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Spatial Agency as an Alternative Approach to Indigenous Tactical Urban Design: A Case Study of the Open-Air Lab

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ABSTRACT

Climate crises necessitate adaptive, cost-effective, and community-driven strategies to enhance urban resilience. Tactical urban design, which includes temporary and experimental interventions, is becoming increasingly vital, particularly in indigenous contexts. This study explores the spatial agency approach within tactical urbanism, emphasizing low-technology techniques, indigenous knowledge, and decentralized design as active elements in transforming public spaces. It aims to review recent trends and alternative tactical strategies in indigenous settings while identifying the attributes and mechanisms that contribute to the creation of sustainable public spaces through spatial agency. Employing an interpretive qualitative methodology that includes case studies and content analysis, the research focuses on the Open-Air Lab in Dakar, Senegal (Codesign Lab, Paolo Cascone). This project, a small-scale public infrastructure initiative born from participatory design, exemplifies a hybrid model that combines traditional craftsmanship, low-tech digital fabrication, and environmentally conscious solutions. The findings indicate that framing spatial agency as an actor-network process brings marginalized actors and practices to the forefront, fostering empowerment, social synergy, and climate-responsive design. The study advocates for a shift in tactical urban design from ephemeral placemaking toward long-term, adaptive strategies grounded in local materiality, community engagement, knowledge systems, and decentralized networks. These insights

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reshape the understanding of urban adaptability and provide practical guidance for architects and planners aiming to create inclusive, climate-resilient public spaces in indigenous and Global South contexts.

Keywords: Spatial Agency; Tactical Urban Design; Sustainability; Public Spaces; Indigenous Context; The Open-Air Lab Project

1. Introduction

Urban environments within indigenous areas around the globe are facing growing challenges due to rapid climate change, accelerated urbanization, and increasing socioeconomic disparities. In response to these issues, tactical urban design has surfaced as a pioneering strategy aimed at fostering sustainable urban transformations through quick, low-cost, and community-driven interventions[1,2].

Conversely, spatial agency offers an alternative lens for architectural and urban practices, highlighting how individuals and communities actively shape environments and policy outcomes[3]. In indigenous contexts, spatial agency not only alters physical spaces but also catalyzes cultural reappropriation and collective empowerment[4]. Through temporary, locally meaningful interventions, it strengthens community resilience over the long term.

In light of this, several emerging real estate and concrete experiences aim to address this paradigm shift and explore the potential of this approach in developing alternative strategies for tactical urban design practices. This is particularly relevant in contexts where indigenous communities are navigating contemporary urban challenges. This study highlights these recent experiences and continues to delve into them.

In this context, the central research problem is how to leverage the spatial agency approach within indigenous tactical urban design to transition ephemeral urban interventions into enduring, resilient public spaces that embody both cultural aspects and adaptive design. More specifically, the primary research goal of this study is to explore how community engagement, technological advancement, and traditional design practices influence the transformation process of an open-air lab project located in Dakar, Senegal, which serves as a case study illustrating a system of agencies based on the empowerment and synergies of various actors. Additionally, what mechanisms facilitate the evolution of temporary urban solutions into enduring and sustainable infrastructural assets within the project?

Based on our research questions, we hypothesize that conceptualizing public spaces as symmetrical systems of diverse actors, which equally integrate active community participation, traditional craftsmanship, accessible low-tech technologies, and innovative performative designs, is crucial for converting short-term interventions into enduring, sustainable public spaces.

This research aims to explore and provide an overview of alternative indigenous urban design strategies through the lens of the spatial agency approach. Moreover, it seeks to identify the key agencies and mechanisms that enable the transformation of temporary urban interventions into permanent and resilient indigenous public spaces, using the open-air lab as a relevant case study.

This study, grounded in an empirical and concrete case analysis, enhances the literature by broadening the theoretical framework of tactical urban design within indigenous contexts. It provides actionable insights for urban planners, architects, and policymakers aimed at promoting sustainable public spaces in similar settings, all through the perspective of the spatial agency approach. Accordingly, the novelty of this approach lies in its explicit integration of key agencies at the same time and in a symmetrical way, such as indigenous knowledge and low-tech digital techniques into a cohesive actor-network, positioning these elements as co-equal actors alongside professional designers. Unlike existing conventional models that favor the adoption and dominance of high-tech technologies and marginalize the importance of other social actors, or consider local traditions as supplementary rather than constitutive in tactical urban design strategies, intervention in indigenous public spaces.

Accordingly, this research adopts an interpretive qualitative methodology, drawing data from the literature and performing document analyses. This study analyzes these data through a rigorous thematic approach to uncover context-specific insights.

This paper is organized as follows. It begins by situating the context of the study within a broader theoretical

framework, reviewing some tactical urban design strategies, urban adaptability, spatial agency, and the view of public spaces as dynamic networks of interaction. We then detail our methodology, explaining the case study design, multi-method data collection, and thematic analysis process. Next, we unpack the Open-Air Lab case, tracing its design rationale, participatory implementation, and evolutionary adaptations. Finally, we present our key findings, discuss their implications for sustainable tactical urban design, and conclude with a synthesis of contributions, acknowledged limitations, and directions for future research. **Figure 1** summarizes the organizational structure of this study.

