town, Grey Bush (CKG)	> 2,000	By the Atlantic Ocean and the Congo River, on a central part of Freetown, close to a dumpsite
Cockle Bay	~ 20,000	Seaside settlement along the Aberdeen Creek
Dworzark	~ 16,500	Hillside community located 5 km away from Freetown city centre, on the Peninsula Mountains
Moyiba	~ 37,000	Hillside community located on the East side of Freetown
Thompson Bay	~ 6,000	West of Freetown

Table 2. Selected settlements in Buenos Aires.
Source: Prepared by the authors

Buenos Aires, Argentina		
Settlement name	**Population**	**Location**
Barrio Mugica (Villa 31)	~40,000	Downtown Buenos Aires, a 20-min. walk from its CBD
Villa 20	~35,000	Lugano neighborhood
Barrio Padre Ricciardelli (Villa 1-11-14)	~40,000	Bajo Flores neighborhood
Rodrigo Bueno	~2,300	Puerto Madero, one of the most expensive neighborhoods in the city
Villa 15	~30,000	Near the district limits and the HQ of the city's social development ministry
Villa Azul	~3,200	Greater Buenos Aires Area, a 40-minute car ride from the CBD

All data was processed using qualitative analysis software, which allowed us to categorise responses into emerging topics, and cross-check them with the results of our desk research. This exercise served as the starting point for the analysis we present in the following section.

While we have engaged with a variety of actors in each urban setting, it is important to acknowledge that the diversity in perspectives by far exceeds those included in this paper. Situations in these settings present heterogeneity in the form of varied lived experiences and perspectives. Our choice of settlements and interviewees relied heavily on partner access, and we acknowledge we were only able to reach a small subset of the population.

3. Results and Discussion: The struggle for the Right to the City during COVID-19 in Buenos Aires and Freetown

During our research, three topics emerged that seem to have had an effect on the potential for forwarding the right to the city agenda during the pandemic: 1) the level of previously situated knowledge and experience, as well as socio-spatial infrastructure that exists in a given slum community; 2) the strength of Government response strategies and; 3) any pre-existing capacities by CBOs to advocate and mobilize.

3.1. Situated knowledge, networks, and infrastructure

Slum settlements have historically grown out of residents' initiatives facing government and market disattention. Some have struggled for decades against powerful natural and political forces for their right to stay in their place. As such, they have accrued situated knowledge, nurtured strong networks, and created socio-spatial infrastructures that have become strategic assets for any successful crisis response. These assets are key to their legitimacy, upon which they systematically build their capacity to advance their own development agendas and claim their right to the city. In Freetown and Buenos Aires, either by takeover or delegation, CBOs from informal settlements spearheaded the response to the pandemic in their territories. This taking of leadership can be understood as a collective reappropriation of the city to remake it in a context of crisis (Harvey, 2012), a reappropriation that could only be possible after a long history of urban struggles for housing and urban rights in each of these two cities.

In both locations, the insights and wisdom gained through lived experience in their communities gave CBOs an added advantage to better identify their residents' needs and vulnerabilities throughout the COVID-19 pandemic, with social organisations, neighborhood leaders, and residents acting as grassroots public health agents. For example, priority lists based on need for government assistance created from CBOs' data and knowledge were widely referenced in our interviews. In Freetown, even with challenges and limitations, organised communities have collected their own data for years, and in the early days of the pandemic, CODOHSAPA developed the Freetown Informal Settlement Covid Data Dashboard (Fiscovidata) in Google forms to record and disperse real-time COVID-19 data (Figure 2). Through a Google form, residents were able to report cases of COVID-19 in their communities, as well as other incidents. The Fiscovidata dashboard is an example of the way in which, even under pandemic constraints, FEDURP/CODOHSAPA adapted their way of producing situated knowledge to fit the needs of both communities and local government.

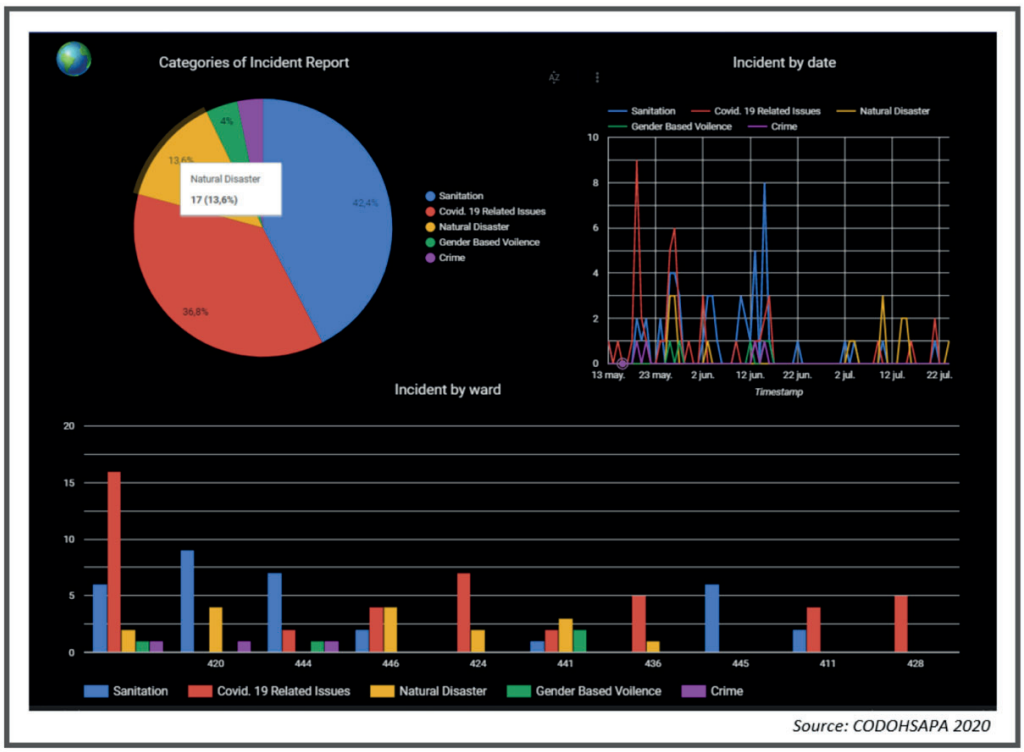

Figure 2. Fiscovidata app snapshot.

At the same time, Freetown's CBOs mobilized according to past experiences from the 2014-2015 Ebola Virus Epidemic. Having had a central role in arresting the contagion during the Ebola epidemic (Richards, 2016), they mobilized their knowledge on how to fight misinformation, conduct public service campaigns, drive behavioral change, and develop community responses adapted to their needs (Bedson et al., 2020; Richards, 2016).

A second asset, key to the legitimacy that empowers CBOs to push forward the right to the city agenda is their strong community networks. Several interviewees in both Freetown and Buenos Aires mentioned that the novelty of the disease made residents weary of official information from authorities, and that kinship networks between territorial referents and residents were key in the effectiveness of sensitization and awareness campaigns, behavior change messaging, and compliance with novel testing and isolation protocols. In Freetown, a resident and community leader said, "95% of people in our community are saying COVID-19 is not real," and that this "affected the spread of COVID-19 in [Thompson Bay]." There, a significant portion of sensitization efforts through community networks was focused on informing preventive measures and containment procedures, as well as combating misconceptions. Posters, radio programs, videos, WhatsApp messaging, and megaphones were all combined to tackle misinformation and share facts about the virus and how to slow the spread. In Buenos Aires, CBOs employed similar strategies, locally articulating public and private initiatives. Organisations informed residents about social distancing, sanitation, and disinfection while distributing free masks, hand sanitizer, personal hygiene items, and cleaning kits. Furthermore, networks of soup kitchens and food banks created under the strain of past economic crises (Neufeld and Cravino, 2001: Pacifico, 2020) doubled their efforts to ensure residents' food security.

As a third asset, CBOs' have persistently worked to create and sustain critical socio-political infrastructure at a territorial level. These are crucial components to support CBOs legitimacy for action during emergencies and, more broadly, in their struggle for the right to the city. Community healthcare centers, *ad hoc* committees, political or religious community organisations, soup kitchens and food banks, schools and sports facilities, parks, and open spaces, are some examples of these physical and social infrastructures from which volunteers can be recruited, care networks can be mobilized, and logistical management practices can be borrowed. Two examples of these infrastructures from Freetown are the Community Disaster Management Committees (CDMC) and the Community Health Workers (CHW). CDMCs are networked, resident-run committees aimed at addressing different types of disaster and risk. They have been around for years now and are present in most of the settlements, where they establish early alert systems and organise and carry out sensitization initiatives, mitigation measures, and direct actions. CHWs were created in 2012 by the Ministry of Health and Sanitation of Sierra Leone to improve health access in a country where community health posts are often inadequately staffed. CHWs are over 15,000 volunteers, trained in health education messaging and integrated community case management and working in different health programs.

3.2. Government response strategies and the right to the city agenda

A second set of variables driving the potential for advancing the right to the city agenda in slum communities during COVID-19 are governments' political positions, as well as their capacities and action in a given territory.

Their capacity entails the tangible and intangible resources managed in the form of a professional bureaucracy, territorial officers, fiscal budgets, and international networks. The Government of the City of Buenos Aires (GCBA) is widely considered a capable local authority governing a city with a GDP per capita equivalent to a European country. During 2020, it was conducting four major slum upgrades with high levels of investment and a sizable staff of street-level public officials. As considerable as this capacity may be, it was not, however, utilised for early action to respond to the COVID-19 outbreak. Its response came "too late" when multiple cases had been detected and the virus was spreading in several settlements (interview with local NGO director). Pandemic measures for slum communities were no different than those aimed at the general population during March and early April, and several interviewees agree that this prompted CBOs to demand targeted policies. This was the case in Barrio Mugica, where a group of CBOs demanded specific response protocols pointing out that overcrowding and inadequate housing conditions hindered adherence to general recommendations, such as stay-at-home or social distancing.

In other cases, CBOs were less capable or willing to take part in the crisis response, due to the attrition and exhaustion of the long-standing power struggle with the GCBA for the right to the city. This is the case of Villa 20-Lugano, where CBOs were not particularly interested in being part of the health response, fully delegating it to city officials,

> ". . . because we had already been working on the upgrading process for the neighborhood and always investing time and effort into ensuring that the work and the process continued in the best way [possible] . . . We are already tired of that . . . and more so now on the frontlines with [this] disease" (interview with Villa 20-Lugano activist/CHW).

Other CBOs, however, like those from settlements going through more contentious upgrading efforts (Barrio Mugica or Playon de Chacarita), seemed to be more inclined to participate in response actions such as contact-tracing, public campaigns, and distribution of facemasks and cleaning products.

When it comes to governments' political positions – that is, the ideological stances of public authorities and their long-term relation with local communities – it is clear that the actor played an important role in the reception of the response. "What matters is who is implementing," says a territorial worker from Barrio Mugica. This "who" refers to the ideological locus attributed to different government agencies and levels, and its intention to furthering a right to the city agenda. As it seems, both in Freetown and Buenos Aires, a given political position is equated with a certain "type" of action, in more or less alignment with a human rights or right to the city approach. In Buenos Aires city, for example, the local government pursued what can be described as a strategy of attrition and fragmentation in Barrio Mugica, using the crisis as a sort of window of opportunity to forward its upgrading agenda, leveraging its large workforce and financial resources. This was evident in the COVID-19-induced speeding-up of the conflictive relocation of a sector called "Bajo Autopista." There, a large percentage of families had been resisting relocation for months (Zapata et al., 2020), but the combination of the pandemic outbreak, water shut-offs, and pests and debris resulting from demolition of already relocated houses served as pressure points for the GCBA to convince residents to accept relocation. According to government officials, families were moved to new homes at a staggering average of 40 households per week during May and June 2020. At around the same time, a seroprevalence study conducted in June 2020 found that this sector had the highest levels of COVID-19 contagion, with 74% of its population having contracted it at some point in time (Figar et al., 2020).

3.3. Mobilizing and advocacy capacity: the struggle for the right to the city during the early months of the COVID-19 pandemic

As the right to the city is a collective right only gained through political and social mobilization, CBOs have historically mediated between government and communities, defending their interests and pushing for more grassroots power and delegation. It is not uncommon, though, for public officials and those in power to try to curb their participation in public policy decisions, by inviting them to engage in very limited and tokenized ways. However, during the early months of the pandemic CBOs were able to negotiate and occupy spaces of relative power and decision-making.

In Freetown, the central government coordinated the response by setting up response teams at the national level (National COVID-19 Emergency Response Center, NaCOVERC) and district level (District COVID-19 Emergency Response Center, DiCOVERC). Initially, implementation of top-down measures from international NGOs often saw very low compliance, and much of this was related with misconceptions and widespread myths about the COVID-19 pandemic. To combat these misconceptions, and to make sure health guidelines were followed, government and INGOs worked with community leaders, who were already well respected and known to use their platform to spread messages about social distancing and hand washing. Several interviewees spoke of a growing recognition emerging in authorities' and other development actors' views towards CBOs.

In some informal communities of Buenos Aires, crisis committees were formed with CBOs, leaders, and key stakeholders of the community, coordinating the weekly response with representatives of the GCBA in a negotiated manner. These committees became spaces where organisations could bring demands, request information, and have a voice in the territorial response to the health and social crisis. They represented real windows of opportunity to find a place at the negotiating table of upgrading programs, highly questioned in their participatory design (Zapata et al., 2020; Capalbo and Percossi

Bossero, 2020). An NGO activist told us about their experience of the crisis committee of Barrio Mugica:

> "For the first time they [government officials] realised that the residents and the organisations had something interesting to contribute. Until now, the tone of the conversation was anti-conversation. The logic of the [upgrade program] intervention was not very empathetic to the popular knowledge of the [community] organisations, [...] [with the pandemic,]. The tone of the conversation did change. [...] I was struck a lot by a very interesting receptivity to proposals and demands. [...] That's basic, super elementary, but they hadn't done it before" (Interview with NGO activist in Buenos Aires).

However, as the months passed, this openness in participation began to diminish. Interviewees spoke to the re-appearance of participatory practices that intentionally create conflicts between neighbors and of partisan political dynamics that began to slowly find their way again into the crisis committee.

It remains to be seen whether these conquered spaces of power and participation in Buenos Aires and Freetown will continue as the world transitions out of the pandemic. In any case, the opportunity to lead and spearhead the response that CBOs from slum settlements gained during the COVID-19 is certainly a political asset for the future of the struggle for the right to the city.

4. Conclusions

The COVID-19 pandemic affected the right to the city agenda in different ways across the global South. This paper focused on the variables behind slum communities' capacities to pursue this agenda during the early months of the pandemic. To do so, it looked at slum communities in Buenos Aires and Freetown, where three topics emerged that seem to have influenced the potential for forwarding the right to the city agenda during the pandemic: the level of CBOs previously situated knowledge, government agencies' political positioning and resource mobilization capacity, and the pre-existing capacities by CBOs to advocate and mobilize.

As a human right, in the sense of a collective political claim (Marcuse, 2012), the right to the city was exercised as grassroot leaders and CBOs from slum communities reappropriated urban space in a context of lockdowns, social distance and generalized fear. In these two cities, we found a struggle for leadership, participation, and community engagement in the response, realising some of the most radical aspirations of *autogestion* [self-management], democratic production, and administration of urban environments. CBOs showed initiative, resourcefulness, and a capacity to organise in the absence of government action, to boost it when the authorities finally intervened, all while creatively recreating what was negated by the COVID-19 pandemic: urban space as locus of social encounters and reproduction of everyday life. Comparing two cities in very different sites of the global south allowed us to illustrate how these initiatives were conditioned by long-term urban policies and the trust held by different development actors (government levels, CBOs, NGOs, grassroots leaders, etc.). But also, how the potential and the intensity of the struggle for a right to the city varied greatly not only between metropolitan areas, but also among different settlements within the same city. As the pandemic unfolds and extends well into 2022, it remains to be seen what effects these experiences of struggles for the right to the city will have in the long run, and how CBOs and local progressive actors will attempt to capitalize on them.

Contributor statement

All authors contributed equally.

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Rethinking the Metropolisation Process in the Global Crisis: Some Critical Reflections for Planning Practices regarding the Case of the Metropolitan Area of Santiago

Diego Moya Ortiz[1]

[1] University of Santiago, School of Architecture; diego.moya@usach.cl; ORCID ID 0000-0003-1229-5291.

Abstract:

The current context of the coronavirus pandemic together with the emerging crisis of neoliberal globalisation have pushed metropolitan areas to a breaking point. In Latin America, this crisis can be summarised as the crisis of subsidiary pro market states to face increasing inequalities regarding health and economy population under the pandemic pressure. Under this context, in the case of the Metropolitan Area of Santiago (MAS), the most affected urban areas have been the vulnerable ones, in both economic and health terms. In this regard, this scenario shows a correlation among the neoliberal policies that have sustained its development and their consequent planning schemes.

This paper will try to characterise how the current MAS has been shaped by some recent structural trends, which are reviewed in general along this work. These trends, broadly speaking, correspond to the economic dynamic of the MAS, its morphological transformation, its consequent land value fluctuation, its centralised and sectoral model of planning and governance, its advanced housing financialization process, the emergence of inclusion demands from organised urban communities, and an uneven context of municipal competition for investment.

I can conclude that these trends jeopardise the Chilean neoliberal-planning framework characterised by a state, which promotes a market-driven urban development under a particular subsidiary policy scheme, a hierarchical institutional action, and a sectoral agency. I also argue that these trends challenge traditional assumptions of the metropolisation process. Lastly, I reflect succinctly on planning practices beyond their theoretical epistemologies from a design logic more in line with Fainstein's perspective of urban justice and planning.

Keywords: metropolisation; coronavirus; neoliberal globalisation, urban inequality, planning

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1. Introduction

The current COVID-19 crisis has revealed the deep social crisis of Latin American countries in relation to social inequality and neoliberal globalisation. In Latin America, most of the uneven metropolitan areas face complications in the health system, the economic weakening of their most vulnerable populations, and the impoverishment of vulnerable population (UN, 2020; LAC-Urban Health, 2021).

In the case of Santiago, Chile, the crisis occurs mainly at the economic and public health level (Canales, 2020). In fact, within the effects of the pandemic, poverty has increased 2% for first time since 2017 (Ministerio de Desarrollo Social, 2021). In this sense, the poorest areas of the metropolitan area have been the most affected sectors in health terms during this period, reflecting a relevant correlation between urban inequality and health disease (Nicolo et al., 2021; Mena et al., 2021; Bilal et al., 2021).

In contrast, the reduction in gross domestic product and the subsequent increase in unemployment of low-skilled workers (ECLAC, 2020) result in a substantial increase in informal economy, while the overcrowded population continues to grow and is the most affected in terms of public health due to COVID-19 (Bilal et al., 2021).

To address this complex pandemic scenario, the Chilean government has launched a package of relief measures aimed mainly at the vulnerable population. In this sense, according to the last public report of the Ministry of Finance (Ministerio de Hacienda, 2021), the public debt is expected to continue to grow steadily until 2025, reaching 38.5% of the GDP, from 34.1% in 2021.

On the other hand, in terms of COVID-19 control, the rapid vaccination process has been partially effective in controlling the spread of the virus. However, issues of urban inequality have persisted and even increased since the social uprising of October 2019 (Jimenez-Yañez, 2020).

Two main processes shape this context: the increasing difficulty of accessing housing by middle and low-income groups (Vergara-Perucich and Aguirre Nuñez, 2020), and the increase in groups of people living under critical conditions in informal settlements (Celhay and Gil, 2020; Gil et al., 2021).

Under this focus, in this article I try to identify the existence of clear trends/issues which today configure the critical scenario of urban issues in the metropolitan area of Santiago (MAS). I analyse these trends from a literature review based on different academic and research sources also linked to my practice as a planner. These trends are the following:

1. The decoupling of the MAS' macroeconomic growth tendency with urban inequality reduction as an intrinsic impediment of the very neoliberal rationale;
2. The urban form conformation of the MAS through uneven morphological and infrastructural transformations;
3. A tight relation of the previous point with land value fluctuation;
4. A fragmented and vertical planning and a governance model based on subsidiarity which does not deliver economic resources to local governments, and has become politically instrumentalized for different actors and stakeholders;
5. An increasing demand by communities for inclusion and self-determination in ordinary ways of urban living;
6. An increasing process of financialization of housing correlated with rising increasing value of housing;
7. Because of the above, an uneven model of competition among districts within the metropolitan area emerges.

I conclude that this subsidiary model of the Chilean State in terms of planning becomes obsolete as the neoliberal model of urbanisation advances. In this regard, the planning required becomes increasingly strategic, jeopardising the centralised, sectoral, and centralised governance structure of the Chilean state. In the end, reviewing Susan Fainsten's thesis about the 'just city' (2014), I elaborate on the impact of this scenario regarding the planning activity of the country.

2. Theories and Methods

In this paper, I use an analytical theoretical view based on the critical political and economic approach of neoliberalism over urban planning and metropolitan process regarding the Latin-American case of Santiago de Chile. Specifically, I consider two main approaches: actually existing neoliberalism (Brenner and Theodore, 2002) and uneven geographical development (Smith, 2008; Harvey, 2019) – which I explain below briefly.

The context of the metropolisation in Santiago de Chile is related to the restructuration of the State during the '80s, along with the introduction of the neoliberal constitution (Jiménez et al., 2018). The case of Santiago de Chile has received particular attention because it has been conceived as the materialisation of the political theory of Milton Friedman in the urban arena (Vergara-Perucich and Boano, 2020).

In this regard, Garretón explains the evolution of the MAS in line with the "actually existing neoliberalism" (AEN) thesis (Garretón, 2017) written by Brenner, and Theodore (Brenner and Theodore, 2002). According to these authors, the neoliberal dogma must be understood as a market utopianism that relies on the idea of market supremacy and competition against any form of institutional solidarity or cooperation. In this sense, the neoliberal agenda tries to justify specific projects to amplify market discipline, competition and services, and goods commodification. Among them: the deregulation of state control over industry, the offensive against organised labor, the reduction of corporate taxes, the privatisation, or withdrawal of public services, the dismantling of welfare programs, the widening of international capital mobility, and the intensification of localities competition. In short, the AEN thesis emphasizes that global neoliberalism is a multiscale phenomenon, which reorganises institutional frameworks; it is context-sensitive and path-dependent. In the end, the term seeks to explain how the neoliberal agenda adjusts itself within institutional path-dependent geometries regarding specificities in terms of institutional frames, governance, state policies, regulatory practices, and political conflicts over time.

In relation to the AEN thesis, Garretón describes some specific features of the evolution of Santiago. The author states that the Chilean state under the process of neoliberalisation adopted new forms of private-public arrangements under the framework of the subsidiary state, by fostering profitable markets around social policies. Indeed, in terms of urban planning, the modernization of the Chilean state entailed increasing social spending but abdicating concrete planning capacities in favor of subsidies and a growing reliance on technocrats for policy design. In this sense, the action consisted in developing financialized ways of rollout neoliberalism in several areas, such as housing, transport infrastructure, and other public services. Besides, this is recognised as a vertical process, in which the state preserves a strong centralised control of political and economic power, characterized by the historical implementation of massive urban policies, with little or no consultation with local governments and citizens. For Garretón, the production of inequality in the MAS is related to particular aspects of the AEN. Firstly, the economy and services of Santiago are based on the specialisation in extractive and globalised financial activities that sharpen socio-spatial inequalities because of the concentration of property of these companies and the closeness of their headquarters in the metropolitan core. Secondly, because of the reinvestment of financial leverage in high-rise buildings and private development of infrastructures. Thirdly, because of the disinvestment in subsidiary spaces created historically by social housing policies, with low-quality education and health, afflicted by poverty and urban violence (Garretón, 2017).

This global process of spatialisation of inequality is also approached from a more general theoretical framework in the work of Smith (2008) and Harvey (2019) through its theory of uneven geographical development (UGD) under global capitalism. According to Smith, capitalism generates not only permanent cycles of expansion and crisis, but mainly spatial-temporal cycles of development in specific geographical areas and underdevelopment in others. In order to amplify the gain rate, capital needs to circulate towards places in which it can take comparative advantages. In other words, this territorial differentiation caused by the spatialisation of accumulation generates disparities and inequality as part of structural process of capital circulation. Harvey takes this idea forward to explain how capital accumulation emerges in space and time. In this regard, the author identifies four processes in which UGD occurs: First, the material roots of capital accumulation. Second, social struggle and class politics, which stem from regional global-local conflicts. Third, the accumulation by dispossession in which the capital appropriates the value of everyday urban life under an extractivist economy form. Fourth, the accumulation dynamics that occurs in a determined space and time. According to Harvey, the state assumes a facilitating role in relation to these processes in which business is fostered from public investment.

Overall, both theories try to explain not only the effects of neoliberalism and global capitalism over urban geographies, but also their influence over particular institutional

and social contexts. Since these conditions are dynamic, but concrete in space and time, they are relevant to evaluate determinant aspects of the metropolisation and urbanisation process.

Based on this theoretical and analytic basis, I use a methodology based on a triangulation and integration method to draw my reflections (Patton, 2002) regarding the underlying trends within the metropolisation process of Santiago during the last decade. To do this, I carry out a literature review of these trends from different academic and research sources also linked to my practice as a planner analyst in the Ministry of Housing and Urbanism (MHU) in the Department of Urban Management. Specifically, I review two main dimensions: desk research (recent literature and studies review) and statistical analysis based on recent studies and census data.

Overall, I understand that this research work has been done within the theoretical approach of reflective practice (Finlay, 2008).

3. Results

In this section, I will briefly describe each of the trends analysed to specify their impact and results on the MAS, and how these are applied to the dichotomies of the Chilean way of urban development processes.

1. The decoupling of the MAS' macroeconomic growth tendency with urban inequality reduction as an intrinsic impediment of the very neoliberal rationale.

As briefly explained before, metropolisation is related to globalisation and can be described as its expression in terms of urban transformation based on localisation of key functions of command and control for the economic global network (de Mattos, 2010). It is also described as the set of institutional, functional, and spatial events that entail the integration of fragmented urbanised regions, which emerge as, connected systems at a higher spatial scale (Cardoso and Meijers, 2021). As was introduced, in Latin American and specifically in Chile, this process has been highly influenced by neoliberal policies, under a particular subsidiary scheme, which has exacerbated the conditions of inequality (Dockemdorff et al., 2000, Garretón, 2017; Moya, 2019). The neoliberal influence in urban planning here is materialised in two correlated ways. Firstly, prioritising the market as a fundamental stakeholder and provider of housing and infrastructure from a centralised state action. Secondly, under a subsidiary state action, which serves lower-income groups through targeted subsidies either for housing or other types of local urban projects.

Based on the metropolisation theory, the emergence of metropolitan areas would be an opportunity for economic specialisation and diversification through the agglomeration of economies in integrated networks of interdependent urban areas at the regional city level. The emphasis of this "optimization" revolves around the idea of "regional integration" through which distribution of economic functions and human capital can amplify benefits from central areas or cities to smaller areas or cities (Iammarino et al., 2018). In this sense, planning measures should be aimed at amplifying these advantages through different reconstitution processes as: cohesive metropolitan development (integration between locations), multiscale transport system adaptation, metropolitan identity conformation (legitimacy), and variable geometry governance (arrangements and coalitions) (Cardoso and Meijers, 2021).

The dichotomy for Santiago is that although the metropolitan area has experienced a capture of local-global metropolitan functions and a big investment in connectivity from 2005, it has not been able to effectively counteract precariousness at the metropolitan level (Orellana Ossandon, 2016). In fact, the inequity of urban development persists and is not correlated substantially with the increase in macro-economic development. This phenomenon can be seen clearly in the MAS, by comparing the evolution of the urban quality life index in the period 2011–2021 (Instituto de Estudios Urbanos y Territoriales, 2021).

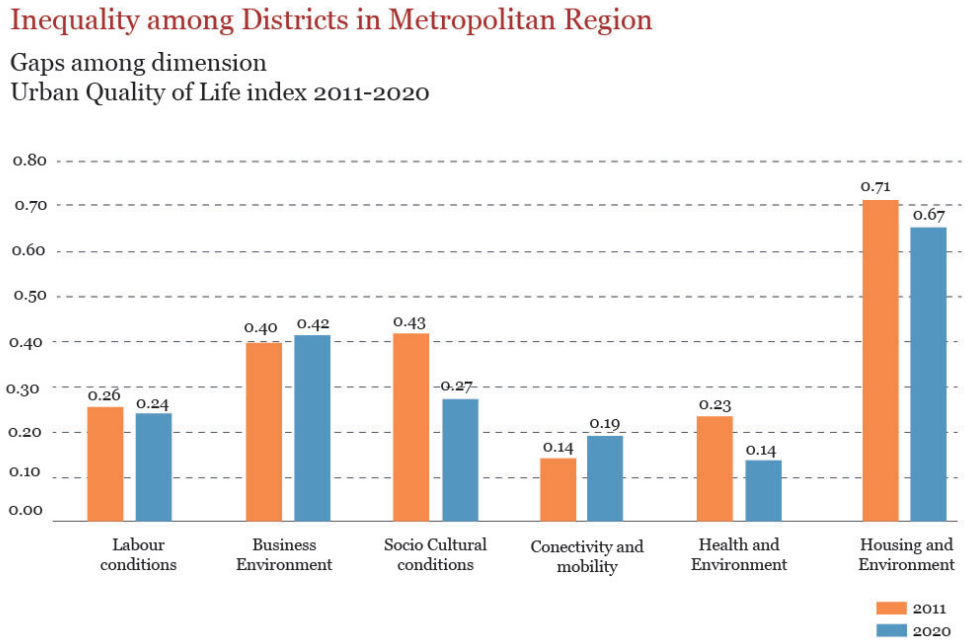

Figure 1. Inequalities among different districts in the Metropolitan Region. The graph shows how the general percentage remains steady and in variables such as economic environment and connectivity and mobility even increase. Source: Adapted from Instituto de Estudios Urbanos y Territoriales Pontificia Universidad Católica de Chile (2021).

2. The urban form conformation of the MAS through uneven morphological and infrastructural transformations.

Within the framework of this global metropolisation process, investment in road infrastructure has been key to activating the processes of specialisation and connection of strategic economic networks in the MAS (Figueroa, 2004). However, these integration processes, paradoxically, have been accompanied by other disintegration processes, generated from spatial fragmentation. More specifically, through road transport infrastructures that have negatively influenced the spatial network of urban areas, especially in low-income districts (Moya Ortiz, 2019).

In the case of Santiago, the wave of franchised highways has allowed the integration of the communal areas with the highest income in networks that are woven at the regional-national-global level remaining quite efficient at the national level. However, at the same time, these infrastructures segregate and confine other districts (Greene and Mora, 2005), such as the case of Lo Espejo, La Cisterna, San Ramón, and La Granja. These districts simultaneously, represent the lowest quality of urban life within the MAS (Instituto de Estudios Urbanos y Territoriales, 2021).

3. A tight relation of the previous point with land value fluctuation.

The expansion of the strategic infrastructure for the metropolitan operation in the global economy has been managed by the action of the Chilean State through private corporations (post-privatisation process) or concessionary franchises (Garretón, 2017). The main objective has been to improve access to certain locations of global economy interest and enhance their connectivity. Two organisations have been fundamental for such development: the Ministry of Public Works (MPW), in charge of the national road infrastructure; and Metro (Public Corporation), in charge of the implementation and administration of Metro lines in the MAS.

In this sense, the land liberalisation for the Chilean case dialogues directly with this deployment and the specific stakeholders that take advantage of the public investment. In several cases, public infrastructure acts as a catalyst for land value, whose income is captured directly by private agents or real estate conglomerates, within a regulatory

framework without tax burden to capture capital gains (Lopez-Morales and Páramo Lopera, 2020).

In contrast, since the housing provision by the Ministry of Housing and Urbanism (MHU) follows a system of subsidies with amounts of money for the purchase of land below market values, the largest share of social housing is developed on suburban lands. These lands, in turn, present a deficit of urban services and facilities. The latter also helps to justify the creation of highways and communication roads in a metropolitan area (Allard and Cociña, 2018). Conversely, real estate developers capture the capital gains generated by the location of central public infrastructure in central areas, without redistributive charges. In this way, the state encourages the appropriation of land value by the real estate market.

4. A fragmented and vertical planning and governance model based on subsidiarity, which does not deliver economic resources to local governments and has become politically instrumentalised for different actors and stakeholders.

The institutional planning and governance framework in the Chilean state is centralised, hierarchical and sectoral with poorly coordinated agendas (Moya Ortiz, 2019). The fragmented actions of various ministries in different areas of the territory generate disagreements and efficiency loss in fiscal spending. Theoretically, this technocratic and sectoral model has been questioned in its operation to face complex problems from the theory of collaborative planning (Innes and Booher, 2010). This lack of articulation not only has a counterproductive impact in terms of public investment, but also allows an instrumentalisation of politics.

Political clientelism in Chile is defined as a political tradition characterised by the transaction of favors in which different and asymmetric actors seek to obtain advantages from this relationship. Therefore, goods or services are traded for political support or votes (Arriagada, 2013).

Since infrastructure projects constitute large investments in metropolitan areas among economically unequal districts, the political wing and the economic capacity of municipalities influence the negotiation and quality of their implementation. In this way, political parties, parliaments, or actors, regardless of their ideology, play an important role in this dynamic. For instance, parties in power may find it easy or difficult to carry out projects according to the type of political affiliation of municipalities and local social movements. A particularly well-studied example is that of UKAMAU, a social movement of settlers, which after many struggles with the MHU, was able to promote a housing project in a central sector of the MAS that benefited 424 families of its organisation. The main social achievement of the movement consisted in accessing land owned by the State Railways Corporation, forcing the MHU to expropriate it, breaking the logic of social housing construction in the periphery (Paulsen Espinoza, 2020). Ukamau's case was feasible in turn, due to its left-wing political character and disciplinary action, which received support from similar political actors, confronting a government administration led by a right-wing political opposition.

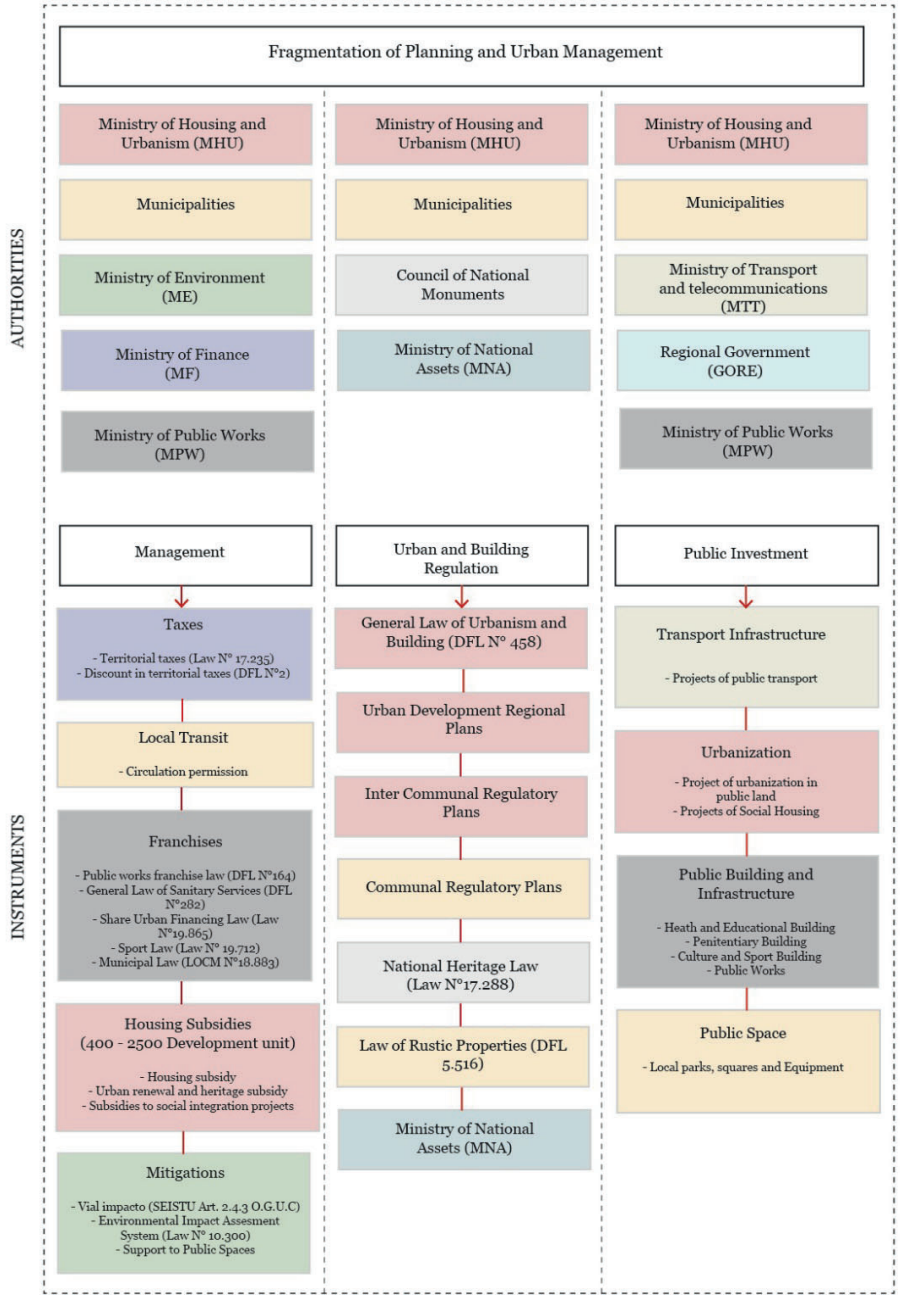

Figure 2. Planning and governance framework showing the different ministries and agencies involved in urban development field. Source: Own elaboration.

5. Increasing demand of communities for inclusion and self-determination in ordinary ways of urban development.

The case of UKAMAU represents the growing number of political organised communities with social, environmental, gender, or ethnic demands in matters of territorial self-determination in Chile as a reaction to a neoliberal state agency during the last decades (Mardones, 2020). In this regard, several actors have thus emerged in the metropolitan area, demanding recognition and greater inclusion in decision-making. The above converges, on the one hand, as a questioning of the representative model of neoliberal democracy itself and its incapacity to address this type of demands. It is relevant to state that after the social unrest in 2019, these conflicts have intensified and gained political representation (Rodriguez Mancilla et al., 2020).

This translates into greater demand for the recognition of social movements and citizens, with diverse interests, who defend "ordinary" ways (In Robinson's sense of ordinary cities) of living and non-homogenising projects of urban life. Concretely, this emerges especially as opposition to projects of global interest of corporations and productive elites.

6. An increasing process of financialization of housing has skyrocketed the value of housing.

The crisis of housing access illustrates another global trend that is manifested in the MAS: the increase in house prices due to financialization and the consequent difficulty for low and middle-income groups to access a dwelling (Vergara Perucich, 2019). According to a study by the Chilean Chamber of Construction, a deficit of 739,000 homes is estimated to date, which would mean that there are 2,218,809 people without housing solutions in the country (2020). In turn, according to figures from the National Techo Organisation, 81,648 families today live in illegal camps, double the number in 2017 (Techo, 2021). The reality of this housing deficit is related to a considerable increase in housing values, which have decoupled significantly from the real wages since 2010.

According to Santana-Rivas (2020), the financialization for the Chilean case is related to the implementation in the eighties of a subsidiary model for social housing provision. This implementation was accompanied, not only by the introduction of social evaluation and of subsidies, but also of the articulation of mortgage loans to the capital market that operates over long terms. This financialization process of housing together with the dynamic of urban market speculation in the MAS demonstrates a cyclical process of land capture, gentrification, eviction, and exclusion expressed in central and pericentral areas during the last two decades (López Morales, 2014; Gassic Kleth, 2020; 2021; López Morales et al., 2021).

In this regard, its effects are verifiable today, where an increase in housing properties value in the Great Santiago has increased 218% in the last decade (Osorio, 2021). This is concomitant with the growth of mortgage debt, which represents an increase of 14% since 2018 (Cuevas, 2020). This context is worsened by the country's fiscal situation after the coronavirus and its global effects, which have additionally reinforced the appreciation of housing as a financial asset.

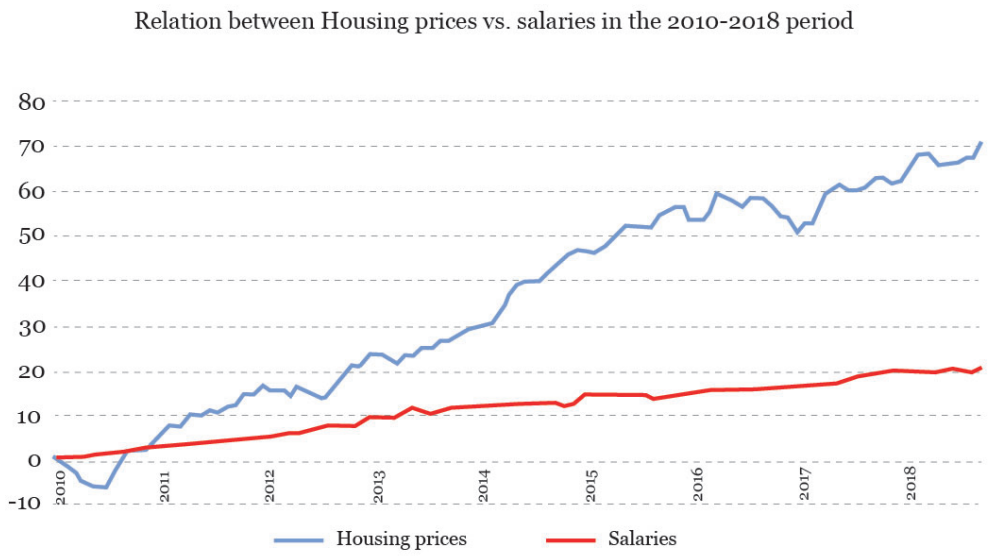

Figure 3. Relation between housing prices and salaries in the Metropolitan area in the period 2010-2018. Source: Adapted from CIPERCHILE (2021).

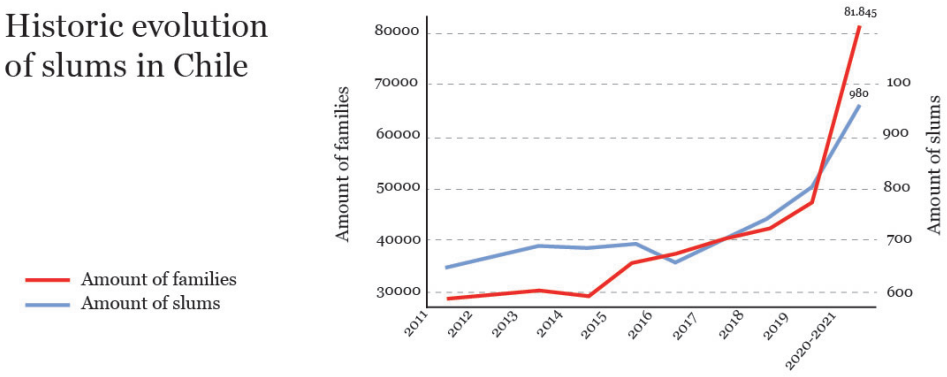

Figure 4. Historical evolution of slums in Chile. Source: Adapted from TECHO (2021).

7. Because of the above, an uneven model of competition among districts within the metropolitan area emerges.

Lastly, the result of this metropolitan market-driven urban development, under an unequal path-dependent basis, fosters a model of competition among different municipalities to attract investment. This competition, in turn, has pushed the middle income and low-income municipalities to the flexibilization of their local regulatory codes (López Morales and Meza-Corvalán, 2015). In other cases, some of them have even incurred in corruption cases (Rodriguez Matta and Rodriguez, 2017). In this way, the MAS has evolved towards an unequal urban structure, with clear spatial segmentation, where the poorest municipalities are fragmented and unable to attract market investment.

As a result of this process, only the wealthiest municipalities, that possess greater political and negotiation capacity, can manage the character and design of urban infrastructure projects. On the contrary, those municipalities with less economic and political capital have stronger difficulties to negotiate with the state and private stakeholders, increasing their dependence on the former (Moya Ortiz, 2019).

4. Discussion

As I have briefly reviewed, the metropolisation process in the MAS results from a concomitant process of different trends.

Despite the economic growth in the MAS, the indicators of urban quality of life have remained constant during the last decade, which shows inertia from the institutional apparatus to counteract the precariousness in the processes of the most segregated districts. In this regard, institutional action has not capitalised regarding macroeconomic investment cycles since it ultimately acts without active planning.

The implementation of transport infrastructure in the MAS has implications for this trend. The deployment of transport infrastructure is asymmetric in terms of morphological cohesion, which generates discrimination in relation to the political capacity of the municipalities involved. It negatively affects the fracture of poor neighborhoods and districts where designs with a substantive economic investment are not prioritised, affecting their spatial and environmental quality. Thus, discriminatory actions take place in the design of technical transport infrastructure.

Both processes are symptomatic, on the one hand, due to the way in which the neoliberal rationality acts, through a market sector that generates investment where profit is ensured and promoted by the state. On the other hand, they are the result of a centralised sectoral institutional design, where the different ministries and their organs act independently. Therefore, those public agencies related to infrastructure of a global productive nature, as the MPW or Metro, have greater political and technical capacity than those of a subsidiary nature such as the MHU.

This structure has an influence on the speculative fluctuation of the urban land value and the effects of the housing financialization. As the infrastructure is deployed without coordination from the State, the private sector can speculate and capture the land value, buying and making profitable land once they have insider information with respect to the different transportation projects. We see here the dichotomic and contradictory logic of neoliberal action of the State in two ways: one, which fosters global economic metropolitan command, and one that tries to remedy the negative impacts of their outcomes in a permanent vicious cycle of inefficient mitigation.

In this regard, the evolution of this form of urbanisation of the MAS over time contributes naturally to exacerbating inequalities, since the subsidiary capacity of the State is insufficient and ineffective to address inequality and urban issues that emerge chronically. The social unrest derived from this inaction and the feeling of marginalisation open doors to new social-political movements, which demand the recognition and defense of their ordinary ways of living but also their political interest. This agency is caused by opposing initiatives or promoting alternatives against the infrastructural agendas promoted by the State and the market. This political shift intensifies the rise of social actors in the face of the inaction of the weakest municipalities, which in theory should be institutionally capable of responding locally to those demands. At the same time, since weak municipalities are unable to compete within the neoliberal urban development framework, they become weightless political actors. Thus, several grassroots social and other political actors enter the political sphere of urban development in a tribalist dynamic.

The pandemic and the neoliberal crisis, at a global level, have accentuated all these processes, especially with issues related to the increase in the housing deficit, unemployment, climate change, and immigration.

In this sense, in a country that dismantled planning as part of the neoliberal project, the restitution of planning agency becomes relevant, but it also poses challenges in a process of political-economic transition and institutional obsolescence. The biggest challenge here, on the one hand, means deepening the analysis of the co-evolution of these processes to address the demands of the most vulnerable populations, which, in turn, will be the most affected ones. In this sense, this also means amplifying capacities and reducing disadvantages for the most vulnerable actors is the main motive in a context of crisis that evolves and requires adaptation from all societal levels. The struggle of critical planners and researchers, in this sense, continues to be political and opens new spaces for research through design and action.

5. Conclusions

The metropolisation process within the covid-19 context, in the case of the MAS, presents clear trends that increase the social crisis and challenge the state's response. These problems demand an institutional change, especially in terms of governance as well as ideology, that will not occur overnight without facing political and cultural resistance. It is important to say these trends are recognised by the public opinion, but they are neither problematised explicitly nor systemically.

In this regard, my first reflection is that the subsidiary model of the State, in terms of planning, becomes obsolete as the neoliberal urbanisation evolves because urban inequality is a structural and overwhelming outcome of neoliberal policies.

My second reflection is that the solutions required from planning become increasingly strategic, jeopardising the centralised, sectoral, and centralised governance structure of the state in Chile. And this is recognised and pushed by social and political movements and communities that demand more inclusion and recognition. Eventually, every urban initiative in this context will be highly politicized and problematic. This means conflictual deliberation between different interests and positions (Benhabib, 1994), which demands from planners, a wide political and technical understanding of the social arena, and its economic complexity. Therefore, it also needs design and a communicative capacity.

In this regard, the question is how to guide spatial processes protecting the most disadvantaged and under-represented populations, and, in turn, to lead the metropolitan

process to take advantage of it, by overcoming neoliberal constraints. The "leftist" point of view states that this is hardly possible and that there is an inherent contradiction questioning urban planning and design from the perspective of class and recognition politics (Fainstein, 2006). However, it does not offer alternatives. On the other hand, neoliberals dismiss planning when it does not satisfy economic growth as the main objective and its mono-cultural ideological scheme (Vergara Perucich, 2018). However, in the meantime, urban inequality remains.

In ethical terms and following Fainstein's ideas, the central role of urban planning and design is the establishment of processes that critically enable capacities in a redistributive way in relation to the recognition of most precarious communities. I argue that this only can occur through the real empowerment of local government and actors, by generating political synergies between global and local interests. In this regard, this aspect implies a critical challenge in terms of scale and its associated political actors because is there precisely where the conflicts of global urbanisation and infrastructure processes are and will be nested and need to be negotiated.

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Spatial Justice and the NIMBY Effect: An Analysis of the Urban Densification Debate in Switzerland and the Netherlands

Tanja Herdt [1,*], Arend R. Jonkman [2]

[1] TU Delft, Department of Urbanism 1; e-mail t.herdt@tudelft.nl; ORCID ID 0000-0003-2789-0667
[2] TU Delft, Department of Management and the Built Environment; e-mail A.R.Jonkman@tudelft.nl; ORCID ID 0000-0002-8928-2846

Abstract: This paper analyzes public debates around land use and densification in Switzerland and the Netherlands to understand how private and public interests are related in the context of urban growth. It is based on the hypothesis that, while there is consensus on the desirability of densification, its implementation can lead to tensions on a local level. Therefore, the acceptance of densification is considered essential for successful implementation. We report on quantitative and qualitative discourse analysis covering public media outlets between 2010 and 2019. During this period, both Switzerland and the Netherlands implemented policies to limit land take and promote densification. Focusing on indicators of spatial equity, we examined the debates in terms of distributive and procedural dimensions of justice. The results show that the debate in both countries revolved primarily around private interests related to ownership, property value, and character of place. Most debates documented the interests of insiders and, in particular, revealed the NIMBY effect (for "not in my back yard") associated with issues of change in the built environment. Public interests and the interests of outsiders, in contrast, were rarely considered in the debates. In addition, we find that, in the face of impending building change, arguments often reflected conflicting social values, such as perceived restrictions on choice, fears of increased social division, and lack of community.

Keywords: Densification; Discourse Analysis; Spatial Justice; Urban Design and Planning

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1. Introduction

Densification is a policy objective in itself and part of broader urbanisation strategies like the Compact City (European Commission, 2011), Green Growth (OECD, 2012), or New Urbanism (Dierwechter, 2014; Westerink et al., 2013). The advantages and disadvantages of densification (Barresi, 2018; Cerin et al., 2020; Claassens, Koomen, & Rouwendal, 2020) and its potential to absorb population growth (Amer, Mustafa, Teller, Attia, & Reiter, 2017; Nabielek, Boschman, Harbers, Piek, & Vlonk, 2012) have been extensively studied. Less attention has been directed towards related perceptions of tensions between private and public interests (Honey-Rosés & Zapata, 2020). Whereas protecting green space, providing needed housing, supporting urban services, and promoting more sustainable lifestyles are widely endorsed, densification implementations are nevertheless

often met with opposition. Such resistance may lead to NIMBY-ism (for "not in my back yard") and underscores tensions between public and private interests.

This paper addresses such tensions between private and public interests in public discourse on densification in Switzerland and the Netherlands. This discourse reflects both substantive and procedural concerns. Furthermore, it influences the extent to which the spatial distribution of benefits and burdens is perceived as equitable and whether individuals and communities consider themselves represented. More than a purely local issue affecting just a few, the debate shapes how spatial developments contribute to shared values (Campbell, 2006). This paper aims to understand better the connection between private and public spatial justice interests.

2. Theories and Methods

2.1 Values and public and private interests

Even when values, such as ontological security, autonomy, well-being, inclusiveness, sustainability, social stability/order, and market efficiency (Elsinga, Hoekstra, Sedighi, and Taebi, 2020) are shared, they can be incommensurable (Dignum, Correljé, Cuppen, Pesch, & Taebi, 2016). Value conflicts primarily surface when inherent values are translated into operational values, norms, and principles.

Conversely, interests reflect a person's or group's stake, such as their welfare or gains and losses. Importantly, conflicting interests may be rooted in the same value sets. Consequently, our analysis of public discourse about urban development and the local implementation of densification focuses on expressed interests rather than the underlying values.

We distinguish between private and public interests. The former may be an individual's, a household's, or a bounded community's. Regarding public interests, we follow Campbell and Marshall (2002), who differentiate the sum of private interests, a collective value that extends beyond the sum of private interests, the upholding of rights awarded to individuals, and the outcome of a process of deliberation or procedural rules. As a policy focused on the societal advantages of compact urban development (Dierwechter, 2014), densification reflects collective values beyond the sum of private ones, which may complement a procedural conception, e.g., planning law. Yet, public discourse may also express utilitarian views, and publicly stated opinions may differ from those of policymakers or planners. Moreover, even if there is broad agreement on public interests surpassing the sum of private interests, some may be more adversely impacted than others. Therefore, we investigated how private and public interests are expressed and how they interact.

2.2 Spatial justice

Fainstein (2010) names equity, democracy, and diversity as integral parts of the just city. Such social justice extends beyond the distributive issue of 'Who gets what?' (Moroni, 2020) and includes values related to how decisions are made and whether individuals' needs are recognised (Fainstein, 2010; Fraser, 1995; Young, 1990). Since just procedures cannot guarantee just outcomes (Fraser, 1995; Jonkman, 2021), distributive justice is only necessary, not sufficient for social justice (Marcuse, 2009).

Next to substantive questions regarding the immediate impact of urbanisation processes, policy implementations have to balance public and private interests and address the localized effects. Madanipour, Shucksmith, and Brooks (2021, p. 6) regard spatial justice accordingly as a "struggle towards equity in social space, a search for a just process that aims at a just outcome, in a combination of the distributive and procedural aspects of social justice."

2.3 Methods

To investigate public and private interests and urban densification's social, economic, and environmental issues, we employ quantitative conceptual and relational content analysis of the public discourse in Switzerland and the Netherlands from 2009 to 2019. Two country-specific datasets of newspaper articles were compiled using a selection of 18 national and larger regional and local newspapers from public news databases (LexisNexis (NL) and Swissdox (CH)).

The two datasets were analyzed using a standardised bilingual coding list of 24 German and Dutch search terms that address economic, social, and environmental issues

related to urban densification. We chose analysis categories based on the model of values and norms in the field of housing suggested by Elsinga et al., (2020). In the paper, the authors define seven values that affect housing design: (ontological) security, autonomy, well-being, inclusiveness, sustainability, social stability, and market efficiency. Additional codes relate to general terms, such as: adaptation of densification policy and planning. A more detailed description of the coding will be provided in a forthcoming publication.

We selected nine codes, three each relating to urban densification's economic, social, and environmental aspects (Table 1). The selected codes capture both the material (e.g., *affordability*) and procedural dimensions of spatial justice (e.g., *public support/protest*, *freedom*). In each category, codes speak to either more public or private interests. For example, in the category *economy/market efficiency* the code *affordability* refers to public interests, whereas *cost* refers to more private interests. To increase analysis precision, each code was defined by multiple terms and synonyms (Table 2).

In two rounds of coding, we used the program Atlas.TI for an analysis of the selected years 2010, 2015, and 2019. Categories were first quantified by automated coding, after which positions and arguments were manually analyzed. Changes in frequency and relative importance were determined through a longitudinal approach. As initial level of analysis, we searched for keywords within a sentence or related paragraph. Subsequently, the identified categories were analyzed for proximity of related concepts referring to societal values.

Table 1. Frequency table of auto-coding results for 2010, 2015, and 2019 in Switzerland and the Netherlands

	Switzerland			**The Netherlands**		
	2010	2015	2019	2010	2015	2019
Number of articles	59	117	111	28	10	97
Costs	15	8	40	9	1	23
Affordability	18	17	19	2	4	37
Market	23	16	25	3	2	20
Spatial Quality	47	53	19	5	3	12
Community/ Social Cohesion	9	8	28	5	3	24
Identity	13	21	59	7	1	10
Public Support/ Protest	3	31	14	13	1	21
Justice (distr.)	5	10	5	4	1	2
Freedom/ Independence	4	8	10	1	0	0

Table 2. Coding examples

CODE	**VALUES**	**GER**	**NL**
Community and social cohesion (COM)	Inclusiveness, social stability, autonomy	Soziales | Gemeinschaft* | Zusammenhalt* | Nachbarschafts-initiative* | Engagement | Nachbarschaftsgefühl | Zusammengehörigkeitsgefühl | Bindung	sociale | gemeenschap* | samenhang | cohesie* | buurtinitiat* | betrokkenheid | buurtgevoel | saamhorigheid | binding
Affordabilty (AFF)	(ontological) security	Bezahlbar*|erschwinglich|günstig*|preiswert*|	Betaalba*|socia*|dure | goedkoop *|

3. Results

3.1 Frequency of addressing issues

3.1.1 Switzerland

In Switzerland, the public debate on densification correlates with public referendums, ultimately determining legislature. Before a referendum, interest groups bring issues to the focus of the deliberation. For instance, the "Landschaftsinitiative" (literally translated as "landscape initiative") in 2009 triggered a debate on densification. The referendum was accepted by public vote in 2013 and came into effect in 2014, tightening the regional planning act, the so-called "Raumplanungsgesetz" (RPG).

After 2014, the debate turned towards the law's implementation on the level of federal states and municipalities, addressing densification strategies through communal zoning and land-use plans. From 2015 on, the debate has focused on local effects of built examples and extensive areal developments. The discussion continued on a more general level following a second public referendum initiative, i.e., the "Zersiedlungsinitiative" ("Sprawl Initiative"), started in 2016 and rejected by the public in 2019.

