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A Parametric Adaptive Placemaking Assessment for Sustainable and Resilient Cities

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ABSTRACT

Currently, urban design can employ the concept of adaptive placemaking to understand how cities and urban environments evolve over time. Placemaking is crucial for promoting community involvement, strengthening social bonds, and boosting the overall quality of life. This study depicts adaptive placemaking in urban contexts, exploring the dynamic interaction between societies and urban environments. The study is based on theoretical and methodological reflection on merging resilience concepts with placemaking principles issued by PPS which results in three main parameters: Environmental, Social, and Connectivity. Those are the extracted Relationship-based parameters. Then, a pilot study for six different urban development projects across different cities with different strategies is assessed based on the proposed method to evaluate each project's success in responsive adaptive placemaking. The methodology includes qualitative assessment of project outcomes and Harvey Balls scoring. The study reveals variations of success across different parameters. Environmental factors show the most deviation, while social parameters, particularly public participation, demonstrate strong performance across most projects. However, connectivity scores average results. The research uniquely combines a multi-parameter evaluation framework that contributes to the growing knowledge on creating adaptive urban environments that can respond to changing societal needs and environmental challenges over time. However, limitations include incomplete data for some parameters and the challenge of generalizing findings across different cultural and geographic contexts. Thus, the study offers practical insights for urban planners and policymakers on creating resilient, and livable cities.

1. Introduction

The idea of adaptive placemaking in urban design involves adjusting various city shapes, designs, or tactics to different social, economic, and environmental situations over time. This perspective acknowledges cities as intricate systems that constantly evolve to address the needs of their inhabitants, as well as to confront new challenges and opportunities. The rapid urbanization, which is deemed unsustainable, has prompted scholars to explore the intricate relationships between urbanization and the ecological environment [1]. The dynamic interplay and harmonized correlation between urbanization and the ecological environment have emerged as a prominent subject of inquiry in the realm of sustainability research [2]. Social sustainability can be delineated as a method for crafting sustainable and thriving environments that enhance wellness, by discerning the requisites of individuals in the places where they reside and work (Abowardah & Elsayed, 2017; Elsayed et al., 2019). Urban areas have the potential to develop lively, sustainable, and resilient environments that are beneficial for both residents and the surroundings by adopting greenway creation strategies. These strategies include the transformation of neglected or underutilized spaces, establishment of linear parks or green corridors along disused railway tracks or water bodies,

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integration of greenways into urban development blueprints, utilization of environmentally friendly building materials and methodologies, and provision of amenities like seating areas and public art installations.[5]. Moreover, understanding adaptive responses facilitates the development of context-specific interventions tailored to the unique needs and characteristics of different urban areas, thereby promoting more sustainable and equitable urban development [6]. Resilience thinking offers a novel approach to understanding complex adaptive systems, with cities as prime examples. To foster urban resilience, it is important to comprehend key characteristics of resilient systems and translating these insights into spatial urban form and renewal processes. According to [7]. These directions aim to enhance our comprehension of urban resilience and inform more effective urban design and planning strategies.

1.1 Resilience as a Concept

Resilience is related to various concepts. No precise definition is proposed. Instead, resilience is understood as a set of concepts for interpreting complex systems. [8]. However, Rockefeller Foundation 2016 states that; Resilience is the capacity of individuals, communities, and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it. Building resilience is about making people, communities and systems better prepared to withstand catastrophic events—both natural and man-made—and able to bounce back more quickly and emerge stronger from these shocks and stresses. It is the capacity of a system to absorb disturbance and reorganize while undergoing change with the intention of still retain essentially the same function, structure, identity, and feedback—in other words, stay in the same basin of attraction.[9]. Moreover, Pfefferbaum, 2005 states that Resilience is "The ability of community members to take meaningful, deliberate, collective action to remedy the impact of a problem, including the ability to interpret the environment, intervene, and move on" (Norris et al., 2008). Resilience approaches are strategies that seek to deploy the adaptive resources and capacities of a society to overcome the problems caused by change. These approaches focus on the internal capacity of a society to overcome harm rather than on external interventions. Resilience can be assessed on various scales: national, regional, urban area, urban, local, or household. Such a distinction is important for policymakers because resilience assessment scales can be useful in determining activities and decisions.[11]. Resilience is increasingly interpreted in a broader meaning across disciplines as a way of thinking, a perspective or even paradigm for analyzing social-ecological systems[12], (Folke, 2006), (P. Kinzig, 2006), [14]. The socioecological approach focuses on the urban scale, viewing the city as an ecological social system. This holistic perspective addresses the mechanisms of change and the interactions among the system's various components. In this approach, cities are adaptable social and technical systems made up of diverse