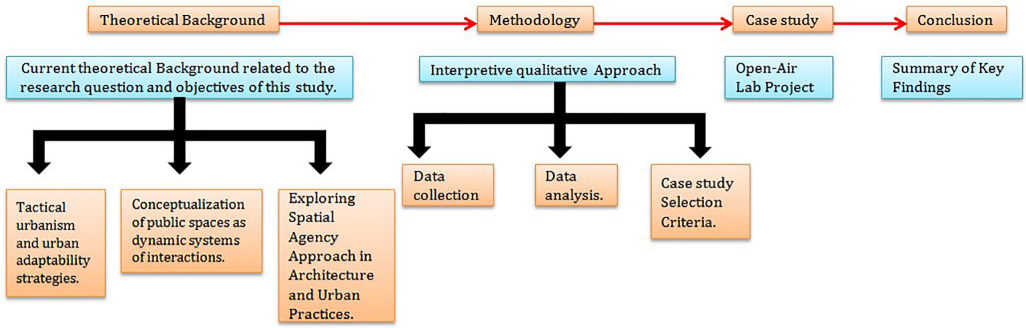

Figure 1. The structure of this research study.

Source: Authors.

2. Theoretical Background

This study's theoretical framework synthesizes perspectives from tactical urban design, urban adaptability, and spatial agency within indigenous contexts. It builds on these foundations to critically reassess how sustainable public spaces are created. By applying the spatial agency approach, the framework explores how indigenous tactical urban design strategies not only challenge conventional urban planning but also foster the development of sustainable and culturally resonant public spaces.

2.1. A Theoretical Overview of Tactical Urban Design Strategies and Urban Adaptability

Tactical urban design is an approach to urban transformation that features low-cost, temporary interventions in the built environment[5]. This approach offers flexible, adaptive urban solutions[6] and employs innovative design practices that incorporate rapid interventions into cohesive, long-term urban strategies[7]. Consequently, these interventions are often community-driven and aim to address local issues, such as challenges associated with domestic planning[8]. Furthermore, this approach enhances public spaces and catalyzes long-term change, effectively accelerating transformation[9,10]. Within this framework, tactical urban design projects can vary widely, encompassing pop-up parks, street art, community gardens, and temporary pedestrianization initiatives[11].

Emerging tactical urban design strategies serve as a means to test relational processes within urban spaces and explore configurations that promote cohesive environments[12]. Accordingly, Wohl[12] posits that these tactical urban strategies can be analyzed through the lens of complexity theory, leveraging relational junctures in situ to investigate the relational configurations of cohesive urban environments. This viewpoint indicates that tactical urban design enables planners to redefine their practices by examining the relational dynamics that precede design interventions.

In the context of indigenous communities, recent studies underscore how indigenous tactical urbanism seamlessly integrates localized building techniques, traditional land-use practices, and community storytelling to foster resilient urban spaces[13]. A notable example is the research conducted by Zavoleas et al.[14], which proposes alternative strategies for incorporating indigenous knowledge into land management. This study emphasizes the importance of integrating a more-than-human perspective from indigenous cultures into computational models for architecture, urban planning, and landscape design.

Additionally, Powell et al.[15] emphasized the importance of adopting a pattern language approach within indigenous tactical urbanism strategies, highlighting the tension

that exists between top-down urban development and local agency. This underscores the need for participatory methods that blend both formal and informal urban practices. Similarly, Marshall[16] noted that indigenous worldviews can enhance regenerative planning paradigms, indicating that crucial elements such as place, culture, climate, and ecosystem needs are essential for achieving sustainability.

2.2. Public Spaces as a System of Interaction Between Heterogeneous Actors

An emerging strand of urban theory conceptualizes public spaces as interconnected networks or systems of interactions among various actors, institutions, and cultural practices. This perspective posits that public spaces are not isolated entities but rather dynamic, adaptive nodes within a broader sociospatial network that facilitate continuous exchange of resources and bolster collective resilience[17,18].

These interactions play crucial roles in constructing a resilient urban fabric, as they promote adaptive governance and a sense of collective responsibility[19,20]. By highlighting connectivity and network dynamics, this approach emphasizes how public spaces can effectively support both cultural expression and environmental sustainability. Research by Talen[21] further demonstrated that when public spaces are perceived as interactive systems, emerging social networks can foster more inclusive urban environments.

Within indigenous tactical urban design, this networked lens reveals how communities seamlessly integrate traditional knowledge with contemporary design innovations to co-create resilient public spaces. It further highlights these spaces as powerful catalysts for social transformation, where adaptive strategies are continuously negotiated and refined through active, ongoing community engagement.

2.3. Spatial Agency as an Alternative Approach in Architecture and Urban Practices

The concept of agency, in its broadest sense, refers to the ability of individuals or groups to act independently and make their own choices[22]. This capacity is crucial in architectural and urban practice, as design decisions can significantly impact the lives and well-being of communities[23]. In this context, Tatjana Schneider and Jeremy Till delve into the role of agency concerning the responsibilities and powers of architects[22]. They build on Anthony Giddens's interpretation of agency to explore the transformative potential of architecture. This perspective extends to spatial agency, which broadens the scope of architectural practice beyond mere aesthetics and technical design to encompass social and spatial considerations[24].

Furthermore, the spatial agency approach challenges conventional top-down methods of urban planning and underscores the importance of participation, collaboration, and acknowledging the agency of all actors[22]. In this context, spatial agency presents a valuable framework for fostering more inclusive, sustainable, and community-focused cities[25]. Within this context, spatial agency serves as a practical means of tactical urban design, facilitating low-cost, temporary interventions that address local needs and ignite long-term transformative change[26].