The topic's presence in the political agenda likely contributed to the number of articles addressing densification doubling from 2010 to 2015. It remained stable until 2019 (Table 1). Auto-coding results show that identity issues have been addressed most frequently and have further increased over time; similarly, cost-related matters. In contrast, "spatial quality" was highly present in 2010 and 2015. In 2019, it was discussed less, as were "justice" and "public support/protest." The frequency of "community/social cohesion," "affordability," and "market" did not change significantly.

3.1.2 The Netherlands

For the Netherlands, the overall number of articles increased sharply in 2019 (Table 1). The fact that almost all topics have been addressed more frequently can be interpreted as response to the economic crisis of 2008 and its impact on the Netherlands' housing market and urban development. Plans were stalled and canceled around 2010, and densification was less of an issue. After 2015, however, the housing market recovered again, and housing prices and the pressure for development increased rapidly. The data also indicate a shift towards urban densification. Compared to 2010, less housing has been developed on green-field locations (Nieland, Meijer, Jonkman, & Hartmann, 2019). This trend is the result of the VINEX-program of large-scale urban extensions ending. In addition, the Ladder for Sustainable Urban Development policy required municipalities and provinces to prioritise inner-urban development.

More frequent references to *affordability*, *market*, and *costs* (Table 1) reflect the rapidly increased market pressure and concerns about housing prices. Cities increasingly struggle to secure affordability. *Community/social cohesion* was found more frequently in 2019, reflecting concerns about the effects of affordability and market developments. In contrast, in relative terms, *public support/protest* and *identity* were more frequent in 2010, addressing non-distributive issues related to the process of urban change.

3.2 Public and private interests

3.2.1 Switzerland

A primary concern of public debate in Switzerland is on identity-related topics, for which there are two distinct sets of arguments. Most arguments focus on private-interest concerns regarding changes in local identity, e.g., the shift from rural to urban lifestyles. The second set comprises arguments of cultural heritage protection as a public interest. It reflects an inherent conflict between preservation and sustainable development, stating that preservation of historic housing may prevent densification and therefore hinders the protection of landscapes and ecosystems (2019: seven sources).

The topics *costs* and *market* rank second in citation quantity. Similar to the topic *identity*, views on *costs* are inward-looking. They articulate the residents' fear of rising housing costs causing gentrification. In 2019, the most cited argument was the critique that municipalities and developers used densification projects to attract taxpayers as new residents (eight sources).

Arguments related to *market* link the issue of gentrification to a mismatch between need and demand. Most statements relate to private interests, such as finding suitable housing despite the increasing shortage of affordable options for middle-income groups in metropolitan areas. The criticism that densification is driven by speculation rather than

environmental concerns is part of this chain of arguments (2015: five sources). Similar to the *cost* debate (eight sources), the call for municipal intervention to prevent higher prices addresses, in effect, public interests.

Loss of social cohesion is also a prominent concern. The number of sources addressing *community/social cohesion* is in the midfield, but gains importance as the debate progresses. The predominant argument against inner-densification projects is the fear of gentrification effects and the loss of social diversity (2019: 28 sources). Both reflect private interests. However, when politicians target the middle-income strata, they address social cohesion as a public value. Social cohesion is particularly important in Switzerland since the promotion of national cohesion is enshrined in the constitution (Federal Constitution, Art. 2). It is further perceived as an essential aspect of economic prosperity and sustainable development. In 2010 and 2015, a relatively small number of citations point to public-interest arguments that call for strengthening social cohesion in densification projects, such as a diverse social mix, citizen participation, and new forms of community housing and public infrastructure. The transformation of arguments from private to public interest is particularly evident when, for example, it is claimed that the new zoning law will not only affect inner-city areas, but will also make housing in the suburbs too expensive for the middle class.

The call for public interventions to ensure affordability appeals also to the public interest. In 2010, this argument led the debate, demanding additional policies or mechanisms against speculation (five sources). Whereas in 2015, the debate focused on the potential impact of downtown densification on the housing market, this shifted in 2019 to more precise observations, for example, the statement that high-rise buildings were not suitable for affordable housing due to their high construction and maintenance costs (2019: three sources).

In contrast, topics coded by *justice* and *public support/protest* do not register significantly. One possible reason for the low number of citations could be the Swiss right of appeal, which allows for demands to adjust a building project before the building permit is granted. In 2010 and 2015, concerns focused on the anticipated surge in appeals and compensation claims resulting in delays and increasing development costs. In 2019, however, concerns shifted toward the unequal distribution of burdens from densification projects at the local level. According to this new line of argumentation, densification is a planning requirement that primarily causes redistribution in favor of private profit, disregarding existing common values. This argument also resonates in the code *public support/protest* results. While the numbers of citations were on a stable low, they increased in 2015 due to a public referendum on a much-debated project: In the case of the Pilatus Arena in the rural community of Kriens, high-rises were developed to cross-finance the public arena project. This triggered a debate on the supposed neglect of rural community values in favor of the arena project and its considerable financial impact on the region. In 2019, the high-rise was often cited in arguments associated with NIMBYism, which reflect homeowners' opposition, for instance, fearing overshadow-effects, which may decrease property value and overall quality of life.

3.2.2 The Netherlands

The primary concern regarding the distributive effects of densification is the potential impact on segregation (four sources). It is argued that urban expansion has favored suburbanisation and enhanced the segregation between urban and suburban dwellers. In contrast, densification is thought to result in fewer socio-spatial divisions and more social cohesion. In 2019, however, also high-rise developments were criticized for their distributive effects. According to architect Sjoerd Soeters, high-rise buildings are exclusive and expensive and not suited for families.

Also regarding affordability, densification is described both as a solution (eight sources) and a problem (five sources). It can be part of a strategy to add much-needed housing and provide suitable housing opportunities for the young and elderly. Simultaneously, densification and large-scale redevelopment projects are feared to displace low-rise social housing, e.g., in Amsterdam and Eindhoven. Residents expect they cannot afford to return once their neighborhood has been redeveloped. They highly appreciate the present sense of community and their neighborhoods' quiet spaces within the buzzing city.

Between 2010 and 2019, market conditions changed significantly. The pressure for new construction has increased, but municipalities' requirements to include high fractions

of social and middle-income housing reduced new developments' financial lucrativeness. It is questioned whether high-rise provides affordable housing, given significant construction and service costs. Similarly, the longevity of demand for high-density living environments is challenged. Because of the urgent housing crisis, pressure to use green fields for development is expected to increase.

Since 2010, a recurrent point of discussion has been whether urban expansion or densification is cheaper (11 sources). Answers depend on the extent to which commentators consider costs related to new infrastructure (e.g., public transport) and externalities (e.g., traffic jams), and on the type and scale of the development.

Next to large-scale green-field developments' effect on segregation, commentators stress their impact on the sense of belonging and social cohesion in suburban city districts (three sources). As part of densification strategies, diversification of neighborhoods is seen as a suitable strategy to strengthen social sustainability. However, residents in low-rise neighborhoods who fear large-scale redevelopment expect densification processes to diminish social cohesion (five sources).

Whereas for cities like Eindhoven and Rotterdam, new developments are seen as adding new layers to the city, several articles critically assess how densification projects blend in with the existing city. In particular, large projects (e.g., Sluisbuurt in Amsterdam and Eindhoven city-center) provoke opposition for the sharp contrast *vis-a-vis* the current city. Thus, the question is how to reconcile the new with the old.

Many projects face opposition from residents who resist change in general or disapprove of particular elements like size, scale, height, or expected effects on parking or other services, e.g., public green space. Often, local opponents stress that they are not against densification *per se*, but that they do not think the location is well chosen. Sometimes they explicitly distance themselves from NIMBY-ism and claim rational arguments for their opposition.

In contrast, urban professionals support densification passionately. They are much less unanimous, however, about the desirability of high-rise buildings. Some take a principled stance, whether in favor or against. Others see high-rise developments as a possible strategy, but only if implemented with care. Several professionals stress that high densities can be achieved without high-rise buildings and that high densities can be realised while still providing sufficient high-quality public spaces. Politicians, such as mayors and council members, seem to struggle to connect the desirability of densification in terms of public interests with residents' concerns and their affected private interests.

4. Discussion

The empirical analysis of public debates in Switzerland and the Netherlands shows remarkable similarities. In Switzerland, building projects' legitimacy is based on a planning system that leaves extraordinary decision-making power to the municipalities while providing processes through which citizens may intervene. When public referendums are discussed, the debate shifts to public interests and involves many stakeholders. This results in a lively public debate of densification and a variety of arguments. In contrast, while the Netherlands' governance system is also increasingly decentralised, there are fewer participatory processes, and planning discussions are more confined to professionals. The new law to prioritise inner-urban development, for example, was hardly mentioned in public discourse.

Our findings show that, in both countries, the debate focuses on private interests, e.g., protection of ownership, private autonomy, and identity. In contrast, arguments that address public interests and communal values are less well represented. For example, with rising costs and inefficient market strategies being the target of the debate, densification is seen in Switzerland increasingly as a threat to social cohesion, especially by middle-income groups. In the Netherlands, the discussion focuses more on which type of development may be suitable and whether high-rise projects can provide affordable housing for inclusive communities.

Most arguments take an inside perspective, referring to current residents' perception of densification as an unwanted agent of change. Accordingly, NIMBY-ism dominates the debate. Outsiders' views or potential benefits of change are rarely addressed. For instance, public interests are not well represented compared to statements about loss or prices and costs. There is only a minimal acknowledgment of public interests that would demand political intervention, such as measures for affordable housing or greater distributive

justice. Accounts on public interests are mostly limited to abstract discussions on the advantages and disadvantages, e.g., saving green space or support for public transport.

Private and public interests are primarily discussed separately and by different groups. Public interests are frequently more abstract and often not addressed by residents who focus on changing their immediate environment. Accounts of specific plans and projects are, in contrast, focused on the impact on the residents here and now. In these accounts, deliberation of the potential for 'outsiders' and benefits concerning public interests only plays a secondary role. Thus, private interests and non-distributive dimensions of equity, including recognition and diversity, are discussed completely separately from public interests and insider/outsider issues. Yet, on their own, both discourses are incomplete and miss essential elements necessary for a thorough and fair "situated ethical judgment" (Campbell, 2006).

5. Conclusions

This study aimed to understand how private and public interests regarding urban growth interrelate in view of spatial justice. The results have shown a disconnect between private and public interests in the public discourse on densification. The fact that decisions may result from systematically incomplete deliberations presents a challenge to fair negotiations and may be detrimental to spatial justice.

In Switzerland, debates on public referendums are held in the media, giving stakeholders and parties opportunities to opinionate and make recommendations. The quality of public debate thus has a direct influence on the planning legislation on the local, federal, and national levels. When private interests dominate the discussion, the result is likely to reinforce existing inequalities in legislation.

Concretization and spatialization of more abstract policy discussions, for instance, by increased engagement of professionals when discussing specific plans and projects, will improve the public debate. Making conceptual considerations more tangible and linking concrete discussions to a broader perspective could facilitate situated ethical judgments. In particular, spatial justice cannot be assessed without connecting private and public interests and situating policies.

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Residential Production and Spatial Inequalities, a Territorial Analysis from the 'Right to the City': The Case of Córdoba Periphery

M. Cecilia Marengo*

* National University of Cordoba – Technical & Scientific Research Council (CONICET) Argentina; mcmarengo@unc.edu.ar ; ORCID ID 0000-0001-5670-5390.

Abstract: Mercantilist logic conditions the possibilities of access to urbanised land, space becomes a scarce asset that involves speculative practices, and a deterioration of its quality occurs in a broad sense linked to the deterioration of urban life and the right to the city. (Harvey 2014, de Mattos 2015, 2016, Rolnik 2018, et al.). The work exposes the way in which housing policy has generated conditions for the production of new peripheral territories. For this purpose, some housing complexes of an ambitious public intervention developed during the period 2003–2010 are examined. The methodology is quantitative and comparative, based on the use of Geographic Information Systems (Software QGis). The approach focuses on the spatial dimension of the house as constitutive of the urban environment. The results show its evolution and implications in the urban structure; understanding the importance of recovering the territorial dimension, the urban configuration, and the conditions for the inhabitants in relations with the city. Finally, the physical and social proximity relationships embedded in the production of public housing complexes and the evolution of neighboring residential environments allow us to reflect on the right to the city in the proposed locations of public housing policy.

Keywords: urban growth; social inequalities; housing policies

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1. Introduction

Numerous studies indicate that the process of socio-territorial transformations in the new century is associated with the intensification of inequalities (Soja, 2010 Secchi, 2015). Since the 1990s, the periphery of Latin American cities has been associated with a more divided urban space. Social inequalities are manifested in the physical form: dual, polarised, and closed residential areas are built next to impoverished places that concentrate vulnerable population, poverty, and low levels of public investment in services and infrastructure. In the current context of financialization of land and housing (de Mattos 2016, Harvey 2014), there is a growing difficulty in accessing to decent living conditions for a large number of urban residents, which has had a significant impact on the 'Right to the City' in terms of access to housing conditions, but also in mobility, services, and accessibility to the structure of opportunities derived from urban development (de Mattos 2016, Rolnik, 2018).

Mercantilist logic conditions the possibilities of access to urbanised land, space becomes a scarce asset that involves speculative practices, and a deterioration of its quality occurs in a broad sense linked to the deterioration of urban life and the right to the city. (Lefevre 1970 cited in De Mattos, 2015). As a result, a highly fragmented peripheral space has been generated, where internally homogeneous but unequal neighbourhoods coexist in a disjointed urbanised territory.

Housing policy does not escape this logic, to the exacerbation of speculative processes of valuation of urban land through the expansion of formal and informal markets that some authors point to as extractivist logic (Svampa &, Viale, 2014). Proof of this is the increasingly distant location of public housing complexes, in peripheral sectors with difficulties in the provision and access to quality services and areas of centrality, (which are configured as possibilities for the use of resources urban, work, education, health, etc.); which represents a tension in relation to the right to the city as access to urban resources and the exercise of participating in the urbanisation process (Harvey, 2014).

In Córdoba Argentina, the spatial growth process is characterised by low densities, discontinuous expansion of urban form, intensification of residential segregation, and urban fragmentation. The research seeks to determine the way in which housing policy has influenced the production of new territories, examining them from the perspective of the Right to the City. For this purpose, some housing complexes of ambitious interventions developed during the period 2003–2010 are examined. Many were located in central or pericentral areas that had suffered floods, or in sectors that were affected by public works. The projects of 12,000 single-family social housing units formed groups of different scales and materialised mainly in peripheral sectors with little urban integration and low-quality in terms of access to the services and equipment in the central city.

The work exposes the way in which housing policy has generated conditions for the production of new peripheral territories that have been configured from its materialisation. More than 10 years after its execution, these territories have transformed their morphology and different situations of changes are recognised at the neighborhood level, derived from the consolidation process itself, as well as the changes in the housing units. Finally, the physical and social proximity relationships embedded in the production of public housing complexes and the evolution of neighboring residential environments allow us to reflect on the right to the city in the proposed locations of the dwellings.

2. Theories and Methods

For Harvey (2014, p.20) "the right to the city is therefore much more than an individual or collective right to the resources that it stores or protects, it is a right to change and reinvent the city with our wishes. It is also a more collective than individual right, since the reinvention of the city depends on the exercise of collective power over urbanisation," that is to say a collective action. In this sense, the author points out that "the growing polarisation in the distribution of wealth and power are indelibly etched in the spatial forms of our cities in which fortified fragments, gated communities, and public spaces are progressively condensing in privatised areas under constant surveillance" (ibid. p.36). The process is characterised by uneven geographical development and a right to the city in the hands of private interests, because the surpluses of the urbanisation process that are turned over to urban development do so from the hand of private investments. Proof of this is, in the case of Cordoba in recent decades, is the significant growth of gated communities and, on the other hand, of informal settlements in the city periphery (Marengo & Lemma M, 2017; Marengo & Monayar 2020).

In Latin America, the housing policies that have been formulated to meet the demand and the housing deficit in recent years have not provided a comprehensive approach to the issue. They have prioritised the construction of new homes in peripheral and low-quality locations, rather than addressing the structural causes behind unequal access to the urban land market (Fernández Wagner, 2015). The process of commercialisation of housing, the speculative management of the land supply, and the difficulty of locating public housing projects in consolidated areas have led to the emergence of peripheral enclaves where social housing is located. Various studies address issues such as the predominantly quantitative response in addressing the housing deficit, the disconnection of housing production from the guidelines and policies for urban development, the role of international financing agencies in the massive promotion of housing, and the commercialisation of the same expressed in the urbanisation of peripheral and distant land, with high rates of profits for real estate developers (Ziccardi, 2015; Marengo & Elorza, 2018). Public action in Argentina with the Federal Housing Plans that were developed in the first decade of the 21st century (Falú, & Marengo, 2015) has had a significant impact on the reconfiguration and extension of metropolitan spaces by promoting a policy of access to mortgage credit unrelated to access to urbanised land. A condition common to several provinces is the almost null action in terms of urban land policy that can guarantee a provision on a scale to make federal programs viable, leaving public housing policy subject to the operation of land markets forces.

In this framework, a comprehensive approach between housing and land policies, and between the quality of housing and the surroundings, becomes important. In the New Urban Agenda approved at the Habitat III Conference in Quito in 2016, emphasis was placed on how the place of residence for the low-income population represents mechanisms for the reproduction of situations of poverty and territorial inequalities. It points out the role of public policy in terms of urban location, and the scale of intervention and the social conformation of the target population of the housing complexes (Marengo & Elorza, 2018), given that the position of housing in the city allows a reading of certain conditions of opportunity, is linked to the locational capital of the inhabitants. Along these lines, Acioli (2018) raises the need for housing policies to consider "housing in the centre" and promote locations that facilitate access to a better structure of opportunities, as a process that would make the right to the city effective.

To analyse the spatial processes and transformations derived from the location of the massive housing programme, 'Mi Casa Mi Vida,' in the city of Córdoba, an approach that integrates quantitative and qualitative analysis was developed. Methodologically data provide by QGIS software, Google Earth satellite images and observations in situ. A secondary source is based on information online from the Cordoba Institute of Spatial Data and census data. The approach focuses on the spatial dimension of the house as constitutive of the urban environment, its evolution and implications in the urban structure; understanding the importance of recovering the territorial dimension, the resulting urban configuration and the conditions for the inhabitants in relations with the city.

3. Results

During the period 2003–2010, the provincial government implemented the public housing policy, the "My House, My Life" programme, the objective was to eradicate slums at environmental risk because they were located in flooded areas. As a result, 70 slums were eradicated in 39 new neighborhoods, all with locations in peripheral areas and in most cases, isolated from the consolidated city. These areas, initially destined for rural/industrial use, required a change in land use pattern to be urbanised (residential). The housing complexes respond to the same organisational typology, blocks with uniform lots of between 250 m² and 300 m² and a single serial housing typology of 42 m². Those on a larger scale (more than 250 houses), have social facilities (primary and secondary schools, health centre, police centre, and commercial areas) and were called 'neighbourhoods-cities.' Given that this programme represented one of the largest actions for addressing informal territories, more than 10 years after its materialisation it is interesting to investigate the evolution that they and their environments present.

Case 1. City-neighborhood "Cuartetos"

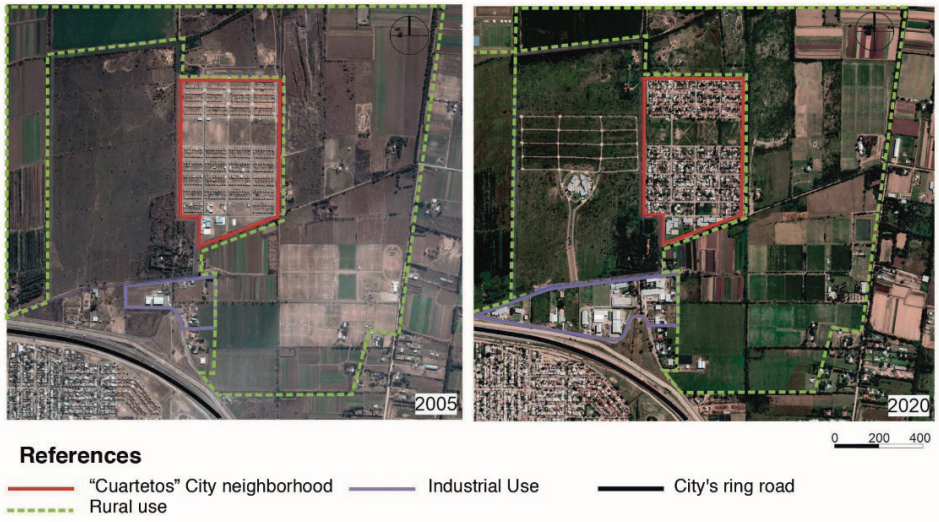

Figure 1. Aerial view of the evolution of "Cuartetos" City neighborhood in 2005 and 2020. Own elaboration.

The neighbourhood was awarded in 2004. It is located to the north outside the city's ring road in an area initially used for agriculture. It is integrated with 480 houses in two sectors with a green space in the centre, totally isolated from the consolidated urban fabric. The distance to the city centre from the neighbourhood is 10.3 km. It has a single public transport line whose journey to the centre is 65 minutes. When analysing the evolution of the surrounding area in 2020, no changes or building consolidation are observed nearby, only the layout of streets and a building in the adjoining rural plot.

The image of the neighbourhood shows a situation of isolation and little vitality in the streets. However, there is a significant percentage of consolidation in the neighbourhood itself, registering extensions of new area inside the plots in the 85% of cases. (Figure 2)

When analysing the evolution of the land value (in the immediate surroundings of the neighbourhood) in the period 2008–2018, it is observed that the average value per square metre has increased 25 times, which indicates the expectations of future urbanisation due to changes in land uses when the policy was implemented (the plots were initially affected to rural use).

Figure 2. Street view in the City-neighborhood "Cuartetos" and some houses modified by the inhabitants. By author.

Case 2. City-neighborhood "Angelelli"

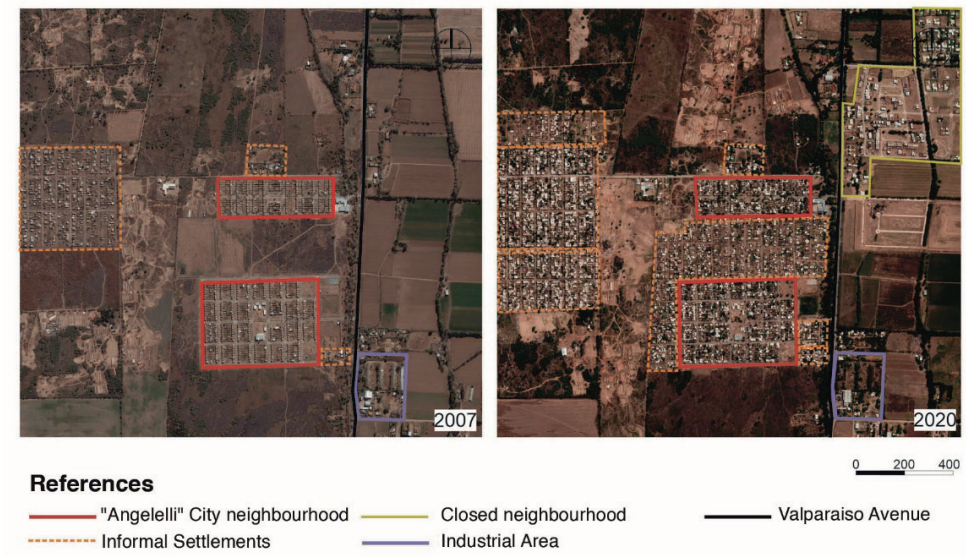

Figure 3. Aerial view of the evolution of "Angelelli" City neighborhood in 2007 and 2020. Own elaboration.

The neighborhood was awarded in 2007. It is located towards the southern sector of the city, in an area of rural use and disconnected from the existing urban fabric. It is integrated with 564 houses in two sectors (N - S). Next to it there is an informal neighbourhood product of the fraudulent subdivision and commercialization of large lots. The distance to the city center is 10.4 km, it has 2 public transport lines and 65 minutes of delay to complete the journey.

When analysing the evolution of the built environment in 2007 to 2020, significant changes are observed in three limits. They are a result of the consolidation of an informal settlement nearby, which maintains the same layout as the housing policy neighbourhood. The consolidation of links with the fraudulent subdivision (present at the time of the inauguration) the largest building consolidation in the informal neighbourhood and incipient processes of private urbanisations (developed by the real estate market) located in the immediate environment, shows a more significant dynamics of change in the surroundings compared to the previous case. Only to the south the use of rural land is maintained.

The dwellings show a significant percentage of consolidation, registering extensions and growths in 88% of cases. When analysing the evolution of the land value (in the immediate surroundings of the neighborhood) in two dates 2008–2018, it is observed that the average value of land (per square meter) has increased 52.86 times in the decade. The dynamics of transformation indicate a greater appreciation of their surroundings due to the change from rural use (original situation) to residential use. Also, the future expectations to developed new urbanisations in the peripheral areas next to the neighbourhood of public housing.

Figure 4. Street view in the City-neighborhood “Angelelli” and some houses modified by the inhabitants. By author.

4. Discussion

The results give an account of the form of production of peripheral territories and provide reflections on the evolution of the surroundings close to the state-produced urbanisations in a time period of more than a decade. The cases presented show how location is *the* central variable for understanding how the relationships of physical-spatial proximity with the urban fabric have been configured (or not), the situations of informality in the forms of access to land and housing, and the degree of vitality or isolation that results from each situation analysed. Also, how the increase in the valuation of urban land near these neighbourhoods evolves, which allows detecting differential processes of territorial appreciation close to state action.

More than 10 years after the implementation of a social housing programme, it has a strong impact on the urban configuration in the periphery of the city, due to the number of housing units built, the scale of the complexes, and the relocation of the vulnerable population. We observe that the form of production of the peripheral territories continues to reproduce an isolated, highly fragmented, disjointed space, with situations of informality and precarious housing that intensify conditions of residential segregation.

In both cases, the value of urbanised land increases, due to the change in land use, (rural–urban). In the case of Angelelli, is registered a very significant increase in the number of times given the consolidation dynamics that it presents. The linkages refer to nearby populous neighbourhoods and a greater demand for location in an urban sector, which, although isolated, recognises links with future urbanisations of private production.

The high value of extensions (new housing units at the back of the lots or in vacant lateral spaces of the house, and in some cases, new constructions on the upper floor) responds to the need to increase the habitable area and solve overcrowded conditions. Additionally, it also responds to the need to have a productive space for income generation

while pointing out the difficulties of access to urban land by new households as a result of family evolution.

5. Conclusions

The physical form that shows in the peripheral growth expands by fragments with internal homogeneity, low socio-spatial mixture, and the intensification of social division of space. The public housing policy does not escape this logic. They are inserted as enclaves, with little solution of continuity with the built environment. The isolated location is an expression of inequity in access to land because it is conditioned to the mobility possibilities of individuals. In highly vulnerable contexts, mobility is associated with access to public transport, its frequency, and the possibilities of afford travel costs. In peripheral contexts, access to urban opportunities relates to the right to the city, conditioned to the possibilities of access to mobility and public transport.

The understanding of what type of physical and social environments were produced where the housing complexes materialised by state intervention are located allows us to reflect on the Right to the City in the peripheral territories. On the one hand, these are isolated locations, exempt of urbanity and vitality. On the other, private spaces (homes) highly transformed to respond to vital needs, show high levels of appropriation and acceptance by the inhabitants. The paradox is thus expressed in two scales of intervention: access to urban opportunities and the valuation of private space.

The mercantile logic is evident in the urbanisation process. It is expressed though the valorisation of residential environments with the passing of time, even in highly vulnerable contexts. At the beginning of the process, it is relegated to locate in peripheral areas where the value of urban land is lower. Then it contributes its valorisation, in a process of spatial fragmentation which leaves vacant spaces to speculation. The cases corroborate that state interventions do not attenuate the speculative land market processes since they contribute to increasing the land value urbanising distant areas.

Finally, the importance of studying the environments that are configured with these interventions is mentioned, as well as the processes of consolidation of the neighbourhoods from the action of the inhabitants themselves who show a high dynamism and appropriation of the place of residence and its surroundings.

In the peripheral territories and close to the housing complexes, informal settlements take place. In some cases, they are large-scale planned operations that show how access to the city and housing is presented as a utopia in our cities. The outcomes, in a broader context of urban production, show that it is necessary to advance in the materialisation of inclusive and sustainable residential environments, as well as they promote another type of statal intervention to attenuate inequalities in the territory and promote more lively urban spaces. Recovering the territorial dimension in the design of housing is the starting point for developing more integrated urban configurations, and promoting greater access to agglomeration opportunities within the framework of the right to the city, as a horizon of equity in the future urban development.

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Who Wins and Who Loses in the Production of Cultural Iconic Architecture?

Inge Goudsmit[1*]

[1*] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; igoudsmit@cuhk.edu.hk
ORCID ID (0000-0003-4045-4640)

Abstract: Recent studies on the role of architecture within urban restructuring processes have become dominated by narratives on neoliberal urban entrepreneurialism, which consider urban development projects as key instruments of growth-oriented regimes and urban elites. In this paper, I want to focus on the role that cultural iconic architecture can play within a community to shape a collective identity and institute an urban imaginary. This study illustrates current cultural developments in Hong Kong, where most of the cultural budget has been spent on the global megaproject of the West Kowloon Cultural District (WKCD). In contrast, the new development areas, particularly the later generations of new towns, lack almost any form of cultural infrastructure. This contrasts with the governments' claims for creating self-contained communities. The provision of cultural buildings, when embedded in social and cultural life, can be an essential mechanism to shape a collective urban character and institute an urban imaginary. This study uses the framework of Kaika (2011) on urban imaginaries as an analytical structure to interpret the production of aesthetic symbols, based on Castoriadis' (1987) account of the imaginary institution of society. The importance of such civic infrastructure has been largely overlooked in the evaluation of existing new towns and the plans for future urban extensions. This, too, should be considered as a right to the city.

Keywords: urban imaginary; iconic architecture; Hong Kong; Right to the City

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Lei Qu

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Astrid Ley

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1. Introduction

> *"On culture and the arts, our vision is to develop Hong Kong into an international cultural metropolis. We support the freedom of artistic expression and creation, and foster the vibrant development of our cultures. We have been actively creating an environment conducive to the diversified development of culture and the arts; providing opportunities for wide participation in culture and the arts; devoting resources to nurturing talent and encouraging innovation; and supporting the preservation and promotion of traditional cultures."*

This is the most recent vision of Hong Kong's Home Affairs Bureau (2020) on the development of culture and the arts. However, despite the ambition to foster and develop culture, this vision seems solely applicable to the urban centre of Hong Kong. At the same time, the new towns, housing half of the city's population, are increasingly devoid of any cultural infrastructure.

Among many Asian urban centres that developed new towns after World War II, Hong Kong has one of the oldest and largest programmes. A new town's success is often measured by its ability to achieve 'self-containment' and independence (Wannop, 1999, Forsyth and Peiser, 2021). Independent new towns should offer plenty of job opportunities and leisure activities, which should arguably lead to a better work-life balance. Since the

1960s, the Hong Kong Government initiated a new town programme to alleviate the growing population in urban centres (Chan, 2001). Nine new towns were designated under three generations: today, these towns host almost half of the city's population. New towns were planned to be self-contained, providing "public and private housing supported by essential infrastructure and community facilities" (Civil Engineering and Development Department, 2016). The New Territories Development Department in 1976 illustrated their ideal: "The new towns will provide more than just housing. They will be places where people can work and play, grow and learn. And with them will come new industries to provide new and better jobs. Planners are providing for a full range of community facilities . . . ." (Hills and Yeh, 1983).

While many scholars have since shown the limitations of Hong Kong's new towns in attaining self-containment in job provision, as factory jobs moved away and new town residents relied on public transport to commute and work in urban centres (He et al., 2020a, Hills and Yeh, 1983, He et al., 2020b, Yeh, 1997, Yeh, 2021), few have looked into self-containment in cultural facilities provision. As Forsyth and Peiser conclude in a recent publication on new towns: "urban design strategies may help in creating a strong sense of community through greater legibility, aesthetic innovations, and the provision of public facilities that fosters community pride" (2021) (see also: Eng, 1996, Ruggeri, 2009).

In this paper, I compare the provision of cultural facilities over several generations of Hong Kong's new towns. It will show that the newest new towns provide substantially less cultural infrastructure compared to the older ones. At the same time, almost the entire cultural budget is spent on the WKCD, a cultural megaproject along the waterfront in the urban centre. I realise that the word 'culture' is itself contentious. While often understood with reference to 'high' culture, not in the least by the Hong Kong government, in this paper, I also highlight the second meaning of 'local culture,' which is often overseen. Drawing on spatial observations and interviews with residents, NGO's and district councillors of the most recent new town Tung Chung, we found that many residents miss urban activity, places to socialise, and that the new town lacks a distinct identity. The argument is that public cultural buildings can be an essential mechanism to institute an urban imaginary and help shape collective urban identity. This is then where the term 'iconic' is relevant; here understood as an opportunity for public architecture to create a distinct and recognisable place or 'the only conceivable or imaginable site of collective (social) life' (Lefebvre, 2003). As can be seen in the older new towns, local landmarks can create distinctiveness, a sense of place, a focus on community life, and a centralised urbanity. The importance of such infrastructure has been largely overlooked in the evaluation of existing new towns and in the plans for future urban extensions. This, too, should be considered as a right to the city.

2. Theories and Methods

2.1 Theory background

Several academic fields, including urban planning, urban studies, geography, and architecture, have been examining the role of iconic architectural projects in urban transformation over the past few decades. As described by Sklair, the term iconic points at a combination of fame and symbolic or aesthetic significance (2017). The neoliberal shift in urban policy from managerial to entrepreneurial strategies is seen as the key to urban development in growth-oriented regimes (Harvey, 1994, Harvey, 1989). From this perspective, iconic buildings serve to attract attention and form distinctive, recognisable images used for the cultural (re)branding of urban areas (Evans, 2003, McNeill, 2009), whether to serve brand corporations (Kaika and Thielen, 2006, Kaika, 2010), cultural institutions (Sorkin, 2002, Evans, 2005), cities (Ponzini, 2011, Zukin, 1995), or nations (McNeill and Tewdwr-Jones, 2003, Ong, 2011).

However, this focus on the political economy of the iconic building obstructs our view of the potential benefits of such icons in public space and the creation of an urban identity. Architecture has the ability to serve as an urban totem, argues Maria Kaika, as architectural icons can function as "exemplifiers of the aspirations and values of societies and as embodiments of myths and wish images for the future" (Kaika, 2011). Following Castoriadis (1987), she claims that architecture is one of society's tools to produce a collective identity or an 'urban imaginary.' Not only can icons function as 'actual imaginaries', they can also project an image that is not there yet, a 'radical imaginary'. Such landmark

projects can encourage social interaction and public life and create 'imageability,' a measure of how easily an environment evokes a mental image, through which it can be understood and recognised (Lynch, 1960).

Public cultural buildings in many cities have such a totemic function: they are located in a central location and influence the building itself and the urban space around them. However, not all infrastructure can fulfil such a function. To become a truly public icon, rather than an 'autistic' icon, a building needs to be embedded in social and cultural urban life, engage with the city around it, enhance the urban commons and inspire civic pride (Kaika, 2011). Community icons, in particular, can 'function as magnets of sociability, crucibles of collective opinion and repositories of shared memory,' and form a counterbalance for monumental global icons (Ho, 2006).

2.2 Methodology

This paper first discusses the background and relationship of Hong Kong's new town programme with the government's direction of cultural policies. Then, this is compared to the actual provision and location of public cultural facilities across different generations of new towns in Hong Kong. Next, zooming into Tung Chung, I will review the cultural infrastructure in this new town. This is complemented by interviews conducted with Tung Chung's local population to understand the reality of everyday life in the new town and the impacts of cultural infrastructure on people's sense of community and identity.

The empirical data for this study was collected using several different methodologies, which were partially incorporated within a year-long Advanced Research and Design Studio for the M-Arch programme within the School of Architecture at CUHK. First, various local stakeholders were invited to give a short lecture and were interviewed by the author and the students. These stakeholders included government town planners, urban planning consultancy firms, local district councillors, civil society representatives, NGOs, and residents. In addition, approximately 25 semi-structured short interviews were performed with local entrepreneurs, residents, and government representatives. Eventually, during the event 'Urban Politics Debate – Planning for Culture in Tung Chung' (May 27th, 2021, at Hong Kong Arts Centre), multiple key stakeholders discussed the situation in Tung Chung with regards to the needs of cultural infrastructure. In addition to the interviews, newspaper articles on Tung Chung were analysed, and we performed 'social listening' (Hollander et al., 2016), reviewing social media comments on the urban life in the new town.

3. Results

3.1. History of Hong Kong cultural policies

Before the handover in 1997, there was minimal effort from the colonial government to develop arts and cultural policies. 'The notion that the best cultural policy is no cultural policy is a direct offshoot of the general policy of laissez-faire' (Ooi, 1995), everything was kept 'at arm's length' (Ho, 2017). The city was often referred to as a 'cultural desert' (Cartier, 2008). The first written arts policy that outlined the blueprint for the development of the arts was published only in 1996. Nevertheless, a booming cultural infrastructure was prominent in the 1980s and 1990s due to various social and political reasons, such as to 'soothe the society' after political upheavals in the late 1960s (Xue, 2013), to complete self-sufficient new towns, to create a 'sense of belonging' (Xue, 2019), to 'improve the image of Hong Kong' before the handover (Ooi, 1995), and more. This led to the construction of most town halls and theatres in older new towns. As Xue (2013) observed, 'the administration adopted a people-oriented policy and started massive and numerous civil infrastructure projects. Civic architecture, including resettlement estates, city halls, libraries, sports complexes, hospitals, and schools, eventually formed the urban landscape of the Hong Kong territory.'

In the last two decades after the handover, however, the spread of public cultural projects is significantly reduced, leaving the later generation of new towns with barely any cultural infrastructure (see Figure 1). On arts and cultural facilities, the Hong Kong Planning Standards and Guidelines (HKPSG) only offer specific guidelines for the provision of libraries. There are no requirements for arts venues and community halls. These are to be "assessed and advised on by the Secretary for Home Affairs" (Planning Department, 2020). The focus on developing an 'international cultural metropolis' is evident through

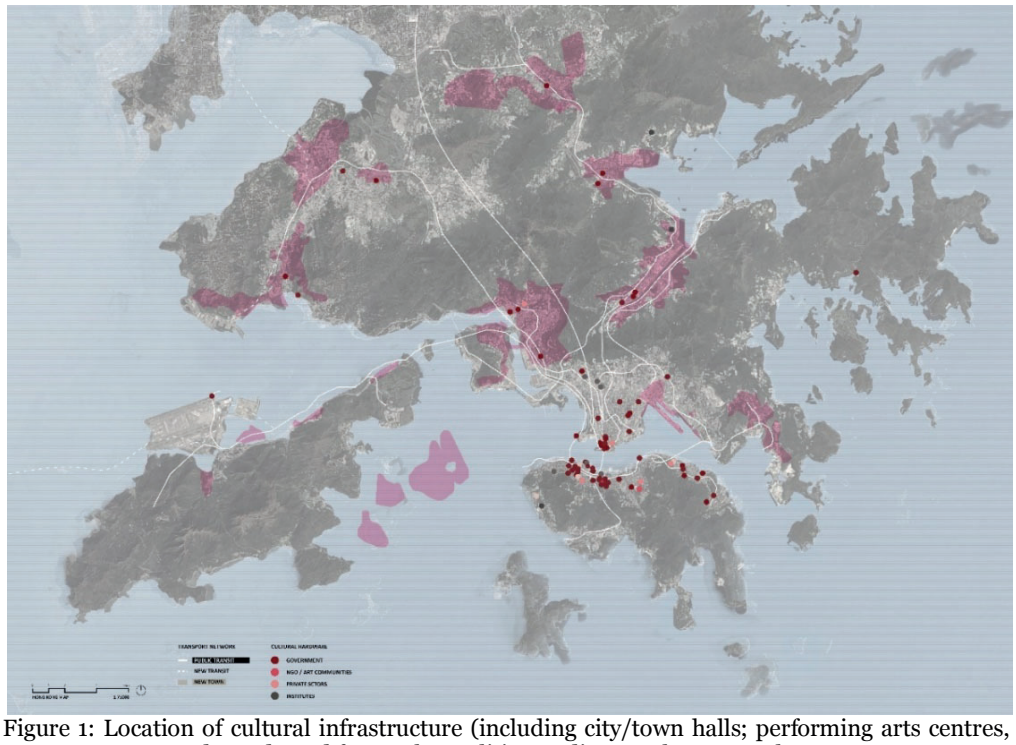

Figure 1: Location of cultural infrastructure (including city/town halls; performing arts centres, museums. Source: data adapted from urbanpolitics.studio; map base: Google maps

the budgetary emphasis on the WKCD. This 40-hectare reclaimed site aims to be an integrated arts and cultural district with world-class arts venues. The idea of WKCD was conceived in 1998 and has always been promulgated as the cultural landmark 'to position Hong Kong as 'Asia's World City' (Cartier, 2008). It hosts an Art Park, the Xiqu Centre, Freespace, and currently under construction are the Hong Kong Palace Museum, M+ museum, and the Lyric Theatre Complex, boosting state-of-the-art architecture for high culture at the heart of the city, hence far from the new towns. While WKCD was initially approved with an upfront endowment of HK$21.6 billion in 2008, the cost has spiked up to HK$70 billion by 2020 (Movius, 2020). No other cultural projects have received government funding of a similar scale, and none were located in the new towns.

3.2. Provision of cultural infrastructure in new towns

The overview of cultural infrastructure in new towns of different generations (see table 1) shows clearly that the first and second generations all enjoy the provision of one town hall or theatre. With the largest population of all new towns (805,000 in 2016), Tsuen Wan has both a town hall and a theatre. The cultural buildings of first-generation new towns were completed roughly 20 years after the year of designation. However, all third-generation new towns lack the provision of any cultural infrastructure. No plans to supply such infrastructure are found in government documents, despite that Tin Shui Wai and Tsuen Kwan O were designated as new towns almost 40 years ago. They have a population of 290,000 and 396,000 respectively, comparable with new towns of other generations.

Meanwhile, although all new towns are provided with libraries and community halls, and thus comply with the HKPSG. However, community halls, on average, fit fewer than 450 persons. They can hardly accommodate their respective populations to live up to their intended function of being a "focal point for local community activities undertaken by all age groups, including such activities as meetings of local community organisations; social group and civic education activities; training courses; and celebration, recreation and sport activities" (Planning Department, 2020).

Generation	New Town	Year Designated	Reclamation	Area (hectares)	Present population (2016)	Planned population	Cultural infrastructure (year of completion)	Library (year of completion)	Number of community halls
1	Tsuen Wan (Tsuen Wan, Kwai Chung and Tsing Yi Island)	1961	Yes	3,286	805,000	866,000	Tsuen Wan Town Hall (1980)	Tsuen Wan Public Library (1974)	12
							Kwai Tsing Theatre (1999)	North Kwai Chung Public Library (1984)	
								South Kwai Chung Public Library (1984)	
								Shek Wai Kok Public Library (1986)	
								Tsing Yi Public Library (2000)	
1	Sha Tin (including Ma On Shan)	1965	Yes	3,591	691,000	771,000	Sha Tin Town Hall (1987)	Lek Yuen Public Library (1977)	13
								Sha Tin Public Library (1987)	
								Ma On Shan Public Library (2005)	
								Yuen Chau Kok Public Library (2017)	
1	Tuen Mun	1965	Yes	3,226	502,000	589,000	Tuen Mun Town Hall (1987)	Tai Hing Public Library (1978)	11
								Butterfly Estate Public Library (1986)	
								Tuen Mun Public Library (1989)	
2	Tai Po	1979	Yes	3,006	278,000	307,000	Tai Po Civic Centre (1985)	Tai Po Public Library (2004)	7
2	Fanling/ Sheung Shui	1979	No	667	261,000	290,000	North District Town Hall (1982)	Sha Tau Kok Public Library (1990)	6
								Sheung Shui Public Library (1994)	
								Fanling Public Library (2003)	
								Fanling South Public Library (2016)	
2	Yuen Long	1979	No	561	164,000	185,000	Yuen Long Theatre (2000)	Yuen Long Public Library (1984)	2
3	Tin Shui Wai	1982	Yes	430	290,000	306,000	Nil	Tin Shui Wai North Public Library (2006)	4
								Ping Shan Tin Shui ai Public Library (2013)	
3	Tseung Kwan O	1982	Yes	1,718	396,000	445,000	Nil	Tseung Kwan O Public Library (2001)	6
								Tiu Keng Leng Public Library (2015)	
3	Tung Chung	1992	Yes	n.a	80,000	124,000	Nil	Tung Chung Public Library (2010)	1
	New Extension			245		268,000			

Table 1: List of cultural infrastructure in new towns (Civil Engineering and Development Department; He, Tao, et al.; Hong Kong Public Libraries)

Not only is the number of cultural infrastructure important, its location within the town is also critical if these buildings are to function as truly local icons. Cultural buildings can help establish an urban centre with greater cultural diversity, contrasting with the large, segregated residential plots that most of Hong Kong's new towns have. Indeed, in

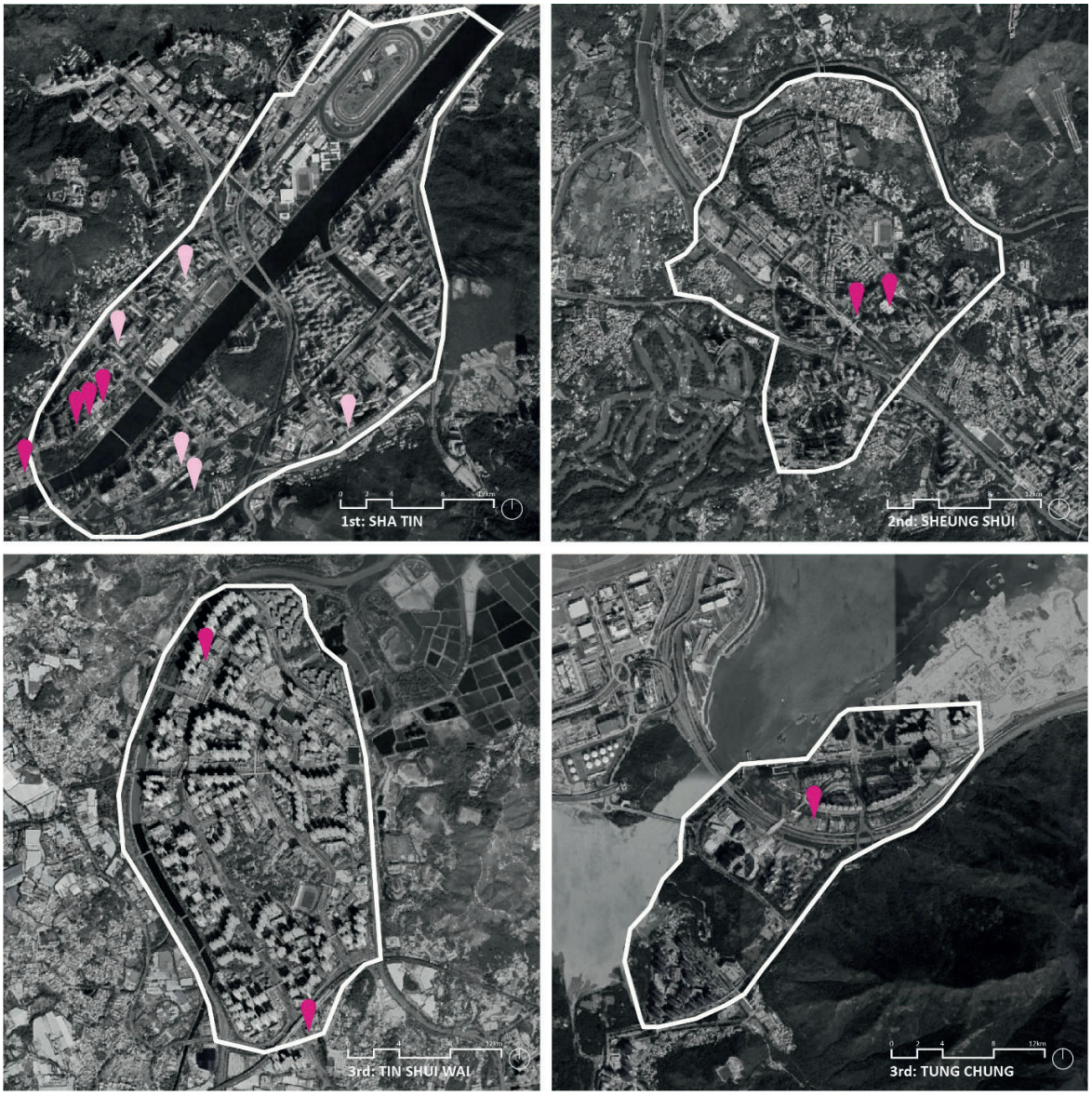

Figure 2: Cultural infrastructure in three generations of new towns: 1st: Shatin; 2nd Sheung Shui, 3rd Tin Shui Wai and Tung Chung. Source: the author; map base: Google maps

the early generations of new towns, the cultural buildings are located in the central location, often near a transportation hub. Xue (2019) observes that 'town halls in Hong Kong are a modest part of the pedestrian bridge network' and can easily be accessed 'from subway or home.' The later generations of new towns lack such a cultural centre. The maps of four of the new towns of different generations show the cultural and public provisions (figure 2).

3.3. Situation of Tung Chung

Tung Chung was designated as a new town in 1992, alongside the development of the international airport. The government intended to develop the town 'into a hub providing commercial, cultural, community, and recreational activities serving Tung Chung and the wider area of Lantau Island' (Planning Department, 2019). Today, the town of 80,000 (with a rapidly growing population) provides hardly any civic infrastructure, with only one district library and community hall (situated within the Municipal Services Building, see Figure 3) far from the public housing estates. Instead, these two facilities are surrounded by private estates and wide empty roads (see Figure 4) and can only be reached from the

Figure 3: Library and municipal services building: non-distinct design, lacking public outdoor space. Source: the author

public housing estates by walking through shopping malls and bridge networks (see Figure 5). They are non-distinct in design and can accommodate only a limited capacity. In addition, the most central location of the new town, next to the public transport interchange, is formed by a shopping mall and private residential communities that developers and their management companies strictly manage. As a result, there are no public functions or cultural facilities.

District Councillor Mr Fong Lung-fei gave firsthand insights on the impact of the poorly-located public buildings: "the lower-income community concentrates in the west, hosting 40,000 people, which is half of the population of Tung Chung, yet the resources focus on East and North" (Fong, 2021). Mr Cheung Yan of Tung Chung Community Development Alliance, a local NGO, further suggested: "there are many low-income residents in the West. They are separated from the East with no basic facilities, such as markets" (Cheung, 2021).

Interviews with members in the local community were also revealing. They showed different needs depending on diverse groups in the population. Interestingly, all groups commented on the lack of a local wet market. These markets in Hong Kong are often incorporated as part of municipal services buildings, and supply, besides a market, sports facilities, a library, a theatre, and other public functions (Xue, 2013). They are not only important for grocery shopping, but they also form part of the wider daily life of residents.

Due to its location near to the airport, Tung Chung houses a relatively large percentage of non-Chinese speakers (21.6% compared to 6.1% in Hong Kong) (Centamap, 2016). When interviewed, members of these communities highlighted a lack of religious and gathering locations. Furthermore, private housing residents were generally satisfied with the overall facilities in their neighbourhood. This is not surprising given the generous amenities in most compounds. Public housing residents, however, responded that there is a lack of public open space, sports facilities (predominantly teenagers and young adults) and performance space for dancing practice (elderly). Furthermore, the younger groups lacked spaces for learning skills, arts, and crafts. One young resident commented strikingly: "We need places to create memories. I grew up in Tung Chung, but I have barely any memories to places there."

Summarising, the empirical data does not directly lead to a plea for cultural facilities if these are understood as places for 'high' culture. Rather, or first, the new town has a need for places to gather, to recreate, to learn, and to pray. In short, places to create a local social culture and to develop a collective urban identity.

Currently, Tung Chung is undergoing a huge-scale extension that will bring the projected population to 268,000, with the first intake of new residents in 2023. In response to complaints about the poor provision and distribution of facilities in Tung Chung East

Figure 4: The facility is surrounded by private estates and empty road networks. Source: the author

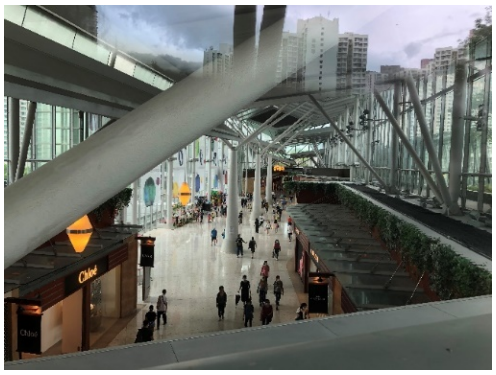

Figure 5: Residents have to pass through commercial mall and bridge network to reach the library and community hall. Source: the author

and West, the Civil Engineering and Development Department (2014) proposed 'a generous provision of GIC [Government, Institution and Community] facilities, recreational facilities and open space to serve the existing and planned population. For instance, in Tung Chung West, a sports centre, a GIC complex (for clinic and social welfare facilities), two primary schools, and two 7-a-side football pitches in Tung Chung West, together with the planned Sports Centre adjacent to the future Area 39 public rental housing site are proposed'. Still, there are no plans for any cultural facilities and infrastructure. The new town community lacks a focal point and "civic culture - the construction of town halls, museums, libraries, concert halls . . . central to identity and image" (Stobart, 2004).

4. Conclusion

This paper discussed the potential role of cultural architecture in the development of a collective urban identity in new development areas. The symbolic significance of an iconic building can, when embedded in the local social and cultural life, contribute to the creation of urban identity and even function as a radical imaginary, instituting an image of a desired future. When reviewing Hong Kong's new towns, most scholars criticize the lack of self-containment through a focus on long commutes to the new towns from the main job provisions. However, there is little attention to the need for public cultural life. In recent years, cultural funding has been predominantly assigned to the central districts of Hong Kong, while the new towns lagged behind. The lack of identifiable social places that residents describe is representative of this. New towns are planned from the top-down, focusing on quantifiable numbers only, and overlook that not only new housing is necessary, but a new community needs to be built. Incorporating distinct, well-positioned public cultural buildings provides an opportunity to create community icons and a local identity, as they can also influence the urban space. We need to learn how to build new towns that are self-contained, not only in a socio-economic sense but also in the provision of public cultural life. With the extension of Tung Chung currently under reclamation, there is an urgent need to recognise this challenge and start to incorporate the provision of cultural infrastructure as soon as possible to prevent this from becoming another 'cultural desert.'

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Dialogues, Tensions, and Expectations between Urban Civic Movements and City Administration: Lessons for Urban Political Evolution from Two Recent Participatory Processes in Portugal

João Seixas [1], José Carlos Mota [2]

[1] NOVA FCSH 1; jseixas@fcsh.unl.pt; https://orcid.org/0000-0002-4948-9113
[2] University of Aveiro 2; jcmota@ua.pt; https://orcid.org/0000-0001-8953-2027

Abstract: This article presents, in a resumed form, our preliminary analysis on the evolutionary framework for new types of intersections, dialogues, and conflicts between urban administrations and civic movements in Portugal. The analysis is based on a conceptual classification spectrum for the characterization and influence of urban movements; and concomitantly on two case studies developed around urban requalification processes in two central public spaces in the cities of Lisbon – the Martim Moniz Square – and Aveiro – the Rossio Garden. In these cases, the conflicts and the interconnections between local authorities and social movements have been evolving through very interesting forms. Expressing not only relevant changes occurring on urban civic movements them-selves, but also an inevitable – although still quite limited and visibly thwarted political culture – reconfiguration on urban governments and its administration.

Keywords: Civic movements; Participation; Governance; Cities

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1. Introduction – Recent trends in Portuguese urban politics

Cities have become the epicentre of most of humanity's major issues, from climate change to social inequalities, from the dilemmas of the digitalization of the economy and urban life, to the formation of new cultures, identities, and communities. This represents an evolution which is leading to an increasingly active combination of crises, pressures, experimentations, and expectations.

In most of Europe's urban territories, after several decades of continuous growth mainly associated with metropolitanisation and urban dispersion, new trends in uses and experiences are now spreading with a growing spectrum of individuals, institutions, and companies assimilating differentiated habitat experiences, working capabilities, mobility, and consumption habits (Sennett, 2016).

These changes are having a strong impact on the fields of urban politics (Merrifield, 2013), especially in terms of the cultures and dynamics of urban government institutions, there are developing different paradoxical realities. The overlaps of several initiatives, proposals, and innovative trends are becoming increasingly visible with organizational and cultural structures that remain considerably classical and bureaucratic, as well as mostly dependent on internal or partisan stimulus. Overlaps that often develop into quite fragmented and unstructured results. Notwithstanding the growing positioning of a vast myriad of innovative strategic and political approaches, it propagates the feeling of the limitations in the capacity building and governing action of several urban governance domains in the face of the challenges before them. These feelings and questions develop, in turn, political reactions that allow the promotion of localist and even populist views.

In Portugal, these structural – and growingly paradoxical – developments are also occurring, combining global trends with specificities arising from an urban culture that

historically has been poorly understood by society and policymakers (Seixas et al., 2019). The current dilemmas facing Portuguese cities and metropolises are strongly conditioned by the combination of structural weaknesses – particularly in terms of the limited capacities and resources of local authorities, in one of the most centralized countries in Europe – with a long period of socio-economic crisis and the resulting austerity policies. Even after the hardest austerity period, followed by a few years of some economic and social improvement, the majority of the main political and regulatory local systems have been maintained (Teles, 2015). They have become increasingly out of step with old needs and new challenges, and most notably on fundamental urban dimensions, such as the current pressing housing and real estate market realms.