elements; a proper combination of these elements can enhance individuals' quality of life. Changes within the system are systematic, where alterations in one element can lead to changes in others, and dynamic[15]. Irani and Rahnamayiezekava states that creating a resilient city involves several key steps: firstly, it enhances systems to reduce their vulnerability to environmental events and mitigate the impact of catastrophic hazards; secondly, it develops the capacity of social agents to access and sustain supportive urban systems; third it reinforces institutions to prevent system fragility and boost agents' capacities. [11]. To use resilience concept on empirical cases, it needs to be defined as" what to what"[16].

1.2 Placemaking Principles

Placemaking principles encompass community driven, visionary, function before form, Adaptable, inclusive, focused on creating destination, context-specific, Dynamic, transdisciplinary, transformative, flexible, collaborative, and sociable (Mahmoud, 2022). The Project for Public Spaces identifies four essential elements that contribute to a great place: (1) sociability, (2) uses and activities, (3) comfort and image, and (4) access and linkages (Mateo-Babiano & Lee, 2020). However, current urban trends show a shift towards placemaking, where local authorities work development with community organizations, business improvement districts, and neighborhood partnerships to drive transformative changes.[17]. Numerous research endeavors within the realm of urban planning have delved into the exploration of Perceived Urban Design Qualities (PUDQs) within the realm of place-making. Ewing and Handy (2009) consider attributes such as convenience, safety, accessibility, comfort, attractiveness, and maintenance to be fundamental elements of the built environment(Ewing & Handy, 2009). Physical environments like plazas, roads, structures, and various associated morphological components within city areas serve as the infrastructure of a city for essential socioeconomic functions such as residency, employment, amenities, leisure activities, and other human activities like interaction, mobility, emotional encounters, etc., that impact the emotional experience in a particular location (Gehl & Rogers, 2013). That effectively enhance social cohesion and impact the sense of community as well. Promoting walkability is a crucial aspect of urban design. Therefore, creating a walk-friendly environment can encourage spontaneous activities and enhance social interactions. It is argued that walkability is attained when streets and walking spaces offer pedestrians a safe and interconnected network that allows them to reach various destinations with minimal time and effort, while providing a pleasant and engaging environment (Middleton, 2021). Moreover, [20] illustrated how gradual enhancements through pedestrian-focused strategies transformed Copenhagen from a car-centric city into one that prioritizes human scale. Research and practice on walkability is driven by well-meaning

| Table 1 Adapted by the Researchers from, | [24], | [25], | [26], | [27] |
|--|-------|-------|-------|------|
|--|-------|-------|-------|------|