On the other hand, Meng et al.[27] underscore a critical aspect of spatial agency in urban practice, which is the potential for incorporating digital tools as mediators in the development of public spaces. This integration not only enhances citizen participation but also fosters collaborative approaches and facilitates placemaking within urban environments. Recognizing these elements is vital for devising innovative strategies in tactical urbanism.

3. Materials and Methods

The methodological framework of this interpretive study is structured to capture the nuanced and context-specific nature of emerging indigenous tactical urbanism. It incorporates established qualitative research methods commonly employed by leading scholars in the field.

3.1. Research Design

We adopt an interpretive qualitative design to illuminate the symbolic and experiential dimensions of urban interventions. This paradigm enables us to trace how diverse actors assign meaning to spatial transformations, and how these shared narratives drive the evolution of public spaces over time. This approach is particularly well-suited to unpacking the layered complexities of indigenous tactical urban design, where cultural narratives and community practices are foundational to understanding resilient design processes.

3.2. Case Study Selection

We selected the Open-Air Lab in Dakar based on strict criteria to ensure that it embodies the hallmarks of indigenous tactical urban design and spatial agency. First, the project integrates traditional craftsmanship with rapid, low-cost interventions, showcasing how local practices can drive agile urban improvements. Second, it enacts spatial agency through community empowerment and participatory decision-making, enabling residents to reinterpret and redesign their surroundings in ways that both preserve cultural heritage and bolster adaptive resilience. Third, its iterative design process, characterized by continuous community feedback and dynamic reconfigurations, aligns with modern urban resilience frameworks.

Environmental sustainability featured prominently through eco-friendly construction techniques and locally sourced materials, whereas social sustainability is achieved by nurturing community cohesion and cultural preservation via participatory co-creation workshops.

Finally, the availability of rich data sources, including detailed project documentation and media reports, ensures that the case provides a comprehensive empirical basis for analysis. **Figure 2** summarizes the case study selection criteria.

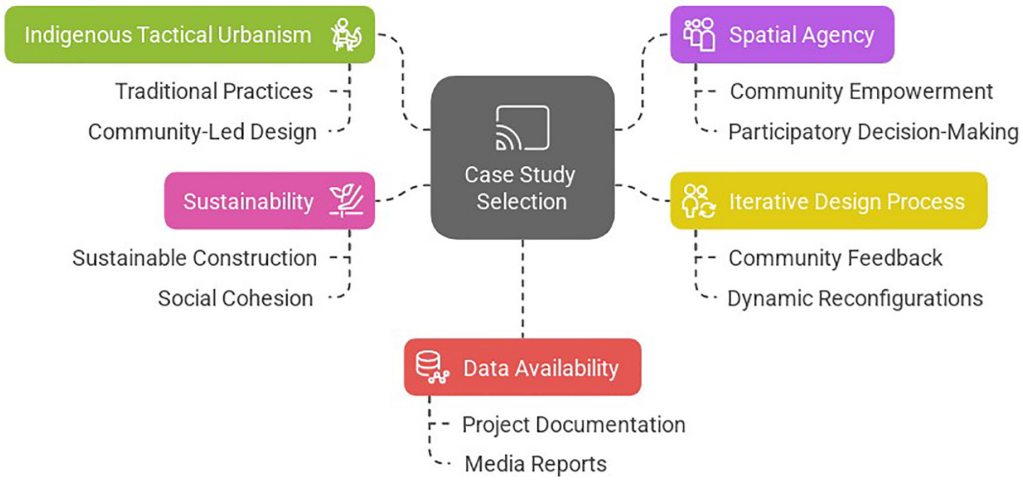

Figure 2. Case study selection criteria.

Source: Authors.

3.3. Data Collection Process

The data collection process for this research follows a qualitative approach, integrating document analysis, case study examination, and secondary data sources to ensure a comprehensive understanding of how the spatial agency approach operates within indigenous tactical urban design. This process includes two steps:

Step One: Document collection from the literature is conducted to review the relevant scholarly literature, policy reports, and architectural studies addressing tactical urbanism, spatial agency, indigenous public spaces, and urban adaptability. This provides a theoretical foundation and contextual background for analyzing the selected case study.

Step Two: Data collection related to the case study focuses on the Open-Air Lab project in Dakar, Senegal, led by the Codesign Lab. We compiled a multimodal dataset including organizational reports, architectural drawings, material and construction-technique schematics, and photographic records of community workshops to capture both the technical and social dimensions of the project. This comprehensive approach reveals stakeholder interactions and design evolution in depth. **Figure 3** summarizes this data collection process.

3.4. Data Analysis Process

3.4.1. Step One: A Comprehensive Analysis

We organized the outputs of our literature review and document analysis into four core themes related to spatial agency, tactical urban design, urban adaptability, and participatory design. This structured thematic framework facilitates

a clear comparative analysis between established theoretical models and the empirical observations from the Open-Air Lab, enhancing our understanding of how theoretical tenets materialize in indigenous tactical urban design practices.

