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Journal of Contemporary Urban Affairs

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Note:

- All members of the Editorial Team have voluntarily provided their affiliation details, which are accurately represented as per their official institutional designations. The Journal of Contemporary Urban Affairs remains neutral concerning jurisdictional claims and respects the institutional affiliations and professional roles of all listed members.

- Editorial Board appointments at the Journal of Contemporary Urban Affairs are made for a fixed term of three calendar years, after which each member will be contacted six months in advance to confirm their willingness to serve a further term; re-appointment is contingent on satisfactory performance, evidenced by timely peer-review activity, strategic engagement, and adherence to COPE principles. Editors who have been inactive—defined as failing to complete requested reviews or contribute to editorial duties over a twelve-month period without prior notice—will be deemed to have resigned and will be formally removed, with vacancies filled by new appointees who enhance the Board's disciplinary and geographic diversity.

- The Journal of Contemporary Urban Affairs does not retain honorary or inactive board positions—every member must remain actively engaged in editorial duties or relinquish their seat.

-All members of the Editorial Board serve in a voluntary (unpaid) capacity, with no financial compensation for their roles. Their participation reflects their academic commitment to the journal's mission.

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About the Journal

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Aims and Scope

The Journal of Contemporary Urban Affairs is an international, peer-reviewed, open-access journal published biannually (June and December) by Alanya University. Responding to rapid urbanisation and widening socio-economic inequalities worldwide, the journal provides a platform for scholarly dialogue that transcends national and disciplinary boundaries. It prioritises innovative, interdisciplinary research that balances social and economic development with resilience in the built environment, critically examining how these forces shape today's urban landscapes.

The journal actively encourages internationally authored submissions and an equally international readership, welcoming robust empirical, theoretical, or mixed-method studies that explore urban transformations across diverse cultural, geographical, and socio-economic contexts. By fostering cross-regional academic exchange and comparative research, it aims to advance original scholarship, propose strategies to bridge global divides, and inform policy and practice. Ultimately, *The Journal of Contemporary Urban Affairs* strives to cultivate more inclusive, resilient, and sustainable cities worldwide.

Scope

The *Journal of Contemporary Urban Affairs* is dedicated to advancing interdisciplinary scholarship on the socio-economic factors shaping modern urban environments world-wide. We welcome contributions that explore, but are not limited to, the following core themes:

1. **Citizenship Rights and Responsibilities**

Investigating socio-economic impacts related to citizenship, including inequality, urban poverty, affordable housing, segregation, civic participation, social equity, welfare, health, accessibility, justice, and rights. *We particularly seek research highlighting economic vulnerabilities within urban communities and proposing actionable solutions to reduce inequality and enhance resilience.*

2. **Territorial Dynamics**

Examining the socio-economic implications of territorial changes, such as housing dynamics, urban migration, resource distribution, economic displacement, land speculation, economic clusters, heritage preservation, and development constraints. *We encourage studies addressing economic disparities caused by shifting territorial patterns and offering strategies to strengthen local economies and mitigate inequities.*

3. **Urban Transformations**

Exploring the socio-economic consequences of urban change, encompassing development, planning, policy-making, transformation, resilience, regeneration, governance, investments, sustainable development, adaptive reuse, globalization impacts, smart cities, opportunities, and innovation. *We welcome inquiries that focus on economic resilience in evolving urban landscapes, presenting policies and frameworks that bolster economic stability and reduce socio-economic inequalities.*

Authorship Criteria

The *Journal of Contemporary Urban Affairs* adheres to the highest standards of publication ethics to ensure the integrity, originality, and scholarly value of all published work.

We do not accept:

- Simultaneous submissions
- Previously published material
- Redundant or duplicate publications

To safeguard academic integrity and relevance, manuscripts must:

- Be original and unpublished
- Demonstrate clear authorial contribution
- Employ rigorous and appropriate methods
- Align with the journal's scope and readership

In addition, all authors are expected to:

- Make a substantial contribution to the research
- Approve the submitted version of the manuscript
- Accept full accountability for every aspect of the work
- Disclose all potential conflicts of interest
- Acknowledge every source of funding and support
- Confirm that all required ethical approvals and participant consents have been obtained and reported
-Provide an accurate CRediT author-contribution statement detailing individual roles
-Make underlying data, code, and supplementary materials openly available (or justify any restrictions)
-Secure written permission for any copyrighted or third-party material reproduced in the manuscript
-Commit to post-publication responsibility, promptly informing the editors of any errors and cooperating with corrections or retractions when necessary.

Readership

JCUA is written for a global audience of:

- Academic researchers and graduate students in urban studies, architecture, planning, and cognate fields;
- Urban practitioners, policymakers, and non-governmental organisations seeking evidence-based guidance;
- Professionals in allied disciplines (engineering, public health, economics, cultural heritage) engaged with urban questions.

Editorial Vision

By embracing an international scope and positioning itself within established academic disciplines, the *Journal of Contemporary Urban Affairs* seeks to enhance global scholarly discourse on critical urban affairs. We encourage submissions employing quantitative, qualitative, or mixed methods, as well as

interdisciplinary and comparative studies that shed light on best practices and challenges across different regions worldwide. Through this comprehensive approach, the journal aspires to be a leading outlet for forward-thinking research that informs policy, guides practice on the socio-economic consequences of contemporary urbanization, and ultimately contributes to more equitable and sustainable urban environments. We invite contributions from the full range of disciplines within the social sciences and arts and humanities, including advanced empirical and theoretical work that addresses both positive and normative perspectives. Priority is given to research articles written for a multidisciplinary audience, demonstrating innovation, high quality, and significant impact. The journal also seeks articles that bridge theory and practice, offering insights relevant to policymakers, practitioners, and academics in urban planning, architecture, and related fields world-wide.

Scholarly Content Policy

Our journal is committed to publishing original scholarly material that contributes to the advancement of knowledge in its respective fields. We ensure that the research we publish meets the academic standards appropriate for a graduate, post-doctoral, and professional research audience. Submissions must present novel findings or insights, adhere to rigorous methodological standards, and be relevant to the interests of a global academic community.

for more information about publication policy please see Publication Policies , » Guidelines for Reviewers

Peer Review Statement

All research articles in this journal undergo a rigorous double-blind peer review process, starting with an initial evaluation by the editor, followed by double-blind reviews conducted by at least two expert referees. The purpose of peer review is to assist the editor in making editorial decisions, while also helping authors improve their manuscripts through feedback. In the double-blind process, neither reviewers nor authors are aware of each other's identities. The typical review period is 8 weeks.

- The selection of reviewers is at the discretion of the editor. Reviewers must be experts in the manuscript's subject matter, should not belong to the same institution as the authors, and must have no recent co-publications with them.
- Reviewers must disclose any conflicts of interest related to the research, authors, or funding sources to the editor without delay.
- Reviewers who feel unqualified to review a manuscript or cannot complete the review in a timely manner should notify the editor immediately.
- Reviews must be conducted objectively, avoiding personal criticism, and reviewers should clearly express their opinions with reasoned arguments.
- Manuscripts under review should be treated as confidential.

The Peer Review Process

Authors submit manuscripts via the online submission system, and they receive confirmation of receipt from the editorial office. The Chief Editor first reviews the manuscript, often with the help of Section Editors (or Co-/Associate Editors). A Section Editor oversees the manuscript through the entire review process and provides a recommendation or decision.

Initially, the manuscript is assessed for its alignment with the journal's scope and its adherence to formal requirements. If found unsuitable, it is directly rejected, and a rejection letter is sent to the author explaining the reasons. If the manuscript meets the journal's scope and guidelines, it is sent for peer review. Reviewers evaluate the manuscript and submit their reports to the Editor-in-Chief, who then makes one of the following decisions based on the feedback:

- Accept without revisions
- Accept with revisions
- Request a resubmission
- Reject

In case of acceptance, the final manuscript is sent to production. Authors may also be asked to revise their manuscript based on reviewers' comments and resubmit it for further evaluation. Review times vary between 4 to 8 weeks, depending on the discipline and additional information required. If rejected, the manuscript is archived, and a rejection letter is sent to the authors. Reviewers may be informed of the final decision.

Once the review process is completed, the manuscript is passed to the Copy Editor, who ensures that it adheres to the correct referencing style and journal formatting. The Layout Editor then prepares the manuscript, including figures and tables, for publication in formats such as PDF and HTML. Finally, the Proof Editor confirms that the manuscript is ready for publication after completing all the necessary stages. The reviewers of a manuscript remain anonymous to each other, and in cases where their decisions differ (accept/reject), the editor may assign additional reviewers. The editorial team ensures that reviews meet high standards of quality. If authors raise concerns about the objectivity of a review, the team takes special care to ensure the review's fairness and quality. When necessary, additional reviewers are assigned to maintain objectivity and academic rigor. The manuscript submission and the peer review process are broken down into the following steps:

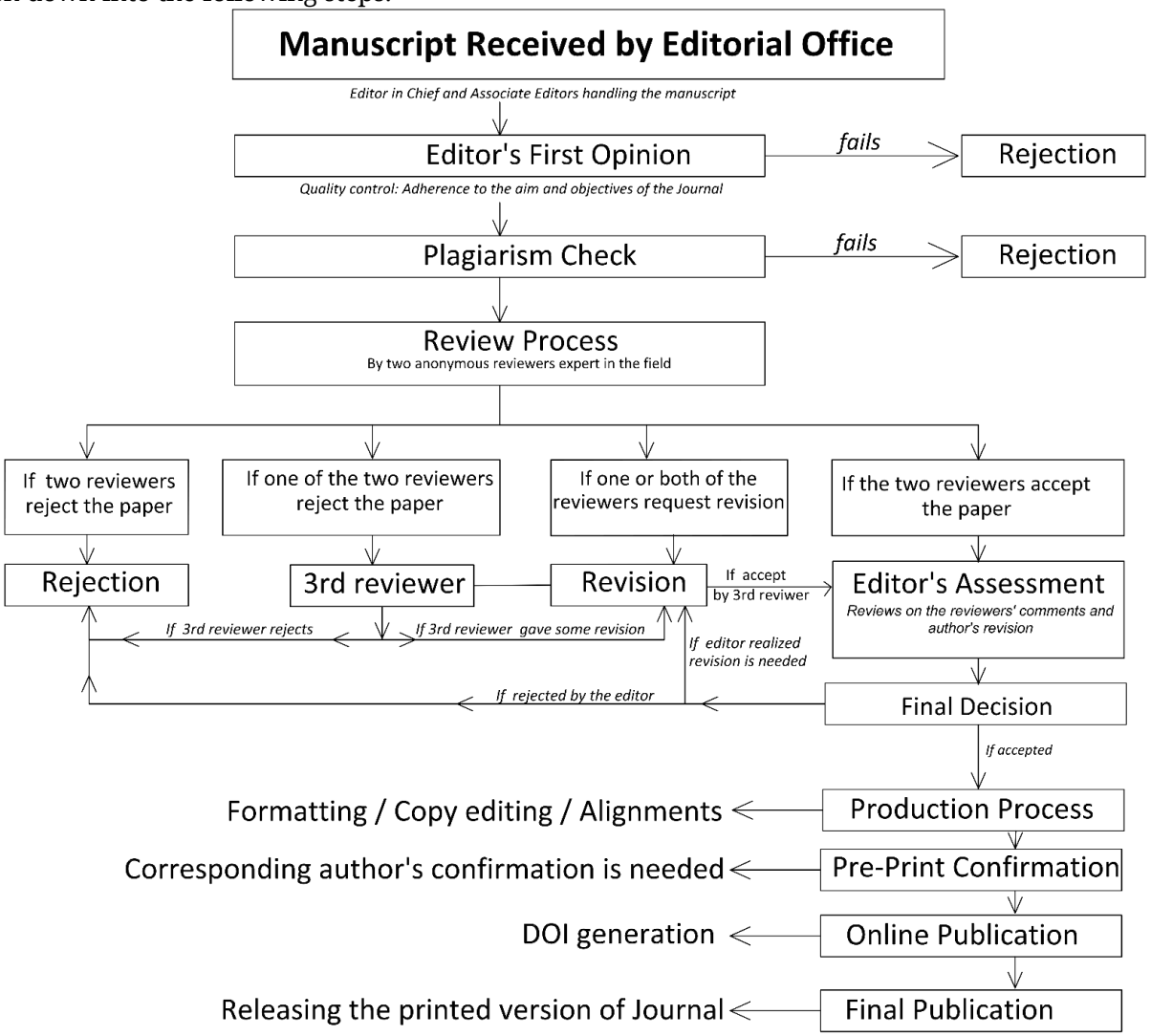

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Figure 1. Peer Review Process.

CrossCheck Plagiarism Screening System

All manuscripts submitted to the Journal of Contemporary Urban Affairs will undergo plagiarism screening using iThenticate's plagiarism detection tools. Any manuscripts found to contain instances of plagiarism or self-plagiarism will be promptly rejected.

What is plagiarism?

Plagiarism occurs when someone uses the ideas, words, or other intellectual property of others, whether published or unpublished, without appropriate credit or permission, and presents them as their own original work. This misleads readers about the true contributions of the plagiarist. Plagiarism can involve content from abstracts, research proposals, institutional submissions, or any other form of unpublished or published materials, and it is considered scientific misconduct.

Self-Plagiarism

Self-plagiarism involves an author reusing portions of their prior work in new publications without proper citation. While this practice, often unintentional, is common—particularly in sections such as the methods—it typically violates copyright agreements with publishers. Unlike plagiarism of others' work, self-plagiarism is not always regarded as scientific misconduct, and policies on this practice may vary among journals. If a journal has a policy on self-plagiarism, it should be clearly communicated to authors.

Types of Plagiarism

Direct plagiarism refers to the uncredited copying of text, while mosaic plagiarism involves borrowing ideas or opinions, along with some phrases or words, without giving proper attribution.

Reporting Plagiarism

In cases of suspected plagiarism, the following steps should be followed:

1. Notify the editor of the journal where the plagiarized article is published.
2. Submit both the original and plagiarized articles with the plagiarized sections clearly marked.
3. If the evidence is sufficient, the editor will arrange a disciplinary hearing.
4. The accused plagiarist will be asked for an explanation.
5. If no response is received within the specified time or the explanation is unsatisfactory, the article will be permanently retracted.
6. The author responsible will be banned from submitting to that journal for at least five years.
7. The head of the relevant institution will be informed.

Copyright and Permissions

Authors are responsible for ensuring that their submission does not violate copyright or ownership rights, such as for figures, tables, photographs, and other data. Authors must obtain and include permissions for any copyrighted material in their final submission and inform the editorial office and publisher when usage restrictions apply. Acknowledgements for such materials should be added in a dedicated section at the end of the paper, clearly crediting the source and copyright.

Adapted from: Bella H. Plagiarism. Saudi J Med Sci 2014; 2:127

Publication Ethics and Malpractice Statement

The Journal of Contemporary Urban Affairs is dedicated to maintaining the utmost standards of ethics in publishing and takes into consideration the guidelines for transparency and excellence in scholarly publishing established by the Committee on Publication Ethics (COPE), the Directory of Open Access Journals (DOAJ), and the Open Access Scholarly Publishers Association (OASPA).

Editorial Procedures

Fair play

At the *Journal of Contemporary Urban Affairs*, we are committed to ensuring that all manuscripts are assessed exclusively based on their intellectual merit, scholarly rigor, and overall contribution to the field. Submissions are reviewed through a fair and transparent process that emphasizes methodological soundness, clarity, and originality. We firmly uphold the principle that an author's age, gender, ethnicity, sexual orientation, nationality, or political beliefs must not influence editorial decisions, thereby promoting an inclusive and respectful academic community.

Submission and Acceptance Guidelines

We provide detailed submission guidelines that outline our requirements for manuscript preparation, formatting, referencing, and ethical considerations. Authors must adhere to these guidelines to facilitate a smooth review process. Our acceptance criteria are transparent and consistently applied, focusing on the quality, relevance, and integrity of the research. We enforce ethical standards uniformly, including policies on plagiarism, data fabrication, and conflicts of interest.

Content Relevance and Scope Alignment

The *Journal of Contemporary Urban Affairs* is committed to publishing high-quality, original research that significantly contributes to the field of urban studies. To maintain the journal's thematic integrity and ensure that readers receive relevant and focused content, all submitted manuscripts must align with the journal's stated aims and scope. Manuscripts that fall outside the journal's scope will not be considered for review. To see the Aims and Scope of the journal please click here.

To ensure alignment with the journal's scope, all submissions must meet the following criteria:

1. **Thematic Relevance**: The manuscript must address contemporary urban issues and align with the journal's focus areas.
2. **Originality**: The research must present original findings, insights, or theoretical contributions that advance the field of urban studies.
3. **Methodological Rigor**: The study should employ robust and appropriate research methods, with clear explanations of data collection, analysis, and interpretation.
4. **Practical or Theoretical Significance**: The manuscript should demonstrate how the research contributes to urban theory, policy, or practice.
5. **Clarity and Coherence**: The manuscript must be well-written, logically structured, and accessible to an interdisciplinary audience.

Submissions that do not meet the scope and relevance criteria will be desk-rejected without proceeding to peer review. Authors will be notified of the decision with an explanation. To ensure your manuscript meets the journal's formatting and submission requirements, please refer to the detailed Manuscript Preparation Guidelines available at the following link: Manuscript Preparation Guidelines

For further inquiries about scope alignment or submission suitability, please contact the Editorial Office at editor@ijcua.com.

Editorial Independence Policy

The Journal of Contemporary Urban Affairs upholds complete editorial independence, ensuring that all editorial decisions are made solely based on scholarly merit, methodological rigor, and relevance to the journal's scope. Although the journal is owned by Alanya University, the editorial process operates independently from institutional influence, financial considerations, or external pressures. The Editor-in-Chief and the Editorial Board have full authority over the selection, review, and publication of manuscripts, following COPE's guidelines on editorial integrity. Any attempts to interfere with editorial decisions will be formally addressed to maintain the transparency, credibility, and autonomy of the journal.

Editorial Decisions and Appeals

Our editorial decisions are made based on objective criteria and are communicated transparently to authors. Each decision—whether acceptance, revision, or rejection—is accompanied by constructive feedback from editors and reviewers.

Authors have the right to appeal editorial decisions if they believe a review contained factual errors, biased evaluations, or misinterpretations of their research. Appeals must be submitted in writing within 14 days of receiving the editorial decision and must include:

1. **A formal appeal letter** outlining the specific concerns regarding the decision.
2. **A point-by-point response** addressing the reviewers' comments, supported by evidence or references.
3. **Any additional clarifications** that may help the editorial board reassess the manuscript.

Review of Appeals:

- The Editor-in-Chief, in consultation with the Editorial Board, will review the appeal within 14 days of submission.
- If necessary, an independent reviewer or a different section editor may be assigned to evaluate the manuscript.
- The outcome of the appeal may result in one of the following decisions:
    - **Uphold the original decision** (rejection remains final).
    - **Invite the authors to submit a revised version** for further review.
    - **Reassign the manuscript to new reviewers** for an additional evaluation.

The final decision on an appeal is made by the Editor-in-Chief in consultation with the Editorial Board and is binding. Authors will be notified of the final decision via email, and no further appeals will be considered after this point.

Editorial and Reviewer Accountability Policy

The Journal of Contemporary Urban Affairs is committed to maintaining transparency, fairness, and accountability in all editorial decisions. Editors and reviewers are expected to evaluate submissions based on scholarly merit, methodological soundness, and relevance to the journal's scope, avoiding subjective biases or personal preferences. To ensure accountability, all editorial decisions are regularly reviewed by the Editor-in-Chief and the Editorial Board. If concerns arise regarding an editor or reviewer's consistent rejection or acceptance of papers based on non-academic criteria, the matter will be formally investigated, and corrective actions—such as reassignment of manuscripts or removal from editorial duties—may be taken. This policy aligns with COPE's ethical guidelines to uphold the integrity and credibility of the peer review process.

Multiple Submissions

The Journal of Contemporary Urban Affairs upholds strict standards against multiple submissions and redundant publications. We do not consider manuscripts that are under review at another publication simultaneously, nor do we accept manuscripts that substantially duplicate content published or submitted elsewhere. Authors must confirm that their submission is exclusive to this journal and is not being

considered elsewhere, ensuring a fair and thorough peer-review process and contributing to the timely and ethical publication of research. Authors are required to ensure that their submitted work is original and has not been published previously in any other journal, book, or conference proceedings. This policy preserves the integrity of published research and provides readers with unique, original contributions to urban studies. By submitting to the journal, authors affirm that their work is original and not under consideration elsewhere.

Submissions that contravene this policy may be rejected immediately. Any instances of multiple submissions or redundancy will be addressed in accordance with the journal's ethical guidelines. Authors are encouraged to comply fully with this policy to uphold the high standards of academic publishing and to support the dissemination of unique, rigorously vetted research.

Policy on Rejecting Unethical or Low-Rigor Submissions: The *Journal of Contemporary Urban Affairs* reserves the right to decline or withdraw any manuscript—at initial screening, during peer review, or even after provisional acceptance—if it is found to breach ethical standards (e.g., plagiarism, fabricated data, undisclosed conflicts of interest) or to fall below the journal's methodological and scholarly thresholds. Editorial decisions to reject on these grounds are guided by COPE Core Practices, documented for transparency, and communicated promptly to authors with a clear rationale; if issues are discovered post-publication, the journal will issue a correction or retraction in line with its Retraction and Correction Policy.

Section Policies

Original Research:

Open Submissions Indexed Double-blind peer review

Review Articles:

Open Submissions Indexed Double-blind peer review

Studies and articles:

Open Submissions Indexed Double-blind peer review

Case Studies:

Open Submissions Indexed Double-blind peer review

Monographic studies:

Open Submissions Indexed Double-blind peer review

Book Reviews:

Open Submissions Indexed Double-blind peer review

Resolving Inconsistencies

In the case that an author has serious and reasonable objections to a review, the Editorial team makes an assessment of whether the said review is objective and whether it meets academic standards. If there is doubt about the objectivity or quality of the review, the Editor-in-Chief will assign an additional reviewer(s).

Additional reviewers may also be assigned when reviewers' decisions (accept or reject) are contrary to each other or are otherwise substantially incompatible.

Publishing Schedule

The *Journal of Contemporary Urban Affairs* publishes two issues each year, in **June** and **December**. Accepted papers are first published online as early-access articles before being compiled into the complete issue.

Manuscripts may be submitted at any time via our online portal. However, to be considered for rigorous peer review, editorial quality checks, and the production process for the upcoming issue, submissions must

be received no later than three calendar months before the publication date (i.e. by 30 March for the June issue and 30 September for the December issue). This timeline ensures adequate time for a thorough evaluation and high-quality publication.

Ethical Standards and Research Integrity

Ethical Standards and Anti-Bias

We are committed to upholding the highest standards of **editorial integrity and fairness**. Our editorial team and reviewers are required to disclose any potential conflicts of interest and to treat all submissions impartially. Decisions are based solely on scholarly merit and relevance to the journal's scope, without discrimination based on authors' race, gender, sexual orientation, religious belief, ethnic origin, citizenship, or political philosophy. We enforce ethical practices consistently across all submissions.

Commitment to Diversity, Equity, and Inclusion (DEI)

Author Name-Change Policy

The *Journal of Contemporary Urban Affairs* is committed to fostering an inclusive and equitable publishing environment. We recognize that authors may need to change their name on previously published articles for various reasons, including gender affirmation, marriage, or divorce. To support author autonomy and comply with equality and diversity policies, we offer a discreet and straightforward process for updating author names on published works. Upon request, we will update the author's name on the article's PDF and HTML versions, as well as the associated metadata supplied to indexing services, without requiring documentation or publishing a public correction notice, unless explicitly requested by the author.

Authorship and Contributor Order

The *Journal of Contemporary Urban Affairs* adheres to the principle that authorship credit should be based on substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; or has drafted the work or revised it critically for important intellectual content; and has approved the final version to be published; and agrees to be accountable for all aspects of the work. While the first author is typically considered the primary contributor, author order is ultimately determined by mutual agreement among the co-authors, reflecting their respective intellectual contributions to the research. In cases where two or more authors have contributed equally to the work, this should be clearly stated in the acknowledgements or a dedicated "CRediT" section within the manuscript, and authors may, by mutual agreement, choose their presentation order, often indicated by a prominent footnote or symbol next to their names. All authors are expected to confirm their individual contributions in line with the CRediT (Contributor Roles Taxonomy) system if applicable to their submission type.

Geographical Diversity & Global South / Emerging Hubs Engagement Policy

The *Journal of Contemporary Urban Affairs* is committed to amplifying scholarly voices from the Global South and other **emerging research hubs**; accordingly, we run periodic themed calls for papers on region-specific urban challenges, offer targeted outreach webinars and manuscript-development workshops, and maintain a geographically balanced Editorial Board with representation from Africa, Asia, Latin America, and the Middle East to ensure culturally informed handling of submissions. Although the journal charges no publication fees, we additionally prioritise rapid, supportive peer review and, where needed, language-editing assistance for authors whose first language is not English. We monitor annual statistics on submissions, acceptances, and published content by world region to gauge progress and refine our initiatives, thereby fostering an inclusive, globally representative discourse aligned with the scope of the journal.

Gender Equity and Inclusion Policy

The *Journal of Contemporary Urban Affairs* is dedicated to promoting gender balance across all facets of its operations, including authorship, peer review, and its editorial board, as a fundamental component of its broader Diversity, Equity, and Inclusion (DEI) commitment. We actively strive to ensure fair

representation and equitable opportunities for all genders, recognizing that diverse perspectives strengthen scholarship and contribute to a more comprehensive understanding of urban issues. Our ongoing efforts include monitoring the gender representation among our contributors and editorial teams, encouraging submissions from and inviting reviewers and editors of underrepresented genders in urban studies, and actively working to mitigate unconscious bias throughout the publication process.

Disclosure and conflicts of interest

Conflicts of interest, also known as competing interests, arise when external factors might influence the impartiality or objectivity of the research or its evaluation. Transparent disclosure of any potential conflicts allows others to make informed decisions regarding the research and its review process. Common types of conflicts of interest include:

- Financial
- Affiliations
- Intellectual Property
- Personal
- Ideological
- Academic

All authors must explicitly disclose any real or potential conflicts of interest related to the submitted work. This includes, but is not limited to, financial support, employment, consultancies, stock ownership, honoraria, paid expert testimony, patents, or relationships with organizations that may benefit or be harmed by the research findings. Authors are required to include a clearly stated "Conflict of Interest" section at the end of their manuscript, preceding the References section. This section should provide a concise summary of any relevant conflicts. If no conflicts exist, the statement should explicitly declare "The authors declare that there are no conflicts of interest."

Reviewers and editors must recuse themselves from handling or assessing manuscripts in which they have any conflicts of interest that could compromise their impartiality.

Data Fabrication and Falsification

At our journal, we uphold the highest standards of academic integrity and research ethics. We strictly adhere to the **Committee on Publication Ethics (COPE) guidelines** regarding data fabrication and falsification. Any instance of misconduct will be thoroughly investigated, and appropriate actions will be taken to maintain the integrity of the scholarly record.

Data Fabrication refers to the intentional creation of non-existent data or research results without having conducted any actual experiments, observations, or data collection. Data Falsification involves manipulating research materials, equipment, processes, or altering, omitting, or modifying data to misrepresent research findings. This includes selective reporting and deceptive image or figure manipulation.

Prohibited Practices: We reserve the right to **reject, retract, or report** any manuscript found to involve:

- Fabrication or falsification of research data, images, figures, or experimental outcomes.
- Plagiarism, including self-plagiarism (text recycling) and unauthorized use of others' work.
- Submission of the same manuscript to multiple journals simultaneously (redundant publication).
- Salami slicing, where a single study is fragmented into multiple papers to increase publication count.
- Citation manipulation, including excessive self-citation, coercive citation practices, or citation stacking to inflate metrics.
- Improper authorship practices, such as ghost authorship, gift authorship, or denial of rightful authorship.

If data fabrication, falsification, or any form of misconduct is confirmed, the journal may:

- Reject or retract the paper (if already published).

- Notify the author's institution and relevant funding bodies about the misconduct.
- Place a submission ban on the authors for a defined period.
- Report the violation to COPE and other indexing databases to uphold academic integrity.

Policy of Screening for Plagiarism

All papers submitted to the *Journal of Contemporary Urban Affairs* will undergo a plagiarism check using the iThenticate software, part of the CrossCheck Plagiarism Screening System. Any papers found to contain plagiarism or self-plagiarism will be immediately rejected. The journal is committed to upholding the highest standards of academic integrity and expects all submissions to be original works of the authors. Proper citation and acknowledgment of sources are mandatory. Authors are responsible for ensuring that their manuscripts are free from any form of plagiarism, including duplicate publication of their own previous work without proper citation. The journal reserves the right to report any instances of plagiarism to the authors' institutions and relevant authorities. By submitting a manuscript, authors agree to these terms and acknowledge that failure to comply may result in sanctions.

Policy on Academic–Practitioner Co-authorship

The *Journal of Contemporary Urban Affairs* actively encourages manuscripts co-authored by researchers and practising professionals (e.g., planners, architects, policymakers, community organisers, industry consultants) to enhance the practical relevance and societal impact of published work. Submissions that demonstrate genuine collaboration—evidenced through shared conception, data collection, analysis, and joint authorship contributions—are prioritised, provided they meet the journal's rigorous scholarly standards. Authors should indicate practitioner affiliations clearly and outline, in the CRediT Author Contribution Statement, how academic and practitioner insights were integrated to address real-world urban challenges or inform policy and design practice.

Policy on Ethical Committee Approval

Our journal adheres to COPE's ethical guidelines, including policies on consent for publication, protection of vulnerable populations, ethical treatment of animals and human subjects, handling confidential information, and responsible business practices. For studies requiring ethical committee approval, authors must provide detailed information about the approval, including the name of the ethical committee, the date of approval, and the approval number. This information must be explicitly stated in:

1. **The Methodology Section**: Include the ethical approval details as part of the description of the study's methods.
2. **The First and Last Page of the Manuscript**: Clearly mention the ethical approval details for transparency.

This statement must appear at the end of the manuscript—under the heading "Institutional Review Board Statement" and **before** the references section. Authors may choose one of the following scenarios relevant to your study (and adjust the details as needed):

-This study received ethical approval from [**Committee Name**], approval number [**Number**], dated [**Date**].

-This study did not require ethical approval as it does not involve human or animal subjects.

-Ethical approval was not applicable to this study in accordance with [**specific guideline or reason**].

-All procedures followed ethical standards and were conducted in compliance with institutional and national regulations.

Data Sharing and Reproducibility

We follow the FAIR Principles (Findability, Accessibility, Interoperability, and Reusability) for data sharing. If authors do not provide access to raw data without a valid reason, their article may be rejected. All submissions must include a Data Availability statement, even if there is no data included.

Retrospective Ethical Review Policy

The Journal of Contemporary Urban Affairs follows the Committee on Publication Ethics (COPE) guidelines regarding retrospective ethical approval. Retrospective ethical approval refers to cases where a study was conducted without prior ethics committee approval, and authors seek approval after the research has been completed. As a general policy, the journal does not accept retrospective ethical approvals, as ethical oversight should be obtained before research begins to ensure compliance with ethical standards, particularly in studies involving human or animal subjects. However, in exceptional cases where authors can demonstrate that ethical standards were followed despite the lack of prior approval, the Editor-in-Chief and the Editorial Board will assess the study on a case-by-case basis. Authors must provide a formal statement from their institution's ethics committee acknowledging that the study aligns with ethical principles and would have been approved under current guidelines. The journal reserves the right to reject submissions that fail to meet these requirements, ensuring that all published research upholds the highest ethical standards.

Policies on the Use of AI

The Journal of Contemporary Urban Affairs follows COPE guidelines in these matters, and authors are encouraged to consult the Committee on Publication Ethics (COPE) resources for further guidance. As stated by COPE, authors remain fully responsible for all content in their manuscripts, including any portions influenced by AI tools, and are accountable for any breaches of publication ethics.

For Authors:

AI or AI-driven large language models (e.g., NovelAI, Jasper AI, DALL-E, ChatGPT, Rytr AI) cannot be credited as authors or co-authors under any circumstances, as they lack the capacity for responsibility and accountability required of human contributors. All intellectual content, including that refined or developed with AI assistance, must be validated and overseen by the human authors, ensuring the manuscript's integrity and ethical compliance.

AI may be employed to improve the clarity, fluency, and readability of the manuscript's text, helping to refine language, resolve grammatical errors, and enhance overall presentation.

Any use of AI—whether for language editing, conceptual refinement, or other non-authorial support—must be transparently acknowledged in the Acknowledgements section. Authors must clearly state how AI was utilized and confirm that final content has been verified by the authors themselves in accordance with COPE guidelines.

Generative AI Images:

The Journal does not accept images produced solely by AI due to unsettled legal, ethical, and copyright concerns. AI-based enhancements to pre-existing images or visuals must be fully disclosed so that editors and readers can assess the nature of the modifications. In rare cases, when AI-generated imagery is integral to the research itself (e.g., studies examining AI image generation methods), such content may be considered, provided it is clearly labeled as AI-generated and ethically sourced, and that it meets all applicable legal and copyright standards.

AI Use by Reviewers:

Peer reviewers must not share or upload any part of a manuscript to generative AI platforms, thus maintaining strict confidentiality and data protection.

Manuscript Withdrawal by the Authors

Authors have the right to withdraw their manuscript from the Journal of Contemporary Urban Affairs at any stage before final publication. To request withdrawal, the corresponding author must submit a formal written request to the editorial office, stating the manuscript title, submission ID, and reason for withdrawal. The request will be processed within seven working days, and once approved, the manuscript will be removed from the editorial system. Withdrawal after peer review or acceptance is discouraged unless there are compelling reasons, such as ethical concerns or significant errors. Authors should note that once a manuscript is published online, it cannot be withdrawn, and any necessary corrections or retractions will follow the journal's Retraction & Correction Policy, in line with COPE guidelines.s.

Peer Review Process

Peer Review Statement

At the *Journal of Contemporary Urban Affairs*, every submitted manuscript undergoes a rigorous double-blind peer review process. We apply consistent review criteria to all submissions, evaluating them based on originality, relevance to contemporary urban issues, methodological rigor, clarity of presentation, and contribution to the field. Our reviewers follow standardized guidelines to ensure each manuscript is assessed fairly and thoroughly, without bias or favoritism. For details on the journal's Peer Review Statement, please visit the following link: https://www.ijcua.com/ijcua/reviewing-procedure

Author and Reviewer Communication

We ensure consistent and professional communication with authors, reviewers, and editorial board members. Our correspondence follows standardized templates that provide clear instructions, expectations, and updates throughout the submission and review process. Feedback to authors is constructive and detailed, aiming to assist in improving their work. We are committed to prompt responses and transparent communication to foster a collaborative and respectful publishing environment.

Publication and Post-Publication Policies

Citation Policies

The *Journal of Contemporary Urban Affairs* adheres to the best practices outlined by the Committee on Publication Ethics (COPE) regarding citation manipulation. We define citation manipulation as the inclusion of references that do not contribute to the scholarly content of the article and are added solely to increase citation counts for personal gain. This includes excessive self-citation, excessive citation to the journal publishing the article, and coordinated excessive citation between journals. Such practices violate publication ethics and are strictly prohibited.

Authors must ensure that all citations are relevant and contribute meaningfully to their work. Legitimate self-citations that address valid academic needs are acceptable. However, any form of manipulative citation will result in immediate rejection of the manuscript and may lead to further penalties, such as reporting to the authors' institutions or relevant authorities. The journal reserves the right to take appropriate action to uphold the integrity of the academic record. For more details, you can check their recommendations here: https://doi.org/10.24318/cope.2019.3.1

Retraction and Correction Policy

Our journal is committed to maintaining the highest standards of scholarly integrity. We recognize that errors, oversights, or misconduct can compromise the accuracy of the academic record. This policy outlines the procedures for addressing flawed, fraudulent, or otherwise compromised publications, ensuring transparency and trust in the scientific record. An article may be considered for retraction if:

1. **Evidence of Fraud or Misconduct**: Data fabrication, data falsification, plagiarism, unethical research practices, or other forms of misconduct are discovered.
2. **Serious Errors**: Errors in methodology or results that significantly undermine the reliability or validity of the research findings.
3. **Duplicate Publication**: If the article has been published elsewhere without proper authorization or disclosure.
4. **Breach of Ethical Standards**: Violation of ethical guidelines, including issues related to consent, confidentiality, or conflicts of interest that invalidate the research.

Retraction Process:

1. **Investigation Initiation**
    - Investigations may be triggered by authors, readers, reviewers, editorial board members, or other concerned parties who provide credible evidence of misconduct or major errors.

- The Editor-in-Chief (or an appointed committee) will perform an initial review of the complaint or evidence.

2. **Inquiry and Evaluation**
   - The Editorial Office requests any necessary documentation from the authors, reviewers, or relevant institutions.
   - The Editor-in-Chief consults with subject matter experts or members of the Editorial Board for an unbiased evaluation of the evidence.
3. **Decision and Communication**
   - If the investigation confirms misconduct or major flaws, the Editor-in-Chief will decide to retract the article, possibly in consultation with the Editorial Board.
   - A written notice outlining the findings and the decision is sent to all involved authors, giving them an opportunity to respond or appeal within 14 days.

Retraction Notice:

The retraction notice will clearly state the reason for the retraction (e.g., data falsification, major errors) and reference the original article. It will be written to avoid defamatory or accusatory language, focusing on factual statements. The retraction notice will:

- Appear in the next available issue and on the journal's website.
- Be prominently linked to the retracted article (PDF and HTML versions).
- Clearly mark the article as "Retracted" in all publicly accessible places where the article metadata is displayed.

Corrections and Errata:

1. **Minor Corrections (Errata)**
   - If an error does not compromise the overall findings or interpretations (e.g., minor typographical errors, mislabeled figures), the journal will publish a **Correction** or **Erratum**.
   - The Correction will be linked to the original article and be clearly labeled.
2. **Major Corrections**
   - If errors significantly affect specific parts of the article but do not invalidate the entire research, a **Corrigendum** may be issued. This corrigendum will include a detailed explanation of the corrections and how they affect the research conclusions.

Expression of Concern:

If a significant allegation of research misconduct or a major error comes to light but conclusive evidence is not yet available (e.g., ongoing institutional investigation), the journal may publish an Expression of Concern. This serves to:

- Alert readers of a potential issue with the article.
- Indicate that an official investigation is underway.

Once the investigation concludes, the Expression of Concern may be replaced with a Retraction Notice or a Correction, depending on the outcome.

Article Removal:

In rare instances (e.g., legal infringement, defamation, extremely high risk of harm if the information remains accessible), the journal may remove the article's text from the online platform. A statement will be published in its place explaining the reason for the removal, in line with best ethical practices and applicable legal requirements.

Follow-up and Indexing

-We will promptly communicate retractions or corrections to indexing databases so that all records accurately reflect the article's status.

-Retractions, corrections, or expressions of concern remain part of the permanent publication record to maintain transparency.

-Any editorial board member with a conflict of interest regarding a suspected article will recuse themselves from the investigation. Authors have the right to appeal retraction decisions. Appeals must be submitted in writing, detailing specific reasons and additional evidence. The Editorial Office will re-evaluate the case with impartial advisors.

Note: Our retraction policy follows the Committee on Publication Ethics (COPE) recommendations and guidelines.

Post-publication Discussions

The Journal of Contemporary Urban Affairs encourages discussion and debates regarding its published articles through letters to the editor or on an external moderated platform such as PubPeer. PubPeer is a platform that facilitates the evaluation and discussion of scientific research after it has been published. The journal follows the guidelines set by the Committee on Publication Ethics (COPE) regarding post-publication discussions and corrections.

CrossMark Policy

For details on the journal's CrossMark Policy, please visit the following link: https://doi.org/10.25034/crossmarkpolicy

Access, Licensing, and Archiving

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Archiving Digital Version

For details on the journal's Archiving Digital Version policy, please visit the following link: https://www.ijcua.com/ijcua/Digitalarchive

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-There are no membership fees in the Journal of Contemporary Urban Affairs.
-There are no language editing fees in the Journal of Contemporary Urban Affairs.
-The authors are not charged for including coloured photos or extra pages in their papers.

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Administration and Transparency

Investigations and Complaints Policy

The *Journal of Contemporary Urban Affairs* is committed to maintaining research integrity and adheres to COPE guidelines for addressing ethical concerns, research misconduct, and formal complaints.