| Resilience Concepts | Description | Adaptive response/ design | Placemaking Parameters extracted |
|--|---|--|--|
| Diversity | Diverse communities, ecosystems, economies, and social systems. diversity of different business types, institutions, sources of food, industries. | principles Emphasize multi- functionality, where spaces can serve diverse user groups and activities. | -Cultural Diversity -Sense of community |
| Redundancy | A plethora of resources that can supply the compromised system until it can be replaced or repaired. | Incorporate redundancy, such as multiple access points, or programmatic elements, to provide functionality if one component collapses. | -Linkage Accessibility |
| Modularity and Independence of System Components Flexibility | Independence of system in case of failure or damaged - Simple, passive and flexible systems. Flexible solutions | Design for flexibility and modularity allowing spaces to be configured or reused as needs change. | - Proximity and flexible solutions |
| Environmental responsiveness& Integration | Integration between systems' functions and natural systems, resources and services. Rely on local resources Renewable energy usage Protect natural environment | - The effective use of any resources near the place or interact with it like greens, respond to nature and ecosystems in an efficient way. | Availability and quality of green spaces Air quality Thermal comfort (Urban heat islands) Walkability |
| Quality of life Enhancement | Potable Water, Sanitation, Energy, Livable Conditions (Temperature and Humidity), Lighting, Safe Air, Occupant Health, and Food. Considering Social Equity | - Lowering the Urban Heat Island (UHI) by using specific materials and the use of green solutions. Enhance Air quality and encourage activities to boost occupant health. - Provide spaces for social cohesion and community | Social cohesion Public participation |

intentions to create livable and sustainable urban futures. To build cities' resilience, scientific research attempts to translate the tools defined for the natural environment to the urban context. This means applying adaptive management and multi-level governance approaches to involve the local community and allow adaptive learning [12]. This study aims to test the tangible elements that can be depicted. Therefore, Table 1 illustrates adaptive responses based on resilience concepts to extract the placemaking parameters that sustain the qualities of placemaking and make it adaptive.

1.3 Adaptive Design

Adaptive design refers to an urban project's ability to address the impacts of climate change through various measures while promoting spatial regeneration. Implementing green, soft, and flexible strategies in urban public spaces can help mitigate the effects of extreme weather events. These include parameters like air quality, greenery, urban heat island etc. These approaches address weather hazards by enabling the system to self-reorganize and recover from disturbances without altering its fundamental state. They also offer significant cultural ecosystem services to the local community, including health, spiritual, and aesthetic benefits. The Millennium Assessment (2005) defines cultural ecosystem services as the intangible benefits people gain from ecosystems. These benefits encompass cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation, and ecotourism.

According to the Millennium Assessment (2005), these services can include elements like landscape beauty, educational information, sense of place, and activities such as walking, all falling under the broad concept of cultural ecosystem services[22](Palazzo, 2020).

2. Methods

Interface between resilience & placemaking

Merging resilience concepts into placemaking strategies and design principles can give rise to more sustainable, adaptable, and resilient to future challenges public spaces. From this integration, we can extract several adaptive response parameters that can guide the design and management of public spaces. Both placemaking and resilience emphasize adaptability and flexibility, recognizing the need for systems and spaces that can evolve in response to changing needs and conditions. They also share a community-driven and collaborative approach, focusing on the internal capacity of societies and the collective action of community members. Both concepts embrace holistic and systems thinking, considering multiple interconnected factors in their approaches. Social aspects are central to both placemaking and resilience, with an emphasis on inclusivity and enhancing the capacity of social agents. Environmental considerations play a crucial role in both concepts, particularly in urban contexts where ecological components and adaptive responses to climate change are increasingly important. Both placemaking and resilience have transformative potential, aiming to create positive change in spaces and systems. The creation of multi-functional spaces aligns with resilience concepts of systems that can reorganize while maintaining their core functions. Finally, both concepts prioritize health and well-being, linking public spaces to public health and aiming to enhance quality of life. These connections provide a framework for creating public spaces that embody both placemaking principles and resilience concepts. They allow for the design and management of spaces that are not only attractive and functional in the present but are also capable of adapting to future challenges and changing community needs. By considering these parameters, designers and planners can create public spaces that are more likely to remain viable, valuable, and resilient over time. The shared characteristics in the middle column (Figure 1) represent the common ground between placemaking principles and resilience concepts. These shared elements demonstrate how integrating these approaches can lead to more adaptable responses and sustainable public spaces. All parameters are extracted from resilience concept and placemaking principles as follows: First, Social parameters incorporate social cohesion, public participation, cultural diversity, and sense of community. Then, Environmental Parameters include the availability and quality of green spaces, air quality, and urban heat islands. Lastly, Connectivity Parameters involve linkage, accessibility, proximity, and walkability. In addition to monitoring adaptive strategies used in each case according to the placemaking strategies analyzed.