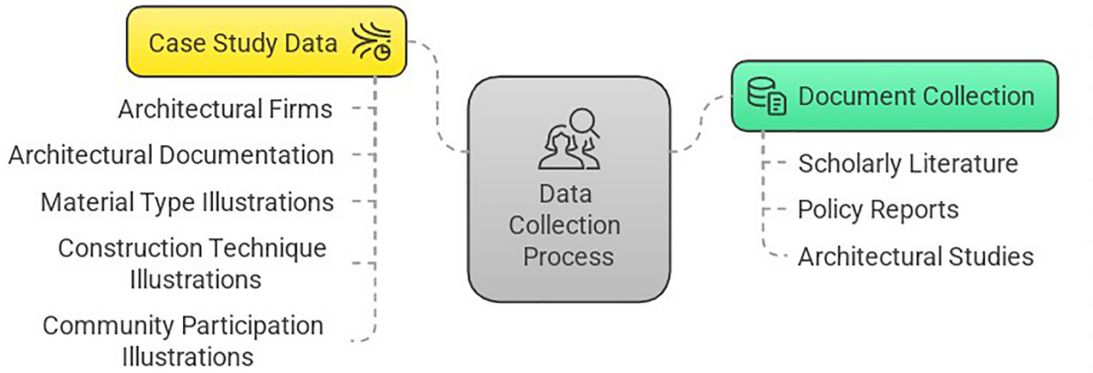

Figure 3. Data collection process.

Source: Authors.

3.4.2. Step Two: Case Study Analysis

A contextual examination of the project's evolution, design strategies, and engagement processes. This is achieved through rigorous qualitative coding to extract and analyze recurring themes such as community agency, low-tech digital fabrication, traditional craftsmanship, and sustainability-driven design, and to examine how these elements interconnect. This systematic approach revealed the synergistic relationships that underpin the spatial agency approach and its role in fostering resilient public-space outcomes.

3.4.3. Step Three: Synthesis of Findings

To draw meaningful connections between tactical urban design and the spatial agency approach, highlighting how small-scale interventions can transition into long-term adaptive public spaces. **Figure 4** summarizes the data analysis process.

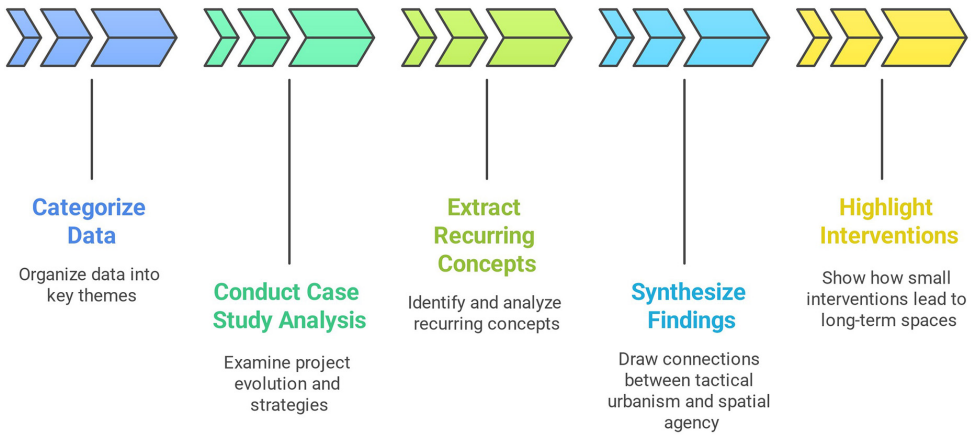

Figure 4. Data analysis process.

Source: Authors.

3.5. Ethical Considerations

The interpretive nature of the study necessitates a reflexive approach to continuously examine how personal biases and preconceptions might influence data interpretation. To maintain the rights and dignity of all participants, confidentiality is maintained by anonymizing sensitive data and storing all data, such as documents and images, on encrypted drives

with access limited to the research team. All the case study's related data such as the technical documents and images used in this study have been extracted and exploited from the open-access website of the architectural firm Codesign Lab, led by architect Paolo Cascone as the designer and the founder of the project, which provides comprehensive project information; we have cited these sources in the reference list to ensure transparency and credibility of the data sources.

All research activities adhere to the ethical guidelines outlined by institutional review boards and respect local cultural protocols, including data-sharing agreements that ensure community co-ownership of findings. This rigorous ethical framework ensures the credibility and integrity of the research.

Finally, this procedural workflow delivers an in-depth, interpretive lens of indigenous tactical urban design via the spatial agency approach, as demonstrated by the Open-Air Lab project. By combining diverse qualitative sources and leveraging a rigorous thematic analysis, this study uncovers how temporary interventions and community narratives converge to shape sustainable public spaces. **Figure 5** summarizes this procedural workflow.

Figure 5. The procedural methodological steps of this research study.

Source: Authors.

4. Description of the Case Study

Dakar, the capital of Senegal, has experienced rapid urban growth, and its population has doubled over the past two decades [28]. Moreover, now faces pressing challenges related to informal settlement expansion, the rise of youth unemployment rates, and uneven access to basic services [29]. Politically, Dakar operates under a decentralized municipal governance model that actively encourages community participation in local decision-making, yet persistent socioeconomic disparities often limit the reach of formal planning processes [28]. These conditions have spurred a thriving grassroots urban innovation scene, where grassroots associations and NGOs partner with municipal actors to pilot low-cost, tactical interventions.

Accordingly, by situating the Open-Air Lab project in Dakar, Senegal, within this complex socioeconomic and political landscape, we highlight how the spatial agency approach can leverage local governance structures and community networks to scale adaptive, culturally resonant public-space solutions.

This project, developed by Codesign Lab under the leadership of architect Paolo Cascone, is a multifaceted in-

tervention that transforms a public space into a dynamic laboratory for community-driven innovation, cultural reappropriation, and environmental adaptability [30]. **Figure 6** provides some perspectives from the open-air Lab project.

Figure 6. An overview of some perspectives from the open-air lab project.