This article presents a preliminary analysis on the evolution of new types of intersections, dialogues, and conflicts between the urban administrations and civic movements in two Portuguese cities. Two case studies were developed, concerning urban requalification processes in two major public spaces in the cities of Lisbon and Aveiro. In both cases, the conflicts and the interconnections between local authorities and social movements have evolved in some form, expressing the changes occurring on urban civic movements, as well as the still limited political culture reconfiguration on urban governments.

2. Urban social movements in Portugal

Social movements organised around urban issues have a long history in European cities. The right to the city (Lefebvre, 1968; Harvey, 2008) is perhaps one of the most relevant perspectives that still inspires the debate about living in the city and the right to housing. In the 1970s, newly environmental and public space qualification movements emerged, influenced by the energy crisis as well as by mobility and safety. Afterwards, collective associations mobilised for the protection of built heritage, stimulated by international organisations such as UNESCO. Recently, a new generation of social movements has emerged that are concerned with the city and its transformation, in response to the crisis of traditional information practices, the erosion of state regulation, and the emergence of global economic actors with power to control decision processes – a situation amplified by the 2008 financial crisis (Mayer, 2009).

Focusing on this latest area of study, there was a convergence of interventions in the city by groups of citizens that appeared through the emergence of a social and environmental awareness of collective life in the city, and acting through the dissemination of technologies from multicultural and connected urban contexts. There is a fundamental motivation that characterises these groups which transcends the markedly ideological or corporate dimension of previous generations, referring them to an action focused on the city as the object and its core elements (the neighbourhood or the street), as the focus of concerned collective forms of organisation, in response to a change in the scale of the functioning and autonomy of local, public associations. Finally, the performance of these recent social movements stands out for its growing technical-scientific robustness, articulating the focal concerns of reflection with collective action (Hamel et al., 2000).

Most of these social dynamics happen when there are combined reasonable densities of sociocultural critical mass, the influence from qualified professions, and some sort of public support (Subirats, 2016). And now, with the development of the new crisis, urban landscapes of wider economic difficulties, qualified unemployment, and growing social and spatial inequalities. Most of the time these civic pressures were triggered by contesting actions of city governments and their public administrations. But, there is a widespread nurturing, particularly in the urban tissue and from younger generations, in the main Portuguese cities and their vast metropolitan territories, of new cultures and forms of exercising civic politics and much more participated, transversal, collaborative, and committed practices. They emerge with strong dynamism and social attention, although with a still relatively fragile capacity for political influence. Despite having been fostered mainly from reactive and protest dynamics, these new practices have demonstrated new propositional and organisational capacities, specifically around more urgent dimensions, such as accessibility to housing, social inequalities, and the quality of public space.

Although these civic dynamics have been primarily fostered through reactive expressions and protesting, they are now demonstrating new propositional and organisational capacities, most notably around most pressing dimensions such as housing accessibility, social inequalities, sustainable mobility and the quality of public space. A widespread nurturing of these movements can be understood, particularly in the denser urban territories, with a dynamism mostly geared by younger, qualified, and digitally connected generations.

Even so, it is possible to identify different types of movements, depending on their main characteristics, as their fundamental motivations, resources, forms of organisation

and networking, cultures and practices, and corresponding results. In this sense, we propose a classification spectrum for the characterisation, dynamics, and influence of urban movements, according with four types of overall typological cultures and characteristics: (i) protest, (ii) reflection, (iii) tactical action, and (iv) civic-political innovation (Diagram 1). Protest-type movements traditionally have a reactive stance on a given issue, whether it is an urban problem or an intention to transform the city, and organise themselves to influence the decision-making process, namely through petitions, interventions with media impact, and, in some cases, legal initiatives. They expect short-term results and mostly exhaust their action with the end of the cause. Its relationship with political power is tense and often conflicting (Mota & Santinha, 2016). Urban social movements mostly driven towards a reflection culture, conversely, are motivated by knowledge and diagnosing and generating ideas about the future of the city, for which they organise debates and forums, producing opinions, and only then taking positions. They do not tend to act in the short term, and exist a bit farther from the media's influence, having higher potential, although mostly through codified and modest ways, to build bridges between antagonistic positions (Mota, 2014). Tactical action movements are mostly motivated by the transformation of cities and public space through guerrilla urbanism or tactical urbanism actions. They intend to drive or achieve transformation through specific, low cost, and visible impact initiatives, desirably through participatory processes (Lydon et al., 2015). Finally, the much rarer civic-political innovative structures or movements, emerge – or evolve – in response to the rise of civic, administrative and political responsibilities, promoted by a growingly demanding citizenry and/or by politicians and public administration requiring or suggesting co-governance actions or programmes. Their aim turns out to be the development of new models for cooperation within public policies and citizen action, promoting the prototyping and design of new/experimental governance solutions. The new experiences of the Citizen laboratories can be proposed as processes or instruments for the development of these types of movements (Parra, Fressoli & Lafuente, 2017).

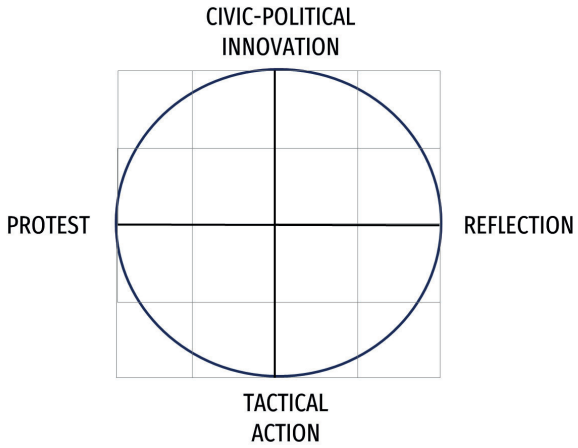

Diagram 1. Typology spectrum for urban social movements. Source: authors

The composition of the various movements of an urban system, with their respective characteristics, dynamisms, and results, is not evidently linear, orderly, or integrated. The several movements in a city do not work in a watertight way, although influencing each other, and often forming common civic ecosystems of combined action that aim to inspire and influence others. Even when they do not work in the same geographical area of influence, they take advantage of their network capacities, knowledge, and experience. Several aim at breaking down classical barriers and supporting new contexts of greater cooperation between local governments, public administration, and civil society (Polyak et al., 2021). Naturally, the emergence of civic groups stems from a limited framework of dialogue between public authorities and citizens, the lack of a shared vision for the future of cities, and the emergence of specific projects without a planning perspective which reflects opportunities for public and private investment (access to European funds or real estate projects).

Following this resumed conceptual framework, an empirical analysis focused on two processes of urban public space requalification (in the cities of Lisbon and Aveiro) and the correspondent civic positioning and expressions, was developed.

3. Two case studies of urban requalification (Lisbon and Aveiro)

3.1. The Martim Moniz square in Lisbon

Martim Moniz square (MM) is one of the most important public spaces in the city of Lisbon. In this large square, there is a rare combination of important urban values, from its central geographical positioning to a significant landscape amplitude and a quite evident urban and intersectional potential (Figure 1). Furthermore, involving MM pulses a rich and diverse social and economic dynamism, thus conjugating a set of remarkable and unusual characteristics making this square a fundamental hinge space for the whole city of Lisbon.

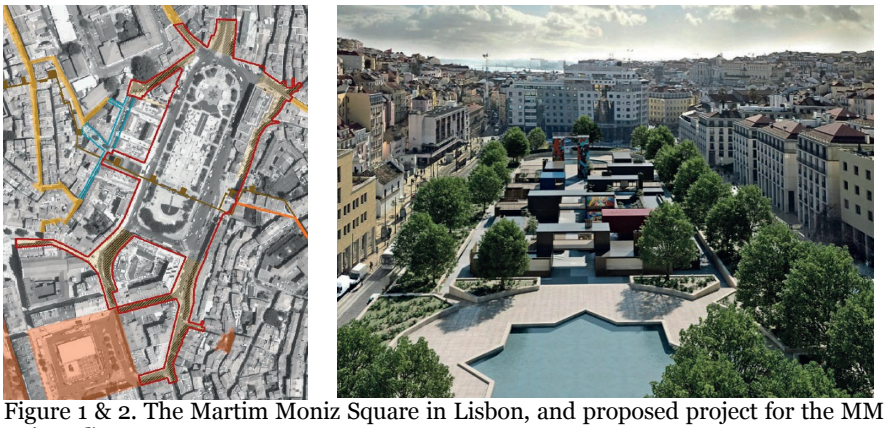

Figure 1 & 2. The Martim Moniz Square in Lisbon, and proposed project for the MM Market (later rejected). Source: CML

Lisbon is increasingly cosmopolitan and integrated in global avant-garde trends, and has distinguished itself in recent years by a rapid process of change. The coexistence and the confrontation is strongly visible between several processes of innovation and change, and with a parallel structure of new types of inequalities and segregation. Today, these dilemmas take place in several domains, and most notably in fundamental urban elements such as access to housing, economic shifts, ecological pressures, and in cultural and communitarian reframing. In view of the vertigo of change and an also growingly visible unbalanced capacity for political regulation, the risks of loss of both social and political perspectives have become notably evident. These risks are particularly expressive around the historical and central territories of the city, where MM is located. The historic centre of Lisbon is today the scene of crucial confrontations and constant imbalances between the "city for the visitors and occasional consumers," and "the city for the residents and everyday inhabitants."

Growing appeal for a qualified green area in MM has existed for several decades. Until recently, however, most of the requalification proposals have been commercial in nature and implemented through quite limited and unsuccessful public-private partnerships. With time, as well as with the new urban pressure, MM and its almost timeless expectant situation became an inevitable point of political confrontation. At the end of 2018, the municipality announced its intension to extend the commercial concession contract with the previous promoter (of a Fusion Market in force since 2012, planned until 2022 and in serious decline for some time), extending it until 2032 and now including a commercial requalification of the square with an open shopping centre with about 40 stores, renamed Martim Moniz Market (Figure 2).

The social reaction to this decision was immediate. The citizens – and several movements – complained not only for the ever-forgotten green space, but also that the new commercial pole would have a great impact in terms of ephemeral and touristic pressures and growing concerns on noise and insecurity.

At a following town hall public meeting, the city mayor started to admit that the solution for MM was the ideal. Unleashing a growing chorus of criticism from various parties, both in the chamber meetings and in the municipal assembly, it now also focused on the lack of transparency of the process and on legal incongruities. Meanwhile, at a public meeting organised by the local district, where the councillors as well as the concession

entrepreneurs were present, the vast majority spoke out against the project and in favour of a qualified green area. In March 2019, a new movement called 'Jardim Martim Moniz' was born, aiming to bring together independent voices, as well as clearer information and decisive influence upon the whole process. At the end of April, a civic petition for an urban garden in MM with almost 2,000 signatures was delivered to the municipal assembly. At the same time, the local district of Santa Maria Maior publicly rejected the market project and demanded a square for residents.

Confronted with the growing civic and political opposition and with the corresponding mediatic debate, the municipality eventually approved the termination of the contract. The decision gave rise to a compensation to the promoter; triggering a completely new process. This process started with a highly concerted effort to listen to the population, through several forms (historical and socio-geographical information, extended surveys, focus groups, and meetings with the civic movements). This new process was organised with external scientific support and extended through different phases. The most mentioned responses clearly pointed at increasing green areas, noise reduction, improvement in pedestrian access, and soft modes of mobility. Also mentioned were other relevant issues, such as a diversification of multicultural activities, more spaces for children and intergenerational meeting areas, and an increase in urban safety. Several preliminary proposals coming from various citizens were also publicly presented (Figure 3).

Figure 3. Some of the proposals developed by participants in the recent public auscultation phases. Source: CML

From the listening phases, and in conjunction with the municipal strategies, a new set of principles were listed for the future of MM and for the definition of the preliminary programme for a future requalification project. At a town meeting in May 2021, the participative report and the guidelines for the preliminary programme were approved unanimously. The municipality thus began the process for an international public tender, stressing the desire to enable innovative solutions. However, and notwithstanding the notable change in the city's urban planning practices in this specific case, this new process could still be understood as dominated by a municipal culture of considerable control on the participatory processes and correspondent directions and decisions. Although heard, the movements were called only on the presentation moments on the final steps of each phase. This administrative and political attitude still does not guarantee a fundamental change in urban management practices by the municipality.

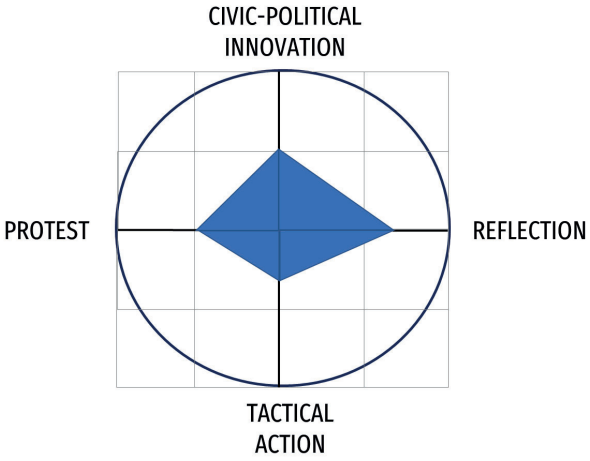

Diagram 2. Typology spectrum for the Martim Moniz urban movement. Source: authors

Therefore, and according to the spectrum previously proposed for the analysis of urban social movements and its influences in local urban governance, Diagram 2 shows, in our view, the main characteristics and evolutionary perspectives corresponding to this case. Having started on a protest base against a contested municipal decision, and developing certain tactical actions, the movement has developed mainly in reflexive terms. The movement subsequently succeeded in getting the local government not only to change its initial decision, but also initiated a new process with greater popular participation. Nonetheless, this public movement has not yet achieved guarantees on the configuration of sustained structural changes from the part of the local administrative cultures.

3.2. The Rossio garden in Aveiro

Rossio is an iconic place in the heart of the city of Aveiro, located between the Bairro da Beira Mar and the central water channel. It has two purposes; it is the only garden serving the surrounding neighbourhood, and is the space where the city's most important collective events take place.

Today the Garden, due to lack of maintenance, has several problems that need to be solved. There are five fundamental problems: the need to clean and conserve the green spaces, urban furniture maintenance; tree species (palm trees); car parking in the surrounding areas, making the relationship between the garden and the neighbourhood difficult; social problems related to some of the user types; and, an imbalance between tourists looking for boat trips and residents looking for the enjoyment of the existing green space.

The requalification project for Jardim do Rossio in Aveiro emerged within the scope of the urban development operations that the Municipality of Aveiro integrated into the Strategic Plan for Urban Development of the City of Aveiro as part of the application for European Funds. The aim of "transforming [Largo do Rossio] as the great central public space of the city, stimulating its pedestrian use and providing it with functionalities for the realisation and organisation of various events in the City," (...) providing "this space with a subterranean car park, which will be the object of a construction and operation concession tender."

Figure 4 & 5. Rossio Garden Projects – phase 1 and 2. Source: Municipality of Aveiro

The project received criticism related to the destruction of the existing garden and the construction of an underground car park, even though it was intended to partially replace the existing parking on the surface. In addition, there are several alternative car parks in the vicinity which aren't used to their capacity. The underground car park option has a fundamental contradiction with the program that finances the operation, since it aims at contributing to sustainable urban development and the decarbonisation of mobility. These aims are apparently related to the financing entity of the operation. Furthermore, the project contradicts the mobility principles advocated for the city, namely the existing technical studies. Also, the commitment to an event venue increases the fears of worsening the acceleration of tourist attractiveness factors, in line with what has happened in recent years with the growth in the offer of local accommodation, and reducing the functions that support daily life, namely for the residents of Bairro da Beira-mar (Figure 4).

The intervention also raised fears about the alteration of the water table in the surroundings, which could affect the old building of Bairro da Beira-mar that is supported by wooden piles. As well, the felling of all the trees was much criticized as "they play an essential role, both in terms of an environmental point of view and of urban comfort."

The choice of the modality of a call for ideas for designing and planning that space was also criticised, as this instrument is an exercise in which the designers respond to a specification that they cannot contradict, they spend limited time researching (which does not allow them to gain knowledge of the object they want to transform) and do a job without any contact with the local authority and the community.

The lack of a participatory process and the impact of the solution generated a huge civic controversy that gave rise to various types of civic movements, as referenced before. The protest movements organised petitions, several public events, which were highly attended, and legal initiatives. The reflections movements promoted public debates and made relevant technical recommendations.

Despite not having backed down on one of the critical issues – the car park – the municipal executive made significant changes to the initial proposal (Figure 5). It increased the green area, reduced the area of the event square, reduced and reformulated car traffic provisions, and resized the sidewalks along the urban façade. Even so, to respond to the need for access to the garden, the Municipality is still proposing to build a new access bridge through the lock zones (next to the estuary) which will certainly increase car traffic pressure in the Rossio area. From the initial project budgeted at seven million euros, the work was awarded for 12.4 million euros, in a concession contract that also involves the management of another car park in the city, plus up to 1.2 million euros for the second bridge.

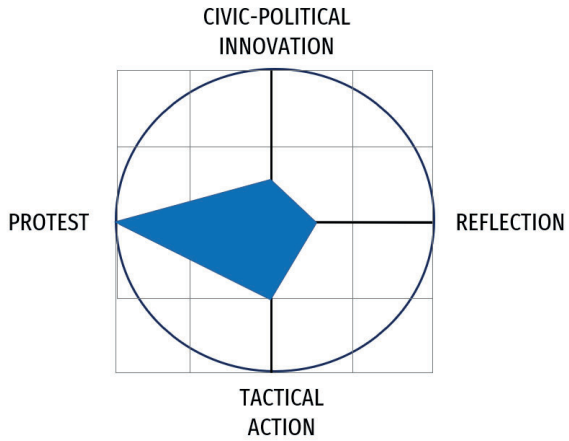

Diagram 3. Typology spectrum for the Jardim do Rossio urban movement. Source: authors

Following the proposed spectrum, Diagram 3 expresses the predominance of a protest nature for the Jardim do Rossio movement, including its high intensity and duration, sustained in some tactical actions of occupation of public space. The reflection, as well as the wider correspondent civic and political innovation dimensions, had some sort of dynamism – although not at all showing structured forms of capacitation. The outcomes of

the actions from this, as well as from other collectives in Aveiro led the local government to partially change its attitude and proposal, although these changes were not directed to the desired dimensions. More recently, the involvement of the collective in the municipal electoral process (in September 2021), being associated with a specific opposition party and without a victorious result, adds uncertainty in the prediction of its future evolution and correspondent ability to influence local politics.

4. Discussion & Conclusions

Our research, here presented in a very concise form, has identified a set of key fields for an expanded interpretation on the recent evolution of Portuguese urban civic movements and the corresponding urban governance attitudes. It not only concerns the more specifically focused urban planning and regeneration processes, but also around possible cultural changes developing on the political and institutional structures of local government, as well as in the evolution of urban movements themselves and correspondent socio-political and civic cultures.

The two case studies presented here show that some decisive lines framing the evolution of urban governance, and are based on the activation of formal, as well as informal intersection processes in the local policy debate, confrontation, and production. This is most notably the case when considerably distinct groups and universes are involved, in a setting with very little history of encounter and dialogue.

On one side, these two case studies show an interesting evolution in the influence capacity of civic movements. The initial plans of the municipalities were changed due to the civic pressures clearly demonstrated. On the other side, however, the decision-making processes themselves are still not clearly open and participatory mechanisms. Which seems to demonstrate that although the urban political power is becoming more sensitive to the pressures of civil society, what is changing within the political-administrative structures is not yet a structural process of connection and dialogue with each city's communities. It is manifest that there is still a long way to go in the reduction of entrenched dichotomies established over several decades, and in promoting a culture of more permanent communication between the different urban actors.

Overall, there are still several governance fragilities that are quite visible, decisively influencing the ways in which the transformation of the territory is processed, without a clear foundation in public policy principles – local, national, and European – and without a due and timely civic involvement. The dialogue between urban local administrations and citizens, when it takes place, is almost always when it is pressed and stimulated by the latter. In one case opening, a new although still unstable participatory process (Lisbon), and in the other still clearly showing little willingness to properly position the citizens' perspectives, using the argument of political legitimacy (Aveiro).

Nevertheless, both cases also show the growing role of protest movements in Portuguese cities, with growing impact in both the media and in institutional contexts. This growth of protest movements has provided incentives to the development of more reflective postures, thus contributing to both the qualification of the debates and to an expected improvement of future processes of dialogue, and possibly to some forms of collective construction cultures. This analysis demonstrates the gaps, but also the potential and richness of the growing interrelationship between the social movements in the city and the local political institutions.

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Gateway Cities as Multi-Cultural Hubs: The History and Potential Future of Tuen Mun, Hong Kong as a Reception Area to Facilitate Regional Migration

Jing SONG [1,*], Nai Huei Casey WANG [2] and Jeroen VAN AMEIJDE [3]

[1] School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; e-mail: songjing@link.cuhk.edu.hk
[2] School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; casey_wang@blend-arch.com
[3] School of Architecture, The Chinese University of Hong Kong, Hong Kong SAR, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305
* Corresponding author

Research highlights

1) This paper explores the social background, living space, and community forms of Tuen Mun, Hong Kong, and examines how public spaces can support a vibrant, diverse, and interconnected community.

2) Using a waterfront and street space as case study sites, field observation studies were done to analyse the use of different types of public space by different people, and the relationships between people's behavioural preferences and spatial diversity.

3) Based on the research, the paper summarizes the key qualities and attributes of public space that can support diverse communities, including spaces for daily life, sociality, affordability, heterogeneity and management.

Keywords: Multi-culture, public space, waterfront, street space

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1. Introduction

In the era of globalisation, immigration has increased and is occurring from the global south to the north, and east to west across most of the world (Kritz, 2015). Hong Kong, as a global city, has established itself as one of the world's major destinations for tourists, business visitors, and immigration (GovHK, 2020). Immigrants are transforming the city into a diversified ethnic mixture, and at the same time, bringing some challenges. Recent arrivals often experience low-income job opportunities, a shortage of social facilities, and a lack of understanding of their social and cultural needs (Qadeer, 2018). Therefore, strategies are being developed to create a multicultural city that supports diverse populations: people from different ethnic backgrounds can live together and can contribute to the development of society.

'Multicultural planning' is a term mentioned by urban theorists in relation to diversity, as part of the important qualities of a vibrant city (Qadeer, 2018). Diversity, as well as equality, are two important drivers of multicultural planning and form an inclusive model that meets the needs of multiple groups, balancing cultural differences and social cohesion (Kymlicka, 2007). Some North American cities have implemented policies based on multicultural planning theory: Chinatowns, Latin barrios, or Russian neighbourhoods, community fairs, parades, and nationality days (Qadeer, 2018), and a large portion of these policies and activities materialise in public spaces. High-quality public spaces are considered as "spaces where groups of cultural and ethnic diversity can harmoniously

coexist" (Mulgan et al., 2006, p. 28). They provide people with opportunities to interact and connect, which helps to break down the social barriers that often separate them (Knapp, 2009), and support multicultural social activities.

Multicultural planning scholars have focused their attention on incorporating the voices of ethnic minorities into urban planning and promoting the possibility of their participation in decision-making, which is considered one of the methods to make planning more inclusive (Qadeer, 2018). However, how multiculturalism can be integrated into urban design has not received much attention. By studying multiculturalism and studying how multicultural spaces are used in cities, designers can better understand how public spaces can serve all groups in the community and enable the community to benefit from the diversity and inclusiveness of public space. Scholars have emphasized that planning theory should be framed around social goals rather than methodology, and "planning frameworks must enable planners to make calculations about 'what should be done,' not just 'how it is done'" (Fincher and Iveson, 2008, p. 5).

This study takes Tuen Mun, Hong Kong as a case study site. This new town is located along a strategic development corridor between Macau, Hong Kong, and Shenzhen, and forms a potentially important gateway for Hong Kong. Since the 1970s, the government's plan to develop new towns has brought industrial development and population growth to Tuen Mun, but its business districts and higher education sectors have not flourished (Butler and McKittrick, 1989), resulting in high proportions of the population having to commute. The lower cost of housing makes Tuen Mun a popular residential choice for recent immigrants. Recent investments and urban development have not benefited the low-income areas, and aging public facilities that are unable to meet diverse needs of residents from Mainland China, Indonesia, India, Pakistan and the Philippines. The lack of culturally-specific public facilities leads to a perceived lack of support and inclusion, and to the increase in social segregation across the town and Hong Kong as a whole.

This paper explores the multi-cultural uses of public spaces in Tuen Mun, Hong Kong, and examines how public spaces can be improved to support a vibrant, diverse, and interconnected community. It documents the historic and social background, living conditions, and the public space activities at several case study sites, and formulates insights and recommendations around inclusive public space design for multi-cultural urban communities.

2. Theories and Methods

2.1 Public space theory

The theoretical literature on multiculturalism and multicultural planning emphasizes the need to recognise the differences that exist around the beliefs and customs in urban planning and design processes, and to stimulate these diverse voices to express themselves in response to different design challenges, requirements, and points of view of diverse stakeholder groups.

The literature related to public space and multicultural planning focuses on urban spaces as platforms for cross-cultural communication, acknowledging that people with different backgrounds have different needs and uses for public space. Scholars focus on the symbolic significance of cultural spaces, the natural enjoyment of landscapes and urban environments, and on the appropriate provision of public facilities (Risbeth, 2001). At the same time, Allweil and Kallus (2008) used the concept of 'public space heterotopias' to analyse how sub-cultures can appropriate public spaces to establish a presence and dialogue with dominant cultural norms, to enable gradual emancipation of these subcultures and achieve societal progress.

2.2 Public space analysis methods

As Tuen Mun is a new town located along an important new development corridor between Hong Kong and Mainland China, the expansion and diversification of its population will continue to accelerate. Tuen Mun's diverse population and potential for cultural exchange will bring different groups into public spaces. Therefore, exploring differences in daily life should be a part of urban design research for the region.

For this research, we define 'public space' as publicly-owned area that is open to the public (Carr et al., 1992). The typological research focuses on two important public space

types in Tuen Mun: streets and waterfront spaces. According to statistics on ethnography from the Hong Kong Social Welfare Department, the proportion of ethnic minorities in Tuen Mun is about 4.2%, most of which come from Pakistan and the Philippines. Demographic data shows that the population of Tuen Mun is evenly distributed among different age groups. Therefore, exploring the differential use of public space by different age groups and ethnic minorities should be an important part of this research.

Based on Jan Gehl's public space context and observation methods, direct observation methods were used to help understand why some spaces are used, but others are not (Gehl and Svarre, 2013). In Hong Kong, the afternoon of a rest day is the time when public spaces are most frequently used (Lai, 2018). Therefore, we selected hour-long time slots in the afternoon of a weekend with good weather conditions to observe and record snapshot observations. As the scope of this research allowed for limited field research, it is intended to formulate first insights and derive general conclusions, and is intended to inform future studies that will use more structured and large-scale data gathering. Referring to guidelines for a qualitative and quantitative methods for ethnographic studies by Low (2019), several observational techniques were combined, with the goal to construct a basic understanding of some typical activity patterns at different locations. People's behaviour in public spaces were documented by mapping and categorising various activities and group types into sub-categories. Activities in Tuen Mun's public space were recorded through calculation, mapping, and tracking (Table 1). Based on these results, we determine some of the factors that affect multicultural activities in public space, and that could be identified as potential opportunities for the development of diverse and inclusive public spaces in Tuen Mun.

Table 1: Analysis of the use of space

	Different Groups of People
Counting	• Calculate how many people are active in the public space surveyed (P). • Count the number of times of use by different groups of people (G). • Calculate the ratio of the two (G/P)
Mapping	• Record the position of people in the public space, reflecting the density of people in the area. • Record the activities of different groups.

3. Results

3.1. Activity results of different groups on waterfront space, Tuen Mun

Our study firstly investigated the butterfly Bay waterfront, which is mainly composed of three types of space: the promenade, the waterfront plaza, and the beach area, which attracts nearby residents and tourists due to its beautiful seascape and convenient public transport connectivity. According to the observation methods and the analysis procedures outlined above, the activity preference of different people in Butterfly Bay waterfront was mapped (Figure 1) and behavioural preference data was summarised (Table 2).

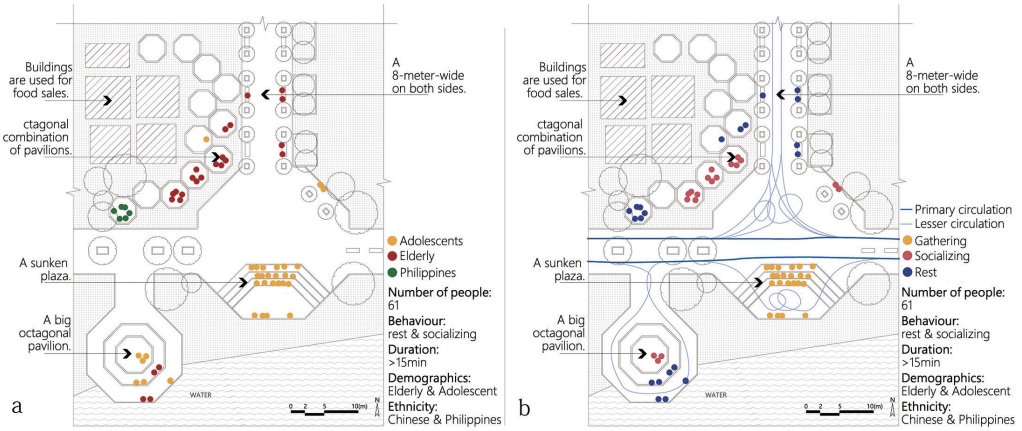

Figure 1: a) the locations of different user groups; b) activities and circulation

Table 2: Activity observations and counts.

Observed activity [a]	Elderlies (person/ratio)	Adolescents (person/ratio)	Children (person/ratio)	Filipinos (person/ratio)
Resting on seating	18/11.1%	2/1.2%	0/0	2/1.2%
Resting on the lawn	0/0	0/0	0/0	10/6.1%
Resting in a pavilion	6/3.7%	4/2.5%	0/0	6/3.7%
Resting by the beach	2/1.2%	0/0	0/0	3/1.9%
Gathering in the square	43/26.5%	22/13.6%	0/0	0/0
Playing	0/0	6/3.7%	9/5.6%	0/0
Socialising	13/8.0%	5/3.1%	0/0	2/1.2%

[a] Counts taken on Saturday, 3rd July 2021, 3.20 – 4.20 p.m.

Based on the above investigation and analysis, the following conclusions are drawn:

- Elderly people have a higher utilisation rate of resting facilities (benches and pavilions), and they prefer to rest on seaside benches with good environment and good air circulation, indicating a sensitivity to overall landscape experience.
- Assembly square and the beach are places where people are most likely to meet, reflecting a high degree of crowd interaction. Both the elderly and teenagers like to hang out in the assembly square, and the open square provides opportunities for different cultural activities to collide.
- Filipino domestic helpers are a special group of public space users with different behaviours from other groups. They like to choose relatively hidden spaces in public areas for activities, including resting, singing, making phone calls, and socialising. These spaces are often surrounded by greenery and have a certain territoriality, but they do not prevent communication with people in other spaces, such as visual and verbal communication. The spaces obtain heterotopic characteristics, which implies that the temporary appropriation of space by a distinct group of users creates a state of 'otherness,' and the space becomes a form of private territory separated from the adjoining public domain.

3.2. Activity results of different groups on street space, Tuen Mun

Kai Man Path is a pedestrian street in the centre of Tuen Mun, less than 100 metres away from the Tuen Mun MTR station. It is an open-air living market popular with local residents. The street is oriented from north to south, with dozens of large and small shops on both sides. It is famous for its low prices and rich variety of goods. This is a vibrant street full of people and activities. The surrounding local residents, Filipino and Indonesian domestic helpers, often visit here to purchase daily necessities. For our study, Kai Man Path and Yan Qi Town Square on the east side were chosen to analyse the significance of streets as public spaces for multiculturalism (Figure 2) (Table 3).

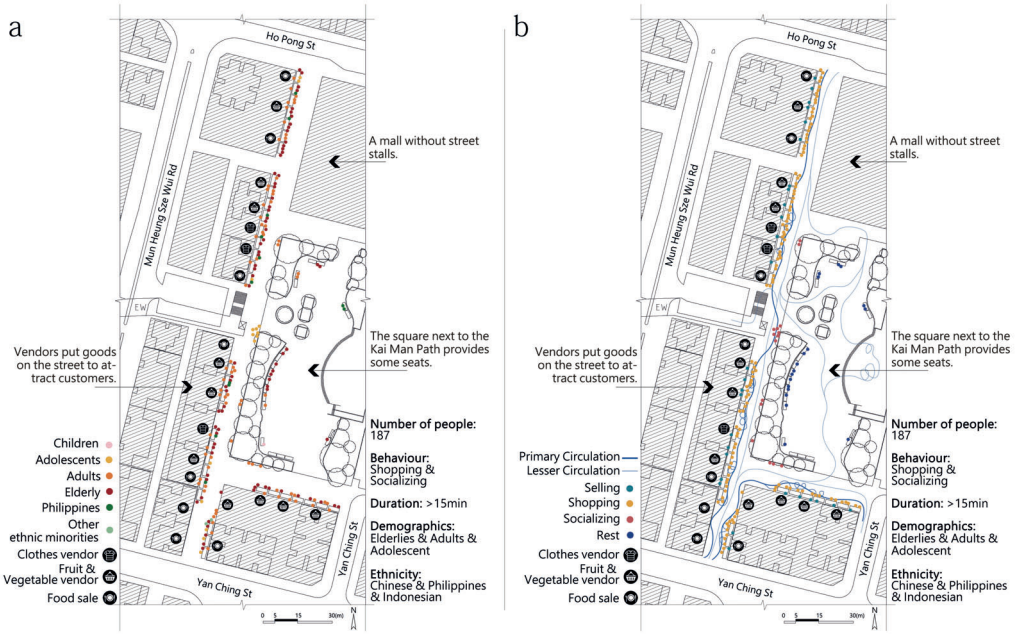

Figure 2: a) the location of different user groups; b) activities and circulation

Table 3: Activity observations and counts.

Observed activity [a]	Elderlies (person/ratio)	Adolescents (person/ratio)	Adults (person/ratio)	Filipinos (person/ratio)
Selling	0/0	0/0	29/15.6%	0/0
Shopping	68/36.4%	8/4.3%	31/16.6%	10/5.4%
Socializing	0/0	7/3.7%	8/4.3%	0/0
Rest	11/5.9%	0/0	4/2.1%	2/1.1%

[a] Counts taken on Sunday, 11th July 2021, 2.15 – 3.15 p.m.

On Kai Man Path, the street is used as an extension of internal space of many shops. The stalls and commodities on the street are arranged in a random pattern. It is difficult to see the boundaries that separate adjacent stalls. Clothes, bags, vegetables, and fruits are hung on street awnings or on simple shelves outside the stores. The price and sales items are marked on the product, and customers can experience the product and evaluate the price on the street without having to walk into the store.

Space users can move freely between shops with blurred boundaries to choose the most suitable products for their price and quality. In this process, various groups (different ages, identities, races) meet and interact. These intersections connect people in society, encourage the expression of different identities, and enhance social and cultural significance. In addition to commodity trading, the street also has social attributes. For example, two young people singing on the street attracted a number of onlookers, and amongst this audience, spontaneous communication between people who did not know each other occurred.

The crowd activities on Kai Man Path reflect that the culture here is not displayed through the characteristics and forms of buildings or the symbolic cultural elements mentioned by Rishbeth (2001), but in the non-fixed elements of the street, including the products, the visual features formed by the complex arrangement, the odours produced by various foods, the sounds of street performers and vendors, etc. Kai Man Path is a good reflection of the personal exchanges and cultural collisions brought about by the street space as a 'daily life theatre.' Affordable and busy adjacent street shops and social behaviours related to shopping create a lively and attractive street atmosphere, and the communities supported by these spaces will become more diverse and vibrant.

4. Discussion and conclusions

This study has explored the multi-faceted aspects around the urban design of multicultural public spaces, through literature and case study investigations in Tuen Mun, Hong Kong. The following summary highlights the key qualities and attributes that public spaces need to have, to support a vibrant, diverse, and interconnected community.

A space for daily life

The study shows that people come to public spaces because of economic, functional, and social factors, in line with Bridge and Watson's notion that public space is a "theatre of daily life" (2000, p. 251). As shown in the survey of Tuen Mun streets and waterfront spaces, people buy goods and daily necessities in the streets, and take a walk or rest on the seaside. Freedom and social activities are often mixed with functional activities, different activities occur in mutual integration and support. The popular fruit and gourmet shops in the streets and the most used public facilities in the waterfront space attract people of different identities, ages, and ethnic groups. These places are regarded as destinations for everyday shopping, eating, resting, walking, and socialising activities. It can be concluded that mixed-use public spaces, which are part of everyday life, should play a significant role amongst the various considerations in the urban design process. Attention should be given to locate spaces and facilities that support diverse and multicultural activities.

Sociality

In the case of the Tuen Mun beach area, it was found that places where gatherings and religious activities are held intersect closely with the pedestrian flows, and people passing by stopped to watch or ask questions that generated exchanges. Similarly, in the analysis of the Kai Man Path, the street performances occurred at a location with the highest amount of pedestrian traffic and intersections, and people stayed and gathered to discuss, and as a result, interact with strangers. Similar to the mechanisms of 'triangulation' described by sociologists (Dines and Cattell, 2006; Whyte, 1980), it was found that vibrant and mixed-use public spaces can lead to spontaneous social interaction between different types of people.

Affordability

Economic usability, or the possibility to participate in public space activities based on cost and affordability, is an important factor in attracting people from different social groups to public spaces. Because inequality is often associated with immigrant populations, socio-economic conditions have an important impact on ethnic minorities' social segregation or integration. In our study, the low-priced goods and services along Kai Man Path attract Filipinos and Indonesians, and also Chinese Hong Kong residents of different ages. Although social class and economic opportunities inevitably influence perceptions and choices, affordable public spaces can bring different kinds of people together, regardless of background. We conclude that urban planning and management policies should be formulated to maintain affordable consumptions and services and facilitate free activities and events that reinforce the public character of public space.

Heterogeneity

Heterogeneity is an important notion in the creation of a vibrant, diverse, and interconnected community. The concept implies not only the differentiation and diversification of public space, but also to give the public the possibility to appropriate and co-develop spaces as part of a natural social evolution. In the investigation of the waterfront space in Tuen Mun, domestic helpers from the Philippines established their

own order in secluded and unconventional urban spaces and displayed their own culture in contrast to mainstream culture. The broadcasting of identity through image and sound establishes a dialogue with the wider public, and helps to create an awareness, understanding, or respect for the domestic helpers' cultural and social backgrounds. These 'public space heterotopias' as described by Allweil and Kallus (2008) could help to achieve emancipation of ethnic minorities, immigrant populations within the wider society and support the exchange of cultures and ideas to inspire societal progress. It can be concluded that besides inclusive urban design, regulation, and management policies for public space activities should be adjusted to assure the comfortable use of public spaces by people from minority cultures.

Management

To strengthen the publicness of public spaces, the degree to which social functions and activities are allowed or stimulated is very important. As an open open-air market, Kai Man Path has various social functions. Different people in Butterfly Bay beach like social activities. Therefore, we conclude that an open-ended approach to different types of social functions and activities should be adopted in the design and management of public spaces, incorporating possibilities for future changes. Pugalis (2009b) emphasized the notion of 'spatial activity planning,' to create vibrant and economically sustainable spaces. In some public spaces in Tuen Mun, due to the constraints of management and social norms, the activities observed were not diversified in line with the full potential of the spaces.

From precedent examples it can be seen how urban designers can help unite local governmental and non-governmental organisations (NGOs) to support street performers, artists, and cultural events representing various cultures or ethnic minorities. These informal social functions, centred around food, music, or art, enrich the cultural diversity of public spaces, and at the same time open a door for the exchanges between ethnic minorities and mainstream culture. Moreover, they create shared spaces for people to experience different and mixed cultures. The study of Tuen Mun shows the positive influence of social functions and activities on the diversity of public spaces, and their impact on the expansion of inclusiveness and publicness of the spaces of the multi-cultural city.

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A 'Cultural District' to Amend Urban Identity: A Framework to Evaluate Cultural Projects in Hong Kong and Shenzhen

WANG Haowen [1,*], Nai Hui Casey WANG [2] and Jeroen VAN AMEIJDE [3]

[1] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; 1155146151@link.cuhk.edu.hk
[2] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; casey_wang@blend-arch.com
[3] School of Architecture, The Chinese University of Hong Kong, Hong Kong, China; jeroen.vanameijde@cuhk.edu.hk; 0000-0002-3635-3305

Research highlights

1) Urban identity is often associated with landmark cultural buildings. This paper focuses on whether the construction of similar projects in rapidly developing new cities can promote the establishment of urban identity.

2) Examples from Bilbao, Paris, and London show how cultural projects are successful if they represent are part of a wider initiatives across local societies and are open to public participation.

3) A new framework is formulated to evaluate the notion of urban identity at the global, regional, and local levels. The framework is applied to Shenzhen's Futian Civic Centre and Hong Kong's West Kowloon Cultural District, highlighting opportunities for improvement.

4) It is concluded that for the establishment of urban identity through cultural projects, these need to be rooted in the cultural evolution and development of the city, combined with its future development direction, and connect into the daily life of residents.

Keywords: urban identity; cultural strategies; urbanisation; public space

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Caroline Newton
Lei Qu

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Lei Qu
Marcin Dąbrowski

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1. Introduction

The notion of urban identity in a city is constructed from three different, but overlapping levels: global, regional, and local (Cheshmehzangi, 2015). At the global level, urban identity is mostly perceived and visual. It uses symbols or a broad image of a city, associating it with uniqueness and characteristics recognised worldwide, such as the Petronas Towers which represent Kuala Lumpur, Malaysia. At the regional level, urban identity is used to distinguish districts from other areas while keeping associations with other parts. At this level, identity can be shaped within the scope of the urban region or wider country. Examples include "Soho" and "Brick Lane" in London (Johnson, 2006). Urban identity at the local level goes beyond physical and visual properties and is defined as an interactive relationship between people and space (Lalli, 1988). At this level, urban identity reflects the details of social nodes such as public domain, public spaces, and city squares. This level is the most critical and practical level of urban identity. Examples are Federation Square in Melbourne and Edinburgh City Centre in Scotland.

Research shows that people's understanding of urban identity will change with different times and stages of urban development. Hence, it is feasible to attempt to shape and change urban identity through strategies for urban planning and design (Oktay & Bala, 2015). Current research around urban identity concludes that 'urban renaissance' can be promoted by 'cultural renaissance,' combining urban identity with local history and

making identity part of an overall urban development strategy (Radstorm, 2014). Specific measures to this end can include protecting the city's cultural heritage and organising cultural activities. Policies and initiatives around local culture help shape urban identity at different levels.

There are different opinions on the effectiveness of policies for promoting urban identity. Some scholars propose that cultural activities positively impact urban identity, but tangible physical elements are still the most dominant factors (Richards & Wilson, 2014). Heritage protection policies by local governments often do not effectively address the development opportunities of urban districts and the needs and aspirations of local residents. The scope of activities of cultural facilities is often small, and they often do not promote the cultural development of a broad and diverse population. To serve the mixed demographics of contemporary cities, cultural development strategies should pay attention to social equity and consider both visitors and local residents (Fainstein, 2007).

During the recent impact of the global pandemic, such as the severe reduction of urban tourism, it has become more apparent that aspects of urban identity are formed by local communities, and policy efforts should be increased around urban identity and development at the local level, instead of focusing on the global and regional levels. There is a need for a comprehensive evaluation of future and ongoing cultural projects, to see if they will improve urban identity in all aspects.

Knowledge gap

Evaluation methods around urban identity focus most often on theoretical research, questionnaire surveys, and matrix analyses to carry out quantitative and qualitative research (Pazhuhan et al., 2020). Existing studies mainly focus on the impact of cultural strategies on tourism, public space, and users. According to our introduction of the theoretical aspects of urban identity, the impact of urban identity on cities and residents is reflected in three levels, and most existing research focuses only on the global level. Few current studies are evaluating the comprehensive impact of cultural strategies on urban identity and how this can improve the quality of life of ordinary local residents. This paper focuses on the question whether urban identity can be constructed or improved through urban planning and design, to benefit the image of the city through impacting the production and experience of urban culture. Our study focuses on the phenomenon of the 'cultural district,' large urban development projects that house new cultural institutions and public spaces designed to boost a city's reputation on the world stage.

Study area: Shenzhen & Hong Kong

Our study was applied to Shenzhen and Hong Kong, two neighbouring cities that are in different stages of development, but which are both constructing a range of new cultural centres as part of the continued economic and societal development of the Greater Bay Area. The development of Shenzhen is based on the cultural amalgamation of historic settlements and new communities within the last 50 years. The accumulation of town and village enterprises and the contribution of migrant workers in Shenzhen, together with favourable policies by China's central government, resulted in Shenzhen's rapid urban growth and economic success (Du, 2020). The development of Hong Kong, which was founded as a free trade, market driven port city, continues to be driven by its geographical and geopolitically strategic location and historical factors. Its identity as a city is formed by the combination of local traditional and western culture, while globalisation has given Hong Kong unique characteristics.

This paper proposes an evaluation system to assess the ability of urban cultural facilities to contribute to the building of urban identity. The evaluation system focuses on the global, regional, and local levels of identity formulation, and explores that the benefits of the production of culture and identity for local residents. Our study included analysis of precedents, including the Guggenheim Museum Bilbao, Les Grands Projects in Paris, and the South Bank in London. Through a comparative analysis of these cases, a comprehensive evaluation system based on three levels of urban identity was constructed. Subsequently, the history and urban development of Shenzhen and Hong Kong were

studied and the evaluation system was applied to evaluate aspects around existing cultural projects in both locations, and identify opportunities for improvement.

2. Case Study Analyses

The Guggenheim Museum Bilbao

The successful transformation of Bilbao, Spain is accomplished thanks to systematic government planning, detailed planning, and design of the urban transformation and the effective implementation of the plan. The Guggenheim Museum Bilbao has helped create a unique global image for the city. The success of this is not only due to the architecture designed by Gehry, but also due to the promotion of Bilbao as a creative city. The Guggenheim Museum Bilbao, promoted by the government, represents the new positioning of Bilbao and is a driving force in establishing its new identity as a cultural destination. While the museum building does not fully reflect the wide cultural offerings of the city of Bilbao, it is an effective representation of its new urban identity.

Les Grands Projects in Paris

The Grands Projects in Paris are a series of cultural projects, historic buildings, comprehensive parks, public buildings, and administrative institutions, aimed reaffirming the cultural, economic, and political identity of the city and the nation from the 1990s onwards. The Grands Projects inherit the country's historical and cultural achievements, provide the public with cultural activities and leisure space, provide public service places, strengthen the connection with the surrounding areas, and represent the country's advanced science and technology development direction. They create a unique global image for the city and the country and lay the foundation for future development.

The South Bank in London

The South Bank is key cultural district in London, home to iconic cultural institutes and public spaces. The South Bank regeneration project, implemented from 1999–2007, has successfully created a unique set of urban spaces in London. The site's identity, building on the legacy of the Festival of Britain and the innovative brutalist Southbank Centre, was strengthened by improving the quality of its public spaces. More mixed-use programming and public space activities have given new meaning to the site's heritage, offering new lifestyle options to local residents, increasing a sense of identity and pride for Londoners and representing the city's multi-cultural characteristics.

3. An Urban Identity Evaluation System

3.1 Evaluation System

The three case studies show how an urban identity can be created at global, regional, and local levels. Our study summarises the key factors that facilitate urban identity at each level and based on the characteristics and strengths of each case, formulate an evaluation system. The evaluation indicators are shown in Table 1.

Table 1. Urban Identity Evaluation System

Levels	Parameters
Global	1. A unique global city image 2. Economic benefits: including income from tourism, for macro and regional level
Regional	3. A unified and unique urban landscape 4. Promoting the development of regional economy
Local	5. Public Space: distribution of main functional areas, functions of public space, traffic conditions, and geographical location 6. User experience of different groups

3.2 Application of the evaluation system - Shenzhen

The Futian Civic Centre

Completed in 2004, the Futian Civic Centre is close to the central business district of Shenzhen and is the seat of Shenzhen municipal government. At the same time, it contains many other functions, such as offices, museums, and conference centres.

From the perspective of global image, the Futian Civic Centre has a unique architecture, but it has not attracted the world's attention. And Shenzhen is not attracting tourists from all over the world. At the regional level, the Futian Civic Centre area has a strict and formal landscape style, but which does not exhibit unique regional characteristics. From the perspective of economic development, the area is a successful part of Shenzhen's urban renewal and transformation, and it symbolises Shenzhen's economic transformation (Wen, 2018). At the local level, the public spaces in the Futian Civic Centre are too ample and not pleasant due to their impersonal scale, as Figure 1 indicates. They are lacking detail and programming and are highly contrasting with the surrounding urban fabric. Plans to upgrade the urban design and function mix are currently underway, to facilitate more leisure activities for Shenzhen residents and improve the vitality of the surrounding area (Lv, 2018).

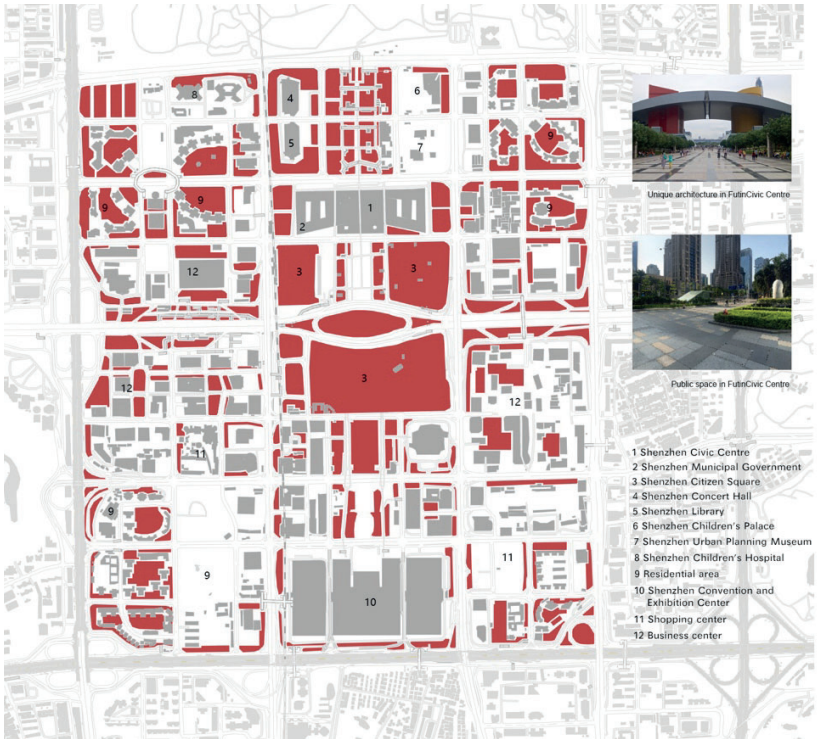

Figure 1. Master Plan of the Futian Civic Centre (source: author; https://www.da-viddu.com/2015/10/22/sz-civic-centre/)

Shenzhen's urban identity is based on the city's recent history of rapid economic development, and its future direction in high-tech and creative industries. Preferential policies have focused on development opportunities for businesses, and public spaces have only recently become part of the urban development strategy. Cultural spaces are not yet facilitating an improved quality of life for all residents, such as residents of urban villages which are an indispensable group in constructing urban identity (Jin & Xu, 2020).

With Shenzhen's gradual internationalisation and industrial upgrading, Shenzhen citizens are paying more attention to the prosperity of spiritual life. The Shenzhen Opera House in Shenzhen aims to introduce high-end culture into Shenzhen and into the daily

life of Shenzhen citizens. However, the proposed architecture, characterised by eye-catching and complex shapes, is not integrated into the urban fabric. The adjacent Qianhai Centre is the new development focus of the Greater Bay Area and even China. The construction of premier cultural venues here has the potential to inspire and upgrade the cultural life of the entire district. The urban setting of the cultural facilities should therefore address the existing urban structure and landscape characteristics to create new public spaces that are integrated into the urban fabric, and have the right scale, facilities, and flexibility to meet the needs of different people.

3.3 Application of the evaluation system - Hong Kong

The West Kowloon Cultural District

Hong Kong's West Kowloon Cultural District is a large reclamation area currently under construction, aimed at creating a world-class cultural district to strengthen Hong Kong's status as 'Asia's World City,' incorporating local and international culture (Siu & Ku, 2008).

The urban identity created by the project aims to reference existing culture from Hong Kong and the Greater Bay Area, by incorporating institutions that feature local culture and art. The initial masterplan for the area, designed by Foster and Partners, incorporated an array of different types of public spaces including parks, promenades, streets, and alleyways that aim to create a mixed-use district that mimics the vibrancy of Hong Kong's existing urban fabric (Legislative Council of the Hong Kong, 2008). The specific aim of the architects was to extend the cultural activities into the public spaces and to "integrate the cultural venues with the everyday life of the city" (West Kowloon Cultural District Authority, 2010). As a result of the interplay between politics, stakeholders, and other economic forces, the design of the project has gone through a series of revisions. As its development is led by pragmatism and efficiency-oriented institutions, following a doctrine of private capital-led urban development tracing back to the city's foundation as a trading hub, the masterplan has incorporated a series of profit-oriented projects (Yiu, 2022). Despite these changes, the plan preserves the intention to combine cultural venues with public spaces, mixed-use facilities and recreation, similar to London's South Bank (Figure 2).

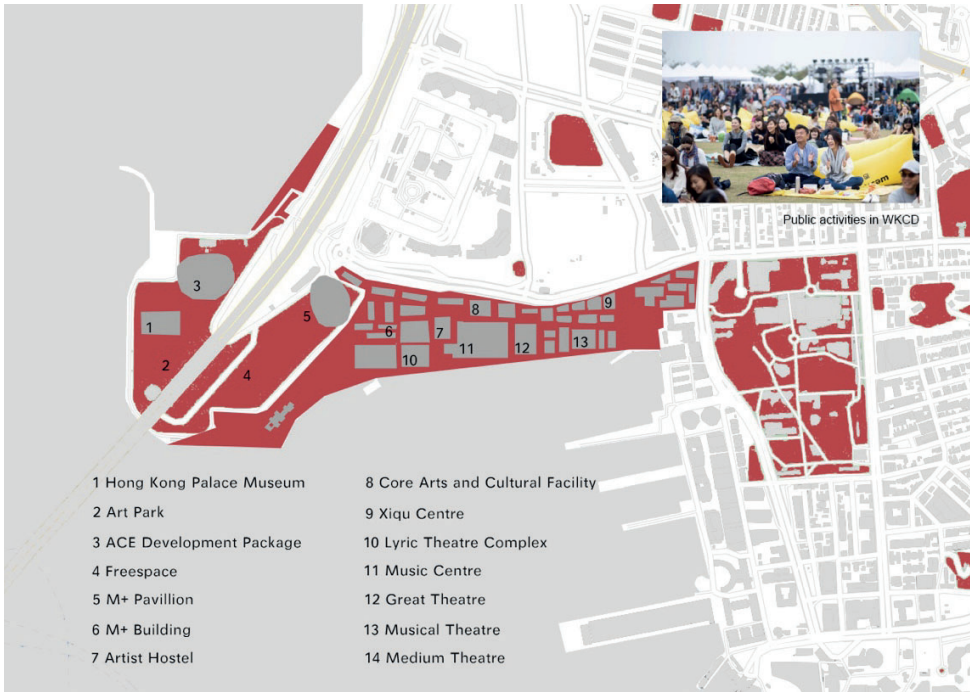

Figure 2. Master plan of the West Kowloon Cultural District (source: author; https://www.getready-hk.com/leisure-and-fun/place-to-go/item/2175-west-kowloon-art-park)

4. Discussion and conclusions

This paper has presented a multi-level evaluation system that can evaluate the contribution of urban cultural districts to the construction of urban identity, based on the study of precedents and literature. Different aspects and dimensions around the construction of urban identity were explored, focusing on the role of cultural districts, their connection to the local context and their urban characteristics. The international case study examples demonstrate how the construction of urban identity is complex and multifaceted, and show how successful precedents offer valuable lessons that could be applied to Shenzhen and Hong Kong. However, this application should accommodate the differences in temporal, socioeconomic, and political conditions. Architectural landmarks with a distinctive character could help to strengthen the identity of a city at the global level, but they cannot constitute the root of urban identity. The construction of urban identity should be based on the historical accumulation of a city's culture, the characteristics of its development and the needs of its inhabitants. At the same time, the concept of urban identity is constantly changing and can be shaped or strengthened through urban planning and design. International examples such as the Guggenheim Bilbao, Les Grands Projects in Paris, and the South Bank in London show how iconic architecture can serve as indicators of societal progress. However, the meaningful implementation of this aspiration is dependent on their assimilation and appropriation into public life through the enabling of broad cultural activities and experiences, in public spaces that are integrated into the fabric of the city.

The local level is the part of the construction of urban identity that is most closely related to the individual experience of its inhabitants, and where detailed measures or effects that impact their Right to the City are experienced. This implies that public buildings, open spaces, and management policies in urban centres should be set up to accommodate a broad range of cultural activities and expressions, inviting participation by all citizens and organised by or in response to community aspiration. As the Right to the City concept implies an inclusive approach to accessibility and co-creation, the production of cultural space in the city should represent and benefit citizens from all backgrounds, to facilitate a platform for cultural expression, exchange, and to provide a sense of belonging for all groups.