Figure 1 Interface between placemaking and resilience for extracted adaptive response Parameters

3. Pilot Study

A pilot study was conducted to overview urban challenges and strategies employed by societies facing those challenges. There may exist a gap in the literature concerning how the characteristics of urban areas contribute to the formation of adaptive placemaking. An absence of research could be identified in comprehending how diverse urban environments impact adaptive reactions. It is possible that there is a deficiency in studies that systematically juxtapose adaptive reactions across varying urban environments. A deeper insight into the diversities in adaptive approaches can enhance comprehension of the urban context's role. The principal research gap that this study tackles is that adaptive placemaking is crucial in resilient cities and it can be monitored through the proposed parameters

3.1 Case Studies

Criteria of Selection

Place making is a purpose driven core according to [18] so the criterion of selection is based on choosing different places with different placemaking responses. Place making is a purpose driven core according to [18] so the criterion of selection is based on choosing different places with different placemaking strategies/responses. Consequently, the proposed parameters are monitored, and the used strategies are analyzed. The case studies are as follows in the table below.

| Table 2 c | case | studies | typol | logies |
|-----------|------|---------|-------|--------|
|-----------|------|---------|-------|--------|

| Cases Introduction | | | | | | | |
|--------------------|--------|----------------|---------------|--|--|--|--|
| Case | Symbol | Location | Placemaking | | | | |
| | | | Typology | | | | |
| | | Country | | | | | |
| High Line | Case A | New York City | Creative, | | | | |
| Park, NYC | | | Ecological | | | | |
| | | | and Transit | | | | |
| | | | Oriented | | | | |
| Bentway, | Case B | Toronto,Canada | Strategic, | | | | |
| Toronto | | | Community- | | | | |
| | | | Led and | | | | |
| | | | Creative | | | | |
| Hammarby | Case C | Stockholm, | Ecological | | | | |
| Sjöstad, | | Sweden | and Strategic | | | | |
| Sweden | | | | | | | |
| Vancouver, | Case D | Vancouver, | Cultural and | | | | |
| Canada | | Canada | Equity Based | | | | |
| Super | Case E | Barcelona, | Strategic and | | | | |
| block | | Spain | Ecological | | | | |
| Project | | | | | | | |
| Federation | Case F | Melbourne, | Cultural and | | | | |
| Square, | | Australia | Strategic | | | | |
| Melbourne | | | | | | | |

A. The high line Park (NYC)

The High Line in New York City represents a notable instance of urban placemaking that excels in both proximity and walkability, two essential factors contributing to its effectiveness as a public space. Situated strategically on the western side of Manhattan, the park spans from Gansevoort Street in the Meatpacking District to 34th Street, traversing lively neighborhoods like Chelsea and Hudson Yards[28]. Its numerous entry points are conveniently positioned near major public transportation centers, facilitating easy access for a diverse range of visitors, including locals, commuters, and tourists. The park's integration with its urban environment enhances connectivity, enabling smooth transitions between the High Line and surrounding residential, commercial, and cultural zones. This proximity cultivates a mutually beneficial relationship, attracting a continuous stream of visitors who enjoy the local amenities while contributing to the vibrancy of the park[29]. The design of the High Line places a strong emphasis on walkability by incorporating inviting, well-maintained pathways and ample seating areas that enhance the comfort and welcoming nature of the space. Strategically positioned benches, lush greenery, and diverse seasonal plantings combine to create a visually appealing and enjoyable atmosphere, enriching the walking experience[30]. Safety measures, including sufficient lighting and regular security patrols, serve to instill a sense of security among visitors, while the provision of elevators and ramps ensures connectivity for all individuals [31]. The park's connection to public transportation options, bicycle storage facilities, and Citi Bike stations further integrates it into the city's grid, promoting transportation sustainable modes of travel. Moreover, the High Line offers a variety of fitness-related activities, encouraging active lifestyles and providing a safe, carfree setting for recreation and leisure, establishing it as a global benchmark for urban placemaking.