1. **Reporting Ethical Concerns and Allegations**

Any concerns regarding ethical violations, research misconduct, or breaches of publication ethics should be reported to the editorial office of the journal. Reports can be submitted anonymously through secure services like ProtonMail or TorGuard. The journal may request raw data, images, or supporting documentation from authors, seek expert editorial advice, or contact relevant institutions to conduct investigations.

2. **Complaint Handling Process**

The journal takes all complaints seriously and follows a structured process to investigate and resolve issues fairly and transparently. We maintain records of the following types of complaints:

- Authorship disputes
- Plagiarism and duplicate publication
- Misappropriation of research results
- Research errors and fraudulent data
- Violations of research ethics and standards
- Undisclosed conflicts of interest

Complaints should be submitted via email to **editor@ijcua.com** with full details. The journal will investigate each case thoroughly and notify the complainant of the **final decision**. If necessary, further actions—such as retraction, correction, or institutional reporting—will be taken to uphold academic integrity. For more information, see Allegations of Misconduct.

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The Journal of Contemporary Urban Affairs is committed to protecting your personal information and respecting your privacy. Any personal details you provide to us, such as your name and email address, will be kept confidential and used solely for the intended purposes of this journal. We assure you that any information collected will be handled in accordance with this privacy statement.

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If subject-specific or institutional/funder repositories are unavailable, authors can use general repositories to share their data such as:

Repository Name	Information on costs	URL
- Dryad Digital Repository	Fees apply	Visit the website
- Figshare	Fees apply	Visit the website
-Harvard Dataverse	Contact repository for datasets over 1 TB	Visit the website
Open Science Framework	Free of charge	Visit the website
Science Data Bank	Free of charge	Visit the website
Zenodo	Donations towards sustainability encouraged	Visit the website

Our journal follows COPE's guidelines on "data sharing and reproducibility". For more information in this regard please see: https://publicationethics.org/topic-discussions/data-sharing

ORCID Number

The journal strongly suggests that all authors submitting a paper obtain an Open Researcher and Contributor Identifier (ORCID) account. ORCID registration provides a unique and permanent digital identifier for the author, which enhances the discoverability of their published work and ensures that proper credit is given to the correct author. The ORCID remains unchanged, even if the author's name, affiliation, or research field changes, ensuring that their past work remains easily discoverable and making it easier to correspond with colleagues. The journal strongly encourages the corresponding authors to include their ORCID in their submission information and suggests that co-authors do the same. The ORCID should be included in the author's information at the time of submission, and if the paper is accepted, it will be published along with the submission.

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Note: The Journal of Contemporary Urban Affairs and its publisher and editorial board follow the guidelines set by COPE in handling any accusations.

Duties

Duties of Editors

The Journal of Contemporary Urban Affairs recognizes and takes into consideration the following potential sources of conflict when evaluating and publishing articles: personal conflicts, financial conflicts, non-financial conflicts, submission by an editor, submission from the same institution, personal relationships, political or religious beliefs, submission by a family member of the editor(s), or by an author whose relationship with the editor(s) may give rise to the appearance of bias. Our publisher and editors are committed to publishing corrections, clarifications, retractions, and apologies as necessary. Our journal follows COPE's guidelines on the "Code of conduct for journal editors". For more information in this regard please see: https://publicationethics.org/media/609/download?attachment

Below are the detailed responsibilities of our editorial team:

Editorial Role	Key Responsibilities	COPE Compliance Highlights
Editor-in-Chief (EIC)	• Sets the journal's vision, scope, and editorial policies. • Makes final accept / reject decisions informed by peer-review and Section Editor input. • Oversees a rigorous, fair, and timely *double-blind* review process. • Investigates plagiarism, authorship disputes, data fabrication, and conflicts of interest. • Leads and appraises the editorial team.	• Follows COPE Core Practices and flow-charts for misconduct, retractions, and corrections. • Safeguards editorial independence. • Requires transparent COI declarations from editors, reviewers, and authors.
Managing Editors	• Screens submissions for scope fit, plagiarism, and formatting. • Coordinates reviewers via Section Editors / Coordinators and tracks deadlines. • Communicates editorial decisions and reviewer comments to authors. • Oversees the entire submission-to-production workflow.	• Implements and enforces double-blind review. • Detects duplicate submissions and ethical breaches. • Maintains strict confidentiality throughout peer review.

Academic Editors	• Provide in-depth scholarly evaluations or select subject experts for review. • Assess methodological rigour and contribution to urban studies. • Recommend acceptance, revision, or rejection to the EIC. • Flag citation manipulation or other unethical research practices.	• Declare any COIs before reviewing. • Report suspected misconduct (e.g., data falsification) directly to the EIC.
Section Editors & Coordinators	• Manage manuscripts within their speciality areas (e.g., Urban Transformation, Citizenship Rights). • Recruit reviewers and ensure timely, impartial evaluations; escalate disputes to the EIC. • Propose thematic issues or special collections.	• Guarantee subject-matter expertise and neutrality. • Declare and manage their own COIs; recuse when required.
Editorial Advisory Board	• Advise on international best practice in urban-studies publishing and journal strategy. • Identify emerging research trends. • Occasionally review submissions or recommend reviewers. • Champion JCUA within academic networks. • Assist the EIC with complex ethical dilemmas.	• Uphold ethical standards and support resolution of serious ethical cases alongside the EIC.
Production & Support Team	• **Copy / Layout Editors:** ensure manuscripts follow journal style and layout. • **Proof Editors:** check final proofs for accuracy and consistency. • **Site Administrators:** maintain submission platform uptime and accessibility.	• Preserve authors' voice while editing. • Monitor for text recycling or undisclosed overlap and alert the EIC.

Policy on the Selection of New Editorial Board Members: Prospective editorial board members of the *Journal of Contemporary Urban Affairs* are selected on the basis of demonstrable scholarly expertise in urban studies or closely related disciplines, a robust record of peer-reviewed publications indexed in reputable databases, proven experience as a conscientious reviewer or editor, and an unequivocal commitment to COPE-aligned ethical standards; candidates must also enhance the board's disciplinary breadth, institutional and geographic diversity, and gender balance while confirming their capacity to undertake timely peer-review and strategic editorial duties without conflicts of interest.

Compliance with COPE Guidelines Policy: All Editorial Board members of the *Journal of Contemporary Urban Affairs* are required to uphold the Committee on Publication Ethics (COPE) Core Practices at every stage of the editorial and peer-review process, proactively familiarise themselves with any updates or revisions issued by COPE, and promptly integrate those changes into their editorial duties to ensure continuous alignment with the highest standards of research integrity and scholarly publishing ethics.

Conflict-of-Interest Handling Policy: To safeguard editorial impartiality, any member of the *Journal of Contemporary Urban Affairs* Editorial Board who is an author, co-author, collaborator, or institutional colleague of a submitted manuscript must immediately declare the conflict of interest and recuse themselves from every stage of its assessment. The Editor-in-Chief will delegate the submission to an independent editor with no conflicting ties, ensuring that the manuscript proceeds through the standard double-blind review workflow without influence from the conflicted party. Failure to disclose or to step aside will result in disciplinary action, which may include suspension or removal from the Board.

Policy on Institutional Conflict of Interest for Editorial Board Members: Editorial Board members of the *Journal of Contemporary Urban Affairs* must recuse themselves from handling or reviewing any manuscript submitted by authors affiliated with the same institution, department, or research centre as their own. Such submissions are automatically reassigned to an independent editor with no institutional ties to the authors, ensuring an unbiased peer-review process and safeguarding the journal's integrity.

Voluntary Service Policy: All members of the *Journal of Contemporary Urban Affairs* Editorial Board serve on a strictly voluntary, unpaid basis, receiving no stipends, honoraria, or other financial remuneration; their involvement is motivated solely by scholarly commitment to the journal's mission, and acceptance of an editorial role constitutes acknowledgement and agreement to these uncompensated conditions.

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Original scientific paper

The Urban Sensory Ambiance of Batroun's Old Patrimonial Souk in the Face of Overtourism

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ABSTRACT

The old patrimonial souk of Batroun, in northern Lebanon, is undergoing deep change due to overtourism. Once a center for local trade and crafts, the souk has shifted since the early 2000s toward tourism and commercial entertainment. This change has disrupted its multisensory ambiance, altering how long-term residents perceive, use, and emotionally connect with space. While efforts to preserve heritage are underway, they often focus more on visual and economic appeal than on lived experience, causing tension between cultural preservation and tourist development. This study fills a gap in heritage and urban studies by using Jean-Paul Thibaud's "commented city walks" method to explore how residents describe and sense these changes. Fieldwork shows that residents increasingly feel dislocation and solastalgia as daily social rituals and sensory familiarity fade in favor of overtourism. The research adds to the growing field of urban sensory studies by demonstrating how sensory perception can help identify cultural loss in heritage sites. It also highlights the need for participatory, sensory-based planning approaches that consider the lived experiences of local communities. By viewing sensory co-construction as a potential bridge between tourism and preservation, the study promotes more inclusive urban transformation models. By foregrounding lived and actual urban sensory experiences, this research not only contributes to the field of urban sensory studies but also aligns with the journal's aim of examining the socio-economic effects of modern urban transformation driven by overtourism, suggesting pathways toward more inclusive and resilient futures in heritage settings.

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Highlights:	Contribution to the field statement:
-Overtourism alters auditory and olfactory ambiances in Batroun's old patrimonial souk. - Commercial transformation displaces traditional spatial practices and social rituals. - Heritage commodification generates solastalgia and dislocation among residents. - Participatory sensory methods reveal inequalities in residents' lived experiences.	This study advances urban sensory studies by applying Jean-Paul Thibaud's "commented city walks" to Batroun's old souk, revealing how overtourism disrupts multisensory ambiances and dislocates residents' sense of place. By integrating concepts of dislocation and solastalgia, it contributes new methodological and theoretical insights into the socio-economic consequences of contemporary urban transformation in heritage contexts.

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1. Introduction

In recent decades, many cities facing economic crises and global challenges have turned to tourism-led strategies as a tool for revitalisation and economic growth. While such initiatives often succeed in attracting investment and visitors, they also generate uncontrolled growth in tourist numbers, producing what the World Tourism Organization (UNWTO, n.d.) defines as *overtourism*: the impact of tourism on a destination in ways that excessively affect residents' quality of life and/or negatively influence visitors' experiences. Beyond questions of spatial and economic management, overtourism has profound implications for the urban sensory ambiance- the atmospheric quality of city spaces as experienced through the senses. This ambiance extends beyond visual aesthetics to include auditory, olfactory, tactile, and thermal dimensions that profoundly shape how people perceive, interpret, and emotionally engage with urban environments (Thibaud, 2015). Thibaud identifies five interrelated elements—spatiality, temporality, sociability, sensoriality, and affectivity—that together explain how the multisensory experience of place is co-constructed by its users.

The impacts of overtourism on sensory ambiance are increasingly evident in historic urban centres, particularly UNESCO-listed sites across Europe. Digital platforms such as Airbnb have accelerated tourism influxes, leading to disruptions in local soundscapes, socio-temporal rhythms, and the intimacy of public and semi-public spaces. Studies show that such transformations commodify neighbourhoods for tourist consumption, creating heightened noise, visual and olfactory pollution, resident displacement, and the erosion of cultural identity (Degen & Rose, 2012; Celata & Romano, 2022; Abbasian et al., 2020; Mazzamuto & Picone, 2022). Municipalities have responded with varying regulatory strategies: Dubrovnik restricted cruise ship entries (Abbasian et al., 2020), Venice proposed entry fees for day-trippers (Bei & Celata, 2023), and Paris and Amsterdam imposed caps on short-term rentals alongside licensing systems and compensation mechanisms. Florence, in turn, prohibited tourist key lockboxes in its historic districts as part of the *Tourism Sustainable & Liveable City* initiative (Seraphin et al., 2018). Some regulations specifically address sensory disruption, for instance, Amsterdam and Venice restrict cruise traffic to protect environmental and sensory conditions, while Prague limits late-night guided tours to preserve nocturnal tranquillity. Collectively, these efforts reflect a growing recognition that sustainable tourism must preserve not only spatial and economic integrity but also the sensory environments that underpin lived experience (Thibaud, 2015).

Scholars have also underscored the significance of sensory heritage in historic environments. Sadiq, Elghonaimy, and Asvar (2025), using phenomenological and experiential mapping approaches, argue that architecture is apprehended not only through vision but also through tactile, auditory, olfactory, and kinesthetic senses. They emphasise that materials, spatial configurations, sounds, and light co-constitute emotional ambiance, and advocate for conservation strategies that protect these sensory dimensions as essential aspects of heritage sustainability. Similarly, the concepts of *dislocation* (Goetz & Nancy, 2018) and *solastalgia* (Albrecht, 2020) have been applied to urban contexts to describe the emotional distress residents experience when transformations erode their affective and relational ties to place. Case studies from Venice (Bertocchi & Camatti, 2022), Barcelona (Álvarez-Sousa, 2021), and Dubrovnik (Abbasian et al., 2020) illustrate how overtourism generates precisely such feelings of loss, alienation, and cultural dislocation.

While much of this research has centred on large European metropolises (Bei & Celata, 2023), smaller-scale Mediterranean patrimonial sites remain comparatively underexplored. This study addresses this gap by focusing on the old patrimonial souk of Batroun, located 54 km north of Beirut. Continuously inhabited since the Early Bronze Age, Batroun bears the imprint of successive Assyrian, Seleucid, Roman, Byzantine, Crusader, and Mamluk periods, later reconstructed in the 19th century. Its souk, with sandstone architecture, corbelled balconies, and labyrinthine alleys, stands as a testament to this layered history. Archaeological features such as the Roman theatre, Crusader fortifications, and the Sea Wall—interpreted variously as a quarry, defensive barrier, or storage zone (Viret, 2005; Salamè-Sarkis, 2009; Sanlaville, 1978) which reinforce its cultural significance. In addition to its archaeological and architectural value, Batroun has been a Christian pilgrimage centre, with landmarks such as the Basilica of Saint Stephen. Yet, following Lebanon's civil war, the souk declined into a

"ghost market," losing its artisanal base. Renovation initiatives launched in the early 2000s reactivated the area, but they also triggered real estate speculation, commodification of space, and tensions between residents and investors. More recently, crises such as Lebanon's financial collapse, the COVID-19 pandemic, and the Beirut port explosion have further destabilised socio-economic life while accelerating the souk's transformation into a spectacle-driven, tourist-oriented environment.

Within this context, the present study investigates how overtourism reshapes Batroun's multisensory ambiance and affects local experiences of identity, belonging, and continuity (Ruby, 2021). Employing Jean-Paul Thibaud's (2002, 2013a) *commented city walks* method, it explores how long-term residents narrate and interpret sensory changes in their environment under the pressures of crowding, commercialisation, and aesthetic rebranding. By foregrounding participatory, sensory-based methodologies, this research highlights how embodied knowledge reveals disruptions often overlooked in conventional heritage and urban planning frameworks.

The significance of this study lies in its focus on a small Mediterranean heritage city, offering insights distinct from metropolitan European contexts. It demonstrates how overtourism disrupts multisensory ambiances, displaces traditional practices, and generates socio-cultural tensions that gradually marginalise residents in favour of tourists and investors. Ultimately, the study argues that participatory and sensory-centred revitalisation strategies can co-create ambiances that sustain cultural continuity while enhancing urban resilience.

2. Materials and Methods

This study employs a qualitative methodological framework to investigate the transformation of Batroun's old patrimonial souk and its implications for urban sensory ambiances. The approach integrates spatial analysis and experiential inquiry, enabling a holistic examination of how architectural modifications, functional shifts, and processes of commercialisation linked to overtourism reshape the souk's sensory identity. The research begins with an assessment of the spatial and functional evolution of the souk, focusing on physical alterations, changes in use, and the reconfiguration of spatial identity. Cartographic surveys are used to map these transformations and to identify areas most affected by commercial pressures and tourist flows.

To examine the embodied experience of the souk, the study applies the method of "commented city walks" [parcours commentés] developed within urban sensory studies (Thibaud, 2002, 2013a). This participatory technique involves accompanying residents along routes of personal or habitual significance within the souk, during which they articulate their perceptions, affective responses, and memories in real time. These walks are documented through audio recordings, field notes, and visual materials, generating an in-situ record of how sensory ambiances are produced and perceived.

The commented city walk approach emphasises co-presence between researcher and participant, situating observation within the lived context of urban environments (Thibaud, 2002, 2013a). It captures the relational and affective dimensions of sensory experience, examining how ambiance emerges through the interplay of spatial arrangements, materiality, temporality, and human interaction (Thibaud, 2015). This is particularly relevant in the case of Batroun's patrimonial souk, where traditional practices intersect with touristic dynamics, producing a layered and contested sensory landscape. By combining spatial surveys with embodied methods, the study interrogates how transformations in the souk's architecture and functions shape sensory perception and influence residents' sense of place (Chelkoff & Thibaud, 1992). The methodological design thus contributes to advancing a deeper understanding of the sensory identity of historic urban environments and informs participatory strategies for heritage preservation that prioritise lived experience.

2.1 Study Design and Setting

The methodological design is structured to provide a comprehensive understanding of the transformation of Batroun's sensory ambiance in the wake of restoration and conversion efforts. The framework integrates three key components:

1. Commented city walks (Thibaud, 2002, 2013a) to capture sensory narratives in real time.

2. Sensory data collection (audio, visual, and field notes) to document ambient qualities.
3. Semi-structured interviews with diverse stakeholders (residents, shop owners, municipal actors) to contextualise sensory experience within broader socio-cultural dynamics.

This integration foregrounds the primacy of sensory engagement in the study of urban ambiances, recognising that "the world is experienced both as a world of objects from which we act and orient ourselves, and as a world of qualities with which we vibrate and are in harmony" (Margier, 2020, p. 209).

Table 1: Steps for applying the "commented city walk" method.

Step	Description	Key Details
A. Selection of Participants	Identify suitable participants for capturing lived sensory experience.	- Residents or regular users of the space (e.g., shop owners, local walkers, artisans). - Ensure diversity in age, gender, and background. - 4–10 participants per session is optimal.
B. Preparation Phase	Prepare the urban site and research framework.	- Select specific zones/paths (e.g., Batroun's old souk). - Provide maps or visual references. - Design semi-structured guides (themes + flexibility).
C. Walking Interview ("Commented City Walk")	Conduct embodied and narrated exploration of urban space.	- Participants guide researcher through space, sharing perceptions, memories, feelings, and sensory cues (sounds, smells, light, textures). - Sessions recorded (audio or audio–video). - Researcher listens/observes, prompts gently. - Duration: ~25 minutes per walk.
D. Post-walk Discussion (Optional)	Deepen reflection and triangulate sensory insights.	- Conduct debriefing interviews to clarify observations. - Use images or playback excerpts for participant feedback.
E. Data Processing	Analyse and synthesise sensory narratives.	- Transcribe and code verbal/sensory expressions. - Map sensory hotspots and discomfort zones. - Cross-compare across participants' walks.

2.2 Participants or Subjects

A central component of the study is the use of "*commented city walks"* (J.-P. Thibaud, 2013a), which involve collecting sensory perceptions from residents and visitors of the old patrimonial souk. The sample includes current residents who still inhabit the souk, former residents who lived in the souk, short-term renters who lease their homes through rental platforms, particularly following the restoration and conversion process, visitors who frequent the souk during the day and at night, business owners and tenants of retail shops and restaurants operating in Batroun's old patrimonial souk, and professionals who previously worked in the souk and recent tenants who have established new businesses in the area. This selection facilitates a comparative understanding of how different user groups perceive and negotiate the shifts in spatial ambiance and social rhythms of the area.

By conducting sensory observations across these diverse groups, the study aims to map the impact of urban transformation on the lived experiences and spatial ambiances within the souk.

The table 2 below shows the age ranges of people who have been in Batroun Souks before the restoration and renovation that started in 2000 (<25 or >25), those who were in Batroun when it was identified as a ghost city (before 2000), and the older generation who knew the old patrimonial souk of Batroun when it was filled with artisanal workshops and merchants (>60). We have all participants' consent to share their participation and experiences, as they have provided a testimony to share.

Table 2: Participants in the "Commented city walk" experience.

Participant Group	Description	Age Range	Number of Participants
Current Residents	People who currently live in the old souk	> 60	< 5
Former Residents	Individuals who used to live in the old souk	> 60	< 5
Short-term Renters	Hosts or tenants using rental platforms (e.g., Airbnb) after restoration	< 45	< 5
Daytime Visitors	People who visit the souk during the day	< 25	> 30
Nighttime Visitors	People who frequent the souk at night	< 25	< 10
Business Owners	Owners of shops, cafes, or restaurants in the souk	< 25	< 5
		> 45	< 5
Long-term Tenants	Individuals who lease and operate businesses in the souk	> 45	< 5
Municipality, Batroun Committees, and organizers	Municipality of Batroun employees who provided Batroun Map, and Batroun committees and organizers	<45	3
		>45	3

The study draws on testimony from Professor Paul Abi Khattar Zgheib's childhood, when he lived in Batroun's old souks. He shares his childhood memories based on sensory experiences and ambiance, and his recently created "commented city walk" through Batroun's alleys, recorded with sounds and photos, aims to depict old Batroun through residents' lived experiences and memories. It also captures the real sensory experience of a typical visit to Batroun's historic souks.

2.3 Materials and Equipment

The study employed a range of materials and equipment to facilitate the application of the Commented City Walk methodology in Batroun's old patrimonial souk.

Primary data collection relied on:

- Audio and video recorders for capturing real-time verbal narratives during the walks.
- Smartphones were used for geo-referencing via GPS and taking environmental photographs.

To support olfactory tracking and environmental sensory logging, pre-designed sensory mapping sheets were distributed to the research team for manual annotation.

The materials can be highlighted as:

- Audio recorder (or smartphone with quality mic).
- Optional: GoPro or body cam for video documentation.
- Map/plan of the area.
- Notepad or observation sheet.
- Camera for visual documentation of key places or sensory cues.

2.4 Procedures and Protocols

The research adopted the "*Commented City Walks"* method as developed by Jean-Paul Thibaud(J.-P. Thibaud, 2002, 2013a), focusing on a step-by-step immersive engagement with participants as they traverse familiar urban routes.

- Walks took place at different times of the day, morning, afternoon and night, to capture variations in sensory ambiance and social activity.
- Participants were selected from various categories (residents, former residents, visitors, business owners, and others) and invited to walk a route of their choice within the old souk, typically lasting around 20 minutes.
- Before each walk, participants were briefed on the process and asked for their consent.

- Each walk was accompanied by a researcher who ensured minimal interference while encouraging participants to share sensory impressions, emotional reactions, and memories triggered by specific urban cues (visual, auditory, olfactory).
- Comments were recorded in real-time using voice recorders, and environmental data such as ambient sounds and air scents were logged simultaneously.
- After completing the walk, participants took part in a 15–30-minute post-walk interview to elaborate on specific observations and discuss perceived changes in ambiance due to overtourism. It was more identified as a group discussion, specifically with the young generation, counted as tourists.
- Each walk and follow-up session were documented with visual data (photos, annotated maps, and sensory logs) for contextual analysis.
- Throughout the process, safety, anonymity, and ethical handling of personal data were prioritized to ensure accessibility and participant comfort

2.5 Data Analysis

Photographs and soundscapes were used to triangulate findings and deepen the understanding of the souk's sensory ambiance. Through collaborative discussion, the qualitative and spatial data showed how overtourism transforms the embodied and emotional experience of the space.

3. Results

The methodological framework of the commented city walk enabled a nuanced examination of how spatial and social transformations shape the sensory ambiances and identities of Batroun's old patrimonial souk. This approach resonates with the conceptual work of Amphoux (1993), who highlighted the ternary rhythm of *familiar ambiance, lived ambiance, and sensory ambiance* (*ambiance connue, ambiance vécue, ambiance sensible*) as critical dimensions through which urban atmospheres may be interpreted. In *La valse des ambiances* [The waltz of ambiances], Amphoux describes these ambiances as distinct yet interwoven perceptual layers—knowledge, life, and meaning—that characterise urban experience. Subsequently, Amphoux, Thibaud, and Chelkoff (2004) formalised this conceptualisation into a methodological framework that informed the present study.

3.1 A Child's Olfactory Journey Through the Alleys of Batroun

The experiential dimension of Batroun's patrimonial souk is deeply embedded in olfactory memory, demonstrating how scent functions as a formative element in the construction of place identity. Childhood recollections of the souk reveal a sensory cartography structured through distinctive odours. Each street, shop, and workshop contributed an "olfactory signature," acting as silent yet vivid markers of both time and space.

For instance, mornings in Batroun often began with the earthy aroma of freshly sawed and sanded wood emanating from carpentry workshops. These scents not only anchored daily routines but also evoked imaginative associations—wood shavings became symbols of adventure, transformed into imagined treasures or gateways to exploration. Progressing through the alleys, the olfactory atmosphere shifted abruptly near the blacksmith's forge, where the acrid odour of heated iron was accompanied by the rhythmic resonance of hammer against metal. This multisensory experience integrated sound and smell, reinforcing the perception of the space as one of productivity and resilience.

Equally significant was the refreshing scent of citrus from the lemonade vendor's stand, which introduced an atmosphere of vitality and playfulness. The lingering trace of lemon oil on the hands symbolised both immediacy and continuity, embedding the sensory experience within the rhythm of everyday life. Further along, the maritime scent of Batroun's harbour—an intermingling of salt, seaweed, and freshly caught fish—reinforced the town's coastal identity and extended the sensory narrative of childhood exploration into maritime imaginaries. The olfactory presence of the butcher's shop, with its blend of raw meat and spice, closed the sensory cycle of daily life by evoking communal rituals of food and family gatherings. These recollections illustrate how olfactory experience contributes to what Proust metaphorically termed "madeleines," sensory triggers that reactivate

memories with striking immediacy. In Batroun, such fragrances constitute more than personal recollections; they embody the socio-cultural fabric of the souk, functioning as enduring sensory imprints that bind past and present.

3.2 Contemporary Journey of the vanishing Scent and sound of Home

In the contemporary period, the sensory landscape of Batroun's patrimonial souk has undergone significant transformation. The compounded effects of the COVID-19 pandemic, Lebanon's severe economic collapse, and the Beirut Port explosions of 2020 have reshaped both domestic and international tourism flows. With a decline in Beirut-centred tourism, visitor activity increasingly shifted toward northern Lebanon, and particularly to the historic souk of Batroun. This intensified influx of visitors, layered onto an already fragile economic context, has profoundly altered the sensory ambience and cultural identity of the souk.

The geographical scope of the present study focused on a specific route beginning at St. Stephan's Church and concluding at the Batroun citadel—colloquially referred to as the "Diaspora Village." This route included Street 14, turning right onto Street 1106, and continuing along Street 11 (see Figure 1). Historically, this section of the souk was characterised by a socio-spatial structure dominated by artisanal economies. Street 14, in particular, hosted a variety of small craft businesses—including a bakery, a dressmaker's atelier, multiple carpentry workshops, and a specialised shop for carpentry tools. These commercial activities often coexisted with domestic life, as property owners typically resided on the upper floors of their workshops, thereby reinforcing a traditional live–work arrangement. The juxtaposition of past and present illustrates a dual narrative: on one hand, the persistence of sensory memory as a formative layer of place identity; on the other, the gradual erosion of these sensory markers under the pressures of economic crisis, shifting tourism, and cultural transformation. Together, these findings underscore the methodological significance of the commented city walk in capturing the ambivalent dynamics of continuity and change in urban sensory ambiances.

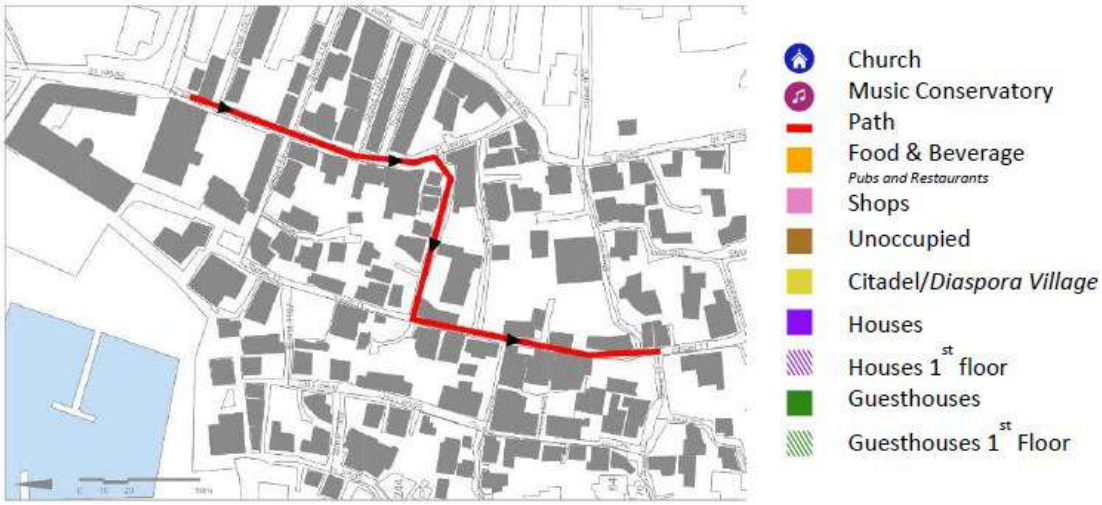

Figure 1. The chosen path for "commented city walk" in Batroun's old patrimonial souk.

Over time, the socio-economic dynamics of this area have undergone a significant transformation. Most of the original proprietors have passed away, and the artisanal heritage associated with the area has experienced a notable decline. The younger generations, many of whom have obtained university degrees in unrelated fields or have shown little interest in continuing traditional crafts, have largely disengaged from these professions. As a result, the ground-floor commercial units that once hosted artisanal practices are now either vacant or converted into tourism-oriented businesses such as restaurants, boutique shops, or entertainment venues. Meanwhile, the upper residential levels have been repurposed into short-term accommodation, including hotels and Airbnb rentals, further contributing to the commercialization and reshaping of the historic urban fabric. We can see this in the

figure 4 where we note the street 14 ambiance and the houses turned into short term accommodation in the upper floor.

Recently, the sensory landscape of Street 14 in Batroun's old patrimonial souk has experienced a profound change. The scent of home-cooked meals, once a characteristic feature of the area, has become increasingly rare. Today, only a few residential units remain occupied by long-term residents, specifically two apartments upstairs and a single ground-floor dwelling, while many traditional homes have been converted into tourist accommodations.

Figure 2. Ambiance of Street 14, with shops and workshops on the ground floor and residences or guesthouses above. © Photo: Prof. Paul Abi Khattar Zgheib.

Figure 3. Guesthouses on the ground floor and residences above in Street 14. © Photo: Prof. Paul Abi Khattar Zgheib.

The former carpentry workshops, now transformed into restaurants, pubs, or street food vendors, emit new dominant olfactory cues, such as the pervasive smell of fast food, alcoholic drinks, and nargileh (waterpipe smoke). The sound environment has undergone significant changes. Where once the street was filled with the sounds of neighbourly conversations and the subtle rhythms of domestic life, it is now dominated by amplified music from hospitality venues, tourist chatter, kitchen noises, the bubbling of nargileh pipes, and the mechanical sounds of tuk-tuks and electric golf carts moving through the narrow streets.

Other sensory elements that were once common, such as the distinct scent of freshly laundered clothes or the aroma of morning coffee shared among neighbors, have largely disappeared. These have been replaced by the sounds and smells associated with commercial activities, such as the deliveries of goods to local restaurants and guesthouses. We can see in figure 3 a whole yard with it's surrounding houses transformed into guesthouses.

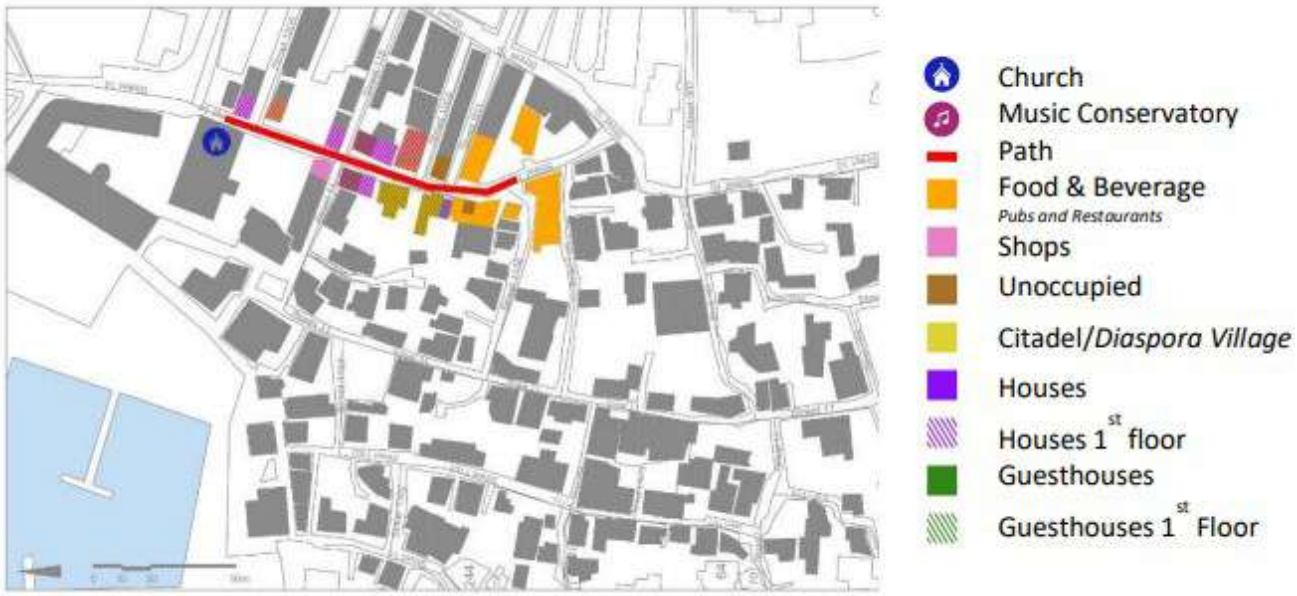

Figure 4. The sensory landscape of Street 14 in Batroun's old patrimonial souk.

A similar pattern of transformation can be seen along Street 1106 as in the Figure 5. Traditionally made up entirely of private homes, this area has experienced uneven yet notable change. The right side of the street keeps its residential feel; however, the left side shows signs of tourism development. While one house remains in its original state, another has seen its courtyard turned into a fast-food restaurant, and two more properties have been completely redesigned into guesthouses, reflecting a broader trend of commercialization and spatial reorganization.

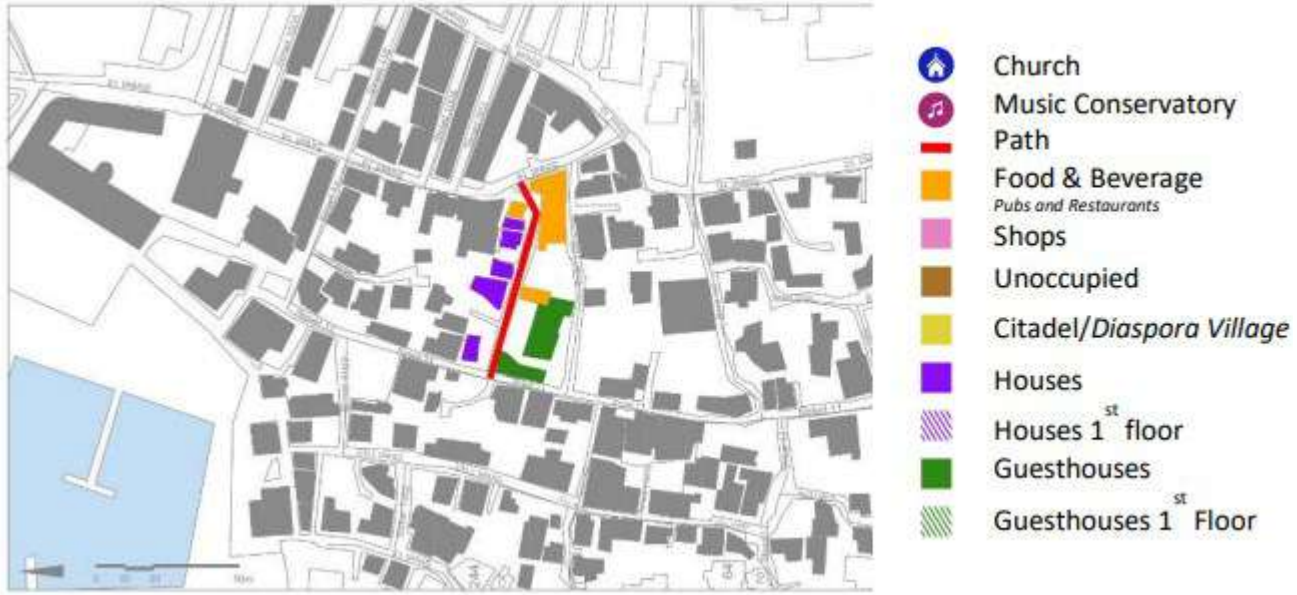

Figure 5. The sensory landscape of Street 1106 in Batroun's old patrimonial souk.

Along Street 11, extending from the intersection with Street 1106 toward the Church of Our Lady of the Yard, next to the area commonly referred to as the Diaspora Village and historically known as the Citadel, significant renovations have been undertaken. You can note this path in the figure 8. Many plots along this route, including traditional Lebanese homes with high ceilings, have been restored. These properties are still partly inhabited by long-term residents or have been converted into tourist accommodations, contributing to the area's ongoing transformation. Unlike neighboring streets, the sound environment here is distinctly different. The absence of concentrated restaurants, pubs, or street

food vendors results in a quieter, less commercial soundscape. Aside from a single Italian restaurant near the limits of the Citadel, the main sounds come from other sources. You can hear religious hymns from nearby churches blending with the occasional hum of tuk-tuks and electric golf carts moving along the pedestrian street. These mechanical noises are accompanied by traditional oriental music emerging from the newly opened conservatory, as in figure 6, housed in a restored old patrimonial building on plot 427 at the edge of the Diaspora Village. The combination of sacred music, machinery, and cultural sounds creates a unique and layered auditory experience. The scent profile here is also mixed. At the start of the street, the smells of home-cooked meals still linger, reflecting the presence of residents. As you move toward the Citadel, these scents are gradually replaced by the aroma of Italian cuisine from the restaurant and the sweet smell of brioche and pastries from KOKO's bakery further along the route, as in figure 7.

Figure 6. The music conservatory was restored, and it opened its doors in the early 2025. © Photo credit to Prof. Paul Abi Khattar Zgheib.

Figure 7. The old patrimonial House, where we note the entrance to KOKO's bakery on the ground floor, and his residence on the upper floor. © Photo credit to Prof. Paul Abi Khattar Zgheib.

This section of Street 11 offers a heightened physical sensory experience. While olfactory stimuli are less intense, the shape and narrowness of the street require heightened body awareness for movement and navigation. When the street narrows near the Diaspora Village, pedestrians often press against building walls or step aside to avoid oncoming tuk-tuks and golf carts. This space constriction

enhances bodily engagement with the environment, creating a sensory ambiance that is both intimate and dynamic yet constrained.

As you approach the Diaspora Village from the entrance near Lina's, beside the Church of Our Lady of the Yard, the auditory experience continues and intensifies. In this transitional space, a layered soundscape develops, where the ambient noise of food preparations from nearby restaurants blends with background music from these eateries. These sounds intertwine with the sacred hymns from the nearby church, forming a complex acoustic environment. The scene is further animated by the lively chatter of tourists and the rhythmic music from passing tuk-tuks and golf carts, creating a vibrant mix of sacred, commercial, and entertainment elements sounds.