Source: Cascone and Laddaga [30].

At its core, the open-air lab project exemplifies the principles of tactical urban design and rapid, low-cost, and flexible interventions that stimulate long-term urban change. However, what sets this case apart is its grounding in indigenous practices and the explicit integration of the spatial agency approach.

4.1. Design Concept of the Open Air Lab Project

The project takes shape as a compact infrastructure within a Dakar public plaza, serving as a hands-on open-air laboratory for local craftsmen. Developed under the African Fabbers initiative, its construction unfolded via a participatory co-creation process that united community members with European makers to establish Senegal's first Fablab. Selected for the 2014 Dakar Biennale [30]. The Open-Air Lab exemplifies innovation through its integration of traditional craftsmanship, collaborative fabrication, and community-driven experimentation.

4.2. Community Engagement and Participatory Design

The project's planning and implementation process was driven by robust community participation. The results of these participatory workshops reveal that local knowledge is central to the decision-making process. In addition, document analysis indicates that the project's iterative design process, characterized by regular community feedback and reconfiguration, has allowed it to adapt to changing social and environmental conditions. This adaptive capacity is central to the concept of social sustainability [30] (**Figure 7**).

Figure 7. Some community engagement and participatory design solutions have been adopted in the open-air lab.

Source: Cascone and Laddaga [30].

4.3. Integration of Traditional and Modern Techniques

The open-air lab leverages both traditional materials and crafts, such as local wood and bamboo, and contemporary materials, such as photovoltaics and low-tech digital fabrication. This hybrid model not only respects the cultural legacy of indigenous building practices but also introduces innovative solutions that address contemporary environmental challenges[30] (**Figure 8**).

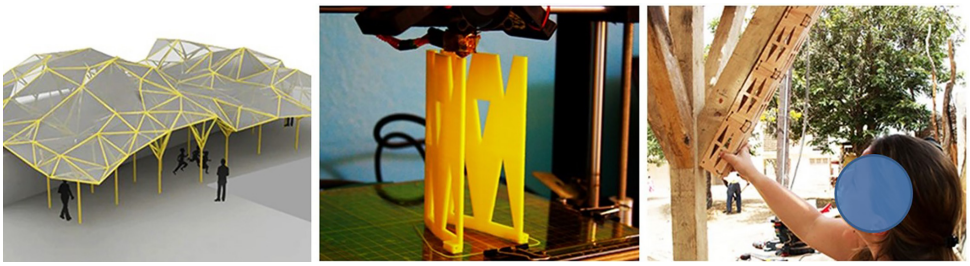

Figure 8. The integration of traditional and modern techniques in the open-air lab project.

Source: Cascone and Laddaga[30].

4.4. Temporary Small-Scale Experimentation Before Project Implementation

The project adopts a temporary small-scale experimental approach to test innovative design solutions before broader implementation, which is a key aspect inherent in tactical urban design strategies[30] (**Figure 9**).

4.5. Modular Structure and Flexibility

The open-air lab was designed as a temporary and adaptable intervention, capable of evolving in response to community needs. It features a modular structural morphology based on a branching system, enabling flexible assembly, scalable growth, and easy reconfiguration[30] (**Figure 10**).

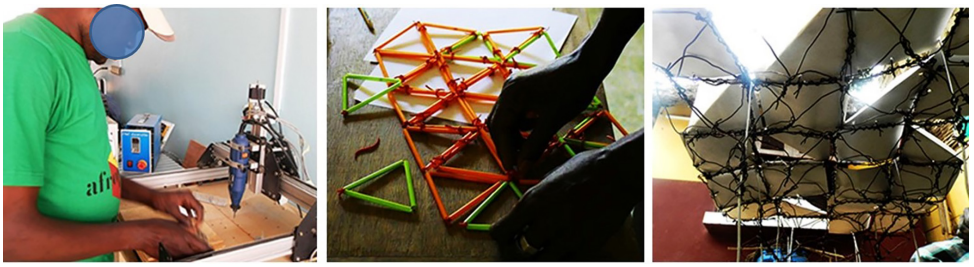

Figure 9. A temporary small-scale experimental approach was adopted in the open-air lab project.

Source: Cascone and Laddaga[30].

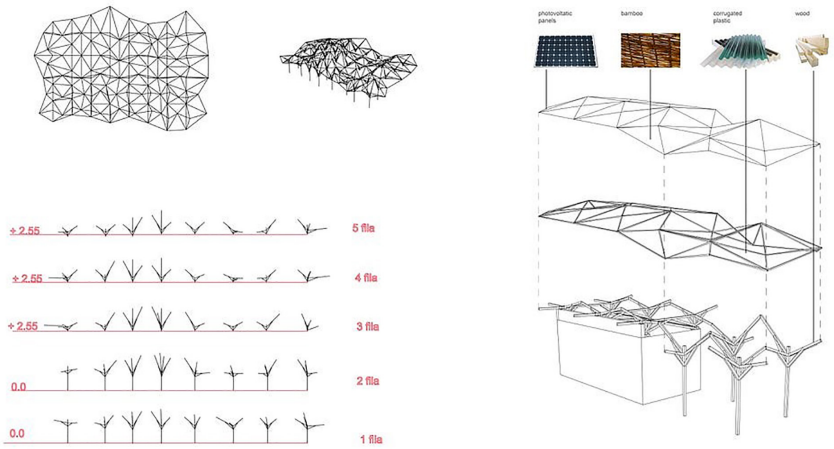

Figure 10. Modular structural system used in the open-air lab project.