B. The Bentway (Toronto)

The Bentway in Toronto represents an innovative urban redevelopment initiative that transforms the area beneath the Gardiner Expressway into a dynamic and versatile public space. Extending from Strachan Avenue to Bathurst Street, The Bentway includes pathways for pedestrians and cyclists, spaces for performances, gardens, and recreational zones, thus establishing a lively thoroughfare that improves urban connectivity. Embracing sustainable design principles, the project repurposes existing infrastructure and incorporates green areas, which not only enrich the urban ecosystem but also help mitigate environmental effects [32]. Through the hosting of diverse cultural events, markets, and community gatherings, The Bentway promotes social engagement and interaction, effectively converting a previously neglected space into a flourishing urban

center [33]. Strategically positioned in proximity to downtown Toronto, The Bentway enjoys convenient access from prominent neighborhoods like Liberty Village, King West, and the Entertainment District, as well as being in close vicinity to landmarks such as the Fort York National Historic Site and Exhibition Place. This advantageous location, coupled with exceptional connectivity via public transportation and alternative modes of travel, ensures that The Bentway caters to a broad spectrum of users, ranging from local inhabitants to visitors. By addressing community needs, including those of the homeless population, The Bentway serves as a model of inclusive urban planning[32]. The project does not revitalize only abandoned areas but also enriches the urban living experience, thereby contributing significantly to the cultural, social, and economic vibrancy of Toronto.

C. Hammarby Sjöstad:

Hammarby Sjöstad in Stockholm is a notable urban regeneration project known for its sustainable development initiatives. Covering approximately hectares 160 of brownfield redevelopment, the project has set ambitious environmental objectives[34], [35], [36], [37], [38] The environmental program implemented in Hammarby Sjöstad has played a pivotal role in shaping the sustainable urban district, emphasizing the integration of environmental considerations into urban development [35]. This initiative has not only influenced other projects like the Stockholm Royal Seaport but has also served as a model for them, drawing inspiration from the experiences gained in Hammarby Sjöstad [39], [40]. The development of Hammarby Sjöstad has been characterized by a strong focus on sustainability, with endeavors to incorporate renewable energy systems at both district and building scales[41]. The project has been lauded for its dedication to environmental technology and for creating a green urban environment within an urban setting [40]. Additionally, Hammarby Sjöstad has been recognized for its innovative approaches, such as integrating photovoltaics in residential areas to promote ecological sustainability[42]). Moreover, the planning processes in Hammarby Sjöstad have been noted for their market-driven nature, which, while efficient, may have limited the involvement of residents in decision-making [43]. Despite this, the project has garnered numerous awards and accolades for its sustainability efforts and commitment to establishing a green and environmentally friendly urban district (Campillo, 2022). Regarding energy efficiency, Hammarby Sjöstad has demonstrated superior performance compared to traditional Swedish buildings, consuming nearly 30% less energy, showcasing the success of its sustainability strategies [44]. The project has also implemented innovative solutions such as district heating, with a significant portion of the heat being sourced from

purified wastewater, contributing to its overall sustainability goals[45].