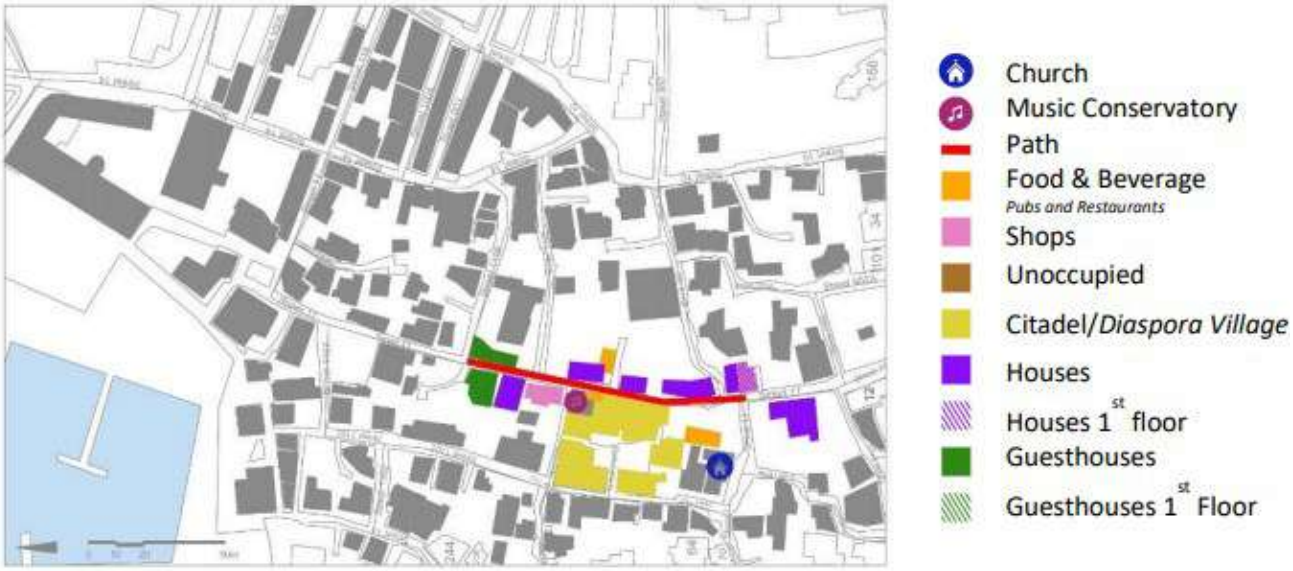

Figure 8. The sensory landscape of Street 11 in Batroun's old patrimonial souk.

3.3 Dislocated belonging and the scent of loss

The modern journey through Batroun's historic souk exposes a deep disconnect between memory and experience, between the familiar sensory rhythms of the past and the fragmented, commercialized atmosphere of today. What used to be a space filled with the everyday scents and sounds of home life, artisanal work, and community interaction has now been transformed into a tourist attraction, visually preserved but sensorially foreign. For longtime residents, this change is more than just spatial or economic; it is profoundly existential. As the smells of homemade meals, wood shavings from carpentry shops, and morning coffee fade beneath the overpowering presence of fast food, hookah smoke, and loud music, the souk's sensory identity becomes increasingly unrecognizable (figure 9). This loss of familiarity triggers a form of solastalgia, as defined by Glenn Albrecht for being a distress experienced when one feels emotionally displaced in a place that was once home (G. Albrecht, 2006). Here, residents stay physically in their neighborhoods, but the environments that once grounded them have disappeared. They are, in essence, at home yet no longer feeling at home, mourning a place that still exists physically but has lost its lived sense of familiarity meaning (Liu, 2024).

This loss is not only internal. It is also social and visible in the empty thresholds and shuttered workshops once animated by generational craft and community exchanges. The children of artisans, now university graduates or labor migrants, have not inherited the professions or the spaces of their parents. Instead, the ground floors of their family homes have become restaurants or shops, while upper floors are rented to temporary guests. The residents who remain, as in figure 10, bear witness to a kind of "dislocation", as described by Benoît Goetz (Goetz & Nancy, 2018): "not one of physical removal, but of emotional and symbolic displacement". They experience a disconnection not only from their past, but also from their former neighbors, whose departures, often driven by economic insecurity, signal a larger separation of collective belonging. The souk, once a shared living environment, is now an increasingly fragmented urban stage curated for others. "*The sensible encompasses both the sensory*,

the signifier (the meaning given to what is experienced by the senses), and the qualifier (the feeling, the emotional connection, etc., that this can produce). The sensitive approach we are talking about then encompasses these three connections." (Manola, 2020)

Figure 9. The ambiance in the old patrimonial souk, street 14, where we can notice the pubs taking over the old crafts workshops. © Photo credit to Prof. Paul Abi Khattar Zgheib.

Figure 10. The resilience of the inhabitants of the old patrimonial souk, street 14, side by side with the pubs and restaurants. © Photo credit to Prof. Paul Abi Khattar Zgheib.

This sensory and social transformation is particularly evident along the route from St. Stephan's Church to the Citadel, now known as the Diaspora Village. While the visual heritage of the area may be preserved through stone restoration and aesthetic regulation, its sonic, olfactory, and proprioceptive dimensions have undergone dramatic alterations. What once evoked stability and communal rootedness now evokes movement, noise, and fleeting presence. Even the body navigates the space differently hugging walls to avoid tuk-tuks and golf carts in streets once walked freely by barefoot children and elderly neighbors greeting one another.

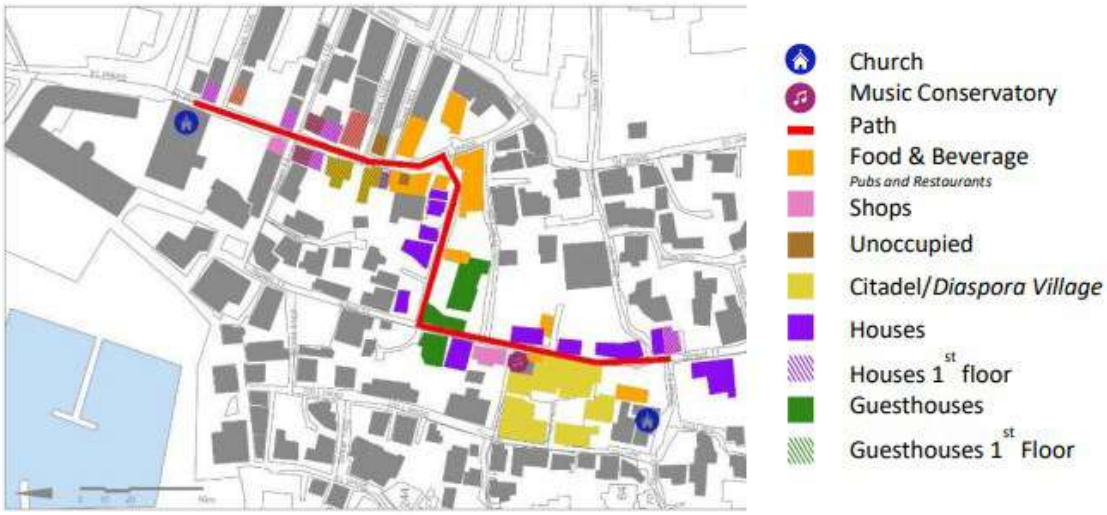

Figure 11. The sensory landscape in Batroun's old patrimonial souk.

Tracing the sensory reprogramming of this familiar urban journey, as in figure 11, this research uncovers the complex connection between place, identity, and ambiance. It demonstrates that heritage cannot be limited to architectural preservation or economic revival alone. Instead, it must also include protecting the intangible, sensory, and emotional aspects of a place that foster a sense of belonging. The transformation of the souk, driven by economic development, has caused significant emotional and cultural dislocation for those who still live there. You can note below in Table 3, the sensory comparative study, as identified by the participants, in street 14, street 1106, and street 11; from Saint Stephan Church to The Diaspora Citadel.

Table 3: The sensory comparative study. Summary of Olfactory and Auditory cues within each of the streets

Street	Olfactory Cues	Auditory Cues
Street 14	- Fading scents of home-cooked meals and morning coffee - Strong presence of: • Fast food • Alcohol • Nargileh smoke - Loss of artisanal smells (wood, bread, laundry)	- Replaced neighborly sounds with: • Loud music from pubs/restaurants • Tourist chatter • Kitchen clatter • Bubbling of nargileh • Sounds of tuk-tuks/golf carts
Street 1106	- Mixed: • Some home-cooked food still present • Fast food from a courtyard-turned-restaurant - Signs of gradual shift to tourist-oriented smells	- Softer than Street 14 but changing: • Residential quiet on one side • Noise from restaurants/guesthouses on other - Transitional, with increasing tourist noise
Street 11	- Begins with lingering home-cooked scents - Further down: • Italian cuisine • Fresh pastries (KOKO's bakery) - Overall more diverse and subtle olfactory presence	- Layered soundscape: • Church hymns • Tuk-tuks/golf carts • Oriental music from conservatory • Background music from restaurants .- Quieter than Street 14; more varied

To address this, urban and heritage planning must go beyond superficial aesthetics and visual stories. They need to focus on the lived and atmospheric qualities of a place, actively listening to the voices

and sensory memories of residents who have not left but increasingly feel alienated in their own homes. Only then can we develop regeneration strategies that are not only sustainable and inclusive but also honor the deep relational bonds that make a place feel like home.

4. Discussion

4.1 Residents between struggle and the search for a home

The transformation of Batroun's old patrimonial souk provides a poignant illustration of how tourism-induced urban change manifests at the level of sensory and socio-cultural experience. Observations reveal an ongoing tension between residents' everyday life and the spectacle of tourism. From balconies overlooking the streets, inhabitants are often seen observing passers-by, their expressions reflecting quiet unease. In other instances, residents attempt to maintain their daily routines within an environment increasingly dominated by high-profile restaurants and hospitality venues. This juxtaposition highlights the dual effect of tourism: while it creates new economic opportunities, it simultaneously produces forms of existential distress akin to what Albrecht defines as *solastalgia*—a condition in which individuals experience a sense of loss and disconnection in the midst of their unchanged geographic locale (Chang, 2023).

This condition is not unique to Batroun but reflects broader global patterns observed in other historically significant urban environments grappling with overtourism. Comparative cases from Algiers' Casbah, Venice, Barcelona, Penang, and Saint-Malo illustrate similar themes: the commodification of heritage, symbolic and physical displacement of local populations, and the gradual erosion of place-based identity, ambiance, and memory (Bertocchi et al., 2020; Ghaderi et al., 2012; Mazzamuto & Picone, 2022).

In the Kasbah of Algiers, another UNESCO World Heritage site, transformations are shaped less by market-driven gentrification than by state-led "preservation" strategies. Such top-down interventions have often overlooked resident participation, resulting in relocations that sever deep-rooted sensory and emotional ties between inhabitants and their environment (Djedi & Belakehal, 2023). While the material fabric is conserved, the intangible atmospheric and lived dimensions—sounds, scents, and patterns of social interaction—are increasingly lost. In this context, Goetz's concept of dislocation becomes particularly relevant, referring not only to the physical displacement of residents but also to their symbolic separation from spaces once central to their belonging (Goetz & Nancy, 2018).

Venice offers perhaps the most emblematic example of overtourism's consequences. With more than 25 million visitors annually, the city has effectively transitioned into what Seraphin et al. (2024) term a "hyperreal museum": a preserved façade devoid of the lived vitality that once animated it. Traditional auditory and olfactory cues have been replaced by the noise of rolling suitcases, water taxis, and amplified tourist activity. A similar trajectory is observed in Barcelona's Gothic Quarter, where long-term residents have been displaced by short-term rentals and traditional housing converted into temporary hospitality infrastructure. Despite emerging regulatory frameworks in these cities, Batroun remains at an early stage of implementing such policy interventions.

Other cases highlight temporal instability. In Saint-Malo, France, tourism produces seasonal volatility: the walled city becomes saturated during the summer months yet nearly deserted in winter. Batroun exhibits a parallel pattern, animated only in autumn through events such as *Capitale de Noël*. This fluctuation generates unstable urban identities and a "sensory void" during off-seasons, undermining the coherence of everyday life for remaining residents. In Penang, Malaysia, comparable dynamics prompted authorities to restrict short-term rentals and introduce heritage protection frameworks, albeit with mixed results (Ghaderi et al., 2012). Collectively, these examples echo Batroun's sensory disjunction between preserved patrimonial structures and an altered experiential fabric within the renovated souk.

4.2 Dislocation of Atmosphere and Belonging

Across these diverse urban settings, including Batroun's patrimonial souk, a consistent pattern emerges: heritage sites increasingly function less as spaces of belonging and more as venues for

consumption, overtourism, and visual spectacle. This shift interrupts sensory continuity—particularly auditory and olfactory—alongside social interaction, directly shaping how residents experience and engage with their environments. A comparative overview of these disruptions is presented in Table 4.

Table 4: Comparative summary between traditional elements and contemporary disruptions across auditory, olfactory and social dimensions.

Dimension	Traditional Elements	Contemporary Disruptions
Auditory	Church bells, everyday conversations, artisanal workshops (e.g., butchers, carpenters)	Loud music, traffic, commercial noise
Olfactory	Smells of home-cooked meals, coffee, fresh laundry, woodwork	Odors from fast food, alcohol, street vendors
Social	Stable, intergenerational communities with shared memory	Transient populations, tourism-driven interactions, erosion of communal belonging

In these transforming urban environments, solastalgia expands beyond an individual emotional response to function as a broader cultural and environmental indicator of displacement. As Albrecht (2006) explains, "solastalgia is the homesickness you have when you are still at home" (p. xx), encapsulating the psychological distress experienced when environments are transformed beyond recognition. Unlike displacement through relocation, solastalgia emerges when "home" itself becomes unfamiliar, rupturing continuity, memory, and identity.

Simultaneously, Rosa's (2018) concept of resonance—defined as a dialogical relationship in which subject and world meet and mutually transform—becomes increasingly diminished in heritage spaces overtaken by tourism and commercialisation. Resonance depends on mutual responsiveness and temporal depth, yet in patrimonial contexts reshaped by market logics and accelerated consumption, the constructed environment ceases to respond to lived experience. Instead, spaces become silent, transactional, and indifferent. Rosa (2018) warns that in a world driven by acceleration and instrumental rationality, "the world becomes silent" (p. 298). Batroun's case exemplifies this condition, as spaces once fostering belonging and identity are reconfigured to serve global markets, privileging visibility over vitality and consumption over connection.

4.3 Interpretation of Key Findings

The comparative analysis of sensory experiences before and after the renovation of Batroun's old patrimonial souk reveals profound disruptions to its multisensory ambiance. These transformations have reshaped how space is navigated, inhabited, and emotionally experienced by long-term residents. The auditory environment, once marked by artisanal sounds and everyday neighbourly exchanges, has been supplanted by a distinctly touristic soundscape characterised by rolling luggage wheels, amplified commercial music, casual tourist chatter, and the ambient noise of outdoor dining. Similarly, the olfactory landscape has undergone a marked shift: familiar scents of home-cooked meals, freshly laundered clothes, and morning coffee shared among neighbours have been replaced by odours of fast food, nargileh smoke, and exhaust from delivery trucks servicing hospitality venues. As a result, spaces formerly reserved for communal interaction—such as morning gatherings—have been eroded.

Applying Thibaud's methodology of "commented city walks" proved critical in uncovering residents' lived sensory connections with the souk. This approach revealed a perceived atmospheric rupture caused by overtourism and a corresponding sense of dislocation. Residents reported feelings of alienation, indicating that the current environment no longer reflects the Batroun they once knew. Traditional rhythms of neighbourhood life—including spontaneous visits, leisurely walks, and rituals such as morning coffee—have been replaced by congestion, tourism waste, and the reduction of communal spaces. Those who resisted converting their homes into rental or commercial properties

described a sense of emotional and physical exhaustion due to the transient occupation of their surroundings.

This evidence reflects a broader emotional and sensory disconnect, whereby attachment to place and spatial familiarity are greatly diminished. The findings resonate with Goetz's concept of urban dislocation, wherein spaces cease to be clearly defined as either "places" or "non-places," instead existing within ongoing processes of creation, transformation, and decay that undermine urban life (Goetz & Nancy, 2018). As residents have remarked, Batroun "is no longer the city we know." Such sentiments parallel Albrecht's (2006) and Martouzet's (2022) articulation of solastalgia, defined as the psychological distress resulting from environmental change while one remains directly connected to home. Collectively, these findings emphasise the need for sensory-based and participatory design strategies in heritage renovation and urban renewal. Designing with and for residents is critical for maintaining sensory, emotional, and cultural bonds to place. Failure to do so risks deepening alienation and eroding urban identity amidst the pressures of mass tourism.

4.4 Comparison with Previous Studies

This study contributes uniquely to heritage and overtourism research by applying Thibaud's (2002, 2013a) "commented city walks" methodology within a patrimonial context undergoing rapid transformation. While the method has previously been employed to examine sensory experiences in modern urban environments—often linked to mobility, gentrification, or transitional urban landscapes (Söderström, 2020)—it has not been widely applied to heritage sites under intense tourism pressure. This research therefore extends the method's scope to a historically layered and culturally significant context such as Batroun's patrimonial souk.

Prior investigations of overtourism in heritage cities such as Venice (Seraphin et al., 2018), Barcelona (Milano et al., 2019), and the Kasbah of Algiers (Djedi & Belakehal, 2023) have generally relied on macro-analytical tools, resident surveys, or socio-economic indicators. While valuable for generating structural and quantitative insights, these approaches often overlook the embodied, sensory, and emotional aspects of how space is experienced and transformed (Augoyard, 2021). In contrast, the "commented city walks" methodology privileges lived, narrated sensory accounts, allowing for the identification of subtle disruptions in spatial and atmospheric perception (Thibaud, 2004; Thibaud, 2011).

The results of this study show that the method is particularly effective in revealing ambiance dislocation, a progressive erosion of the sensory identity of space as experienced by long-term residents. Such ruptures are especially evident in soundscapes—shifting from artisanal rhythms to touristic noise (Thibaud, 2013b)—and smellscapes—transitioning from domestic to commercial odours (Balez, 2024). These sensory disruptions are closely tied to the decline of everyday routines and community rituals, signalling a loss of spatial belonging and emotional continuity.

4.5 Strengths and Limitations

The principal strength of this study lies in its innovative application of Thibaud's (2002, 2013a) "commented city walks" methodology to a patrimonial setting affected by overtourism. This approach generated rich, in-situ insights into residents' sensory and emotional experiences, exposing phenomena such as dislocation and solastalgia that are frequently overlooked in more conventional heritage or tourism research.

Nevertheless, several limitations should be acknowledged. The study's relatively small sample size may not fully capture the diversity of resident experiences. Furthermore, sensory data is inherently subjective, raising questions about its generalisability. However, within the framework of "commented city walks," repetition and redundancy of sensory accounts are considered reliable indicators, thereby strengthening the interpretive value of the findings. Finally, the research was conducted over a limited timeframe, preventing consideration of seasonal or long-term variations. Despite these constraints, the study establishes a robust foundation for expanding the use of sensory and participatory methods in heritage and urban transformation research.

4.6 Implications and Future Directions

The findings underscore the importance of integrating sensory and participatory approaches into heritage site planning, particularly in contexts subject to overtourism. The disruptions identified here demonstrate that sensory environments significantly shape residents' sense of belonging and place identity. Consequently, policymakers, planners, and designers are urged to adopt people-centred strategies that safeguard sensory and cultural continuity alongside economic development.

Future research should extend the application of the "commented city walks" methodology to other patrimonial and urban contexts, particularly across longer timeframes, to account for seasonal variations and longitudinal changes in urban atmospheres. Expanding this methodological approach promises to enrich understandings of how heritage sites are lived, sensed, and transformed under the pressures of tourism and globalisation.

5. Conclusion

The investigation of Batroun's old patrimonial souk demonstrates how overtourism profoundly disrupts the multisensory ambiance of historic environments. Once defined by artisanal sounds, domestic smells, and neighbourly exchanges, the souk has gradually shifted toward a touristic soundscape and olfactory landscape dominated by commercial activity, amplified music, and transient presences. Through the application of Thibaud's "commented city walks," the study captured residents' lived sensory experiences, revealing the extent to which these transformations erode emotional bonds to place, producing feelings of dislocation and solastalgia. These insights reinforce the significance of sensory dimensions in understanding heritage transformation beyond visual and economic metrics.

The findings further highlight that heritage preservation, when driven primarily by aesthetic and commercial logics, risks neglecting the intangible sensory and cultural continuities that sustain community identity. Batroun's case illustrates that preservation strategies cannot be reduced to architectural façades or tourist branding; they must also engage with the affective and atmospheric qualities that shape belonging. By incorporating residents' sensory narratives, urban planning can move toward more inclusive and participatory approaches that mitigate alienation and reinforce local attachment to place. Such strategies are crucial in contexts where tourism simultaneously promises economic revitalisation and generates cultural estrangement.

Nevertheless, this study recognises its limitations. The relatively small and localised sample, coupled with the subjective nature of sensory accounts, constrains the generalisability of findings. While repetition across narratives strengthens the interpretive validity of the results, broader and longitudinal research would be required to capture seasonal shifts and wider community perspectives. Comparative studies across different heritage cities would also allow for a deeper understanding of how varying management models shape urban sensory ambiances.

Future research should therefore expand the methodological use of "commented city walks" and sensory mapping tools to other patrimonial contexts. Integrating these approaches with policy analysis and participatory design frameworks would allow planners and heritage managers to better align conservation strategies with the lived realities of residents. By foregrounding the sensory and emotional layers of heritage experience, this study contributes to urban sensory studies and underscores the necessity of people-centred approaches in addressing the challenges of overtourism. Ultimately, safeguarding the multisensory identity of places like Batroun's souk is not only about conserving history, but also about sustaining the everyday atmospheres that make heritage meaningful and alive.

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Conflicts of Interest
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References

Abbasian, S., Onn, G., & Arnautovic, D. (2020). Overtourism in Dubrovnik in the eyes of local tourism employees: A qualitative study. *Cogent Social Sciences*, *6*(1). https://doi.org/10.1080/23311886.2020.1775944

Albrecht, G. A. (2006). *Solastalgia: Environmental distress as solastalgia*. *Alternatives Journal*, *32*(4–5), 34–36.

Albrecht, G. A. (2020). Negating Solastalgia: An Emotional Revolution from the Anthropocene to the Symbiocene. American Imago, 77(1), 9–30. https://doi.org/10.1353/aim.2020.0001

Álvarez Sousa, A. (2020). La percepción de los problemas del overtourism en Barcelona. RECERCA. Revista de Pensament i Anàlisi, 26(1), 59–92. https://doi.org/10.6035/recerca.2021.26.1.4

Amphoux, P. (1993). *La valse des ambiances [The waltz of ambiances]*. In *Évolution des modes de vie et architectures du logement* (No. 42, pp. 83–88). Paris: Éditions PUCA.

Amphoux, P., Thibaud, J.-P., & Chelkoff, G. (Eds.). (2004). *Ambiances en débats [Ambiances in debate]*. Bernin, France: À la Croisée.

Augoyard, J.-F. (2006). L'expérience esthétique ordinaire de l'architecture : Parcours en espace public [The ordinary aesthetic experience of architecture : A journey through public space]. In É. Bajolet, M.-F. Mattéi, & J.-M. Rennes (Eds.), *Quatre ans de recherche urbaine 2001–2004. Volume I* (pp. 35–40). Tours, France: Presses universitaires François-Rabelais. https://doi.org/10.4000/books.pufr.1093

Balez, S. (2024). *Fragrances architecturales : L'expérience olfactive des lieux [Architectural fragrances: The olfactory experience of places]*. Paris, France: Hermann.

Bei, G., & Celata, F. (2023). Challenges and effects of short-term rentals regulation: A counterfactual assessment of European cities. *Annals of Tourism Research*, *101*, Article 103605. https://doi.org/10.1016/j.annals.2023.103605

Bertocchi, D., & Camatti, N. (2022). Tourism in Venice: Mapping overtourism and exploring solutions. In J. van der Borg (*Ed.*), *A Research Agenda for Urban Tourism* (pp. 109–125). Edward Elgar Publishing. https://doi.org/10.4337/9781789907407.00013

Bertocchi, D., Camatti, N., Giove, S., & van der Borg, J. (2020). *Venice and overtourism: Simulating sustainable development scenarios through a tourism carrying capacity model. Sustainability, 12*(2), 512. https://doi.org/10.3390/su12020512

Celata, F., & Romano, A. (2022). Overtourism and online short-term rental platforms in Italian cities. *Journal of Sustainable Tourism*, *30*(5), 1020–1039. https://doi.org/10.1080/09669582.2020.1788568

Chang, D. (2022). Review of *Albrecht, "Earth Emotions: New Words for a New World"*. *The Trumpeter*, *38*(1), 130–136. https://doi.org/10.7202/1095397ar

Chelkoff, G., & Thibaud, J.-P. (1992). L'espace public, modes sensibles : Le regard sur la ville [Public space, sensitive modes: The view of the city]. *Les Annales de La Recherche Urbaine*, *57*(1). https://doi.org/10.3406/aru.1992.1694

Degen, M. M., & Rose, G. (2012). The Sensory Experiencing of Urban Design: The Role of Walking and Perceptual Memory. *Urban Studies*, *49*(15), 3271–3287. https://doi.org/10.1177/0042098012440463

Djedi, H., & Belakehal, A. (2023). The heritage atmosphere to the test of appropriation: Case of the Kasbah of Algiers. *Bulletin de la Société Géographique de Liège, 80,* 285–308. https://doi.org/10.25518/0770-7576.7009

Ghaderi, Z., Mat Som, A. P., & Henderson, J. C. (2012). Tourism crises and island destinations: Experiences in Penang, Malaysia. *Tourism Management Perspectives*, *2–3*, 79–84. https://doi.org/10.1016/j.tmp.2012.03.006

Goetz, B., & Nancy, J.-Luc. (2018). *La dislocation : architecture et philosophie [Dislocation: Architecture and Philosophy]*. Éditions Verdier.

Liu, L. (2024). "Feelings are strong here": A proximate reading of solastalgia in *The Last Pulse*. *Journal of Australian Studies*, *48*(1), 121–134. https://doi.org/10.1080/14443058.2023.2287473

Manola, T. (2020). Une invitation à (re)penser les enjeux écologiques par le sensible [An invitation to (re)think ecological issues through sensitivity]. *Diversité*, (198), 121–126. https://doi.org/10.3406/diver.2020.4907

Margier, A. (2020). Review of *Jean-Paul Thibaud, En quête d'ambiances. Éprouver la ville en passant [In search of atmospheres: Experiencing the city in passing]*, Genève, MétisPresses, 2015, 325 p. *Espaces et Sociétés, 179*(4), 209–212. https://doi.org/10.3917/esp.179.0209

Martouzet, D. (2022). Review of *Les émotions de la terre. Des nouveaux mots pour un nouveau monde [Earth's emotions: New words for a new world]*, by G. Albrecht (C. Smith, Trans.). Paris: Les liens qui libèrent, 2020 [2019], 370 p. *Nouvelles Perspectives en Sciences Sociales, 17*(2), 679–683. https://doi.org/10.7202/1092787ar

Mazzamuto, M., & Picone, M. (2022). The commodification dilemma: Tourism pressure and heritage conservation in Barcelona. *Societies*, *12*(4), Article 111. https://doi.org/10.3390/soc12040111

Milano, C., Novelli, M., & Cheer, J. M. (2019). Overtourism and Tourismphobia: A Journey Through Four Decades of Tourism Development, Planning and Local Concerns. *Tourism Planning & Development*, *16*(4), 353–357. https://doi.org/10.1080/21568316.2019.1599604

Rosa, H. (2018). *Résonance : Une sociologie de la relation au monde [Resonance: A sociology of the relationship to the world]* (S. Zilberfarb & S. Raquillet, Trans.). Paris, France: La Découverte.

Ruby, C. (2021). Review of *Didier Tallagrand, Jean-Paul Thibaud & Nicolas Tixier (Eds.), L'Usage des ambiances. Une épreuve sensible des situations [The use of ambiances: A sensitive test of situations]* (Paris: Hermann, coll. Les colloques Cerisy, 2021, 495 pp.). *Questions de communication, 40*, 568–570. https://doi.org/10.4000/questionsdecommunication.27734

Sadiq, A. S., Elghonaimy, I. H., & Asvar, M. (2025). Searching in phenomenology theory in practice: A multisensory approach to architecture in historical places. *Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism (ICCAUA)*, *8*(1), 980–996. https://doi.org/10.38027/ICCAUA2025EN0139

Salamè-Sarkis, H. (2009). *Histoire de Batroun* [History of Batroun]. Official website of the City of Batroun. Retrieved from https://www.academia.edu/download/85875730/Histoire_De_Batroun.pdf

Sanlaville, P. (1978). *Étude géomorphologique de la région littorale du Liban [Geomorphological study of the coastal region of Lebanon]* (3 vols.). Publications de l'Université Libanaise, Section des Études Géographiques. Beirut, Lebanon.

Seraphin, H., Fotiadis, A., & Gowreesunkar, V. (2024). Editorial: Liveable cities for locals and visitors: challenges and opportunities for destinations. *International Journal of Tourism Cities*, *10*(4), 1185–1191. https://doi.org/10.1108/IJTC-12-2024-305

Seraphin, H., Sheeran, P., & Pilato, M. (2018). Over-tourism and the fall of Venice as a destination. *Journal of Destination Marketing & Management*, *9*, 374–376. https://doi.org/10.1016/j.jdmm.2018.01.011

Söderström, O. (2020). Review of *Jean-Paul Thibaud. 2015. En quête d'ambiances : Éprouver la ville en passant [In search of atmospheres: Experiencing the city while passing by]*. *Ambiances.* https://doi.org/10.4000/ambiances.689

Thibaud, J.-P. (2002). Une approche des ambiances urbaines : Le parcours commenté [An approach to urban atmospheres: The guided tour]. In *Espaces publics et cultures urbaines*. Lyon, France: CERTU (Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques).

Thibaud, J.-P. (2004). Une approche pragmatique des ambiances urbaines [A pragmatic approach to urban atmospheres]. In P. Amphoux, J.-P. Thibaud, & G. Chelkoff (Eds.), *Ambiances en débats* (pp. 145–161). Bernin, France: À la Croisée. https://hal.science/hal-01879806v1

Thibaud, J.-P. (2011). The sensory fabric of urban ambiances. *The Senses and Society, 6*(2), 203–215. https://doi.org/10.2752/174589311X12961584845846

Thibaud, J.-P. (2013a). Commented city walks. *Wi: Journal of Mobile Culture*, *7*(1), 1–32. https://hal.science/hal-00980752

Thibaud, J.-P. (2013b). Music, sound and space: Transformations of public and private experience. *SoundEffects: An Interdisciplinary Journal of Sound and Sound Experience*, *3*(3), 79–89. https://doi.org/10.7146/se.v3i3.18446

Thibaud, J.-P. (2015). The backstage of urban ambiances: When atmospheres pervade everyday experience. Emotion, Space and Society, 15, 39–46. https://doi.org/10.1016/j.emospa.2014.07.001

Viret, J. (2005). Les « murs de mer » de la côte levantine [The "sea walls" of the Levantine coast]. *Méditerranée, 104,* 15–24. https://doi.org/10.4000/mediterranee.2052

Zacca, D. T. (2023). Experiencing spaces and places through human senses with the presence of nature. *Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism-ICCAUA*, *6*(1), 496–505. https://doi.org/10.38027/iccaua2023en0325

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Heritage-Led Urban Regeneration in Rome: Recontextualising the Campo Trincerato through Network Strategies

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ABSTRACT

Contemporary peri-urban landscapes face fragmentation, marginalisation, and the neglect of widespread cultural heritage. This article explores heritage-led regeneration as a strategic framework to revitalise marginal areas by focusing on the Campo Trincerato in Rome, a system of fifteen forts and three batteries constructed between 1877 and 1891. Despite being largely abandoned, these fortifications remain structurally intact and spatially coherent, offering opportunities for reconceptualisation as infrastructural nodes within broader urban and territorial networks. The study adopts a multi-scalar methodological approach, combining architectural analysis of typological and structural features with contextual investigation of accessibility, ownership, and planning frameworks. Results reveal that while the Campo Trincerato maintains its systemic coherence, institutional fragmentation and limited reuse represent major barriers to regeneration. Nevertheless, its configuration as a defensive ring highlights potential to establish cultural polarities, ecological connections, and community-driven functions in Rome's suburban areas. The findings underscore the significance of integrating cultural heritage into contemporary regeneration strategies, transforming neglected military infrastructure into catalysts for urban identity, social cohesion, and sustainable development.

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Highlights:

- Heritage-led regeneration influences social cohesion and territorial identity in marginal peri-urban landscapes.
- Institutional fragmentation constrains the reuse potential of military fortifications as cultural infrastructure.
- Multi-scalar methodological analysis enhances recognition and regeneration potential of 19th–20th century military heritage.
- Network-based recontextualisation strategies strengthen urban regeneration outcomes by integrating cultural, social, and environmental dimensions.

Contribution to the field statement:

This research provides actionable insights for policy and planning by demonstrating how heritage-led regeneration of Rome's Campo Trincerato can address institutional fragmentation and socio-economic marginalisation. By reframing military heritage as infrastructural networks, it offers a replicable approach to integrate cultural assets into urban policies, strengthening identity, cohesion, and sustainable territorial development.

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1. Introduction

Urban regeneration has become a critical policy imperative as cities worldwide grapple with the decline of peripheral areas characterised by economic disinvestment, social exclusion, and physical deterioration (Couch, 2003; Roberts et al., 2017). In many metropolitan contexts, peripheral and peri-urban territories have increasingly emerged as fragile landscapes where structural inequalities converge, producing fragmented settlement fabrics and systemic marginalisation. Over recent decades, regeneration strategies have evolved from an initial emphasis on physical renewal towards integrated models that attempt to incorporate social, cultural, and economic dimensions (Tallon, 2020). Despite this shift, achieving sustainable transformation in marginalised areas remains elusive (Scaffidi et al., 2025).

Contemporary scholarship identifies several persistent obstacles that impede long-term regeneration outcomes. Among the most critical is the difficulty of generating lasting economic opportunities in peripheral locations where structural disadvantage and spatial isolation prevail (Fainstein, 2014). Furthermore, regeneration processes often carry the risk of gentrification, which can displace existing communities and exacerbate inequality (Davidson & Lees, 2010). At the same time, fragmented communities struggle with weakened social ties, making the rebuilding of cohesion and collective identity particularly challenging (Amin, 2002). Together, these factors illustrate the need for regeneration approaches that transcend singular interventions, instead addressing the multidimensional nature of urban marginality while leveraging existing territorial and cultural assets as catalysts for inclusive transformation. The marginality of contemporary peri-urban areas increasingly spans economic, cultural, and environmental dimensions, producing conditions of pervasive insecurity and disintegration that undermine community attachment and identity ties to place (Ricci, 2019). These areas often function as liminal spaces, marked by progressive abandonment, physical deterioration, and socio-economic fragmentation. Consequently, urban regeneration in these contexts is not only a question of spatial reconfiguration but also of cultural and social reintegration.

In this debate, heritage-led regeneration has emerged as a promising strategy for repositioning cultural assets as central drivers of territorial revitalisation (Evans, 2005; Pendlebury et al., 2004; Ricci et al., 2024). This approach proposes that heritage is not simply an object of preservation but a dynamic resource capable of generating economic, social, and cultural value. A growing body of research demonstrates the multifaceted potential of heritage in this regard. Economically, cultural assets can stimulate opportunities through cultural tourism and creative industries (Richards, 2011), contributing to new local production chains while counteracting processes of homologation and delocalisation typical of the globalised economy. Socially, heritage strengthens community identity (Mediani, 2025) and builds social capital by integrating historical dimensions with contemporary aspirations, creating new platforms for dialogue, cooperation, and collective agency in fragmented contexts. Spatially, heritage-led interventions can reshape the urban fabric by producing high-quality public spaces, enhancing liveability, and mending fractures in the settlement pattern. In this way, heritage helps to redefine urban hierarchies and supports the emergence of more balanced polycentric development models.

Yet, despite its promise, heritage-led regeneration literature reveals persistent gaps and contradictions. First, most studies concentrate on high-profile or marketable assets—such as historic centres, cathedrals, or former industrial complexes—while overlooking more challenging heritage types (Ashworth & Tunbridge, 2017; Pendlebury, 2013). These overlooked categories include large-scale infrastructures, modernist ensembles, and particularly military heritage, which often lack obvious cultural appeal or economic potential. Second, existing research tends to analyse heritage in isolation, focusing on individual sites rather than examining broader systemic or networked approaches (Högberg, 2016). This fragmentation has limited understanding of how distributed heritage systems might be leveraged as territorial infrastructures for regeneration.

Military heritage, in particular, has received little sustained attention in urban regeneration debates. Historically designed for concealment, defence, and restricted use, these sites rarely align with conventional cultural heritage paradigms. Their transition into civilian life is complicated by legal

complexities, environmental remediation costs, and uncertainties regarding adaptive reuse (Douthwaite et al., 2024; Bagaeen, 2006). Moreover, while military fortifications were often conceived as interconnected networks with spatial and functional coherence, they are generally approached through piecemeal, site-specific interventions that neglect their systemic character. This disconnect between historical logic and contemporary planning undermines their potential role as structural components in urban transformation. Addressing these gaps requires a conceptual and methodological shift: from perceiving heritage as isolated monuments to recognising it as networked infrastructure embedded within urban, social, and territorial systems. By adopting this perspective, heritage-led regeneration can evolve into a more holistic and transformative strategy, capable of integrating conservation imperatives with socio-economic and spatial development objectives. The challenge lies not only in valorising difficult heritage types but also in situating them within broader debates on marginality, identity, and urban resilience.

This study contributes to these debates by focusing on Rome's *Campo Trincerato*, a nineteenth-century defensive system that illustrates both the limitations and potential of heritage-led regeneration in peripheral urban contexts. By framing the Campo Trincerato as a coherent infrastructural network rather than as isolated artefacts, the research demonstrates how heritage can be repositioned as a catalyst for urban regeneration, social cohesion, and territorial identity, thereby complicating existing narratives and offering a new pathway for heritage-informed urban policy.

2. Modern military fortifications and suburban landscapes

Throughout history, fortifications have played a central role in shaping the cultural and physical landscapes of cities and territories. From antiquity to the contemporary era, societies have constructed systems of territorial delimitation—urban walls, roads, hydraulic networks, and Roman *centuriation*—as instruments to measure, organise, and protect human space (Soja, 2011). Within this broader lineage, fortifications represented not only defensive mechanisms but also markers of identity and symbolic boundaries between the "inside" and the "outside." The interior space embodied safety, stability, and community, while the exterior signified uncertainty, conflict, and danger. These dualistic representations were continually reshaped in response to evolving military technologies and political dynamics. The nineteenth and twentieth centuries witnessed a dramatic reconfiguration of these traditions. Advances in artillery—particularly rifled guns and explosive projectiles—rendered traditional bastion systems obsolete (Hogg, 1977; Hughes, 1991). In their place, entrenched camps were constructed as complex systems of strategically spaced forts designed for mutual coverage through crossfire. These defensive networks emphasised passive protection, employing reinforced earthworks and subterranean casemates to absorb explosive impacts. Despite their technological sophistication and strategic value, such systems faced structural obsolescence as military doctrines shifted, maintenance costs rose, and geopolitical conditions evolved. By the late nineteenth century, many were gradually decommissioned or abandoned.

Concurrently, modern urbanisation processes reshaped territorial boundaries, dissolving the once-clear demarcations between core and periphery, urban and rural. The expansion of metropolitan areas systematically transcended historical limits—physical, administrative, and cultural—creating diffuse urban forms that eroded the visibility and coherence of historic defensive landscapes (Soja, 2011). As a result, many fortification systems became absorbed into expanding suburban fabrics, losing their original functionality while retaining their spatial imprint. These processes have been particularly evident in European cities, where abandoned military heritage often persists as hidden or forgotten structures within the urban periphery (Colavitti et al., 2021).

Today, nineteenth- and twentieth-century military fortifications remain underexplored in regeneration scholarship. They occupy liminal positions: too recent to be valorised as monumental heritage, too obsolete to be easily adapted, and too complex to be dismissed outright. Their marginalisation within both urban development and heritage policy creates critical gaps in the literature, particularly concerning their potential to serve as cultural infrastructure for contemporary regeneration strategies.

2.1 Reconceptualizing military heritage: from barriers to territorial infrastructure

In their spatial complexity, fortification systems transcend conventional heritage categories. They can be conceptualised not only as architectural artefacts but also as integral components of territorial ontology (Pepe & Vitali, 2022). Their significance extends beyond their original defensive function, embodying a dual epistemological value.

First, they represent an invaluable semiotic archive of territorial signs, deliberately inscribed by past generations as tangible expressions of their spatial, technological, and organisational conceptions. As stratified palimpsests, they document the diachronic evolution of human–geographical relationships, providing rare insights into shifting paradigms of urban defence, control, and identity.