When applying these concepts to the phenomenon of the 'cultural district,' it becomes clear that these initiatives can contribute to the cultural content and identity of the city, but only when the conditions of openness, connectivity, and integration within the wider context are achieved. Successful urban centres are places that are open to transformation by their inhabitants, linked to the accumulation of cultural traditions and activities that are part of their daily life. As part of the economic and cultural development of large cities, cultural districts contain unique and accessible cultural places and public spaces that can help to improve the quality of life of their inhabitants while strengthening the regional and international image and attractiveness of the city. As research on this topic is limited, the role of cultural districts in generating urban identity should be further studied in more detail.

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Track 5

Human-centred and Nature-based Approaches in Cities

Track editors:

Dr. Claudiu Forgaci
Dr. Rene van der Velde

In the Age of the Anthropocene, people and ecosystems have been battling for their fair share of space in ever-urbanizing landscapes. Yet, it has become clear that seeking and building synergies with nature is the only sustainable strategy of urban development. In this context, urbanism needs to consider human well-being and biodiversity on an equal footing. Urban space needs to be designed, planned, governed and used as a place for dynamic socio-ecological encounters and dialogues. Let us explore and be explicit about ways in which we can better steward nature in cities while providing high quality environments for citizens.

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Transforming Leftover Spaces into a Resilient Urban Landscape in Tehran: A MICMAC analysis of Key Social-Ecological Factors

Maryam Naghibi [1, *], Mohsen Faizi [2], Claudiu Forgaci [3], and Ahmad Ekhlassi [4]

[1] PhD, School of Architecture and Environmental Design, Iran University of Science and Technology; Resilience Fellow, 4TU.DeSIRE-program; maryamnghb@gmail.com ; 0000-0002-8822-6922
[2] Professor, School of Architecture and Environmental Design, Iran University of Science and Technology, Tehran, Iran, mfaizi@iust.ac.ir; 0000-0003-1022-0990
[3] Assistant Professor, Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology; c.forgaci@tudelft.nl; 0000-0003-3218-5102
[4] Associate Professor, School of Architecture and Environmental Design, Iran University of Science and Technology; ekhlassi@iust.ac.ir

Abstract: Concerning resilient urban landscapes, current research emphasizes that we can no longer ignore ecological systems and social aspects. Thus, planning and design approaches must fundamentally address public needs and preferences. This research focuses on resilience from a community, infrastructure, social-ecological perspective, while there are still considerable gaps in integrated and holistic views on resilience. Moreover, providing more public spaces is a challenge, especially in cities with a high population density. Considering vacancy as an underexplored resource for socio-ecological benefits, this study intends to demonstrate how intervention in urban leftover spaces can transform into socio-ecological landscapes contributing to urban resilience. Moreover, choosing the design intervention will directly influence the vacancy; therefore, user preferences should be considered. With an analysis of critical aspects through experts' opinions of landscape resilience in leftover spaces, the paper shows that *Flexibility* was the most effective, while *Activity* affected most properties. Also, to focus on human preferences, a questionnaire was distributed among 386 residents. The findings suggest that the diversity and density of trees, type of activity, and water may create resilient urban landscapes and provoke satisfaction. The study results might inform particular research projects and interventions that consider landscape as a resource for resilience.

Keywords: Leftover spaces; Resilience; Social-ecological systems; Urban landscape

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Claudiu Forgaci
Rene van der Velde

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1. Introduction

Urbanisation is becoming a major modern problem, having widespread concerns for human well-being and natural ecosystems (Colléony & Shwartz, 2019). In the urban structure, parks can be considered the lungs of each city (Swierad & Huang, 2018) – both ecologically and socially. Green spaces implemented for ecological benefits (Klein et al., 2015; Kara & Oruç, 2021) also bring life to the urban area, enhance social quality, create opportunities for social interactions (Nordh & Østby, 2013), physical activity (Cohen et al., 2014; Klompmaker et al., 2018), recreation (Wen et al., 2018), health, and well-being (Wang & Rodiek, 2019; Chalmin-Pui et al., 2021). Thus, transformations in urban green spaces require incorporating particular humans need to be connected on multiple levels (Swierad & Huang, 2018). In this regard, previous studies have noticed that limited spatial access to green spaces (Barbosa et al., 2007; Rigolon et al., 2018), as well as those inadequate or poorly maintained (Bahriny & Bell, 2020) were some of the most critical concerns. Conversely, it is not easy and generally out of budget to find new public spaces (Lokman, 2017).

Besides conventional open (green) spaces, there are spatial discontinuities in urban landscapes, like leftover spaces that present areas of great potential for ecological research, social experiences, and the development of cities (Naghibi et al., 2020). In addition to providing alternative spaces where humans and nonhumans can interact (Pearsall & Lucas, 2014), vacant land can lead to community revitalisation and reclaiming neighborhoods (Gobster et al., 2020), and encourage multiculturalism. It also demonstrates how unoccupied land may contribute to urban greening.

Concerning resilient urban landscapes, current research emphasizes that neither ecological systems nor social factors can be ignored (Crowe & Foley, 2017). Social and ecological values can be intertwined; transforming unpleasing landscape spaces into community engagement, and opportunities for increasing the resilience of social-ecological systems may emerge (Folke, 2006; Kremer et al., 2013). In this regard, resilience theory presents insights into socio-ecological systems and their sustainable management (Folke, 2006).

Rather than problematizing these spaces (Gobster et al., 2020), leftover areas are proposed to be transformed into green and open space development and management (Kim, 2018). When occupancy and care replace signs of abandonment and neglect, repurposed leftover spaces within previously dense city regions can contribute to community cohesion and a sense of place (Stewart, 2019).

Considering vacancy as a potential socio-ecological resource (Kremer et al., 2013; Anderson & Minor, 2017), this study intends to demonstrate how intervention in urban leftover spaces could transform into socio-ecological landscapes contributing to urban resilience. Moreover, choosing the design intervention will directly affect limiting the unoccupied spaces; hence, public needs and priorities should be assessed (Palamar, 2010).

The current study addressed a socio-ecological framework through the mixed methodology recognising cities as human-centered environments developed and maintained for citizens. It is suggested that by assessing vacancy, socio-ecological characteristics of neighborhoods that contain leftover spaces, landscape architects and urban planners may support resilient landscapes more effectively (Kremer et al., 2013).

2. Theories and Methods

Trancik's *Finding Lost Space* (1986) introduced the notion of prescriptive lost space, in which he proposes that lost spaces are unpleasant and unproductive zones devoid of community. Because the cultural environment is linked to the people's character, Trancik believes it is critical to comprehend their perceptions. Despite the relevance of this study, he did not conduct any interviews with users to further inform his concept of space or place, whether lost or not.

According to Lynch (1960), rather than considering the city as an object, how the city is perceived by its residents is critical. Moudon (2003) highlights the urban design discipline's dilemma, namely the dichotomy between its prescriptive and descriptive natures, arguing that the former emphasizes the "what should be" while the latter emphasizes the "what is." Urban design is as much about understanding "what should be" as it is about understanding "what is," and one of her recurring criticisms of this dichotomy is that urban designers often overthink the prescriptive "should be" without a strong knowledge of the descriptive "what is."

Based on the theoretical background, this study implements a mixed-methods research design in relation to a case study in Tehran, Iran, addressing both experts' and community opinions. Opinions were collected in the form of professionals' revisions (selection of the properties, instructions on how to fill out the tables, mapping the leftover sites), and a survey was conducted with a mix of professionals and non-professionals.

The current study conducted a three-phase methodological framework as follows:

Phase 1: A questionnaire for selecting variables of interest by twenty-two experts. Cross-Impact Matrix Multiplication Applied to Classification (MICMAC) was used to analyse data. Michel Godet (1997) developed MICMAC, a structural analysis tool for structuring

ideas. MICMAC is a qualitative system dynamics technique that allows researchers to connect all the components (Mirakyan & Guio, 2015). MICMAC can be used as a tool for reflection, decision-making, a component of a more advanced analysis process, and attempts to locate the independent and dependent factors.

Phase 2: Identify the most relevant attributes and levels using a Multi-Criteria Decision-Making (MCDM) method.

Phase 3: Distribute a questionnaire for community preferences.

2.1. Tehran case study

The study examined socio-ecologically resilient interventions on micro-leftover spaces in Tehran, Iran's capital, a densely populated metropolis with limited space (Naghibi et al., 2021). The selection of micro-leftover spaces was based on the existing facilities (mapping the sites) and possible project improvements (regarding each site's characteristics and city regulation). Considering the limited availability of open spaces in the city, developing a hierarchy among various interventions in micro-leftover spaces and identifying the essential elements representing residents' preferences in public places was critical. Spaces in Tehran were among the remaining places selected for this study. Citizens were interviewed in advance to identify the location as vacant space. Considering real cases in Tehran supports participants' better imaginations of the space and accurately evaluates the variables and preferences.

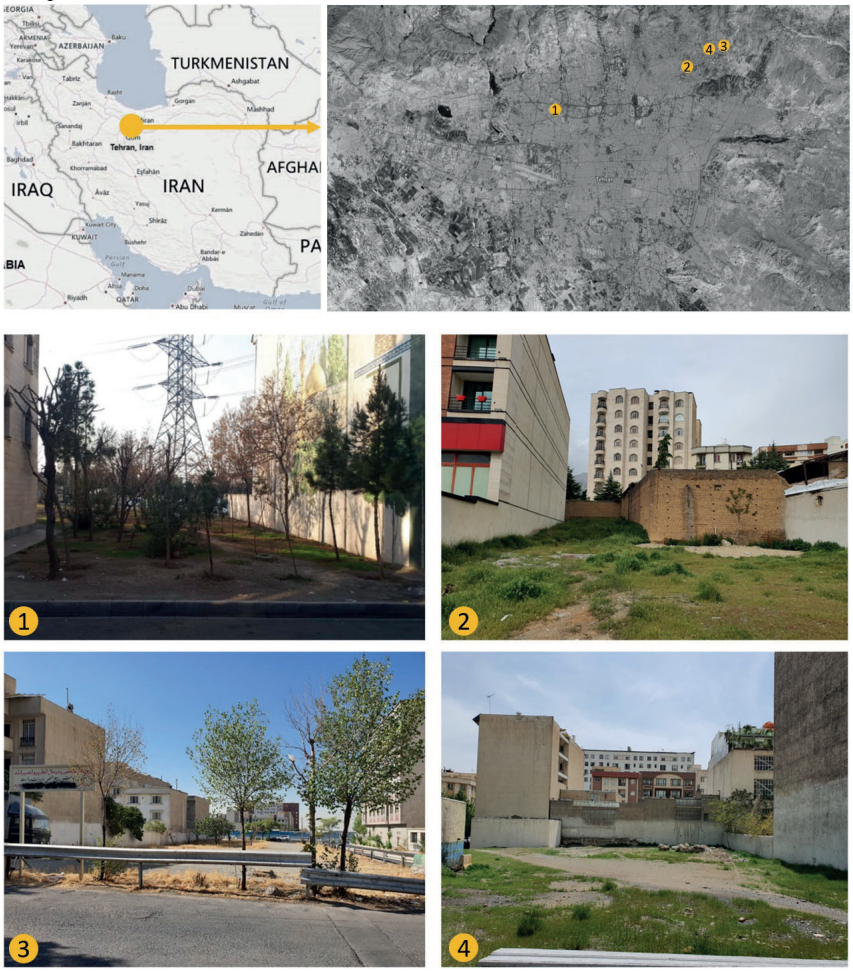

Figure 1. The location of the case study (https://www.whereig.com/iran/where-is-tehran.html)

2.2. Phase 1: Questionnaire Design for MICMAC analysis

A literature review provided the main factors to verify content validity (Lynn, 1998), and the experts evaluated the first version regarding its relevance, clarity, meaningfulness, and completeness. Thus, the first step depended on expert opinion. Twenty-two specialists

were invited from several disciplines and domains (landscape architecture, architecture, urban planning, and urban design). The data were statistically analysed in MICMAC to examine the inter-relationships between characteristics for the resilience landscape of left-over spaces. Through a graphical illustration in multiple clusters, the characteristics may be divided into four categories: autonomous, linkage, dependent, and driving.

2.3. Phase 2: Identifying the most relevant attributes and levels

In this section, the experts select the most important attributes in general. A Multi-Criteria Decision-Making (MCDM) method was used to find the optimal weight.

2.4. Phase 3: Questionnaire structure for residential preferences

As previously stated, one of the main objectives of the research was to explore the residential preferences for small urban green spaces in residential neighborhoods. This study assessed respondents' opinions of different attributes separately and explicitly, and the relative importance weight of each attribute based on residents' responses. The research was conducted in the form of a questionnaire due to the value of this approach in gathering opinions/preferences, especially when the sample size was relatively large. The questionnaire is also affordable and well-known to the majority of participants. The experimental questionnaire was divided into two sections: The first section was meant to record demographic information, while the second comprised questions about preferences for small urban green spaces. The preference questions were compiled and elaborated from the MICMAC and experts' decision presented in the previous section in five items: Flexibility, Connectivity, Activity, Density of Trees, and the Water dimension. In this section, participants were asked to evaluate each factor of leftover spaces on a four-point Likert scale (1=No Preference, 2=Slightly Prefer, 3=Strongly Prefer, 4=Very Strongly Prefer)

3. Results

3.1. Interpretation of the MICMAC questionnaire

In order to recognise the influence of each factor, it is necessary to define a hierarchal structure of the factors based on the driving and dependency power (Figure 2). Some factors may significantly influence, while others may stand alone or have just a minor role. MICMAC is an approach for better achieving the goal. It also shows how various factors are organised into distinct groups graphically. Autonomous, Dependent, Linkage, and Driving variables are the four types of factors (Kannan et al., 2009). The autonomous variables are typically ineffective drivers. Weak driver and strong dependent variables make up the dependent quadrant. The linkage variables are strong drivers and dependents, making them extremely unstable. Strong drivers that are independent are found in the independent quadrant.

The matrix must converge towards stability at the end of a certain number of iterations to demonstrate the validity. In the matrix of effective factors with three rotations of data, it is 100% desirable, indicating the high validity of the questionnaire.

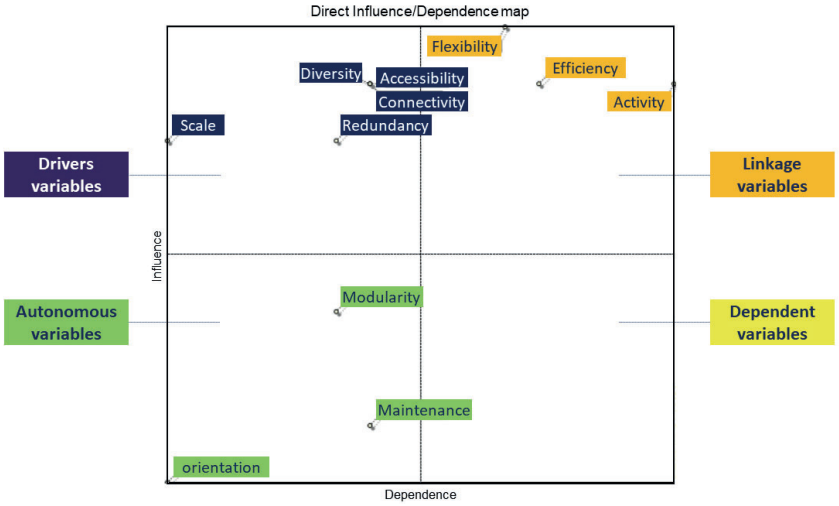

Figure 2. Pattern of variables dispersion of direct influence/dependence map

MICMAC analysis revealed further information about each factor's driving and dependency power, indicating relative importance and interdependence. The key findings of the study have been organised into four main clusters reported by MICMAC:

1. Variables with autonomy

Modularity, Maintenance, and Orientation variables have low driving and dependent power. These variables are disconnected from another resilience system in the landscape because they have so few linkages. These connections might be crucial in the long term.

2. Variables that are dependent

Quadrant-driving's power is weak, despite its high dependency power. The competence of these variables for achieving other variables is considered insignificant.

3. Linkage variables

Linkage variables such as Flexibility, Activity, and Efficiency are strong and intense in dependency and driving force. These variables are inherently unstable, and their actions will influence others.

4. Driving variables

Despite their weak dependency, Accessibility, Connectivity, Diversity, Redundancy, and Scale have high driving power, making them significant variables (Figure 2). These factors are classified as linking and driving variables.

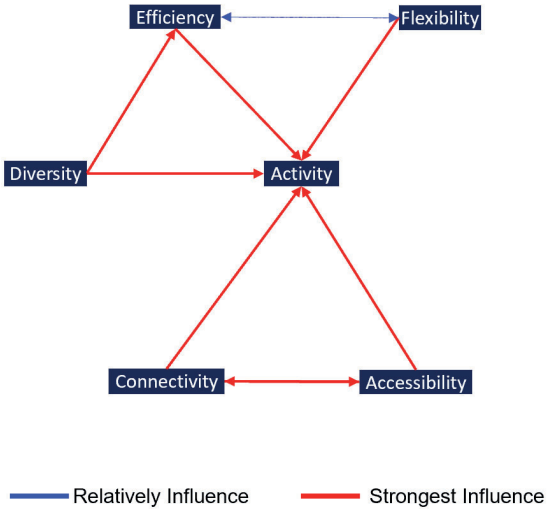

Figure 3. Direct influences graphs.

Accessibility, Efficiency, Flexibility, and Connectivity may all impact Activity, as seen in Figure 3. Efficiency is directly influenced by Flexibility, Diversity, and Activity. Furthermore, Efficiency can be influenced indirectly by Flexibility, Connectivity, Accessibility, and Activity.

3.1. Weighting Criteria

According to the experts' point of view, five factors were chosen as the critical attributes of socio-ecological resilience. The mentioned key factors of socio-ecological resilience and their levels are illustrated: Diversity and Density of Tree, Bushes, Flowers; Diversity of Pavement; Diversity of Covering; and Diversity of Planting, Water, Connectivity, Flexibility, Efficiency, and Activity.

Following the experts decided on the criterion's choice, the main attributes (flexibility, tree diversity and density, type of activity, Connectivity, and water) were determined based on the questionnaires.

Water	Tree	Connectivity (physical)	Activity	Flexibility
Small fountain	Dense trees	High Connectivity	Individual Activity (passive)	Flexible Spaces
Mirror pond	Some trees	Low Connectivity	Social Activity	Rigid Spaces
No water	A few trees		Mixed Activity	
			Recreational Activity	
			Economic Activity (community garden)	
			Green Space for Walking	

Figure 4. Attributes and levels of interest in this research

3.2. Residential preferences

This study had 386 participants. The majority of participants (n = 181) were between the ages of 25 and 34, followed by 18 to 24 years (n = 103), 35 to 44 years (n = 63), 45 to 54 years (n = 20), 55 to 64 years (n = 13), and over 65 years (n = 6). On average, 60.4 percent of participants were female, while 39.6 percent were male. The majority of the participants (n = 200) had a master's degree, and the majority of them were either students (n = 165) or employed (n=153).

Friedman's test is used to understand the hierarchy of preferences. The mean of the factors is shown according to participants' priority (Table 1). Priority ranking reveals that Activity indicators such as Individual Activity, Social Activity, and Walking achieved the highest average. The indicators with the lowest average are No-water, Low density of trees, and Rigid spaces that follow the experts' opinion.

Table 1. Friedman test results for participants' Preferences.

Index	Indicators	Mean	Std. Deviation	Mean Rank
Activity	Individual Activity	3.63	.607	12.12
	Social Activity	3.40	.722	11.01
	Walking	3.35	.729	10.75
	Mixed Activity	3.28	.715	10.40
	Play-Sport	3.25	.740	10.21
	Economic Activity	2.64	.842	7.15
Water	Fountain	3.11	.816	9.47
	Pond	3.03	.812	9.02
	No water	1.54	.739	3.07
Connectivity	High Connectivity	3.10	.828	9.45
	Low Connectivity	2.65	.879	7.35
Flexibility	Flexibility	3.09	.749	9.41
	Rigid Space	2.39	.735	6.00
Tree - density	Tree- High density	3.15	.791	9.65
	Tree- Medium density	2.65	.729	7.25
	Tree- Low density	1.73	.789	3.68

Activity reached the highest rank based on the results, followed by Water dimension, Tree density, Flexibility, and the state of Connectivity. To study the most preferred indicators of each factor, the Individual Activities ranked as the first in terms of Activity. In terms of planting density, parks with a high density of trees have the highest priority. To determine

the water elements priority, the highest mean belonged to Fountain, followed by Pond. Flexibility is the fourth factor, and the least important factor is Connectivity.

The Mann-Whitney U test is applied to compare significant differences between gender groups. The test revealed that there were significant differences in preferences of Flexibility (sig: .029), Play-Sport (sig: .003), and Mixed Activity (sig: .001). Females were more interested in Flexible spaces (Mean Rank: female 203.11, male 178.87), Mixed Activities (Mean Rank: female 207.70, male 171.87), and surprisingly Playing or exercising (Mean Rank: female 206.08, male 174.34).

In terms of Mixed Activity, the Mann-Whitney U test is employed to understand the significant differences based on gender; however, the result of the ANOVA test showed that occupation status affects participants' preferences (Levene Statistic shows that they have equal variances). There are no significant differences between professionals and non-professionals, and the education degree did not affect participants preferences (Levene Statistic shows that they have equal variances).

Table 2. The ANOVA test regarding experience

	Test of Homogeneity of Variances		ANOVA					
	Levene Statistic	Sig.		Sum of Squares	df	Mean Square	F	Sig.
occupation	.236	.918	Between Groups	5.77	4	1.443	2.88	.023
			Within Groups	190.88	381	.501		
			Total	196.65	385			
education	.763	.550	Between Groups	.88	4	.220	.42	.788
			Within Groups	195.77	381	.514		
			Total	196.65	385			

The outcomes of the Mann-Whitney U test indicated notable differences between professionals' status and preferences of trees in terms of high and medium density. A significant difference could not be detected statistically between crossed variables regarding low density. Both groups preferred a high density of trees. Both groups demonstrated a lower preference for a low density of trees.

Table 3. Mann-Whitney U test in terms of tree density

	Tree- High density	Tree- Medium density	Tree- Low density
Mann-Whitney U	12631.500	15046.500	18201.500
Wilcoxon W	30022.500	35146.500	35592.500
Z	-5.836	-3.543	-.398
Asymp. Sig. (2-tailed)	.000	.000	.690

Table 4 shows which continuous variable had the highest average value (column Mean Rank). It is, however, done only where a determined statistically meaningful difference between the crossing variables is determined. Compared to medium to high density of trees, the professionals were more interested in medium-density, demonstrating a lower preference for high density.

Table 4. Compared to medium to high density of trees

	Professional	N	Mean Rank	Sum of Ranks
Tree- High density	Yes	186	161.41	30022.50
	No	200	223.34	44668.50
	Total	386		
Tree- Medium density	Yes	186	212.60	39544.50
	No	200	175.73	35146.50
	Total	386		

Although most participants preferred flexibility for small urban parks, the results of one-way ANOVA revealed significant differences between age groups and preferences of rigid spaces (F 2.719, 5; α= 0.02). It can be seen that participants above 54 years old had the lowest preference for rigid spaces (Mean= 2). However, participants between the ages of 35 and 44 have the highest preference for these rigid spaces (Mean= 2.54).

4. Discussion

According to Forgaci (2020), urban designers and planners must translate a city's complex social-technical environmental system into resilience-building spatial changes. The dichotomy is enhanced through large-scale planning without community engagement, which originating from top-down urban concerns. This study challenges the polarised mindsets currently evidenced within planning by hypothesizing that it is not the small-scale lots concepts as problematic, but rather the dichotomizing framework and modernist legacy that characterise the concepts. The study's main objective is to explore and discuss more approaches to small-scale vacant structures. In this regard, the concept of resilience was utilised as a theoretical umbrella and applied to the case study. The recent study has highlighted that socio-ecological aspects are particularly relevant for vacant lands. They open up for community involvement and contribute more integrative and practical approaches to produce resilience thinking helpful in addressing the urban landscape dichotomies.

The categorisation of variables provides a foundation for understanding the phenomena of changes in any variable and their consequences on others. Improvements in links and dependent variables will result from incremental changes in independent variables. The study will assist transdisciplinary research in collecting data and possible multidimensional studies.

The "Flexibility" variable significantly influences on the other variables since it has a considerable impact on the future of the resilience landscape in leftover spaces (see Figure 2). Flexibility has a lot of driving and dependence power as a linking variable. Overconcentration on engineering measures puts urban systems' qualities of flexibility and adaptability at risk in the long term. The significant difference lies in the bottom-up structure of the organisation and commitment involved and the absence of a ready-made pre-existing infrastructure. Therefore, based on the findings of Mariani & Barron (2014), flexibility appears to be one of the emerging criteria for a working plan of interim use management. Thus, flexibility should be considered on both infrastructural and minor scales.

This study strives to reveal the possibilities latent in small leftover spaces, but not dictate a particular consequence. In this regard, to trace landscape in the fabric of vacancy in the city, ideas were illustrated in Figure 5. Concerning human-centered development, proposed ideas are adapted to create strategic interventions and develop knowledge on how the nature of cities can be better recognised and extended in the contemporary, unpredictable era.

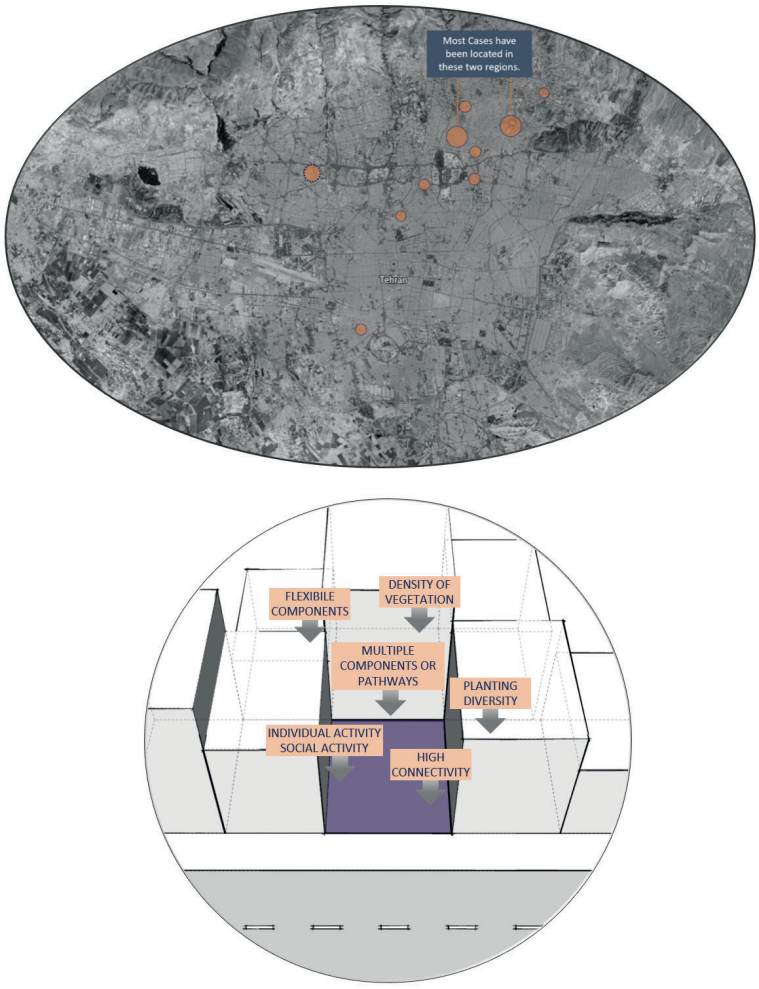

Figure 5. The compatible proposals with the sites' potentials

This study has revealed further directions in extending knowledge on leftover space through real cases. Also, future research directions would be conducted for vacant lands in varying contexts and climates to understand whether the same properties still emerge as preferences. Accordingly, future research will be required to evaluate the effects of these strategies on design decisions and monitor how resilience impacts the design process. Also, a set of design principles to measure instruments and developed in different cases could be considered. Based on the methodological challenges in the urban landscape, a design-driven research approach could shed more light on the effects of design principles derived from the findings of this paper.

In the light of recognising and intervening in small spaces for various people, methods that involve more participants will be more effective. It is also necessary to consider qualitative aspects of leftover spaces to promote resilience. It might be helpful to consider extended visual landscape quality assessment methods with user preferences to prevent these spaces from being unoccupied.

5. Conclusions

The novelty of the current study is implementing a mixed-method, a theoretical analysis concerning a case study in Tehran, concerning experts and community preferences to interpret the needs and interests of open space. Focusing on leftover spaces in Tehran, Iran, this research strengthens the idea that flexibility improves vacancy conditions. Furthermore, the findings propose that leftover spaces greening projects may achieve social and ecological goals.

Vacant land greening enhances neighborhood conditions while transferring vacancies to urban spaces can recover advantages to the neighborhoods. In comparing medium to the high density of trees, the professionals were more interested in medium-density, while they demonstrated a lower preference for high density.

Small-scale designs promote the success of city-wide programs. Large-scale approaches might not consider particular regions or areas, such as residual spaces, brownfields, and leftover spaces. In contrast, appropriate area programs can afford more opportunities and details to respond to community concerns.

Concerning the planning and design for leftover spaces, community engagement may be the critical step to determining the problem of urban spaces. The current study looked at the differences between the opinions of experts and non-professionals. While the experts consider flexibility the most critical factor, non-professionals consider activity the most important factor. Thus, multiple socio-ecological factors in metropolitan settings have resulted in the vacancy. Municipalities should be receptive to proposing suggestions from communities to use the abandoned property.

Contributor statement

Maryam Naghibi: Conceptualization, Writing – Original Draft, Visualisation, Software. **Mohsen Faizi:** Supervision, Methodology, Writing - Review & Editing. **Claudiu Forgaci:** Supervision, Writing - Review & Editing, Methodology. **Ahmad Ekhlassi:** Supervision, Validation.

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Global Approach - Local Solutions: Sectorial Planning Approaches for a Sustainable Urban Future in Piura, Peru.

Trinidad Fernandez [1,*], Stella Schroeder [2]

[1] Fraunhofer Institute for Industrial Engineering IAO, Stuttgart, Germany; trinidad.fernandez@iao.fraunhofer.de; https://orcid.org/0000-0003-4766-6689

[2] University of Piura, Piura, Peru; stella.schroeder@udep.edu.pe; https://orcid.org/0000-0001-8591-2719

* Corresponding author

Abstract:

Smart and sustainable urban development is one of the leading solutions for local adaptation strategies and the efficient use of resources. The Morgenstadt Global Smart Cities Initiative (MGI) is a project funded by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU), strengthening the development and implementation of sustainable transformation processes in cities. A sectoral approach based on empirical evidence analyses the resilience and climate risks from Piura (Peru), which is strongly affected by the consequences of climate change. The initiative uses the Morgenstadt City Lab methodology to develop integrated strategies and roadmaps for sustainable urban development. It contains a multidisciplinary survey and analysis technique. The data is leveraged by applying various methods, such as workshops, expert interviews, indicator surveys, clusters, and cross-impact analyses. Within the framework, a sustainable city profile is developed, identifying possible interventions, and co-creating project ideas with various stakeholders to improve resilience and climate change adaptation potential. The proposed solutions combine ecological and resilience objectives with opportunities for social and economic innovation that sustainably support urban development. They seek to become pilot projects and agents of sustainable integration and social inclusion that support different vulnerable communities and areas in the city.

Keywords: climate change adaptation; sustainability; smart cities; urban resilience

Names of the track editors:
Claudiu Forgaci
Rene van der Velde

Names of the reviewers:
Claudiu Forgaci
Thorsten Schuetze

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1. Introduction

The global trend of rapid urbanisation has forced cities to seek solutions that respond to different challenges in a fast problem-solving-oriented manner, emulating traditional unsustainable resource-intensive solutions and patterns (Simon, 2016). Cities contribute heavily to global climate change, responsible for roughly 70% of global greenhouse gas emissions, as well as being the hardest hit by the effects of climate change with rising temperatures worsened by air pollution and heat island effects, along dense populations facing high risks of infectious disease transmission, to name a few (OECD, 2008). Sustainable urbanisation has come to the forefront of debates, research, and policy agendas in recent years, where taking action will be especially important for developing countries, which will be most affected by the effects of climate change. A United Nations (Cousens & Szabó de Carvalho, 2020) survey revealed that climate change is one of the greatest national concerns, raising the importance of global cooperation to tackle it.

1.1 About the MGI

The MGI is a project funded by the Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU) through the International Climate Initiative (IKI) aiming at helping cities increase their resilience to climate change impacts, as well as to support their GHG emission reduction efforts. The initiative builds on the implementation of City Labs to analyse, identify, and develop sustainable cross-sectoral solutions to optimize urban infrastructures, processes, or services in Kochi (India), Piura (Peru), and Saltillo (Mexico).

As part of the IKI network, the MGI's primary objective is to mitigate the consequences of climate change in the pilot cities, to increase their resilience to climate risks, and to preserve their natural resources. The structure of the project fosters peer-to-peer learning, innovation, sustainable urban development practices, and collaboration between the local and global research communities, cities, citizens, as well as the private sector. The multi-stakeholder dialogue and the holistic urban system assessments in the participant cities are the vital elements to achieve the project's objectives. Furthermore, the project methodology supports the cities in the development and implementation of analytical methods, strategic planning tools, and the increase of local expertise for a holistic, long-term, and sustainable urban development process.

The selection of the three participant cities were based on their vulnerability and the challenges they face in terms of climate change. All of them present a high degree of urbanisation or urban growth, and have identified urbanisation as a source as well as a solution to many sustainability challenges in regional development strategies. However, India, Mexico, and Peru don't have a coherent approach that underpins urban climate change and sustainable urban development with innovative policies and efforts to develop carbon-neutral, interconnected, and sustainable technologies and infrastructures.

Altogether, the MGI initiative begins a long-term and sustainable transformation process, leading to replicable and financially viable solutions for a resource-efficient, resilient, and liveable city of tomorrow.

1.2 About Piura

The city of Piura is located in Northwestern Peru and is the capital of the region (Figure 1). The city is a service centre within a region characterised mainly by agriculture and fishing.

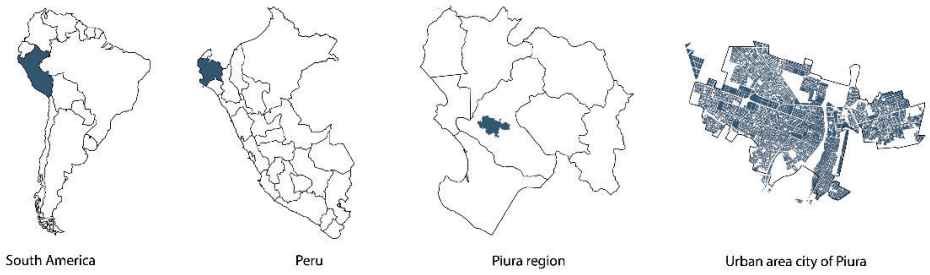

Figure 1: Location of Piura. Source: Own elaboration, 2021.

Due to its geographical location, the city and region are very vulnerable to climate change. The most important natural disaster is caused by the El Nino (FEN), a cycle of changes in water temperature and air pressure that affects regional rainfall (Broad, 2002) and which, in its last event in 2017, affected the areas surrounding the river that runs through the city, exposed to the effects of flooding (Figure 3).

Since the '70s, the city has experienced exponential urban growth and has its origin mainly in rural-urban migration, a trend that was noticed throughout the country. This has led to the informal occupation of land for residential use and has generated what is known as "land invasion" (Solá Morales i Rubió, 1997) of vulnerable land without basic water, electricity, and drainage services. The city of Piura shows sectors of urban segregation well defined by this informality.

Furthermore, the rapid growth challenges the ability of the city to respond to it led to a reduction of biodiversity, loss of agricultural land, heavy traffic producing air pollution, and increased energy consumption. In addition, the city centre of Piura is close to the riverbanks, and has become highly vulnerable to the effects of climate change, as it lacks a relationship between the city, the water, and green areas which could serve as protection

against flooding. Moreover, blind water basins cause heavy flooding during the rainy season.

Figure 2: City of Piura during FEN 2017. Source: Own photographs, 2017

1.3 Objective

Within the framework of the MGI project, City Labs are implemented to identify possible areas to intervene and co-create project ideas with various stakeholders to improve resilience and climate change adaptation potential.

As part of the wider project, the main objective of this article is to present an overview of the main findings of the sustainable city profile and the development of project ideas. The resulting roadmap aims to support the city's efforts to mitigate GHG emissions, adapt to climate change, and conserve biological diversity. The proposed solutions are based on the concepts of smart cities, resilient cities, and nature-based solutions (NBS), combining ecological and resilience objectives with opportunities for social and economic innovation that sustainably support urban development. In this context, the City Lab seeks to support Piura to become a model of innovative, locally adapted, and climate-smart solutions aimed at increasing its resilience to the impacts of climate change, and preserving and efficiently using its resources at the same time. Additionally, these solutions are nature-based and stimulate the local economy.

2. Theories and Methods

2.1. City Lab Methodology

The Morgenstadt City Lab methodology consists of an in-depth analysis of a given city to create overarching systemic understanding of how it works (Fraunhofer-Gesellschaft, 2014). Multiple City Labs have already been implemented in several cities, mostly in Europe but with some already deployed in the global south. While most urban studies are based on macroeconomic data such as population growth, economic growth, and real estate prices, the City Lab approach is based on a city as an ecosystem approach. The City Lab framework is structured on three main levels of analysis: governance, technologies and infrastructure, and socio-economic strategy. Data gathering based on performance indicators for assessing the quantifiable sustainability performance; key action fields essential for sustainable development and a digital on-site assessment where the MGI team conducts interviews with key stakeholders to identify the main challenges, opportunities, and key impact factors that influence the development of initiatives, projects, and programmes deployed in each city. The results of each City Lab include an individual sustainability profile, a detailed analysis of specific urban sectors, an action-oriented roadmap, as well as the development of innovative measures and projects.

2.2. Selection process of project ideas

Following the analysis, 35 project ideas and interventions for the city of Piura were conceptualised and categorised using a ranking tool. This tool aimed to examine which project ideas have the greatest potential to meet the needs for the city of Piura, as well as the requirements of the MGI project and to prioritize and develop the most promising ones accordingly. Each of the proposed project ideas was evaluated using this tool. The criteria considered the alignment of the ideas with the city's objectives, the engagement of local stakeholders identified during the City Lab activities, the potential for replicability within the region, as well as their potential regulatory constraints and risk of approval by different governmental levels. The tool also considered the potential for GHG mitigation and climate change adaptation, specifically considering resettlement and rehabilitation issues. Finally, the framework also ranked the projects according to their need for financial sup-

port from the public sector, the likelihood of obtaining public funding to support the project, and the interest that the measures could generate to secure the participation of the private sector for financial support in its implementation. Each of these criteria was assigned a specific score, based on the experience of previous City Labs (e.g., City Lab Coimbatore in India), as well as the KPIs of the MGI project.

3. Results

This section shows the main results of the City Lab and the relationship of the selected projects with each other and towards the sustainable development of Piura. After using the raking tool, these projects have been approved in a formal process, considering the information received during the stakeholder workshop, as well as internal workshops with local project partners.

A city vision for steering the long-term development was defined reflecting the most important challenges for the city's future. The results of the City Lab shall contribute to transform Piura into a city with adequate management of water resources and with integration of the Piura River as a recreational area. A model city of ecological, economic, and social sustainability with accessible public spaces, native vegetation, and adequate urban infrastructure designed for its inhabitants. Also, the city should have a reliable, sustainable, and equitable energy supply.

3.1. City Lab results

Figure 3 illustrates the comprehensive framework applied in Piura and its performance in the different sectors of the city analysed. In a further step, the City Lab Piura is focused on the three sectors of urban planning, energy, and water. The sectors have been selected based on the critical sustainable urban development challenges as well as local stakeholder consultation.

Figure 3: Sustainable Profile of Piura. Source: Fraunhofer IAO, 2021.

Piura is intrinsically vulnerable to climate change, largely due to its geolocation within a desert biome, making it prone to periods of drought which are becoming longer-lasting events. Experts predict that the FEN will not cause more intense rains that cause flows in the Piura River greater than those seen on previous occasions, but it will increase the frequency of such rains leading to high flows of water in the river and bringing more challenges to the increasing urbanisation. One of the most urgent challenges is an effective "territorial ordering" referring to areas at high risk of floods and extreme climatic effects, for which it is necessary to definitively determine habitable areas.

The analysis of the most critical action fields of Piura crystallized the city pathways towards sustainable development. They can be categorised into three clusters establishing digital connections and tools to improve resource efficiency; the utilisation of unique energy unexplored opportunities and favourable conditions; and the need to plan and implement sustainable development initiatives in Piura. These clusters involve major actions that are envisaged as key to the city's sustainable urban development and climate resilience of the city.

Piura's scenario is quite complex, but with great opportunities. The proposed interventions co-created in the City Lab contribute to sustainable development by considering the ecological, economic, and social pillars of sustainability necessary to prepare Piura to become a city prepared for the future challenges of climate change. Broadly speaking, the solutions aim to optimise the use of resources, seek opportunities for economic growth, and improve life quality for its citizens, emphasizing the protection of the population most vulnerable to climate change.

3.2. Sustainable urban measures

The main climate change mitigation measure would be to avoid deforestation and informal urban expansion, as well as the creation of new green areas within it, all of them closely linked to the control and ordering of the city's population growth. Furthermore, new native vegetation that needs little water can be accommodated to improve soil quality, heat islands and promote shady public spaces for citizens. Therefore, Piura has great potential to benefit from nature-based solutions (NBS). These proposals seek to take advantage of green infrastructure as a sustainable urban drainage system (SUDS) that would also provide multiple environmental, social, and even economic benefits. Three of the prioritized projects are presented in this paper because of their high potential to create resilient cities with the use of NBS. Table 1 sums up the main aspects related to their contribution to the sustainable pillars. Projects are described highlighting the key components of the project ideas, including their objectives, building blocks, implementing partners, possible funding, as well as environmental impact considerations.

Table 1: Main aspects of prioritized projects related to their contribution to the sustainable pillars.

Projects/ Sustainability Pillar	Ecological	Social	Economical
Tactical urbanism	Increase of green areas. Depending on intervention, use of energy and water optimisation technologies	Social cohesion and citizen participation for neighbourhood interventions	New opportunities and attractiveness of the city
Decentralized system for sustainable water management	Better management of water resources	Promote the responsible use of water. Ensure access to water	Recovery of resources resulting from water losses, optimisation of the service allowing for service improvement and expansion possibilities
Arborisation of the city	CO_2 absorption by vegetation. Decreasing Urban Heat Islands (UHI)	Improve the thermal comfort of the city by improving the life quality of its citizens	Optimising water resources and maintenance of green areas

3.2.1 Tactical urbanism including urban gardens and pocket parks

Through Tactical Urbanism, the project seeks to transform the public spaces of Piura, making them more environmentally friendly and pleasant for its citizens. Thus, the intervention includes urban gardens and the provision of pocket parks, reinforcing the idea of an inclusive and sustainable city over time. Part of the proposal is to offer job opportunities to the vulnerable, socially and labour-excluded population. Through education and training tools, a mutual learning system is forged that is replicable over time. Thus, contributing to local development and betting on the talent of the community. It is proposed to use viable, sustainable, low-cost, flexible construction systems; in addition to grey water reuse methods, since in the city the water resource represents another problem. The project intends to ensure that there are quality public spaces for everyone and that over time the radius of reach is greater, supplying the entire city.

3.2.2 Decentralised system for sustainable water management

Due to the location of Piura in a desert region, the natural sources of water are scarce. This factor leads to the need for proper resource management. However, the management of the water cycle in the city is deficient, caused by a lack of planning towards a sustainable development and by the irresponsible use of this resource (e.g., use of potable water for irrigation of green areas). In this way, the project seeks to implement decentralised wastewater treatment systems to contribute to the reduction of irresponsible drinking water consumption wherever it is not required. The decentralised system for sustainable water management proposes to motivate the private sector and society to implement this type of methodologies as a means of orientation towards a Circular Economy, increasing the interest of replication in other areas. Additionally, by implementing this type of system, the city seeks to promote the responsible use of water and will contribute to the awareness of citizens about these issues.

3.2.3 Arborisation of the city aligned with a reforestation programme of urban green corridors

The project focuses on increasing urban green coverage through an arborizing programme. Interventions focus on the development of urban green corridors that seek to link important natural areas of a city through a strip or corridor characterised by extensive vegetation. In this way, a kind of skeleton is created, capable of articulating greener and healthier cities. The project identifies the main streets where deforestation has occurred due to urban mobility projects or with potential for new vegetation and where linear spaces with green corridor potential can be linked. The cultivation of native plants in local/municipal/private nurseries is incorporated. This project contributes to decrease the temperature of the city and improve thermal comfort by mitigating heat islands and generating microclimates to reduce energy consumption. Moreover, it contributes to counteract CO_2 emissions, and represents an opportunity to promote the use of sustainable mobility. This not only improves the life quality of the citizens, but also contemplates recovering the regional native species characteristic and the city image.

4. More than finding a solution

By consolidating the City Lab methodology in Piura, the results outline the challenges around its performance and strategic implementation of sustainability, providing a profile that identifies areas for improvement, supporting the process of identifying solutions, as well as offering a vision that supports the elaboration of plans and strategies that prepare the city to adapt to climate change, and interventions (including NBS) supporting them.

However, it is necessary to address the gaps and offer suggestions, according to the different challenges in the implementation of the City Lab as well as in the formulation of project ideas.

These findings should be evaluated with caution due to three methodological limitations that could compromise their external validity: Firstly, the city does not have an accessible database, which made it difficult to collect data and indicators. Being that Piura is the capital of the province and the department, some data did not refer to which level was being referred to. Secondly, the MGI activities were carried out at the same time as the study of the new Metropolitan Development Plan was underway, which may have resulted in a delay of the proposed actions. Finally, the study envisaged a series of field activities, including visits, workshops, and interviews, which due to the Covid-19 pandemic had to be adapted to a digital format, limiting the active participation of some stakeholders.

The analysis showed that the city has focused on isolated solutions, which makes more concrete the need for integration of the various parallel and subordinate plans that do not integrate global and national strategies into their plans. As Albert (2019) states, resources are not always the problem, and much more can be done by aligning resources around a vision or master plan. The author argues that it takes more than just the implementation of clean technologies or optimisation using ICTs to prepare a city to face the challenges of climate change.

Furthermore, based on the assessment, a lack of interest, and investment of resources was observed, but also a lack of prioritisation not only from the city administration, but also from different actors involved in Piura's urban development. Working in a co-creative process aims to foster acceptance and appropriation of the projects by the different local stakeholders. Clear commitment and human and financial resources allocated to sustainability at city level are needed to ensure the implementation of interventions at a comprehensive level, to avoid becoming fragmented initiatives (Krellenberg et al., 2019).

Finally, the research leads to some recommendations for further project development: Coordination with various similar initiatives in the city is essential, and if possible, it is worth waiting for the results to enrich the urban analysis. In the case of pilot projects, it is important considering an appropriate phase and efforts to deepen the pilot projects outlining so that they do not remain an idea but where interested stakeholders work together on their concretisation.

5. Conclusions

The project does succeed in establishing a strategy and project ideas that respond adequately to Piura's needs, as well as prepare for the future.

However, it remains to establish a robust concept for measuring the impact of these measures, as well as to ensure local actors following up on the development and performance of them. Furthermore, the involvement of the local actors to develop and concretise the project ideas are not entirely clear, as the MGI envisages implementing only one pilot, leaving it outside the initiative and as a task of the city to pursue the remaining ones.

During the process, the importance of focusing the city's efforts on establishing comprehensive plans that break down sector silos more than solutions and establish an opportunity to work together became clear. While some project ideas have a reference somewhere in the globe, work should focus on the opportunities that the city has. As such, the city should align implementations to consider the impact factors that can influence and support the development of these urban demonstrations.

According to the results, the interdisciplinary study, conceived in a first way with smart city concepts, has been adapted in a good way to address climate change adaptation and mitigation. It remains a task to develop the methodology further to respond to new lines of research in a more concrete way, incorporating the concepts of circular economy and citizen participation.

Finally, research underlines the importance of multi-sectoral studies, especially in the cities most vulnerable to climate change, considering how it will impact urban development, but also to keep their citizens safe from potential climate hazards.

Data Availability Statement

The City Lab is a framework developed by Fraunhofer. More information can be found here: https://www.morgenstadt.de/en/projekte/city_labs.html
Publications about the MGI project and the City Lab Piura can be found here: https://mgi-iki.com/. The City Lab Report is expected to be published in November 2021.

Contributor statement

Conceptualisation: Author 1, Author 2; Funding acquisition: Author 1; Investigation: Author 1, Author 2; Methodology: Author 1; Project administration and Supervision: Author 1; Visualisation: Author 1, Author 2; Writing-Original Draft: Author 1, Author 2; Supervision, Writing – Review & Editing: Author 1, Author 2

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Analysis of the Influence of Cognitive-Emotional Design on Mental and Physical Human Health Using the Example in Public Architectural Environment of Downtown in Seoul, South Korea

Alisa Kolova [1] and Tamer Abdallah Sammour [2,*]

1 Department of Architecture & Global Smart City, Sungkyunkwan University, Suwon 440-746, Korea; alicakolova@yandex.com; 0000-0003-0578-0109
2 Department of Architecture & Global Smart City, Sungkyunkwan University, Suwon 440-746, Korea; tamersamm@hotmail.com; 0000-0002-6382-8679
* Corresponding author

Abstract: The study's main objective is to identify how the architectural environment influences residents' mental and physical health living in Seoul, South Korea. One of the significant highlights of the study is to show the correlation between human psychology and architectural design that influences the ecosystem's health. Successful strategies can establish a positive relationship between psychological effects, including mental issues, and an ecosystem's health. Urban ecosystems have been associated with mental disorders, anxiety, and stress for centuries, with little research focusing on the major causes. New studies on neurourbanism tend to address these issues to tackle the urban challenges and promote the creation of green cities. The latest designs of Seoul, South Korea should create cities that consider the economic, physical, social, and environmental impact on mental issues on the current population without compromising future generations to experience the same.

Keywords: Neuroarchitecture; urban ecosystem; neurourbanism; human well-being; green infrastructure.

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1. Introduction

Environmental psychology is an interdisciplinary field of research that examines the relationships between individuals and their surroundings. The term "environment" is widely defined in the field and encompasses natural habitats, social settings, artificial environments, learning environments, as well as informational environments, among others. Environmental psychologists are typically researchers interested in how people interact with and react to their physical and social environments. They may look at why certain people like recycling, what encourages individuals to adopt environmentally-friendly practices, and why particular surroundings make people feel more productive and happier. Although there is a significant link between architectural design and human psychology, individuals both inside and outside the design industry generally don't recognise or even ignore this link (Ricci, 2018). Apart from that, there is a significant and bidirectional reciprocal link between design and psychology. Kaplan discusses the importance of the environment on the psychological health, highlighting the psychological benefits that nearby nature offers (1992).

Design has been shown to have significant physiological impacts, yet our perceptions of good design in our culture are influenced by a variety of factors, including psychology, human experience, and the way our brains work. Architects are always conscious of their work's influence on their clients and their way of life. Each of them is aware that factors such as the color of a place or the lighting in a room influence how people feel when

exposed to design. Neuroarchitecture takes this a step further by comprehending how the design environment affects the brain's activities and processes to apply the findings to the conception and building of places. Creating environments in which the occupants' brains may be defined by everything from the layout to the wall colors is a joint endeavor between architects and neuroscientists. The difficulty is in comprehending why certain places promote or obstruct emotions and then intelligently constructing to accomplish a specific goal, whether it is a less hectic workplace, a health facility for healing, or a learning institution for a more advantageous learning experience, to name a few examples.

2. The Mechanism of Neuroarchitecture

"Unscathed" neuroarchitecture is built upon neurobiological tools like sweat sensors, electroencephalograms, and electrocardiograms for the objective measurement of how our corpus reacts to specific architectural stimuli in order to take into account the feelings elicited by architecture's design process. Architectural studies of today, however, fail to possess all these devices of science, neither do they have the time or technology to apply these findings to the designs of theirs. Facilities like the San Diego Architecture Neuroscience Academy or the Polytechnic University of Valencia's LENI Research Group on Neuroarchitecture are producing scientifically-based research. The LENI study is an example of how pediatric waiting rooms are designed. How do they operate? To begin with, a gathering of individuals evaluated aspects of the rooms of waiting to find out the ones that were most soothing. They then created an environment that improved these aspects. Digital simulation was a helpful equipment for neuroarchitecture in this process because it enables the utiliser to use an area, in spite of the fact that it has yet to be built, and research the impact of this environment on their behavior.

3. The Impact of Green Areas on Human Health

The routes leading to health benefits in green areas are varied and complicated. Different models were developed to explain the connection between health and green space. Paiva and Jedon (2019) recommended the following: (Matthias Braubach et al., 2017) better quality of the air; higher activity physically; compensation of stress; and (Hemeida and Mostafa, 2017) increased cohesiveness. FINSA (2019) identifies physical exercise, nature involvement, relaxation, and social connections as key health paths. (Santa Luzia Industr 2020) submitted that urban green space mitigates the impact of the urban heat island, offering protection against health risks linked to heat, improving capital social and cohesiveness, and improving activity physically. Besides the aforementioned paths, The United Workplace (2019) proposed exposure to natural microorganisms and the increased immune system as an important connection between nature and health. Comparative contributions and their possible synergistic effects of the various routes are yet to be clarified. Meanwhile, a lack of understanding of the underpinning causal routes to well-being results and the complicated environmental and complex change variables impede targeted policy initiatives. In-depth multidisciplinary research is required to address such wisdom niches in health and urban environments (Kondo, Fluehr, McKeon, & Branas 2018).

There is good evidence of health advantages from psychological relaxation and restoration from interaction with greenspace and nature (Kondo, Fluehr, McKeon, & Branas 2018). In touch with nature (e.g., green space), contacts were indicated to have beneficial effects for those with high-stress levels by changing them into a more positive emotional state (Braubach, Egorov, Mudu, Wolf, Ward Thompson & Martuzzi, 2017) and stimuli in natural conditions may assist restore a feeling of well-being for people with mental tiredness. (World Health Organisation, 2021) indicated a key role for improved immune functioning in natural-health pathways. In Japan, associations have been shown among going to woodlands and favorable immunological responses, including the production of anticancer proteins (Braubach, Egorov, Mudu, Wolf, Ward Thompson, & Martuzzi, 2017). This indicates that systems of immunity gain from being exposed directly to natural settings or interaction with particular green area elements. Children who are more vulnerable to particular germs or allergens in the initial annum of life have also been found to be less likely to have recurrent wheezing and allergic sensitivity (2020 ECU Summer Study Abroad Program, 2020). It has been found that living in residential neighborhoods with more street trees has a reduced asthma prevalence (Hosey, 2018).

The improvement of cardiovascular health, mental health, neurocognitive development, overall well-being, and prevention of obesity, cancer, and osteoporosis was shown with physical exercise (Editor, 2015). Providing accessible and beautiful urban settings

could motivate individuals to stay alone for longer and make exercise easier. The value of green urban space and the availability of particular facilities contribute to the physical activity of older adults (Ruiz Arellano, 2015). Physical exercise in a green environment may be especially beneficial for urban people with mental health issues (Hemeida & Mostafa, 2017). There is considerable evidence that urban green spaces benefit from mental health (Higuera-Trujillo, Llinares Millan, Montanana i Avino & Rojas, 2020). Greater neighborhood greenery has been significantly linked to better mental health (Ebong., Deshpande, Yilmaz, & Mazumder, 2011). As well, greater greenery across all socioeconomic strata and in both sexes has been associated with better physical and mental well-being in Spain (Higuera-Trujillo et al.). The connections were greater for the surrounding greenery assessed by the NDVI than for accessibility geographically unique green areas. Further research has also shown that physical exercise has not mediated this relationship.

4. Neurarchitecture and Neurourbanism in South Korea

Despite the danger of nuclear and missile strikes Northern missile strikes, a battle that was not officially completed, Seoul is an extremely sophisticated town. Samsung and LG use part of these technologies for the Sustainable Cities Index 2015 to become the most self-sustaining city in Asia. In contrast, the limitation of growth has contributed to a rise in congestion in the city. The number of people within the city is restricted to further growth, both inside and outside, and the infrastructural development for cars and public transit has to rise to meet the demand that is already there.

Conversely, the limitation of growth in the city led to an increase in congestion. Restricting growth toward inward and upward focuses on the number of individuals in the town, as well as the installation of structures for road cars and public services must meet the demand that exists today. Forward-thinkers aim towards the idealised concept of the "ubiquitous metropolis" to become a more sustainable city. Technology is the cornerstone to the omnipresent city idea. Seoul is a global pioneer in digital and open data governance. This comprises a large high-speed network for the Internet. In an omnipresent city, the open flow of data makes it possible for people to assess its influence on the environment and the appropriate measures to be taken to minimise its negative impact. The notion is that urban people may modify their lives in an eco-friendly way by upgrading technological infrastructure. The Personal Travel Assistant system is an example of this in action. This system provides the public transit network with real-time information. It enables users to obtain carbon emission statistics and other green travel alternatives.

4.1 Human health and natural environment

South Korea is the first OECD country to have produced an explicit green growth strategy (Figure 1). The President of the Republic of Korea announced that the country would transition to a Low-carbon, Green Growth model to guide long-term economic development over the next half-century (Connections by Finsa, 2019).

Research has proven that green infrastructure and green areas reduce the temperature of the buildings and, as a result, the cities. Which is the most ongoing issue nowadays in the World. But also, the green area cleans the air for breathing which enhance human health (Duan et al., 2018). That is the first reason why human health is closely related to the natural environment, and urban green spaces are a source of the natural environment in cities that actively promote and maintain humans' physical fitness and well-being (Holt et al., 2019; Nath et al., 2018). So, we can suggest that the frequent visit and maximum time consumption in the green environment resulted in positively inhuman physical health.