D. Vancouver's Chinatown, Little India, and Punjabi Market

Vancouver's Chinatown, Little India, and Punjabi Market are significant cultural and economic hubs with unique environmental aspects. Research on Vancouver's Chinatown highlights issues of gentrification and revitalization [46], [47], [48]. Gentrification processes in Vancouver are increasingly using sustainability and green consumption narratives, contributing to ecological gentrification[49]. Vancouver's Chinatown has evolved, retaining its tourist appeal but losing its status as a primary residential and business location for the Chinese community[47]. The environmental and heritage values of maintaining Vancouver's pre-1940 houses, constructed with old-growth forest wood, are discussed, emphasizing the need for policy efforts to preserve this non-renewable resource[50].In terms of environmental justice, studies have examined the health inequities faced by informal recyclers in Vancouver, emphasizing the occupational exposure and social determinants of health affecting this group[51]. Additionally, the integration of healthy and environmentally sustainable food initiatives in Vancouver schools showcases efforts to improve dietary health and reduce carbon emissions within educational settings[52] .Furthermore, the study of urban wood smoke exposure in Vancouver highlights spatial and demographic variations, shedding light on environmental justice aspects related to wood smoke emissions[53]. The cultural significance of Chinatown in Vancouver is explored in the context of race-definition processes and cultural hegemony, demonstrating how the racial category is constructed and legitimized through institutional practices[54]. The presence of Chinatown in Vancouver has been instrumental in shaping the city's identity as a global and diverse metropolis [55]. Moreover, the role of Chinese voluntary associations in Vancouver's Chinatown in bridging generational gaps and fostering social activities underscores the community-building aspects of these spaces[56]. Chinatown is located near the historic shops and restaurants of Gastown, and near the vibrant Dr. Sun Yat-Sen Classical Chinese Garden. The Punjabi Market is in South Vancouver along Main Street, expanding from East 48th to East 51st Avenue. It lies within the Sunset district, approximately 5-6 km south of downtown. The market is located east of Oakridge and west of Fraser Street, near Queen Elizabeth Park. The nearest SkyTrain station is Langara-49th Avenue, about 1 km away [57] (Punjabi Market, n.d.).

E. The Superblock, Barcelona

The Superblock or Supermanzana (SM) model, developed in Barcelona, aims to improve connectivity, equity, health, and livability by reorganizing the existing urban structure and transforming public spaces at the neighborhood level. The SM model involves creating a system of superblocks within the main road network, with each superblock consisting of several blocks and the streets, sidewalks, and squares between them. The size of the superblocks is about 400x400 meters, based on the average walking and driving speeds in urban areas. The original superblock model, which emphasized three-by-three block enclosures and their interior pedestrian spaces, is gradually giving way to the green axes model, which seems more viable. The latter puts the focus on longitudinal continuity, also enabling the connection with pre-existing green spaces. The road network within the superblocks is designed for access traffic, while the roads on the edges of the superblocks are for fast and cut-through traffic. Measures such as reducing car lanes, changing traffic directions, setting speed limits, and providing logistic platforms for goods help discourage cut-through traffic within the superblocks. However, there have been critical issues in the implementation of the Poblenou SM, such as the presence of oneway roads with the same direction on the borders of the superblock, dissatisfaction among non-residents regarding reduced car parks, and a feeling of discrimination among residents living on the bordering thoroughfares compared to those living inside the superblock[59] .The Superblock project in Barcelona aimed to address the chronic lack of open space in the city, showcasing the importance of creating accessible green areas for residents.[59]. These green axes, extended to the entire city of Barcelona, seek to improve citizens' access to green spaces, prioritize active travel, and reduce motor vehicle traffic. By implementing the SM model, Barcelona aims to create more sustainable and livable neighborhoods, reclaiming public space, and promoting modes of transportation other than cars. [59] The innovative land use intervention aims to reclaim space for people, reduce motorized transport, promote sustainable mobility and active lifestyles, provide urban greening and mitigate the effects of climate change [60].

F. Federation Square, Melbourne

Federation Square in Melbourne, Australia, faced initial struggles in meeting social, environmental, and connectivity criteria when it was inaugurated in 2002. Criticisms were directed towards the square's abstract, deconstructivity architectural style for not adequately representing Melbourne's cultural heritage and its lack of inviting informal gathering areas.[61] Furthermore, the square encountered challenges in hosting events that appealed to a