Second, these systems retain morphogenetic capacities, shaping settlement expansion and territorial organisation long after their military function has lapsed. The linear and nodal logic of fortifications—rings, axes, and interlinked strongholds—continues to condition urban growth patterns and infrastructural alignments. Even in contexts of socio-economic transformation, their regulatory influence persists, anchoring development trajectories and preserving latent potential for future reinterpretation.

This dual value requires scholars and practitioners to rethink fortifications not as obsolete relics but as enduring infrastructural frameworks. Reconceptualisation involves moving from an understanding of these sites as barriers—isolated, concealed, and militarised—to recognising them as territorial infrastructures capable of supporting regeneration. When reactivated, they can function as ecological connectors, cultural polarities, and socio-spatial anchors within fragmented peri-urban landscapes.

The transition from historical to contemporary urban models has produced profound disjunctions in how fortifications are treated in planning policies. Typically, intervention strategies operate through sectoral and often conflicting logics: heritage conservation remains isolated from urban development, while social policies rarely integrate cultural or spatial dimensions. This fragmented approach reinforces exclusion, preventing integrated strategies that could reconnect the multiple temporalities embedded in contemporary territories.

Military heritage exemplifies these challenges. Conceived as defensive barriers, these structures were deliberately segregated from civic life. Their subsequent obsolescence reinforced perceptions of isolation, leaving them vulnerable to neglect or piecemeal redevelopment (Bagaeen, 2006). Yet their systemic organisation—as interconnected belts or networks—suggests untapped potential. Reconceptualising fortifications as integrated systems rather than isolated problems enables their transformation into active elements of regeneration strategies.

By reframing these artefacts as infrastructural networks, it becomes possible to overcome the dichotomy between conservation and development. Instead of viewing them as static constraints, they can be mobilised as dynamic frameworks that mediate between heritage protection and urban innovation. This approach aligns with contemporary calls for integrative governance and holistic regeneration strategies capable of addressing multi-scalar urban challenges (Roberts et al., 2017; Pendlebury, 2013).

2.2 Case study selection: the Campo Trincerato of Rome

Rome's *Campo Trincerato* constitutes one of the most extensive and coherent defensive systems built in late nineteenth-century Europe. Constructed between 1877 and 1891, it was designed as a permanent entrenched camp to safeguard the newly proclaimed capital of unified Italy. At the time, Rome's defences relied primarily on the ancient Aurelian Walls, which were inadequate against modern artillery, prompting the construction of a new fortified belt (Fara, 1985; Cajano, 2006, 2022).

The system consisted of fifteen forts and three batteries, strategically distributed to form a defensive ring approximately 40 kilometres in circumference and positioned about 6 kilometres from the city centre (Figure 1). This infrastructural belt not only provided military coverage but also acted as a territorial device of considerable importance, regulating access routes and shaping the peri-urban landscape (Fara, 1985). The names of the forts were derived largely from their locations or from the ancient consular roads they were intended to protect, underscoring their integration into the pre-existing geographical and historical framework of Rome. Their consistent siting along primary routes

and intermediate heights allowed for coordinated territorial control, with each fort placed at an almost regular distance from the others, thereby ensuring a systematic and interdependent network of defence. The strategic positioning of the Campo Trincerato highlighted its dual role: militarily, it functioned as a shield capable of mutual crossfire protection; territorially, it embodied a ring-like infrastructural form that mirrored Rome's historical patterns of urban growth. This duality explains why, even after its decommissioning in the early twentieth century, the system has retained a latent influence on the morphology of the city.

In this regard, the Campo Trincerato offers a particularly valuable case study. Its completeness as a defensive network, its strong territorial imprint, and its current state of marginalisation together provide a critical testing ground for rethinking heritage-led regeneration. Analysing its systemic characteristics allows for the exploration of how military heritage can be recontextualised from obsolete barriers into infrastructural networks capable of supporting cultural, social, and ecological renewal in peri-urban areas.

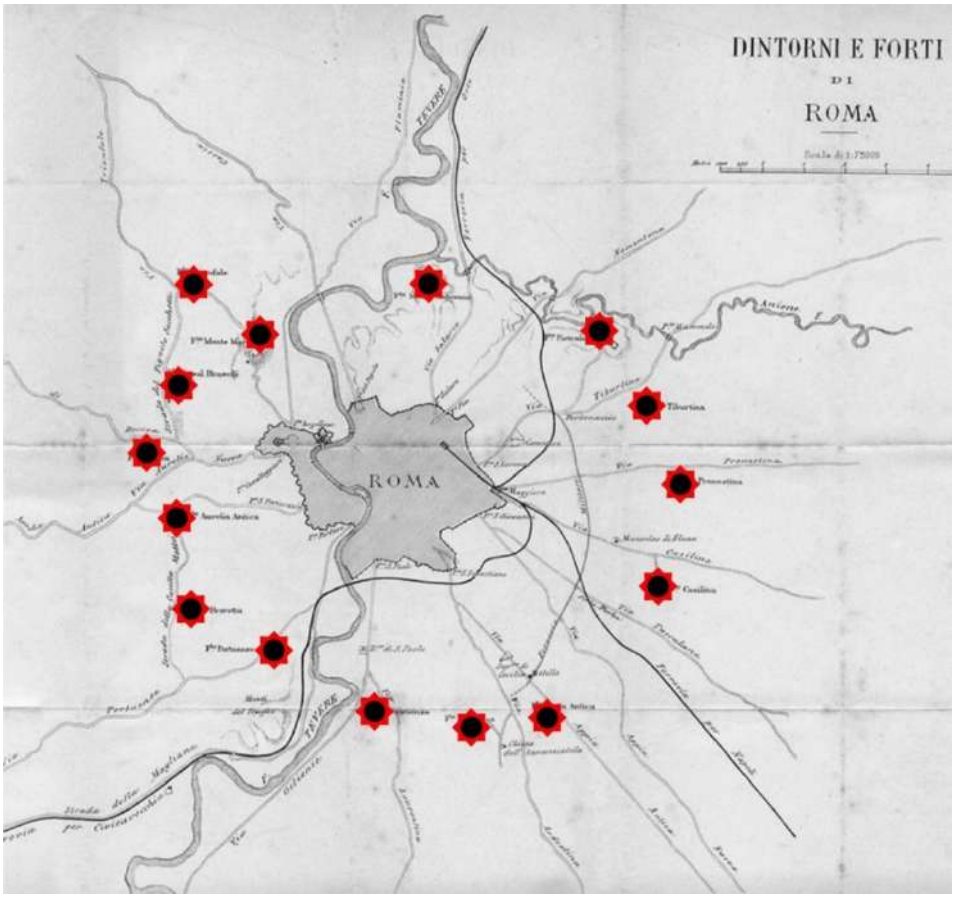

Figure 1. The forts of Rome in 1883.
Source: *Elaboration by the authors from Rerum Romanarum, Storia dei Forti di Roma.*

Today, however, the Campo Trincerato's forts are embedded within the suburban fabric of Rome, reflecting highly heterogeneous conditions of ownership, conservation, and reuse. Some sites remain under the control of military authorities, others have been transferred to municipal ownership but remain abandoned, while a few have been adapted for cultural or community purposes. This fragmented situation exemplifies the broader challenges facing European military heritage: despite their architectural coherence and historical significance, such systems often suffer from institutional fragmentation, neglect, and limited integration into contemporary regeneration strategies (Rossi et al., 2009).

3. Methods

The methodological framework adopted in this research is grounded in a multi-scalar approach to the knowledge and design of modern military fortifications. Given their complexity and systemic nature, the analysis was developed at three distinct but interconnected levels: the individual asset (architectural scale), the local settlement and landscape context, and the urban–territorial level. This hierarchical structure recognises that fortifications are not isolated artefacts but nodes within broader spatial and cultural systems.

3.1 Theoretical orientation

The research contributes to ongoing debates in heritage and urban studies by proposing "heritage networks" as a methodological alternative to site-specific approaches. Rather than focusing solely on the preservation of single forts, the study considers the *Campo Trincerato* as a distributed system with infrastructural coherence. This theoretical contribution emphasises that historically integrated systems, such as nineteenth-century military belts, should be reconceptualised as territorial infrastructures for regeneration. Such a shift aligns with calls in the literature to bridge conservation with socio-economic transformation, positioning heritage as a dynamic force within contemporary regeneration strategies (Pendlebury et al., 2004; Galuzzi & Carollo, 2021).

3.2 Analytical framework

The methodology combined systematic documentation with comparative contextual analysis in order to capture the multifaceted character of the *Campo Trincerato*. Data were collected on the physical, constructional, functional, and ownership characteristics of each fort. This micro-level information was then cross-analysed with local (settlement and landscape) and metropolitan scales to identify network-based models and potential synergies for regeneration.

A comprehensive analytical framework was developed to evaluate the system across two main scales:

- **Architectural scale**:
  - ✓ *Typological and structural characteristics* (physical dimension) were documented to understand the evolution of late-nineteenth-century military architecture, including materials, design typologies, and adaptation potential.
  - ✓ *Legal and managerial evolution* (administrative dimension) was traced through historical decrees, ownership changes, and governance structures, highlighting institutional fragmentation and barriers to reuse.
- **Urban–territorial scale**:
  - ✓ *Localisation, contextualisation, and accessibility* (physical dimension) were analysed through GIS mapping, settlement integration studies, and transport connectivity assessments to identify spatial patterns.
  - ✓ *Framing in town planning instruments* (administrative dimension) involved a review of regulatory plans (1931, 1962, 2008) to trace shifting policy approaches and their implications for regeneration.

This dual-dimension matrix (Figure 2) provided a tool for integrating physical—spatial evidence with institutional—regulatory contexts, ensuring a holistic evaluation of both tangible and governance-related factors.

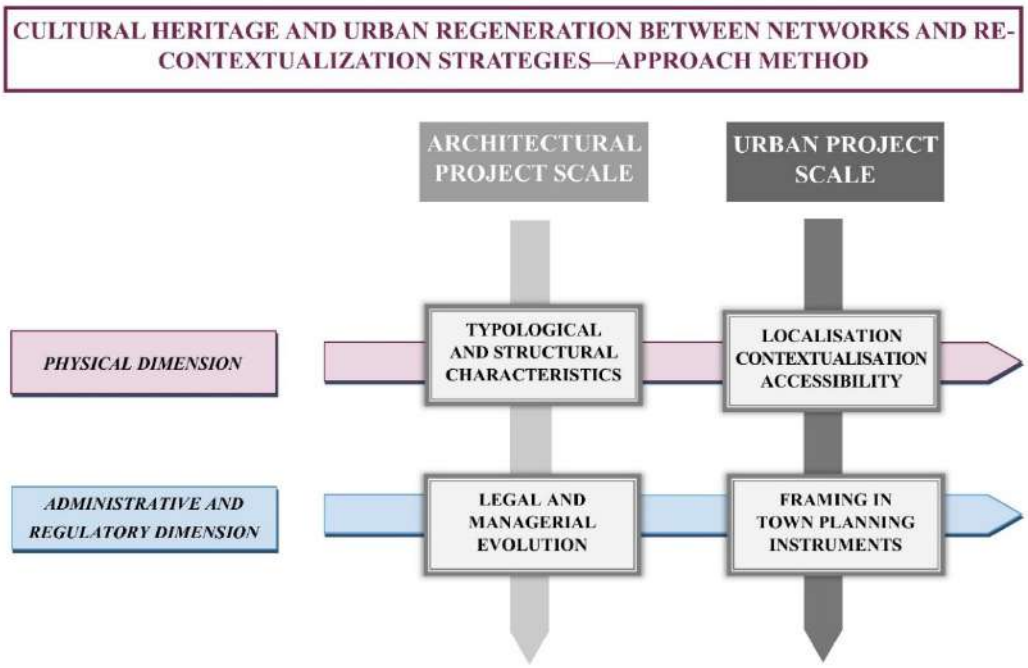

Figure 2. Structure of the study methods.

3.3 Participatory and policy-oriented dimensions

Beyond documentation, the methodology sought to move from passive conservation towards integrated and participatory regeneration. Community involvement and stakeholder dialogue were considered essential for reconnecting military heritage with contemporary urban identity. The approach is ambitious in scope: on one hand, it provides criteria and assessments for administrations tasked with heritage and planning policy, enhancing the recognition of fortifications' *morphogenetic influence* on urban growth; on the other, it outlines practical pathways for involving local communities in regeneration processes, thereby strengthening territorial identity and collective memory (Galuzzi & Carollo, 2021).

3.4 Replicability and transferability

The strength of this methodological approach lies in its replicability for other European contexts. By considering fortifications as territorial phenomena—complex systems composed of interdependent artefacts and relationships—it establishes a template that can be adapted to different historical and geographical settings. The framework not only supports Rome's *Campo Trincerato* but also offers insights into similar military belts across Europe, where conservation challenges intersect with socio-economic and cultural opportunities.

4. Results

As part of the research work, the four aspects that contribute to defining criteria and guidelines for the valorisation and regeneration of the fortification system and to configuring territorial and landscape networks were explored in depth.

4.1 Typological and structural characteristics

Forts have a predominantly trapezoidal and semi-hypogeal structure, with specific architectural and functional characteristics:

- a 'head front' (side facing outwards) between 100 and 200 metres long, garrisoned by numerous artillery posts.
- two oblique sides, also garrisoned by artillery batteries.
- a 'ravine front' (long side) facing the centre of the town, where the entrance to the fort itself was located.

The centre of the main front, as well as all the corners and the entrance gate, were protected by caponiers (semi-circular emplacements where short-range artillery batteries and machine guns were placed).
The few differences between the various forts were, for the most part, related to the characteristics of the territory on which each was erected: for some, the angle of the oblique sides was accentuated or diminished, for others a straight ravine front was preferred, for others still it was structured with a slightly concave 'V' shape ('tenagliato'); in some cases the access was moved to one side of the ravine front rather than to the centre of it; some forts had the ravine front protected by external embankments, others, where the ground did not allow it, had to be protected by armed caponiers, just as some forts had external Carnot walls manned by riflemen, while others had walls uncovered to possible enemy assaults (Chiri et al., 2021; M.G., 2021). These typological and structural characteristics testify to the evolution of 19th-century military architecture in response to innovations in artillery and warfare techniques, making the forts a heritage of considerable interest not only historically but also technologically and constructively (Figure 3).

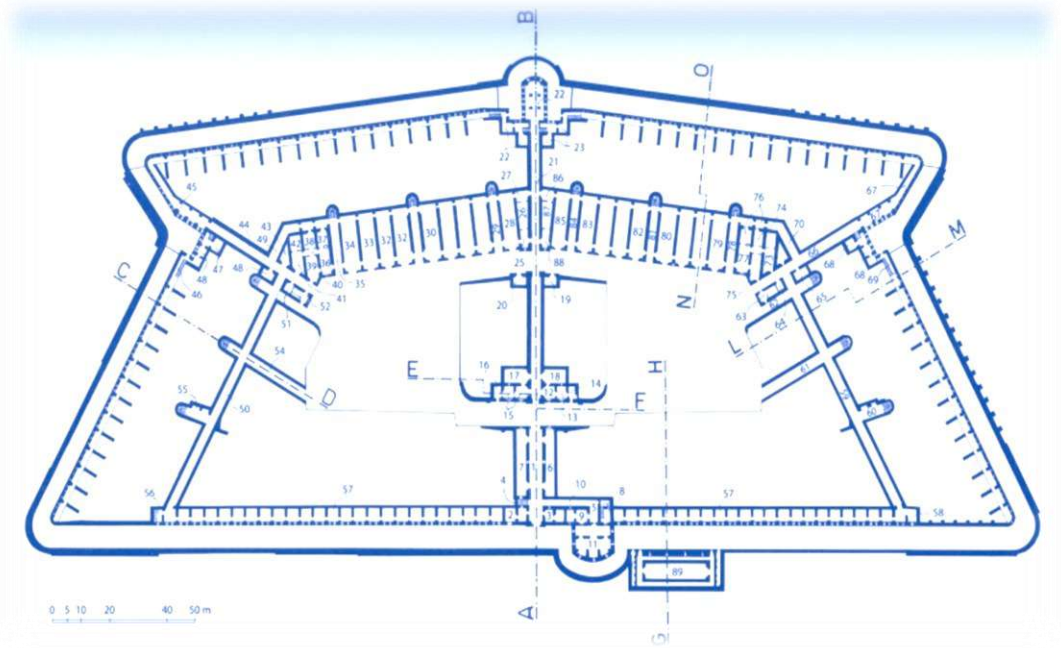

Figure 3. Plan of Forte Prenestino.
Source: *Elaboration by the authors from Rerum Romanarum, Storia dei Forti di Roma.*

4.2 Legal and management evolution

The process of decommissioning the Campo Trincerato formally began in 1919, when a Royal Decree officially removed the capital's fortifications from the list of State fortifications (Fara, 1985). This measure marked the beginning of a long and complex process of transformation in the use and management of these structures.
In the period following its decommissioning, Rome's Campo Trincerato went from being used exclusively for military purposes to being progressively integrated into the urban fabric with a prevalent use as a public green area, sanctioned by urban planning instruments. However, the complex process of clearing and recovery has meant that this transformation is still in progress, with several areas awaiting definitive redevelopment and enhancement in respect of their historical and landscape importance. The presence of landscape and, potentially, historical-artistic constraints represent an important legal instrument for the protection of this heritage (Table 1).
Some forts and areas of the Campo Trincerato were reused by the Ministry of War as warehouses and barracks, maintaining a military destination, albeit different. Gradually, with the urban expansion of Rome, some areas of Campo Trincerato were incorporated into the city fabric, losing their original isolated function. The slow process of removal from state ownership and restoration only began in

1962, also in implementation of the General Regulatory Plan provisions. The transfer of ownership from the State (Ministry of Defence or Agenzia del Demanio) to Roma Capitale was often long and complex, also due to the costs of clearance and recovery of the structures, often in a state of abandonment or partially buried, which represented a brake on their redevelopment.
The complexity of bureaucratic procedures and the fragmentation of institutional competences have further slowed down the redevelopment of this heritage.

Table 1: Ownership and state of law of the forts of Rome.

Forts of Rome	Municipality	Current Use	Restriction	Availability of the property
Monte Mario	I	Italian Army—8th Infrastructure Department	D.M. 06.08.2008	In a state of abandonment
Trionfale	XIV	Italian Public Property Agency—Ex-Barracks "Arnaldo Ulivelli"	D.M. c23.11-2007	Being delivered to Rome Capital, not available
Braschi	XIV	Italian Army—Barracks "Casal Forte Braschi—Nicola Calipari"	D.M. 06.08.2008	Military area
Boccea	XIII	Italian Public Property Agency—Ex-Military Prison Forte Boccea	D.M. 28.04.2008	Being delivered to Rome Capital, hosts cultural events and exhibitions
Aurelia Antica	XII	Italian Finance Police—Barracks "Cefalonia Corfu"	D.M. 11.08.2008	Military area
Bravetta	XII	Italian Public Property Agency	D.M. 28.04.2008	Being delivered to Rome Capital, occasionally open to the public
Portuense	XI	Italian Public Property Agency	D.M. 13.07.1984	Being delivered to Rome Capital, open to the public
Ostiense	IX	Italian Police—Barracks "Forte Ostiense"	D.M. 15.11.1975	Military area
Ardeatina	VIII	Italian Public Property Agency	D.M. 28.04.2008	Being delivered to Rome Capital, not available
Appia Antica	VIII	Italian Air Force—Re.S.I.A.	D.M. 05.08.2008	Military area
Casilina	V	Italian Air Force—Ex-Air Base Centocelle "Francesco Baracca"	D.M. 23.02.1984	Military area (in a state of abandonment)
Prenestina	V	Italian Public Property Agency—CSOA Forte Prenestino	D.M. 28.04.2008	occupied and self-managed social centre
Tiburtina	IV	Italian Army—Barracks "Albanese Ruffo"	D.M. 29.04.2004	Military area
Pietralata	IV	Italian Army—Barracks "Antonio Gandin"	D.M. 23.04.2012	Military area
Monte Antenne	II	Rome Capital, IT	D.M. 06.8.2008	Being delivered to Rome Capital, not available

Some forts are still owned by the State and used by the Ministry of Defence, but the majority, even though they have been handed over to Rome's capital, are unused and in a state of neglect and degradation.
This condition of marginality of the fortified heritage reflects and at the same time amplifies the socio-economic problems of the peripheral areas in which they are located, creating a vicious circle of neglect and deterioration that involves both the physical structures and the surrounding social fabric.
Gradually incorporated into the urban fabric, forts have taken on different functions or have been temporarily abandoned:

- among the forts currently or partially abandoned are Monte Mario, Casilina;

- forts handed over to Roma Capitale include Trionfale, Boccea, Bravetta, Portuense, Ardeatina, Monte Antenne;
- forts used as barracks include Braschi, Aurelia Antica, Ostiense, Tiburtina, Pietralata;
- among the forts used for Air Force activities are Appia Antica, Casilina;
- among the forts, the only one to have assumed the function of a social centre, as a place for sociability, meeting, recreation and organisation of collective time, and for the exchange of ideas, visions, energy and knowledge, is Forte Prenestino.

4.3 Localization, contextualization, accessibility

A second aspect concerned the study of the insertion of the forts into the urban context (Rossi et al., 2009). The extent, altitude of each fort, type of urban context and accessibility were considered. The location and main construction characteristics of the structure were also analysed (Table 2).

Table 2: Localization, contextualization, accessibility.

Forts of Rome	Surface Area (ha)	Altitude *(a.s.l.)*	Overhead photo	Context	Urban accessibility	Building structure
Monte Mario	8.4	145 m. a.s.l.		urban park	private road transport	hypogeal
Trionfale	21.0	126 m. a.s.l.		urban landscape	metropolitan railway network	semi-hypogeal
Braschi	8.2	98 m. a.s.l.		urban landscape	private road transport	semi-hypogeal with moat
Boccea	7.3	89 m. a.s.l.		urban landscape	Metropolitan network	semi-hypogeal with moat
Aurelia Antica	5.7	85 m. a.s.l.		urban landscape	private road transport	semi-hypogeal with moat
Bravetta	10.6	78 m. a.s.l.		urban park	public transport on separate site	hypogeal with moat
Portuense	5.2	62 m. a.s.l.		urban landscape	private road transport	hypogeal with moat
Ostiense	8.8	36 m. a.s.l.		urban park	Metropolitan network	superficial

Ardeatina	11.2	54 m. a.s.l.		urban park	private road transport	hypogeal with moat
Appia Antica	16.5	76 m. a.s.l.		agricultural landscape	private road transport	hypogeal with moat
Casilina	3.8	50 m. a.s.l.		urban landscape	metropolitan network	hypogeal with moat
Prenestina	13.4	36 m. a.s.l.		urban landscape	metropolitan network	hypogeal with moat
Tiburtina	23.8	32 m. a.s.l.		urban landscape	metropolitan network	hypogeal with moat
Pietralata	25.4	36 m. a.s.l.		urban landscape	private road transport	superficial
Monte Antenne	2.5	65 m. a.s.l.		urban park	private road transport	hypogeal with moat

The Campo Trincerato in Rome, incorporated in the suburban urban fabric, today represents an eloquent palimpsest of urban metamorphoses, (Bevilacqua & Ulivieri, 2023; Spadafora et al., 2023) representing simultaneously:

- a testimonial heritage of late 19th century military architecture;
- a system of artefacts that have progressively lost their original function;
- potential spaces for urban regeneration capable of reactivating territorial connections.

The current condition of the forts reflects the complex dynamics of transformation that run through the urban margins: artefacts of significant historical-architectural value that risk obsolescence and degradation, but at the same time hold extraordinary potential for social and cultural revitalisation.

The refunctionalisation of these fortified systems is therefore a crucial challenge for contemporary urban policies: a challenge that requires integrated approaches capable of combining conservation, innovation, community participation and socio-economic regeneration.

The objective is to transform these spaces from passive heritages to active resources, reconstructing new forms of territorial belonging and social cohesion, while fully respecting their historical stratification and heritage value. Today, these structures, although largely incorporated in the recent process of urban expansion, have remained excluded from reconfiguration and redevelopment processes.

4.4 Framework in municipal town planning instruments

The evolution of the Roman Campo Trincerato's urban role can be analysed through the main planning instruments that have guided the city's development during the 20th and 21st centuries.

The 1931 General Regulatory Plan (PRG) of Rome, drafted under the Fascist Governorship, represents the first urban planning instrument with a vision of the city's expansion outside the Aurelian Walls. The 1931 PRG recognised Rome's Campo Trincerato with a certain ambiguity: although it did not define a clear public destination, it implicitly recognised the potential of these areas, located on the margins of the planned urban expansion, as possible future green spaces or equipment areas, once their primary military function had been surpassed. However, there was no organic and defined strategy for the redevelopment and civil use of the forts and the Campo Trincerato areas. The priority of the 1931 PRG was the monumental expansion of the city and the creation of new neighbourhoods.

The 1962 General Regulatory Plan (PRG) of Rome represented a fundamental turning point for the fate of Campo Trincerato. For the first time, a permanent civil function was defined for most of the forts and areas of the Campo, allocating them mainly to Zone N - Public Park. This choice recognised the historical landscape value of these areas and their potential use as important green lungs for the expanding city.

Rome's new General Regulatory Plan (PRG) of 2008 confirmed for the Campo Trincerato areas the destination for public green areas and local public services. Current urban planning regulations place landscape and, potentially, historical-artistic constraints on many of these areas, protecting their integrity and special characteristics, integrating them into the urban fabric and recognising them as important resources for the quality of life of citizens.

A third aspect concerned the planning indications over time, identifying the zoning of the 1931, 1965 and 2008 PRGs (Table 3).

Table 3: Classification of forts in the City Plans of 1931, 1965 and 2008.

Forts of Rome	Zona PRG 1931	Zona PRG 1965	Zona PRG 2008
Monte Mario	Public Park	N - Public parks and sports facilities	Instituted parks
Trionfale	Public Park	N - Public parks and sports facilities	Public services at urban level
Braschi	Public Park	N - Public parks and sports facilities	Public services at urban level
Boccea	Prisons	M - general equipment and services	Public services at urban level
Aurelia Antica	Communal cottages	M - general equipment and services	Instituted parks
Bravetta	*Out of paper**	G - private green	Instituted parks
Portuense	*Out of paper**	M - local public facilities and services	Public Green and Public Services of local level
Ostiense	*Out of paper**	G – Constrained private park	Public services at urban level
Ardeatina	*Out of paper**	N - Public parks and sports facilities	Public Green and Public Services of local level
Appia Antica	Respect zone	N - Public parks and sports facilities	Instituted parks
Casilina	Private Park	N - Public parks and sports facilities	Public Green and Public Services of local level
Prenestina	Public Park	N - Public parks and sports facilities	Public Green and Public Services of local level
Tiburtina	Public Park	N - Public parks and sports facilities	Public services at urban level
Pietralata	Public Park	N - Public parks and sports facilities	Instituted parks
Monte Antenne	Private Park	N - Public parks and sports facilities	Historical villas

** Not included in the planning tables*

5. Discussions

5.1 Network effects and institutional coordination challenges

This research aimed to activate a process of recognizing the value of fortifications as nodes in a network of physical and intangible relationships, promoting shared paths of valorization and re-

functionalization. The empirical analysis provides mixed evidence regarding this central objective, revealing both the potential and fundamental limitations of the network approach.

The study's implicit hypothesis – that military fortifications can function as integrated territorial infrastructure for urban regeneration – receives partial support from physical evidence but encounters substantial challenges from institutional realities. The documentation confirms that the Campo Trincerato maintains spatial coherence as a territorial system (40km circumference, consistent 6km distance from centre), supporting the theoretical premise of network potential. However, the ownership analysis demonstrates that this historical integration has been systematically dismantled through administrative fragmentation, with assets distributed across seven different institutional entities.

While the historical evidence supports the premise of systematic territorial organization, contemporary conditions suggest that network effects cannot be assumed but must be actively constructed against substantial institutional resistance. This finding supports calls for integrated governance approaches (Roberts et al., 2017) while providing concrete evidence of the institutional barriers that must be addressed.

5.2 Methodological performance and limitations

The dual analysis matrix combines artifact-scale and urban context-scale assessment. Asset-level analysis provides a detailed characterization of individual forts, while urban context mapping reveals integration patterns and accessibility conditions. The systematic documentation approach effectively establishes baseline conditions necessary for regeneration planning, providing comprehensive data about ownership patterns, physical characteristics, and planning evolution.

The comparative analysis tactic across the fifteen forts successfully identifies patterns in ownership transition and physical characteristics, enabling systematic rather than anecdotal assessment. The revelation that 60% of forts remain institutionally fragmented despite decades of public planning designation represents a significant finding about implementation challenges.

The methodological limitations indicate that future research addressing similar aims requires mixed methods approaches combining documentary analysis with stakeholder consultation, process evaluation, and institutional analysis. Future research should balance systematic documentation with detailed process analysis of successful cases.

5.3 Empirical findings and theoretical implications

The systematic documentation reveals three key findings that challenge existing assumptions about military heritage regeneration while providing concrete evidence about institutional and spatial constraints.

First, the ownership analysis (Table 1) demonstrates that institutional fragmentation represents the primary barrier to network-based regeneration, with assets distributed across military agencies (7 forts), public property administration (6 forts), and municipal control (2 forts). These finding challenges theoretical propositions that historical defensive systems can function as integrated territorial infrastructure by providing quantitative evidence of administrative complexity that must be overcome to realize integration.

Second, the physical and contextual analysis (Table 2) reveals significant variation in urban integration despite consistent architectural typology, with surface areas ranging from 2.5ha to 25.4ha and diverse accessibility conditions. This empirical evidence supports Högberg's (2016) critique of heritage network assumptions while demonstrating that network effects require active construction rather than passive recognition of historical relationships.

Third, the planning evolution analysis (Table 3) documents a progressive shift from military to public designation spanning eight decades, yet implementation remains limited despite consistent zoning for public use since 1962. This finding provides specific evidence of temporal mismatch between designation and realization, supporting Pendlebury's (2013) observations about heritage policy implementation gaps while quantifying the scale of the problem.

5.4 Regeneration potential and empirical limitations

The research identifies genuine regeneration opportunities within Rome's Campo Trincerato system while acknowledging significant empirical limitations: without systematic analysis of surrounding community characteristics, local economic conditions, or resident engagement preferences, broader extrapolation remains speculative; the persistence of administrative fragmentation requires active construction rather than passive recognition, with interpretation and community engagement to realize regeneration potential.

Despite its criticalities, Rome's Campo Trincerato system represents an extraordinary opportunity for heritage-led urban regeneration processes (Salmoni, 2024). Its configuration as a ring around the city offers the possibility of:

- create an integrated system of cultural polarities in peripheral areas;
- define a green ring of ecological connection between different parts of the city;
- implement public functions and collective services in areas often lacking in urban facilities;
- developing pilot projects for social and economic reactivation with the involvement of local communities.

The valorisation of this fortified system could be an exemplary case of how cultural heritage can become a strategic element to counter phenomena of urban marginality, promoting territorial identity, social inclusion and local economic development through an integrated approach that overcomes the traditional separation between conservation policies and urban development strategies. A systemic intervention on Rome's Campo Trincerato would represent not only an action to protect a historical heritage of exceptional value, but above all an opportunity to rethink the role of the suburbs in the contemporary metropolitan structure, transforming elements of discontinuity into potential urban, social and cultural connectors.

6. Conclusion

Cultural heritage can broadly be understood as a shared resource and a common good, valued for its intrinsic aesthetic, spiritual, and intellectual dimensions. Within this broader framework, nineteenth- and twentieth-century military fortifications exhibit distinctive characteristics (Vafaie et al., 2023). On the one hand, they constitute a widespread yet often concealed heritage, composed of structures defined more by emptiness than fullness—spatial voids, functional absence, and fragmented relations with the surrounding urban fabric. On the other hand, these fortifications embody multi-scalar forms of architecture that connect the urban dimension with broader territorial and landscape contexts awaiting reinvention and revelation. The regeneration of fortified places thus represents not only an architectural or planning challenge but also a socio-cultural opportunity. It enables the re-establishment of community belonging to the history of twentieth-century landscapes while allowing experimentation with new forms of use. Such interventions can contribute to stitching together fragments of the city and, at the same time, prefigure new urban landscapes enriched with identity and historical continuity. When interpreted systematically through the lens of the "historical frame," these artefacts can form the structural foundation for restoring urban, environmental, and social quality. In doing so, they become pivotal in reconfiguring fragmented and discontinuous peripheral areas of contemporary cities.

6.1 Valorising fortifications as a structural component of the project

Addressing twentieth-century fortifications as an integral part of modern cultural heritage requires a multidisciplinary approach (Buratti, 2022). It involves more than restoration or preservation; it demands recognition of their historical, architectural, and social significance, along with strategies to ensure their usability and relevance to contemporary communities. The Campo Trincerato in Rome offers an exemplary testing ground for such integrated methodologies. Here, it is possible to move beyond consolidation to embrace environmental, landscape, and social regeneration, thereby redefining architectural and territorial relationships. This approach reveals and recontextualises often inaccessible or faded sites as intelligible and meaningful parts of a new peri-urban landscape. In this way, heritage-led regeneration emerges as an integrative paradigm capable of overcoming the

traditional dichotomy between conservation and innovation, recognising historical stratification not as a limitation but as a valuable resource for building cohesive, sustainable, and vibrant cities.

6.2 Valorising fortifications as a laboratory for social innovation

Reconceptualising the Campo Trincerato fortifications also implies inverting conventional urban planning perspectives. Cultural heritage must no longer be considered solely as a restricted or static object of conservation but as a dynamic laboratory for experimenting with innovative forms of life, production, and coexistence (Roversi et al., 2021). The active participation of local communities in processes of rediscovery, interpretation, and reuse can generate virtuous cycles of social cohesion. Educational and cultural programmes centred on these sites can engage marginalised groups, promote intergenerational and intercultural dialogue, and create new spaces for social interaction within peripheral contexts that are often marked by isolation and fragmentation.

When historic buildings are acknowledged as central components of complex socio-urban ecosystems, collective memory can itself become a driver of sustainable development. Active participation through co-design and consultation ensures the cultural and functional relevance of interventions, transforming fortifications from "islands of the past" into engines of social and urban regeneration (Sokka et al., 2021). To realise this potential, however, an integrated model of welfare that includes culture and landscape is required. Such an approach depends on:

- collaborative multi-level governance involving public institutions, private actors, the third sector, and local communities (Della Spina, 2024);
- flexible and adaptive planning tools that merge conservation with innovation;
- co-design processes that harness both local and professional expertise;
- diversified financing strategies combining public, private, and community resources.

6.3 Valorising fortifications as a leverage for local development

Finally, fortifications should be recognised as structuring infrastructures that can act as levers for local development. Their regeneration is not only linked to environmental and landscape dimensions but also to socio-economic strategies aimed at strengthening cultural identity, stimulating local economies, and reducing inequalities between central and peripheral territories (Tousi et al., 2025). The restoration and reinterpretation of sites such as the Campo Trincerato can reactivate processes of collective identification, thereby reinforcing the bond between community and territory (Roversi et al., 2021). As tangible witnesses of national and local history, these structures provide the foundation for new shared narratives that help counteract the sense of uprootedness common in suburban contexts.

Adaptive reuse of the Campo Trincerato can also generate diversified economic opportunities. These range from the creation of cultural, artistic, and educational hubs to the development of sustainable tourism integrated into metropolitan networks, as well as the establishment of creative industries, artisanal activities, and innovative community services. Contemporary uses may include co-working spaces, cultural welfare services, creative workshops, and circular economy centres (Aldossary et al., 2025). Such enhancements may involve single-site interventions or more complex networked strategies, extending from musealisation to the programming of cultural events, the creation of tourist itineraries, and the revitalisation of surrounding public spaces.

From this perspective, heritage-led regeneration is not confined to physical restoration but constitutes a holistic transformation process. It contributes to rethinking marginal areas comprehensively, fostering urban resilience, social equity, and sustainability. By reconciling the multiple temporalities embedded within contemporary territories, the regeneration of fortifications supports the emergence of new urban policies that integrate conservation, development, and innovation. Further research should deepen the analysis of community engagement practices, governance mechanisms, and financial models to support long-term regeneration. Promising areas of inquiry include comparative studies of military heritage reuse across European cities, the role of digital technologies in participatory planning, and the integration of ecological infrastructure with cultural heritage systems. Such research would not only enrich theoretical frameworks but also provide practical tools to guide policy-makers and practitioners in scaling up heritage-led regeneration strategies.

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The Authors declare that there is no conflict of interest.

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References

Aldossary, M. J., Alqahtany, A. M., & Alshammari, M. S. (2025). Cultural Heritage as a Catalyst for Sustainable Urban Regeneration: The Case of Tarout Island, Saudi Arabia. Sustainability, 17(10), Article 4431. https://doi.org/10.3390/su17104431

Bevilacqua, M. G., & Ulivieri, D. (2023). Defensive architecture of the Mediterranean (Vol. XIV). Pisa University Press. https://doi.org/10.12871/9788833397948112

Buratti, B. (2022). Da presidio militare a sito culturale: il Forte Aurelia a Roma [From military garrison to cultural site: Forte Aurelia in Rome]. In M. Fumo & S. F. (Eds.), Dall'ingegneria militare all'architettura fortificata. Fortezze militari, paesaggi urbani e genio italiano [From military engineering to fortified architecture. Military fortresses, urban landscapes, and Italian genius] (pp. 31–42). Luciano.

Cajano, E. (2006). Il sistema dei forti militari a Roma [The system of military forts in Rome]. Gangemi. http://www.loc.gov/catdir/toc/casalini05/06421709.pdf

Cajano, E. (2022). La tutela dei beni architettonici a Roma negli anni Trenta del Novecento: tra conservazione, recupero e innovazione [The protection of architectural heritage in Rome in the 1930s: Between conservation, recovery and innovation]. Gangemi. https://www.loc.gov/catdir/toc/casalini19/5236302.pdf

Chiri, G. M., Fiorino, D. R., Morezzi, E., & Novelli, F. (2021). Paesaggi militari del Campo Trincerato di Roma. Progetti per Forte Aurelia [Military landscapes of Rome's entrenched camp: Projects for Fort Aurelia]. Politecnico di Torino, Collana Cultura della Città.

Colavitti, A. M., Floris, A., & Serra, S. (2021). Nuove prospettive per la rigenerazione urbana e territoriale. Il riuso del patrimonio militare dismesso tra regimi di tutela e opportunità di sviluppo [New prospects for urban and territorial regeneration: The reuse of disused military heritage between protection regimes and development opportunities]. In F. Gastaldi & F. Camerin (Eds.), Rigenerare le aree militari dismesse: Prospettive, dibattiti e riconversioni in Italia, Spagna e in contesti internazionali [Regenerating abandoned military areas: Perspectives, debates and reconversions in Italy, Spain and international contexts] (pp. 550–562). Maggioli. https://doi.org/10.30448/UNI.916.50825

Della Spina, L. (2024). A decision support evaluation framework for community-based collaborative urban regeneration processes. Sustainability, 16(15), Article 6434. https://doi.org/10.3390/su16156434

Fara, A. (1985). La metropoli difesa. Architettura militare dell'Ottocento nelle città capitali d'Italia [The defended metropolis: Nineteenth-century military architecture in Italy's capital cities]. Stato Maggiore dell'Esercito, Ufficio Storico.

Galuzzi, P., & Carollo, R. (2021). Una strategia per il riuso e la valorizzazione delle strutture fortificate di Verona come telai storici per la rigenerazione della città contemporanea [A strategy for the reuse and valorization of Verona's fortified structures as historical frameworks for the regeneration of the contemporary city]. In F. Gastaldi & F. Camerin (Eds.), Rigenerare le aree militari dismesse: Prospettive, dibattiti e riconversioni in Italia, Spagna e in contesti internazionali [Regenerating abandoned military areas: Perspectives, debates and reconversions in Italy, Spain and international contexts] (pp. 733–751). Maggioli. https://doi.org/10.30448/UNI.916.50825

Hogg, I. V. (1977). Fortress: A History of Military Defense. St. Martin's Press.

Hughes, Q. (1991). Military architecture: The art of defence from earliest times to the Atlantic Wall (Rev. and expanded 2nd ed.). Beaufort Publishing Ltd.

M.G., P. (2021). I forti ottocenteschi a Roma: cenni e spunti di approfondimento sulle tecniche costruttive murarie [Nineteenth-century forts in Rome: notes and insights into masonry construction techniques]. In G. M. Chiri, D. R. Fiorino, E. Morezzi, & F. Novelli (Eds.), Paesaggi militari del Campo Trincerato di Roma. Progetti per Forte Aurelia [Military landscapes of Rome's entrenched camp. Projects for Fort Aurelia]. Politecnico di Torino. Collana Cultura della Città, Torino.