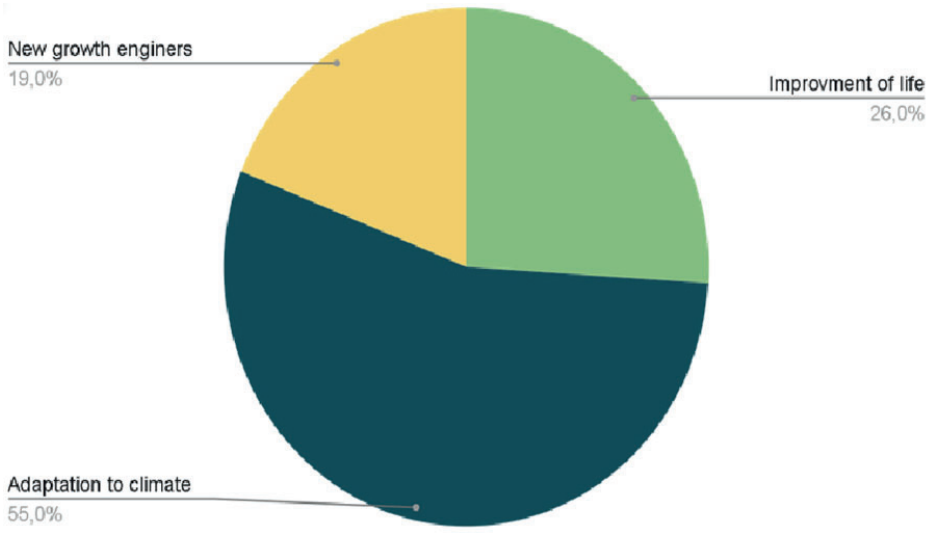

Figure 1. Distribution of the Green Growth Budget

4.2 Urban Green Spaces

This theory was proven by the huge research study undertaken in Daejeon (South Korea), where about 55.4% (299.3 km2) of the city is designated as green areas, including urban natural forests, neighborhood parks, pocket parks, and children's parks – which is higher than any other major city in the country. Moreover, the researching district is surrounded by several densely forested mountains and shares a boundary with the Dae-Chung dam at its northeast border (64.3 km² surface areas). The land use/land cover (LULC) map of Daejeon is the typical spatial distribution pattern (Figure 2) of large cities in the Republic of Korea, and includes: intensified developed central areas, a mixture of natural and developed areas outside of the city centre, and areas with more vegetation along the city's borders, except for the northern part of the city.

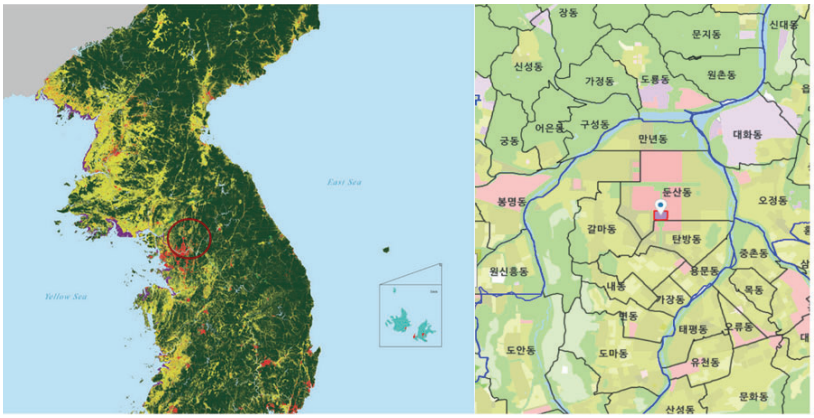

Figure 2. Zoning of Daejeon (Distribution of land use)

There is a reason why we can adapt this research to other cities and try to find the solutions for the exploring issues. During a cross-sectional study based on 400 respondents was proven that Urban green landscapes are well documented for mental well-being as shown in Table 1. In this researching paper the researchers, according to the Forest Resources Establishment and Management Act in Korea, created the abbreviation UGS which means refers to "planted and managed forests or trees in urbanised areas for enhancing urban dwellers' health, recreation opportunity, resting, and emotional integrity." Based on this definition, UGS may include almost all vegetated spaces in urban

areas, such as urban parks, street trees, green walls, and amusement parks, which is too broad for urban dwellers. For these reasons, the Korean Forest Service restricted the definition of UGS to "easily accessible UGS in daily life with minimal time and financial costs." In sum, they concluded that there is rich evidence indicating the numerous positive effects of UGS on urban dwellers, such as enhancing physical/mental health, social interactions, and SWB, based on the attention restoration theory, stress reduction theory, and the Biophilia hypothesis (Table 2). This study examines the effects of frequency of visits and time spent in UGS on the SWB of urban dwellers in Daejeon, Korea. In addition, they investigated the primary motivations and constraints of visiting UGS for heavy, moderate, and light/non-users (Bravo Santisteban et al., 2016).

Quota	Groups	Number of Respondents (%)	Total
Age	20 - 29	97 (24.3)	400
	30 - 39	97 (24.3)	
	40 - 49	110 (27.5)	
	50 - 59	96 (24.0)	
Gender	Male	200 (50.0)	400
	Female	200 (50.0)	

Table 1. Sampling quota by age and gender groups (Bravo Santisteban et al., 2016)

Category	Variables	Factor 1	Factor 2	Cronbach's α
Positive affect	Good	0.7778	-0.1824	0.9176
	Pleasant	0.8125	-0.1813	
	Happy	0.8057	-0.1517	
	Joyful	0.8103	-0.1828	
	Contended	0.7902	-0.1390	
	Posistive	0.7527	-0.2383	
Negative affect	Bad	-0.1614	0.8315	0.9099
	Unpleasant	-0.1178	0.7823	
	Sad	-0.1625	0.7007	
	Afraid	-0.2119	0.7452	
	Angry	-0.1504	0.7520	
	Negative	-0.2666	0.7914	
Life satisfaction in general	In mostways, my life is close to my ideal.	0.8777		0.9374
	The conditions of my life are excellent.	0.8475		
	I am satisfied with my life.	0.8567		
	So far, I have goten the important thingsI want in life.	0.8751		
	If I could live my life over, I would change almost nothing.	0.8403		

Table 2. Measuring Frequency of Visits and Time Spent in UGS (Bravo Santisteban et al., 2016)

Moreover, they explored the cross-sectional study conducted in South Korea after which they also concluded that green spaces could positively impact social well-being by providing an ideal platform for social interaction (Hong et al., 2019). But in this case, the researching interest was focusing on the older part of the population. This study investigated certain sociodemographic characteristics of elderly urban residents, such as their socioeconomic status and health behavior, and the effect of exposure to the urban green areas on mental health concerning stress and symptoms of depression. Therefore, to ensure ongoing improvements in mental health and maintain the mental health of elderly urban residents, it is critically important to give more attention to identifying vulnerable elderly groups and to either construct new urban green spaces or develop suitable nature-based activities that utilise existing resources (Hong et al., 2019).

Furthermore, we considered the results of the huge research study on the influence of neighborhoods and around the landscape on the physical and mental human health in Korea. The researchers compared the results of human health diagnostics of citizens from two different residential districts. They tried to realise the reasons for these results and

their connections with the green areas and landscape. So, the users of the Busan U-Healthcare centre in the rural area had healthier test readings than those of the Daegu U-Healthcare centre, which was surrounded by apartment buildings and commercial business areas. But still, they could not guarantee that only the amount of green zones impacted these results (Lee and Lee, 2019).

4.3 A green city created by its citizens

The metropolitan city of Seoul has a population of over 10 million people and continues to grow. At the same time, the quality of life for its residents has been enhanced significantly each year. More than 76% of the parks & landscape of Seoul is forest area concentrated on the outskirts. Thus, the space available for leisure and relaxation during daily life is insufficient, particularly in the city's CBD (서울정책아카이브 Seoul Solution, n.d.).

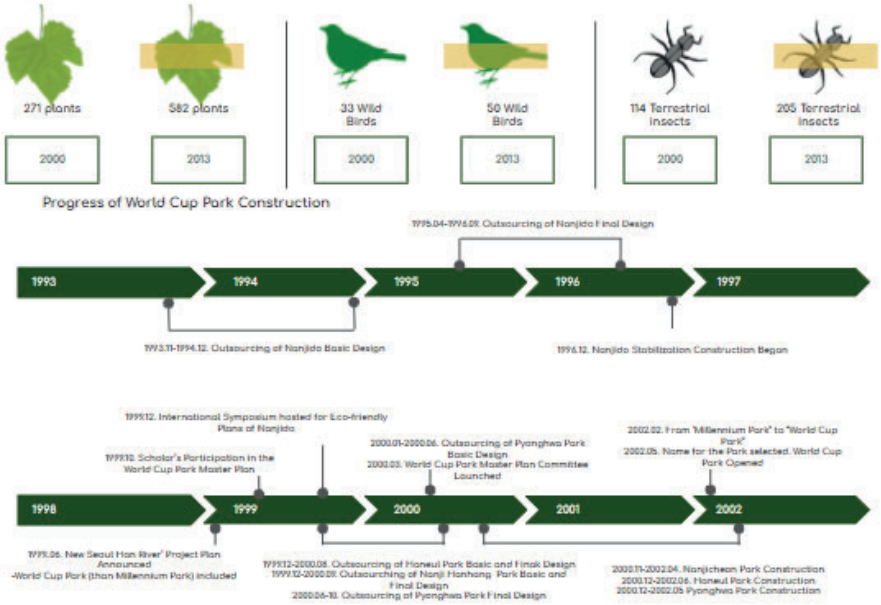

Figure 3. The increase in Species of Plants and Animal in one district in Seoul near Han River (Seoul solution, 2015)

The amount of green and park spaces has increased, and include Children's Grand Park in 1973, Yeouido Park transformation 1980 (Figure 4), Seoul Grand Park in 1984, Hangang Park in 1986, World Cup Park in 2002, Seoul Forest in 2005, Dream and Forest Park in northern Seoul in 2009. At the same time, the city government created small parks in neighborhoods and working spaces through the Wall Removal Project in 1996, the Roof Garden Project in 2000, and the School Park Project in 2006. As a result, parks make up a total of 170 km² or 28% of the metropolitan area. By type, 38.56% of this area is urban nature parks, 23.21% is natural parks, 25.45% is neighborhood parks, 1.29% is children's parks, and 1.40% is reserved for cemetery parks. The impact of this development has also affected animals and plants, as new species emerged (Figure 3). The Parks & landscape policies of Seoul are implemented in two axes: ecological conservation and expansion of parks & landscape. Seoul created Hangang Park, World Cup Park, Seoul Forest, and Dream Forest Park in northern Seoul, among others, as part of its decision to increase the city's park area, which expanded around 12% (152 km² in total area to 170 km²) between 1995 and 2011. The share of Seoul made up of park areas increased about 4% during the same period, from 24.2% in 1995 to 28.1% in 2011 (서울정책아카이브 Seoul Solution, n.d.).

Figure 4. The transformation of Yeouido Plaza (1971) to Yeouido Park (1980) (Seoul solution, 2015)

Currently, the government is still focusing on the development of green infrastructure in many parts of South Korea, especially downtown in Seoul. The development of green areas is the part of the 2030 Seoul Plan (Figure 5). Moreover, the government has decided to focus on the development of the green culture around the population and ingrate them to this system. So, in 2003, Seoul introduced a citizen-involved park management system for the creation and management of Seoul Forest where Seoul Green Trust participated in the creation and management of Seoul Forest. Intending to become 'A green city created by its citizens,' Seoul has since applied this new management concept to its urban greening programs. In 2012, the mayor mentioned the idea of having urban parks and green spaces adopted by residents in the Mayor's Hope Diary. The adoption program was introduced the following year, pursued by the Park & Green Space Policy Department (서울정책아카이브 Seoul Solution, n.d.).

Figure 5. The main elements of the 2030 Seoul Plan

The Korean Government understood the role of green areas a lot of years ago. Currently, in the realm of city-making, three contemporary notions represent the leading values. The three alternative models, however, share the following common objectives:

1) To make materialistic progress with less social or environmental harm;
2) To maintain a balance between the three competing values – economic, social, and environmental;
3) The social and environmental aspects are exploring at the same time because it has a strong connection.

5. Conclusions

Mental laxity and stress decreasing, enhanced social cohesiveness and psychosocial links to the homes, a system of immunity advantages, and better physical activity opportunities are the possible causative routes that may lead to green urban spaces. Green infrastructure can also give ecosystem uses linked to extreme heat exposures, and air and noise destruction. There seems to be fairly consistent evidence of health benefits of relaxation, stress management, and other psychological consequences. Many studies have shown that if greenery is near the home, the health advantages of that greenery may provide benefits to health independence and their physical activity level. The health advantages rely on the greenery of residential areas generally and may be supplied via sufficient urban planning procedures. The health advantages of physical exercise in green areas rely on the accessibility of public green areas suited for dynamic recreational and athletic fun. Green areas can also assist in reducing environmental and health disparities by giving equal access to and profit from common surroundings and equitable environmental services like decreasinging noise and air pollution to all population groups.

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Pocket Parks in Hong Kong: A Vital Resource for Both Urban Life and Well-being

Hee Sun (Sunny) Choi *[1], Ka Chung (Kane) Wu [2], Wai Yin (Gemma) Sung [3], Tsz Ho (Jonathan) Hui [4], and Gerhard Bruyns [5,*]

[1] Adjunct Assistant Professor, School of Design, The Hong Kong Polytechnic University; hee-sun.choi@polyu.edu.edu.hk
[2] Co-founder and Lead Data Scientist, ThinkCol Transform, Hong Kong, SAR; kane.wu@thinkcol.com
[3] AI and Data Project Manager, ThinkCol Transform, Hong Kong, SAR; gemma.sung@thinkcol.com
[4] Data Scientist, ThinkCol Transform, Hong Kong, SAR; jonathan.hui@thinkcol.com
[5] Associate Professor, School of Design, The Hong Kong Polytechnic University; gerhard.bruyns@polyu.edu.hk
* Corresponding author.

Abstract:

Between 1971 and 2020, 'Natural' spaces in urban areas in Hong Kong, which include green areas, planting trees, and ornamental landscape features, increased in quantity at an average annual rate of 0.26% within the urban area of Hong Kong (World Data 2020). These provide residents with the opportunity to connect with and experience nature (Dunn et al., 2006; Palliwoda et al., 2017). The health benefits of this are increasingly being recognised (Soga and Gaston 2016; Mell 2017), with evidence of an enhancement in both the physical and mental health of people living near parks and natural spaces (Lovell et al., 2014).

Although a small number of countries have created policies and strategies to increase opportunities for people to visit natural spaces, these tend to be at a macro, national level rather than considering in detail biophilic design, as in design for the love and appreciation of nature, at a local and neighbourhood level (Mell 2017; Ten Brink et al., 2016). This is a vital component, when considered in the context of the fundamental disconnection to nature that is occurring for so many who join the continuing migration pattern from the rural to the urban (Soga and Gaston 2016).

Within this context, this paper uses the small urban pocket parks in Hong Kong as a testing ground, assessed using predictive Artificial Intelligence (AI) as a methodology to assess and understand the extent to which the character of these spaces may influence a better connection to nature within urban areas.

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1.Introduction

A recent white paper published by The Hong Kong Government entitled, "Public Open Space Accessibility in Hong Kong" (2018) observed that most residents visit the natural environment very infrequently, on average once a month. In addition, the paper notes that Hong Kong's urban public space, as in outdoor recreational space that is accessible to the public, is generally small scale, which coupled with the high population density results in the per person area allowance to be relatively low. According to a 2017

study from Civic Exchange, Hong Kong Residents have only 2.7 square metres (29 square feet) per person, whilst Singapore has 7.4 square metres (79.6 square feet) and New Yorkers 10 square metres (107.6 square feet) of urban public space per person.

Research into user preference in relation to biodiversity and urban park design (Botzat et al., 2016; McCormack et al. 2010) has found that the appearance and arrangement of these parks is more important to the majority of users than whether they achieve a balance in their biodiversity. Research has also found that users are more likely to use spaces that are more open with increased visibility rather than heavily planted enclosed spaces, due to concerns over safety (Qiu et al., 2013).

In his 1981 publication, *The Social Life of Small Urban Spaces*, William Whyte highlighted how people use public space in New York, including how moveable seating in these pocket parks is popular. This is so because it allows people to form personal and communal space in their own way, and how some enclosure can help quieten traffic and focus on the sounds of birds and waterflow. User preference is also influenced by cultural and individual identity, with the design of natural settings influenced by the historical and cultural context of the setting (Chan et al., 2016; Cooper et al., 2017). In order to measure these preferences, and contrast with a purely quantitative approach, a qualitative form of research can allow a more nuanced understanding of these (Gill et al., 2008).

Factors such as these can result in user preference for urban natural spaces being very closely linked to the characteristics of the space itself and, as users tend to use just one or a few urban natural spaces, focusing on a specific area allows exploration of local level factors such as place attachment and their importance in determining user preferences (Davenport and Anderson 2005). Hence, in this research, we sought the views of local users of a specific case study series of urban public spaces and contrasted them with the morphological and natural setting from across Hong Kong Island. Using the combination of a qualitative approach mirrored against artificial intelligence (AI) modelling, the research reflects on two areas of enquiry; (i) the role of urban ecology environments in connecting people with nature, and (ii) built features as facilitators for connecting with nature.

As one of the most densely populated places on earth, Hong Kong has an overall population of over 7.5 million people in a 1,104 square kilometre territory. Development tendencies place an emphasis on the compression of not only urban space, but also dwelling sizes. As a consequence of a lack of accessible and liveable public spaces, as well as the persistent obstacles created by the COVID-19 pandemic, the state of urban dwellers' well-being, considered in terms of their level of health, happiness, and comfort, can reasonably be questioned.

2. Theories and Methods

2.1. Case studies

Using a series of nine out of 169 pocket parks (see Figure 1), a multi-method approach is utilised to assess and reflect on the provision and use of urban natural spaces in Hong Kong. The combination of a qualitative approach mirrored against AI recommendations are drawn for ways forward in connecting the natural spaces arising from built features and the development of differentiated forms of natural spaces.

Central & Western District	Type	Area (m^2)	Operation Hour
1. Third Street Sitting-out Area	Sitting-out Area	~ 90.5	24 hrs.
2. Oaklands Avenue Sitting-out Area	Sitting-out Area	~ 181.8	24 hrs.
3. Bonham Road Rest Garden	Rest Garden	~ 99.2	24 hrs.
4. Upper Station Street Sitting-out Area	Sitting-out Area	~ 75.1	24 hrs.
Wan Chai District	**Type**	**Area (m^2)**	**Operation Hour**
5. Queen's Road East/Swatow Street Sitting-out area	Sitting-out Area	~ 99.3	24 hrs.
6. Hennessy Road Playground Sitting-out Area	Sitting-out Area	~ 127.5	24 hrs.
7. Wing Ning Street Sitting-out Area	Sitting-out Area	~ 206.0	24 hrs.
8. Lau Sin Street Temporary Rest Place	Temporary rest place	~ 167.2	24 hrs.
9. Electric Road Sitting-out Area	Sitting-out Area	~ 565.4	24 hrs.

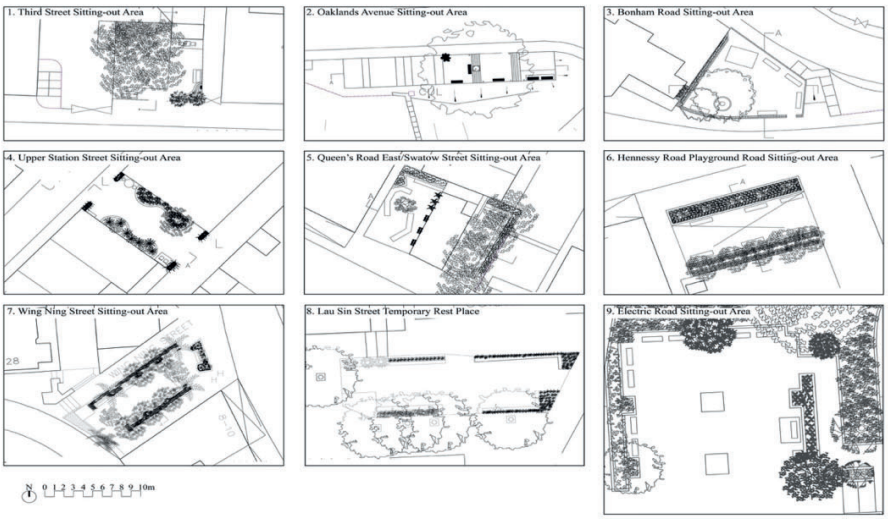

Figure 1. Location and size of nine pocket parks (source: Author 2021)

Three sitting-out areas in the Central District and one rest garden in the Western District were selected based on their reasonable accessibility to residential dwellings and bus/minibus transportation links, and also influenced by the rising terrain and topography within these districts. The five pocket parks within the Wanchai District were selected based on the reasonable accessibility from the surrounding commercial or

residential buildings and proximity to the MTR train station. Macro analysis examines the relationship between park features and the park usage across parks.

	Method	Purpose
Macro-Analysis	Green View Index	Quantify the greenery seen from a user's point of view
	Pearson Correlation Matrix	Analyse the correlation between the parks' usage and their macro-attributes
Micro-Analysis	Ordinary Least Squares Regression	Analyse the linear relationship between usage and the park's micro-attributes recorded in different zones for each individual park

Table 1. Key Methodology Summary

This data was recorded over a three-month period from June to August 2021, with a summary of key methodologies shown in Table 1. The number of total visits for each park was calculated by aggregating all the individual visit records. Secondly, factors such as the Greenview Index, vegetation diversity, and surrounding land use were selected to infer the relationship between them and the number of total visits. In total, a correlation matrix containing pairwise correlation coefficients between each pair of variables is formed and the correlation coefficients between each pair of values are then studied. The Pearson correlation coefficient between two variables is the covariance of the two variables divided by the product of their standard deviations ($\rho_{X,Y} = \frac{cov(X,Y)}{\sigma_X \sigma_Y}$). The closer the Pearson correlation coefficient between two variables is to 1, the more positive the correlation is; in contrast, the closer the number is to -1, the more negative the correlation is. If the coefficient is 0, it means no linear relationship is found between the variables.

For this study, we chose Green View Index (GVI) as a means to quantify greenery in each park. Traditionally, GVI of an image is calculated by $\frac{Area_g}{Area_t}$, where $Area_g$ is the area of green pixels occupying the image, and $Area_t$ is the total area of the image (Li et al., n.d.). We took multiple photographs at each of the nine sites that capture the scenery users would see when using the park. By calculating GVI for the site photos, we measure the general greenery seen at the park. With the advent of AI, we forgo the use of extensive image processing techniques to manually isolate green pixels in the images and instead, then, we feed the images directly into a deep learning model and infer their GVI. We adopted a pre-trained residual network model (ResNet) for this task. ResNet is an artificial neural network (ANN) architecture first introduced by He et al. in 2015 – which is now commonly used in various computer vision tasks.

The model is pretrained on images from the Cityscapes dataset and Google Street Views and their corresponding GVI ground-truths. It is shown that this model's prediction achieves a mean absolute error (MAE) percentage of 4.67% on the test dataset (Cai et al., 2018), to transform and resize our site photos to an array of 224x224x3, the input dimension required by the model, before being fed into the model for inference. After inference is done for each image, an average is taken across a combination of images belonging to the same park to represent the overall GVI for the park. Site photographs of each pocket park are used to calculate GVI as it better represents human perception of the environment. Furthermore, the research also used Gradient-weighted Class Activation Mapping (Grad-CAM) (Li X., et. al., n.d.), a technique used for producing visual explanations for deep learning models such as ResNet, to inspect the predictions made by our model on the input images.

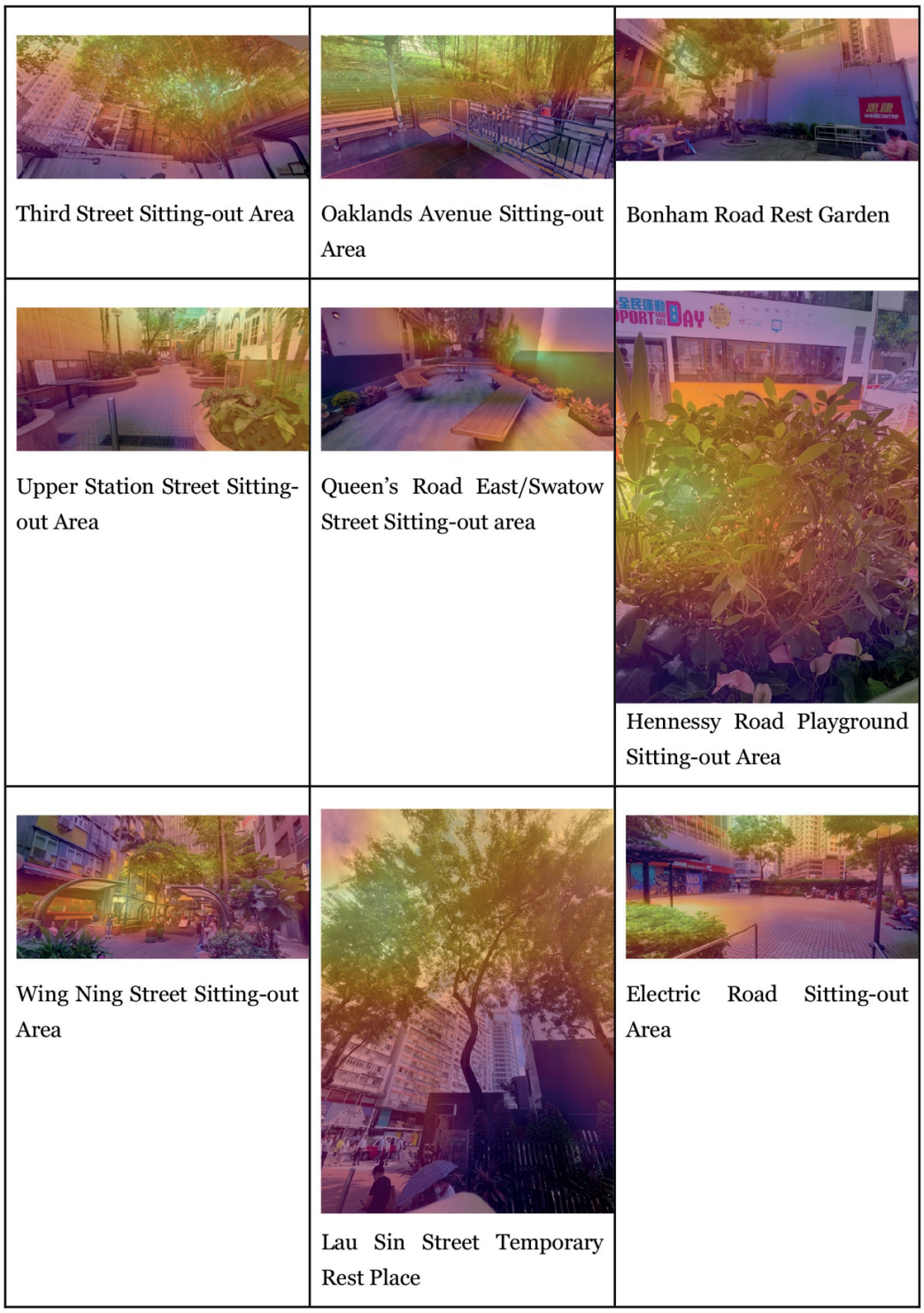

Figure 2. Grad-CAM feature visualization of ResNet's final convolutional layer on-site photos (source: Author 2021)

For micro analysis, individual analysis of the relationship between built features of a park and its usage was examined. Each park is split into up to four approximately equal zones by symmetry or purpose of use. For each park, the data was transformed from diagrams and tables into a standardised, analyzable format. For visit records of each park, a person's code, enter date and time, and leave date and time were collected into a single table for further analysis. Similarly, the environmental data for every two minutes were

concatenated into a table with time, temperature, humidity, noise level, and heat index as attributes. A Jupyter Notebook with Python code for data preprocessing and analysis was prepared and hosted on Google Colaboratory. Before feeding the data into the analysis, it was checked for outliers or special circumstances, such as rainy weather or unusual recordings from the sensor.

Due to privacy concerns, the time of arrival, time of exit, and a place/facility used within the park had to be manually recorded by an observer in the park. Data was collected for each park for 6 hours/day and 7 continuous days. The data was observed every morning, noon, and evening for two hours each: 8:30am–10:30am, 12pm–2pm, and 5pm–7pm. It should be noted that time spent in the park outside of recorded times was not taken into account.

In addition, environmental data, such as temperature, humidity, and noise levels were recorded using sensors for each of the four zones of the park during the time when the observer was in the park. Heat index, a human-perceived equivalent temperature, was then calculated from the temperature when the relative humidity is factored in. Rothfusz's equation for the calculation was used for the heat index (National Weather Service Organisation, 2014).

Basic information about parks' usage was first retrieved from the data, such as the total number of visits to the park, average time spent in the park, and the density distributions of time spent in the park. Then the retrieved results were compared across factors like weekday and park zones to identify features affecting the usage. Lastly, Ordinary Least Squares (OLS), a variation of linear regression which models linear relationships between independent variables and a continuous dependent variable. OLS fits coefficients of linear equations such that the sum of squares of residuals is minimized. It can be used to help identify a significant relationship between two or more variables.

3. Results

3.1. Limited Fluctuation across Environmental Factors

Perhaps because the data collection was within the summer months of Hong Kong, the usage of the parks did not fluctuate significantly with environmental factors, such as temperature, humidity, and noise level. This is shown by the unrejected null hypothesis between the coefficients of temperature and humidity when linear regression is fitted for the Hennessy Road Playground Sitting-out Area. Heat index, on the other hand, has a negative coefficient. This implies that fewer people are likely to be in the park during high human-perceived temperatures, even though the effect is minute.

This does not necessarily mean that lower human-perceived temperatures would increase usage rate. It should be noted that the standard deviation amongst all pocket parks for temperature is only within 1–2 degrees. Unlike other countries where there is a stark contrast between day time and night time temperatures, Hong Kong experiences milder temperature change with the biggest temperature range within the week at 8.9 celsius only. Other environmental factors, such as humidity and noise, do not deviate much both in range and standard deviation. Given that the analysis is based on sunny and cloudy days only, special weather circumstances, such as rain or typhoons, are not accounted for. While it would be interesting to monitor the change of visiting numbers throughout the year, environmental factors might not be the most influential factor in visiting rates across the summer months.

3.2 Macro Features in Enhancing Pocket Park Usage Rate

Ultimately, accessibility and land use are macro factors that determine the usage of pocket parks. The most important predictor of the usage of a park seems to be its location, especially when it's in a commercial district. How busy the area directly reflects the number of visits to the park.

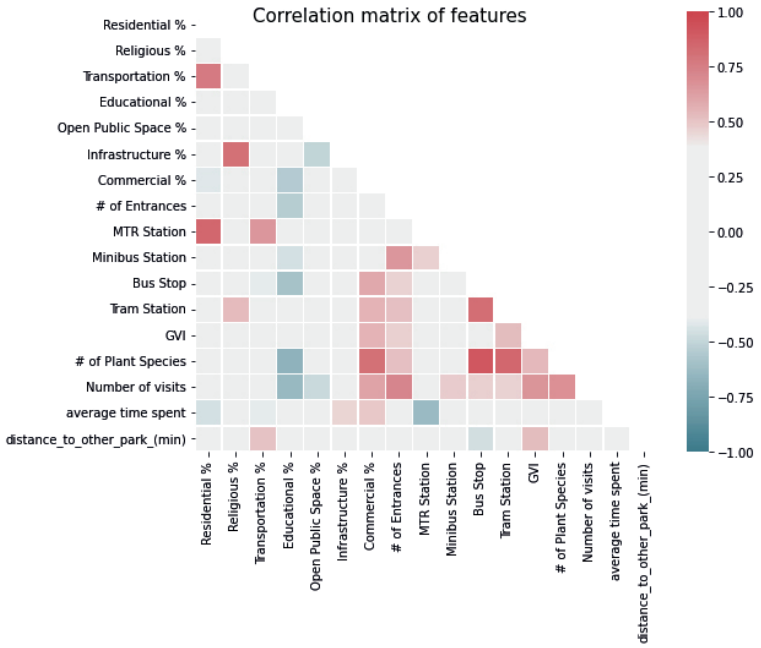

Figure 3. Correlation matrix of features (source: Author 2021)

	Residential %	Religious %	Transportation %	Educational %	Open Public Space %	Infrastructure %	Commercial %	# of Entrances	MTR Station	Minibus Station	Bus Stop	Tram Station	GVI	# of Plant Species	Number of visits	average time spent	distance to other park (min)
Residential %	1.00	-0.05	0.77	-0.35	-0.06	0.04	-0.42	0.15	0.85	0.34	-0.26	-0.23	-0.01	-0.27	-0.04	-0.45	0.14
Religious %	-0.05	1.00	-0.01	0.08	-0.09	0.81	0.18	0.28	-0.11	-0.32	0.28	0.53	0.10	0.23	0.10	0.29	-0.25
Transportation %	0.77	-0.01	1.00	-0.02	-0.19	0.05	-0.29	-0.38	0.66	-0.18	-0.40	-0.23	-0.03	-0.36	-0.36	-0.40	0.51
Educational %	-0.35	0.08	-0.02	1.00	-0.05	0.16	-0.54	-0.53	-0.24	-0.45	-0.59	-0.34	-0.34	-0.67	-0.64	-0.08	0.17
Open Public Space %	-0.06	-0.09	-0.19	-0.05	1.00	-0.50	-0.15	-0.09	-0.29	-0.21	0.04	-0.20	-0.35	-0.13	-0.48	-0.13	-0.34
Infrastructure %	0.04	0.81	0.05	0.16	-0.50	1.00	0.13	0.33	0.05	-0.19	-0.07	0.29	0.31	0.04	0.34	0.46	0.05
Commercial %	-0.42	0.18	-0.29	-0.54	-0.15	0.13	1.00	0.17	-0.38	-0.22	0.60	0.56	0.56	0.81	0.61	0.50	0.07
# of Entrances	0.15	0.28	-0.38	-0.53	-0.09	0.33	0.17	1.00	0.28	0.66	0.47	0.52	0.47	0.52	0.72	0.16	-0.24
MTR Station	0.85	-0.11	0.66	-0.24	-0.29	0.05	-0.38	0.28	1.00	0.47	-0.15	0.04	0.31	-0.10	0.11	-0.63	0.35
Minibus Station	0.34	-0.32	-0.18	-0.45	-0.21	-0.19	-0.22	0.66	0.47	1.00	0.30	0.12	0.05	0.22	0.48	-0.26	-0.28
Bus Stop	-0.26	0.28	-0.40	-0.59	0.04	-0.07	0.60	0.47	-0.15	0.30	1.00	0.83	0.21	0.91	0.48	0.00	-0.46
Tram Station	-0.23	0.53	-0.23	-0.34	-0.20	0.29	0.56	0.52	0.04	0.12	0.83	1.00	0.53	0.86	0.47	-0.01	-0.07
GVI	-0.01	0.10	-0.03	-0.34	-0.35	0.31	0.56	0.47	0.31	0.05	0.21	0.53	1.00	0.55	0.67	0.07	0.52
# of Plant Species	-0.27	0.23	-0.36	-0.67	-0.13	0.04	0.81	0.52	-0.10	0.22	0.91	0.86	0.55	1.00	0.68	0.15	-0.15
Number of visits	-0.04	0.10	-0.36	-0.64	-0.48	0.34	0.61	0.72	0.11	0.48	0.48	0.47	0.67	0.68	1.00	0.35	-0.08
average time spent	-0.45	0.29	-0.40	-0.08	-0.13	0.46	0.50	0.16	-0.63	-0.26	0.00	-0.01	0.07	0.15	0.35	1.00	-0.04
distance to other park (min)	0.14	-0.25	0.51	0.17	-0.34	0.05	0.07	-0.24	0.35	-0.28	-0.46	-0.07	0.52	-0.15	-0.08	-0.04	1.00

Table 2. Details of the correlation

As observed from the correlation matrix (see Figure 3), the number of visits positively correlates with the percentage of commercial land use. The reason for this could be that commercial districts tend to be busier. If we look at the five parks situated in Wan Chai district (see Table 2), a more commercial district than the other selected pocket park areas, the average number of visits across these parks is 164.8, compared to 36.25 for the other four parks. In contrast, the number of visits positively correlates with the number of entrances to the park, which suggests a positive relationship between accessibility and the usage of a park. The correlation matrix is calculated with a sample size of nine. Whilst it could be argued that this sample size is too small to be representative enough, the calculation involves large confidence intervals, meaning that the resulting coefficients are still statistically valid under our assumption. Increasing the sample size by collecting data from more parks will certainly provide more significance to the discovered relationships, and this is a potential next step for the study.

3.3 Hong Kong's Unique Relationship Between Greenery and Pocket Park Usage

Park	Number of visits for the week observed	Average time spent	GVI (Values rounded to 3 decimal points)	Number of Plant Species
Third Street Sitting-out Area	34	25 min	0.258	3
Oaklands Avenue Sitting-out Area	71	32 min	0.253	3
Bonham Road Rest Garden	10	37 min	0.200	3
Upper Station Street Sitting-out Area	30	36 min	0.206	5
Queen's Road East/Swatow Street Sitting-out area	120	48 min	0.158	7
Hennessy Road Playground Sitting-out Area	146	36 min	0.323	15
Wing Ning Street Sitting-out Area	135	64 min	0.278	7
Lau Sin Street Temporary Rest Place	210	24 min	0.347	9
Electric Road Sitting-out Area	213	59 min	0.357	8

Table 3. Usage statistics, GVI, and number of plant species by park

While there is a correlation between the greenery variables and the number of visits, the relationship between the greenery and the usage of the nine pocket parks remains inconclusive. The Green View Index (GVI) and vegetation diversity report a positive Pearson correlation (0.667 and 0.681, respectively) with the number of visits, but it should be noted that both of these factors are highly correlated with another feature – the percentage of commercial land use (0.557 and 0.812). This reflects that the increased number of visits are likely caused by the parks' position within a busy commercial district. To illustrate this coincidence, the parks that have lower than 100 total visits are all situated in less commercial districts of the island and contain five or fewer types of plant species, while the parks that have above 100 total visits are all situated in busier commercial districts and have seven to 15 types of plants.

3.4 Data analysis for Nine Parks

	Temperature		Humidity		Decibel level		Time		Heat index		Benches	
Park	Coef	P>|t|	Coef	P>|t|	Coef	P>|t|	Coef	P>|t|	Coef	P>|t|	Coef	P>|t|
Third Street Sitting-out Area	0.017	0.484	0.005	0.103	0.003	0.000	0.032	0.000	-0.007	0.231	0.098	0.000
Oaklands Avenue Sitting-out Area	-0.15	0.000	-0.011	0.000	-0.010	0.000	0.034	0.000	0.040	0.000	0.000	n/a
Bonham Road Rest Garden	0.100	0.005	0.016	0.000	0.000	0.898	0.067	0.000	-0.026	0.024	0.152	0.000
Upper Station Street Sitting-out Area	-0.414	0.000	-0.047	0.000	0.015	0.000	0.045	0.000	0.132	0.000	0.006	0.696
Queen's Road East/Swatow Street Sitting-out area	-0.091	0.148	-0.007	0.350	0.057	0.000	0.149	0.000	0.018	0.394	0.000	n/a
Hennessy Road Playground Sitting-out Area	0.150	0.414	-0.005	0.764	0.037	0.000	0.254	0.000	-0.120	0.044	0.000	n/a
Wing Ning Street Sitting-out Area	0.312	0.213	0.075	0.001	0.016	0.000	0.179	0.000	0.046	0.560	0.253	0.000
Lau Sin Street Temporary Rest Place	-0.444	0.013	-0.093	0.000	-0.001	0.001	0.289	0.000	0.144	0.016	0.000	n/a
Electric Road Sitting-out Area	0.084	0.487	0.005	0.633	0.004	0.533	0.271	0.000	-0.030	0.486	0.070	0.000

Table 4. Ordinary Least Square regression coefficients for each park.
All values are rounded to three decimal places.

4. Discussion

In summary, Table 4 displays every park's OLS regression results where the target variable (dependent variable) is the number of users in a zone at a certain time and the features (independent variables) are the micro-attributes of the zone at that time. The micro-attributes are checked for multi-collinearity, again using a pairwise pearson correlation. As heat index is calculated from temperature, there is an obviously strong correlation (PCC > 0.9) for some parks. Besides this, no other correlation between the independent variables is observed. For each micro-attribute, we show the coefficient and the *p*-value of the coefficient across parks. For some parks such as Upper Station Street sitting-out area and Queen's Road East/Swatow Street sitting-out area, the number of benches across different zones of the park is the same, therefore yielding a null *p*-value as no difference is observed across all samples of the data. A positive coefficient implies that the attribute has a positive effect on the zone's usage, and a negative coefficient implies a negative effect. The magnitude of the coefficient represents how big the effect is. The validity of this analysis is affected by the likelihood of people gathering together in close proximity for group activities, causing users to dwell in one zone regardless of the zone's attributes. A potential future step for this OLS regression analysis is to examine the existence of spatial autocorrelation in the collected data.

Figure 4 includes a taxonomy of the common landscape characteristics and features found in the nine parks.

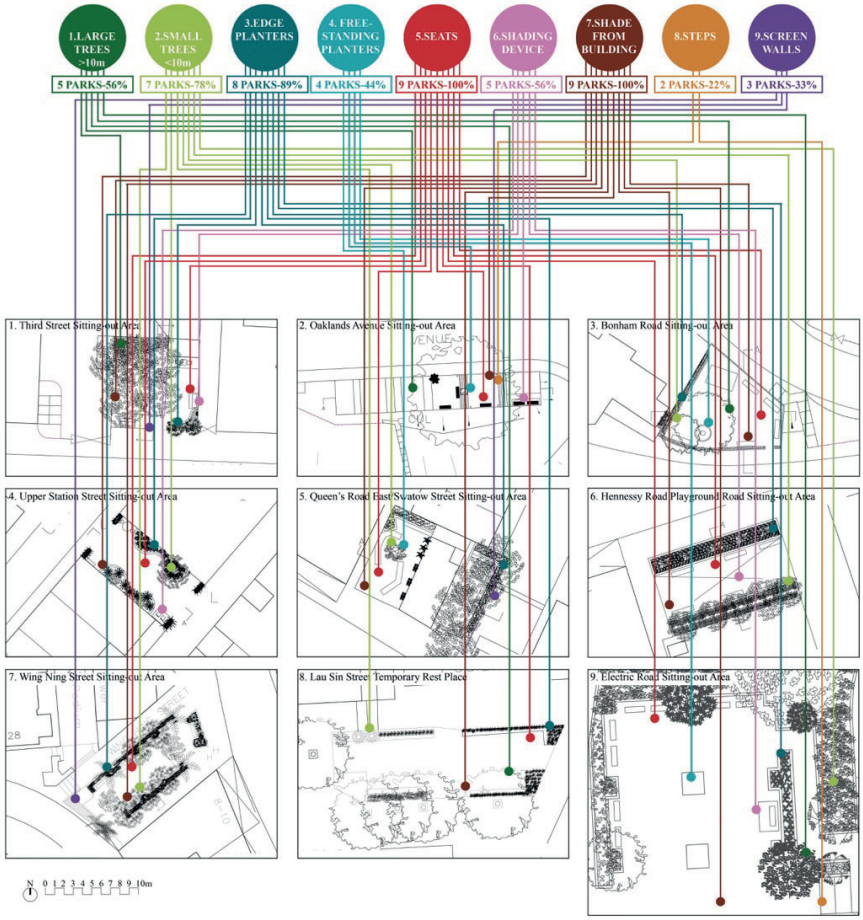

Figure 4. Hong Kong pocket parks: a taxonomy of characteristics and features (source: Author 2021)

Some findings can be drawn from this taxonomy: 1) There are limited lawns and limited seating areas; 2) A lack of facilities and features to avoid strong sun or rain; 3) No water features; 4) No flexible seating; 5) No particular consideration for the usage of

locally sourced materials in the design of flooring, fence, chairs, or canopies; and 6) No clear linkage or evolution in the relationship between the urban landscape and its inhabitants.

5. Conclusions

This paper has focused on the question of the quality of accessible amenity spaces in Hong Kong and how these may influence well-being, using nine different pocket parks situated within three districts of Hong Kong Island.

The paper found that not only does Hong Kong have one of the lowest provisions of public space per person, the small amount that is available is not well used. Whilst each park is generally arranged with seating amongst various types of trees, shrubs, and bedding plants, beyond this there are limited facilities to enjoy the park itself, as well as limited areas of shade and canopy. For example, within urban Paris there are many more outdoor table tennis tables within pocket parks than there are in Hong Kong, to provide an additional amenity for the fun and enjoyment for all ages. The chess tables provided within the pocket parks in New York would be another example of this.

Looking in detail, the Third Street Sitting-Out area, Oaklands Avenue Sitting-Out area and the Bonham Road Rest Garden are located in the hilly Central and West districts of Hong Kong, with only a limited amount of plants and trees. Due to the limited accessibility by foot, not many users were using those parks. In contrast, Hennessy Road Playground Sitting-Out area, Swatow Street Sitting-Out area, and Electric Road Sitting-Out areas are more accessible and this seems to directly link to make them more popular. Through the AI data analysis initial links were established between traffic noise and park usage, but this was not conclusive and a more detailed assessment of how these correlate could be a useful topic for future research. The introduction of AI as a succesful and predictive research tool for the detailed assessment of urban design components including landscape design is considered as a more general and transferable finding from the research.

The research has highlighted the gradual increase in the provision of urban landscaped areas in Hong Kong and the importance of these to the well-being of urban residents, both generally and particularly considering the ongoing COVID-19 virus. Given the low usage of the landscape spaces in Hong Kong, the user response to these can be concluded to be more negative than positive. The user response to the landscape provision in Hong Kong can be concluded to be between passive usage and negative. The study stresses the importance of responsive urban landscapes that are intimate, integrated, and inviting, can better provide for user preferences as an environmental necessity with a specific form in the in-between and interstices between buildings, roads, and walkways in Hong Kong, for both the present and the future.

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Re-structuring Underutilised Urban Green Voids in Noida, India

Joseph Rahul Pallipamula [1]

[1] rahulpallipamula@gmail.com; https://orcid.org/0000-0002-7626-9394

Abstract: The urban growth of cities is insatiable. It grows over the farm that once nourished it, over the streams that quenched its thirst, and even over the forest that treated it as its own. Now to sustain the ever-growing appetite, it has to set up elaborate systems, funded extensively, to source resources from outlying lands. Cities barely incorporate ecosystem services in their intransigent land-use plans. This negligence aggravates the socio-economic exclusion, food insecurity, and over-burdened ecosystems. The study will be based on Noida, in India, which was an expanse of agrarian land that has transmuted into a landscape of fragmented green voids with issues like a water crisis, pollution, as well as shrinking productive and regulatory landscapes. These urban voids have been termed as 'recreation spaces' in the land use plans of Noida, but have been rendered barren as no specific purpose has been assigned to them. The study explores the dynamic relationship between society and the agrarian landscape, i.e. how the society influences the agrarian regime, and concurrently, how the agrarian landscape shapes the society. Secondly, the study analyses the production of ecosystem services, patterns in land-use change, and variations in climate and environment. Ultimately, it explores the possibilities of a novel model for the fragmented voids.

Keywords: Sustainable Urbanisation, Sustainable Development Goals, Landscape Approach, Ecosystem Services, Socio-Economic inclusion

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1. Introduction

Noida is one of the fastest-growing satellite cities of Delhi. It lies in a low lying area between the Yamuna and Hindon rivers, which makes it fertile as well as susceptible to floods. The river bifurcates into natural and man-made canals which support more than 80 agrarian villages within this region. This network of canals not only irrigates the farmlands, but also contributes to the hydrology of Noida by channelizing rainwater towards '*johads*.' This suggests that the inhabitants of Noida had an understanding of the water system and the soil. The fertile agricultural land that once catered to Delhi's growing population and food supply were soon used for setting up industries by the banks of the rivers. This paved the way for Noida to be planned as an industrial town. With the expanding population of Delhi and the declaration of parts of Noida as a special Economic Zone (SEZ), it has now transformed into a satellite city for Delhi. Besides rapid urbanisation and reduction in green spaces through encroachment, commercialisation by developers, a lack of supporting policies and change in land use regulations, and agricultural spaces have been pushed to the edges of the city. Noida followed the same planning principles as Chandigarh, dividing the regions into sectors with specific land uses. The new residential sectors/townships encompass the existing villages and increased the land values, forcing villagers to sell off their farmlands. The villagers turned from self-sufficient farmers to servicemen and started catering to the people of townships. Grid development was being favoured among the society, because they saw it as a western concept. On the contrary, the urban villages are organic in nature and have mixed-use

development. Unfortunately, the planning of 'sectors' led to fragmentation and disconnection between the people, canals, and forests. The inhabitants of Noida are oblivious to the connection they had with their ecology or food systems.

As Noida focuses on urbanising fast to cater to the growing population and needs, the neglect towards green spaces and urban ecology increases. This has led to the creation of several fragmented underutilised barren voids within the city. The major issue faced in underutilised spaces is that they are prone to *ad hoc* construction, and also are encroached upon by urban villages in the proximity, disturbing the urban fabric and systems. The present cityscape disregards the importance of spaces that enhance social life. The urban voids can act as an opportunity to strengthen the community and create shared spaces for triangulation. A void has more probability designed as commercial complexes as a recreational space, rather than creating a public realm. Thus, there is a push for maintaining green spaces within urban areas while providing spaces for leisure and shared learning spaces for children.

Mahatma Gandhi in his idea of '*Swaraj*' stated that the agrarian culture has always held the social structure together as it curbs unnecessary competitiveness and promotes small scale technologies and a decentralised polity. The study asks the question, "The disregard of the relationship between society and the agrarian landscape in our way of urbanism has led to the degeneration of ecological and social balance in our cities. How can the restoration of this landscape lead to the creation of socially viable spaces?" The study will try to understand the impact of reincorporating the agrarian culture into urban pockets as a way to make our cities more socially viable.

2. Theories and Methods

2.1 Noida: Evolution of master plans and their tendencies

The sectoral division of Noida has made it highly dependent on the usage of motor vehicles on wide high-speed roads that make all sectors alien to each other, and where none of the sectors fulfils all necessities. The sectoral bifurcation has left voids, ones that were once farmland now lie barren.

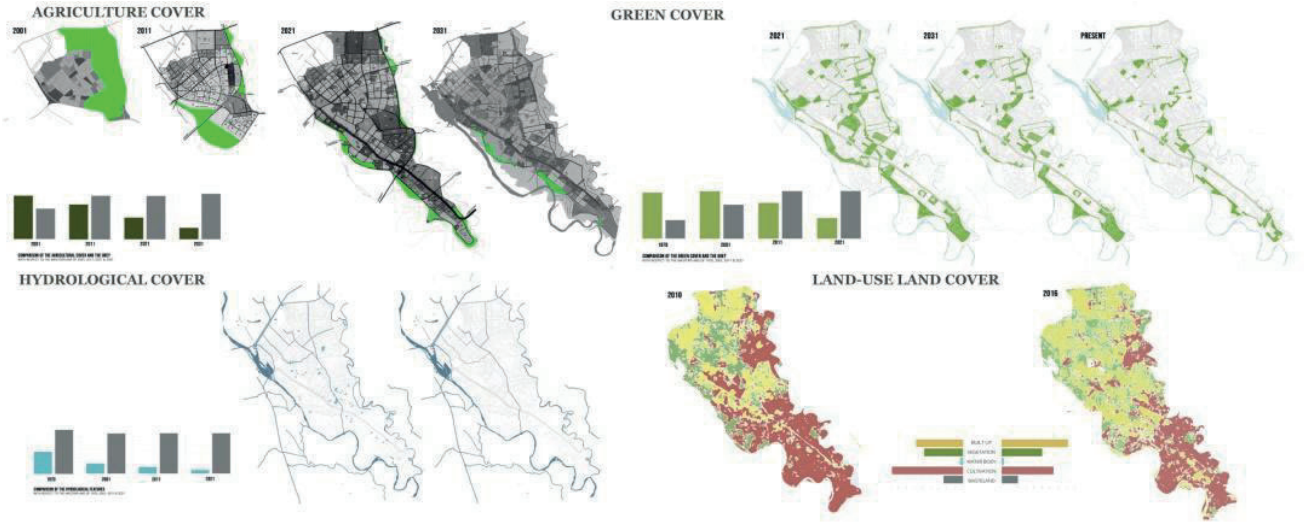

Figure 1: Change in Agriculture, vegetation, and hydrology cover in past decades

Statistics show that with new development the percentage of agricultural land has been drastically reduced, and the new master plan displaces farmers to the banks of the Yamuna and Hindon rivers. The drastic change in the land-use use pattern has also forced the agrarian population to change their occupation to adapt to the developing cityscape. The dense weave in the urban fabric has also forced the interwoven green spaces to shrink considerably. The new master plan of 2031 showcases that only a fragment of floodplains is left as green areas. In reality, even these flood plains are encroached by temporary furniture markets or damaged by local sand mafias. With planned development, all the green spaces are manicured and lack biodiversity. This has further disrupted the local

ecology of the region. The irrigation canals are disconnected and now carry wastewater and storm water from adjoining residential areas and industries to the rivers. For example, the Shadra canal is disconnected from its watershed and adjoining green spaces and has become a nuisance to the neighbourhood.

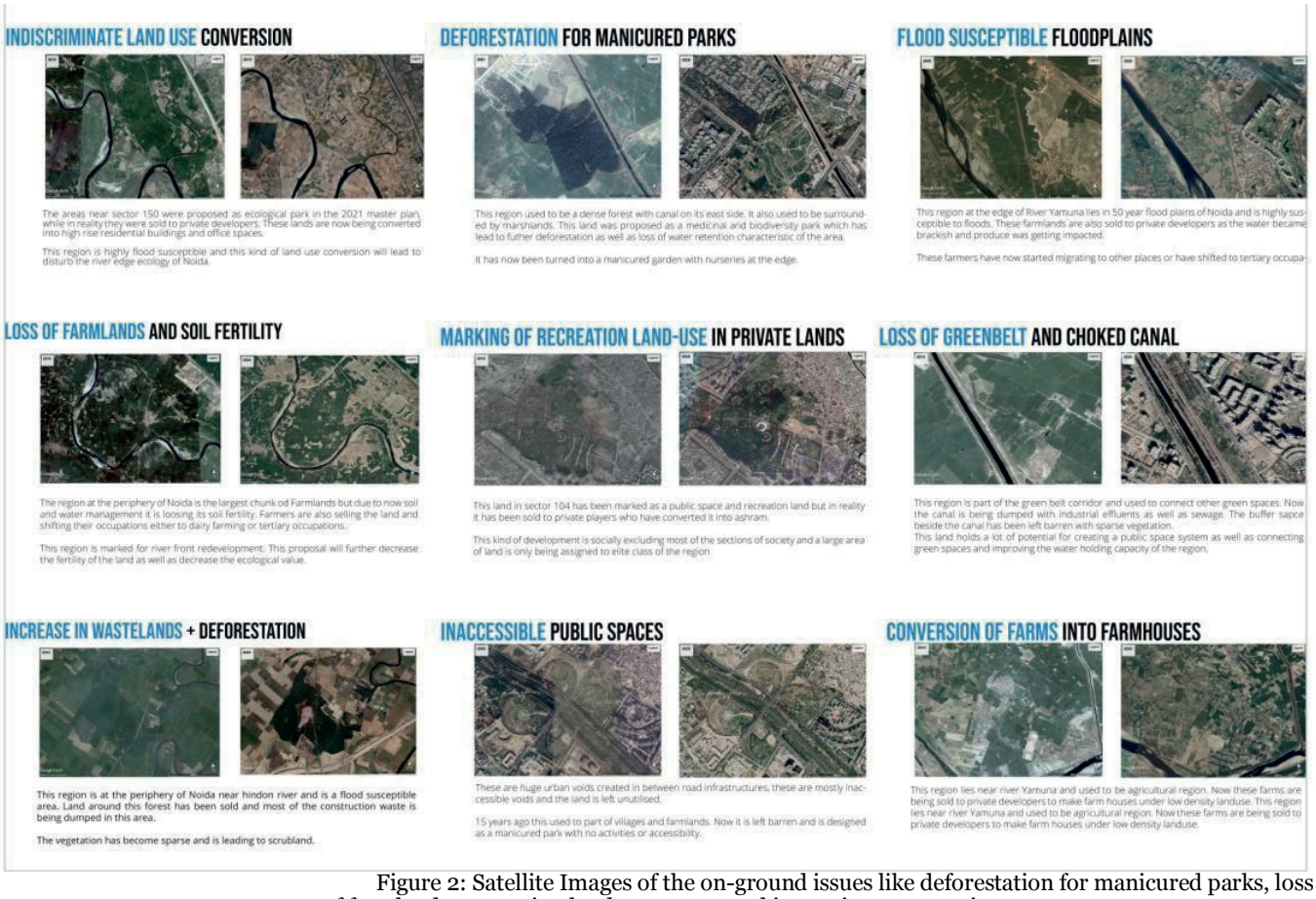

Figure 2: Satellite Images of the on-ground issues like deforestation for manicured parks, loss of farmlands, recreation land uses converted into private properties, etc.

Primary surveys noticed that most of the interwoven green areas (recreation land use) have either been encroached by various buildings, left barren, or abandoned. An attempt was made to activate a large chunk of green space through a children's park. The park remained underutilised and now lies barren with rusty swings. Observations state that two major reasons were; firstly, a single activity cannot cater and sustain such large green patches. Secondly, the site had high-speed roads, commercial zones, and office parks on its periphery, which makes the idea to build a children's park incomprehensible. In another case, a patch of forest was cut down to make way for a 'biodiversity park.' Such a pattern can be seen throughout prime locations in the city. Hence, these green areas that lie on each level, i.e. region, city, and neighbourhood can be reactivated by initially restoring the ecology by reusing wastewater, urban agriculture, edible landscapes, energy production zones, community gardens, etc. After which, passive and active recreation, along with multifunctional activities based on adjoining demographics, could help conserve such areas from shrinking and disseminating.