diverse audience consistently. From an environmental perspective, the original design included minimal greenery and extensive use of hard surfaces, leading to the urban heat island phenomenon and an unwelcoming ambiance, particularly in summer months. The intricate architecture resulted in high energy consumption for climate control purposes.[62] Connectivity emerged as another prominent issue due to the multi-level layout creating obstacles for individuals with mobility impairments. The lack of clear signage and complex configuration added to visitor confusion, while the initial design did not seamlessly connect with public transportation hubs[61]. Melbourne nearby has transformed into an exceptionally dynamic global metropolis, serving as a venue for a variety of artistic, cultural, and athletic activities across a range of expansive areas, grand auditoriums, and narrow passageways. Nevertheless, Federation Square does not serve as the focal point of all these events as initially envisioned, and it is failing to meet the criteria of being a sufficiently "engaging" space as stipulated in its founding principles. There is a restricted number of pathways connecting Federation Square to the Central Business District[63], [64]. Access on the eastern perimeter, along Flinders Street, is confined to the northwest and northeast intersections, without any crossings in between. Connectivity on the western boundary is harmonized with the entrance to the Flinders Street Station tram stop. Movement from the southern edge is restricted to crossings over Princes Bridge.[65]. These obstacles underscore the significance of considering various user requirements and local surroundings in urban planning. Nonetheless, it is essential to acknowledge that Federation Square has undergone several enhancements post-opening to tackle many of these challenges, illustrating the ongoing process involved in successful urban space enhancement.[64]

4. Results

Table 3 A structured approach to evaluating complex urban development projects across multiple dimensions, facilitating comprehensive analysis and informed decision-making in urban planning and policy

| | Adaptive Responses Parameters | | | | | | | | | | |
|---|-------------------------------|----------------|--------------------------|--------------------|-------------------------|-----------------------|-----------------------|-------------------------|------------|-----------|-------------|
| Case Studies | Environmental Parameters | | | Social Parameters | | | | Connectivity Parameters | | | |
| | Green spaces | Air quality | Urban heat islands | Social cohesion | public participation | cultural diversity | Sense of community | Linkage | Accessible | Proximity | walkability |
| Highline Park (NYC) | • | • | • | • | • | • | • | • | • | • | • |
| Bentway (Toronto) | • | • | • | • | • | • | • | • | • | • | • |
| Hammarby Siöstad (Stockholm) | • | 0 | • | • | • | • | • | • | • | • | • |
| Vancouver (Chinatown , Little India, And Punjabi Market) | • | 0 | 0 | • | • | • | • | • | • | • | • |
| Superblock Barcelona, Spain | • | • | • | • | • | • | • | • | • | • | • |
| Federation Square, Melbourne | 0 | • | 0 | 0 | 0 | • | 0 | • | • | • | 0 |
| KEY | • | Ach | ieved | Partially Achieved | | | ed | O Unachieved | | | |

The schedule compares six urban development projects across 11 parameters grouped into three categories: Environmental, Social, and Accessibility. The achievement levels are represented by Harvey Balls, where a 100% filled ball indicates "achieved," a 50% filled ball indicates "partially achieved," and a 0% filled ball (empty) indicates "unachieved."

- Highline Park (NYC): This project stands out as the most successful, achieving full marks (100% filled Harvey Balls) across all parameters. It excels in environmental aspects, social engagement, and accessibility, making it a benchmark for urban development projects.
- 2. Bentway (Toronto): The Bentway shows strong performance, particularly in social parameters and urban heat island mitigation. It partially achieves goals in green spaces, air quality, linkage, and accessibility. Overall, it demonstrates a well-rounded approach to urban development.
- 3. Hammarby Sjöstad (Stockholm): This project achieves full marks in most categories, especially in social and accessibility parameters. It excels in green spaces but shows room for improvement in air quality and partially achieves its urban heat island mitigation goals.
- 4. Vancouver (Chinatown, Little India, and Punjabi Market): This area shows mixed results. It excels in public participation and sense of community but struggles with environmental parameters, particularly air quality and urban heat island effect. Social cohesion and cultural diversity are partially achieved. Notably, data for the "Walkability" parameter is not clear.
- 5. Superblock Barcelona, Spain: Barcelona's Superblock project demonstrates excellent performance across most parameters, fully achieving goals in environmental and accessibility aspects. It shows partial achievement in fostering a sense of community. "Connectivity parameter" is clarified through the availability of spaces for walking, spaces for children to play, and comfortable spaces for people to relax in. That fosters local services and commerce. In addition, it provides flexible spaces capable of accommodating various occasional uses.
- 6. Federation Square, Melbourne: This project shows the most room for improvement among the case studies. It struggles particularly with environmental parameters and social engagement. However, it achieves full marks in linkage and shows partial achievement in air quality, cultural diversity, and accessibility.