Pendlebury, J., Townshend, T., & Gilroy, R. (2004). The Conservation of English Cultural Built Heritage: A Force for Social Inclusion? International Journal of Heritage Studies, 10(1), 11-31. https://doi.org/10.1080/1352725032000194222

Pepe, D., & Vitali, D. (2022). Il patrimonio culturale metafora dell'interdisciplinarità: storie, conoscenze, tecnologie e professioni [Cultural heritage as a metaphor for interdisciplinarity: stories, knowledge, technologies and professions]. Educazione Sentimentale, 36/2021, 103-119. https://doi.org/10.3280/EDS2021-036010

Ricci, L., Imbesi, P. N., & Perrone, F. (2025). Regenerating the hidden cultural heritage: The case of the Campo Trincerato in Rome. In O. Gervasi, B. Murgante, S. Misra, E. Stankova, C. M. Torre, A. M. A. C. Rocha, D. Taniar, B. O. Apduhan, & E. Tarantino (Eds.), Computational science and its applications – ICCSA 2025 workshops (pp. 440–454). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-97663-6_32

Roberts, P., Sykes, H., & Granger, R. (2017). Urban Regeneration (2 ed.). SAGE Publications Ltd. https://doi.org/10.4135/9781473921788

Rossi, P. O., Bruschi, A., Ferretti, S., Guarini, P., Giovannelli, A., Grimaldi, A., & Tamborrino, L. (2009). Operare i forti, per un progetto di riconversione dei forti militari di Roma [Operate the forts: For a project to reconvert the military forts of Rome]. Gangemi.

Roversi, R., Longo, D., Massari, M., Orlandi, S., & Turillazzi, B. (2021). Cultural heritage as activator of circular urban dynamics. TECHNE – Journal of Technology for Architecture and Environment, 22, 218–226. https://doi.org/10.36253/techne-10607

Salmoni, V. (2024). La rigenerazione urbana e la cultura: Dalle opportunità alle realizzazioni [Urban regeneration and culture: From opportunities to achievements]. Urbanistica Informazioni, 314, 137–138. https://doi.org/10.62661/ui314-2024-137

Soja, E. W. (2011). Postmodern geographies: The reassertion of space in critical social theory. Verso.

Sokka, S., Badia, F., Kangas, A., & Donato, F. (2021). Governance of cultural heritage: Towards participatory approaches. European Journal of Cultural Management and Policy, 11(1), 4–19. https://doi.org/10.3389/ejcmp.2023.v11iss1 article 1

Spadafora, G., Ferretti, S., & Pallottino, E. (2023). I Forti di Roma: Una lettura a scala urbana [The Forts of Rome: An urban-scale interpretation]. In M. G. Bevilacqua & D. Ulivieri (Eds.),

Defensive architecture of the Mediterranean (Vol. XIV, pp. 883–890). Pisa University Press. https://doi.org/10.12871/9788833397948112

Tousi, E., Pancholi, S., Rashid, M. M., & Khoo, C. K. (2025). Integrating cultural heritage into smart city development through place making: A systematic review. Urban Science, 9(6), Article 215. https://doi.org/10.3390/urbansci9060215

Vafaie, F., Remøy, H., & Gruis, V. (2023). Adaptive reuse of heritage buildings: A systematic literature review of success factors. Habitat International, 142, 102926. https://doi.org/10.1016/j.habitatint.2023.102926

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From Connectivity to Liveability: Enhancing Urban Waterbody Accessibility through Space Syntax in Dhaka

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ABSTRACT

Urban waterbodies play a vital role in enhancing ecological sustainability, social interaction, and neighbourhood liveability, yet in rapidly urbanising contexts such as Dhaka, they are increasingly threatened by encroachment, pollution, and reduced accessibility. This study investigates the accessibility and spatial integration of two significant urban waterbodies (Dholaikhal Narinda Pond and Shahjahanpur Jheel) under the Dhaka City Neighbourhood Upgrading Project (DCNUP), which seeks to revitalise public open spaces for disadvantaged communities. Using Space Syntax analysis, the research assesses spatial configuration through measures of Connectivity (CN), Global Integration (Rn), and Local Integration (R4) to evaluate accessibility at city and neighbourhood scales. Results indicate that Dholaikhal Narinda Pond demonstrates higher connectivity and global integration values, positioning it as a potential city-scale destination capable of enhancing urban inclusivity. By contrast, Shahjahanpur Jheel, though limited in city-wide accessibility, exhibits strong local integration, highlighting its potential as a neighbourhood-scale public space. These findings underscore the importance of aligning spatial analysis with urban design strategies to enhance accessibility and maximise social benefits. The study concludes that integrating syntactic measures into early project planning can help policymakers and urban designers anticipate patterns of use and achieve more equitable and sustainable revitalisation of public waterbodies in Dhaka.

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Highlights:	Contribution to the field statement:
-Higher connectivity (CN) increases accessibility, making Dholaikhal Narinda Pond more suitable as a city-scale public space. -Global integration (Rn) enhances spatial equity, supporting Dholaikhal's role as an inclusive urban destination. -Local integration (R4) improves neighbourhood liveability, positioning Shahjahanpur Jheel as a community-scale public space. -Intelligibility of the spatial grid predicts potential public use, guiding equitable waterbody revitalisation strategies.	This study advances urban spatial research by applying space syntax to assess accessibility of Dhaka's waterbodies, revealing distinct city- and neighbourhood-scale potentials. It contributes new evidence on how spatial configuration influences equitable public space use, offering a replicable methodological framework for sustainable urban revitalisation in rapidly urbanising contexts.

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1. Introduction

Currently, over half of the world's population resides in dense urban areas, where life unfolds not only within buildings but also in the open spaces between them(Gehl, 2012) . These open spaces—parks, playgrounds, streetscapes, and waterbodies—are essential components of the urban environment,

contributing to livability, social interaction, mental well-being, and ecological balance. (Chiesura, 2004). In many cities, especially those in the Global South, rapid and often unplanned urbanization has led to the significant decline of open spaces. In the same way, Dhaka is a megacity with a higher population density, and has open spaces far less than the recommended standard. Dhaka has fewer green and public open spaces, such as parks and playgrounds, than any other megacity in the world (Alam et al., 2025). The 1995–2015 Dhaka Structure Plan acknowledged this fact as well and strongly suggested the preservation and maintenance of green spaces and water bodies which is essential for ecological balance and social equity. However, the rapid population growth led to a continuous decline in public open spaces over the decades. A land cover change study revealed that Dhaka City lost 7,146 hectares of green spaces between 1989 to 2020 (Nawar et al., 2022). Over the past two decades (2001–2021), the built-up area expanded by 27%, leading to the disappearance of many major open spaces, including waterbodies (Rahman, 2022). In 2020, urban green space made up only 1.9% of Dhaka's land area, reflecting a clear negligence of preservation measures (Khan et al., 2023). The draft Dhaka Structure Plan (2016-35) suggests a minimum of 20% open space; however, Old Dhaka retains only about 5%, and New Dhaka approximately 12%, including streets, sidewalks, parks, playgrounds, and waterbodies.

Among various open spaces, urban waterbodies—lakes, canals, and ponds- hold special significance. They provide not only ecological and environmental services, such as stormwater retention and microclimate regulation, but also have the potential to create peaceful, inclusive public spaces. Historically, Dhaka was once referred to as "The Venice of the East" owing to its extensive network of rivers, canals, lakes, and ponds. Despite this decline, the remaining waterbodies can still play a transformative role in urban life if they are revitalized and made publicly accessible. Numerous scholars have emphasized that accessibility is one of the most important criteria for the effective functioning of open spaces. As and when accessibility is ensured at a proper scale, many waterbodies can serve as vibrant public spaces that support social cohesion and enhance the quality of life. On the contrary, when such spaces lack accessibility, they often become underutilized, neglected, or vulnerable to antisocial activities, contributing to urban decline. Again, when an open space is located near a major road with a high level of accessibility from the city grid, it can create overcrowded situations, depriving the local community. A similar situation is observed in the Dhanmondi residential area, where the Dhanmondi Lake, being highly integrated into the city's urban spatial grid and having high accessibility, attracts a significant number of visitors (Roni et al., 2022). This has resulted in increased traffic congestion and reduced privacy for the local community. Such conditions can negatively impact the quality of life and disrupt the intended balance between community use and broader public engagement. Therefore, assessing accessibility is essential to achieving sustainability and livability in the planning and design of open spaces. Space Syntax is a widely recognized analytical method for understanding spatial configurations and evaluating accessibility in urban environments. While this technique has been employed in numerous studies to assess open space accessibility, its application prior to the implementation of open space projects remains limited.

Recognizing the urgent need to reclaim and repurpose these vital urban resources, DCNUP aims to improve the urban open spaces in unplanned and underdeveloped neighborhoods to make Dhaka more liveable by creating safer, more accessible, and user-friendly public spaces for all residents, with a particular emphasis on the needs of women, the elderly, youths, and people with disabilities. As part of this project, two proposed sub-projects—Dholaikhal Narinda Pond in the Nayabazar-Sutrapur area and Shahjahanpur Jheel in the Khilgaon-Basabo area—are targeted for redevelopment, transforming into accessible public open spaces with appropriate amenities for the citizens' well-being. Such development projects focusing on revitalizing water bodies can increase property values and encourage more socio-economic activities in the surrounding areas. They can attract residents, local businesses, and informal economic activities (e.g., street vendors, cultural events). However, the success of these projects depends largely on ensuring accessibility on a proper scale. Both of these waterbodies remain largely inaccessible and underutilized. Dholaikhal Narinda Pond is surrounded by informal structures and physical barriers that limit public accessibility and visibility, while Shahjahanpur Jheel lacks defined access points and proper pedestrian connectivity to the surrounding neighborhoods. As a result,

these spaces have failed to serve their potential contribution to society as a public space. The success of these projects depends largely on their accessibility. It is essential to assess whether these spaces should primarily serve their immediate neighbourhood communities or be integrated into the broader city-wide network. This raises a critical question about the scale and nature of accessibility and how it affects the potential of these waterbodies to become a vibrant and functional public space, either at the neighbourhood level or at the city scale. To address this question, this study employs Space Syntax analysis, a well-established tool for assessing accessibility in urban areas. By examining connectivity and spatial integration (Global Rn and Local R4), the analysis provides valuable insights into the accessibility of the two sites. The data-driven findings of the space syntax analysis, accompanied by insights gathered from the literature review, can help urban designers in formulating design strategy focusing on accessibility, considering local and city scales. Thus, the study attempts to provide some recommendations for the revitalization of such waterbodies to transform them into accessible open spaces. The paper has four sections. The first section discusses the conceptual framework of open space and the significance of accessibility as a primary criterion of open space. It also introduces the theoretical foundations of space syntax and a brief overview of syntactic measures, which are used to assess accessibility. The second section presents the methodology carried out in this research. The third section focuses on the result of the syntactic analysis. In the last section, the paper concludes with a discussion, followed by limitations of the research and further recommendations.

2. Literature Review

2.1 Theoretical Definition and Qualitative Criteria of Open Space

Various researchers have defined open space as the public and private land that is accessible to everyone (Ho et al., 2021). It is typically characterized by openness, inclusivity, and the potential for public use. Such spaces often support recreation, social interaction, and community engagement. They range in scale from small playgrounds to expansive recreational areas like hunting grounds (Khan, 2014). Nilufar (2000) identifies three primary functions that open spaces serve-

a) It can serve recreational purposes, fulfilling both physical and psychological needs, thereby addressing essential social and psychological aspects of human well-being.
b) It can help preserve and enhance essential environmental resources and ecological systems—such as air, water, soil, and plant life
c) It can influence economic development decisions related to land use patterns and land values, local economy, tourism, etc

In the book, “Urban Open Spaces- Designing for User Needs”, Francis (2003) mentions four characteristics for a good public open space (POS)- accessibility, activities, comfort, and sociability. In assessing various public spaces ranging from the city scale to the neighbourhood scale, researchers found some common features among the most successful and interactive ones. These successful spaces typically share four qualities determined by Mark Francis: (a) they are accessible to all; (b) they encourage diverse public activities; (c) they provide a sense of comfort and visual appeal; and (d) they foster an environment where social interaction naturally occurs. Thus, public open spaces have direct as well as indirect impact on the economic upliftment of the surrounding community.

Mark Francis also identified inaccessibility as one of the major reasons why public space fails to draw people. Studies indicate that the spatial articulation and proximity of urban open spaces significantly depend on their accessibility (Coombes et al., 2010; Swanwick, 2009; Wright Wendel et al., 2012). In efforts to preserve and enhance the value of existing urban open spaces, Thwaites & Simkins (2006) emphasize that in cities, human experiences are shaped by the organization of spatial elements and street connectivity. Well-designed spatial articulation and enhanced connectivity of the urban spatial grid can significantly improve people's engagement with the open spaces and outdoor environment. Therefore, to ensure accessibility to POS, streets should be planned and designed as vital parts of the urban spatial grid (Zhai et al., 2021).

However, over the decades, Dhaka grew organically due to the lack of controlled development and planning. This unplanned growth adversely impacted street connectivity and significantly affected the accessibility of the city's public open spaces. In several open spaces throughout Dhaka, access is

limited due to narrow streets and discontinuous sidewalks (Khan & Tabassum, 2024). The accessibility of urban open spaces serves as a key indicator for assessing a city's overall livability. Ensuring good accessibility to public open spaces is crucial for allowing residents to fully experience the ecological and social benefits provided by parks. When people can easily reach and use these spaces, they are more likely to engage in recreational and community activities. Studies have also shown a strong positive correlation between access to open spaces and higher levels of happiness among urban residents (Zhang & Zhou, 2018). Accessibility measurement can be used to assess the effectiveness and rationality of the spatial layout of public service facilities. It also provides a basis for comparing the strengths and weaknesses of different planning schemes (Long et al., 2023). In the case of Dhaka, it has been observed that many projects suffer from a lack of accessibility at the proper level, considering the city or regional level. In fact, research initiatives are rarely undertaken to investigate accessibility in the case of implementing any Public Open Space (POS) project in Dhaka.

2.2 Space Syntax Measures and Accessibility to Open Space

To determine the spatial arrangement of urban landscapes, users' temporal spatial behaviour, the routes they choose, and the relational patterns that connect different spaces, other studies have used computational simulations, such as space syntax (T. Zhang et al., 2020). Space Syntax is a method for describing and analyzing the relationships between social structure and spatial structure (Khan, 2014). The analysis of the urban grids is based on the axial map, where every street intersection within the urban grid is recorded as an intersection of axial lines (Hanson, 1989). It focuses on comprehending how human movement, interaction, and accessibility to urban environments are influenced by morphology and spatial configuration of urban spaces following the theory of Natural Movement (Jabbari et al., 2018; Mohamed et al., 2024; Valipour et al., 2019). Space Syntax is conceptually derived from the Theory of Natural Movement, and the two are closely interrelated in explaining how spatial configuration influences urban mobility. According to the "Theory of Natural Movement," as proposed by Hillier, the physical layout of streets primarily determines patterns of pedestrian and vehicular movement, independent of land use (Hillier et al., 1993). Integrated spaces will become increasingly important in urbanity, as they are located along people's regular movement network. Space Syntax builds on this foundation by providing a quantitative and analytical framework to model and measure these spatial relationships. Using tools like axial maps, Space Syntax translates the abstract idea of natural movement into measurable spatial properties. Syntactic metrics offer a reliable proxy for estimating where people are likely to move, eliminating the need for time-consuming and resource-intensive pedestrian counts. In this framework, movement is seen as an emergent property of spatial form, meaning that a well-constructed spatial analysis can provide sufficient insight into mobility patterns without direct observation. Therefore, it identifies which streets in the urban grid are most likely to attract movement.

Several space syntax metrics, such as Connectivity, Integration, Control, and Choice, can be used to evaluate the accessibility of spaces. These metrics aid in comprehending how the spatial arrangement of urban areas influences mobility and navigation (Yamu et al., 2021). According to (Hossain et al., 2025) Researchers can comprehend the potential connection between the physical form, spatial arrangement, and social dynamics in an urban setting by analyzing accessibility through space syntax. There are four first measures, which in turn are correlated to create second-order measures.

a) Integration

Integration in space syntax refers to the efficiency how a space may be accessed from every other space in a given spatial system. It also refers to the relative shallowness or depth of any spatial system as perceived from a particular location within it. Rankings of the integration values are made from the most segregated line to the most integrated. The term "integration core" refers to the collection of the most integrated streets, whose nature, form, size, coverage, and other characteristics are primarily determined by the geometry, connection, and structure of the urban system as well as how it is growing. Understanding the local spatial structure of integrated lines (R=3 or 4) is another application of the method, which involves computing a

more immediate measure that provides integration value among the spaces up to three or four steps away from the root (Khan, 2014). Empirical research has now shown that integration closely matches patterns of space occupancy, use, and movement seen in towns and cities across the globe**.**

b) Choice (CH)

Choice (CH), the second metric, indicates how much of a specific element (axial line) should be covered by the shortest paths connecting every space in the spatial system to every other space. One dynamic global metric is the global choice (Khan, 2014).

c) *Connectivity (CN*)

Connectivity (CN) is the number of spaces that immediately connect a space of origin. It is a local syntactic metric that is constant. A higher CN number denotes greater mobility possibilities and improved accessibility.

d) Control (CV)

The degree of choice a location offers its near neighbours as a destination is represented by the Control (CV) (Hanson, 1989).

Space syntax provides quantitative evaluations of various levels of accessibility inside the urban spatial network by analyzing network centrality. Researchers emphasize the value of space syntax techniques in evaluating open spaces' usability to improve their social and physical functionality in a city (Long et al., 2023; Tannous et al., 2021). Previous researchers found a relationship between road network analysis from space syntax and public open space accessibility. If the streets adjacent to the parks are more integrated, the accessibility to the parks is also higher (Huang et al., 2020). Currently, a number of studies have adopted the space syntax method for quantitatively assessing accessibility of various types of spaces (Khan, 2014; Rahman & Nilufar, 2024). Syntactic analysis has also been used to evaluate urban waterbodies' accessibility. A study used space syntax and GIS to assess the Songxi River's urban riverfront accessibility through axial and segment models, analyzing integration and choice (Luo & Lin, 2023). Another study applied space syntax to analyze global and local integration of access routes at Dhaka's Hatirjheel Lakefront to understand accessibility (Hossain et al., 2025).

All these studies found a strong correlation between the spatial integration of a city's street network and accessibility of adjacent open spaces. Given the city's complex urban fabric and irregular street connectivity, ensuring the scale of public accessibility and engagement remains a significant challenge, often contributing to the failure of projects in achieving their intended goals. Therefore, such a method can be effective in the decision-making process for determining the level and scale of accessibility of urban projects in dense developed cities like Dhaka.

3. Materials and Methods

3.1 Study Design and Setting

The study setting includes dense, mixed-use neighborhoods in Nayabazar-Sutrapur and Khilgaon-Basabo. The selected study areas for this research are Dholaikhal Narinda Pond and Shahjahanpur Jheel. These waterbodies are two significant sub-projects under the DCNUP targeted for redevelopment as large-scale recreational spaces. However, both projects face critical challenges related to accessibility, which is essential for transforming them into functional public spaces.

Table 1: List of Study Area.

Sl no	Name of the open space	Zone	Ward No	Area (sq m)	Open space Category
1.	Dholaikhal Narinda Pond Development	Nayabazar-Sutrapur	44	14,200	Waterbody
2.	Shahjahanpur Jheel Development	Khilgaon-Basabo	11	21,290	Waterbody

Figure 1. Satellite image of Dholaikhal Narinda Pond.

Figure 2. Satellite image of Shahjahanpur Jheel.

The study adopts a quantitative method. The research was conducted through a combination of literature review, field surveys, and space syntax analysis. A literature review was conducted to establish the theoretical framework, while fieldwork documented existing physical conditions and accessibility barriers. Axial map of Dhaka city was produced, and syntactic measures (Connectivity, Integration Rn and R4) were analyzed using DepthmapX. Regression analysis was employed to examine the relationship between the syntactic measures (Rn-CN and Rn-R4) for understating the intelligibility of the study areas and determine the level and scale of accessibility of the two sites. Based on the analytical outcomes, design suggestions were formulated to strengthen the socio-spatial integration of the revitalized waterbody sites.

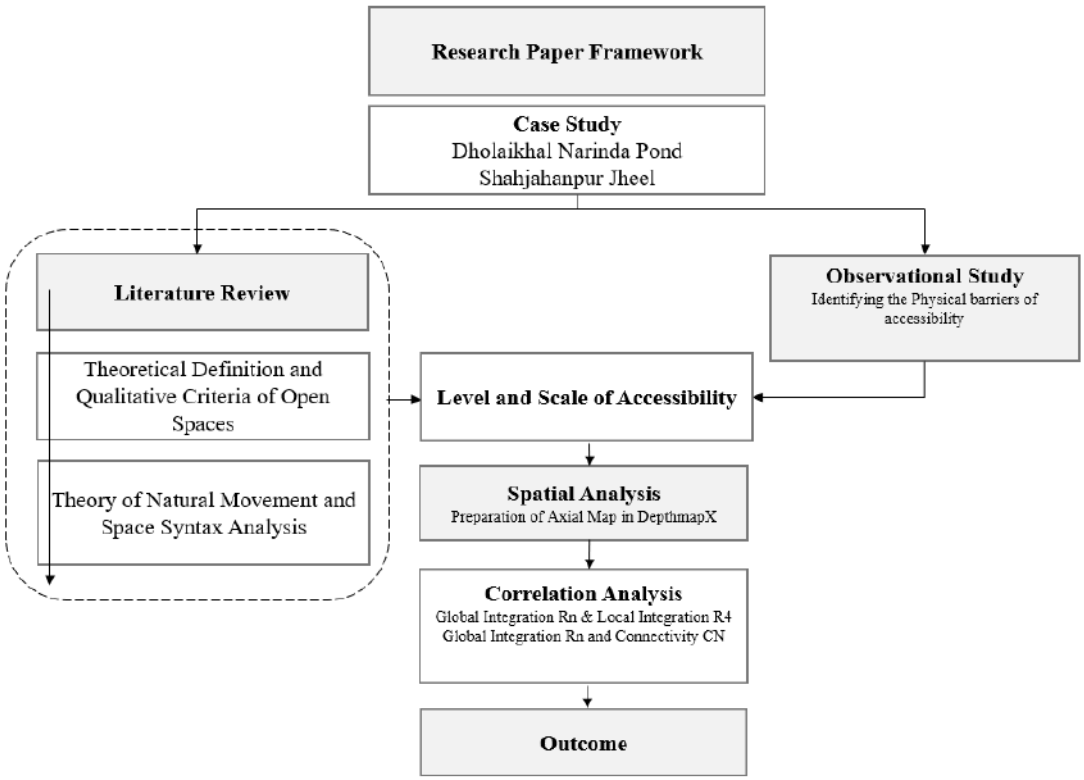

Figure 3. Research framework.

3.3 Historical Background and Present Condition of the Study Area

A field survey was carried out to observe the current scenario, record the present conditions, identify the accessibility barriers, and comprehend the social dynamics of the study areas in order to thoroughly analyze the geographical accessibility of the study areas. Relevant maps were collected from government authorities.

Figure 4. Figure-Ground Maps of Dholaikhal and Shahjahanpur Jheel.

3.3.1 Dholaikhal Narinda Pond

This site is located in Ward 44, near Dholaikhal Street, Sutrapur, and has its unique charm, reflecting the effervescent history of Old Dhaka. It was originally a part of the Dholaikhal canal excavated during the Mughal period between 1608 and 1610. This canal served both defensive and navigational purposes, flowing through the heart of the city and connecting the Balu River near Demra to the Buriganga River. Over time, the canal became clogged with debris and was eventually transformed into an underground drainage system in certain sections. Dholaikhal Narinda Pond, which spans 4.2 hectares of land and serves as a retention site, is a minor section of the historic Dholaikhal (Das & Islam, 2010). The surrounding neighbourhood is predominantly residential, with many metal workshops operating at the ground level. The area has witnessed significant changes, with remnants of the canal's historical significance still evident in the urban landscape.

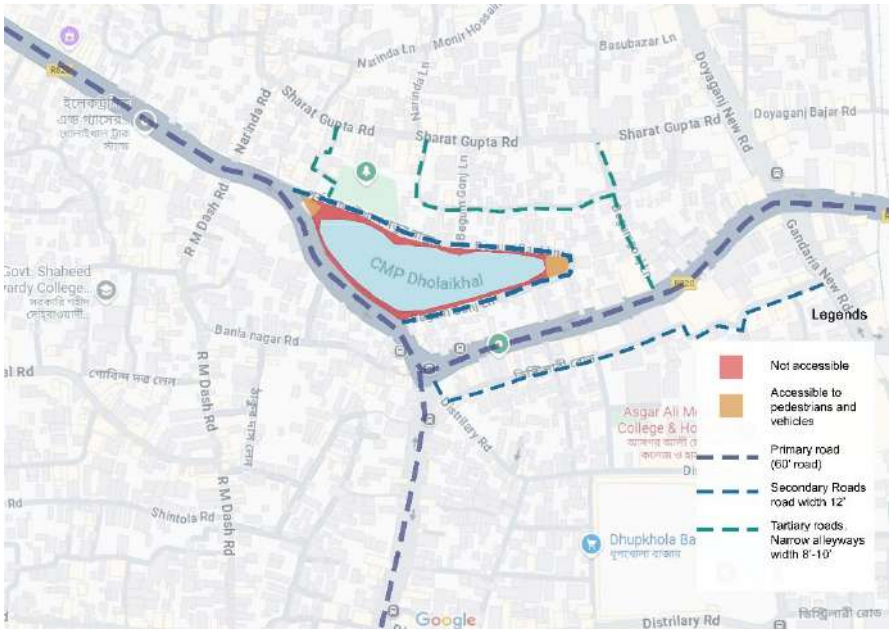

Figure 5. Map of accessibility Dholaikhal Narinda Pond.

Figure 6. Surrounding environment of the Dholaikhal Narinda Pond.

Dholaikhal Narinda Pond currently suffers from several critical spatial challenges that hinder its potential as a public open space. The site lacks direct access from the surrounding street network and visual permeability, as perceived by potential users, as it is enclosed by a boundary wall. The adjacent informal structures also work as a physical barrier and obstruct sightlines. Moreover, the pond itself is in a state of severe neglect, with accumulated dirt and waste contributing to water pollution and further deterring engagement. This physical enclosure, combined with the absence of designated access points and poor connectivity with the surroundings, results in a significant lack of accessibility. Therefore, limits the effective prevention of community interaction with the waterbody and has no connection with the surrounding neighbourhood. As a result, the space remains entirely unused by the public and

has no public activity. These factors have collectively disconnected the pond from the surrounding urban fabric, making it an underutilized space. Thus, accessibility became a primary design issue during revitalization.

3.3.2 Shahjahanpur Jheel

Shahjahanpur is one of the historical Jheels of Dhaka, which is relatively bigger in size. It is located to the northwest of the Central Railway Station, in a dense, middle-low-income residential neighbourhood of Dhaka. Over the years, encroachments, sewage pollution, and land repurposing for development have changed the Jheel's dynamics. These changes have significantly altered its original character and affected the surrounding community. The site is delimited by the railway tracks to the east. This creates a physical separation and limits accessibility, which gives the neighbourhood an introverted character.

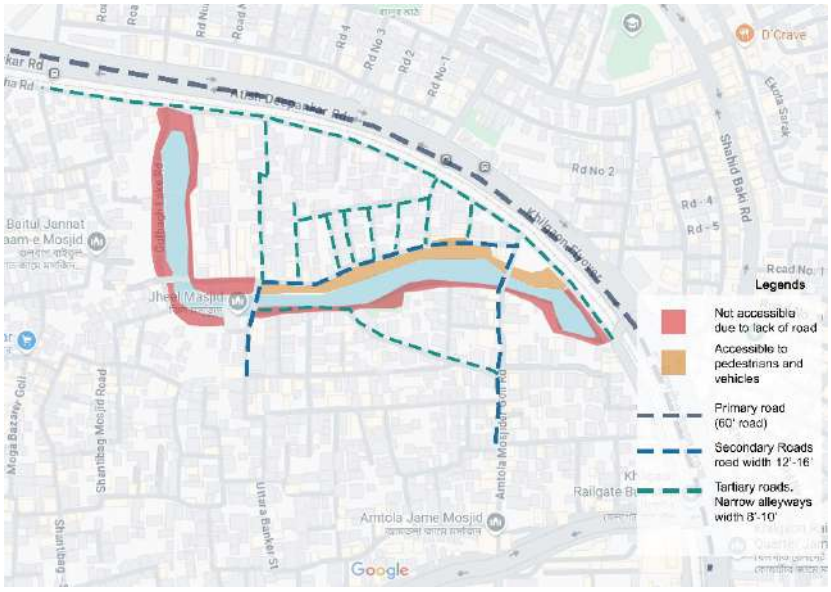

Figure 7. Surrounding environment of the Dholaikhal Narinda Pond.

Figure 8. View of the surrounding urban environment of the Shahjahanpur Jheel.

Shahjahanpur Jheel does not have any prominent visual barrier like Dholaikhal Narinda Pond; it still suffers from limited accessibility. Access to the site is limited primarily from the adjacent primary roads. Access is mostly restricted to the internal circulation network, having narrow, unpaved streets and alleys. Many of these streets are discontinuous and lack proper pedestrian infrastructure. Additionally, encroachments and private landholdings along the Jheel's edge further constrain public access at several points. While some informal activities, such as a local *Bazaar*, take place along the water edge, overall public activity of the space is limited. The waterfront edge is fragmented and has no defined pedestrian access to the waterbody.

3.4 Spatial Analysis

To assess the spatial configuration and accessibility of the two study areas, Space Syntax analysis was carried out using DepthmapX, which is a widely used tool for quantitative assessment. The axial map of Dhaka was generated in DepthmapX, representing the city's road network through the fewest and longest lines of sight and potential movement. The axial map served as a key analytical tool for examining the spatial integration of the study areas in relation to the broader urban grid of Dhaka, highlighting the degree to which these areas are spatially integrated or segregated.

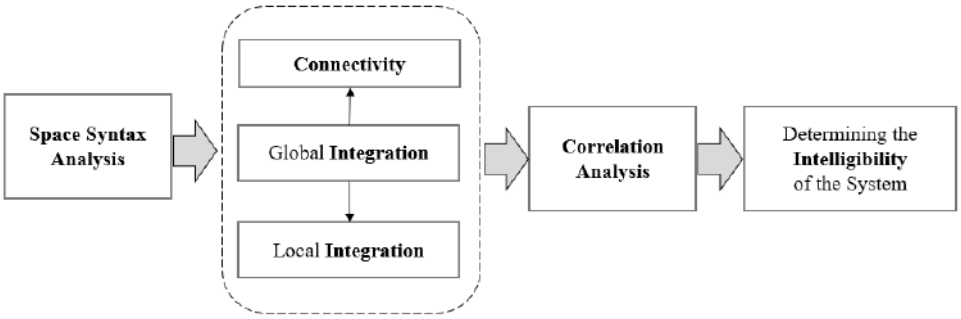

Figure 9. Analytical framework.

Using the axial map, global (Rn) and local (R4) integration values, and connectivity (CN) values were extracted and analyzed to determine the relative spatial accessibility of the study area. The intelligibility of the system was measured by the correlation of global integration-connectivity (Rn-CN) and global integration-local integration (Rn-R4). From a local level to a broader city context, it results in a strong sense of grid reliability. Following the space syntax analysis, the required scattergram plots, correlation charts,and graphs were produced. This analysis helped reveal the degree to which the spatial structure supports or hinders accessibility.

The overall spatial structure of Dhaka appears to be well integrated with the other spaces at the centre and gradually segregates towards the outer side of the city (Figure 10). The syntactic measures-connectivity and integration (Rn and R4) of Dhaka and the study areas are listed in Tables 2, 3 and 4. Integration values ending at or above 1 indicate strong integration, while more segregation is indicated by integration values between 0.4 and 0.6.

Table 2: Maximum, Minimum, and Mean Connectivity, and Integration (Global and Local) Value of Dhaka.

Maximum, Minimum, and Mean Connectivity, and Integration (Global and Local) Value of Dhaka			
	CN	**Rn**	**R4**
Min	1	0.430179	1.09697
Average / Mean	6.72046	0.765563	1.89624
Max	84	1.17387	3.77738

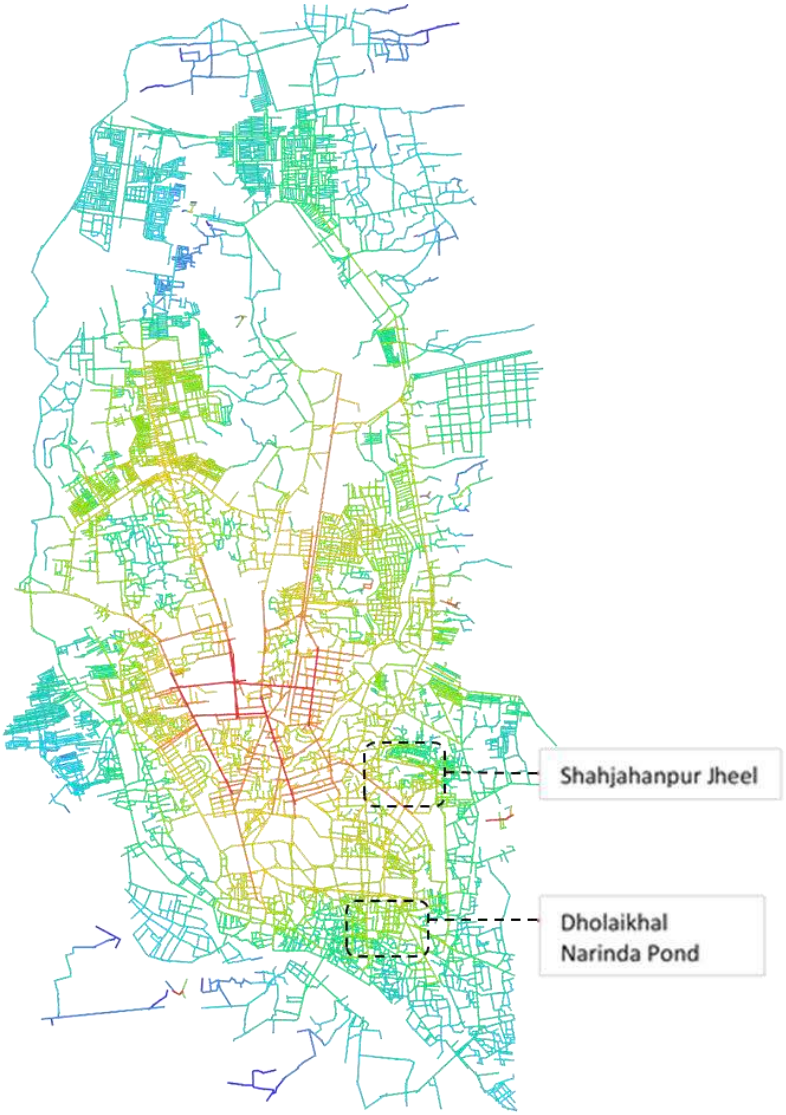

Figure 10. Integration map of Dhaka (produced by authors in DepthmapX).

Table 3: Connectivity and Integration Values of Dholaikhal Narinda Pond.

Connectivity and Integration Values of Dholaikhal Narinda Pond

Sl No	Access Roads	Road Type	CN	Rn	R4
1	Dholaikhal Road	Primary Road	13.00	0.750829	2.31568
2	Begumganj Lane	Secondary Road	3.53	0.763939	1.74706
3	East Dholaikhal New Road	Secondary Road	4.00	0.771046	2.063479
4	New Doyagonj Road	Primary Road	7.00	0.812399	2.10207
5	Distillary Road	Primary Road	5.00	0.798859	2.07016
6	Gendaria New Road	Primary Road	31.00	0.946619	2.915960
7	Kather Pool New Road	Primary Road	7.52	0.746217	2.08281

Table 4: Connectivity and Integration Values of Shahjahanpur Jheel.

Connectivity and Integration Values of Shahjahanpur Jheel					
Sl No	**Access Roads**	**Road Type**	**CN**	**Rn**	**R4**
1	Atish Dipankar Road	Primary Road	29.00	1.02045	2.96263
2	Shahjahanpur Road	Primary Road	20.00	1.004932	2.63088
3	Aamtola Mosjid Goli Road	Secondary Road	23.00	0.956867	2.750479
4	Jheelpar Road East	Secondary Road	3.00	0.977161	2.46262
5	Jheelpar Road north	Secondary Road	9.00	0.929055	2.34635
6	Jheelpar Road south	Secondary Road	7.75	0.917772	2.23913
7	Neighborhood Unnamed Street 1	Tertiary Road	7.02	0.984203	2.586422
8	Neighborhood Unnamed Street 2	Tertiary Road	8.23	0.984912	2.668161

4. Results

4.1 Syntactic Analysis of Dholaikhal Narinda Pond

Dholaikhal Narinda Pond's spatial arrangement demonstrates a key position within Old Dhaka's urban grid. The primary access node is formed by the convergence of four key streets: Dholaikhal Road, Doyagonj New Road, Kather Pool New Road, and Distillery Road. This junction acts as a critical spatial node, offering a structurally strategic entrance to the site. Among the access routes, Gendaria New Road exhibits the highest connectivity value (CN = 31) and a significantly high global integration value (Rn = 0.946), placing the study area near the city's integration core. This indicates that Gendaria New Road is not only highly connected to adjacent segments but also exhibits high spatial proximity within the urban network, establishing it as a principal circulation axis with strong potential to enhance accessibility to the site.

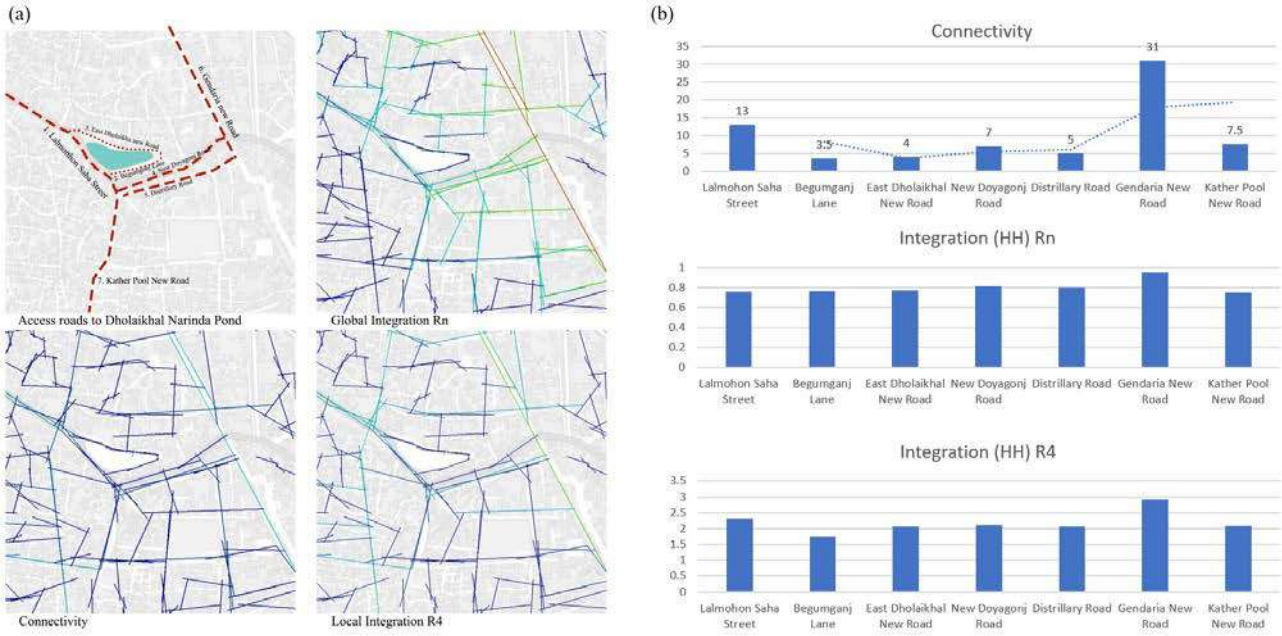

Figure 11 (a). Axial Maps of Dholaikhal Narinda Pond.
Figure 11 (b). Graphs showing connectivity, Global and Local integration values of Dholaikhal Narinda Pond.