Consequently, the urban arrangement of NOIDA should be rethought to shield the current green belts from the development of encompassing structures.

2.2 Understanding issues: mapping trends of ecology and social (city and small level) realities, the idea of recreation

The layers such as impervious surfaces and normalised differentiation of the vegetative index (NDVI) show how changes in them are increasing the urban heat island effect. Similarly, the increase in impervious surfaces is also causing hindrance in the absorption and storage of rainwater. The primary survey revealed issues of choked drains that cause waterlogging. NDVI layers establish the changes in the density of vegetation along the Expressway where high-density highrise structures are being built at an unprecedented rate. NDVI becomes a tool in assessing the degree of degradation in vegetation and also becomes a source of proof. NDVI can be used even more to track crop health in agricultural areas. In statistical terms, the percentage of built-up in the Noida area was 29.52% during 2010, which increased to 55.03% in 2016. It also shows some positive land use analysis in which the wastelands are getting reduced and are getting replaced by vegetative areas that are showing an increasing trend over the years.

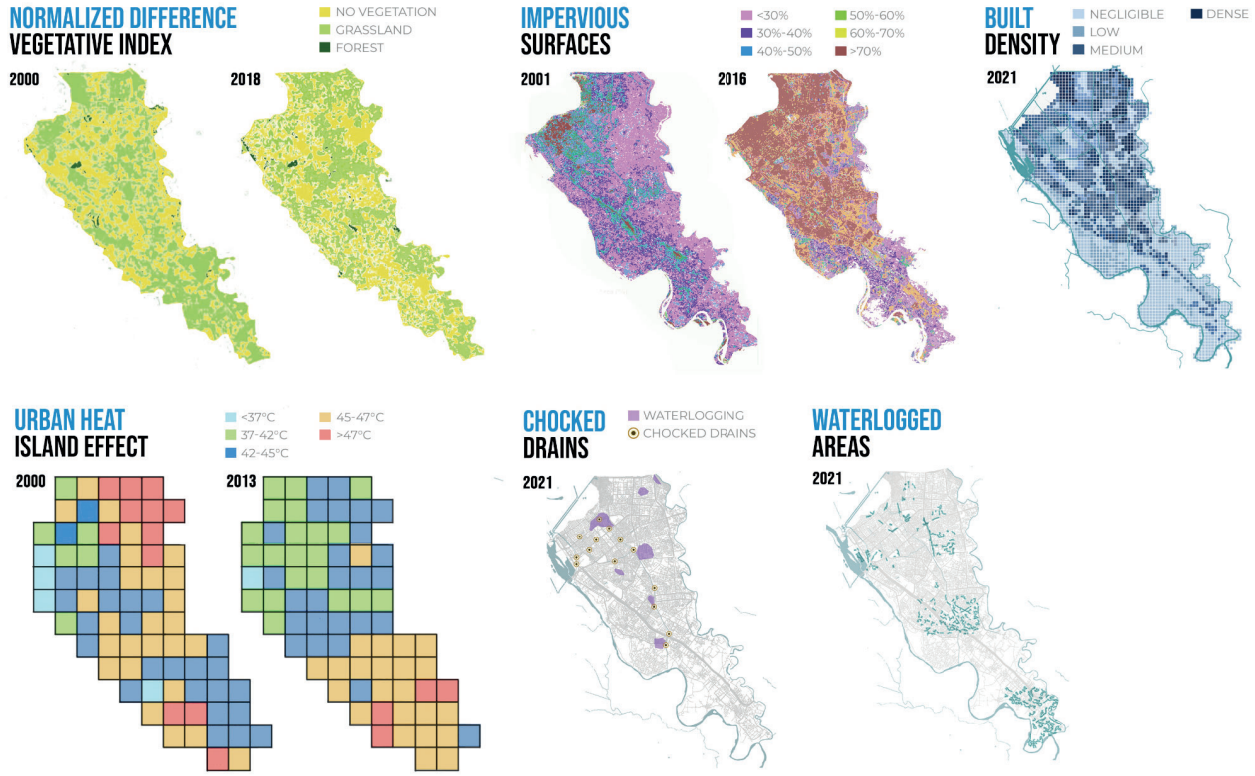

Figure 3: Landsat images showing changes in NDVI, impervious surfaces, the urban heat island effect, waterlogged areas and choked drains (Source: GIS; Author; Noyingbeni Kikon, et al., 2016; Singh, Prafull & Chaudhuri, Anindita, 2017).

With the increase in urbanisation, the urban vegetation is also increasing with a decrease in the Open Land. It can be seen that the city doesn't have a definite pattern of growth overall but has spread across in every direction. It can be seen that though the change in the forest remains negligible in terms of percentage. The fast growth in population and expansion of urban built areas has led to the transformation of the natural landscape into impervious surfaces. Remote sensing-based estimates of impervious surface area (ISA) has emerged as an important indicator for the assessment of water resources depletion in urban areas and developed a correlation between land-use change and their potential impact on urban hydrology. According to the built density map, it can be seen that density is increasing in the new coming development areas along the expressway, putting more pressure on resources and creating a higher urban heat island effect. Along the expressway, agricultural lands are being sold to developers and more highrise high-density housing is coming.

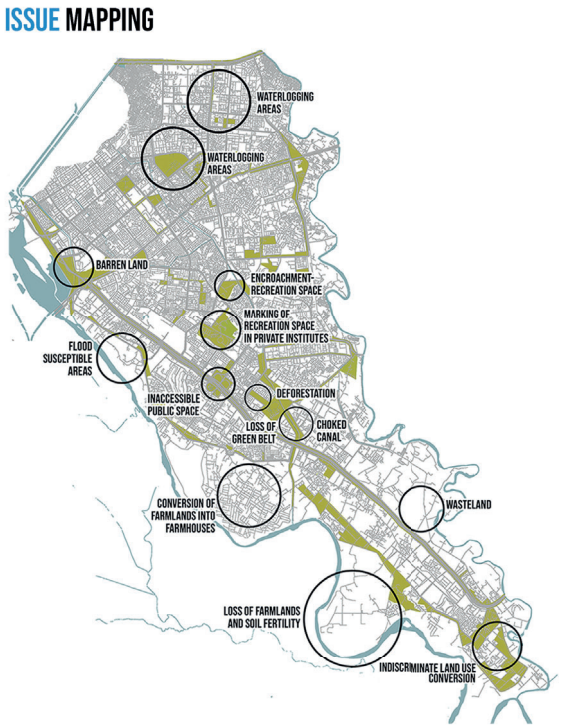

Figure 4: Primary issues in Noida

Overlaying these maps indicate how non-inclusive planning is affecting livelihood, food security, city resilience, as well as the recreation and well-being of a city.

2.2.1 Prevailing food chain

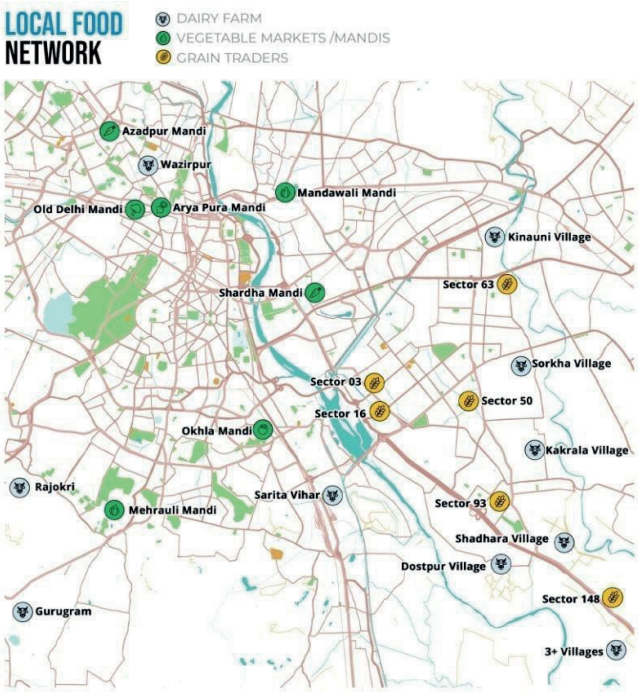

Figure 5: Location of *Mandis*, Wholesale markets and Dairy in Noida.

Gautam Buddha Nagar is an important food processing district as well as cold storage district. However, agriculture in West Uttar Pradesh is highly dependent on rain and groundwater, rendering sourcing and productivity unreliable. This kind of unreliability also brings fluctuations in prices and the quality of produce. The prevailing food chain of Noida showcases a disparity and disconnection in the supply chain. There are no '*mandis*' (State-regulated wholesale markets) and weekly markets do not have any dedicated spaces, forcing distributors, and farmers to source and sell produce, respectively, from neighbouring districts. The kind of master planning that contributed to the homogenous nature of the city is also one of the reasons why agriculture has shifted out of the city; there is no provision in master plans regarding including or catering to agriculture. The correlation between shrinking farmlands and growing barren underutilised spaces suggests that there is no provision regarding the activities of recreation lands and in-between green belts that is why they are underutilised urban voids without any meaning. One could take a look at the food link map and understand if Noida was to go through a disaster, there would be no production in Noida itself, and so Noida isn't self-sustainable due to this breakage.

2.3 Land Valuation for Recreation

Noida has limited options for recreation and most of it involves indoor passive recreation. Even the options available in Noida are not socially inclusive or diverse, the majority of large public spaces charge entrance fees, while others cater to a specific section of the demography. There are almost negligible active/passive recreation facilities in Noida, whereas, its parent, Delhi has many viable options of passive and nature-related recreation. The limited options of recreation keep voids and edge inactive and are sparsely populated. This eventually becomes a breeding ground for crime within the city, as there are no eyes on the street, no gender-/children-friendly spaces, and no point for triangulation. This cycle of underutilised spaces turning into neglected to unsafe is the reason why the idea of recreation among the inhabitants have to be restructured, to ensure spaces remain lively, safe, and inclusive.

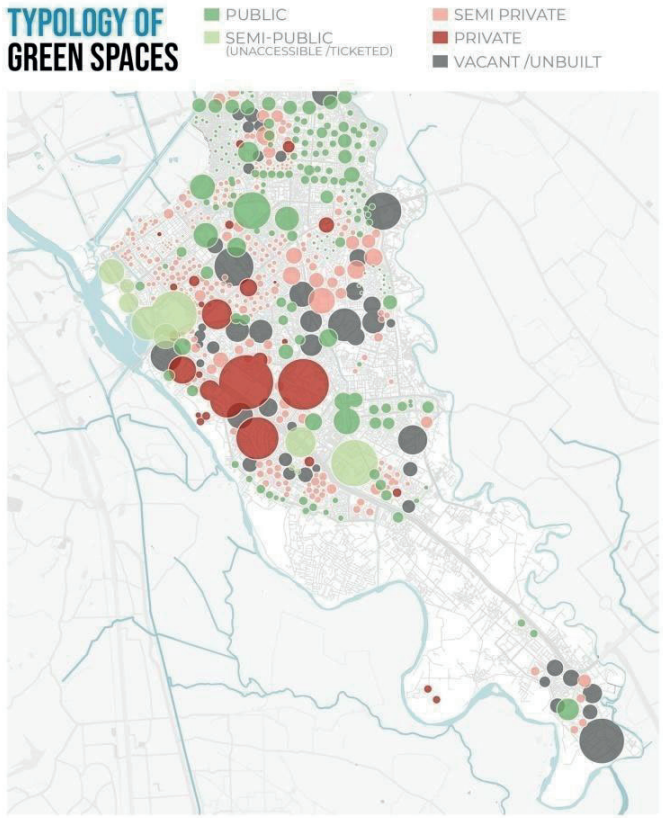

Figure 6: Map showing typology of public spaces in Noida

2.4 How can we change the idea of recreation with landscape planning and bring in a catalytic lifestyle change?

According to spatial attribution, recreation can be classified into user-oriented, resource-based, and intermediate (Clawson & Knetsch, 1966); (Patmore, 1972)). Man's relation to landscape is usually not related to utilitarian or economic purposes. Several approaches for understanding the relations between recreation activities and landscape types are needed to achieve an optimal combination of both recreation and preservation of nature and landscape (Zee, 1990)). Creating and maintaining recreational facilities and providing goods and services to recreationists may have a positive impact on the economy of a region (Zee, 1990). It must also be made sure that the recreational facilities do not harm the natural landscape and ecosystems, as it will then lower its value. This makes it important to understand the behaviour of the visitors and their impacts. The analysis of the relationship between recreation and landscape can be carried out by landscape evaluation, impact analysis, and behaviour pattern analysis (Zee, 1990)

Land evaluation is a process for assessing the features of Land Units (LUs) in order to determine if they meet the needs of certain land uses (Land Utilisation Types, or LUTs) (Van der Zee 1986, based on FAO 1977) (Zee, 1990). Land assessment necessitates the collection and inventory of a wide range of fundamental data related to land, water, and human development, and therefore may be a useful tool for better understanding the relationships between landscape and recreation (Zee, 1990). Fishing, boating, hiking, and other recreational activities would be popular in a rural setting near forests. Like every human activity, outdoor recreation influences the natural environment and can be as destructive as any industry. As a result, while determining whether land units are suitable for a certain form of leisure, consideration must be given to the impact that activity will have on those land units (Zee, 1990). The land valuation theory has been used in this study to develop a spatial framework for Noida with the vision of it becoming the novel model of future planning. Data collected regarding artificial and natural hydrology networks, demographic changes, and the characteristic development of the society and their needs have been used for the basis of developing the strategies for the framework. The gap in the availability of recreation means and the shrinking agricultural land/practices has been the main focus of spatial planning.

3. Results

The vision is to utilise ecosystem services to cater to the city's potential as a solution to the above issues. When we map ecosystem services, we are able to understand the potential of resources in the city as well as locate them spatially. These ecosystem services can be utilised to create provisional services to enhance the economy and community, as well as for regulatory purposes.

3.1 Understanding the selected regions:

The areas for interventions in the study are selected based on criticality and their potential. This section defines the base for the multi-scalar approach. The selection of areas is divided into three hierarchies: the Region, City, and Neighbourhood levels. The areas are then divided into four typologies: the river edge, green belts, urban voids, and community buildings/parks. The aim is to provide ecosystem services, accessibility, diverse recreation, and production benefits in these typologies. Figure 6 entails the conceptual proposal that could contribute to creating a human-centred and nature-centric city.

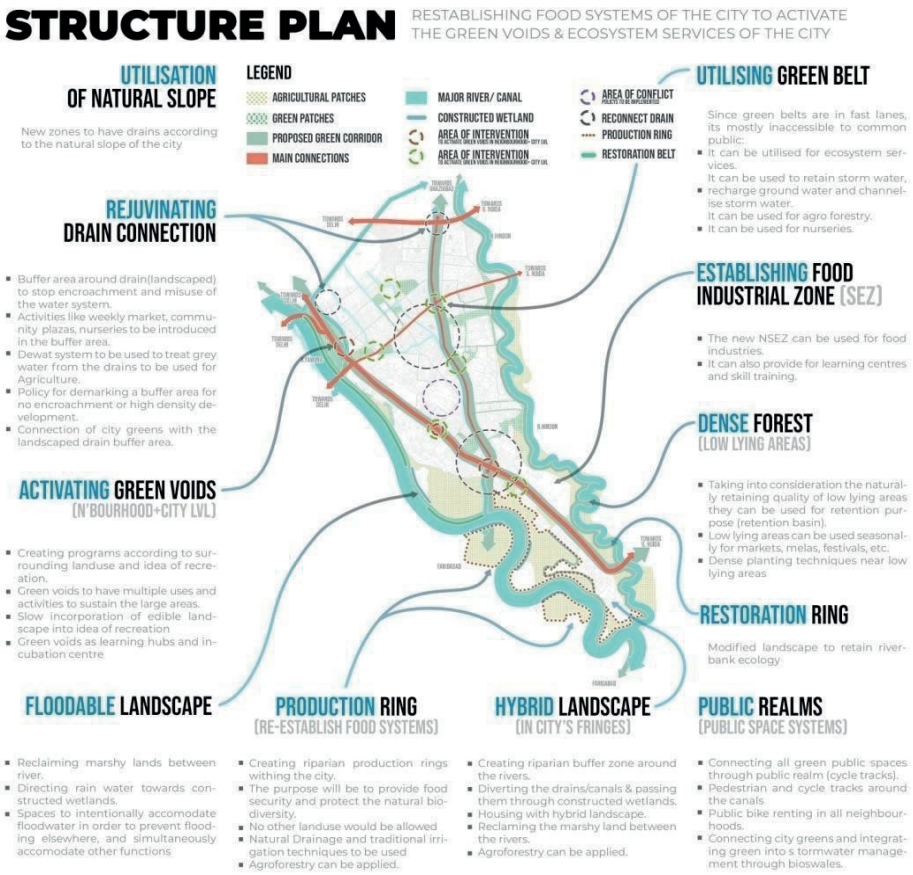

Figure 7: Proposed Structure Plan for Noida in order to re-establish the food systems and activate the green urban voids for ecosystem services

The programming in Table 1 entails the suitability of these provisions in each typology. For instance, the river edge can be utilised to provide ecosystem services that provide flood protection and manage stormwater, as well. It could be made accessible through cycle tracks and landscaped pedestrian tracks. There could be diverse recreation possibilities like agro markets, agro learning hubs, horse riding, fishing, and gastronomy tourism. The landscapes that would suit the river edge could provide benefits like pomiculture, pisciculture, agriculture, and floriculture. Then the intertwined green belts can be used to channelize rainwater and retain them to slow the speed. These green belts could become passive recreation zones for various sectors and could also be apiculture and floriculture corridors which can be maintained by the horticulture department. The urban voids hold the major potential of creating recreation zones at each level. They could be used for training people about urban agriculture, the children could also learn through the changing landscapes.

3.2 The New Idea of Recreation:

We can bring in a change in the idea of recreation of people of Noida by understanding the value of the ecosystem and incorporating it into our planning, while also giving purpose to all recreational spaces that are left void. People should be active stakeholders of these lands and should be able to use them for themselves. This could also mean we can incorporate edible landscapes and workshops to teach people how to create community gardens. There are many residents who cannot afford a backyard, these people can come here and plant vegetables which they can also utilise as a community. Hence, the aim should be to re-establish the food systems of the city in order to activate urban voids and ecosystem services of the city.

AREA OF INTERVENTION	ECOSYSTEM SERVICES	LINKAGES/ ACCESSIBILITY	DIVERSE RECREATION	PRODUCTION ENTERPRISES
RIVER EDGE	FLOODABLE LANDSCAPE, FOREST, INTEGRATED AGRICULTURAL ZONES, RETENTION AREA BIOSWALES, CONSTRUCTED WETLANDS	CYCLE TRACKS, LANDSCAPED PEDESTRIAN ROUTES.	AGRO STATION (MARKET,CAFE), AGRO LEARNING HUBS, HORSE RIDING, WILDERNESS TOURISM, WEEKLY GASTRONOMY TOURISM, FISHING, AGRO-TOURISM, BIRD TOWER	POMICULTURE, PISICICULTURE, AGRICULTURE, ANIMAL HUSBANDRY, DAIRY FARMING, FLORICULTURE, SEED FARMING, SEWAGE FARM.
GREEN BELT	FLOODABLE LANDSCAPE, BIOSWALES, RETENTION PONDS, ENTOMOHABITAT, FORESTATION BY MIYAWAKI	CYCLE TRACKS INTEGRATION	PASSIVE RECREATION ZONES, LEARNING THROUGH LANDSCAPE	FLORAL BELT, POMICULTURE, APICULTURE CORRIDORS.
URBAN VOIDS	FLOODABLE LANDSCAPE, BIOSWALES, RETENTION PONDS, ENTOMOHABITAT, FORESTATION BY MIYAWAKI	CYCLE TRACKS, PBS SYSTEM, PARKLETS, EXHIBITION/ VENDING CORRIDORS.	FOOD HUBS, HAATS, CULTURAL CENTERS, SKATING RING, BUTTERFLY GARDENS, WORKSHOP AREA, PASSIVE RECREATION ZONE, AMPHI-THEATRE, EDIBLE LANDSCAPE, PET ZONES, SAND PITS, SPLASH POOLS, NURSERIES, SPONGE PARKS, TREE HOUSE ZONES, SPORTS AREA.	VERTICAL FARMING, APICULTURE, POMICULTURE, PISCICULTURE, FLORICULTURE.
COMMUNITY SPACE	SUNKEN MULTI-PURPOSE ZONES AS FLOODABLE LANDSCAPE	CYCLE TRACKS, PBS SYSTEM	EDIBLE LANDSCAPE, SUNKEN MULTIPURPOSE ZONES, TERRANCE GARDENS.	FLORICULTURE, APICULTURE, POMICULTURE

Table 1: Programming table for the selected hierarchies

In Table 1 we create a novel model for sustainable urbanisation. Through the programming and attributing different purposes and benefits to each space, the value of the area is being increased and new meanings are being brought in the mind of the city dwellers regarding such public spaces. Residents of Noida, whether from societies or urban villages, can both benefit from these spaces. A flow could be created which would mainly focus on the livelihood, produce, and recreation value of Noida. The flow would indicate how tourists, migrants, urban villagers will visit each typology, what benefits will they gain, and how will they participate. Apart from demography, the flow would also indicate how the ecosystem services will work together, for example, how the wastewater from urban societies will flow towards retention and cleaning zones, how productions from integrated farming zones will benefit the farmers, and how it will reach the city dwellers thus reestablishing the food link.

The idea of passive recreation, as well as community participation and learning recreation, is included in the programming. Through these activities, the programming also brings in the opportunity of new economies and livelihood for people of urban villages and migrants. This also keeps farmers at the centre and focuses more on provisional and regulatory ecosystem services.

4. Discussion

The planning in NOIDA is mainly focused on private developers, housing, or economic opportunities for EWS is not considered in the planning of the city. The urban villagers have to sell their land to the private developers, they gain compensation but they lose their livelihood and start working at factories, etc. Soon all farmlands are sold and the urban village is pressed between many high rise residential apartments. These urban villages have no opportunities and start to cater to the society residents. This also gives rise to thefts, as well as the loss of the skill force. The sectoral planning has also made certain voids in between; these green lands were once connected and had a flow of drains, now they're just barren lands. The new model for such areas should follow the understanding of ecosystem services provided by different landscapes. Recreational potentials should also be considered in rural landscapes according to suitability. It must also be made sure that the recreational facilities do not harm the natural landscape and ecosystems, as it will then lower its value. This makes it important to understand the behaviour of the visitors and their impacts. The management framework can be made according to the various components of interventions and could be divided into Implementation, Training, Funds, and schemes and monitoring, each division can identify various stakeholders that will perform these activities. The funding agencies will mostly be private developers, as Noida is mainly developed by these private developers who want to increase the real estate value of their lands and also for CSR purposes. The phasing can be done according to the ease of application and time, and also according to the

requirement of integrated farming. Hence, we see how repurposing these urban voids and critical spaces not only provides resilience, but also provides recreation, learning experiences, new livelihood opportunities, and food security to the city of Noida.

5. Conclusions

With more and more regions being urbanised, diminishing agricultural lands affects the occupation of people and increases the stress over the remaining agricultural land. The disregard of the relationship between society and the agrarian landscape in our way of urbanism has led to the degeneration of ecological and social balance in our cities. So, we need to shift planning, and we require a more pragmatic approach. For instance, the voids created as a result of sectoral planning can be repurposed and connected through the green belts running along with the city. These intertwined green belts along with the urban voids can be utilised for ecosystem services received from certain landscapes. People should be active stakeholders of these lands and they should be able to use them for themselves. Flows of ecosystem services and the economy can be created with the aspect of utilising the full potential of the city's natural features, as well as demography. Our planning should give a dynamic purpose to our lands, there should be a continuous flow of economy and social attributes. In this way, a novel model is created that we need to understand the pattern of a city, we need to access its ecological and social layers, and find a point that fills several gaps. In the case of Noida, it was the fragmentation loss of the ecosystem and lack of recreation which led to understanding the opportunity the fragmented urban voids hold for becoming socially viable and ecologically relevant hubs.

Data Availability Statement

Derived data supporting the findings of this study are available in Science data Bank at [10.11922/sciencedb.01206], reference number [31253.11.sciencedb.01206].

Contributor statement

The author confirms sole responsibility for the following: Conceptualization, Data Curation, Formal analysis, Investigation, Methodology, and Writing – Original Draft.

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Deurbanized Cities as Strongly Sustainable Human Settlements

Joshua Hurtado Hurtado [1]*, Marzia Sangio [2], Andrés Fernández [3], and Arta Bytyqi [4]

[1] University of Helsinki; joshua.hurtado@helsinki.fi; ORCID: 0000-0002-6848-7949*
[2] The Bartlett School of Architecture, UCL; Kensington Aldridge Academy, London, UK; marzia.sangio2015@gmail.com; ORCID: 0000-0001-7232-8898
[3] School of Interdisciplinary Studies, University of Glasgow, Dumfries, Scotland; research@ecologicaldevelopments.org; ORCID: 0000-0003-4178-2099
[4] UN-Habitat Kosovo, arta.bytyqi@un.org, ORCID: 0000-0002-1813-9962
* Corresponding author.

Abstract: Current approaches to sustainable urbanism follow a weak sustainability approach, which assumes technological and market-based solutions to sustainability problems in human settlements. This makes them inadequate from a sustainability perspective to both respect the sustainability perspective and to maintain critical natural capital in the long-term. Additionally, concern for the well-being of the cities' inhabitants becomes a secondary issue. We argue that de-urban design and deurbanization offer a viable path for redesigning urban human settlements according to strong sustainability principles. This paper examines the potential of the deurbanization framework to regenerate cities and transform human settlements into permanent habitats that build harmonious relations between human beings and non-human natural elements. We first identify key principles of strong sustainability and deurbanization, and address their relevance for the design of human settlements. We synthesize concepts and practices into the deurbanization framework to establish what practices would constitute deurbanized human settlements, and we briefly illustrate how some of these practices would take place in a design-case study. Finally, we establish deurbanization as a strongly sustainable approach to redesigning cities because it views the human and non-human natural world as equally valuable and necessary for life to flourish.

Keywords: Deurbanization; De-urban design; Strong Sustainability

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1. Introduction

In complex settings such as urban environments, where multiple systems and dimensions intersect, most mainstream sustainability proposals are guided by technological and market-based solutions (Huang et al., 2015; Rees & Wackernagel, 1996). Such solutions depend on many special features (e.g., energy-saving, green construction), which makes the initial development cost of such cities much higher than a conventional city of the same size, and often makes them a distant dream (as in the case of Dongtan eco-city) (Cheng & Hu, 2010). By considering the natural capital and the manufactured capital (as well as their kinds of well-being they generate) substitutable, mainstream approaches to urban sustainability can be said to follow the weak sustainability paradigm (Pelenc & Ballet, 2015).

Weak sustainability downplays the importance of the political and social dimensions of sustainability and its proposed solutions fail to adequately remain within the planetary boundaries (Steffen et al., 2015), and may in fact increase the vulnerability of cities. In this context, we propose the idea of deurbanization (Sadri & Zeybekoglu, 2018a), a concept emerging from the de-urban design field, as an integral approach to sustainability in cities. We argue that, based on its features, deurbanization can lead to the strongly sustainable

redesign of cities that views the human and non-human natural world as equally valuable and necessary for life to flourish.

We first offer an overview of the theory on strong sustainability and deurbanization. Then, we synthesize and detail different practices that would be characteristic of deurbanization, and outline some of them in a design-case for the city of Dumfries. We finally discuss what makes deurbanization strongly sustainable.

2. Theories and Methods – Strong sustainability and deurbanization overview

2.1. The principles of strong sustainability

Strong sustainability is a paradigm of sustainability that seeks to preserve the integrity of natural ecosystems, understood as natural capital (Daly, 1991), because of its contributions to welfare, such as by providing resources for meeting human needs or by absorbing waste (Ekins et al., 2003). It is one of the different forms of sustainability identified by Turner (1993), which emphasizes the non-substitutability of critical natural capital, and is opposed to the weak sustainability paradigm, which assumes perfect substitutability between natural capital and other forms of capital (social and economic). The principles of strong sustainability, outlined below, offer ideas on what criteria must be followed so that human settlements, specifically cities, can be redesigned so that they become strongly sustainable and are able to generate well-being for human and non-human beings:

2.1.1. Aligning human societies with the Earth

Human activity, particularly that linked to capitalist economies and societies, has contributed to widespread ecological degradation, making the Earth both hotter and fuller (Bonnedahl & Heikkurinen, 2019a; Brand et al., 2021). Current societal forms of organization depend on the transformation of nature into capital, and this is visible in how the notions of development, growth, wealth and demand all view the elements of the biosphere as something that can be converted into capital for economic processes.

Strong sustainability critiques the way human societies organise themselves around the transformation of nature into capital, and emphasizes the need of reaching sustainable lifestyles by aligning human activity to be in approximate harmony with the biophysical surroundings (Bonnedahl & Caramujo, 2018). To move towards strongly sustainable societies, there needs to be a recognition of the embeddedness of human societies in an earthbound whole, and "their relations to the biophysical world with its systems, processes, and non-humans, must be recognised and understood" (Bonnedahl & Heikkurinen, 2019b, p. 10).

2.1.2. Reaching well-being in coexistence and meeting inclusive needs

In contrast to the weak sustainability paradigm that emphasizes development, growth, and wealth, strong sustainability instead considers as a foundational concept that of *well-being in coexistence*, which promotes human quality of life while simultaneously respecting all life for other actors, such as species and systems (Bonnedahl & Heikkurinen, 2019b, p. 5). This entails adopting a post-anthropocentric perspective wherein the human species is not considered above or most important than other species and natural entities. Reaching well-being in coexistence would mean building up the resilience of ecosystems and maintaining the integrity of both species as a whole and individual members in them.

Building on the concept of well-being in coexistence, a goal of strong sustainability is *meeting inclusive needs* (Bonnedahl & Heikkurinen, 2019b, p. 9). Meeting inclusive needs goes beyond simply satisfying the needs of human beings, adapted according to the context. It requires that the relations between elements in ecosystems are mapped out and the need of each element is identified so that their integrity can be maintained and ecosystems are not rapidly deteriorated by human activity. This way, when human activity may endanger ecosystems, a needs assessment can be conducted so that human needs and the needs of non-human others are balanced and met.

2.1.3. Combining sufficiency, effectiveness, and efficiency to cultivate autonomy

Heikkurinen and Bonnedahl (Heikkurinen & Bonnedahl, 2019, pp. 294–295) have argued that three pillars should drive any attempt and sustainable change: sufficiency, effectiveness and efficiency. Of these, sufficiency is the most important one: producing and consuming in a scale that is relevant for well-being, to meet (inclusive) needs. Effectiveness is necessary to produce the *right* things for meeting these needs, while ensuring a fair distribution in alignment with the biophysical needs of the Earth. Efficiency is required to produce and consume better, using fewer resources per unit. Together, these pillars could orient societies to cultivate autonomy.

Autonomy, in the context of strong sustainability, should be understood as collective autonomy in the form of democratically and deliberatively decided self-limitations (Brand et al., 2021). Reaching autonomy through sufficiency, effectiveness, and efficiency will facilitate that reaching the conditions for living a good life do not inflict upon others' (both human and non-human) ability to do the same at this point in time and in the future (Brand & Wissen, 2021; Kallis, 2019).

2.2. Deurbanization: The concept of the de-urban design field

De-urban design is an emerging field of studies that applies design techniques, methods, and mindsets to reimagine cities so that they become aligned with their biophysical surroundings. The key concept in this field is deurbanization, which seeks to remedy the harms caused by urbanization processes in ecological, social, and economic fields. From the perspective of de-urban design, urbanization has dismantled the strong social solidarity systems of cities and turned "the resilient, interconnected, and harmonious life of our planet to a vulnerable, disconnected, and unharmonious one" (Sadri & Zeybekoglu, 2018a, p. 206). The field identifies several problems intrinsically linked to urbanization, such as acceleration of social dynamics that disarticulates social ties and drives the emergence of inequalities, the destruction and exploitation of the natural world fostered by construction and consumption systems, increased vulnerability against natural disasters, and dependency on the external ecological systems to fulfill the needs of an urban settlement's inhabitants (Sadri & Zeybekoglu, 2018a).

As a response to these problems of urbanization, the field proposes the idea of deurbanization: a transdisciplinary project that takes as its object of study a specific type of sustainability transition (from urban spaces to *de*-urban ones), and an end-state for sustainable cities (human settlements that are neither urban nor rural, aligned with the biophysical capacities of natural ecosystems) (MacCarthy & Hurtado Hurtado, 2020). Deurbanization entails "eliminating the ecological, ethical, social, cultural harms that urbanization imposed on the planet, natural ecosystems, and human settlements; and regenerating and transforming these human settlements into eco-communities and permanent habitats" (Sadri & Zeybekoglu, 2018a, p. 212). In this regard, what deurbanization aims at achieving is the redesign of human settlements so that human needs are met while maintaining the integrity of the surrounding ecosystems as much as possible.

Crucially, the deurbanization vision focuses on freeing the redesigned habitats from any kind of oppression, hegemony, and violence. Human settlements would be comprised of "independent, communal, and collective communities where people can work, produce, and enjoy their lives in solidarity rather than competition" (Zeybekoglu & Sadri, 2019, p. 415). They would also instill an ethos of harmony with nature while cultivating civic and human values (Sadri & Zeybekoglu, 2018b).

Cities still constitute the core focus of the deurbanization proposal. From the perspective of de-urban design, rural settlements are mostly suited for agrarian societies, and – as a whole – human civilization has moved away from these kinds of dynamics. The modern world has also led to rural areas being affected by many of the same problems of urban ones: capitalist structures and relations, unsustainability due to the use of fossil fuels, agricultural production with big industrial machines and processes, etc. De-urban design considers cities as centers of cultural production and where most of the advances in political culture are taking place in the contemporary world. Hence, the idea for cities under the de-urban design perspective is to transform them into producers of food, water, and of fertile ecological spaces as well. This would allow the needs of producers/consumers to be resolved, since the residents of deurbanized cities would become sustainable prosumers.

2.3. Methods

Because this paper attempts to synthesize previous research on deurbanization and de-urban design and establish deurbanization's vision as one of strong sustainability for human settlements, no empirical methods are used. Instead, two qualitative approaches are used to illustrate how deurbanization *might* work as a human- and nature-centered approach to the design of cities:

1) Theory-building through integration. With what we call in this paper theory-building through integration, we seek to incorporate different concepts and identified practices that are relevant for the deurbanization concept into a whole. This is intended to outline in more detail what sorts of practices are envisioned for deurbanized cities and are compatible with strong sustainability. This was done through a literature review.

2) Design case study. What is presented as a case here is not something that already exists as a whole, but a *proposal* for *designing* a deurbanized city, as well as some ideas highlighted by that proposal. In this case, the proposal is for a deurbanized city center in Dumfries, Scotland.

3. Results – Concepts, practices, and illustrative proposal of deurbanization

3.1. Concepts and practices constitutive of deurbanization

3.1.1. The restoration of ecological and communal life

For restoring ecological and communal life, deurbanization suggests that the development of *local intelligence* is vital for the harmonization of human activity and the biophysical surroundings. Development of local intelligence involves developing a sense of place and of community, and of recognising places as living systems. Studies in built environment have addressed the centrality of viewing socio-cultural and ecological systems as partnered (Cole et al., 2013), and if the members of a specific community are skilled in identifying patterns of nestedness and of interaction, they are more likely to be able to redesign their settlements to adapt to their surroundings.

Deurbanization also promotes the idea of *shrinking cities*, because decreasing the population of the cities can also decrease the pressure on the biophysical surroundings of the city. But deurbanization does not simply suggest the decrease of a city's population, but emphasizes the key aspects of cultivating *leadership, networks, learning, and trust* (Herrmann et al., 2016).

Some of deurbanization's proposals for restoring ecological and communal life are most appropriate in shrinking cities, such as *community-supported agriculture* and *urban food-gardening* (Bloemmen et al., 2015; Zoll et al., 2018). Regenerative food systems that are able to operate at small spatial scales, such as *Agroecological Symbiosis* (AES), are also compatible with de-urbanization's vision because they reintegrate all forms of waste into food and energy production (Helenius et al., 2020; Koppelmäki et al., 2019). These alternatives combine the strong sustainability in food production with a focus on meeting human needs and strengthening networks in a given location. Moreover, anthroponics uses human waste to feed plants, the natural nitrogen cycle decomposes human waste, which plants absorb as nutrients through their roots – by doing so water is also purified (Sánchez, 2015).

The aforementioned concepts and practices are representative of strong sustainability's principles of aligning human societies with the Earth and cultivating autonomy. Community-supported agriculture, urban gardening, and AES, enabled by the development of local intelligence and occurring in shrinking cities, contribute to the well-being in coexistence of human and non-human beings by fostering collaboration and the emergence of prosumer subjects, simultaneously reducing the stress on neighboring ecosystems.

3.1.2. Political, social, and economic organisation in deurbanized cities

Urban settlements in contemporary societies foster alienation and instrumental relations among its human inhabitants. Deurbanization seeks to remedy this by advocating for small cities where all its inhabitants can participate in meaningful decision-making practices. The goal of deurbanization on this theme is to orient a city's inhabitants to establish "local economies, governmental, social, cultural, educational institutions (invisible structures); and last but not least, ethically connect to each other" (Sadri & Zeybekoglu, 2018a, p. 213).

Because of the local scope of deurbanized cities, *economic democracy* is vital for ensuring strong sustainability's goal of meeting inclusive needs. Small-scale local agroecology cooperatives, which display economic democracy in their decision-making processes, have the best potential for achieving degrowth goals (Boillat et al., 2012), and it stands to reason that this potential can be translated into the context of deurbanization. *Diverse economic practices* that escape the hegemony of capital and contribute to well-being in coexistence, such as barter markets, time banks, intentional communities, and local currencies, among others (Gibson-Graham & Dombroski, 2020), are also suitable for deurbanized cities and can fulfill deurbanization's aspiration for greater ethical interconnection among a city's residents.

On this theme, deurbanized cities embody strong sustainability principles because participation in meaningful decision-making processes, economic democracy, and diverse economic practices can more effectively lead to deciding the *right* things to produce, and how to produce them efficiently, distribute them equitably, and only at a relevant-scale for well-being.

3.1.3. Key spaces for human-nature interaction

Deurbanization envisions two key spaces for human-nature interaction, while ensuring that additional space is left free of human intervention so that natural ecosystems can thrive. The first space for human-nature interaction are *food forests* which, properly managed, would be able to generate socio-cultural, environmental, and economic benefits. These include, but are not limited to: meaningful and safe employment with a social purpose, contributions to the well-being of the community, water conservation and soil formation, increase in biodiversity, economic viability, and shared ownership and decision-making (Albrecht & Wiek, 2021, p. 94).

The second space are *border zones*, spaces of intermediate habitats where human beings and wildlife would be able to come into contact without one invading the residing area of the other. These border zones could manifest in multiple ways: in holistic community parks, rewilded corridors in the periphery of the city, or the aforementioned food forests. Border zones are inspired by literature on ecotones, in this case also considering human beings as part of a zone's biodiversity (Brownstein et al., 2015).

Deurbanization, however, emphasizes the need to preserve *sacred sites*: natural locations untouched and unaffected by human activity. These need to be previously demarcated and known by a deurbanized city's inhabitants, so that they are respected and free from human intervention.

3.2. Vision for a deurbanized Dumfries

3.2.1. Overview

In the west of Scotland, the center of Dumfries has been experiencing social, economic, and environmental deterioration since 2011, as seen in Figure 1. As people are seeking affordable housing and green spaces in other areas of the city, the buildings are left vacant, hence, the streets and the city core have also lost their livability.

We elaborated the initial stages of a de-urban design project for the regeneration of Dumfries center, with the intention to revitalize derelict and underutilized areas of the town, and provide benefits in health, education, local economy, and mutual aid. These would build on the local intelligence of Dumfries' inhabitants. The proposal is expected to lead to community-supported agriculture practices in Dumfries and economic democracy, once they are consolidated. Other aspects of deurbanization, such as Urban Food Forests and Sacred Sites, are not illustrated here because of the scope of the project (Dumfries city center). It is important to emphasize that what is shown here is not the complete deurbanized vision of Dumfries, but only an initial stage.

Figure 2 shows the installation of urban food gardens and food containers throughout the neighborhood, as well as the rewilding of peripheral areas of the center. This follows deurbanization's idea of reaching well-being in coexistence by minimizing invasive-destructive interventions and regenerating green areas.

3.2.2. Self-sufficient community and social sustainability

The regenerative concept of urban food gardens would promote new, alternative economic dynamics that would help Dumfries' residents engage in more sustainable lifestyles and promote a transformation of the city towards inclusive and socially conscious sustainability.

Through urban food gardens, residents would organise and support each other to grow organic food with a skilled gardener overseeing the dynamics and training locals. Moreover, urban food gardens could foster democratic decision-making, which contributes to a sense of belonging and ensures the social sustainability of interventions.

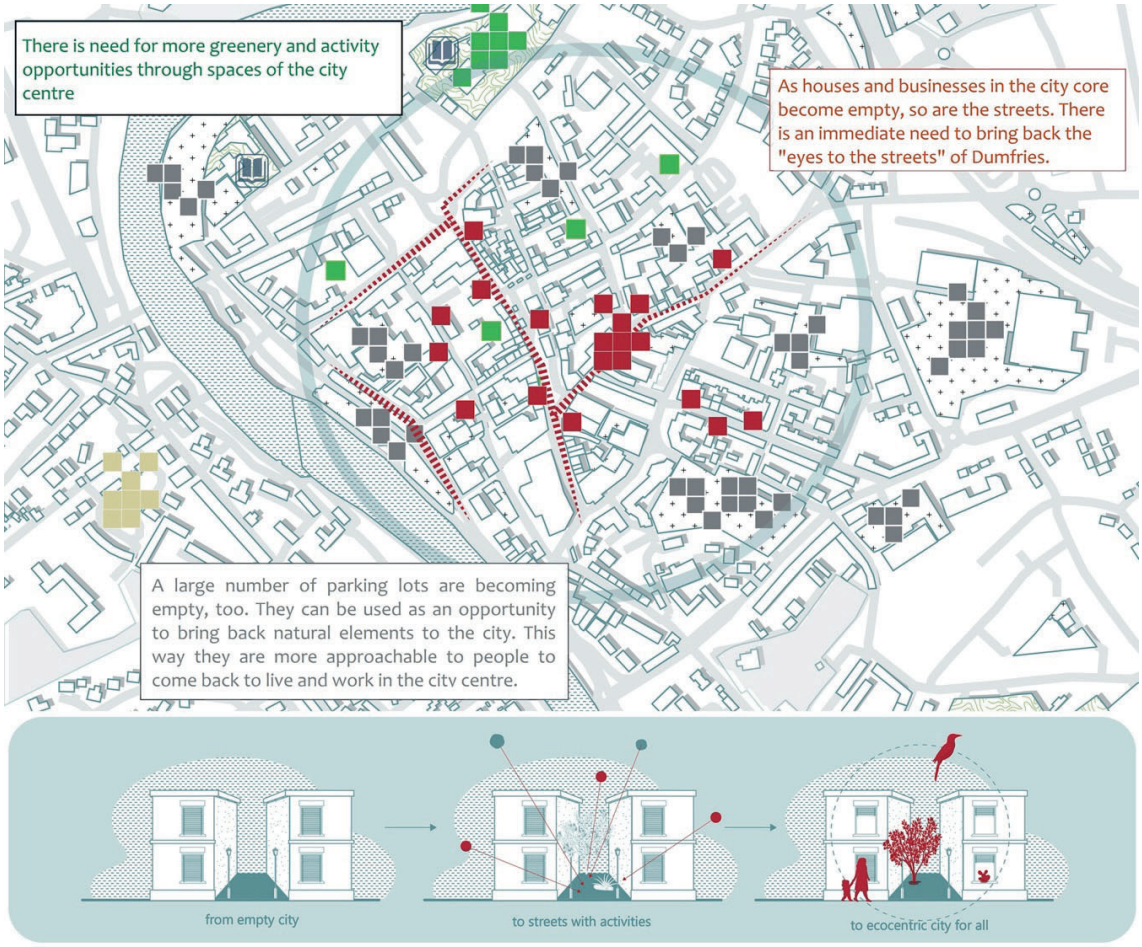

Figure 1. Green spaces, empty houses, parking lots, and residential areas in Dumfries.

Figure 2. Initial stage of deurbanized Dumfries city centre.

4. Discussion: Deurbanization as a strongly sustainable vision for human settlements

The results in the previous section highlight how deurbanization is a proposal for re-designing human settlements, specifically cities, to become strongly sustainable. What this means is that such settlements would be aligned with the biophysical conditions of the surrounding environment, would seek to reach the well-being in coexistence notion by building up the resilience in ecosystems and meeting inclusive needs (both of humans and

of non-humans), and would encourage sufficiency, effectiveness, and efficiency practices to cultivate the autonomy and self-management of the city.

In this regard, deurbanization is both human-centered and nature-based, as the focus on meeting inclusive needs implies. For human beings, it would meet the integral needs of the individual (such as basic necessities like food, water, shelter, and emotional and social necessities like trust, care, and meaningful participation) and it would cultivate some needs of the post-human subject, such as empathy, rich affective life, and interconnectedness (Braidotti, 2013).

For the non-human beings of natural ecosystems, deurbanization's focus on building up resilience of locations where humans intervene in (such as in food forests) and maintaining the integrity of locations where humans should avoid going into (such as the sacred sites) would ensure that reaching conditions for living a good life in a deurbanized city does not inflict upon the well-being of non-human others at present and in the future. Ultimately, the current tensions in urban centres between humans and nature would mostly disappear because the deurbanized city would constitute a *renaturalized* human settlement: the city would function as a space for healthy nature-culture relations where mutualistic relationships between people, animals, and the land are strengthened.

Though only an initial-stage proposal, the Dumfries design case establishes some deurbanization elements that could expand and become consolidated if the project were to be consolidated. These include urban food gardens and its associated practice of community-supported agriculture. Economic democracy could also take place by developing the local intelligence and allowing a neighborhood's residents to make decisions on how food is to be produced and economic initiatives are going to be developed.

Based on the outlined practices of deurbanized human settlements and their application in the Dumfries case, we argue that these proposals are strongly sustainable for two reasons. The first is that deurbanization views the non-human natural world as equally valuable and necessary for life to flourish, and designs cities accordingly. The second reason is that notions of justice and fair-share, visible in sufficiency, effectiveness and efficiency practices, and replace the imperative of material accumulation and expansion characteristic of contemporary urban settlements.

5. Conclusions

One of the most important and common attitudes promoted for intervention of urban development is adopting sustainable strategies with the intention to respect and safeguard the environment and its relationship within human beings. However, mainstream sustainable interventions adopted in green urbanism often do not consider maintaining the integrity of the natural environment nor integrating social and political dimensions into their proposals.

This paper argued that deurbanization is a strongly sustainable vision for human settlements, specifically cities. It outlined some concepts and practices that are constitutive of deurbanization. These include the development of local intelligence, trust, networks, and learning; community-supported agriculture; urban food gardens; Agroecological Symbiosis; economic democracy; diverse economic practices; food forests; border zones; and sacred sites, among others. These practices embody the principles of strong sustainability, mainly the alignment of human societies with the Earth, the ambition to reach well-being in coexistence and meet inclusive needs, and the integration of sufficiency, effectiveness, and efficiency in the dynamics of human settlements.

Ultimately, the vision of deurbanization is one about valuing both human and non-human life equally and designing human settlements so that all kinds of life are able to flourish. However, as deurbanization is relatively new and certainly unknown to the general population, future research could address this gap by conducting interviews and questionnaires with citizens to find out their attitudes towards de-urbanizing the spaces they live in and changing their lifestyles.

Contributor statement

1. Joshua Hurtado Hurtado- *Supervision, Conceptualisation, Methodology, Writing-Original Draft*

2. Marzia Sangio - *Methodology, Writing-Original Draft, Review & Editing, Visualization*

3. Andres Fernandez - *Writing-Original Draft, Resources*

4. Arta Bytyqi – *Review & Editing, Visualization.*

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Harnessing the Environment for Socio-ecological Encounters and Knowledge Spillovers: Lessons from the Greater One-north (GO) Creative City Design Explorations

Daniel R. Y. Gan [1], Xia Hua [2], and Rudi Stouffs [3,*]

[1] Simon Fraser University; drgan@sfu.ca; https://orcid.org/0000-0002-7920-9231
[2] Tongji University; xhua@tongji.edu.cn; https://orcid.org/0000-0001-5965-4023
[3] National University of Singapore; stouffs@nus.edu.sg; https://orcid.org/0000-0002-4200-5833
* Corresponding author.

Abstract: Knowledge cities may be understood as cities that rely primarily on the global knowledge economy such that they attract the creative class in our globalized world. Examples include but are not limited to New York City and San Francisco. As East Asia undergoes rapid urbanisation, more cities, e.g., Shenzhen, are modelled to capture the economic benefits of 'knowledge spillovers' (Henderson, 2007). The Knowledge Spillover Theory suggests that innovation is concentrated in some quarters of the city because of informal social exchanges across co-located industries. Business incubators are often introduced to accelerate these processes. For instance, Launchpad@One-north, Singapore, is surrounded by media corporations, a university, a business park, mass transit, and nature areas. The Greater One-north area required spatial planning as more intensive developments were expected to serve future housing along the southern waterfront. Action research-by-design was employed to examine the economy-ecology outcomes from scenarios of varying densities. In this paper, we identify two types of economy-ecology synergies that may be achieved by careful spatial design for socio-ecological encounters. Four scenarios with different orientations toward the economy-ecology dichotomy illustrate these to varying degree. Overall, a high-quality environment is synergistic. Simultaneously centring humans and nature may attract talent and accelerate innovation in knowledge cities.

Keywords: Socio-ecological encounter; knowledge city; knowledge spillover; spatial planning; research-by-design

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1. Introduction

Considering the well-being of people and biodiversity on equal footing in urban planning requires clear articulation of their synergistic pathways and mechanisms. In the absence of these articulations, this research "transcends paradigms" (Costanza, 2014) by acknowledging the economic objectives of developers while attempting to address (1) property and (2) resource conflicts in the "planner's triangle" (Campbell, 2016) in a spatial planning exercise for a real-world client. This paper examines one of our two overarching paired questions in the economy-ecology dichotomy:

(2a) How might the retention of greenfields enhance informal social processes that support innovation in a knowledge economy?
(2b) How might density and new technologies introduce contact with nature to support the well-being of people and nature in a knowledge city?

These questions simultaneously extend Campbell's conceptualisation of economic objectives to global levels while zooming in to everyday lived experiences at individual- and city-levels. This paper aims to investigate how economy-ecology outcomes of different spatial planning proposals affect 'knowledge spillover' (Henderson, 2007). We build on a study which examines the varying impact of differing spatial densities and configurations on the outcome of knowledge, science, or creativity-driven city development.

In the knowledge economy, knowledge is conceptualised as the main driver of production (Virno, 2004, p. 64), and as such the knowledge-based economy has become the main driver of urbanisation (Westlund, 2014). Ingi Edvardsson and colleagues defined 'knowledge city' (KC) as a city where "both the private and the public sectors value knowledge, nurture knowledge, spend money on supporting knowledge dissemination, and discovery and harness knowledge to create products and services that add value and create wealth" (Edvardsson et al., 2016, p. 538). In developing KCs, design can play an important role in ameliorating the capitalist commodification of knowledge and spaces (Thrift, 2006) as a common instrument to 'create new modes of collective becomings' (Grove, Krivý, Rickards, Schliwa, Collier, Cox, & Gandy, 2019). For example, the *density* of the built environment and the compositional characteristics of spatial proximities can influence how common needs in a knowledge economy are satisfied (Westlund, 2014).

In contrast to dominant approaches in extant studies, our study uses a bottom-up approach through the method of research-by-design in conjunction with an urban planning studio to understand the impact on and role of ecology (broadly defined) in practice-led solutions for KC development.

2. Theories and Methods

2.1 Knowledge spillover: An ecological economic concept

Knowledge spillover may be understood as a specific form of positive externality when formal research and development or informal learning in firms and universities benefit another entity, including individual employees, new ventures, or other firms that utilize the new knowledge (Hua et al., 2022). A wide range of literature from economic geography to cluster research frame KC planning as a spatial intervention to facilitate and derive societal benefits from knowledge spillovers. Geographers Bjørn Asheim and Eric Clark (2001) assessed the 'creative city' as 'imagineering device, place marketing tool, and urban policy lodestar' (p. 808). More critically, geographers Ron Martin and Peter Sunley (2003) described a Marshallian industrial district or cluster as little more than a well-marketed 'brand' that "at its core is based on an image of a high-productivity, knowledge-rich, decentralised, entrepreneurial, and progressive economy *within the reach* of local policy-makers" (p. 29, emphasis added). As such, knowledge spillover is always (g)locally contextual and ecological.

Formally, the knowledge spillover theory of entrepreneurship (KSTE) explains how and why knowledge 'spills over *by entrepreneurship* and generates growth and progress for society' (Ghio et al., 2014, p. 9, emphasis added). Associated concepts with spatial implications include global knowledge pipelines (Bathelt et al., 2004), new knowledge ventures (Ghio et al., 2014), and psychosocial knowledge atmosphere (Marshall, 1890; Raffaelli, 2001; cf. Gan, Fung, & Cho, 2021). Briefly, knowledge pipelines allow the inflow of market knowledge and innovation to energise 'local buzz,' which needs to be nurtured (Bathelt et al., 2004). Since investing in research and development inevitably results in some knowledge that may not be directly relevant to a company, setting up spin-offs or new ventures based on these and other knowledge, including tacit knowledge, harnesses these otherwise unutilised resources for local economic growth (e.g., Ghio et al., 2014). Whether the local information flow yields productive outcome depends on its psychosocial atmosphere, which necessarily decays with distance (Audretsch, Lehmann, & Warning, 2005; Lee, Hong, & Sun, 2013), is not easily transplanted (Marshall, 1890) and requires effort (Gan & Best, 2021). Together, they facilitate economic growth via knowledge spillovers.

Given our spatial planning purposes, we extended the concept of knowledge spillover with the actor-network theory (Hua et al., 2022). Briefly, Porter (1990) argued for the collocation of supporting *and rivalrous* firms to generate competitive advantage in a study of productivity across 10 nations. But Jon Swords (2013), a researcher of creative clusters in the United Kingdom pointed out that the process of knowledge spillover is a black box

in reality, which is 'opened and exposed to a critical light that [potentially] destabilize[s] the actor-network' (p. 379). From a macro perspective, geographer Jamie Peck (2014) echoed David Harvey's (1989) criticisms that entrepreneurial urban governance commodifies places to generate very narrow forms of innovation. David Audretsch and Maryann Feldman (1996) parsed apart knowledge flow from locational effects on the concentration of innovation activities. They showed that innovation clustered due to the *actual sharing* of knowledge and not simply because the firms were near one another. These garnered scholarly attention on knowledge spillover in small, multi-sectoral communities.

2.2 Translating knowledge spillover into spatial planning?

Despite uncertainties around the mechanisms of knowledge spillover, one may postulate several spatial intervention strategies that interweave multiple factors. KCs require (1) conducive environment for knowledge production and exchange. Barron and Harrington (1981) show that creativity is affected by motivation, role models, places, and working schedules. For example, thought leaders that motivate innovation may be more easily encountered in cities that (2) draw together different, but complementary ways of knowing. Knowledge work may require quiet space for independent thinking and social space for communication. Enabling and inspiring work spaces are important but (3) adequate and comfortable living environments, including natural environments, are also necessary. Affordable housing, accessible and high-quality amenities and health provisions, and convivial public spaces could better attract knowledge workers.

Multiple institutions, infrastructure, and services working synergistically together are required to support these KC development strategies. They entail socio-aesthetic judgment to strike a reasoned and 'dynamic balance,' e.g., for comfortable working *and* living spaces at the individual level. High-quality residences usually result in expensive houses or apartments, but affordable housing is required for young entrepreneurs, students, and supporting workers. A shorter commute increases life satisfaction, which may be important for sustaining innovation (Richardson et al, 1974; Garrod & Willis, 1992; Stutzer & Frey, 2008). Convenient public facilities and neighbourhood spaces should support various lifestyles (Lennard, 1987). Richard Florida (2010) argues that lifestyles affect where people choose to live and work. The distribution, quality, and availability of affordable housing are critical to satisfy of all the three knowledge job types and support a thriving (human) ecology (Niedomysl & Hansen, 2010).

At an organisational level, a mix of institution types and sizes is also required. According to planner and geographer Gregory M. Spencer and colleagues (2010), the presence of industry-specific clusters is associated with higher average income and employment growth in Canadian city-regions. Their careful operationalisation of industrial clusters partially accounted for general urban differences that may have altered these economic performances. This was in line with Feldman and Audretsch (1999) who found that 'diversity across complementary industries sharing a common base' (p. 427) increased benefits from research and development. Large firms were more likely to spend on research and development which may spill over such that small firms in clusters with more large firms would exhibit more innovation (Acs & Audretsch, 1988, p. 687). High-technology firms were more likely to be found nearer to universities that produced more science graduates than social science graduates (Audretsch & Lehmann, 2005, p. 1199). Both large firms and relevant universities are sources of knowledge spillovers that may be exploited. How these institutions sit on and fit together within a landscape is subject to different spatial planning decisions.