Comparative analysis results were as follows:

- Environmental Parameters: Highline Park and Superblock Barcelona excel, while Federation Square faces significant challenges.
- Social Parameters: Highline Park, Bentway, and Hammarby Sjöstad demonstrate strong social engagement, while Federation Square struggles in this area.
- Connectivity Parameters: Most projects perform well in this category, with Highline Park and Hammarby Sjöstad achieving full marks across all accessibility metrics.

Overall, Highline Park emerges as the most successful project across all parameters, while Federation Square shows the most room for improvement. The other projects demonstrate varying strengths and weaknesses, with generally strong performances in social and connectivity parameters, and more varied results in environmental aspects. This analysis provides valuable insights into the successes and challenges of different urban development approaches, offering lessons for future projects aiming to create sustainable, socially engaging, and accessible urban spaces.

5. Conclusion and Future Studies

The analysis of the adaptive response parameters across the six urban development projects reveals a generally well-validated set of metrics, providing valuable insights into the effectiveness of these initiatives. The environmental parameters, including green spaces, air quality, and urban heat island mitigation, show the most variation in achievement levels. This diversity suggests that environmental factors may be more challenging to address uniformly or are more dependent on local conditions and resources. Despite this variability, the strong performance of projects like the Highline Park and Superblock Barcelona demonstrates that comprehensive environmental improvements are achievable in urban settings.

Social parameters, encompassing social cohesion, public participation, cultural diversity, and sense of community, emerge as consistently strong across most projects. This trend indicates a growing recognition of the importance of community engagement and social connectivity in urban development. Notably, public participation stands out as the most universally achieved parameter, fully realized in five out of six projects, underscoring its central role in successful urban initiatives.

Connectivity parameters, including linkage, connectivity, proximity, and walkability, also show generally positive results across the case studies. However, the incomplete data for

proximity in two cases and walkability in one case slightly diminishes their overall validation. This gap in data highlights the need for more consistent measurement and reporting of these factors in urban development assessments.

The Highline Park in New York City serves as a benchmark for the entire set of parameters, achieving full marks across all metrics. This comprehensive success validates the feasibility of addressing all these aspects within a single project and sets a high standard for future urban development initiatives.

Overall, the chosen adaptive response parameters appear to be well-selected and broadly applicable across diverse urban contexts. They provide a comprehensive framework for evaluating project success, encompassing crucial environmental, social, and connectivity factors. However, the variation in achievement levels, particularly in environmental parameters, suggests that these aspects may require more tailored approaches or face greater challenges in implementation.

Future studies and urban development projects could benefit from ensuring complete data collection for all parameters, especially proximity and walkability, to enhance the validation of these metrics across different urban contexts. Additionally, the consistent success in social parameters across most projects indicates a positive trend in prioritizing community needs and engagement in urban planning. This analysis not only validates the chosen parameters but also highlights areas for potential improvement and focuses on future urban development initiatives. It underscores the importance of a holistic approach to urban planning that balances environmental sustainability, social cohesion, and connectivity to create truly adaptive and resilient urban spaces. Foster community capacity and empowerment through the utilization of art to cultivate community empowerment and cohesion; and establishing participatory mechanisms for discourse and communal governance. Enhance and mobilize the constructed landscape through the development of facilities that adapt to a diverse array of individuals' social, visual, and emotional requirements.

Conflict of Interest

The authors declare no conflict of interest.

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