Other access roads - such as Dholaikhal Road, Doyagonj New Road, and Distillery Road- exhibit moderate connectivity values (ranging from CN 5 to 13) and global integration values ranging from Rn = 0.746 to 0.812 (Figure 11 b). These values closely approximate the mean city-wide metrics (CN = 6.72; Rn = 0.765), suggesting that these streets, while not as dominant as Gendaria Road, are still relatively well integrated into Dhaka's spatial hierarchy and can support moderate levels of pedestrian and vehicular flow. Additionally, the site is accessible from secondary neighborhood streets such as Begumgonj Lane and East Dholaikhal New Road, both of which have comparable global integration values (Rn ≈ 0.763–0.771). Although their connectivity values are relatively low (CN = 3.5–4.0), their spatial depth within the network indicates potential for improved local accessibility, especially if supported by physical and visual permeability enhancements. However, from the field survey, it was seen that the current physical barriers hinder accessibility. The pond is entirely enclosed by a boundary wall, which restricts direct visual and physical access from surrounding streets and neighborhoods. From a syntactic perspective, while the axial network around the pond exhibits promising integration characteristics, the lack of permeability at the boundary interface inhibits its functional role as a public space.

4.2 Syntactic Analysis of Shahjahanpur Jheel

The spatial structure of Shahjahanpur Jheel reveals a locally coherent but peripherally situated site within Dhaka's broader axial network. The site is located near two major roads – Shahjahanpur Road and Atish Dipankar Road, which have comparatively higher Connectivity, local and global integration value. However, the Jheel itself lacks direct frontage on these primary corridors and instead remains spatially recessed, accessible solely via internal neighbourhood streets. The principal approach to the site is through Amtola Masjid Road, a secondary neighbourhood street that connects the Jheel to the major roads. This secondary road plays an important role in site accessibility with relatively high values- CN 23, Rn 0.956867, and R4 2.750479, thereby functioning as the primary connector between the Jheel and the surrounding urban fabric. The other surrounding neighborhood streets show local integration (R4) values that are consistently high, ranging from 2.631 to 2.963 (Figure 12 b), suggesting a spatially coherent and legible local system. This suggests that Shahjahanpur Jheel is quite accessible within its immediate surroundings due to the well-integrated local street network. However, from the physical survey, it was observed that these are very narrow roads, limiting their capacity to support vehicular movement and functioning primarily as pedestrian pathways. In contrast, the global integration values (Rn), while moderate to high, are not uniformly strong across all streets. This indicates that the Jheel is relatively segregated from the larger city grid.

However, many of these streets have low connectivity (CN values ranging between 3.00 and 9.00), limit movement options, and reduce access from areas beyond the immediate neighborhood. It was also observed during the field survey that the poor connectivity of the internal circulation network limits accessibility from the highly integrated primary roads. While local and global integration values are strongly correlated, the site's limited physical connection to the broader urban grid constrains its accessibility at the city scale. Overall, the syntactic values highlight a fragmented spatial structure that reinforces Shahjahanpur Jheel's orientation as a neighbourhood-scale public space rather than a city-scale destination. In summary, the spatial configuration of Shahjahanpur Jheel makes it highly accessible at the neighborhood scale, emphasizing its potential to become a community-focused public space.

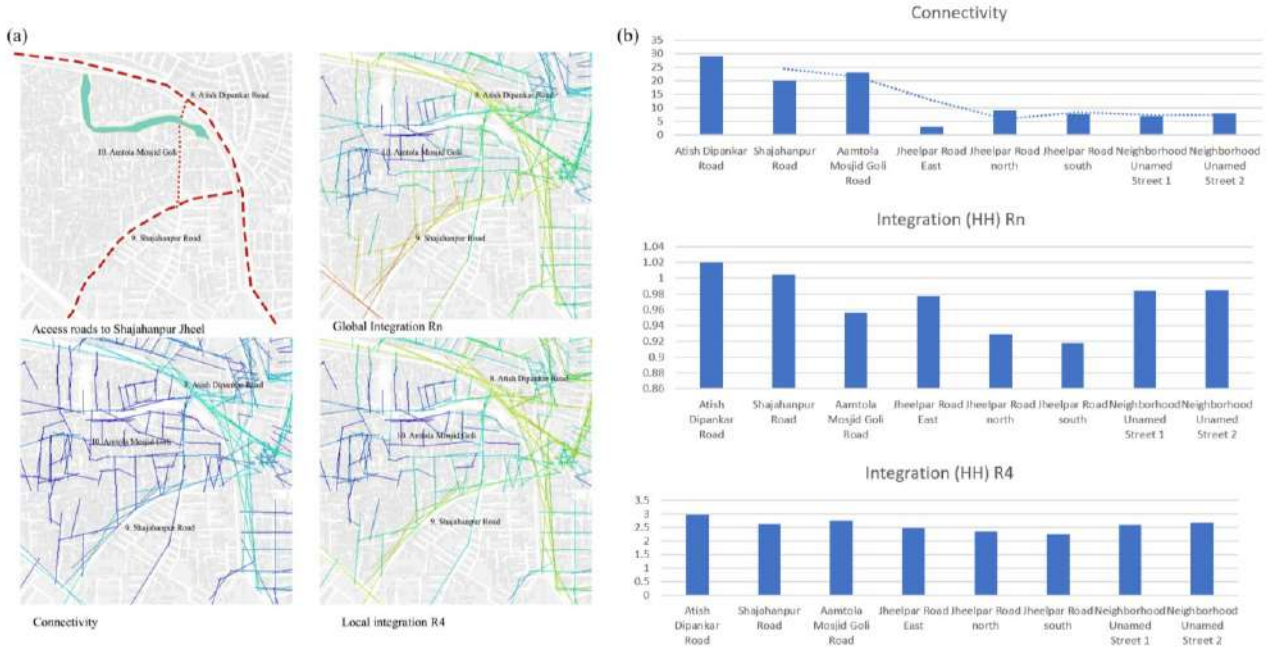

Figure 12 (a). Axial Maps of Shahjahanpur Jheel
Figure 12 (b). Graphs of connectivity, Global and Local integration values of Shahjahanpur Jheel

5. Discussion

The syntactic analysis reveals the degree and level of accessibility of the study areas compared to the city-scale and local scale. Dholaikhal Narinda Pond is well-integrated within Dhaka's urban grid, particularly due to its proximity to major intersection of highly integrated roads. Shahjahanpur Jheel exhibits strong local integration and coherence within its neighbourhood, but lacks direct access from major roads. The local roads are more segregated from city's spatial network, making the Jheel functionally more suited as a neighbourhood-scale public space rather than a city-wide destination.

Table 5: Correlation value of Global and Local Measures of the two study areas.

Correlation value of Global and Local Measures of the two study areas				
Study Area	**Correlation value R of Rn-R4/ Intelligibility**	**Equation**	**Correlation value R of Rn-CN/ Intelligibility**	**Equation**
Dholaikhal Narinda Pond	0.823178155	y = 4.2858x - 1.2371 R^2 = 0.6776	0.8470453	y = 118.4x - 84.41 R^2 = 0.7175
Shahjahanpur Jheel	0.819626194	y = 5.3213x - 2.5911 R^2 = 0.6718	0.4874873	y = 128.01x - 111.04 R^2 = 0.2376

Between the two study areas, Dholaikhal Narinda Pond is located at a major point where four main roads of Old Dhaka intersect. The connectivity (3.5–31.0) and global integration (0.746–0.947) of the surrounding roads closely align with average city values (CN 6.72; Rn 0.766), indicating the site has better accessibility. Therefore, the site fulfils Mark's criteria of being a good public space. In the scattergram (Figure 13a), global Integration vs connectivity shows a strong positive correlation ($R \approx 0.85$), indicating that roads can be easily accessed from different parts of the city, attracting a larger population. Additionally, the global vs. local integration scattergram (Figure 13 b) also shows a strong positive correlation ($r \approx 0.82$). This balance suggests Dholaikhal's local access roads are also well-connected locally and reasonably integrated at the city scale. In both cases, the tangent of the slope is also very steep. These correlations indicate that Dholaikhal has the potential to draw residents and

attract visitors from the larger part of Dhaka. Rethinking the physical enclosure, along with the formalization of entrance points at high-integration nodes, would significantly enhance the site's accessibility and its potential to serve as a city-scale urban destination. Few interventions, like providing a sidewalk in the key avenues leading to a formal entrance plaza at the intersection point of the primary roads, can create a more inviting entrance to the pond. By removing the existing physical boundary, and adding a few more access points on the north and east sides of the study area, accessibility can be enhanced. Additionally, widening the neighborhood streets- East Dholaikhal New Road and Begumganj Lane, and upgrading them to a more inviting promenade will encourage walking and cycling activity. These interventions will significantly benefit the local residents as well.

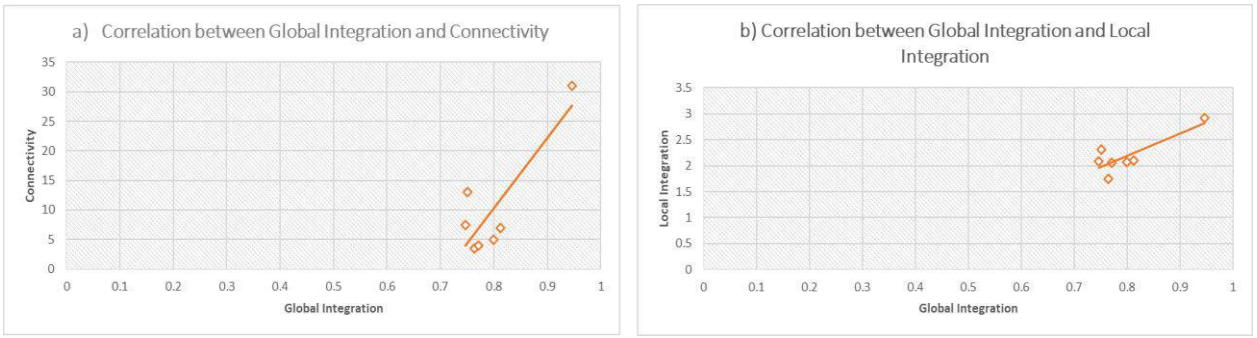

Figure 13 (a). Scattergram of Rn vs CN of Dholaikhal.
Figure 13 (b). Scattergram of Rn vs R4 integration of Dholaikhal.

In contrast, Shahjahanpur Jheel is deeply embedded in a densely built, compact residential fabric. Its spatial configuration fosters a neighbourhood-oriented public space. The scattergram (Figure 14a) reveals a weaker correlation between connectivity vs global integration (R≈0.49), indicating that connectivity does not consistently align with global integration. This suggests irregular spatial relationships, that the neighborhood streets are not well-integrated into the broader city network.

However, the spatial analysis (Figure 14 b) reveals a strong correlation between local and global integration (R≈ 0.82). Although neighbourhood streets are more segregated from the city's spatial network, the site has better accessibility within the confined neighborhood context. Again, this also fulfils Mark's criteria of accessibility, considering the neighborhood scale. It can serve the local movement effectively. This reflects a coherent and intelligible local network emphasizing the Jheel's role as a neighborhood-oriented public space. The spatial analysis suggests that the accessibility of Shahjahanpur Jheel should be limited to the neighborhood residents only. Therefore, design interventions should focus on limiting accessibility to the neighbourhood only.

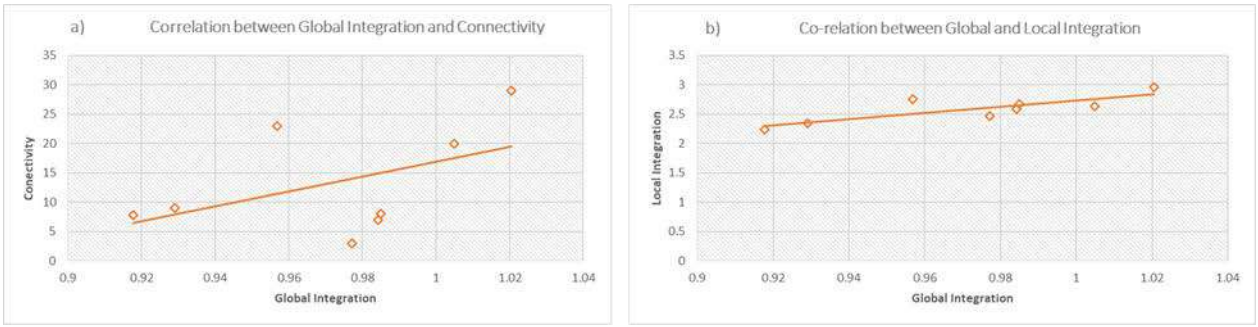

Figure 14 (a). Scattergram of Rn vs CN of Shajahanpur Jheel.
Figure 14 (b). Scattergram of Rn vs R4 integration of Shajahanpur Jheel.

Improvement of the local access routes, enhancing pedestrian walkways, and creating inviting edges along the Jheel is required for Jheel's revitalization. Additionally, widening the narrow feeder lanes, promenade along the water edge, and street furniture, walking and cycling trails, introducing *ghats* to access the waterbody, and provision for fishing and swimming activity, etc., will promote vibrant activities along the Jheel. This will, in turn, result in making the Jheel an inviting local gathering place and enhancing daily social interaction.

Finally, the results align with Hillier's theory that pedestrian movement patterns are shaped primarily by the spatial configuration of the urban grid. It is also evident in other research as well, where accessibility was assessed through space syntax analysis, public spaces can function more effectively and be used by the public more frequently when they are located in a highly intelligible spatial system appropriate to the scale- city or neighbourhood level.

6. Conclusion

This study examined the accessibility and spatial integration of Dholaikhal Narinda Pond and Shahjahanpur Jheel through the lens of space syntax, with the aim of understanding how urban waterbodies can function as inclusive public spaces in rapidly urbanising Dhaka. Using syntactic measures of connectivity (CN), global integration (Rn), and local integration (R4), the analysis quantified accessibility at both city and neighbourhood scales, addressing a critical gap in evaluating open spaces prior to redevelopment. The results highlight distinct spatial potentials for the two sites. Dholaikhal Narinda Pond exhibited high connectivity values (CN up to 31) and strong global integration (Rn $\approx$ 0.95), supported by strong correlations between integration and connectivity (R $\approx$ 0.85). These measures place it close to Dhaka's integration core, indicating strong potential as a city-scale public space. By contrast, Shahjahanpur Jheel, though more segregated at the city scale, demonstrated consistently high local integration (R4 values between 2.63 and 2.96) and a strong correlation between local and global integration (R $\approx$ 0.82), reinforcing its potential as a neighbourhood-scale community space. Together, these findings confirm that accessibility is scale-dependent and must be considered when designing inclusive urban interventions.

The broader contribution of this research lies in linking spatial configuration to social equity and liveability in dense urban contexts. The intelligibility of the spatial grid, measured by the correlation of global integration with connectivity and local integration, proved to be a reliable predictor of potential public use. This demonstrates that space syntax offers policymakers and urban designers an evidence-based framework to anticipate patterns of accessibility and design revitalisation strategies that align with both community and city-wide needs. In doing so, the study advances beyond conventional qualitative approaches, offering measurable insights into how urban waterbodies can enhance inclusivity and social cohesion. Despite its contributions, the study acknowledges limitations, particularly its focus on spatial metrics without incorporating long-term behavioural or socio-cultural dynamics. Future research should complement syntactic analysis with community engagement, post-implementation movement studies, and ecological assessments to capture broader dimensions of liveability. Nevertheless, the methodological framework developed here is replicable for other dense, informal urban contexts across the Global South, providing both theoretical and practical guidance for sustainable and equitable revitalisation of waterbodies as public open spaces.

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The author(s) declare(s) no conflicts of interest.

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The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

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References
Alam, I., Nur, S. M. S., & Mitra, C. (2025). Accessibility to Public Open Space of a densely populated city: a case study of Dhaka, Bangladesh. *Computational Urban Science*, *5*(1), 23. https://doi.org/10.1007/s43762-025-00187-9

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, *68*(1), 129–138. https://doi.org/10.1016/j.landurbplan.2003.08.003

Coombes, E., Jones, A. P., & Hillsdon, M. (2010). The relationship of physical activity and overweight to objectively measured green space accessibility and use. *Social Science & Medicine*, *70*(6), 816–822. https://doi.org/10.1016/j.socscimed.2009.11.020

Das, B., & Islam, I. (2010). Analyzing the Proposals of FAP 8B Project of Dhaka and Present Context of Retention Pond Areas and Canals. *Journal of Bangladesh Institute of Planners*, *3*(1), 89–102. https://doi.org/10.3329/jbip.v3i1.76866

Francis, M. (2003). *Urban open space: Designing for user needs*. Washington, DC: Island Press in cooperation with the Landscape Architecture Foundation.

Gehl, Jan. (2012). *Life Between Buildings*. Island Press.

Hanson, J. M. (1989). *Order and structure in urban space: A morphological history of the City of London* (Doctoral dissertation, University College London). University of London.

Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural movement: or, configuration and attraction in urban pedestrian movement. *Environment and Planning B: Planning and Design*, *20*(1), 29–66. https://doi.org/10.1068/b200029

Ho, D. C., Lai, L. W., & Wang, A. (2021). The effects of 'publicness' and quality of publicly accessible open space upon user satisfaction. *Environment and Planning B: Urban Analytics and City Science*, *48*(4), 861–879. https://doi.org/10.1177/2399808320903733

Hossain, S. T., Al-Ramadan, B., Bilal, M., & Altuwaijri, H. A. (2025). Enhancing Accessibility in Public Spaces: A Computational Study of Hatirjheel Lakefront Using Space Syntax. *ISPRS International Journal of Geo-Information*, *14*(1), 29. https://doi.org/10.3390/ijgi14010029

Huang, B.X., Chiou, S.C., & Li, W.Y. (2020). Accessibility and Street Network Characteristics of Urban Public Facility Spaces: Equity Research on Parks in Fuzhou City Based on GIS and Space Syntax Model. *Sustainability*, *12*(9), 3618. https://doi.org/10.3390/su12093618

Jabbari, M., Fonseca, F., & Ramos, R. (2018). Combining multi-criteria and space syntax analysis to assess a pedestrian network: the case of Oporto. *Journal of Urban Design*, *23*(1), 23–41. https://doi.org/10.1080/13574809.2017.1343087

Khan, F. A., & Tabassum, N. (2024). Assessing walkability in Dhaka's Central Business districts. *Transportation Research Interdisciplinary Perspectives*, *27*, 101184. https://doi.org/10.1016/j.trip.2024.101184

Khan, M. (2014). Study of Open Spaces in the Context of Dhaka City for Sustainable Use: A Syntactic Approach. *International Journal of Engineering and Technology*, *6*(3), 238–243. https://doi.org/10.7763/IJET.2014.V6.704

Khan, M. W., Hossain, Md. S., & Alam, M. (2023). GIS-Based Analysis to Identify the Distribution and Accessibility of Urban Green Space in Dhaka Metropolitan City, Bangladesh. *Journal of Geographic Information System*, *15*(01), 35–52. https://doi.org/10.4236/jgis.2023.151003

Long, Y., Qin, J., Wu, Y., & Wang, K. (2023). Analysis of Urban Park Accessibility Based on Space Syntax: Take the Urban Area of Changsha City as an Example. *Land*, *12*(5), 1061. https://doi.org/10.3390/land12051061

Luo, Y., & Lin, Z. (2023). Spatial Accessibility Analysis and Optimization Simulation of Urban Riverfront Space Based on Space Syntax and POIs: A Case Study of Songxi County, China. *Sustainability*, *15*(20), 14929. https://doi.org/10.3390/su152014929

Mohamed, A. A., Kronenberg, J., & Łaszkiewicz, E. (2024). Integrating space syntax with field observations to understand the spatial logic of park infrastructure. *Journal of Asian Architecture and Building Engineering*, *23*(6), 2115–2133. https://doi.org/10.1080/13467581.2023.2278883

Nawar, N., Sorker, R., Chowdhury, F. J., & Mostafizur Rahman, Md. (2022). Present status and historical changes of urban green space in Dhaka city, Bangladesh: A remote sensing driven approach. *Environmental Challenges*, *6*, 100425. https://doi.org/10.1016/j.envc.2021.100425

Nilufar, F. (2000). *Urban life and use of public space: Study of responsive public open spaces for supporting urban life in Dhaka City*. University of Dhaka.

Rahman, M. H. (2022). A study on determining land use/land cover changes in Dhaka over the last 20 years and observing the impact of population growth on land use/land cover using remote sensing. *Malaysian Journal of Civil Engineering*, *34*(2), 1–9. https://doi.org/10.11113/mjce.v34.17812

Rahman, Md., & Nilufar, F. (2024). An investigation into the land use pattern of Dhaka: Identifying activity nodes for a compact city. *Spatium*, *52*, 1–13. https://doi.org/10.2298/SPAT240630014R

Roni, N. A., Tanvir, M. R., Tomal, T., & Iqbal, M. M. J. I. (2022). Spatial structure of retail development in planned residential area of Dhanmondi, Dhaka, Bangladesh. *Open Access Library Journal*, *9*(9), 1–21. https://doi.org/10.4236/oalib.1109088

Swanwick, C. (2009). Society's attitudes to and preferences for land and landscape. *Land Use Policy*, *26*, S62–S75. https://doi.org/10.1016/j.landusepol.2009.08.025

Tannous, H. O., Major, M. D., & Furlan, R. (2021). Accessibility of green spaces in a metropolitan network using space syntax to objectively evaluate the spatial locations of parks and promenades in Doha, State of Qatar. *Urban Forestry & Urban Greening*, *58*, 126892. https://doi.org/10.1016/j.ufug.2020.126892

Thwaites, K., & Simkins, I. (2006). *Experiential landscape*. Routledge. https://doi.org/10.4324/9780203462096

Valipour, E., Mobaraki, A., Nikoofam, M., & Tayyebisoudkolaei, S. (2019). Establishment of Space syntax to read and analyze urban network; the case of study, Famagusta city of Cyprus. *Journal of Contemporary Urban Affairs*, *3*(1), 154–160. https://doi.org/10.25034/ijcua.2018.4692

Wright Wendel, H. E., Zarger, R. K., & Mihelcic, J. R. (2012). Accessibility and usability: Green space preferences, perceptions, and barriers in a rapidly urbanizing city in Latin America. *Landscape and Urban Planning*, *107*(3), 272–282. https://doi.org/10.1016/j.landurbplan.2012.06.003

Yamu, C., van Nes, A., & Garau, C. (2021). Bill Hillier's Legacy: Space Syntax—A Synopsis of Basic Concepts, Measures, and Empirical Application. *Sustainability*, *13*(6), 3394. https://doi.org/10.3390/su13063394

Zhai, Y., Li, D., Wu, C., & Wu, H. (2021). Urban park facility use and intensity of seniors' physical activity – An examination combining accelerometer and GPS tracking. *Landscape and Urban Planning*, *205*, 103950. https://doi.org/10.1016/j.landurbplan.2020.103950

Zhang, S., & Zhou, W. (2018). Recreational visits to urban parks and factors affecting park visits: Evidence from geotagged social media data. *Landscape and Urban Planning*, *180*, 27–35. https://doi.org/10.1016/j.landurbplan.2018.08.004

Zhang, T., Lian, Z., & Xu, Y. (2020). Combining GPS and space syntax analysis to improve understanding of visitor temporal–spatial behaviour: a case study of the Lion Grove in China. *Landscape Research*, *45*(4), 534–546. https://doi.org/10.1080/01426397.2020.1730775

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Original scientific paper

Influence of the Mass Rapid Transit System on Plotted Residential Property Prices: A Case Study of Gurugram, India

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ABSTRACT

Mass Rapid Transit Systems (MRTS) are increasingly recognised as critical drivers of urban transformation, particularly in rapidly urbanising cities at the Global level. However, empirical research on their influence on plotted residential property markets in emerging urban contexts remains limited. This study investigates the socio-economic impact of the Delhi Metro Line extension in Gurugram, India, across the various phases of the metro project. Using a mixed-methods approach, it combines a hedonic price modelling of 300 residential properties from 2007 to 2024 with qualitative surveys and spatial analysis. The study measures "proximity premiums" and contextualises them through stakeholder perspectives. The results indicate that properties within 500 metres of a metro station experienced price growth of 20–25% after project announcement and around 30% post-operation, relative to earlier trends. These effects are highly localized, with premiums diminishing beyond 1km and disappearing beyond 1.5-2km. The hedonic model confirmed distance to the nearest station as a key determinant of price with an average 12% price decrease per kilometre ($p < 0.01$), along with other influential variables like plot size, proximity to the CBD, and highway access. The model showed strong explanatory power ($R^2 \approx 0.64$). The findings reveal that MRTS can substantially enhance residential property prices but also influence the spatial distribution of economic opportunities, potentially intensifying socio-economic disparities if unregulated. This paper advances the debate on land value capture in Indian cities, offering evidence-based recommendations for equitable urban development strategies in the context of contemporary urbanisation.

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Highlights:	Contribution to the field statement:
- The implementation of MRTS led to a 20 to 30% increase in the value of homes within 500 meters of stations, which supports the bid-rent theory in a growing city. -The price of the property is increasing significantly, with the most significant jumps occurring near metro stations and the smallest jumps more than 1.5 km away. -About half of the price premium showed up during the planning and building stages, and the other half showed up after metro operations started.	This study offers insights into how the Mass Rapid Transit System (MRTS) infrastructure shapes socio-economic patterns in a rapidly urbanizing Indian city. It shows the novel empirical examination of the relationship between plotted residential property prices and the context of an emerging economy, with a specific focus on Gurugram, India. It helps people understand how public transportation affects property prices in cities with extensive planned development. This paper contributes to transit value research by examining price fluctuations in the different phases of the metro project. It provides decision-makers with important information on how to maximize land value.

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1. Introduction

Urbanisation in the twenty-first century is marked by unexpected rates of spatial expansion, infrastructural investment, and socio-economic transformation (Iamtrakul et al., 2024; Begam et al., 2024). In many emerging cities, urban transport infrastructure—particularly the Mass Rapid Transit System (MRTS)—serves not only as a mobility solution but also as a catalyst in reshaping the urban land markets, investment patterns, and choices of residential location (Yu et al., 2024). Improvements

in accessibility from major projects, like metro rail transit, usually lead to higher property prices, aligning with traditional urban economic theory (Tang et al., 2022; Barbosa, 2024).

According to Alonso's (1964) bid-rent theory, shorter travel times and better connectivity make people more willing to pay for well-located land. Empirical research across the world confirms this theory. Many studies have shown that being close to mass transit, such as rail or metro, is linked to higher property values (Zhang et al., 2024; Jiang et al., 2020). For instance, a meta-analysis by Rojas et al. (2024) found that in Southern Sweden, house prices increased by about 2.3% on average for every 250 metres reduction in distance to a railway station. However, commercial properties often experience greater value gains. One study reported a roughly 12% hike in commercial values within 0.25 miles of a transit station because businesses are willing to pay more for good accessibility. These capitalisation effects have been documented (Ko, 2021; Zhang, 2023; Guan et al., 2021).

Overall, across cities in North America, Europe, and Asia, transit accessibility adds value to nearby properties, although the impact of the premium varies. Not all research, however, highlights a uniform positive impact of transit investments. Local conditions can change or even reverse the effects of improved accessibility. For example, proximity to a new rail station in suburban Washington, DC—a car-oriented setting—negatively impacted the real estate market in the neighbouring area (Acuña, 2023). The adverse effects were caused by noise, traffic, crime, and parking issues. Likewise, a study in Manchester (UK) found no significant change in house prices before and after the opening of a new tram line, indicating that local factors and alternative transport options can alter the expected accessibility benefits (Rennert, 2022). Similarly, in Atlanta, where a high crime rate near some MARTA stations reduced the benefits of accessibility, mixed effects on nearby home values were observed (Acolin et al., 2022).

In contrast, many U.S. studies have shown significant increases from transit. In Chicago, for instance, land values around planned metro stations began rising years before the service started (Acton et al., 2022). Similarly, in Wuhan, China, property prices within 1.6 km of new subway stations jumped by about 7–14% after the stations opened (Bardaka, 2024). These findings show that transit infrastructure generally has a significant impact on the real estate market, although the timing and magnitude of impacts depend on local urban conditions. Transit infrastructure often catalyses positive change in neighbourhoods by attracting more commercial activities and improving amenities, which in turn can boost property values of nearby areas. However, it is important to be mindful of the potential risk of gentrification, which can displace lower-income residents who are affected by the improved accessibility (Bardaka, 2024). These complex results emphasise the importance of integrating MRTS projects with broader urban planning strategies to ensure sustainable development (Begam et al., 2024).

1.1 Background and Context

Gurugram, previously known as Gurgaon, is part of India's National Capital Region and presents a relevant case study to examine how transit development impacts these dynamics, with implications for both real estate markets and socio-spatial equity. In the past two decades, the city has undergone significant urbanisation and infrastructural development, including the extension of the Delhi Metro and the establishment of a local metro system, which is developed and operated by private players. Consequently, real estate activity and land prices in Gurugram have seen a significant increase, particularly in the plotted residential sectors.

However, there has been a paucity of scholarly research regarding the reactions of these markets. The real estate sector in the study area encompasses a substantial portion of "plotted development," distinguishing it from literature focused on residences or commercial structures. In such settings, the development of infrastructure projects, especially the transit system, is directly linked with land/property prices as well as projections of future development. While this model is standard in Indian cities, few studies examine how transit investments affect these properties and the socio-economic dimensions of contemporary urbanisation (Parihar et al., 2025). It is crucial to understand how investments in mass rapid transit systems affect the prices of plotted residential properties and

also increase the demand for residential, commercial, and industrial properties along metro corridors (Begam et al., 2024).

1.2 Problem Statement and Research Gap

In India, plotted developments form a substantial part of the urban land market, often in both regulated sectors and informal colonies. However, most of the empirical literature concentrates on market trends related to built developments such as offices and apartments, as well as commercial properties. In contrast, the dynamics of plotted properties remain comparatively less explored and understudied. Emerging research in India has now begun to record these effects. For instance, Singhal and Tyagi (2021) found that the price of commercial properties declines while the Delhi Metro is being planned and built, but increases after it opens.

There is still uncertainty about when this value uplift occurs, how much it varies, and its geographic impact, particularly for plotted properties. The study by Karthigeyan and Chander (2020) examined the impact of a Chennai Metro station on development in the influence zone (within a 10–12-minute walking distance) by assessing accessibility and other factors, including MRTS availability. Kashyap and Berry (2015) examined the value of land near Jaipur metro stations and suggested changing zoning regulations to maximise these benefits. Several studies analyse price changes across spatial and temporal dimensions (e.g., Malhotra & Rastogi, 2020), while global empirical studies highlight the heterogeneous capitalisation by type of properties and market segments.

For example, the impact of Seoul's Metro Line 9, utilising a spatial difference-in-differences approach, showed that office spaces and high-end apartment developments experienced the most significant value gains from the new line. In contrast, lower-priced residential areas saw comparatively minor benefits (Chun-Chang et al., 2020). This contribution highlights inequality concerns, as high-investment properties and affluent neighbourhoods might benefit disproportionately from transit-induced improvements, likely exacerbating the value gap between different areas (Schirripa Spagnolo et al., 2024).

Zhang et al. (2024) identified significant appreciation in residential property prices due to the introduction of light rail, compared to land-assessed values in regions that experienced slight declines. Suri and Cropper (2024) estimated a 7–8% increase in property sale prices within 1 km of the Metro in Mumbai, affecting both commercial and residential land values. Wang et al. (2021) found the most substantial impact of rail transit on housing prices within a 400 m radius along Fazhou Metro Line 1 during different phases of the project. The most significant impact occurred in the operation phase, with a 19.6% average increase compared to the construction phase.

Despite this progress, no prior research has systematically examined the impact of MRTS on plotted residential property prices through the different phases of development—announcement, construction, and operation. Nor have studies assessed how far the benefits extend spatially. Most international research focuses on built-up properties in developed nations. There is a lack of empirical evidence from Indian cities, particularly about changes in the value of plotted residential property over time. This study aims to address that gap by examining the relationship between Gurugram's plotted residential market and mass rapid transit development by estimating:

(a) the magnitude of price upliftment for plotted residential property due to MRTS,
(b) the distance over which these effects are felt, and
(c) the project phase during which value changes are most significant.

1.3 Objectives and Hypotheses

The study examines the impact of MRTS on residential property prices in Gurugram across different stages of the project. The goal is to measure the price increase linked to metro access and to explore how prices change over time and space. Key questions include: Did property prices get influenced by the metro, and what was the impact of the metro during different phases of the project? These four hypotheses are proposed: (H1) Anticipation Effect: Pre-Operation Capitalization: Prices near planned metro stations rose before the system became operational. (H2) Operational Effect: Post-opening

capitalization: property prices appreciated significantly near the metro station. (H3) Distance Decay: the price depreciates as one moves away from the metro station, reaching its maximum within 500m and becoming negligible beyond 1.5–2 km. (H4) Local Amenities: Other factors (e.g., plot size, proximity to CBD or highways) also influence prices, but metro proximity remains significant after controlling for these. These hypotheses, which draw from urban economic theory and previous studies, form the strong base of our research and require empirical testing in the Indian context.

1.4 Significance and Structure of the Paper

The study offers academic and policy relevance. It is among the first studies to evaluate MRTS impacts on plot-level residential property values in an Indian city. By analysing phase-wise value changes across the metro project lifecycle (announcement, construction, and operation) and distance decay, the study contributes depth to existing literature, which typically focuses on post-completion analysis. The findings support implementing more effective land value capture mechanisms within a policy framework (Development Control regulation, Floor Area Ratio). If property prices rise by ~30% near stations, a portion could be tapped for infrastructure funding. The Ministry of Housing and Urban Affairs (2017) also encourages such practices in national policy. Furthermore, insights into the spatial extent of price benefits can inform zoning changes, increased Floor Area Ratios (FAR), and affordable housing mandates near stations to avoid displacement and support inclusive growth. The methodology used in our research enhances the robustness of findings and overcomes common data limitations in developing urban settings. The paper is structured into four sections as shown in Figure 1 , with Section 2 focusing on the methods and materials, research procedure, and data analysis. Section 3 presents the results of applying Hedonic Price Modelling and Difference-in-differences, along with price trends by metro phase. Section 4 presents an interpretation of empirical results and key findings, concluding with a discussion on future research scope. It also discusses findings related to the hypotheses, offers policy implications, and examines limitations.

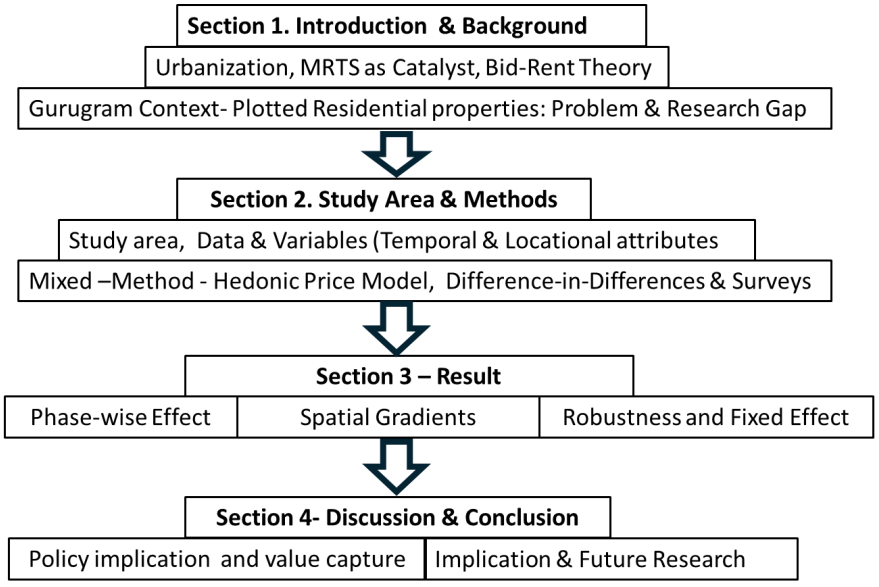

Figure 1: Structure of the paper.

2. Materials and Methods

2.1 Study Design and Setting

This study employed a mixed-methods research design to assess the impact of the Mass Rapid Transit System (MRTS) on plotted residential property prices in Gurugram, India. The use of both quantitative and qualitative methods was essential due to the complex relationship between determinants (e.g., metro proximity, plot size, market trends, etc.) of the property price. The methodology consists of two primary components:

1. Hedonic Pricing Model (HPM): This quantitative analysis (Erdoganras et al., 2023)(Muto et al., 2023) Assesses how proximity to metro stations and other factors affect residential property prices across three phases—pre-construction (2007), during construction (2008-2010), and post-operation (2011)—as well as prices in 2024. To verify the robustness zone, DID has also been applied by comparing the property prices in the treated zone and the control zone (Chen et al., 2022).
2. Qualitative and Spatial Analysis: Field surveys and stakeholder interviews complemented by Geographic Information System (GIS) mapping provided a spatial-temporal understanding and validation of the model's findings.

The study focused on the urban corridor served by the Delhi Metro's Yellow Line extension in Gurugram. The prominent metro stations analyzed in the corridor included Guru Dronacharya, Sikenderpur Metro station, MG Road, Iffco Chowk, and Millennium City Centre. Plotted residential areas within a 2000 m radius of metro stations formed the primary treatment zone, aligning with typical influence zones developed by literature and National Transit-oriented Policy (2020). Properties beyond 2000m from the metro station were considered control zones, reflecting general market trends unaffected by MRTS, and were used for comparison. Key neighbourhoods studied were along the metro station, including planned and unplanned areas like Sushant Lok, DLF Phases (1–5), urban village, colonies, and South City. This double-checks approach aided a strong analysis of metro-induced price variations and supported triangulation, hence improved the reliability and depth of the study's findings.

2.2 Participants or Subjects

We conducted field surveys and interviews with primary stakeholders in Gurugram's real estate sector, including property dealers, property owners, developers, and urban planners. They shared insights on price trends and the perceived impact of the MRTS by providing sales details of the properties, such as price, plot size, and other property features. Many reported a rise in prices after the announcement or during metro construction, while some noted buyer hesitation during construction phases. Their perspectives helped us deepen our understanding of the context of the study. Simultaneously, we analyzed approximately 300 residential property transactions from 2007 to 2024 to create our empirical dataset for statistical analysis. Together, stakeholder perceptions and transaction data formed a solid basis for examining the metro's influence on property values.

2.3 Materials and Equipment

To develop a comprehensive and reliable dataset, the study adopted a triangulation approach, sourcing data from primary and secondary sources, which ensured reliability in both qualitative and quantitative parameters of property price trends near Gurugram's metro corridor. Primary data were collected through stakeholder interviews and surveys. In contrast, secondary data on property prices were sourced from online platforms such as MagicBrick and 99acres, as well as from reputable real estate consulting firms like JLL (2021) and other Consulting firms. As the survey helped us to understand the study area in detail, online sources provided additional strength to our database. GIS was used for referencing the properties and measuring other distance-based attributes, like distance from the metro station, city centre, major highway, etc. Distances were measured as straight lines from the metro station to the property, and statistical analysis was conducted using SPSS. The whole data set included details of 300 residential properties and their sale price from 2007 to 2024.

2.4 Procedures and Protocols

The whole data set consisted of the addresses of 300 plotted residential properties along the metro corridor, property features like age of the building, no. of floors, area, distance from the nearest metro station, distance from the CBD, and Distance from the nearest park/ green space, distance from the nearest hospital and school, width of access road. The data also consisted of property prices from 2007 to 2024, in per sq m. To study the impact of the metro on property pieces, a Hedonic Price model was formulated, which calculated the natural log of property sale price as the dependent variable and considered other attributes as independent variables and interaction terms of different phases of the metro project. The logarithmic transformation helped to standardize the price distributions and made

it easier to understand he coefficients as percentage impacts. Along with this, GIS was used to map the price change and delineate the study area and distance bands, as shown in Figure 2. This visual representation helped to confirm the model and its results. Furthermore, the difference-in-differences (DID) was employed to study the causal effect of the property prices within 500m from the metro station as the treated group, with the properties more than 2000m away as the control group. Ultimately, integrating empirical results with spatial analysis enhanced the study's validity, thereby strengthening confidence in the conclusion.