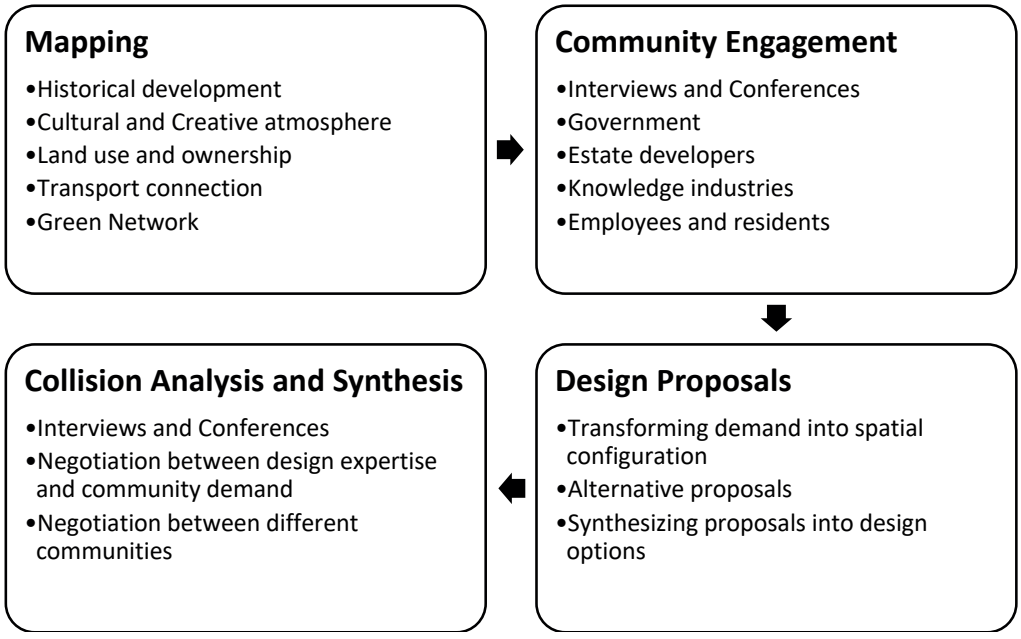
2.3 Method: Research-by-design

In view of the permutations that may result from various planning practices and emphases, we adopted 'action research-by-design' to study the economy-ecology outcomes of possible spatial planning solutions, also known as design-based research. Research-by-design is based on the notion that some practice-based knowledge cannot be accessed through conventional deductive approaches but requires systematic observations and sense-making from messy (but often coherent) practices. Contextual, *in-situ* observations in studio settings provide insights into considerations and processes of design activities, which target specific, everyday issues, and are crucial for practice-based knowledge. Compared to conventional research, research-by-design focuses on the action of professional and creative practices, to produce tacit and experience-based knowledge that are not easily accessed by other means. It admits as data a plurality of design tools and expressions such

as drawing, writing, distributing, and performing into the arena of urban studies. As urban study inevitably involves particular spatial information and immediate experience of local context that sometimes cannot be easily illustrated and communicated by non-spatial research methods, research-by-design offers unique insights to articulate and rethink situated knowledge among urban practitioners.

On the premise that knowledge spillover processes are embodied experiences, investigative explorations, drafting, modelling, design critiques, especially through engagements with the community of planners, developers, scholars, and space users, as well as reflection are important for practice advancement. Through these activities, planners gradually form their ideas of feasible and ideal spatial solutions, e.g., to facilitate better knowledge exchange and/or enhance natural assets. The primacy of inductive analyses does not negate, but complements quantification. Compared with various technological methods in extant studies, research-by-design is uniquely positioned to yield new, 'intuitive' concepts and issues, and may therefore result in more persuasive and feasible socio-spatial solutions, e.g., that which enables knowledge spillover.

A four-step procedure culminating in 'collision analysis' guided our data collection and analysis processes, which may or may not mirror planners' processes. (1) Mapping focuses on the historical development; the extant cultural and creative infrastructure; land use and ownership, and contextual analysis including the extant transport and green network. (2) Community engagement includes interviews with stakeholders like the government, estate developers, industrial operators, and residents for their contribution to the idea of KC development. (3) Design proposals transform demand into spatial configuration, and synthesize proposals into feasible design options. (4) Design collision analysis identifies 'where local and national global competition interests come face-to-face and, in some cases, collide" (Evans, 2009, p.1007), and forms the basis of our economy-ecology discussion in this paper. Specifically, we compared the economy-ecology outcomes across various planning solutions.



2.4 Observation site: NUS planning studio

Participant observation was carried out at a master-level urban planning studio at the National University of Singapore (NUS) in 2019. The planning brief was developed in conjunction with Jurong Town Corporation (JTC) — a government agency that develops and manages state-owned industrial land, including 812 hectares around One-north, a medium-sized employment centre west of Downtown Singapore. The studio brief required student planners to propose spatial plans in six teams, each focusing on a distinctive spatial quality, namely mobility, centrality, spatial continuity, work-life balance, and nature and human connections. For the purposes of our comparative 'collision analysis,' these

resultant spatial solutions were crystallized as two-dimensional maps, to assist with identifying and analysing their commonalities and differences. Post-action informal interviews were conducted with students and tutors, around the considerations and decisions that led to different solutions. Stakeholders such as major office towers and incubators in One-north were also interviewed, including officers from the JTC, the NUS Office of Estate Development, the Prime Minister's Office (PMO) National Population and Talent Development Division, and the Singapore Science Park.

2.5 Planning site: Greater One-north creative city

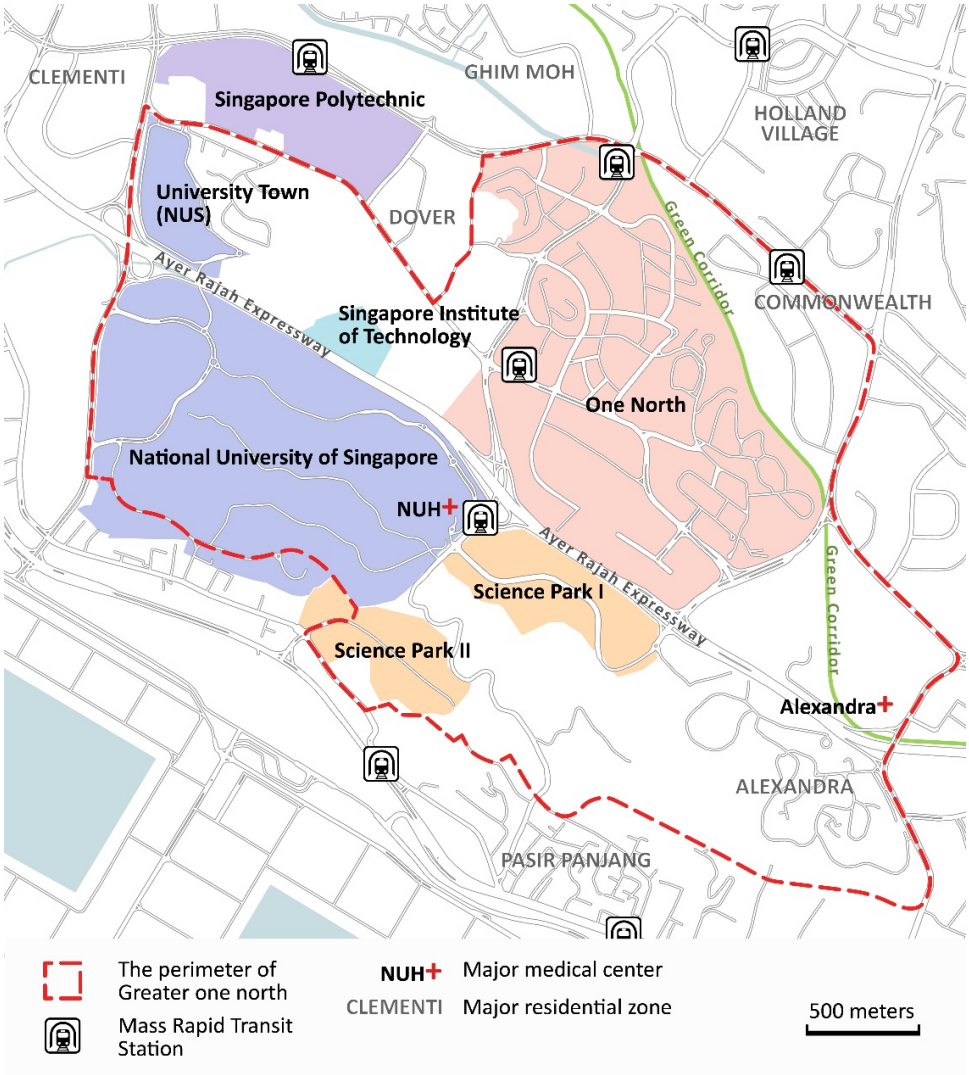


Figure 1: Fragmented developments in Greater one-north

One-north was planned and developed as a knowledge-based industrial estate in Singapore to accommodate high-tech businesses and research institutions in biomedical sciences, info-communication, and media since the early 1990s when Singapore sought to move up the global value chain, shifting its economic growth from labour-intensive industries to technology- and knowledge-intensive industries. Its location took advantage of convenient transit node at Buona Vista and proximity to educational and research institutions, including NUS and Singapore Polytechnic. The original intentions envisioned high-density, mixed-used urban neighbourhoods, offering researchers, scientists, technopreneurs, and venture capitalists having an ideal environment for research and collaboration. A master plan was developed by Zaha Hadid Architects in 2001, and was implemented in part as of time of studio, in the area south of Buona Vista, including office buildings, campuses, and a few residential buildings. Some of the most recent developments include Launchpad@One-north in 2014, an incubator refurbished from flatted factories for light industries to house high-tech start-ups and 'ensure that the innovation and entrepreneurship drive in Singapore would not rely solely on large research institutes' (Phua, Prakash,

& Chia, 2018, p. 60). Its location just north of Science Park I partially completes the development along North Buona Vista Avenue, north of the Ayer Rajah Expressway (AYE). Most of the remaining land are greenfields or very low-density 'black and white' bungalows spread some distance apart from each other.

To maintain a good street-level connectivity in a high-density development, the first phase of One-north was designed as low-rise with building bases covering the whole plot with no or less setbacks compared with other similar streets in Singapore. Food and beverage shops were arranged in the pedestrianized area in blocks, and bridges in the sky connect all buildings of the first phase, allowing more interactions between different entities. The second phase of One-north took a more concentrated approach by housing all tenants and facilities in a single high-rise building complex (Fusionopolis), to facilitate a more vibrant lived-in community.

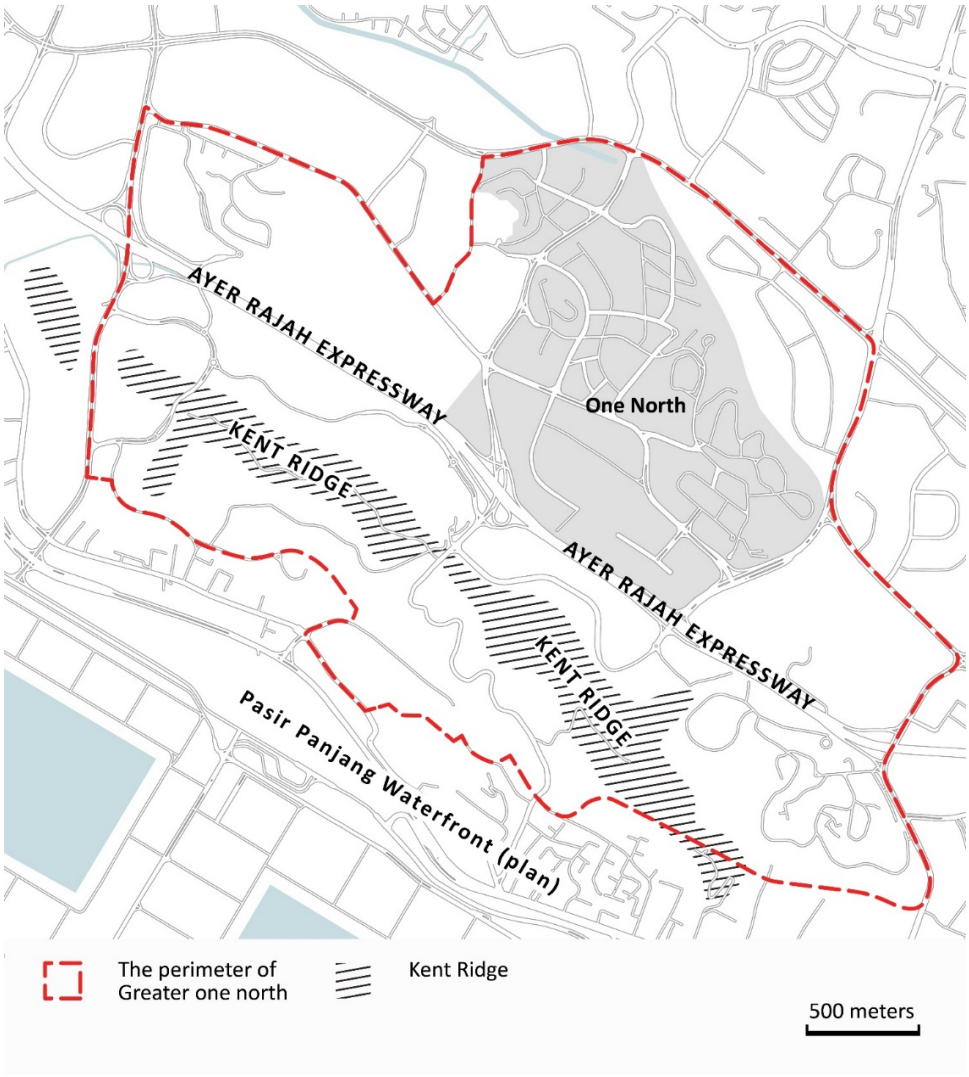


Figure 2: The physical barriers

Although a variety of issues concerned the six teams, two planning challenges stood out. Despite the intentions to create an environment to 'live-work-play-learn,' insufficient dwelling units were constructed. New residential developments were expensive and separated from existing affordable housing at Commonwealth. Most workers commute from neighbourhoods beyond the planning site. The lack of housing meant that few people remained in this area after working hours, besides visitors to retail and restaurant outlets near Buona Vista transit station.

In addition, spatial connections within the area were constrained by major roads such as the dual-four lane Ayer Rajah Expressway (AYE), bridged by dual-one, dual-three, and

dual-four vehicular flyovers, and six pedestrian bridges. South of AYE was Kent Ridge, on which much of NUS was sited and part of which was developed as Kent Ridge Park, up to 61 metres above sea level. The limited number of existing public bus routes between One-north and other research areas does not address this fragmented development, neither do development-specific shuttle buses that serve internal travel demand to and from transit stations. All these served to increase commute time. These physical barriers pose considerable challenges to connect planned residential development along the southern waterfront on retired docklands.

3. Results

Based on common observations that the extant land use pattern created urban fragmentation and monolithic, monofunctional areas, which impaired the urban life of these areas, the teams proposed distinctive spatial plans, with permutations of monocentricity vs. polycentricity, limited vs. extensive 'air-rights' development across AYE, and a lower vs. higher residential-to-working population ratio as shown in Table 1, resulting in four urban futures which are detailed elsewhere (Hua et al., 2022).

Urban futures	Spatial network		Bridging the AYE		Residential to Working	
	Monocentric	Polycentric	Limited	Extensive	Low 1:1	High 2:1
Scenario A1	√		√		√	
Scenario A2	√			√		√
Scenario B1		√	√		√	
Scenario B2		√		√		√

Briefly, futures A1 and A2 both feature one contiguous mixed-use area, invariably around the current Launchpad@One-north and Science Park I, decking over limited parts of AYE, e.g., between transit stations at National University Hospital (NUH) and One-north, or more extensively along a large stretch to enable a more contiguous urban fabric. The former resulted in the lower overall development density (similar to the University Town), whereas the latter featured a higher overall development density (similar to Fusionopolis). Their differences are best exemplified by the following spatial plans.

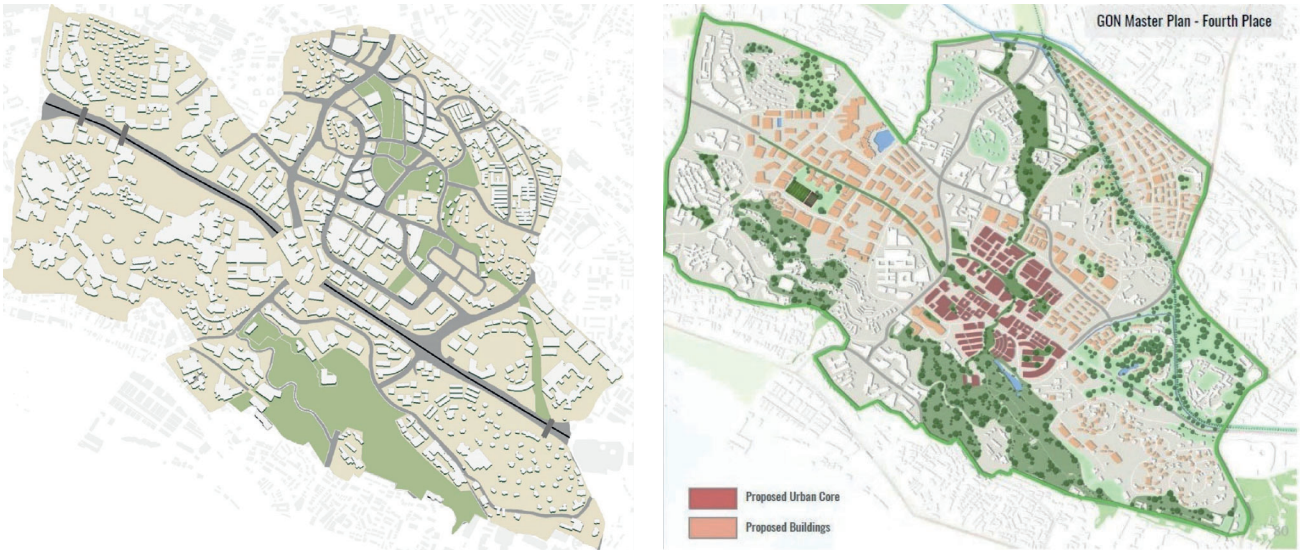


Figure 3: Possible spatial solutions in futures A1 (left) and A2 (right; notice proposed decking over AYE from University Town to Portsdown Avenue).

Correspondingly, futures B1 and B2 both feature multiple mixed-use areas of different hierarchies, with limited or extensive decking over AYE, to support transportation needs from lower or higher residential-to-working population ratios as shown in Figure 4. Besides the central core, there will be other subcentres across the site. Across the six proposals, these subcentres may be located near University Town, next to One-north, or towards Alexandra. The air-rights development over AYE is limited to the location of the centre and sub-centres in future B1 which expects a lower resident-worker ratio and a

lower development density (comparable with University Town or Fusionopolis). In an extreme case of future B2, the entire AYE between University Town and Alexandra may be built underground. The overall development density is the highest in this scenario and may be similar to downtown Singapore.

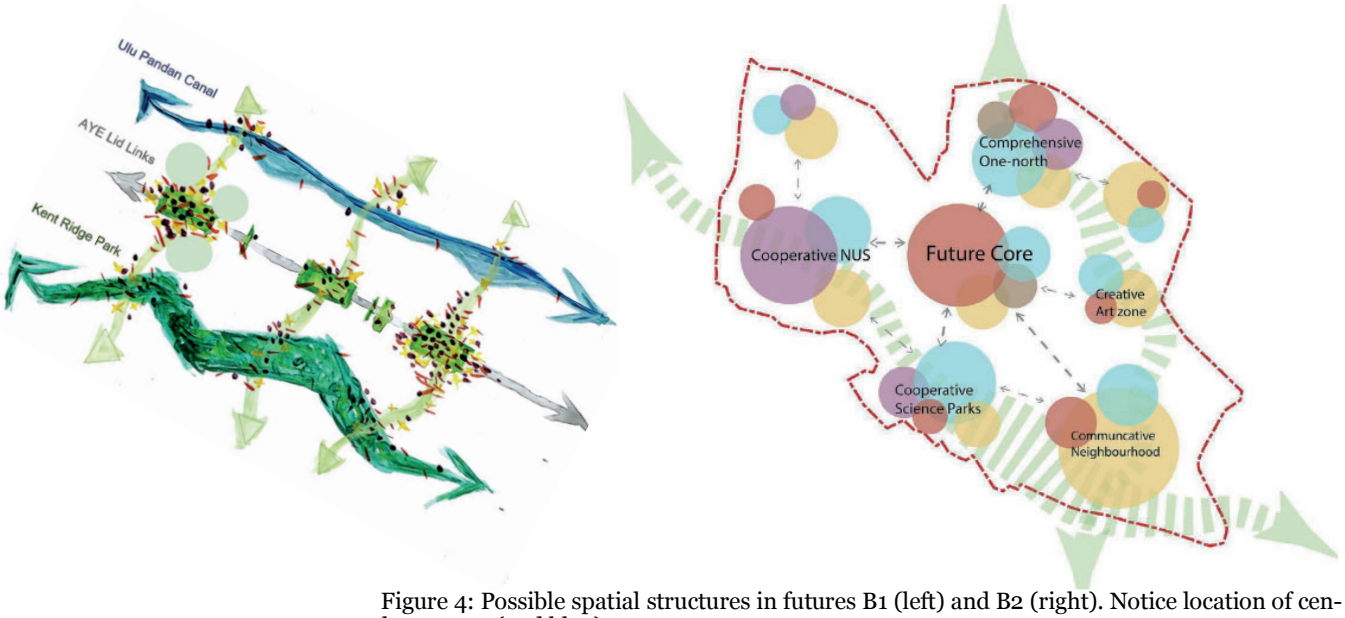


Figure 4: Possible spatial structures in futures B1 (left) and B2 (right). Notice location of centres along green (and blue) connectors.

4. Discussion

We now turn to analysing possible economy-ecology outcomes in these resultant spatial plans/structures using interpretive visual analysis, supplemented by observations and conversations with the student planners. Scenario A1 was driven by the economic intention of creating a vibrant linear urban core along Buona Vista Avenue, connecting the north and the south across AYE. Student planners were very aware of site-specific challenges to meet increased transportation needs of future residents, and sought to minimise the introduction of additional commercial uses for which additional residences will be required to meet the minimum 1:1 residential-to-working population ratio. As such, the approach was to strategically introduce commercial uses at the most critical point to connect the transit and commercial node at NUH with existing commercial developments along North Buona Vista Avenue. The concentrated commercial corridor likely supports vibrant night life and may serve as focal points for interactions and knowledge exchanges across job types in Greater One-north. Knowledge spillovers likely occur, but separate from greenery.

These economic-driven decisions of minimal but strategic change to improve urban life led to the retention of large swathes of existing greenery. However, the current patterns of green space use likely remain unchanged. Inherent in this spatial plan is the position that development is generally detrimental to the environment, and should thus be minimised while prioritising urban vitality. Student planners are pragmatic and cautious (but possibly realistic) in their estimation of their abilities to effect change. The implementation approach is incremental and with preference for shorter planning time horizon.

Scenario A2 addresses the same north-south fragmentation with greater gusto, resting on the assumption that improvements in engineering and construction technologies (and air-rights development) will allow minimal encroachment into greenfields while improving urban vitality. Careful introductions of built elements into green areas create opportunities for landmark developments, and efforts are made to introduce green and blue areas as connectors or focal points in otherwise built areas, including those on the AYE deck. Despite the higher density achievable through this spatial plan, it is easy to imagine greater human-nature interactions, and the possibility of casual relationship-building and knowledge exchanges along the green corridor on the way home, which may be brought to nearby restaurant outlets or landmark spaces. One may just as easily move to larger green

spaces further along the green corridor for immersive nature experiences to reduce cognitive load (Gan, Zhang, Ng, 2021).

This technology-enabled solution strikes a visionary balance to achieve both intensive urban development and opportunities for human-nature interactions. The high-quality environment, including 'active' and 'passive' greenery, serves to support knowledge spillover and KC development. Inherent in this spatial plan is the position that development is not necessarily detrimental to the environment, and that good quality high-density urban developments are possible. Student planners are thorough but optimistic in their estimation of planning and technology to effect positive change. The implementation must be phased, likely with a long-time horizon. Fine-grain planning and careful urban design guidelines, land parcellation, and effective development control will be required.

Scenarios B1 and B2 both featured the use of green (and blue) corridors for transportation, and sited their multiple urban centres at nodal points along their intersections. It is noteworthy that both of these spatial plans remained more schematic, suggesting that more effort may be required to imagine how these spatial structures may be realised. Regardless, their urban visions were clearly communicated in other drawings. Whereas B1 imagines well-distributed commercial and residential functions along three urban-nature spines flanked by larger green or blue corridors for active use or relaxation, B2 emphasizes the mixing of retail, office, educational, residential, and logistic functions across all of its polycentres, each with different characteristics. Greenery, both natural and man-made, serves to add urban character.

These conceptual solutions may or may not espouse similar values towards greenery and are idealistic in different ways (Chiaradia, Sieh, & Plimmer, 2017). Their orientation towards the economy-ecology dichotomy is unclear (or they may assert the absence of dichotomy). Both are premised on the possibility of a high degree of harmony between nature and humans who would live apart from or in nature areas. Whereas the former treat natural green spaces differently from man-made green spaces, the latter does not. The former evokes idyllic rural lifestyle in an urban work environment, while the latter necessitates large swathes of high-density development to finance the decking over of the whole AYE, which may be arguably beneficial for the environment elsewhere through intensive developments here. If these urban visions and spatial structures are to be implemented, much more careful planning and zone-based detailed guidelines may be required.

5. Conclusions

This study used action research-by-design to examine economy-ecology outcomes in different spatial plans given the same planning context. Different economy-ecology orientations may shape spatial planning profoundly, resulting in different economy-ecology outcomes that may or may not support KC development. In detailed spatial plans, two types of economy-ecology synergies may be identified, i.e., intensive developments to minimise ecological impact (synergy by separation, e.g., A1), and connective spatial design for socio-ecological encounters (synergy by encounter, e.g., B1). The four scenarios with different orientations toward the economy-ecology dichotomy illustrate these synergies to varying degrees. Their varying development densities alone do not provide sufficient indications. High quality environments (e.g., A2) are synergistic in both ways. Simultaneously centring people and nature may be necessary to attract talent and accelerate innovation in knowledge cities.

Contributor statement

DRYG, XH and RS co-conceptualised the book-length project from which parts of this paper are drawn. XH curated the initial manuscript draft and visualizations (Figures 1 & 2). DRYG conducted additional analysis. XH validated these analyses. RS provided supervision and project administration. JR obtained funding and resources. All authors participated in the review and content editing of the manuscript.

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A Sense of Place: Site Specificity as a Way to Foster Resilient Urban Landscapes

Cristina Wong [1]

[1] Universidad de Piura; cristina.wonglent@gmail.com; ORCID ID 0000-0003-2348-2842

Abstract: The current paper presents a tool able to achieve sustainable landscapes, meaning that the final product is the intertwining of design processes instead of arriving at a predetermined final form which is unfolded with the systems found in place. Spatial explorations are realised under the methodological umbrella of Research through Design, where the territory is analysed, synthetized, and evaluated through creative manners. This results in the exploration of geographical, cultural, and social dimensions in the form of mapping and designing transformative models. The aim of this research paper is to explore the idea of site specificity as a design tool to achieve sustainability in social-ecological systems, which claims the capacities of resilience and adaptation as its essential components. The emergence of proposing this project in Lambayeque, Peru arises from the need to mitigate the ravages caused by natural disasters, where flooding wreaks havoc resulting in the loss of productive land and critical infrastructure, as well as devastated towns, affecting mostly vulnerable population. The result is the capacity of natures – with a certain degree of manipulation – to become the stitching element throughout a dispersed territory in the form of green and blue networks running across the region, as part of sustainable urban water landscapes.

Keywords: site specificity; climate change adaptation; resilience; landscape urbanism

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1. Introduction

Traditional urbanism discourse is usually stirred towards a connotation where natural and rural landscapes are relegated to secondary places. However, there is evidence of systems-based thinking, where ecology is taken as essential to address urban planning and design. One of the commonly borrowed terms from ecology is resilience, which deals with complexity and change, terms seen as the basis for innovation since change is deep-rooted in system dynamics (Erixon et al., 2013).

In order to achieve integral sustainable projects, the territory is viewed as a socio-ecological system where ecology is considered as a pivotal part of urban planning, thus giving the same level of importance to the built environment and to natural landscapes (ibid.) highlighting the relationships and processes among humans and nature. The socio-ecological system approach emphasizes the symbiotic relationship among the human dimension – people, communities, economies, societies, cultures – and the ecological dimension, and how these shape each other through time. By understanding the territory as a complex ecological model, uncertainties are considered fundamental since disturbances are embedded within socio-ecological systems, and which are subject to sudden and unpredictable change (Lister, 2007). The ubiquitous presence of abrupt uncertainties calls for an adaptive capacity in order to accommodate change, which are especially acute nowadays due to climate change-related events such as floods, droughts, heatwaves, and wildfires, among others.

A research-by-design case in the Lambayeque region, Peru is taken as a testing ground. The rapid urban growth of the last decades currently dominates the natural environment of Lambayeque, creating a false sense of self-sufficiency at the city level, comprising most functions and programmes on an urban scale. According to Tucci (2009), floods resulting from natural disasters are the main vulnerability suffered by developing countries. Moreover, natural disasters are intensified due to climate change, resulting in the loss of productive land and infrastructure, as well as devastated towns, affecting mostly vulnerable population. In the Peruvian case, the El Niño Phenomenon – FEN – affects the country resulting in heavy rains, floods caused by higher levels of river streams, landslides, extreme temperature, diseases such as cholera, and finally, large losses of endemic fauna and flora. Additionally, in 2017 a new climate pattern emerged called 'El Niño Costero' (Coastal El Niño), which caused even greater havoc: 14 of the 25 existing regions were declared in a state of emergency, disease outbreaks occurred, thousands of people died, and vast agricultural areas flooded. In the years when natural disasters affect the country, the national GDP is reduced by 5–7%, representing approximately 10 billion dollars.

In the current paper, site specificity is presented as a tool to design on multiple spatial and temporal scales, where both conceptual and tangible site exploration is possible, taking into account the perception and engagement of the human dimension to the site. Moreover, site specificity puts the idiosyncrasy of a community and physical features of landscapes on the same level of importance, creating an opportunity for the final design to be precisely curated for the place instead of coming up with a predetermined form. The aim of this research paper is to delve into site specificity as a design tool to achieve resilience within socio-ecological systems, and as a way to foster sustainable territories, acknowledging that the site results from an array of cultural, geographical, topographic, and social practices where the greater patterns such as geomorphology and hydrology are of the outmost importance (Berrizbeitia, 2007).

The working methodology is Research through Design 'RTD,' a "research method in which spatial design plays the main role" (Nijhuis & de Vries, 2020, p. 87), which allows for exploration by thinking and producing, where the agency of mapping plays a fundamental facet

An aspect of novelty to put forward with this paper is the notion of existing landscapes as the canvas where not just new landscapes are designed, but a new codependency of associations – relating this process to the milieu (Corner & Hirsch, 2014) – to the precise site where flooding takes place in order to create spatial interventions in the form of transformative models. This performance is a result of reading the territory under the umbrella of site specificity, understanding the geographical, cultural, and social formations of the region. It also takes into account the capacity of nature-based solutions – through mapping and transformative models – to illustrate the resilience and adaptive capacity as a way to overcome challenges faced by the Lambayeque region, in the form of green and blue networks running across the region that are part of sustainable urban water landscapes.

2. Theories and Methods

Landscape urbanism focuses mainly on structures or contexts that adapt to conditions, not to the mere shape of the place resulting in an aesthetic design (Berrizbeitia, 2007) that is capable of hosting innumerable forms of processes, relationships, and interactions. It is important to mention the omnipresent role of ecology in this approach, which in turn harbours processes of codependency.

Corner describes the specificity of site as an approach that takes into account its 'environment, culture, politics, and economies, as a programme unto itself' (Corner & Hirsch, 2014, p. 286). For the study, this position is merged with the one from Berrizbeitia, where the specificity of site places the experiences and physical attributes of a given landscape on the same level of importance (Berrizbeitia, 2007). By placing experiences, not just programmes or events, in such an assertive scene, the human agency is taken as a crucial piece of the ecosystem. The non-equilibrium paradigm in ecology considers humans as "learning and active agents of change" within ecosystems (Pickett et al., 2004, p. 376); it pays special attention to the dynamics and processes drawn within systems, while describing resilience as the "ability of a system to adapt and adjust to changing internal or external

processes" (ibid., p. 373). This better aligns with the current project, as well as with urban planning and design disciplines since urban landscapes are considered systems of change where the built environment and its dynamics are in constant fluctuation.

Unlike the architectural object, a landscape urbanism project develops, adapts, evolves, and even improves over time. Moreover, it will possibly suffer change in its composition or structure over time (ibid.). For the Lambayeque case study, the course of time is comprised by two components: seasonal change and disruptive change – as uncertainties arising from extreme events such as the El Niño Phenomenon.

The RTD methodology is used as an umbrella for research and as a way to explore spatial possibilities to generate innovative results. In this context, the term 'design' is understood as a form of research in itself and as a "research method in which spatial design plays the main role" (Nijhuis & de Vries, 2020, p. 87). This methodology results in design explorations, in the making of several transformative models, aiming to expose challenges and opportunities of the site, and possible design solutions in order to face extreme weather conditions. The aforementioned methodology is used in order to put forward the idea of site specificity as a tool to achieve long-term sustainability.

In addition to the approach described above, this study takes the principles of spatio-temporal multi-scalarity in order to determine the degree of manipulation of the landscapes to achieve water security facing contingency and change. Thus, the spatial scales are the macro scale corresponding to the Lambayeque region, the meso scale corresponding to the Chancay-Lambayeque sub-basin, the micro scale corresponding to the rural town of Chongoyape, and finally, the streetscape scale corresponding to a closer look into the built tissue.

Figure 1. Spatial scales. Diagram of spatial scales: macro, meso, micro, and streetscape.

3. Results

3.1 Resilience and adaptive capacity thinking

Allowing a landscape to perform in multiple ways can fulfill the demand for public spaces while achieving sustainable development. Long-term sustainability requires the capacities of resilience and adaptation as its essential components.

The dynamic characteristic of ecosystems mentioned in the previous section is encouragement to design dynamic processes as resilient and adaptive systems that are able to steer paths in case of any known or unknown disturbances, in order for them to "adapt to changing conditions over time" (Berrizbeitia, 2007, p. 183). In this context, resilience is measured by how much uncertainty and change an ecosystem might absorb before changing paths or regimes (Czerniak, 2007; Erixon et al., 2013). In the Chancay-Lambayeque sub-basin, that would be translated into the amount of rainfall that the river can accom-

modate – after a natural disaster – before 'flipping' into a new behaviour of flooding. Additionally, "watersheds are integrators of diverse processes" given that subterranean water from aquifers, aquitards, aquiclude, and aquifugues accrue sediments and minerals that can be helpful or polluting agents downstream of the basin (Pickett et al., 2004, p. 376). Moreover, in the words of Folke (2016), "it is possible to convert different vulnerabilities and uncertainties into windows of opportunity, basing the transformation of landscapes on multi-scalarity, resilience, and flexibility, also adding the ability to adapt to design." It is within this framework that the current case study takes place, designing green and blue infrastructures in an array of spatial and temporal scales in the Chancay-Lambayeque sub-basin.

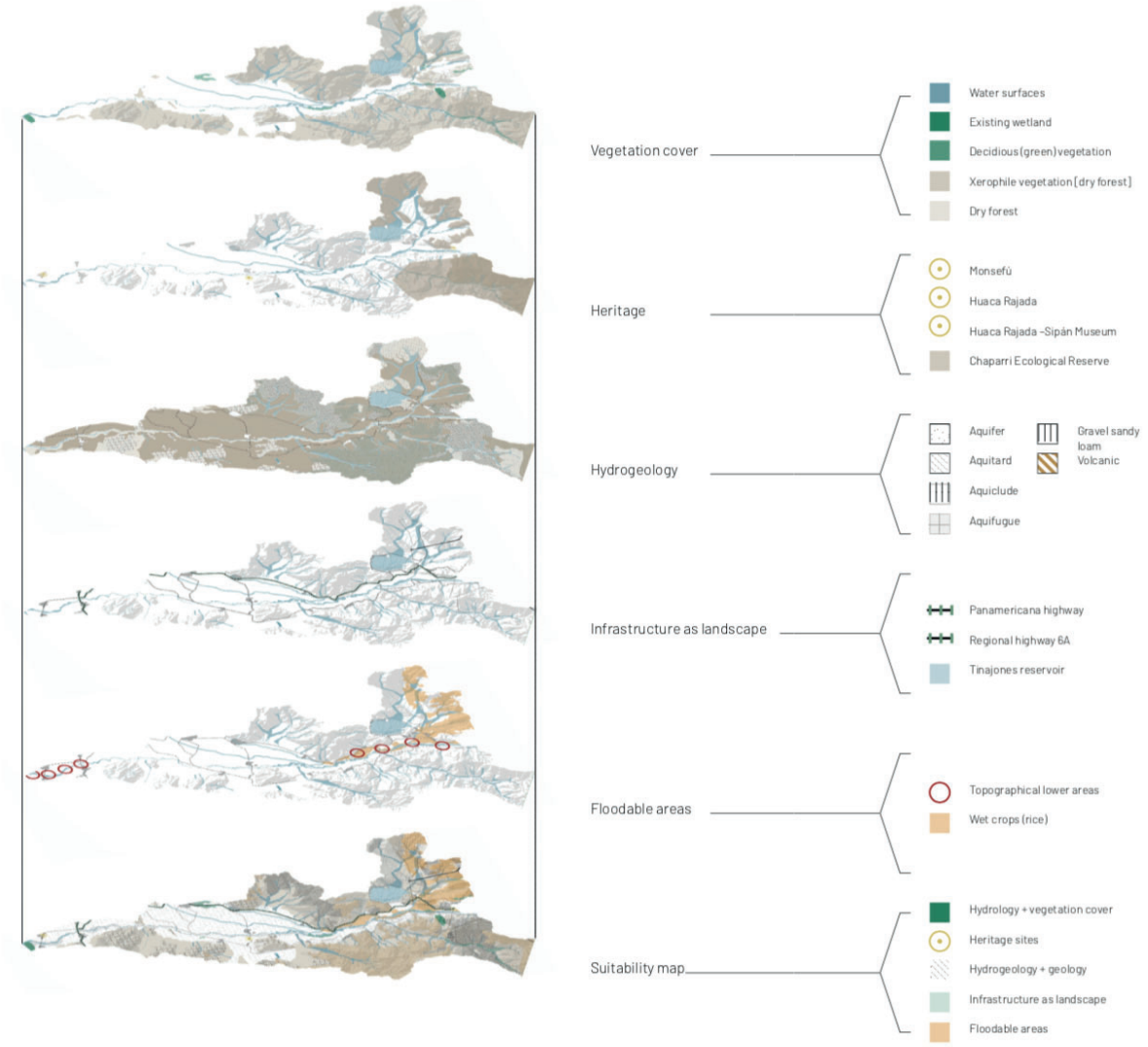

Figure 2. Analysis of the Chancay-Lambayeque sub-basin. The analysis of the territory using site specificity as the main exploration tool allows for the design to evolve taking into consideration physical qualities and idiosyncrasies of the sub-basin. Layers of the initial analysis and design include: vegetation cover, heritage sites, hydrogeology, infrastructure as landscape, and floodable areas resulting in a suitability map for the sub-basin.

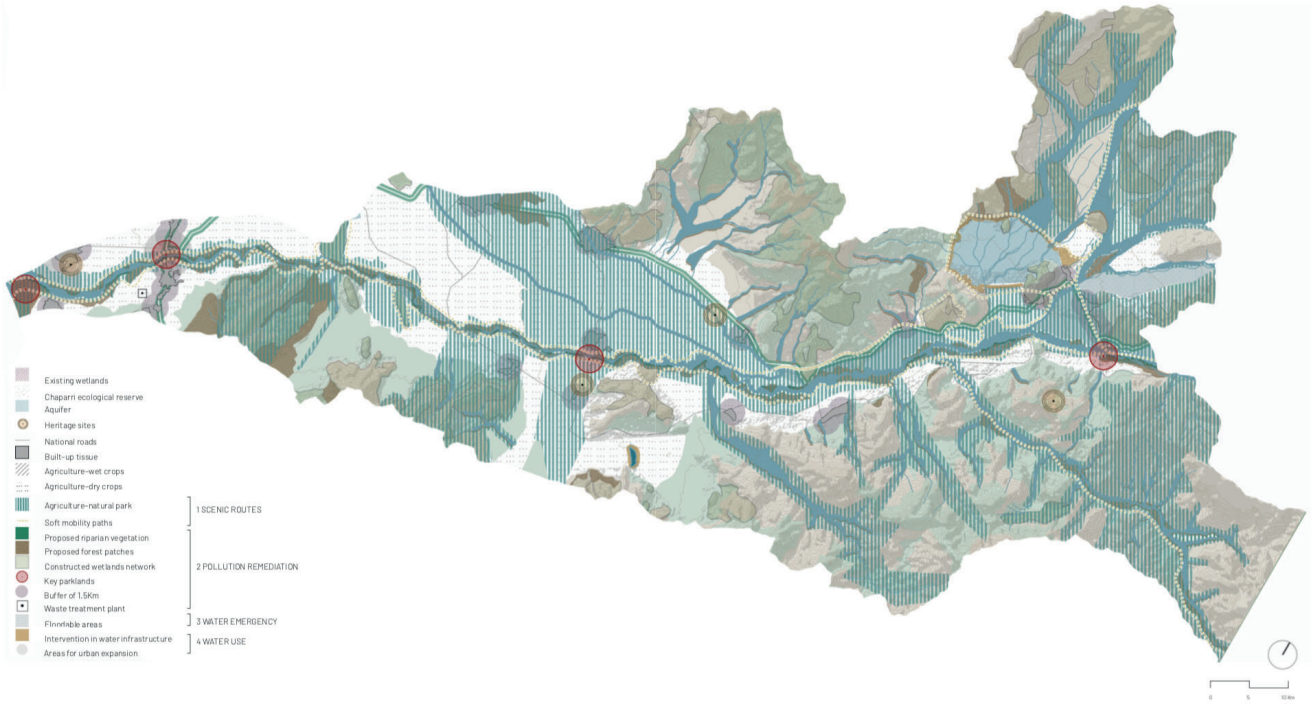

Figure 3. Agriculture-natural park as a result. The proposal at the sub-basin level results in an Agriculture-natural park along the Chancay-Lambayeque river corridor, which is comprised by four strategies: Scenic Routes, Pollution Remediation, Co-existence with water, and Use/Recreation water. These strategies, in turn, are composed by spatial interventions that are tested in smaller-scale sites that are transformative models along the river corridor, which function as the linking element at the meso and macro scale, initiating the proposal of the park green & blue networks, where an array of landscapes intertwine, profiting and retrofitting among each other achieving a new equilibrium of coexistence with flooding. (Wong, 2018)

Resilience and adaptive capacity thinking are closely related to sustainable development. For the current project, this is comprised of the design of green and blue networks which take the parcels close to the river axes, turning them into protected areas, creating an Agriculture-Natural Park. By giving this river corridor the status of a regional park, it will oblige farmers adjacent to the river to use natural pesticides and fertilizers, improving the soil next to the river, which in turn, improves the overall water condition. In return, the production is designated with an organic label which are valued much higher than that which results from 'regular' practices. Furthermore, rice producers next to the river will improve their crops by having regular water flow into their parcels. However, in the case of a natural disaster emergency, their crops can be used as part of the floodable emergency water system that incorporates the aforementioned space for river overflow. The overarching aim of the Park is to facilitate movement through the valley and to be the integrator among natural and man-made landscapes – while protecting biodiversity – into the expansion of existing growing cities. Moreover, it becomes the link that rural communities need in order to economically thrive (Wong, 2018). As part of the nature-based solutions, a network of constructed wetlands is designed, in addition to vegetation strips along water streams and terraced indigenous vegetation that is crucially important in the upper part of the sub–basin. Additionally, constructed wetlands are the main mechanism to remediate pollution in the sub-basin and water storage in case of drought. Forest patches are the main source of restoration of the water table, currently in danger for the construction of illegal wells. Finally, main crops of the region are rice and sugar cane, which need plenty of water. A strategy for self-organising, a fundamental requirement of long-term sustainability (Lister, 2007), in the upper part of the sub-basin is the diversification of crops to ones that do not need much water to sustain themselves, such as sweet potato, arracacha, strawberries – root crops – and, native fruit trees such as mango and passion fruit, to name a few.

By proposing these strategies, the sub-basin is able to adapt to unexpected changes without changing paths, which means that the recurring images from despair resulting

from El Niño Phenomenon would belong to the past. Moreover, by generating a multi-scalar plan for the sub-basin, the perception and engagement at local and regional scales would be improved with either ecological performative agendas or architectural activities. These agendas and programmes are particular to the site, given that they correspond to the specific conditions of Lambayeque. So, the natural, rural, and urban landscapes ought to be adaptive to flooding from natural disasters and for the sporadic drought, given its geographic location within the ecosystem of a dry forest. Finally, by facing the adaption to future complexity, the performative ecology in the form of green and blue networks nourishes resilient and adaptive capacities within the Chancay-Lambayeque sub-basin.

3.2 The making of a transformative model

Site specificity is a way of understanding the landscape by engaging with it. Engagement modes include: observing, modeling, drawing mapping, among others. Moreover, the agency of mapping is used not just as a tracing method, but as a tool for discovering the landscape, resulting in a model that unfolds at the same time that constructs the project step by step, not being able to foresee its final form, drawing a line with planning, which leads to a fixed end (Corner & Hirsch, 2014, p. 212).

Figure 4. Transformative model. The figure shows the restoration of a section of the river and protection of endemic fauna and flora – such as the carob tree, *palo santo* – as part of the ecological performative agenda.

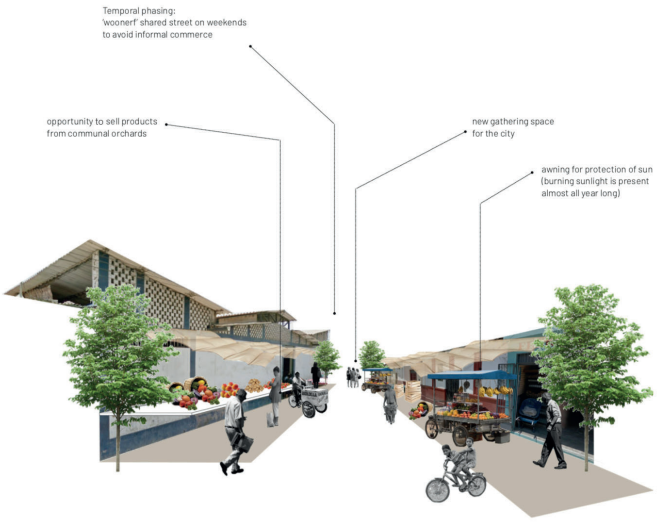

Figure 5. Transformative model. The figure shows the diversity, multifunctionality, and temporal phasing in architectural seed projects, as part of the programmatic performative agenda.

4. Discussion

The starting point of this paper raised the idea of interpreting the Lambayeque region as a socio-ecological system, taking into consideration the range of tools, methods, and interventions that emerge from the coalition of urbanism, landscape architecture, and ecology to understand natural and man-made landscapes as living ecologies and agents of change. During the initial thesis the case study was introduced, where site specificity was used as a design tool to inform the final project with knowledge arising not only from the physical attributes of the site, but also from the intangible ones. Consequently, the project resulted in a series of transformative models as a way of exploration able to respond to future states of flooding. It should be considered that the essence of this tool is not to claim to be a specific configuration destined for success, since multiple variables come into play within each unique ecosystem, where the greater or lesser manipulation of the landscapes might result in an array of interventions. Furthermore, the final results are designed experiments that accommodate growth and change in the light of future adversities.

Adaptive projects have shown positive impacts in territories around the globe. Moreover, adaptive design and green and blue infrastructure calls for designing in a systemic way using multiple scales, and taking into consideration different contexts, perspectives, and voices (Bacchin et al., 2014; Lister, 2007). This study considers this requirement by using site specificity as a tool to understand a place from the ecological and societal dimensions, addressing unique issues in each spatial scale. By viewing the project under the tool of site specificity, designers can acquire knowledge from the site itself and, especially from the present and future users. Thus, leading to a sustainable proposal able to respond to the particular challenges of the site.

Ecosystems are comprised of physical and intangible attributes such as the idiosyncrasy of a community, cultural connotations of a place, and its historic events that evolved with time. Site specificity is also known as the initial step of taking into consideration local knowledge or bearing in mind the context where one is designing. By not having a coined term for this step, it diminishes its importance, disregarded to be barely used during the primary steps of the diagnosis. The second idea to put forward with this paper is to place site specificity as the coined term for describing this step, intertwining ecological and societal dimensions resulting in deeply-rooted design interventions. Finally, site specificity is not the definitive lens that results in a final design however, it is a design tool for exploration across multiple spatial and temporal scales (Berrizbeitia, 2007).

The use of the site specificity tool in the case study allowed to accomplish a thorough reading of the territory where new relationships of co-dependency were drawn within the region taking the Chancay-Lambayeque River as the carrying structure, proposing an agriculture-natural park, where both ecological – for protecting coastal dry forests and endemic fauna – and programmatic in the form of architectural seed projects whose dimensions are managed as performative agendas, along with functions, formal, and spatial attributes, and processes (Czerniak, 2006) in order to achieve a new sustainable equilibrium of coexistence with exceedance of water resulting from unexpected climate-related events. Furthermore, the design tool informed the aforementioned new equilibrium and afforded the project with the capacities of resilience and adaptation, which are at the core of sustainability. This way the project can withstand perturbations in the future, maintaining or adapting a stable state without changing courses.

5. Conclusions

Viewing the city through the lens of site specificity offers a way for exploration and discovery, and creating transformative models. This is a set of possibilities that allows, inter alia, for connections between the natural and man-made landscapes, thus generating correlations between different components of each system while engaging local communities in the decision-making and design processes, which is one of the principles to achieve adaptive design and planning, as argued by Kato & Ahern (2008). Moreover, the early involvement of the whole array of stakeholders gives them a sense of ownership, which allows for appropriation of spaces and for the community to be a strategic part of the monitoring and maintenance processes.

In the case of the Chancay-Lambayeque sub-basin, the Agriculture-natural park was designed to function as the main axis of the region, achieving climate adaptation for the transition to a new balance. It can be concluded that a network of green and blue infrastructure is necessary to improve – and even guide – access to natural areas that over time have been disappearing to accommodate highly urbanised environments (Bacchin, 2015; Wong, 2018). The use of the site specificity tool allowed for the recognition of ways of living which were not considered during the initial site visits, where only the physical attributes were recognised. As this study suggests, the site specificity tool improved the perception of the place, granting the appropriate knowledge to propose a design able to accommodate complexity.

The future direction[1] for this research project, Intertwined Natures, is currently under way in the rural town of Chongoyape, Lambayeque, where participatory design workshops are planned for the coming months. Community engagement and participatory design are taken as key tools in order to inform resilience in the bigger scale, since it is pointed out by Folke (2010) that "transformational change at smaller scales enables resilience at larger scales." Moreover, the project aims for high levels of participation and collaboration among different stakeholders, community involvement in order to achieve a sense of appropriation of the proposed spatial interventions and a "sense of belonging." Furthermore, the small-scale functions as a "driver for innovation, and thus for slow change and adaptation at larger scales" (Erixon et al., 2013, p. 278). Finally, the prospective idea of creating dialogues and cooperation bonds between academia and local communities is one of the objectives of the project in order to inform resilience.

1 Update: Given the upsurge of the Omicron variant during the COVID-19 pandemic, the aforementioned workshops had to be put on hold until further notice.

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Type of the paper: Peer-reviewed Conference Paper / Full Paper

Rioplatense: Archives, Surveys and the Imaginability of the Buenos Aires Shoreline

Martin Flugelman Olmeda [1], Luisa Lerman [2], Ivan Breyter[3] and Sofia Frasquet Dreyer[4]

[1] martin.flugelman@fadu.uba.ar; 0000-0001-6763-7397
[2] lululerman@gmail.com
[3] ivanbreyter@gmail.com
[4] sofiaclarafrasquetdreyer.532a@fadu.uba.ar; 0000-0002-2055-8226

Abstract: Through a visual exploration of the Rio de la Plata's littoral zone in Buenos Aires, the project seeks to reframe the ecological and aesthetic significance of the *post-natural* shoreline. The aim is to bring into focus the small-scale ecosystems at stake in the large-scale destruction of River Basin ecologies, exploring the liminal littoral where hybrid ecosystems flourish. The method consists of the study of visual documents from the shoreline that enable new ways of seeing the *amphibious territories* we live in. The muddy, shallow shore in Buenos Aires has always presented a problem for urban planning. Deemed unattractive and featureless in conventional terms, it has been severely undervalued as both a fragile ecosystem and waterfront. The built environment has been superimposed on top of an artificial sealed surface, and the native flora and fauna has been suppressed and controlled. The identity of the autochthonous landscape has largely been lost and the city's inhabitants never really come into contact with the wetlands. The shoreline is a valuable urban commons that supports an ever-shifting, intricate system that thrives as a forgotten margin of the city. This research focuses on the urban shoreline, understanding it as a political subject and space in conflict, and in need of new approaches to urban practices.

Keywords: urban landscapes, atlas, post-natural, amphibious cities, coastal cities, river cultures.

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1. Introduction

Since the early days of colonial settlement in Buenos Aires, the city has struggled to fortify itself against the unpredictable movements of the river and its widely-fluctuating tides. In its efforts to control the shore, urban development has claimed large tracts from the river, dumping debris along its banks, contaminating its waters, and piping its streams. Although the fragile autochthonous ecosystem has been severely disrupted, pockets of ecological resilience along the shoreline offer glimpses into an alternative future for the post-natural (Institute of Post-natural Studies, 2020*)* landscape. The aim of this investigation is to bring into focus the complex urban ecosystems at stake in the large-scale destruction of River Basin ecologies. The project belongs to an ongoing visual exploration of the city's shoreline through a variety of lenses that contemplate photographs, art works, and cartography through the history of the site.

The shoreline is considered a landscape, and so to study its complexities it is necessary to acquire different sorts of information, in this case both visual and written documents. For some authors of intellectual history, 'landscape' is considered a result of the subsequent observation and interpretation of a sum of natural and artificial elements. As Simmel (1911) describes in his book *Philosophy of Landscape*, the concept of art does not

operate in the daily discourses and gestures of people although there are configuration models that can be classified as artistic. Only when these models become governed by their own norms, do they cease to be at the service of daily life and configure an object in itself that responds to its own logic and presents a work of art. Under this configuration is how the landscape is conceived and therefore, it must be considered as a visual composition.

The Rio de la Plata estuary is a part of the Guarani Aquifer, one of the most important water systems in South America (Secretaría del Ambiente de Paraguay, 2003). It is the city's primary water source, sewage disposal, and the maritime route through which commodities leave the region; and it is a vital part of Latin America's neo-extractivist (Svampa, 2017) technical infrastructure. For hosting many complex relationships, the landscape of the Río de la Plata cannot be considered one, but many.

The accumulation of visual representations from diverse historical moments and its geolocation allows the interpretation of emerging similarities and variations on these complex urban sites. The study of visual documents enhances our capacities to transcend the verbal dichotomies, a product of the translation from visual statements to verbal categories. In order to review the relationship between citizenship and it's the territory that we must take critical looks at these visual tools to build new dialogues that approach the urban controversies for a sustainable urban practice.

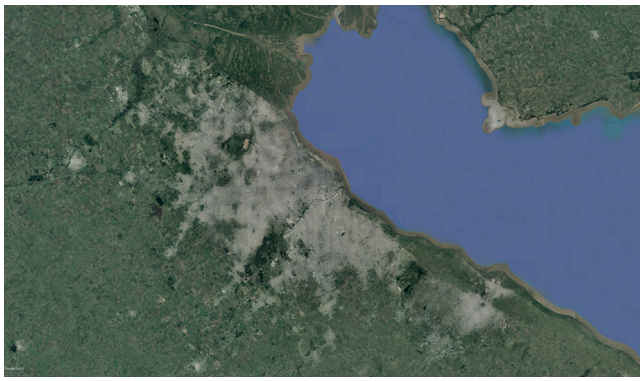

Figure 1. Rio de la Plata Basin and Buenos Aires Metropolitan area. The shoreline depicts a diverse and complex ecological and urban landscape.

2. Theories and Methods

Buenos Aires is one of the main ports in the Rio de la Plata River basin, and is home to a vast biodiversity that is largely unprotected and under unprecedented pressure from exploitative practices. Every year, thousands of hectares of land have been burnt to significantly expand arable land, agrarian enterprise, and private housing projects in the Basin. (Medio en Moron, 2022). Given the far-reaching consequences for water ecology in the region, the Argentine citizenship is pushing the Congress to discuss the *Ley de humedales (Wetlands law)*. If discussed and passed, the law would dictate protections for the invaluable ecological asset that later, should be implemented. (Huberman, 2020) The basin needs to be addressed as an urban commons.

In the current absence of ecological stewardship and long-term vision, a wide diversity of uses have been designated along the shore, including informal settlements, private clubs, exclusive neighborhoods, commercial concessions, highways, railways, and airports. The built environment has been superimposed on top of an artificial sealed surface, and the native flora and fauna has been suppressed and controlled.[1] Along the 200 km shoreline, the identity of the autochthonous landscape has largely been transformed and the city's inhabitants never really come into contact with the wetlands.

The study of the landscape through images allows the articulation of various views diluted in a homogeneous historical space, enabling comparability of uses, activities, and knowledge that shape living. The urban landscapes of Río de la Plata have as their main

challenge to integrate nature, rivers, and their shores with service infrastructures, industrial architectures, working-class neighborhoods, collective housing, and the various activities that take place at the river.