Source: Cascone and Laddaga[30].

4.6. Environmental Sustainability

The project also incorporates environmentally conscious design principles, using locally sourced materials and sustainable construction techniques, rainwater harvesting, thermal comfort, and solar energy. This approach not only minimizes the ecological footprint but also reinforces the link between cultural sustainability and environmental stewardship, a dual focus that is increasingly recognized in the literature on resilient urban design [30] (**Figure 11**).

Figure 11. Some related environmentally sustainable solutions used in open air lab projects.

Source: Cascone and Laddaga [30].

Overall, the open-air lab serves as an exemplary model of indigenous tactical urban design, demonstrating how it can be effectively implemented to shape dynamic public spaces that remain both adaptable and culturally meaningful. It offers a solid empirical foundation for exploring how temporary, community-led interventions can be scaled and sustained over time, a question that remains central to contemporary urban research. The case study is examined through an interpretive methodology, using triangulated data sources such as document analysis, to ensure a comprehensive understanding of the complex and multilayered dynamics involved.

Finally, to clearly illustrate the sequence of activities from conception to implementation and consolidation, we include a visual timeline (**Figure 12**). This timeline highlights four key phases as follows, providing a structured overview of the project's development process.

1. Design concept and community mobilization: initial stakeholder meetings, workshops to map local material flows, and sketch prototyping.
2. Prototype Fabrication & Testing: modular unit assembly by local craftsmen using both traditional rammed-earth and digital-fabrication tools, followed by on-site performance reviews.
3. Iterative adaptation: Community-driven reconfigurations based on weather resilience, sustainability feedback, and user input, documented through participatory surveys and photo-journals.
4. Consolidation and knowledge transfer: transition from temporary labs to permanent public amenity, handover workshops for local institutions, and dissemination of open-access technical manuals.

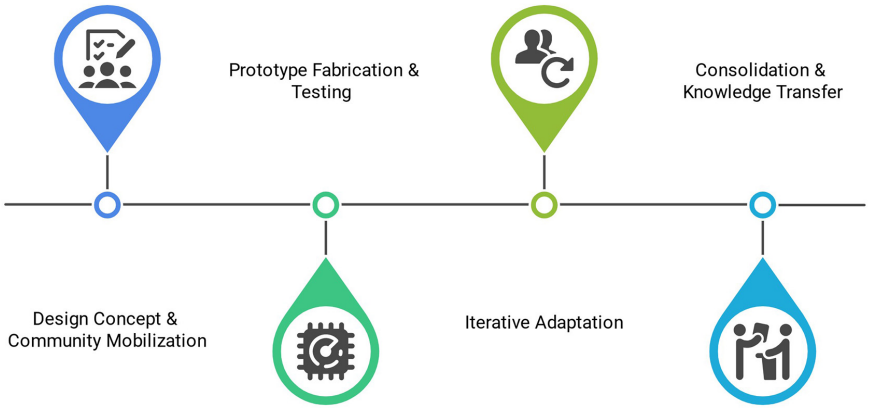

Figure 12. Timeline of the Open-Air Lab project phases (design, prototyping, adaptation, consolidation).

4.7. Comparative Insight with Empirical Case Studies

While our focus on the Open-Air Lab in Dakar provides an in-depth illustration of spatial agency in action, the underlying agencies we identify, such as community-led design workshops, modular low-tech fabrication, and the elevation of indigenous knowledge as core actors, are broadly transferable through concrete case studies in similar contexts.

In a North African context, the Ksar of Tafilelt in the M'zab Valley (Ghardaïa, Algeria) offers another compelling illustration: by convening Mozabite craftspeople in co-design workshops and combining their traditional rammed-earth techniques with simple digital modeling tools, one could prototype adaptive shade structures that both resonate culturally and enhance thermal comfort [31].

Similarly, in Indonesia, architect Eko Prawoto has empowered rural communities to build earthquake-resistant bamboo and coconut-wood structures through resource surveys and hands-on workshops, blending local craftsmanship with contemporary design to maximize both resilience and affordability [32].

In humanitarian contexts, the architect Nader Khalili's Super Adobe method exemplifies how refugees themselves can erect durable earth-bag domes using sandbags filled with local soil, stabilizers, and barbed-wire tensile reinforcement to create both temporary shelters and permanent spaces.

These concrete examples confirm that the spatial-agency approach positioning community led design, local knowledge and low-tech methods as first-class actors, and can guide community-driven tactical urban design across diverse geographical contexts [32]. Accordingly, **Table 1** summarizes this comparative insight.

Table 1. Comparative insight from empirical case studies from diverse geographical contexts.

Case Study	Location	Key Actors and Mechanisms	Outcome and Transferable Insight	References
Ksar of Tafilelt	M'zab Valley, Ghardaïa, Algeria	Mozabite craftspeople in co-design workshops; traditional rammed-earth techniques; simple digital modeling tools	Prototyped adaptive shade structures that resonate culturally and enhance thermal comfort; demonstrates that local artisans and low-tech tools can yield climate-responsive design solutions.	Spatial Agency [31]
Eko Prawoto's Rural Workshops	Yogyakarta, Indonesia	Architect-led resource surveys; community-driven bamboo and coconut-wood construction; hands-on fabrication sessions	Enabled earthquake-resistant community structures that blend traditional craftsmanship and contemporary design; shows how modular, low-tech prototyping fosters resilience and affordability.	Tafilelt Association [32]
Nader Khalili's Super Adobe	Iran & USA (Refugee Camps)	Refugee participation in earth-bag dome construction; sandbags with local soil + stabilizers; barbed-wire tensile reinforcement	Created durable shelters that transition from temporary to permanent, empowering refugees with self-building agency; illustrates how simple materials can support dignified, scalable housing.	Tafilelt Association [32]