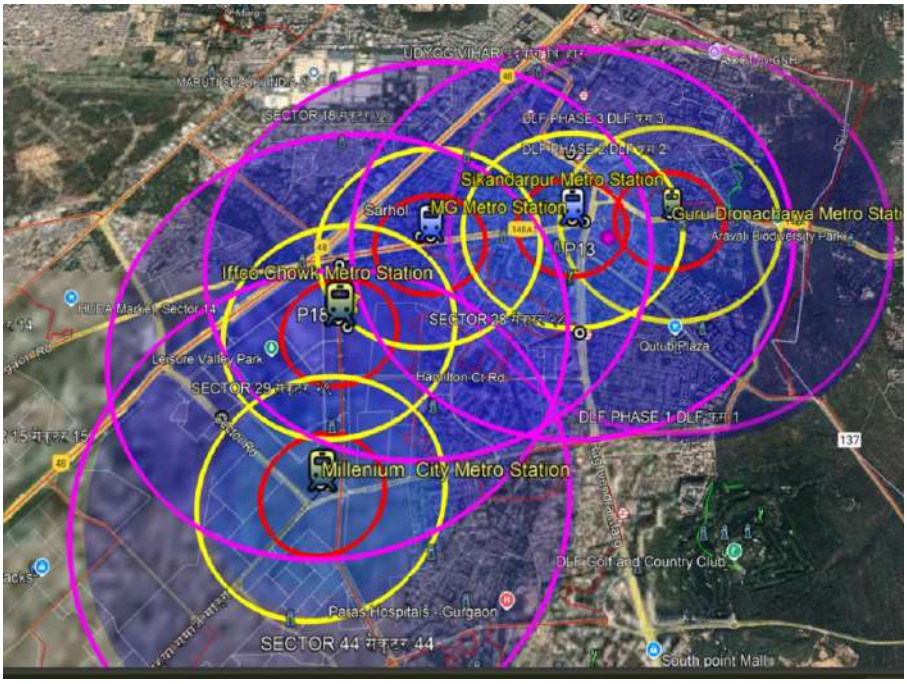

Figure 2. Spatial representation of the metro station and the influence zones.

Figure 2 illustrates the five identified stations: Guru Dronacharya Metro Station, the initial station originating from Gurugram, extension of the Delhi Metro yellow line in Gurugram, Sikenderpur, MG Road, Iffco Chowk, and Millennium City Centre. The figure illustrates three distinct distance bands distinguished by colours: red indicating a radius of up to 500 meters from the metro station; yellow representing a distance of 501-1000 meters; and pink denoting a distance range of 1000-2000 meters.

2.5 Data Analysis

The study utilized Hedonic Price Modeling (HPM) to evaluate the results, decomposing property prices accordingly. The HPM decomposes a property's price into the implicit values of its attributes. Our dependent variable was the natural logarithm of the sale price per square meter of each plotted residential unit, which normalized the distribution and enabled percentage-based interpretation of coefficients.

The core regression model is structured as follows in Equation 1:

$$ln(P_i) = \beta_0 + \beta_1(DisMetro_i) + \beta_2(DisMetro_i \times PostAnnounc_i) + \beta_3(DisMetro_i \times PostOpen_i) + \sum_k \gamma k X_{ki} + \varepsilon_i$$

Where:

- P_i - Price per square meter of plot i
- $DisMetro_i$ - Distance of plot i to the nearest metro station (km)
- $PostAnnounc_i$- Dummy variable = 1 if a sale occurred after the metro announcement (2007)
- $PostOpen_i$-Dummy variable = 1 if sale occurred after metro operation began (2010–2024)
- $\sum \gamma k X_{ki}$ - Vector of other property and locational attributes
- ε_i - Error term

This result illustrates the impact of metro proximity on the three phases of the project, as shown below:

- β_1 (Pre-announcement slope)- examined the impact of the proximity to the metro station before the announcement of the metro project. Moreover, showed a negligible effect.
- β_2 (post-announcement change): Indicated a negative value, which means an increase in the property prices after the announcement of the metro, driven by the expectation of the buyers.
- β_3 (post-operation change): After the operation of the metro, an additional price premium was noticed. A prominent negative coefficient indicates a sharp price increase due to proximity to the metro.

The model also studied the control variables related to location, property features, and accessibility, which impact the property prices. The key variables are as explained below:

Distance to nearest highway (m) - This measures road accessibility to the closest highway, which in this case is NH48. Better connectivity to the road and proximity generally enhance the property prices. However, extreme nearness sometimes causes disadvantages, such as noise.

Distance to CBD (m) - This is the straight-line distance from the property to the city's commercial hubs, such as DLF Cyber City and MG Road. As proximity to the CBD increases desirability and price premiums, a negative coefficient was expected.

1. Distance to nearest park (m) - A negative coefficient was expected, as proximity to green spaces and parks is associated with fundamental amenities that directly relate to health and the environment.
2. The width of the access road (m) indicates the width of the road next to the property, which reflects better neighbourhood infrastructure and improves accessibility, thereby promising a positive coefficient.
3. Plot Area (sqm) - Plot size is the most critical factor of the property, and larger plots often have a lower price due to the effect of "bulk discounts" compared to smaller plots. So, expecting a slightly negative coefficient.
4. Year of the sale fixed effect- A variable affected by macroeconomic factors such as inflation, policies, and the tax structure, influencing the real estate market and property prices. Additionally, dummy variables were created for each transition year (2007-2024) to ensure that the results accurately reflect changes in property prices within the specific study area rather than across the entire city.

To address potential spatial autocorrelation, standard errors were clustered by neighbourhood. Residual diagnostics confirmed the model's reliability. Using statistical modelling, we assessed R^2 and the F-statistic to evaluate the model's fit. Aside from observational data, the study also introduced a quasi-experimental framework. Consequently, the study analyzed the difference between treated and control zones to capture metro-related impacts, employing interaction terms of distance and time in a difference-in-differences (DID) approach. It examined the causal effect of metro accessibility on property prices. The model specification is as follows in Equation 2:

$$Price_{2024} = Treated + Price_{2010} + DID$$

The variables of the model are explained below:

Price $_{2024}$ -Dependent variable as the current property price.

Treated -A binary variable (1=property within 500m of the metro, 0=otherwise), highlighting baseline spatial advantage even before the metro's impact.

Price $_{2010}$ -Control for starting property prices to measure the difference and time-invariant features.

DID -This is the interaction between treated properties and controlled properties.

It is observed that the impact of metro accessibility is slightly greater in privately developed areas due to better last-mile connectivity. It is also confirmed that property prices in the metro-influenced zones are not directly affected by the city's overall market trend, but rather by metro accessibility.

We examined the data from the field surveys to identify common statements regarding the metro's impact. We compared these findings with the timeline and magnitude of effects indicated by the regression analysis. For example, many local realtors and residents remembered that "prices in Sector 54 started creeping up as soon as news of the Rapid Metro surfaced," highlighting an anticipation effect

that occurred well before the line began operations. Some respondents also noted that during construction, confusion and noise from ongoing works led to some buyers being unsettled, indicating a lesser impact on property prices in that period. These direct observations provided qualitative support for the phase-wise findings, as per the model, including increased values following announcements and the potential for a period during construction. They also emphasized that attributing price changes to the metro was a visible and transparent process, especially compared to other infrastructure development. For example, if a specific sector saw a spike in 2010 because of a significant development launch unrelated to the sector, our interviews and local insights helped identify this. This confirmed our analysis, which was described in detail, including the incorporation of year effects and regional factor controls. The phased analysis is beneficial here – by demonstrating that the distance to the station became important only after the metro initiative and not before, we strengthen the argument that the change began openly by the metro (assuming other factors would not systematically produce the same pattern). Additionally, we compared our findings with established empirical patterns from the literature. It is observed that property prices and the distance decay in the study area are significant, which supports the theoretical assumptions and previous studies. The following section presents the analysis results and highlights the extent and timeframe of property price changes due to MRTS.

3. Results

3.1 Presentation of Key Findings

It is evident from the analysis that the metro availability and accessibility in the study area have a significant impact on the residential property prices. (Jiang et al., 2020) (Rey-Blanco et al., 2024). The results of the Hedonic Pricing Model (HPM) and Difference-in-Differences (DID) are summarized in Table 1 and Table 2, which also prove the same. The introduction of metro accessibility created a price premium, particularly after the metro's official announcement and subsequent opening. Specifically, the post-announcement period saw a distance premium of approximately 4.7%. In comparison, the post-operation phase resulted in an increased premium of around 9.1% for every kilometre closer to a metro station. The findings indicate that the metro plays a significant role in defining the land and property market.

Table 1: Hedonic Regression Results – Determinants of Log Land Price (₹/sq m).

Variable	Coefficient (β)	Std. Error	Significance
Distance to Metro (km)	–0.008	0.012	(n.s.)
Distance × post-announcement	–0.047	0.011	*** (p < 0.001)
Distance × post-operation	–0.091	0.014	*** (p < 0.001)
Plot Size (100 sq m)	–0.026	0.005	*** (p < 0.001)
Distance to CBD (km)	–0.059	0.008	*** (p < 0.001)
Distance to Major Highway (km)	–0.022	0.007	** (p < 0.01)
Distance to Nearest Park (km)	–0.015	0.006	** (p < 0.01)
Access Road Width (m)	+0.0035	0.0012	** (p < 0.01)
Constant	9.631	0.078	***
Year Fixed Effects	Included	–	–
Adjusted R^2	0.632	–	–
F-statistic (model p-value)	57.97 (p < 1e-59)	–	–

*Note: *(n.s. = not significant; **p<0.01; **p<0.001)*

Table 1 presents the findings of the Hedonic Price Modelling, which quantifies the relationship between metro accessibility property attributes and locational attributes on residential property prices in the study area, highlighting a significant price uplift during the post-announcement and post-operation phases. The model shows 64.3% of the variation in the property prices, which indicates a strong explanatory power.

Table 2: Result of DID Regression analysis.

Variable	Coefficient (₹)	Std. Error	t-Statistic	p-Value
Intercept	5000	1200	4.17	< 0.01
Treated (Within 500m)	22000	3200	6.88	< 0.001
Price_2010	0.65	0.05	13	< 0.001
DID Interaction Term	28330	3100	9.13	< 0.001
Model Summary				$R^2 = 0.835$

Table 2 summarizes the Difference-in-Differences (DID) regression results, showing a substantial positive causal impact of metro access on property prices. The DID interaction terms (Rs. 28330/-) are highly significant, which proves that the proximity to the metro enhances the property prices.

3.2 Statistical Analysis

This section presents the results of the Hedonic Price Modelling (HPM) and Difference-in-Differences (DID) analysis, which shows the quantification of the influence of metro accessibility on the property prices of the plotted residential area in Gurugram. The Key findings, which include:

- Distance to Metro: The pre-announcement coefficient ($\beta = -0.008$) was not significant, confirming that, before the metro's announcement, proximity to the metro did not affect land prices. After the announcement, however, proximity to the metro became a significant factor, with a 4.7% price premium per kilometre closer to the metro station during the announcement-to-construction phase.
- Post-Operational Impact- Following the metro's operation, property prices increased by 9.1%, indicating a significant rise in property values.
- Other factors- Each factor behaved differently, for example, plot size, which showed a negative relationship with property prices, as demonstrated by the HPM. Similarly, proximity to the CBD and major highways was associated with higher property prices.

The results were aligned with a multicollinearity check, confirming that the high correlation did not skew the relationships between variables.

The DID coefficient is ₹28,330 per sqm ($p < 0.001$), indicating that, after accounting for baseline differences and price trends, properties near metro stations gained ₹28,330/sqm more than others due to the metro becoming functional.

4. Discussion

The results of this study highlight a strong connection between proximity to the metro and the price of residential properties in Gurugram. We observe that the metro's announcement and subsequent operation significantly increased the price, confirming that both anticipatory effects (before construction) and realized benefits (after metro operation) contributed to raising property values.

This reinforces the idea that MRTS infrastructure serves as a key driver of urban property price appreciation. The temporal effect of the metro (pre- and post-opening) demonstrates the broader economic principles of value capture and accessibility, where early stages of a transportation project (announcements and planning) can already influence market behaviour, and the operational phase amplifies these effects as accessibility becomes a tangible benefit.

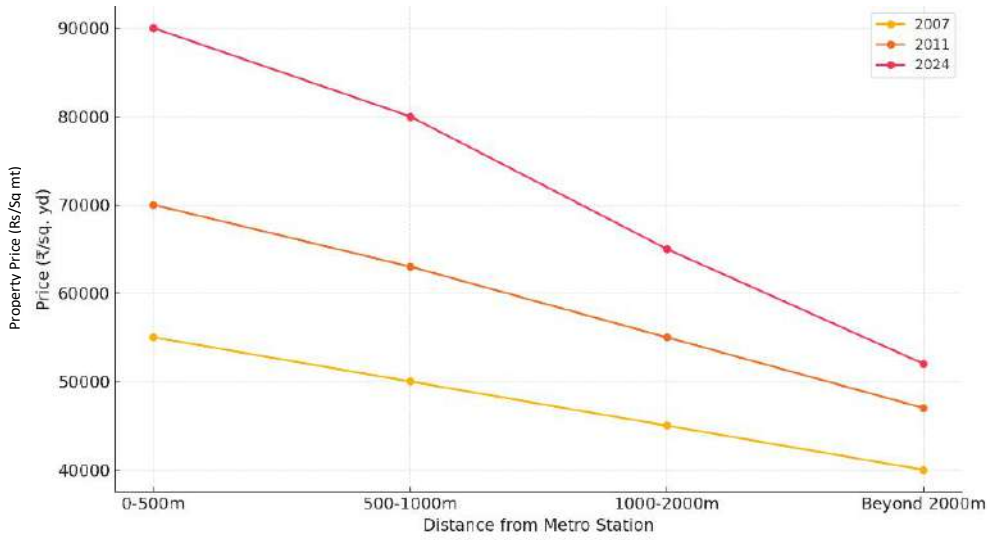

Figure 3. Property Prices Vs Distance from the Metro.

The line chart, as shown in
Figure 3, shows how property prices change over time across four distance ranges from metro stations—0–500m, 500–1000m, 1000–2000m, and beyond 2000m—during the years 2007, 2011, and 2024. It reveals a steady trend that property prices decrease as the distance from the metro increases.

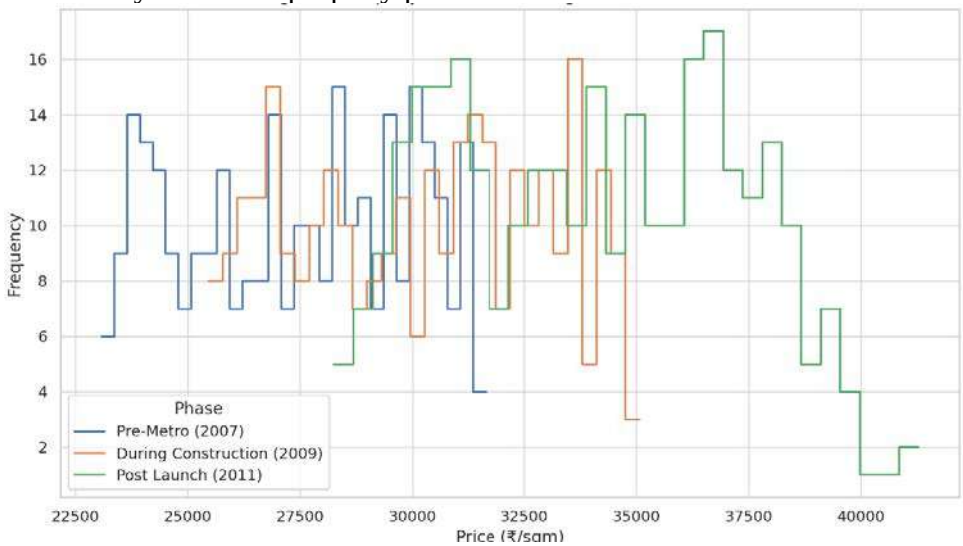

Figure 4. Histogram showing the frequency distribution of property prices during the project phases.

The histogram compares the frequency distribution of property prices across different phases of the metro project, representing the metro's positive impact on prices. The chart indicates an upward shift in the price distribution, with the maximum hike in prices occurring near metro stations.

The results of the study align with international studies (Choi & Hyun, 2022), which proves that the infrastructure facility, especially transit systems, promotes property prices. However, in our study area, the introduction of the Mass Rapid Transit System (MRTS) has shown the same effect on the residential property prices. However, along with this development, the challenges related to socio-economic equity, affordability, and urban policy are also examined by other studies. The study shows that in Gurugram, the infrastructure-related growth and transit-oriented development may produce inequality without proactive policy intervention, as proven by many other studies (Erdoganras et al., 2023). The results of the research align with other global studies (Cárdenas et al., 2023; Diao et al., 2021) related to the impact of MRTS on property prices. Gurugram's findings are consistent with these international benchmarks, which typically report a 10–20% price increase for residential properties near new transit stations. Zhu et al. (2022) demonstrate that the role of accessibility of transit infrastructure is highly context-dependent, with other local factors like proximity to parks, schools,

and hospitals in enhancing property prices, while shopping centres have limited impacts, highlighting how existing amenities moderate transit benefits. However, what distinguishes this study is the phase-wise analysis, which shows that property prices in Gurugram started to rise even before the metro became operational (during the announcement-to-construction phase). These insights underscore how expectations of improved accessibility can shape market dynamics well in advance of project completion, providing valuable lessons for policymakers and urban planners for sustainable development.

The mixed-method approach is the strength of our research, combining both qualitative and quantitative analysis. This approach helps us to understand both the local market trend and statistical trends. The observational aspects of the research require cautious inference about causality. While the DID method was used to assess the metro's impact on property prices in isolation, other unobserved factors also influence property prices, which can be added in further research. Additionally, the dataset of 300 properties is not comprehensive, so additional research could examine more properties. Another limitation of the study is the quality of geospatial data, as the study used GIS to measure proximity to metro stations and other variables. Future research could incorporate ridership data and other more accurate measurement metrics.

The research revealed an uplift in the plotted residential properties in Gurugram, presenting an opportunity for policymakers and regulatory authorities to capture land values through betterment levies and similar mechanisms. That additional fund can be used for infrastructure improvement. For future research, it would be valuable to examine the socio-economic impact of property enhancements on prices, both for residential and other land uses like commercial and retail properties in Gurugram itself.

5. Conclusion

This study examined the influence of the Mass Rapid Transit System (MRTS) on plotted residential property prices in Gurugram, India, across the phases of metro development. By integrating hedonic price modelling with qualitative surveys and spatial analysis, it demonstrated that metro accessibility is a decisive factor in shaping property markets. Properties located within 500 metres of metro stations experienced a significant 20–30% increase in value, with premiums tapering beyond 1.5–2 km. Importantly, nearly half of the price appreciation occurred during the announcement and construction stages, reflecting strong anticipatory effects, while the operational phase further consolidated these gains.

The findings confirm the central hypothesis that distance to the metro station exerts a strong and measurable effect on property values, consistent with urban economic theories such as bid-rent and accessibility capitalisation. They also highlight other locational determinants—plot size, proximity to highways, and central business districts—that interact with transit accessibility in determining price outcomes. Beyond their economic significance, these results underscore broader socio-spatial implications. While MRTS development creates opportunities for value capture and urban growth, it also risks exacerbating affordability challenges and socio-economic inequality if not coupled with inclusive planning mechanisms. Like many empirical studies, this research faced limitations in terms of data scope and spatial resolution, and unobserved variables may still influence property price dynamics. Future research could expand the dataset, adopt spatial econometric techniques, and investigate the impacts on rental markets, land-use conversion, and affordability outcomes. Comparative analyses between planned and unplanned neighbourhoods would also provide valuable insights into the differential capacity of localities to capitalise on transit investments.

In conclusion, the evidence from Gurugram demonstrates that MRTS infrastructure not only enhances residential property values but also reshapes the urban economic landscape. Policymakers and planners must seize this opportunity by implementing robust land value capture instruments, zoning reforms, and affordable housing mandates. Doing so will help ensure that the benefits of transit-led development are reinvested equitably, advancing both sustainable urban growth and socio-spatial justice in rapidly urbanising Indian cities.

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Conflicts of Interest
The authors declare no conflicts of interest.

Data availability statement
The original contributions presented in this study are included in the supplementary material. Further inquiries can be directed to the corresponding author. Data supporting the findings of this study are available from the corresponding author upon reasonable request. Sources of publicly available data (e.g., circle rates, online listings) are cited within the paper.

Institutional Review Board Statement
Not applicable.

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References

Acolin, A., J. Walter, R., Skubak Tillyer, M., Lacoe, J., & Bostic, R. (2022). Spatial spillover effects of crime on private investment at nearby micro-places. *Urban Studies*, *59*(4), 834–850. https://doi.org/10.1177/00420980211029761

Acton, B., Le, H. T. K., & Miller, H. J. (2022). Impacts of bus rapid transit (BRT) on residential property values: A comparative analysis of 11 US BRT systems. *Journal of Transport Geography*, *100*, 103324. https://doi.org/10.1016/j.jtrangeo.2022.103324

Acuña, R. (2023). End of the line: The impact of new suburban rail stations on housing prices. *Journal of Transport and Land Use*, *16*(1), 67–86. https://doi.org/10.5198/jtlu.2023.2199

Barbosa, F. C. (2024). Rapid Rail Transit (Metro) System. Implementation and Expansion Technical and Operational Challenges Review - The D.C. Metrorail Case Study. *2024 Joint Rail Conference*, 12. https://doi.org/10.1115/JRC2024-124681

Bardaka, E. (2024). Transit-induced gentrification and displacement: future directions in research and practice. *Transport Reviews*, *44*(3), 567–571. https://doi.org/10.1080/01441647.2023.2282285

Begam, S., Jha, P., Yadav, P. K., Joy, M. S., Rawat, P., & Bansal, T. (2024). Urban transformation through transit: the case of Delhi metro. *Discover Cities*, *1*(1), 31.

https://doi.org/https://doi.org/10.1007/s44327-024-00035-1

Cárdenas, J., Gallego, J. M., & Urrutia, M. A. (2023). Announcement of the first metro line and its impact on housing prices in Bogotá. *Case Studies on Transport Policy*, *11*, 100941. https://doi.org/10.1016/j.cstp.2022.100941

Chen, W., Ding, Y., & Dong, Y. (2022). *Research on the influence of metro on housing price via difference-in-difference model*. In Y. Lu & C. Cheng (Eds.), *International Conference on Computer Application and Information Security (ICCAIS 2021)* (Volume 12260, Article 1226001) (*Proceedings of SPIE—the International Society for Optical Engineering*, pp. 26). SPIE. https://doi.org/10.1117/12.2637401

Choi, P., & Hyun, D. (2022). The Effect of Urban Railway Opening on House Prices in a New Town in the Metropolitan Area. *Journal of Real Estate Analysis*, *8*(1), 109–125. https://doi.org/10.30902/jrea.2022.8.1.109

Chun-Chang, L., Chi-Ming, L., & Hui-Chuan, H. (2020). The Impact of a Mass Rapid Transit System on Neighborhood Housing Prices: An Application of Difference-In-Difference and Spatial Econometrics. *Real Estate Management and Valuation*, *28*(1), 28–40. https://doi.org/10.2478/remav-2020-0003

Diao, M., Li, Q., Sing, T. F., & Zhan, C. (2021). Disamenties of Living Close to Transit Tracks: Evidence from Singapore. *SSRN Electronic Journal*, *September*, 1–33. https://doi.org/10.2139/ssrn.3932579

Erdoganras, F., Cihangir Camur, K., & Satoglu, G. (2023). A Study of the Metro and Housing Value Interaction with Hedonic Price Model: Comparison of Ankara Batıkent and Koru Metro Stations. *Mimarlık Bilimleri ve Uygulamaları Dergisi (MBUD)*, *8*(1), 161–177. https://doi.org/10.30785/mbud.1284843

Guan, C., Tan, M. J., & Peiser, R. (2021). Spatiotemporal effects of proximity to metro extension on housing price dynamics in Manhattan, New York City. *Journal of Transport and Land Use*, *14*(1), 1295–1315. https://doi.org/10.5198/jtlu.2021.1915

Iamtrakul, P., Padon, A., Chayphong, S., & Hayashi, Y. (2024). Unlocking Urban Accessibility: Proximity Analysis in Bangkok, Thailand's Mega City. *Sustainability*, *16*(8), 3137. https://doi.org/10.3390/su16083137

Jiang, Y., Gu, P., Cao, Z., & Chen, Y. (2020). Impact of Transit-Oriented Development on Residential Property Values around Urban Rail Stations. *Transportation Research Record: Journal of the Transportation Research Board*, *2674*(4), 362–372. https://doi.org/10.1177/0361198120911054

JLL. (2021). *The future of Indian real estate: Transit and land value linkages*.

Karthigeyan, D., & Chander, S. (2020). *Impact of metro station in its immediate neighbourhood – A case study of Chennai Metro Rail Corridor*. *International Journal of Advanced Research in Engineering and Technology*, *11*(3), 10–18. https://doi.org/10.31224/osf.io/2q4va

Ko, K. (2021). Case study of property value transfer attributed to transit: spatial and temporal hedonic price impact of light rail in Minnesota's Twin Cities. *Journal of Public Transportation*, *23*(1). https://doi.org/10.5038/2375-0901.23.1.2

Muto, S., Sugasawa, S., & Suzuki, M. (2023). Hedonic real estate price estimation with the spatiotemporal geostatistical model. *Journal of Spatial Econometrics*, *4*(1), 10. https://doi.org/10.1007/s43071-023-00039-w

Parihar, M., Birje, B., Chaturvedi, T., Grandhi, N., Iyer, K., Nemani, K., & Purswani, H. (2025). *Analyzing the Role of Infrastructure in Socio-economic Development: A Case Study Through a Transit-Oriented Development Lens* (pp. 1643–1658). Springer, Cham. https://doi.org/10.1007/978-3-031-87550-2_114

Rennert, L. (2022). A meta-analysis of the impact of rail stations on property values: Applying a transit planning lens. *Transportation Research Part A: Policy and Practice*, *163*, 165–180. https://doi.org/10.1016/j.tra.2022.06.013

Rey-Blanco, D., Zofío, J. L., & González-Arias, J. (2024). Improving hedonic housing price models by integrating optimal accessibility indices into regression and random forest analyses. *Expert Systems with Applications*, *235*, 121059. https://doi.org/10.1016/j.eswa.2023.121059

Rojas, A., Carleton, L., Joyeux, R., & Milunovich, G. (2024). Train stations' impact on housing prices: Direct and indirect effects. *Transportation Research Part A: Policy and Practice*, *181*, 103979. https://doi.org/10.1016/j.tra.2024.103979

Schirripa Spagnolo, F., Borgoni, R., Carcagnì, A., Michelangeli, A., & Salvati, N. (2024). A spatial semiparametric M-quantile regression for hedonic price modelling. *AStA Advances in Statistical Analysis*, *108*(1), 159–183. https://doi.org/10.1007/s10182-023-00476-w

Singhal, S., & Tyagi, Y. (2021). Analyzing the Influence of Metro Stations on Commercial Property Values in Delhi: A Hedonic Approach. *Real Estate Management and Valuation*, *29*(4), 10–22. https://doi.org/10.2478/remav-2021-0026

Suri, P., & Cropper, M. (2024). The Benefits of Public Transit to Households: Evidence from India. *SSRN Electronic Journal*, *2024*, 54. https://doi.org/10.2139/ssrn.4934584

Tang, H., Li, M., & Fan, Z. (2022). Analysis of the Influence of Urban Rail Transit on Real Estate Value. *International Journal of Mathematical Models and Methods in Applied Sciences*, *16*, 119–123. https://doi.org/10.46300/9101.2022.16.20

Xiaowen Wang, Xiaowen Wang, & Linna Li. (2021). Spatio-temporal effects of urban rail transport on residential prices around stations: A case study of Harbin Line 1. *Geographical Research*, *40*(10), 2808–2822. https://doi.org/10.11821/dlyj020201073

Yu, H., Zhu, S., Li, J. V., & Wang, L. (2024). Dynamics of urban sprawl: Deciphering the role of land prices and transportation costs in government-led urbanization. *Journal of Urban Management*, *13*(4), 736–754. https://doi.org/10.1016/j.jum.2024.08.002

Zhang, D., Liu, J., Liu, K., & Zhang, Y. (2024). The non-linear impact of urban rail transit on commercial property prices: Based on a spatial heterogeneity perspective. *Applied Geography*, *171*(28). https://doi.org/10.1016/j.apgeog.2024.103385

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Assessing Urban Sprawl and Agricultural Land Loss: A 40-Year Remote Sensing Study in Çanakkale

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ABSTRACT

This study investigates the spatial expansion of rapid urbanization and its pressure on agricultural and natural lands within a socio-economic framework. Covering a 40-year period from 1984 to 2024, the research focuses on the central district of Çanakkale and employs spatial analysis methods alongside regression models. Findings reveal significant losses in agricultural lands adjacent to the city center due to urbanization, coinciding with rising employment in industrial and service sectors. Land use and cover maps for multiple years were produced from remote sensing data, achieving classification accuracy above 85% and kappa coefficients exceeding 0.80, ensuring analytical reliability. Regression results indicate a strong negative correlation between employment in the service sector and agricultural land ($r = -0.82$, $p < 0.05$), highlighting the role of economic transformation in rural land use change. The study demonstrates that urbanization should be understood not only as physical growth but as a process intertwined with economic restructuring and social change. By integrating spatial transformations with socio-economic dynamics, it offers insights into balancing development with the protection of productive land. The findings contribute to contemporary debates on inclusive, resilient, and sustainable urban environments, enriching the academic literature on the socio-economic dimensions of urban transformation.

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Highlights:

- Urban sprawl significantly alters agricultural and natural land, leading to irreversible land use transformations.
- Expansion into rural areas disrupts traditional livelihoods and triggers socio-economic shifts at the local level.
- Spatial analysis reveals the role of urban development in fragmenting ecological and productive landscapes.
- Understanding the socio-ecological consequences of sprawl is critical for guiding sustainable urban planning.

Contribution to the field statement:

This study contributes to the field by providing four decades of remote sensing evidence on urban sprawl and agricultural land loss in Çanakkale, Türkiye. By integrating spatial and socio-economic perspectives, it advances understanding of land-use change dynamics and offers insights for sustainable urban planning and land management policies.

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1. Introduction

Since the Industrial Revolution, cities have become centers of economic production and resource consumption, leading to rapid, often unplanned and uncontrolled urbanization (Kraus et al., 2022). This increase in urban populations has resulted in the expansion of settlements beyond core urban centers, often in a low-density, fragmented, and dispersed manner (Lu et al., 2023). This phenomenon is widely defined in literature as urban sprawl and is particularly associated with inefficient land use patterns that extend beyond metropolitan boundaries (Ewing, 1997). Globally, this form of expansion has placed considerable pressure on natural and productive land resources, particularly agricultural areas. Extensive research conducted in different geographical contexts has revealed that urban sprawl has resulted in significant losses of agricultural land, biodiversity (Imbrenda et al., 2021; Yussif et al., 2023) and that these losses will continue in the future (Bose & Chowdhury, 2020; Chen et al., 2020; Li et al., 2022; Mohammadyari et al., 2023; Ren et al., 2023; Simkin et al., 2022;).

1.1. Types of Urban Sprawl

Urban sprawl is a complex phenomenon that manifests in various typologies and spatial forms. Harvey and Clark (1965) were the first to systematically classify this phenomenon, identifying three basic types of sprawls: continuous development, ribbon development, and leapfrog development. Continuous development refers to low-density, unplanned horizontal growth originating from the city center. This type of sprawl typically involves the systematic conversion of agricultural lands and natural areas into urbanized zones. Ribbon development describes a linear settlement pattern that emerges along major transportation corridors. This form often results in unequal access to infrastructure services and increased dependence on transportation. Leapfrog development refers to new constructions that are spatially disconnected from the existing urban fabric, occurring in low-density areas and lacking spatial continuity (Glockmann et al., 2022). This form of development creates fragmented landscapes and spatial segregations, posing significant threats to ecological integrity (Rizkiya et al., 2023).

Harvey and Clark's framework has been expanded over time to include additional dimensions. For instance, Wilson et al. (2003) categorizes urban growth into three main forms: infill, edge expansion, and dispersed development. Infill refers to the urbanization of vacant parcels within the existing urban fabric and is, in some literature, considered outside the scope of urban sprawl. In contrast, edge expansion denotes a continuous form of growth that extends beyond existing urban boundaries. Dispersed development consists of irregular settlements in low-density, fragmented, and poorly accessible areas. This form is frequently criticized in planning literature for increasing public service delivery costs, prolonging travel times, and contributing to the fragmentation of natural areas (Lovera, 2015).

The different forms of urban sprawl not only pose significant challenges for spatial planning but also generate complex environmental and socioeconomic effects. Unplanned development complicates the effective and sustainable provision of infrastructure services, leads to the irreversible loss of agricultural land, and reduces open natural areas and biodiversity (Gumma et al., 2017; Halder et al., 2021; de Sousa et al., 2023). Furthermore, increased surface runoff raises the risk of water pollution and threatens water quality (Tu et al., 2007). Spatially dispersed and extensive development intensifies dependency on private vehicle use, resulting in increased greenhouse gas emissions and air pollution; the expansion of impervious surfaces heightens flood risks and exacerbates the urban heat island effect (Moazzam et al., 2022; Yuan et al., 2018) In addition, longer travel distances significantly increase energy consumption (Obregón-Biosca et al., 2016). Beyond these environmental impacts, urban sprawl deepens the spatial segregation of urban populations, exacerbates social inequalities, and leads to changes in lifestyles and spatial justice issues. Therefore, urban sprawl should be examined not merely as a physical phenomenon but also in relation to its broader socioeconomic contexts (Oyalowo, 2022).

1.2. Socio-Spatial Impacts of Urban Sprawl

Although urban sprawl is primarily associated with economic factors, it is also shaped by numerous variables such as demographic dynamics, spatial planning policies, physical geography, environmental

features, and transportation infrastructure (Magidi & Ahmed, 2019; Zhang et al., 2025; Wu et al., 2021). In developed countries, factors such as globalization, market economy, the dominance of capitalist ideology, and the declining livability of inner-city areas have accelerated the process of urban sprawl (Scott, 2017). Conversely, in developing countries, the main driving forces behind urban sprawl include informal settlements on public lands, rural to urban migration, inadequate planning practices, and the efforts of low- and middle-income households to find affordable housing on urban peripheries (Deng & Huang, 2004; Festus et al., 2020). In this context, urban sprawl emerges as a multilayered phenomenon shaped by both internal (country-specific) and external (global) dynamics, driven by a wide array of interacting forces.

In low-density residential areas, the establishment of infrastructure and the delivery of public services require high costs and reduce service efficiency (Hajilou et al., 2023). This situation may lead to the economic and social decline of city centers over time and deteriorate the quality of public spaces (Maryati & Humaira, 2015). The spatial dispersion that emerges with the process of urban sprawl weakens social relations at the neighborhood scale; the erosion of neighborly ties and decreased interaction undermines community identity and the sense of belonging. This becomes particularly evident in suburban areas, where social isolation tends to increase.

Moreover, the promotion of a lifestyle dependent on automobile use reduces physical activity, thereby negatively impacting public health. In areas with low walkability and fragmented spatial integrity, individuals' active participation in daily life diminishes, which adversely affects both physical and mental well-being (Genovese et al., 2023). In unplanned and rapidly developing suburban zones, ensuring public safety and order becomes increasingly difficult, potentially resulting in rising crime rates and weakened social control. On the other hand, traffic congestion and prolonged travel times lower the quality of daily life and lead to significant delays in accessing work or education (Cruz-Sandoval et al., 2025).

All these processes not only reduce individual quality of life but also deepen social inequalities. The spatial segregation of different socio-economic groups increases urban polarization and creates injustices in access to resources, services, and opportunities. In this context, urban sprawl is seen to fuel socio-spatial polarization and reproduce income disparities on a spatial scale (Scheba et al., 2021). Therefore, urban sprawl should be addressed not merely as a physical phenomenon but also as an urbanization issue directly related to social justice, equity, and quality of life.

1.3. Monitoring the Dynamics of Urban Sprawl

Various methods have been developed to identify and monitor urban sprawl. Urban sprawl exerts pressure on agricultural land, forests, pastures, meadows, and wetlands surrounding settlements, resulting in changes in LULC (Antalyn & Weerasinghe, 2020). Therefore, identifying LULC, which is one of the methods used to monitor urban sprawl, is valuable for revealing the negative impacts of urban expansion (AlQadhi et al., 2021; Sharma et al., 2024). Various methods have been developed to identify and monitor urban sprawl. These methods are based on the assessment of indicators such as built-up area growth, land-use mix, land cover change detection, construction density, population density, income level, education level, and GDP, which represent socio-economic conditions, spatial geometry, landscape changes, transportation, and visual measurements, either together or individually (Mosammam et al., 2017). Given the dynamic and spatially dispersed nature of urban sprawl, conventional field-based observation techniques are often insufficient for capturing long-term and large-scale land use changes. Remote sensing, due to its high spatial and temporal resolution, is one of the effective tools for identifying and monitoring urban sprawl (Kaya & Dervisoglu, 2023). Classification methods (supervised, unsupervised, pixel-based, object-based, etc.) (Balha et al., 2021) and tailored indices (normalized difference vegetation index (NDVI) (Yasin et al., 2019), soil-adjusted vegetation index (SAVI), normalized difference water index (NDWI) etc.) are the most commonly used remote sensing methods used to determine LULC (da Silva et al., 2020).

1.4 Problem Statement and Research Gap

Urban sprawl, particularly in unplanned areas, constitutes a significant form of urban growth that exerts pressure on agricultural lands, forests, and natural ecosystems, thereby giving rise to a range of environmental, social, and economic challenges. This process entails not only the transformation of the physical environment but also the reconfiguration of rural production systems, societal lifestyles, and local economic structures (Hussain & Imitiyaz, 2018). Although a substantial body of research has examined the spatial patterns, environmental impacts, and planning needs of urban sprawl in large metropolitan areas, similar transformations in medium-sized cities (with populations ranging from approximately 0.5 to 5 million) have not been explored in sufficient depth (Chettry, 2023). Yet, these cities are critical for understanding contemporary urban change, as they often experience rapid but still manageable transformation phases. This makes them strategic sites for generating transferable policy insights, enabling proactive interventions before reaching unsustainable thresholds.

Medium-sized cities, having not yet reached their full carrying capacities, are poised to undergo more intense spatial transformations in the coming years due to increasing population and investment pressures. Given their current development trajectories, these cities are positioned at a critical juncture in terms of sustainability, resilience, and land management. In Turkey, the impacts of urban sprawl are becoming increasingly visible not only in metropolitan areas but also in medium-sized cities. However, the multifaceted effects of these processes on spatial structures, land use patterns, and local socio-economic systems remain underrepresented in academic literature, particularly in comparative or cross-regional contexts.

In this context, the province of Çanakkale, located in northwestern Turkey, offers a representative and internationally relevant case. Its coastal geography, historical heritage, university-town identity, and ecotourism potential intersect with recent public and private sector investments, generating complex land use pressures. Particularly in the central district, areas that once exhibited rural settlement characteristics have gradually been opened to development. Trends such as the replacement of detached housing with apartment blocks, the increase in impervious surfaces, and the decline of urban agriculture have become prominent. These dynamics reflect broader challenges seen in other coastal and heritage-rich cities worldwide, where economic growth and spatial expansion must be balanced against the protection of agricultural lands and cultural landscapes.

This study aims to quantitatively and qualitatively analyze the land use and land cover (LULC) changes in the central district of Çanakkale between 1984 and 2024 using Landsat satellite imagery and remote sensing techniques, with the goal of capturing the dynamics of urban sprawl over a four-decade period. Furthermore, it seeks to discuss the effects of this spatial transformation on urban–rural interactions, the evolution of agricultural production systems, and the restructuring of the local social fabric. The scarcity of comprehensive studies addressing such multi-layered transformations in similar urban contexts underscores the originality of this research. By combining long-term spatial data with socio-economic interpretation, the study not only advances methodological approaches to LULC change analysis but also enriches the academic literature on the socio-economic dimensions of urban transformation in medium-sized cities.

1.5 Objectives and Hypotheses

The primary objective of this study is to analyze the impacts of urban sprawl on agricultural and natural areas in the city of Çanakkale between 1984 and 2024. To this end, eight different spectral indices were utilized to enhance class separability in satellite imagery. Subsequently, a supervised classification was performed using the Support Vector Machines (SVM) algorithm, and land use/land cover (LULC) maps were generated. These maps aim to reveal the spatial and temporal changes in agricultural and natural areas under urban growth pressure.