The approach method is carried out from a semiotic context that argues that adopting a gradualist perspective allows us to effectively address the complexities of *visual statements*: "In the history of visual semiotics, there have generally been developed theoretical proposals based on projecting categories of verbal language. These developments verbalize the analysis and description of the visual, and reduce and simplify it in polar terms: light-dark, straight-curved, large-small, etc. It is a logic of binary type which shares the oppositional criteria of affirmation-negation and truth-falsehood that belongs to the verbal language. However, the world is not like that, and it must be taken in consideration that every language has its limitations. A combination of different languages can be a surpassing instance to address more comprehensive analysis of visual expressions.[2]

So as to transcend the boundary of translation from visual to verbal categories, this research uses different frameworks that try to dissolve linguistic dichotomies such as artificial-natural in order to apprehend the complexities of these relations and the interconnectedness amongst humans and the environment. In this sense, the objective is to embrace all discourses that try to dialogue and broaden this non-binary and non-human-centered vision. Multiple visual sources are implemented: Firstly, the *Archivo Buenos Aires,*[3] compiled at the Facultad de Arquitectura, Diseño y Urbanismo, Universidad de Buenos Aires by Lombardi's chair, enrolled as a research project. This archive is concerned with determining relevant sources to study the construction of the shape of the city of Buenos Aires, organising different atlases and collections that gather cartography, images of the urban landscape, documentation of works, projects, plans and codes, public speeches in reports, and the news. It only uses public information, and shares it for training and research activities.

This project aims to develop three (3) collections that deal with the ways of collecting, cataloging and associating that information, and disseminate it on open platforms to provide feedback on the passages between archive and production of images, in order to articulate disciplinary knowledge and public interest through the study of urban form as material and cultural production: 1. Buenos Aires in historical images; 2. Buenos Aires in photography; and 3. The atlas of records and landscapes of Buenos Aires. These sets constitute a network of sources that crosses the function of the image as a historical document, artistic construction, and projectual speculation. Secondly, the *Atlas/Archivo*, a web atlas and archive that focuses on the cultural landscapes of the Río de la Plata, developed by Alberto Delorenzini and his team, also expands the horizons of *imagenes* and how to move from documents to atlases.

3. Results

The main and general result is a taxonomic categorisation of the urban landscape of the Rio de la Plata basin from studying visual documents. Thus, the research produced a revision of existing databases and the widening of current archives. This interpretation from files and sources build new gazes and a feedback loop of construction of knowledge about the study case. Furthermore, a reformulation of the working tools by expanding the Internet archive Archivo Buenos Aires. Therefore, placing the Basin into the limelight with new research categories allows us to build disciplinary relevance on how to activate the relationship between citizenship and its landscape.

As a specific result, we developed a new vocabulary to address the complex relationships of the urban landscape and make visible the hidden realities of the city of Buenos Aires, the territory we inhabit and transform. These categories emerged during the research process and came as a result of comparing visual documents from various historic moments. The categories, images, and atlases help us define the themes that make the Río

de la Plata landscape so complex, bringing out unseen relationships of the city. In this sense, we recognised three (3) conditions that organise the figures, images, and narratives Buenos Aires should be addressed as: Amphibious City, Post-Natural Scenario, Coastal City.

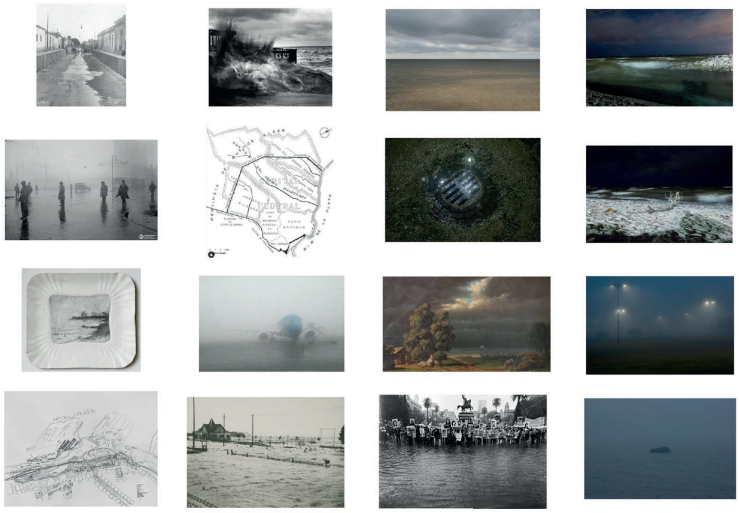

Figure 2. Visual documents representing the atmospheric condition of the landscape. Floods, Sudestada wind, fog, and rains. Rio de la Plata materializes in different ways, forms and materialities.

- *Amphibious city*

Buenos Aires is sited on the end of the *pampa*, a wetland composed of streams, a plain with a limited slope and meandering channels that flow into the river. Over this landscape, an abstract orthogonal grid was imposed, neglecting the territorial information. Cartography is not neutral, it represents matters of high political interest that account for the existence or non-existence of things. To draw something is to include it and not to do so is to exclude it. A great majority of the early cartographies about Buenos Aires deliberately omit the hydric condition of the territory. This is an act of violence and lack of sensitivity that later is transferred to the way of conceiving and inhabiting the city.

With the creation of the Virreinato de la Plata, Buenos Aires became the gateway to the continent for the Spanish empire. Its port was the engine that kept the movement going in this village. The relationship with the river has always implied commercial activity; water was and still is, the road for the flow of goods. In addition, the native landscape of Buenos Aires did not correspond with the hegemonic canons of beauty that existed towards landscape in those times (Silvestri, 2001). The absence of exotic beauty contributes to a lack of care and invisibility of the coast. The river was only seen as an infrastructure that facilitated the economical aspects of the city. The lack of controls on the industries and absent policies regarding the water issue and urban solid waste, led to an impossibility of relating in a sustainable way with the water streams. In this scenario, the hygienist modernity found in Buenos Aires a fertile setting for the *intubation* of urban water streams and the expansion of the city over the river wetlands.

Despite the efforts to make nature invisible, the Rio de la Plata shoreline materializes and expresses itself in the city through climate: the *Sudestada*, floods, humidity, and fog are the ways in which the river is present in urban life. As Mathur & Da Cunha (2014) propose, *water is everywhere before it is somewhere (*Mathur & Da Cunha, 2014, p.8). Figure 1 is an atlas of representations around these footprints left by the river: Prilidiano Pueyrredon paintings describe the coast in the northern part of the city in the late 19th century and the photographs of Marcos Zimmerman portray the river in its fierce behavior; waves hitting against the concrete walls of the sharp and straight edge of the North

coastline. This collection also takes into account Enric Miralles' project for Retiro in the early 1990's in which he introduced the Río de la Plata into the city through a coastal walk.

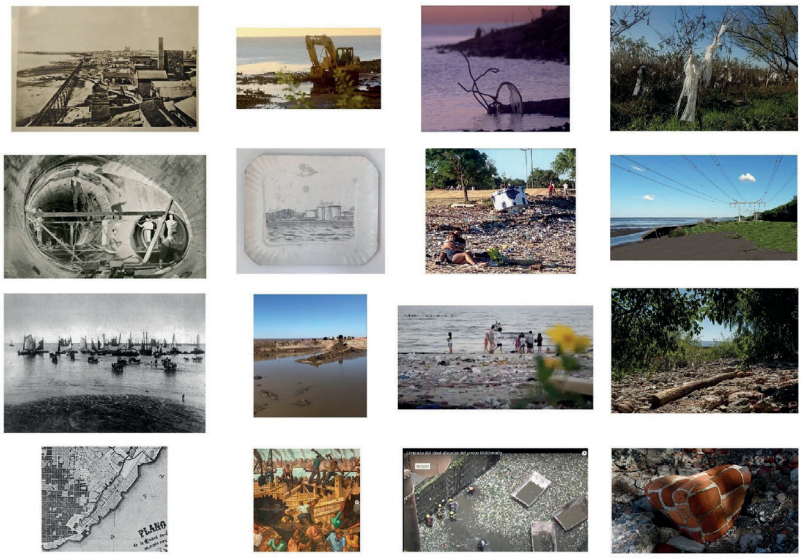

Figure 3. Visual documents representing the anthropic transformations of the landscape. The shallow river water are constantly transformed and shaped to expand the city borders over the wetlands.

- *Post-natural scenario*

Buenos Aires has multiple growth vectors; strangely the coastline is one of them. The constant expansion of the water produced a city that seems to have no end; it extends both towards the pampas and towards the Río de la Plata. The wetlands are easy to mold. The possibility of an ever-shifting border leads to a lack of predictability in urban policies and projects that deny the native riparian landscape. The waterfront is a repository of large-scale urban infrastructure and exclusive private property perched on artificial landfills.

The various uses of the river by the citizens can be seen from the illustrations of Essex Vidal to the images of Costanera Sur. The transformation of Buenos Aires into a metropolis with poor policies of legislation regarding the natural sources meant the exposure of fresh water to contamination, affecting the recreational and productive uses associated with the La Plata basin. This is the reason why the images of people doing recreational activities in the silver waters are analogic registers from the start of the 20th century. Currently, the coastline shows the post-natural condition of the city. The natural environment cannot continue to be observed as a material that we can get rid of. The binomial relation between nature and culture has to be transcended, to build a look that understands the complexity of the interactions.

Of the entire coastline filled with rubble, dirt and garbage, the Costanera Sur Ecological Reserve is the greatest exponent. (Observatorio Metropolitano, 2020) What was the historic center of the city, one of the points with the greatest history with the river, where empires and immigrants arrived, the Military Junta of the 1970's dumped tons of material to bury the memory. What was a river beach is now a continent. The project to expand the central area of Buenos Aires, made from rubble and bodies of disappeared people, implied covering centuries of cultural heritage. Like many other Argentine urban projects, it was left unfinished and abandoned, and all kinds of vegetation from the region grew on this massive sculpture of dictatorial land-art. In Figure 2, we can see this symbiosis between artifice and nature, pollution, and vegetation, also waste and waste polished by water. The records allow us to understand the resilience of the native landscape that sprouts in the few interstices that are vacant.

Figure 4. Visual documents representing the transformations of the coastline. From urban baths for recreation to debris and contaminated beaches.

- *Coastal City*

The river beaches from the first half of the 20th century, bring us closer to an imaginary scenario where the population embraces the principles of the amphibian city by having contact with fresh water from bathing in the ecological heritage. The State's infrastructural works that had been designed for the southern waterfront, inaugurated in 1918 and made the riverside recreation possible for the *porteños* public. The river was transformed into a popular space for leisure, and it meant the possibility of a coastal landscape accessible to crowds that began to thicken the city. Afterwards, contamination and the discontinuity of policies for maintenance of this type of spaces, deteriorated the promenades and the Río de la Plata began to move away from the community landscapes to become a forgotten border.

Currently, these beaches are shores of rubble and of waste that convert the Río de la Plata into a hostile cemetery of destroyed materials and trash. However, community efforts are emerging to continue to build a bond on these deteriorated margins. The riparian space is a disputed place, constantly attacked by real estate development and urbanisation: as an example, the recent episode of the contest *Buenos Aires y el Río, Costa salguero*, carried out by government institutions, the Argentine architectural association and the public university of architecture (GCBA, SCA, FADU, and FADEA), for a project to privatise the public land of a sector of the city shoreline for the construction of apartments and commercial centers. (Observatorio del Derecho a la Ciudad, 2020) This contest was promoted under the slogan of bringing the city closer to the river. Again, partial, fragmentary, and exclusive logics are imposed on riparian planning. In turn, in the delta and the lowlands of the northern area, the construction of private neighborhoods on native forests is deteriorating the wetland condition of these territories.

The figures gather editorial and family photographs, journalistic notes of people enjoying the river and the overcrowded river beaches. The city had its coastline and its beaches and continues to have them. These figures seek to articulate the recreational practices of the past and the coastal present to show the current landscape in parallel to the productive shoreline landscape. The atlas seeks to reorient the vectors of the past, towards new *past* horizons that are more muddy, swampy, flourishing, and wetter, and above all, more accessible to the population.

Figure 5. Composition of paint and current photographs of the riverside. Photo collage regarding past representations of a less anthropic landscape and new urban riversides.

4. Conclusions

The records of these footprints document the behavior of the basin and allow us to visualise and understand the facets of the environment. Assuming and studying them is essential for the projection of a city that takes into account the conditions of its territory and landscape. An action that is imminent to face the global ecosystem crisis that we are beginning to experience.

Researching the current state of the city's edge and its history enables us to project it into new scenarios and allows us to understand the importance of stopping the expansion of the city with the prevailing logic up to now, reviewing previous modes of use and building new ways of linking with the native landscape. It is time to think about the rights of the environment, an approach that harbors non-violent ways of incorporating the subjugated minority, which in this case is the native environment, and to carry out measures so that the future of the natural heritage is not determined by policies in favor of economic and private interests.

The images aim to address the possibility of a future that embraces the environment, reviewing experiences from an *amphibious* past and sustainable projects from the present.

Figure 6. Composition of paint and current photographs of the riverside. Photo collage regarding past representations of inhabiting the riversides and the same recreational practices done today.

5. Discussion

To begin with, the research project faced the challenge of looking in different databases to gather the information, process it, categorise it, and upload it to digital platforms

for public access. This was done within the Chair Lombardi in FADU-UBA and with assistance of multiple collaborators during the years. What began as informational databases for student assignments, within the years transformed into an ambitious project for studying and producing feedback loops of knowledge between databases, analysis, student projects, and lecturer's research.

Furthermore, discontinuous and insufficient financial resources made the project ran a slow pace and rhythm disabling consistent progress and visualisation of data a hard task.

Currently, the riverside is on the limestone, the urban, and rural exploitation is obscene and hardcore. Communities and citizenship are fighting to introduce sustainable agendas and to shift decision-making. The research project has been exploring these possibilities, thinking, producing information, and research that are increasing public awareness about these issues. A wide range of actors and stakeholders, ranging from architects, urban experts, and non-experts, visual artists, performers, and musicians have been introducing a river-oriented view to their practice. We understand that the discussion should be done in educational frames and in the territory, connecting with organisations and communities, and making research expand the limits and be part in the transformation of landscape.

Data Availability Statement

Research results: *Archivo Buenos Aires* (Lombardi, Flugelman, 2019). Compilation of historic visual documents of the City of Buenos Aires. Retrieved September 15, 2021, from https://sites.google.com/view/ba-imagenes-historicas/inicio

Contributor statement

Conceptualisation: Martin Flugelman Olmeda.

Data Curation: Martin Flugelman Olmeda, Luisa Lerman, Ivan Breyter, Sofia Frasquet Dreyer.

Funding Acquisition: Martin Flugelman Olmeda.

Investigation: Ivan Breyter, Sofia Frasquet Dreyer.

Methodology: Martin Flugelman Olmeda, Sofia Frasquet Dreyer.

Project Administration: Martin Flugelman Olmeda.

Resources: Roberto Lombardi.

Visualisation: Martin Flugelman Olmeda, Luisa Lerman, Ivan Breyter, Sofia Frasquet Dreyer.

Writing - Original Draft: Martin Flugelman Olmeda.

Editing: Martin Flugelman Olmeda, Sofia Frasquet Dreyer.

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Designing Reflexive Spaces with Human Waste: Communities of Resourcefulness in Brussels, Berlin, and Hong Kong

Markus Wernli [1*]

School of Design, The Hong Kong Polytechnic University; mswernli@gmail.com; orcid.org/0000-0002-8027-7354

Abstract: This paper compares eco-sanitation interventions in Hong Kong, Berlin, and Brussels by applying a structurally extended SWOT matrix for evaluating their transformative relations and capabilities in their respective contexts. The enablers and barriers underlying these human waste cycling communities are assessed by combining qualitative-quantitative data collection and multiform analysis. By complementing the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis with the emergent framework of Ideas-Arrangement-Effects (I-A-T), the study assesses the explorative potential manifested in these cases. The eco-toilet communities address unsustainable food systems by acting in concert with people, places, and microbes in a profoundly self-implicating process that stems from an oscillation between actionable immersion and perspectival detachment. This dynamic creates a reflexive conduit for counter-intuitive doing and thinking that diversifies dominant and hegemonic perspectives. The three cases demonstrate how cultivating a rich, interactive context on the physical, social, and psychological levels is conducive to the suspense and exchange of positions and a plurality of perspectives on the world, both human and nonhuman. Community acceptance and individual satisfaction with urban eco-toilets stems from balancing this unsettling repositioning with supportive involvement, whereas disrupting bathroom routines, group debates, and agroecological experimentation makes people act in better-attuned relations with unknowable otherness.

Keywords: Agroecological urban toilets, regenerative waste integration, Terra Preta fermentation, Structural SWOT, collectivized resourcefulness.

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1. Introduction

What does it mean to work with communities on ecological revitalization when designers abandon the single-minded paradigms of efficiency and crisis response? What is implied in the more-than-human collaboration when designers accept their complicity in the environmental and societal precarity that now prevails? Addressing this complexity, how can a wide range of positions be invited for manifesting unprecedented perspectives as the premise for actionable creativity? These questions are considered by examining what spaces of reflexivity emerge when perspectives of humans and nonhumans are placed in direct dialogue, whereas situations become multidimensional and open to change. This paper argues that attention oriented at material engagement with ordinary experience, including bodily defecation, expands the capabilities and collective action. Co-learning processes in profound exchange with the given eco-social context has been described as 'resourcefulness' (MacKinnon and Driscoll, 2013) and evolve from the reorientation of internal priorities in person and institution, expressed in locally manifested value creation and social relations. Resourcefulness is often neglected from reporting in urban design in favor of externally imposed 'resilience' (ibid). Although previous research, par-

ticularly debates on 'infrastructuring,' have noted the importance of engaging the messiness of social entanglements (Mang and Reed, 2012; Karasti, Baker, and Millerand), recognising uncertainty and incompleteness as catalytic opportunity in communities are largely missing (Mosleh and Larsen, 2020; Akama and Light, 2020; DiSalvo, Clement, and Pipek, 2012).

This article focuses on designing for and with curiosity. The aim is to provoke reflection about the mental models underpinning reality formation and sensibility since it can radically ground, liberate, or hamper creative perspective-taking. Discussion about the importance of iteratively examining the instructive relationships with the world is emerging in design (Luján Escalante, 2019). The argument is that the mode of design needs to change – from the impartial, discipline-centric projecting onto the world, towards becoming 'equipment for social learning' for how to live with the contingencies inside the damaged biosphere (Bonnet et al., 2020). It requires exploring practices aimed at generative inconsistencies for asking what such emotive accounts can contribute to discourses in design. For this, the article presents three eco-toilet cases of productive uncertainty, then evaluates related observations with a causal framework, and concludes with overarching implications.

2. Designing for collectivized resourcefulness

Increasingly, grassroots-level design engages with productive uncertainty for restoring local food systems, reviving communitarian links in the city, and defending alternative ways of inhabiting the world. This passion for locally enacting social change in the face of an ever-deepening techno-economic mediation of reality mobilizes communities worldwide to practice the 'autonomous design of themselves' (Escobar, 2018, p. 5). Communities here revolve around the environmental context they intend to transform while designing their capacity for a plurality of social life they truly want (Lobenstine, Bailey, and Maruyama, 2021). Increasingly, concerned urban communities wonder how future generations will grow sufficient food on a drastically smaller ecological footprint. Humus-rich, healthy soil ecologies are critical here since they provide vital storage capacities for water, nutrients, and carbon dioxide (Schneider and McMichael, 2010). This section introduces collectivized resourcefulness cases in Brussels, Hong Kong, and Berlin where regenerating soil ecologies and disrupting deep-seated urban unsustainability implies that communities formed around bringing their excrement to fruition in the city.

2.1. Brussels: L'Usine du Trésor Noir

In the Belgian capital, human waste upcycling gravitates around architects and artists affiliated as Collective Disaster. The group formed in response to a call in 2014 by the Belgian Ministry of Environment to revitalize a derelict downtown park (Amaya 2016). In collaboration with two dozen neighbors, over the summer of 2015, Collective Disaster realized a community-run, ecological public toilet facility (Figure 1). Uniquely here, the respective composting processes dictated the spatial and organisational arrangement of the placemaking initiative. The onsite treatment of excrement as a publicly accessible process triggered consideration of what could be encountered, experienced, and learned. The community consolidated the insights gained into a comprehensive, open-source manual for all involved to carry out the maintenance involved.

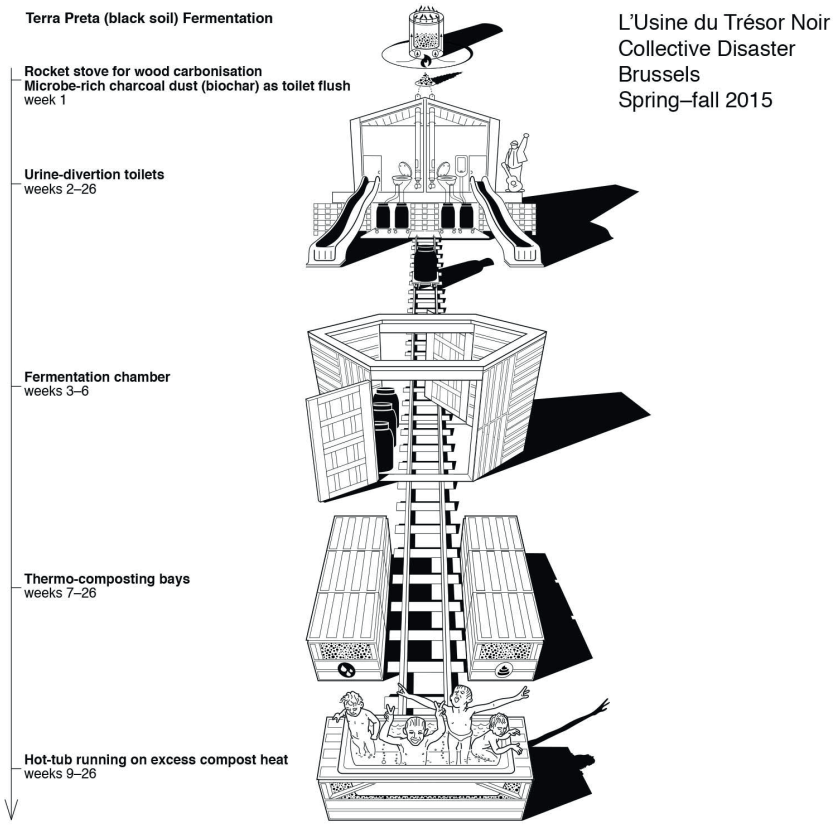

Figure 1. Architecturally arranged composting experience.

The resurrection of excrements through materially performative structures and novel social constellations became known as L'Usine du Trésor Noir. To overcome resentment, the collective involved neighbors in planning, building, and operating facilities that incorporated spacious, urine-separating toilets and heat-capturing composting for powering public hot-tubs. This closed-circuit between waste and leisure in the open public was unprecedented, and entailed unknown possibilities and risks. It required from all involved a healthy dose of trust and responsiveness to difference.

The pyramid-like toilet facilities operated over six months and were built on top of an elevated platform with spacious front stairs that doubled as a stage for performances. On the backside, visitors exited the toilets on slides, one for females, one for males. The platform's interior stored the sealed collection barrels to separate urine from solids and preprocess them with microbially activated charcoal dust. Using the multi-stage fermentation process of the *Terra Preta* method, pathogens can be eliminated, nutrients retained, and human waste can be made into fertilizer within one year. From the collection chamber, narrow-gauge tracks connected to the adjoined composting site for swiftly transferring full barrels on trolleys for harnessing the excess heat. The park-enlivening public toilet garnered several awards and international acclaim. In its downtown setting, the Trésor Noir community exemplifies empathetic exploration of the possible and unknown based on imaginative and material repositioning of issues like urban wastefulness, land access, and multi-ethnic cohabitation. It brought together soil experts, authorities, and concern groups to reconceive, at least temporarily, operational infrastructures for sanitation, composting, and recreation, crossing divides between resource conservation and social capabilities.

2.2. Hong Kong: Anthroponix

The university-endorsed community of urine-cycling citizens in Hong Kong responded to mounting food safety and environmental health concerns. The initiative was instigated by the author and offered urbanites deprived of balconies and land access to growing plants indoors (Figure 2). Following a public call in 2017, 22 households of diverse sociocultural backgrounds joined this Urban Ecology Adventure to ferment their urine – with the addition of sauerkraut brine – into a fertilizer substrate to grow edible plants. The

simple material relationship between participants' urine and the environment constituted a provisional ecological proposition since the possibility of the fertilized plants was interlinked with the person feeding it.

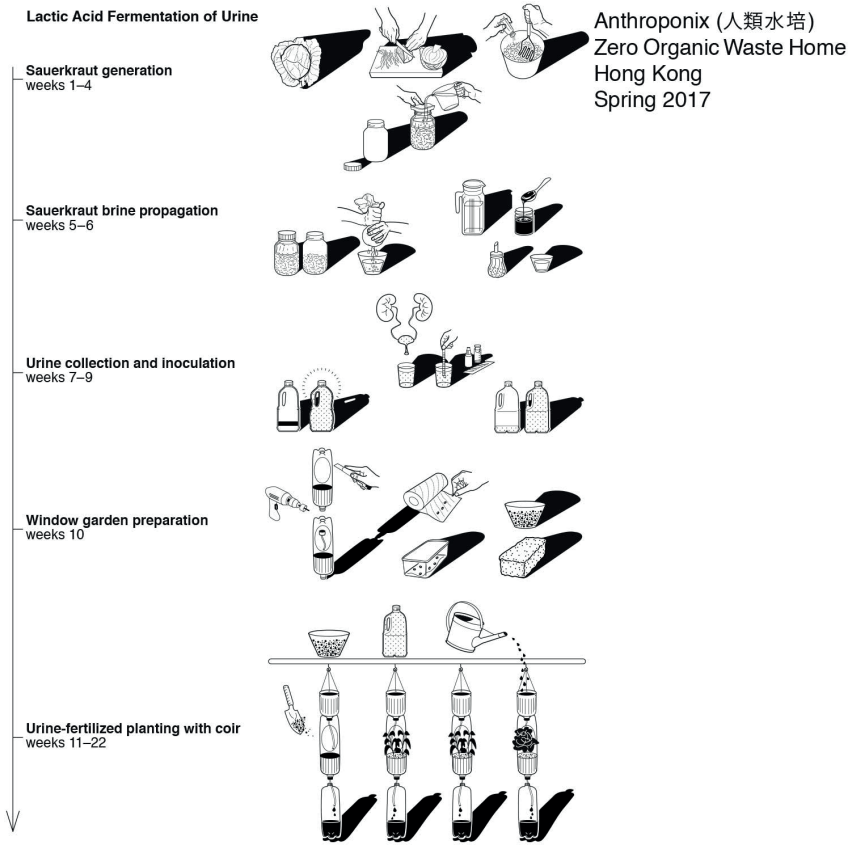

Figure 2. Fermenting urine inside collective food pedagogy.

Each fermenting urine specimen became part of an annotated self-examination passage that involved medical dipstick testers, diet monitoring, and botanical tracking. Participants consolidated all data into an intricate Mutual Thrivability journal. The community spearheaded an untested closed-loop resource system that required participants to jointly overcome technical and affective ambiguities. The imperfect technical setup invited tinkering, instructive failing, and social curiosity – all forms of excitement stemming from responding to unsettling relationships that ignited unifying purpose, social engagement, thus captivating participants' inventiveness for over three months. The empathetic exploration led many to continue their fermentation experiments or join garden groups long after the project ended.

The agroecological experiment reframed human waste as a responsibility-triggering agent. It countered visions of the urban as an inevitable nutrients' sink, instead reimagined the household as a resource hub between human and environmental circulations.

2.3. Berlin: DYCLE (Obst aus Babywindeln)

Responding to severe soil degradation and water shortages in the German capital region, an artist-led human waste reuse program has evolved in recent years. Under the name DYCLE, the communal start-up pioneers the eco-friendly transformation of baby nappies into fertile soil for fruit orchards since 2014 (Figure 3). The proposition is to cultivate fruit tree orchards along the city's outskirts led by diaper-upcycling families. Building on revenue from tree adoptions rather than the sale of diapers, the DYCLE enterprise entails custom production of biodegradable diaper inlays and communal composting into *Terra Preta* black soils, to grow heirloom fruit trees. The engaged families meet weekly at a central processing point to exchange soiled inlays with fresh ones (Debatty and Matsuzaka, 2019).

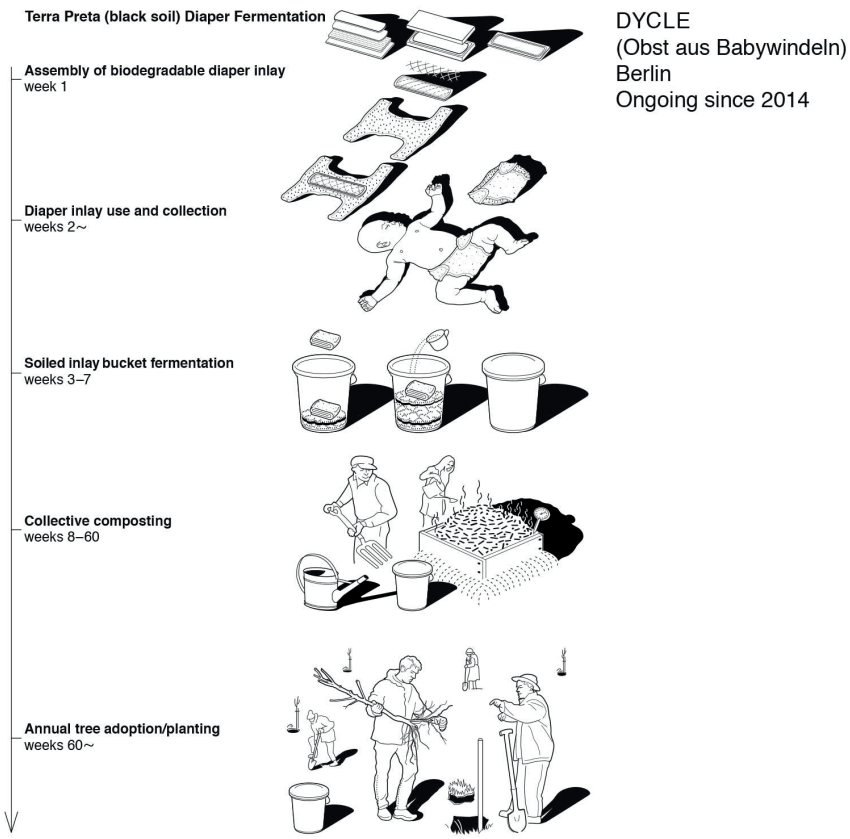

Figure 3. Tree adoptions supports the social enterprise.

DYCLE established a value-creating local economy that spans community, soil care, food forests, and livelihoods. Advancing this biosocial enterprise required that all elements and procedures be custom-configured to serve the larger purpose. It took the DYCLE team six years of trial and error to develop diaper inlays that would satisfy both the needs of the baby and the soil. Several hackathons and maker occasions provided gradual breakthroughs for incorporating local plant fibers into appropriate diaper inlays. While the community around DYCLE's core team fluctuates, its empathetic exploration inspires communities increasingly beyond Berlin to adopt the diaper-to-orchard economy. Generations growing up with diaper-fertilized orchards help normalize the agroecological use of human waste and affirm humanity's role in Earth's shared metabolism.

All three excrement upcycling communities demonstrate, in their respective context, how advancing commitment, practices, and capabilities prompted curiosity about the human function of replenishing the biophysical foundation. With this disposition, the author wished to further probe the value of productive uncertainty in communal experimentation by diverse citizens inside their daily lives. The following section introduces how the research was conducted with these actors.

3. Methods and analysis

This research presents three urban eco-toilet communities to evaluate the enablers and barriers to collaboration under uncertainty. The research responds to the need to justify urban eco-toilet experiments, find ways to sustain them, and tailor follow-up interventions. The author wanted to examine the characteristic features and frames of reference in communities that equip communities with agency to self-manage their place-bound arrangements.

3.1. Gathering research material

The study integrated participant observation, document review, and interviews into a multiform analysis. Based in Hong Kong, the author knew the organisers of the cases in Brussels and Berlin from eco-sanitation networks, but was neither involved in planning

these projects nor implementing them. The research material was collected by the organisers of each case and compiled by the author. In Hong Kong, the author conducted 54 interviews, while the organisers in Brussels and in Berlin held retrospective focus groups, each with 15 participants. All field notes highlighted the position and possible influence of the respective organisers, also drafts of the manuscript were subjected to validation of respondents. The stronger analytical attention towards the shorter-term Hong Kong case was intended to balance its perceived impact against the two longer-term cases in central Europe. Detailed data sets are available in the author's dissertation (Wernli, 2020).

3.2. Analyzing creative productivity under uncertainty

To evaluate the data, the author adopted SWOT analysis, whereby the internal Strengths and Weaknesses of an organisation are correlated to the external Opportunities and Threats for determining fruitful future directions. However, design innovation studies indicate how SWOT analysis is limited to account for novelty, since it takes existing organisations and contexts as point of reference (Dorst, 2005, p. 145). Also, the terms ascribed to Strengths, Weaknesses, Opportunities, and Threats predefine assumptions that delineate the examination. To evaluate the precedence-setting eco-toilet cases, each of the four SWOT terms were correlated with the three dimensions of the Idea-Arrangement-Effect (I-A-E) framework used in systems design (Lobenstine, Bailey, and Maruyama, 2021). For assessing the Strengths and Weaknesses, participants of the eco-toilet interventions walk themselves through the given Arrangements (A) at play then relate them to the Ideas (I) embedded in those Arrangements to be able to contextualize the systemic Effects (E) thereof. The subsequent Structural SWOT analysis thus focuses on reflecting upon the arrangements of one's reality to change for improving the prospects of thriving coexistence.

3.3. Coding and Structural SWOT analysis

Research materials were summarised in text descriptions and analyzed inductively using open coding to give voice to the diverse actors and permit themes to emerge. The Structural SWOT analysis was used to render connections among (non)human actors, material practices, emergent perspectives, and symbolic discourses. Guided by criteria from the Idea-Arrangement-Effect (I-A-E) framework, the following questions assessed Ideas (I), Arrangement of value creation (A1), Arrangement of practices (A2), and systemic Effects (E) in regard to the cases Strengths (S-):

- (S-I) what collective vision work well in pursuing the initiative?
- (S-A1) what is unique about the community's self-validation?
- (S-A2) what is specific to the community's practices?
- (S-E) what are benefits for (nonhuman) actors stemming from the initiative?

Regarding Weaknesses (W-), the questions were:

- (W-I) what conventions hamper the progress?
- (W-A1) what forms of validation are underperforming and why?
- (W-A2) what practices are detractive and why?
- (W-E) what resources could improve contributions to overall thriving?

Regarding Opportunities (O-), the questions were:

- (O-I) what are future ambitions?
- (O-A1) where are offering gaps of contributions?
- (O-A2) what synergies can be accessed to address weaknesses?
- (O-E) how do proliferating effects create synergies?

Regarding Threats (T-), the questions were:

- (T-I) what trends of thought are on the horizon?
- (T-A1) what techno-economic counterforces are outperforming the initiative?
- (T-A2) what are the behavioral barriers to change?
- (T-E) what macro-level changes are cause for concern?

The following section discusses the results by correlating the pluralization of perspectives generated from dialogue with Structural SWOT with subjecting ordinary experience to what initially might have been unthinkable.

4. Results: Productive uncertainty of urban eco-toilets

The following chart (Table 1) summarizes the Structural SWOT analysis of the research material. In this analysis, the Strengths, Weaknesses, Opportunities, and Threats components are specified with narratives (vision), value creation (economic arrangements), practices (work arrangements), and systems' functioning (effects) to better account for the enablers and barriers underlying them. Comparing the eco-toilet communities, side by side, allows acknowledging the overall propensities, and link the results back to existing conceptions as listed in the right-most column.

Table 1. Structural SWOT of urban eco-toilet cases to identify their enablers and barriers.

	BERLIN	BRUSSELS	HONG KONG	*Enablers/Barriers*
Strengths				
(S-I) Collective vision	Intergenerational resource sovereignty (joint enterprise)	Regenerative placemaking (joint purpose)	Human/plant health interactions (joint discovery)	*Collective imaginary*
(S-A1) Arrangement: Value creation	Periurban resourceful economy	Neighborhood resourceful economy	Peer-to-peer resourceful economy	*Collaborative economies*
(S-A2) Arrangement: Practice	Self-implication in food forest cultivation	Self-implication in urban park revitalization	Self-implication in interspecies alliance	*Distributed responsibilities*
(S-E) Effects: Functioning	Fulfillment from intergenerational links and cross-sector technology innovation	Fulfillment from coevolution with biophysical foundation	Fulfillment from failure-tolerant learning and cohesion	*Living environmental citizenship and technology development*
Weaknesses				
(W-I) Collective vision	Elimination-driven focus	Confrontational, activist design	One-off research cycle	*Single-minded framing of dichotomies*
(W-A1) Arrangement: Value creation	Prohibitive property rights (inaccessible land use rights)	Weak institutional and legal framework	Expertise silos	*Challenge to divert resources away from vested interests*
(W-A2) Arrangement: Practice	Reliance on volunteer labor (competitions)	Reliance on migrant workers (inequality)	Reliance on goodwill (tokenism)	*Challenge to engage commitment over time*
(W-E) Effects: Functioning	Active policy engagement	Cross-sector compensation and funding	Scientific priority and educational credit-bearing	*Social recognition leading to the food-enabled city*
Opportunities				
(O-I) Collective vision	Pan-urban resource proliferation	Public/private coevolution	Mutualist caregiver	*Coproducing food sovereignty*
(O-A1) Arrangement: Value creation	Local resourcefulness hubs (convivial conservation)	Upcycle waste with waste (not pristine resources)	Consumer/producer tie-ups (urine to fodder production)	*Collectivised esourcefulness*
(O-A2) Arrangement: Practice	Eco-regenerative industry (localization)	Eco-entrepreneurial provider (infrastructuring)	Eco-literate household network (platforming)	*Multiplying local efforts planetwide*
(O-E) Effects: Functioning	Convivial afforestation and conservation program (eco-city development)	Provision of eco-regenerative toilets in urban margins (participatory urban metabolism)	Community-supported resource recovery (right to reintegrate human waste)	*Radically participative food systems*
Threats				
(T-I) Collective vision	Reclusive 'nature' conservation	Perfectionism (purity ideals)	Immunity from decay (mortality fear)	*Hegemony and defensiveness*
(T-A1) Arrangement: Value creation	Market substitutions (underpriced external resources)	Convenience standards	Dehumanization of work	*Singular path dependencies*
(T-A2) Arrangement: Practice	Routine use of disposable diapers	Routine use of flush toilets	Routine use of external fertilizer	*Inertia to change*
(T-E) Effects: Functioning	Ecological breakdown (extreme events)	Social distancing (labor shortage)	Biophobia (Nature Deficiency Disorder)	*Breaching tipping points*

4.1. Strengths

Propelled by the *Terra Preta* movement, municipal revitalisation, and pro-environmental discourse, the eco-toilet initiatives in all three cases made human waste upcycling into an attractive, social proposition responding to its urban context. The interventions sparked a collective imaginary spanning intergenerational enterprise, regenerative placemaking, and human/plant health interactions for transcending stigmas associated with human waste. This shared narrative translated in the social arena into prototypical collaborative economies that stimulate value chains between city and countryside, neighbors and visitors, or peers and mentors. It means that conventionally segregated roles (like consumers and producers) could be fluidly exchanged, thus use-values questioned and redefined. Such community mobilisation spurs cross-sector technology development and environmental citizenship as manifested in inventive appropriations of organic resource reintegration tailored to the site-specific needs on the level of landscape, neighborhood, and household. The intergenerational purpose, biophysical linkage, and cohesion in a failure-tolerant group of learners made what is commonly relegated to 'sanitation services' into fulfilling experiences. Essentially such 'defamiliarization as social activity' (Cohen, 2000, p: 97) was about experientially embedded, negotiating material responsibilities that triggered in participants 'what else/how else' mode of thinking and multiple perspective-taking essential to intersubjective creativity (Glăveanu, 2020). In effect, these emergent, more-than-human alliances can candidly suspend the prerogatives of domination (Borda, 2006, p: 27) in the rich context of multiform exchanges between humans and nonhumans.

4.2. Weaknesses

The eco-toilet initiatives face societal obstacles that can hamper their advancement. Regarding conventions, the 'humanure' communities find themselves working against unhelpful dichotomies that make it challenging to break new ground. Long-standing urban sanitation regimes reduce (human) waste to a matter of efficient elimination forgoing its regeneration potential. Obstacles are also self-imposed, like in the Brussels case when overambition on the organisers' side posits a confrontational activist proposition, or, in the Hong Kong case, a one-off, short research cycle impedes longer-term prospects. Regenerative eco-toilets demand receptive soils, negotiable frameworks, and evolutionary thinking before they come to fruition. Property privileges make nutrients-deprived lands inaccessible, legal frameworks mandate eco-toilets to be connected to the resource-wasting sewers, and there is a stubborn lack of willingness to interlock waste management with resource proliferation. For the lack of mainstream support, the cases rely on hackathons, migrants' employment programs, service learning schemes, and neighbors' goodwill – that can be short-lived. The self-perpetuating cause behind these weaknesses is the absence of social recognition for the 'food-disenabled city' (Tornaghi, 2017) unfit to reintegrate organic resources, including human waste. Thus, the cases need to go past awareness and perceive themselves as alternative models for addressing the politics of food-energy-water nexus and top-down control mechanisms. Since operating eco-toilets demand temporal and spatial resources of caregiving labor the three cases 'biosocial protocols' (Galloway, 2004) brought renewed and self-disclosing purpose for human waste that need to be stipulated to much larger segments of society.

4.3. Opportunities

All three cases create multiform opportunities in their respective urban settings, ranging from landscape proliferation, employment prospects, socio-material capabilities, and environmental subjectivities. As manifestations of an alternative urban narrative, city dwellers experience themselves as part of a long-range urban/rural evolution, participative park revitalization, or human/plant co-cultivation, whereas conventional roles are blurred for unexpected, ever-emergent capabilities to spring up. Opportunities arise when eco-toilets in the global north are not just considered gap-fill approaches, but models to be scaled-out anywhere metabolizing humans are present. Diaper upcycling aimed at grassroots conservation manifests a nourishing node in a network of resourcefulness, eco-toilets harnessing multiform energies, and the consumer/producer tie-ups fostered in these metabolic economies create use-value in direct alignment with their biophysical foundation. Perceived beyond arborist diapers, jacuzzi-heating toilets, and urine ferment, the cases represent applied strategies of bringing ecologically regenerative literacy to practices of localized industries, entrepreneurship, and households. The life-proliferating productivity of bio-energy, regenerative greening, carbon-sequestering, and synergetic world-participation from circular humanure systems cannot be emphasized enough especially *vis-à-vis* tightening government budgets. In a rapidly destabilizing world where all

life forms inescapably coexist because they feed on each other, eco-toilet routines become part of the 'provisional proposition' (Glăveanu, 2020) of more-than-human health interactions that intimately reflects both opportunity and crisis of concurrent human/environment relations.

4.4. Threats

In the face of accelerating climatic disruption, resource depletion, and rampant social inequality, the impulse for command-and-control 'solutions' is on the rise whilst cementing the complete faith in human domination, narrow purity regimes and market-driven solutions. Eco-toilet designers find themselves in the paradox of being challenged, as well as affirmed by the socio-ecological functioning and dysfunctions of our times. The eco-toilet cases do not trade purity for messy existence or deny creature comforts to humans on the move. They attempt to incorporate both by balancing the needs of humans and nonhumans towards regenerative and just landscapes. Weather extremes may potentially nullify the diaper-fertilized afforestation efforts, while ensuing migration streams will increasingly demand low-cost and ambulant, thus inventive eco-toilet approaches. Pandemic fears may discourage urbanites from fermenting and composting while such probiotic citizen agency may provide valuable insights for the sedentary, dirt-averse lifestyles of our times. The impediment for eco-toilets is continuing the narrative that further detaches 'human development' from 'natural environment' as to 'protect' them from each other. Following this vision, capitalist production is propagated with market and state substitutions, that defer the environmental costs of external inputs like fuels, feeds, and fertilizers to future generations, thus entirely undermining the regenerative value of locally recovered biomass including human waste (Tornaghi, 2017). And what is considered 'nature' is securely placed into sanctuaries to eliminate the frictions between conservation efforts and capitalist production (Büscher and Fletcher, 2019). This binary thinking is also behind the widespread ignorance for how the dirt-expelling bodies and the impure otherness inside humans is what enables them to live.

5. Conclusion

While the eco-toilet cases in Berlin and Brussels are underpinned by activist urban soil care in the face of environmental degradation, the Hong Kong case strongly resonates with its biosocial inheritance of its (recent) past that emphasizes collectivized resourcefulness and food sovereignty through the reintegration of human waste. Assessing three cases of urban eco-toilets in Brussels, Berlin, and Hong Kong highlights the following:

1. *Strengths*: Collectivized urban eco-toilets become increasingly essential as complementary approach for responding to resource shortages, fluctuating sanitation needs and city dwellers' disconnect to their biophysical foundation;
2. *Weaknesses*: Eco-toilet alternatives operate in the unregulated territory outside of elimination-driven sanitation regimes – it makes them over-reliant on the goodwill and labor input of concerned citizens;
3. *Opportunities*: Thriving urban eco-toilet communities balance unsettling bathroom routines, group debates, and agroecological experimentation with a rich interactive context to embrace the unknowable;
4. *Threats*: Historical demonization of bacteria and social experimentation, augmented in the context of a global pandemic, can make it challenging to engage citizens in the material implications of their own sanitation;
5. *Reflexivity:* The applied Structural SWOT analysis can better account for the inventive potential of precedent-setting eco-toilets through its focus on systemic functioning and multi-perspectival inventiveness.

The social creativity in the three cases stems from the fact that human waste can be reimagined and used in multiple ways, as health indicator, worm food, soil conditioner, intergenerational arc, or civic resistance. The task then for designers is not only to include the perspectives of (unwanted) otherness but also problematize the lack of recognition for the diminished creative potential of such marginalized, human or nonhuman – that ultimately hampers the advancement of humanity overall.

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Rethinking Living Labs: Dialogues between Urban and Rural Context

Aysu Gürman[1], Pınar Ergül Taşkıran [2] and Eylem Keskin [3,*]

[1] Research Assistant; aysu.gurman@yasar.edu.tr; https://orcid.org/0000-0001-9813-2455
[2] PhD Student, pinarergul@iyte.edu.tr; https://orcid.org/0000-0002-4762-4844
[3] PhD Candidate; eylemkeskin@iyte.edu.tr; https://orcid.org/0000-0001-7843-3453
[*] Corresponding author
Authors 2 and 3 are YÖK (Turkish Council of Higher Education) 100/2000 Doctoral Scholarship Recipients

Research highlights

- Living labs have the potential to act as a bridge between the dichotomies of urban and rural context.
- Living labs enhance the dialogues with the nature-based and human-centered practices.
- Different actors become active actors by exploring, examining, designing, and experimenting in different steps of design, innovation, and development processes.

Keywords: living labs; urban-rural dichotomy; human-centered; nature-based; smart city

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1. Introduction

The 'Smart city' has recently been introduced as an innovative concept to use Information and Communication Technologies (ICTs) for an improved quality of life, resilience, and sustainability. It ensures to meet the economic, social, and environmental desires and needs of not only the present generation but also future generations. This understanding has evolved through three generations: Smart City 1.0 (technology-driven), Smart City 2.0 (technology-enabled), and Smart City 3.0 (citizen co-creation) (Cohen, 2015). Different from the first two generations, the focus of the third generation, Smart City 3.0 is directed toward citizens and their dialogue with the city through co-creation. It refers to a collective knowledge co-production and exchange process in which citizens are encouraged to think, create, and act together. It proposes creative and innovative spaces in cities: a design laboratory (design lab), a fabrication laboratory (fab lab), and a living laboratory (living lab) (Velibeyoğlu, 2018). This study focuses on the living labs and their potential to enhance the dialogues with human-centered and nature-based practices.

2. Theories and Methods

Living Labs (LLs) are innovative platforms proposing products (an object, a service, a technology, an application, system, etc.) as creative solutions to the existing problems in real-life contexts through exploration, examination, and experimentation by bringing different stakeholders together (Steen & Van Bueren, 2017, p. 10–11). Users, private actors, public actors, and knowledge institutes as actors co-create and shape this innovation process in LLs. In other words, LLs are the networks of different types of actors that stay in these development steps (Leminen, Westerlund & Nyström, 2012). They intentionally develop new ideas, scenarios, concepts, and systems with the integration of research and innovation. With this intention, LLs provide platforms of open innovation networks through human-centered innovation practices. They position themselves in between the human-centered design, and participatory design, and provide a platform for design developments in resolving the sustainability challenges (Dell'Era & Landoni, 2014).

The current mainstream approach of LLs is to focus on 'other ways of doing' with small-scale initiatives and experiments through technology-user interaction in real-time and in the urban context. In its common sense, focusing on issues at stake through participation in small scale in LLs seems to provide a self-consistent and self-sufficient understanding. However, these ideal intentions are not always applicable in real life and impose some constraints on social inclusion and upscaling in LL projects. First, LLs experience the problem of social inclusion due to the citizens' lack of technological, economic, and intellectual resources (Da Schio, 2019). In addition to personal and social incapability, economic and geographical conditions may result in a gap between certain groups having no access to modern information and communication technology. For example, rural areas may experience poor quality or limited access to urban infrastructure services. Thus, people living in rural areas do not have an equal chance to take action for defined issues at stake and work in collaboration with other participants in urban areas. Second, LLs experience the problem of upscaling because they may not take into consideration the social, economic, cultural, and political conjecture (Da Schio, 2019). This prevents LLs from addressing the majority's current priorities and reaching the broader public to participate. Thus, it is very valuable for the mutual development of urban and rural areas that the proposed creative solutions extend beyond the physical and social boundaries of LLs and reach a broader urban context with its network potential. Although LLs mostly work in urban areas, they have the potential to enhance the quality of life in the rural context. While rural area faces the obstacles such as "the complexities of demographic challenges, consequences of emigration/immigration, ageing of the rural population, climate change, and its implications for the livelihoods of the rural population," LLs aim to produce contemporary ways of life with a more sustainable and effective matter in 'social dimension,' 'economic aspects,' and 'environment issues' (Zavratnik, Superina & Stojmenova Duh, 2019). In this regard, the study aims to explore the potentiality of Laboratories to take responsibility for the ongoing dichotomic dialogue between urban and rural areas through proposing a co-creative process with target groups and creating a network within the disjointed smart city initiatives.

In this study, the opted methodology is examining different examples in a qualitative form of inquiry with a cross-reading between different cases of LLs around the world. This study categorizes different levels of involvement of urban to rural and rural to urban areas, and how they are from examples of LLs as a framework for future smart city studies.

3. Results

As a global issue, LLs whose aim is to find nature-based solutions in the collaboration of various actors for more sustainable and resilient cities take a central role in sustainable development in cities. Asking the questions such as: what citizens primarily need in an environmental crisis, how much time the development of nature-based projects takes, how citizens take part in the process, and how nature-based solutions linked with ICT solutions are critically substantial in LL initiatives (Chronéer, Ståhlbröst & Habibipour, 2019).

Discussing the potential of LLs to create a discourse on urban-rural dichotomy, LLs from five different cities having similar concerns and intentions from around the world will be examined: Helsinki, Malmö, Yarra, Frascati, and İzmir. These LLs which had different main objectives at the beginning have recently taken nature-based solutions and green infrastructures as their common denominator to prioritize resiliency and adaptivity in their cities (European Commission, 2013).

3.1. Examples of LLs

1. Helsinki LL (Arabianranta): Helsinki Smart City initiative with its multilevel stakeholders and aiming for "a quadruple helix of innovation in a climate of openness, experimentation, democracy, and inclusivity" as De Falco, Margarita, & Jean-Paul (2019) put it. In their review of six EU cities; Amsterdam, Barcelona, Helsinki, Naples, Stockholm, and Vienna; Helsinki steps up collecting all the points on their inquiries on urban core impact and urban periphery impact scores. According to De Falco et al., (2019), the inclusion of urban peripheral areas differentiated Helsinki from its equivalents. This is one of the main reasons why the Helsinki LL, Arabianranta, holds importance in social innovations in local communities with its human-centered approaches. It has an opportunity to interact with its more than 10,000 residents if they volunteer to be participants in the LL. The LL aims to provide services and products through inclusive co-creation processes for the local community of Arabianranta, which is a peripheral district of Helsinki with heterogeneous residents from different economic and ethnic backgrounds (Dell'Era C. & Landoni P., 2014).

2. Malmö LLs: The city of Malmö has become essential with its interlinked three LL structures. Based on the "interventionist innovation" approaches, these LLs are mostly human-centered, but also in respect of sustainability in natural resources. There are three interlinked LLs in Malmö:

    1. The Stage – Located in a culture district in Malmö, the LL "focuses on cultural production and cross-media" through cultural inclusion and collaboration with different stakeholders (Ehn et al., 2014).
    2. The Neighborhood – A "design-driven platform" commissioned by the municipality to encourage "sustainable lifestyle and services." The Neighborhood LL brings different stakeholders to incubate social innovations that could help the inhabitants of Malmö on a wider scale (Ehn et al., 2014).
    3. The Factory (STPLN) – Located at Västra Hamnen, which is known for becoming an architectural playground after brownfield regeneration; The Factory is focusing on sustainability issues such as recycling, mass production, and climate change through co-creation processes which enhance the production of knowledge, social and democratic innovation, and collaboration (Ehn et al., 2014).

3. Livewell Yarra LL: Based in Melbourne, Australia, Livewell Yarra LL is an initiative which has different stakeholders of the community, local government, and academics. The LL's initial concern is climate change. It promotes "low carbon living" and "helps communities to decarbonize." Researchers, government workers, politicians, academics, and community members came together in co-creation processes in workshops, learning groups, and projects to engage the users in more "action-based forms of low-carbon living" (Sharp & Salter, 2017).
4. Frascati LL: One of the first members of EnoLL (European Network of LLs), Frascati LL is located near Lazio, Italy, in the area of Frascati which is a rural area mostly known for its wine production. Interestingly, its increasing number of institutional centers is also the ground zero for technological research in Italy. It focuses on technological developments and sustainability. This is why Frascati LL has three disparate yet intertwining main missions:
    - Help incubation processes of the Space technologies to the non-space sectors,
    - Strengthening agriculture by developing new technologies in precision farming, boosting local tourism, and supporting the agricultural science community,
    - Building an e-professional interface for the community (CO-LLABS, 2007).

5. Sasalı BioLab: Sasalı Biolab (Sasalı Climate Sensitive Agricultural Education and Research Institute) in İzmir, Turkey, which won the first prize of the ISBN2019 Sustainability Award, is a unique attempt of LLs to create a dialogue between urban and rural areas. Developed within the scope of the European Union's Urban GreenUp program, the project aims to reduce the effects of climate change and to expand nature-based practices in collaboration with academic, local, managing, and contacting actors. It is placed between a strategic point where both nature and industrial production could meet without detriment to each other: While the axis of urban to natural habitat is positioned from east to west; the collective production of mankind, agricultural fields to the natural preservation area lies on the north-south axis. After the projecting and implementation phase in the process, the applications will be tested by academic actors and reported to the EU in the monitoring phase. Accordingly, it will be suggested that similar projects be implemented in other cities.[1]

4. Discussion and conclusions

This study uncovers how LLs could engage with nature through citizens and discusses the participatory approach of LLs both in urban and rural areas for envisioning a resilient and adaptive city with green infrastructures. The examples of LLs focusing on the existing dichotomies of urban and rural areas in cities show how these discourses can be connected by creating dialogues with the participation of different active actors. Different from other examples, Sasalı Biolab has the intention to create a discourse on extending the nature-based and human-centered practices from its existing location to other cities. Different

[1] Additional brief information about Sasalı Biolab is obtained from an online interview with Dr. Koray Velibeyoğlu (Department of Urban and Regional Planning, Izmir Institute of Technology).

actors become active by exploring, examining, designing, and experimenting in different steps of design, innovation, and development processes. In this regard, the participatory approach in LLs has the potential to enhance the dialogues between urban and rural areas, and to regain the almost forgotten bond to nature in disjointed urban areas. Another discussion of this bond might reveal the nature of a rigid dichotomy between nature-based and human-centered solutions is a conundrum, a dilemma of Anthropocene Epoch: Protect Nature, to protect the human race in the nature.

Data Availability Statement

Due to the research approach, the findings of different examples worldwide may not give consistent datasets concerning each other. Some LL examples are project-based and completed their missions, therefore there is no influx of regular data each year.

Contributor statement

Author Statement
Author 1: Conceptualization, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing
Author 2: Conceptualization, Project Administration, Resources, Writing – Original Draft, Writing – Review & Editing
Author 3: Conceptualization, Investigation, Methodology, Writing – Original Draft, Writing – Review & Editing
Contributor (Dr. Koray Velibeyoğlu): Supervision

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Appendix

About IFoU

The International Forum on Urbanism (IFoU) is a network of universities, research institutes and knowledge centers with the task to strengthen the international collaboration in the field of Urbanism. Governmental and professional institutions that are related to the planning and design of the built environment, can be associated members.

IFoU aims for the following objectives:

- to initiate and realize international comparative research in the fields of urban design, planning and management of metropolitan areas and regions;
- to support the development and dissemination of knowledge on the international level;
- to organize international exchange programs of training and education;
- to facilitate the dialogue between the academic world, professional organizations, corporate entities and politicians in the above mentioned fields.

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Urbanism is a way of thinking and acting needed for sustainable development; urbanists are becoming inter- and transdisciplinary, bringing science, technology, and design into their field. As the world is in a cascading of crises related to, e.g. health, energy, food, and water, as well as issues of, e.g. traffic, housing, and services, integrated approaches become increasingly relevant as most of these challenges are related to each other. Having a holistic urbanism viewpoint is the path to resilience and sustainability. Here, we are not referring to a longer list of notions but particularly encouraging dialogues between (possibly perceived) conflicting discourses. This book is the proceedings of the 14th IFoU conference, a stepping stone towards a new culture of working together. Such a cultural change is needed to face the complexity and uncertainty of current and future challenges.

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