5. Results and Discussion

The findings from the open-air lab project in Dakar demonstrate that indigenous tactical urban design, when integrated with spatial agency, can transform temporary interventions into enduring, resilient public spaces. The project's design concept as a small infrastructure that serves as an open-air laboratory for local craftsmen highlights the effective use of low-cost, temporary interventions, aligning with tactical urban design's core principles [5,6]. In addition, robust community engagement and participatory design processes were critical; local knowledge, gathered through iterative workshops and reconfigurations, not only informed the design but also enhanced the project's adaptive capacity, thus supporting the research hypothesis that active community participation, combined with traditional design practices and accessible technologies, is essential for long-term urban resilience.

Moreover, the integration of traditional materials such as wood and bamboo with modern techniques such as photovoltaic systems and low-tech digital fabrication underscores a hybrid model that respects indigenous cultural legacies while addressing contemporary environmental challenges [13,14]. The project's modular structure and flexible design, exemplified by its branching morphology, reflect the transformative potential of spatial agency as articulated by Schneider and Till [22] and further supported by Meng et al. [27], wherein

local actors reconfigure their environment through participatory and adaptive processes.

These findings align with and extend the literature on tactical urban design and public spaces as dynamic systems of interaction [17,18,21]. Previous studies have emphasized low-cost and rapid interventions as catalysts for urban change [7,9]. These findings illustrate how these interventions, when anchored in indigenous practices and empowered by spatial agency, not only counteract top-down planning but also foster sustainable, culturally resonant urban spaces.

The findings also reveal a strong alignment with the three pillars of sustainability, namely, environmental, social, and economic sustainability, as shown in **Figure 13**. Environmentally, the open-air lab project integrates locally sourced materials and sustainable construction techniques, minimizing ecological impact while promoting resilience. Socially, the participatory approach empowers local communities, preserving cultural heritage and reinforcing collective spatial agency through iterative, community-led design. Economically, the use of low-cost, rapidly deployable interventions enhances urban adaptability.

In summary, this study confirms that indigenous tactical urban design, when mediated through the spatial agency approach, provides a strong framework for transforming temporary public spaces into enduring infrastructural assets (**Table 2**). It offers empirical support for the research questions and hypotheses, reinforcing that a holistic, participatory approach is essential for achieving sustainable urban development within indigenous contexts. **Figure 14** provides a conceptual diagram summarizing how spatial agency, tactical urbanism, and indigenous knowledge interact within the context of the open-air lab project.

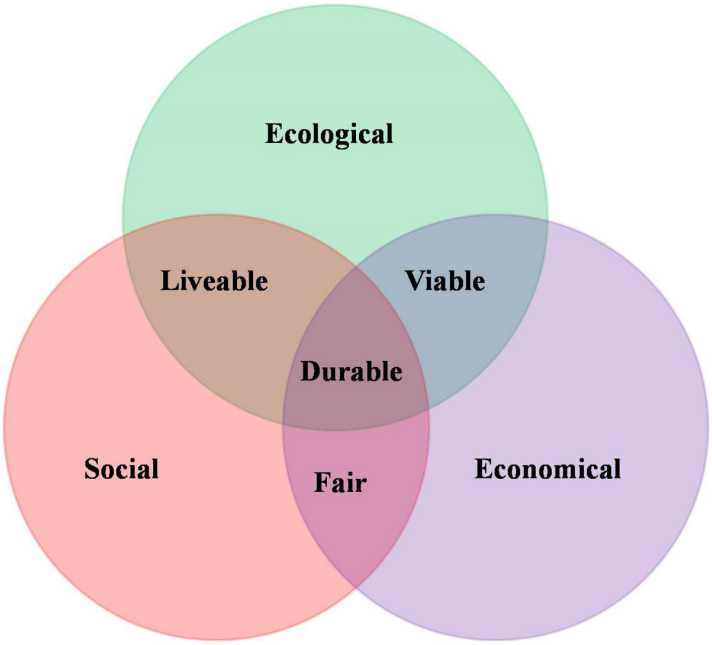

Figure 13. Three pillars of sustainability.

Source: Authors.

Table 2. Summary of the core research questions alongside their key findings and principal implications.

Research Question	Key Findings	Implications for Practice
RQ1. How does community engagement co-shape the transformation process of the open-air lab project?	Iterative workshops captured local knowledge → designs adapted to traditional practices. Active participation boosted ownership and long-term maintenance.	Embed community-led facilitation as a standard early-stage tactic; allocate budget for recurring co-design sessions.
RQ2. What role do traditional materials & low-tech methods play in resilience?	Wood, bamboo & rammed earth combined with low-tech digital fabrication → hybrid, modular units. Branching morphology allowed incremental upgrades over time.	Adopt modular, locally-sourced material palettes; incorporate simple digital modeling tools to accelerate prototyping while honoring cultural legacies.

Table 2. *Cont.*

Research Question	Key Findings	Implications for Practice
RQ3. How do temporary interventions evolve into lasting public spaces?	Open-Air Lab's small infrastructure functions persisted beyond pilot phase. User-driven reconfigurations led to unplanned but durable adaptations (e.g., seating platforms repurposed permanently).	Design tactical-urban design projects with built-in adaptability, allowing funding and permits for phased permanence once community validation occurs.
RQ4. In what ways does spatial agency foster sustainability across environmental, social, and economic axes?	Spatial agency network elevated indigenous actors → balanced decision-making. Holistic lens bridged quick interventions and long-term climate resilience.	Frame future projects within an actor-network model, ensuring indigenous knowledge and low-tech innovation are recognized as first-class actors in planning, design, and maintenance stages.

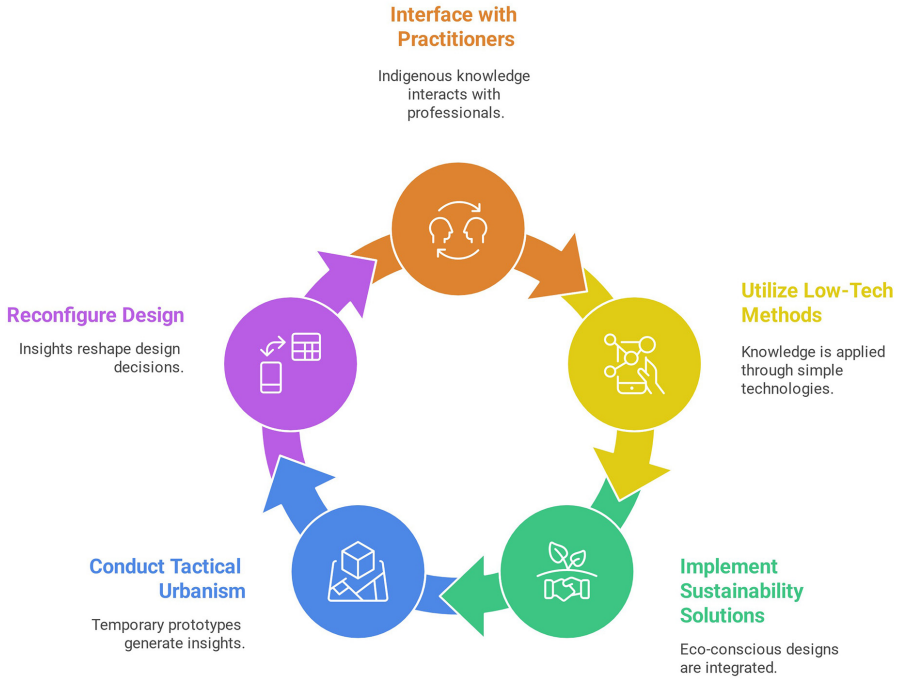

Figure 14. Conceptual model summarizing how spatial agency, tactical urbanism, and indigenous knowledge interact within the context of an open-air lab project.

5.1. Research Limitations

This study's insights are derived from a single case, the open-air lab in Dakar, which may limit the generalizability of the findings across different cultural and urban contexts. Additionally, while the interpretive qualitative methodology provides rich contextual understanding, it may introduce subjectivity despite the rigorous thematic analysis employed.

5.2. Implications and Practical Recommendations

Integrating the spatial agency approach into indigenous tactical urban design holds substantial transformative potential for developing sustainable public spaces. Local architects and urban planners should prioritize community engagement and integrate traditional knowledge throughout the design process, ensuring that projects are culturally grounded. They are also encouraged to adopt hybrid solutions that blend traditional craftsmanship with low-tech digital fabrication, enabling context-sensitive and sustainable interventions.

By embracing adaptive practices through iterative design processes, urban spaces can evolve in response to shifting environmental and social conditions. Additionally, supporting decentralized governance structures can empower communities and strengthen local stewardship in urban decision-making.

5.3. Future Research Recommendations

Future research should investigate the scalability and transferability of the spatial agency approach across diverse indigenous and urban contexts through comparative case studies. Combining quantitative metrics with qualitative insights would provide stronger evidence of the long-term impact of such tactical interventions. Adopting mixed-method approaches and conducting cross-case analyses could further improve the empirical rigor and validity of future findings.

6. Conclusion

This study shows that integrating the spatial agency approach into indigenous tactical urbanism can transform short-term urban interventions into lasting, resilient public spaces rooted in local cultural identities and responsive to environmental challenges. The open-air lab project in Dakar demonstrates that when community engagement, traditional design practices, and accessible low-tech innovations are combined symmetrically, they generate a dynamic sociotechnical network capable of reimagining urban space in a holistic and adaptive way.

Furthermore, this research highlights the importance of conceiving of public spaces as evolving networks, where decentralized decision-making and continuous feedback loops promote both social cohesion and long-term infrastructural resilience. While limited by the scope of a single case study, the findings offer practical insights for urban planners, architects, and policymakers aiming to integrate indigenous knowledge and low technology into tactical urban design strategies. This paves the way for more sustainable and inclusive urban environments. Future research should investigate the scalability of these approaches across diverse cultural contexts and analyze additional case studies to refine further the theoretical framework and practical applications of spatial agency in indigenous tactical urban design.

Author Contributions

Conceptualization, F.B.; methodology, A.C.; formal analysis, F.B.; data curation, A.C.; writing—original draft preparation, F.B.; writing—review and editing, A.C. All authors have read and agreed to the published version of the manuscript.

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The data that support the findings of this study are available from the corresponding author upon reasonable request. Owing to privacy or ethical restrictions, certain data related to project evaluations and user interactions are not publicly available.

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Conflicts of Interest

The authors declare no conflict of interest.

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