In the second phase of the study, the relationship between changes in agricultural land and various socio-economic and demographic indicators was examined. These indicators include total in-migration and out-migration, migration by educational level (primary, undergraduate, master's, and doctoral), agricultural population, number of tractors and trees, neighborhood-level population changes, and employment rates in the agricultural, industrial, and service sectors. The overarching goal is to understand the socio-economic dynamics influencing agricultural land transformation and to uncover the links between urban expansion, demographic mobility, and rural restructuring.
Within this framework, the following hypotheses are tested:

- **H1:** Between 1984 and 2024, agricultural lands surrounding the urban center of Çanakkale have significantly declined due to the impacts of urban sprawl.
- **H2:** There is a statistically significant correlation between the net migration rates of neighborhoods affected by urban expansion and the loss of agricultural land.
- **H3:** A negative correlation exists between the reduction in agricultural land and the agricultural population, number of tractors, and number of trees.
- **H4:** Migration by educational attainment (particularly higher education) and sectoral employment shifts (from agriculture to industry and services) are associated with land use changes and the urban transformation of rural areas.

By integrating spatial analyses with socio-economic indicators, this study seeks to examine the effects of urban growth on rural and peri-urban areas from a multi-dimensional perspective, thereby contributing to the literature on land systems and urban-rural interactions.

1.6 Significance and Structure of the Paper

This study is significant in that it adopts a multidisciplinary approach to examine the spatial and socio-economic impacts of urban sprawl in Çanakkale, a medium-sized city. While remote sensing techniques are employed to reveal the pressure of land use changes on agricultural areas, the study also explores the social implications of these changes through demographic and socio-economic data. In doing so, it provides a more comprehensive understanding of the transformations and lifestyle shifts occurring in rural areas as a result of urban growth processes. The findings offer valuable insights that can inform sustainable urban planning and rural development policies.
The article is structured in fifth steps as follows:
1: Firstly, literature review is presented on the conceptual framework of urban sprawl and its socio-economic impacts.
2: This is followed by a detailed explanation of the research problem, objectives, and hypotheses.
3: The third section describes the methods used for analyzing remote sensing and socio-economic data.
4: In the fourth section, the land use changes and related socio-economic findings from the case of Çanakkale are discussed.
5: Finally, the paper concludes with a summary of key findings, policy recommendations, and suggestions for future research.

2. Materials and Methods

This study investigates the relationship between urban sprawl and changes in agricultural land, forests, and grassland (including pasture and meadows) in the city of Çanakkale over the period from 1984 to 2024, utilizing remote sensing data and geospatial analysis methods. The methodological workflow adopted in this study is illustrated in Figure 1.

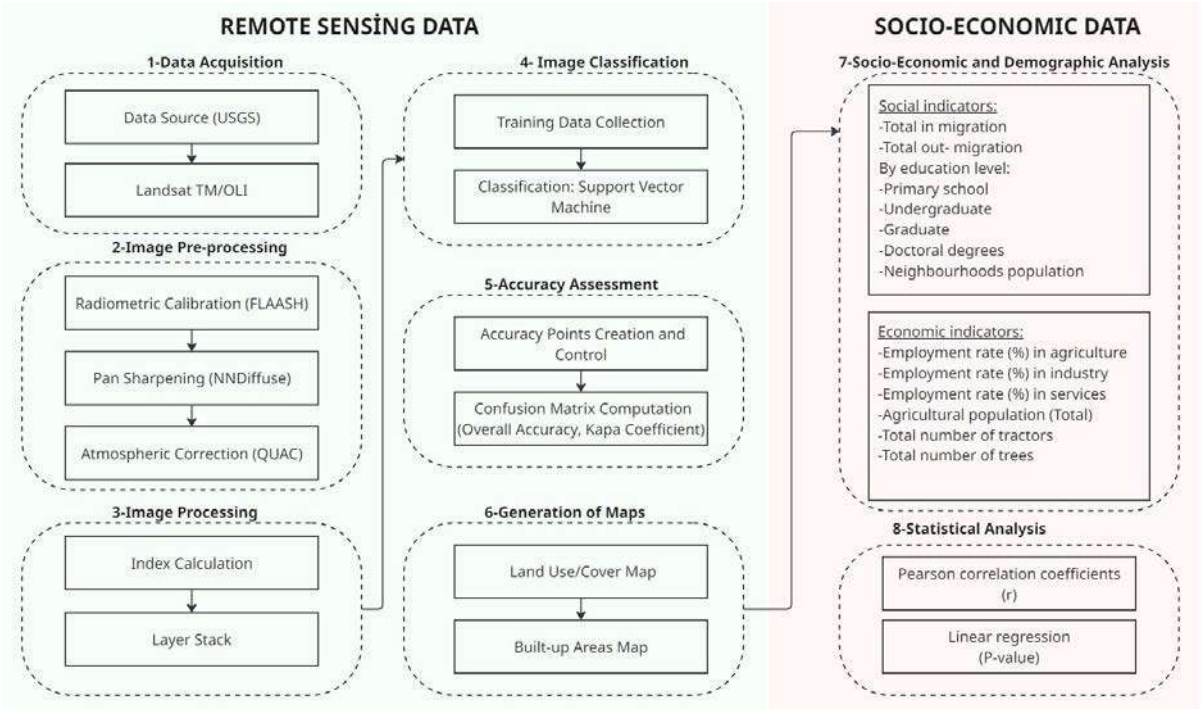

Figure 1. Workflow Diagram Illustrating the Step-by-Step Process of Inserting Subjects.

2.1 Study Area and Time Frame

This study was conducted within the administrative boundaries of Çanakkale, Türkiye. Çanakkale is situated in the northwest of Türkiye, to the south of the Marmara Region and the north of the Aegean Region (Figure 2). Çanakkale is in the subtropical Mediterranean climate zone with a regional Marmara climate characterized by transitional effects from both Mediterranean and Black Sea climates, characterized by mild winters and very hot and dry summers. The total population of the study area is 204454 people.

The temporal scope covers a 40-year period from 1984 to 2024, selected to capture long-term patterns of urban expansion and its impacts on agricultural and natural land. The availability of consistent Landsat satellite imagery for this period supported this selection.

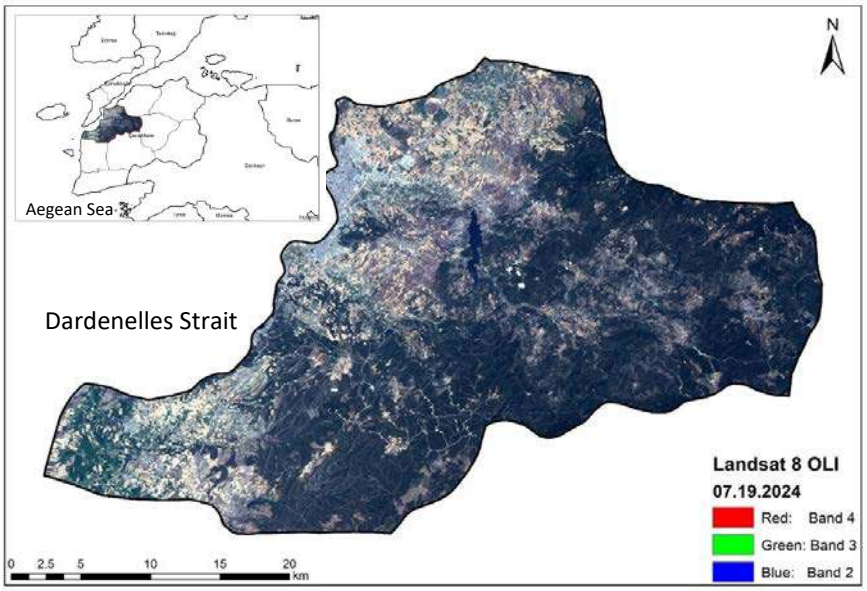

Figure 2. Location Map of the Study Area within the Boundaries of Çanakkale Province, Türkiye.

2.2 Remote Sensing Data and Pre-processing

Multitemporal satellite imagery was acquired from the United States Geological Survey (USGS), including Landsat Thematic Mapper (TM) and Operational Land Imager (OLI) sensors. These images provide medium-resolution (30 m) multispectral data suitable for land cover analysis. Images were selected based on minimal cloud cover and seasonal consistency. In this study, five Landsat TM/OLI images were used to produce LULC maps (Table 1). Pre-processing steps were applied to the images for further processing. First, radiometric correction was performed using the FLAASH algorithm. For Landsat 8 OLI images, radiometric correction was applied to the multispectral bands first, followed by the panchromatic band. Second, the 15 m spatial resolution panchromatic band of Landsat 8 OLI was used to enhance the resolution of the 30 m multispectral bands to 15 meters through pan-sharpening (using the NNDiffuse algorithm). Since Landsat 5 TM images do not have a panchromatic band, they were used with a 30 m spatial resolution. Third, atmospheric correction was performed on all images using the Quick Atmospheric Correction (QUAC) algorithm. Finally, the raw image reflectance values, which were initially provided as scaled integers, were converted to actual physical reflectance values, making all images ready for processing.

Table 1: Specifications of Landsat TM/OLI Images.

Satellites	Acquisition Date	Sensor	Spatial Resolution
Landsat 8	07/19/2024	OLI	15 m
Landsat 8	07/08/2014	OLI	15 m
Landsat 5	07/12/2004	TM	30 m
Landsat 5	07/01/1994	TM	30 m
Landsat 5	07/21/1984	TM	30 m

2.3 Image Processing

To obtain the LULC maps, index calculations were first performed to highlight specific features in the images. In In this study, a total of eight indices including brightness, greenness and wetness layers of Tasseled Cap Transformations (TCT), NDVI, normalized difference built-up index (NDBI), normalized difference moisture index (NDMI), soil adjusted vegetation index (SAVI), and modified soil adjusted vegetation index (MSAVI) were used for LULC classification. Table 2, the "intended use" of each index in assisting the image classification process is provided. For some classes, such as grassland, multiple indices were used. The reason for this is that the NDVI index performs better in identifying areas with higher vegetation density, while the MSAVI index is more successful in areas with lower vegetation density and soil influence. As a result of the trials, a total of eight indices were used in the production of LULC maps in this study, including three tasseled cap transformation components (Crist & Cicone, 2007), NDVI (Singh et al., 2016), NDBI (Zha et al., 2003), SAVI (Huete, 1988), and MSAVI (Qi et al., 1994) (Table 2). All index layers were stacked into a composite image to be used as input for classification.

Table 2: Indexes Used in LULC Classification and Their Descriptions.

Index	Area of use	Intended Use	Formula
TCT-Brightness	Soil reflectivity	Built-up, bare/burnt Land	0.3029 * Blue + 0.2786 * Green + 0.4733 * Red + 0.5599 * NIR + 0.5080 * SWIR1 + 0.1872 * SWIR2
TCT-Greenness	Presence and density of vegetation	Agricultural land, forest	-0.2941 * Blue - 0.2430 * Green - 0.5424 * Red + 0.7276 * NIR + 0.0713 * SWIR1- 0.1608 * SWIR2
TCT-Wetness	Moisture content in plants and soil	Water, forest, and agricultural land	0.1511 * Blue + 0.1973 * Green + 0.3283 * Red + 0.3407 * NIR - 0.7117 * SWIR1 - 0.4559 * SWIR2
NDVI	Vegetation density	Forest, grassland, agricultural land	(NIR - Red) / (NIR + Red)
NDBI	Urban area	Built-up	(SWIR - NIR) / (SWIR + NIR)
NDMI	Moisture analysis	Forest, grassland	(NIR - SWIR1) / (NIR + SWIR1)
SAVI	Vegetation (reduces soil impact)	Agricultural land, forest	((NIR - Red) / (NIR + Red + L)) * (1 + L)
MSAVI	Low vegetation areas	Grassland	0.5 * [2 * NIR + 1 - sqrt((2 * NIR + 1)² - 8 * (NIR - Red))]

2.4 Image Classification

After all the indices were calculated, all layers were merged to create a single 8-layer image for classification. For all years (1984, 1994, 2004, 2014, and 2024), training data for six classes (built-up, agricultural land, grassland, bare/burnt area, forest, water) were collected. In this study, eight spectral indices were utilized for regional land cover classification. The grassland and pasture categories were merged due to their high spectral similarity and the fact that they are frequently treated as a single category in municipal reports. This approach ensured both spectral consistency and administrative coherence. Finally, the images were classified through supervised classification using the Support Vector Machine (SVM) algorithm, a widely used non-parametric classifier.

SVM identifies the optimal decision boundary that best separates the data into two classes, aiming to maximize the margin between them (Vapnik, 1999). The classification process of SVM is based on four fundamental principles: (a) if the data are linearly separable, SVM identifies the hyperplane that provides the widest possible margin between the two classes; (b) the data points closest to this hyperplane, known as support vectors, are used to define the decision boundary; (c) the hyperplane is selected to maximize the distance to these support vectors; and (d) if the data are not linearly separable, kernel methods are employed to project the data into a higher-dimensional space where linear separation is feasible (Burges, 1998).

Due to its high accuracy and low training data requirements, SVM is a widely preferred method for the classification of satellite imagery such as Landsat (Fragou et al., 2020), Sentinel (Kavzoglu et al., 2020), and MODIS (Sheykhmousa et al., 2020). SVM was selected for this study because of its strong performance in distinguishing spectrally similar classes in complex datasets, its effectiveness with limited training data, its ability to separate non-linear boundaries through kernel functions, and its robustness against overfitting.

Support Vector Machine (SVM) with a Radial Basis Function (RBF) kernel was employed for the classification. The SVM parameters were determined through experimental trials, with a gamma value of 0.2 and a penalty parameter (C) set to 500. For each class, approximately 20 to 50 training samples were selected using a trial-and-error approach to ensure adequate representation of spectral variability, and a total of approximately 250 samples were collected.

2.5 Classification Accuracy Assessment

Accuracy assessment was conducted using the Spatial Analyst Tools module in ArcGIS, specifically the “Segmentation and Classification” tools. A total of 120 validation points were generated using the stratified random method to ensure balanced spatial representation. This method was chosen to improve the evaluation of user accuracy, particularly for underrepresented classes such as water surfaces. The validation points were converted to KML format and visually interpreted in Google Earth using high-resolution imagery. Subsequently, these points were used as attribute data in ArcGIS, and a confusion matrix was computed to derive overall accuracy, producer’s accuracy, user’s accuracy, and the Kappa coefficient.

2.6 Generation of Land Use/Cover Maps

Land Use/Land Cover (LULC) maps were generated for multiple time points (1984, 1994, 2004, 2014, and 2024) to capture the spatiotemporal dynamics of urban expansion and its impact on agricultural and natural areas. The classified images resulting from the SVM algorithm were post-processed to refine class boundaries and eliminate isolated misclassified pixels through majority filtering. The LULC classification schema included five primary land cover categories: urban/built-up areas, agricultural land, forest and natural vegetation, water bodies, and barren land.

Each LULC map was visually inspected and validated using high-resolution imagery and available ancillary data (such as CORINE land cover maps, historical records, and local knowledge where applicable) to ensure thematic consistency across the years.

The resulting LULC maps served as the foundation for subsequent spatial and statistical analyses, particularly in assessing the socio-economic drivers of land transformation and quantifying the extent of urban encroachment into non-urban land uses.

2.7 Socio-Economic and Demographic Analysis

In the second stage of the study, a socio-economic and demographic analysis was conducted to investigate the underlying factors contributing to the transformation of agricultural lands, particularly in relation to urban expansion. This stage aimed to evaluate the associations between land use change and a range of human-induced variables that reflect demographic mobility, rural restructuring, and shifts in economic activity.

The analysis utilized neighborhood-level indicators, including total in- and out-migration, migration by education level (primary school, undergraduate, graduate, and doctoral degrees), the number of agricultural workers, the quantity of registered tractors and fruit-bearing trees, population changes at the neighborhood scale, and employment distributions across the agriculture, industry, and service sectors (Turkish Statistical Institute, n.d.).

To quantitatively assess the relationships between these variables and changes in agricultural land, two complementary statistical methods were employed. First, Pearson correlation analysis was used to determine the strength and direction of bivariate associations between agricultural land change and individual socio-economic indicators, with correlation coefficients (r) interpreted according to conventional thresholds. Second, linear regression analysis was conducted to identify the extent to which selected variables explained variance in land cover change. Since R^2 is simply the square of the correlation coefficient in simple linear relationships, we reported only the correlation coefficient (r) and p-values to evaluate the strength and significance of the relationships. These analyses provided empirical evidence on the socio-economic dynamics driving land conversion processes. By integrating spatial and statistical methods, the study offered a nuanced understanding of how urban growth intersects with demographic trends and agricultural transitions in the context of Çanakkale's peri-urban landscape.

3. Results

3.1 Classification Accuracy Assessment

The overall accuracy of the LULC maps produced as a result of classification is between 86% and 90% (Table 3). The LULC maps produced in this study reveal the spatial changes in the analyzed region between 1984 and 2024 (Figure 3). The classification was performed across six main classes: built-up areas, agricultural land, meadow and pasture areas, forested areas, bare and burnt areas, and water bodies. In this classification, meadow and pasture areas were considered as a single class name with grassland. When the time series of maps was analyzed, a significant increase in built-up areas was observed. Urbanization appears to have concentrated around urban centers, and this process has exerted pressure on agricultural land. The observed reduction in agricultural land is seen as a direct consequence of the pressure of urbanization on the outskirts. On the other hand, an increase in water surfaces was detected in some areas due to the construction of dam reservoirs. When examining forested areas, fire-related losses over the years stand out. The map for 2024 clearly shows this change. A vast forest area is observed to have transformed into burnt land, which is a direct result of the large-scale forest fires that occurred in July and August 2023. This situation serves as a striking example of the impact of natural disasters on land cover.

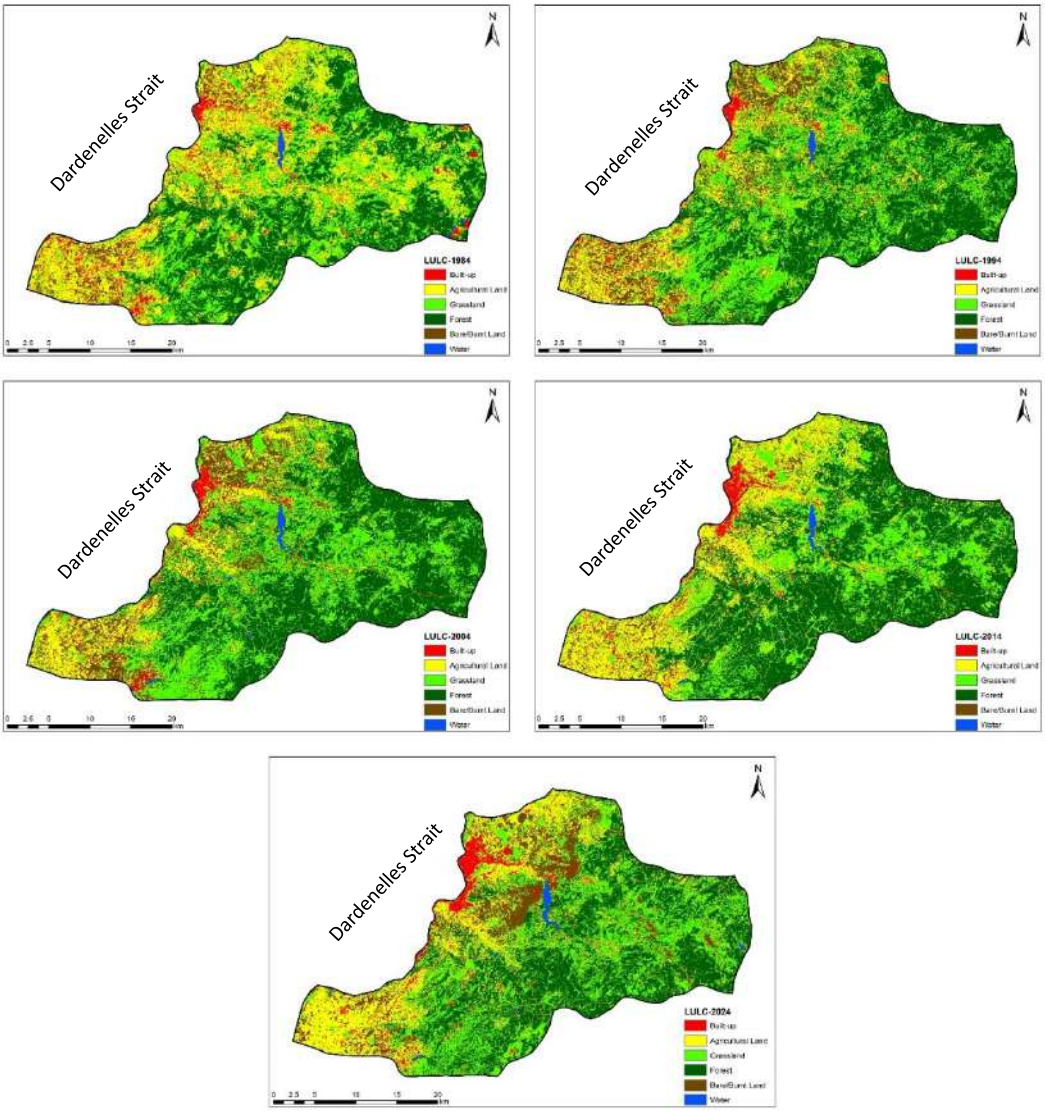

Figure 3. The LULC Maps Produced in this Study between 1984 and 2024.

Table 3: Accuracy Assessment of LULC Maps.

Years	Overall Accuracy	Kappa Coefficient
1984	86.60%	0.83
1994	90.90%	0.86
2004	89.70%	0.86
2014	90.90%	0.88
2024	87.70%	0.84

3.2 Urban Sprawl and Agricultural Land Conversion

An examination of the urban development process reveals that the city center was initially established in a location close to the coastline (Figure 4). This point of origin determined the direction of settlement and led to the continuation of urban sprawl along the coastal strip. Over time, the construction of a ring road beyond the city center facilitated expansion into new areas, and the space created by this road became a significant corridor for urban growth. Several factors influencing the spatial expansion of the city were identified during this process. In particular, natural geographical features such as the coastline, the development of transportation infrastructure, political decisions to relocate public facilities outside the urban core, and topographical characteristics have all been key elements shaping

the direction and form of urban areas. These dynamics demonstrate that urban sprawl is shaped not only by physical geography but also by socio-political and economic decisions.

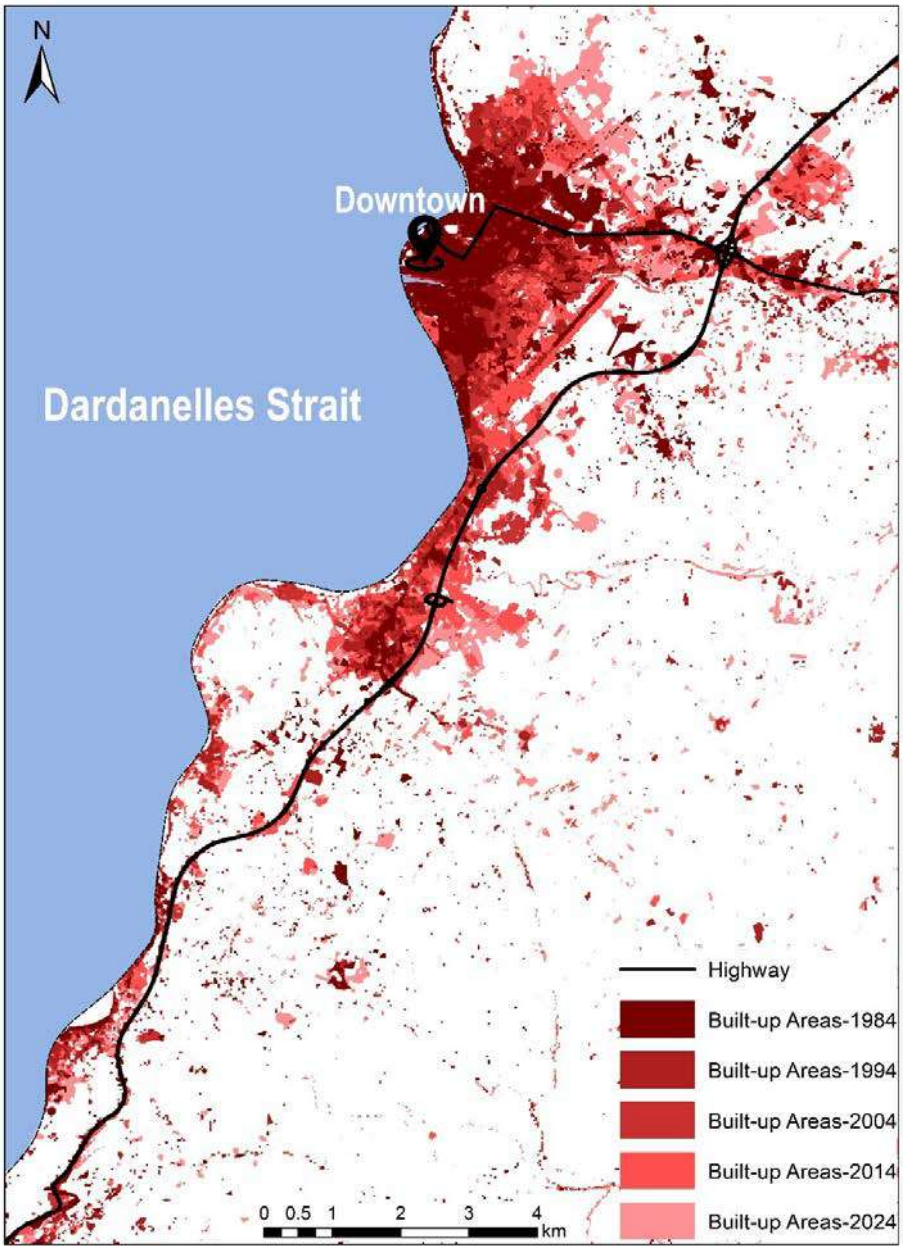

Figure 4. Built-up Areas Change between 1984 and 2024.

Images from Google Earth Pro were used to determine the visible impact of urban sprawl (Google Earth, n.d). However, since the highest resolution image of the oldest date can be obtained in 2006, the first image was acquired in 2006, and the other image was acquired in 2024, following the temporal scope of the study. The first example focuses on the area surrounding the largest settlement closest to the city center (Figure 5). This area is characterized by a flat plain composed of fertile agricultural land. However, over time, unplanned urban development has led to the conversion of these productive agricultural areas into built-up zones, resulting in the loss of natural land cover. This clearly illustrates the negative impact of urban sprawl on agricultural production areas.

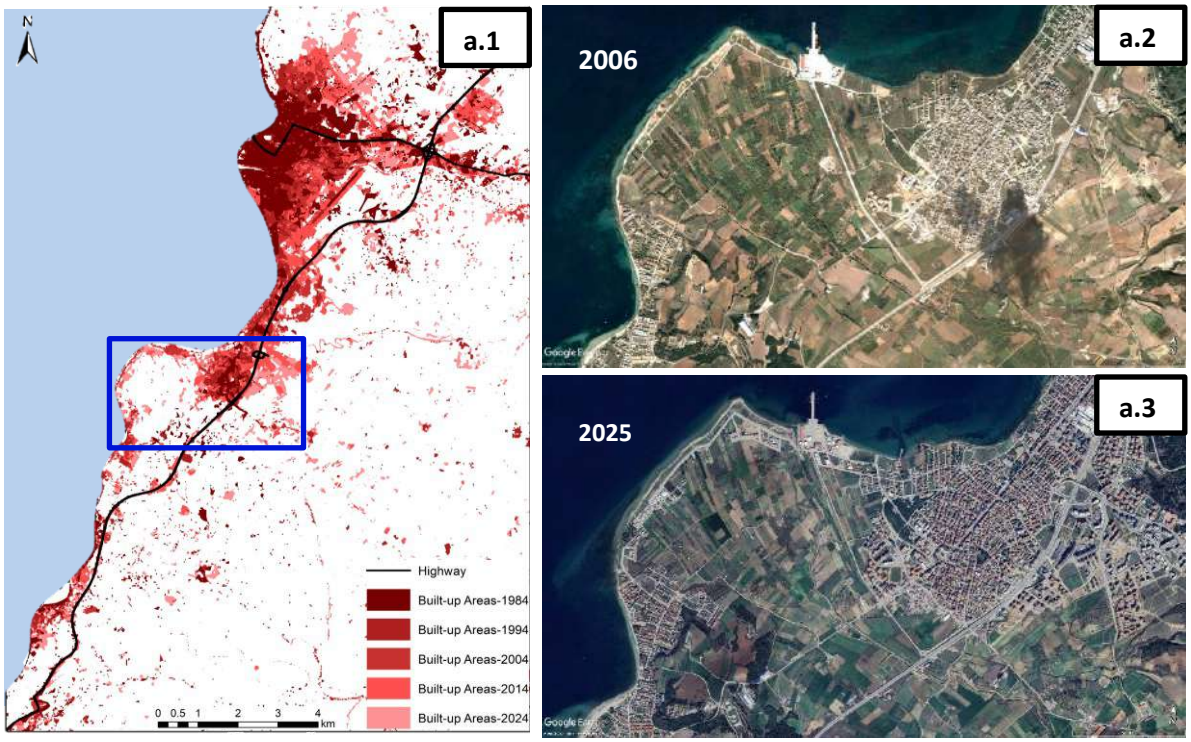

Figure 5. Urban Expansion is over Fertile Agricultural Land Near the City Center. (a.1) Temporal Change of Built-up Areas Produced in this Study, (a.2) Satellite Image of the Area from 2006 (Google Earth, n.d.), (a.3) Satellite Image of the Area from 2024 (Google Earth, n.d.).

The second example includes an image taken directly from the city center (Figure 6). Initially, the airport and ring road were planned outside the urban settlement; however, over time, they became surrounded by the expanding urban fabric and were eventually encompassed within residential areas. This example demonstrates that large-scale infrastructure investments with non-residential functions can also trigger urban sprawl and influence the direction of urban development.

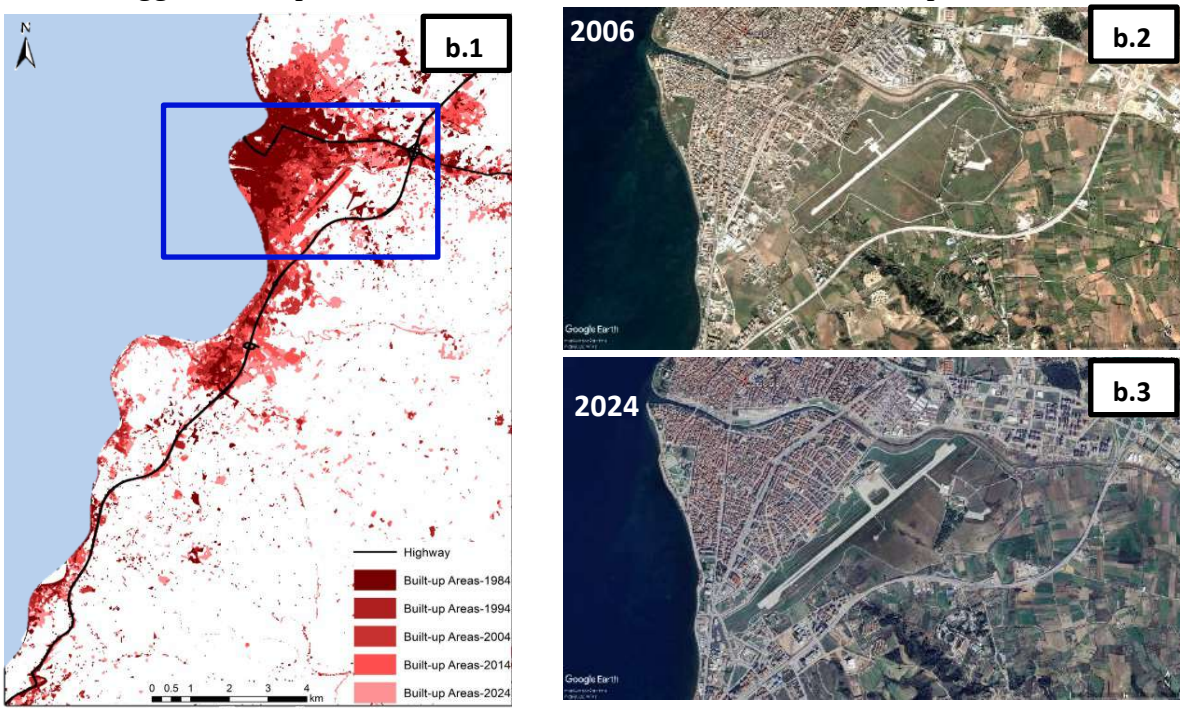

Figure 6. Urban Sprawl Enclosing the Airport and Ring Road was Originally Planned Outside the City. (a.1) Temporal Change of Built-up Areas Produced in this Study, (a.2) Satellite Image of the Area from 2006 (Google Earth, n.d), (a.3) Satellite Image of the Area from 2024 (Google Earth, n.d).

The third example illustrates the impact of the location of public investments on urban sprawl (Figure 7). A hospital complex constructed on the urban periphery has redirected the trajectory of urban growth, leading to the conversion of surrounding agricultural, pasture, and grassland areas into built-up zones. This case highlights that public investments play a strategic role not only in the provision of services but also in guiding spatial development.

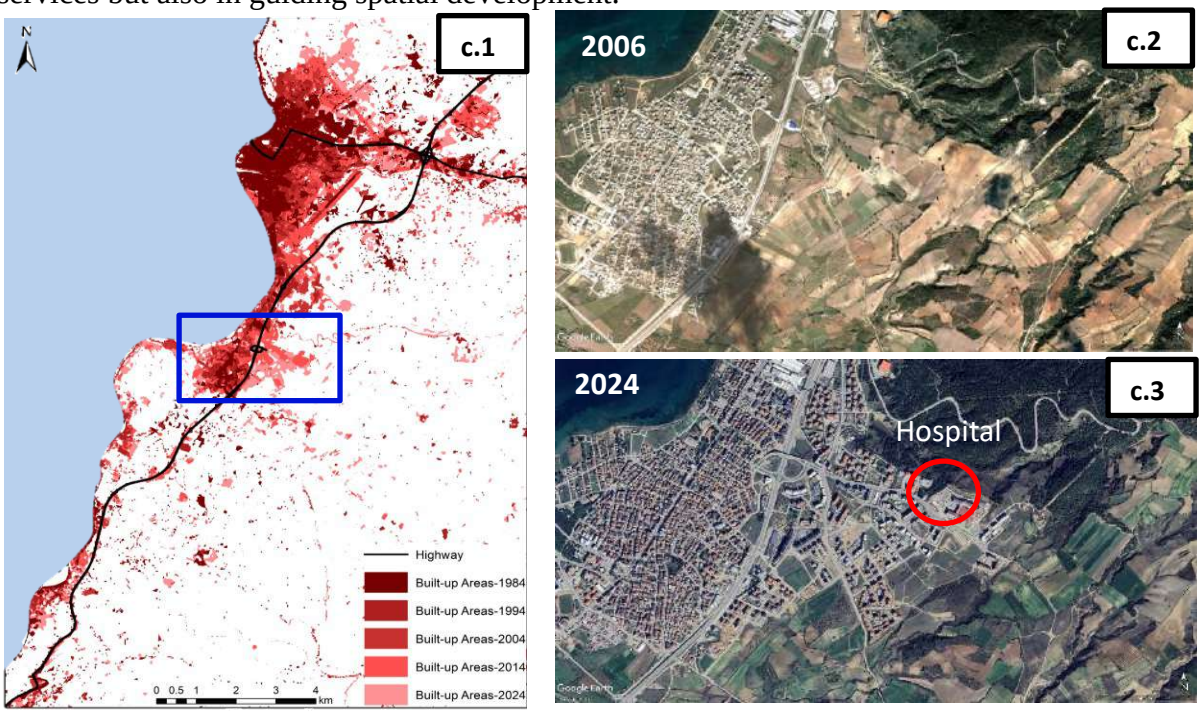

Figure 7. Directional Shift in Urban Growth Due to a Hospital Complex on the City's Edge. (a.1) Temporal Change of Built-up Areas Produced in this Study, (a.2) Satellite Image of the Area from 2006 (Google Earth, n.d), (a.3) Satellite Image of the Area from 2024 (Google Earth Pro); the Hospital is Indicated with a Red Circle.

The final example points to large-scale forest loss resulting from wildfires (Figure 8). It has been determined that the fires were primarily caused by human activities and rapidly spread due to meteorological conditions. In this context, the proximity of residential areas to natural environments places significant pressure on ecosystems and leads to the destruction of habitats. This situation demonstrates that urban sprawl threatens not only land use patterns but also environmental sustainability.

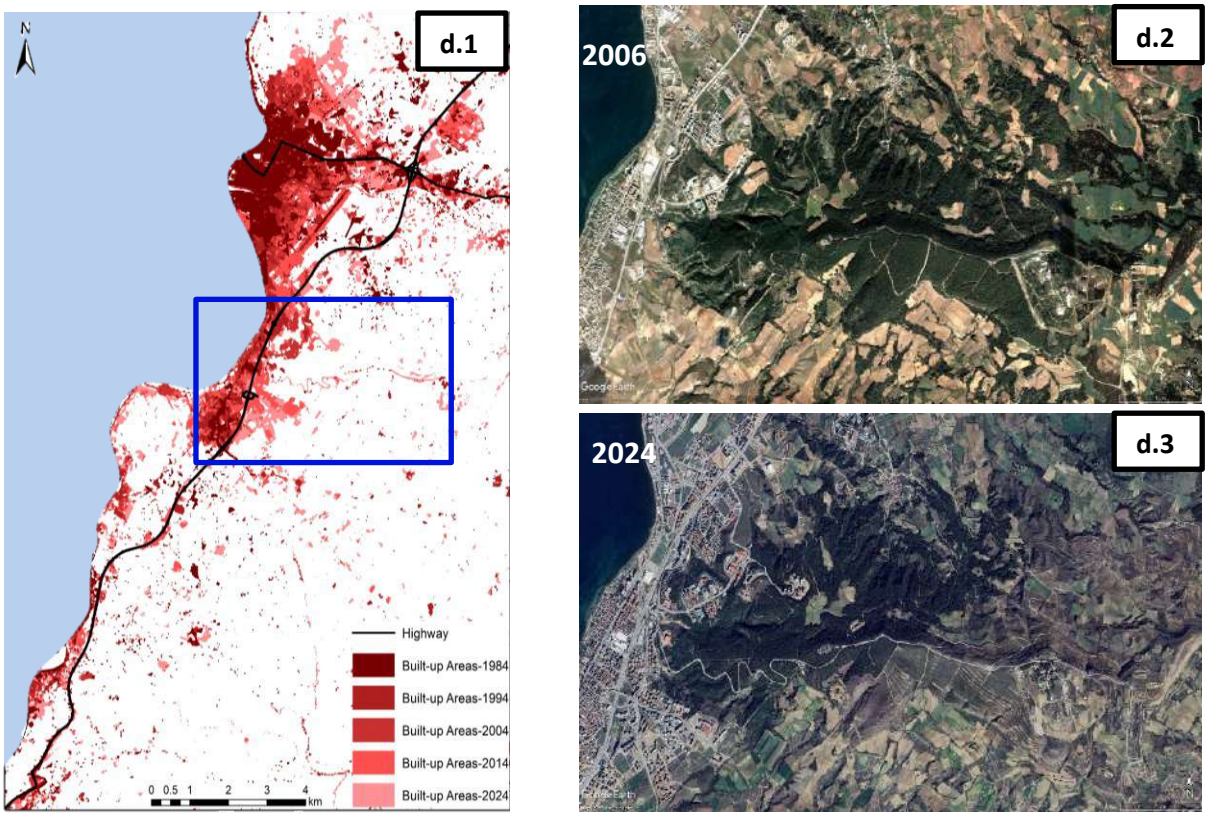

Figure 8. Large-scale Forest Loss Caused by Wildfires Near Residential Areas. (a.1) Temporal Change of Built-up Areas Produced in this Study, (a.2) Satellite Image of the Area from 2006 (Google Earth, n.d.), (a.3) Satellite Image of the Area from 2024 (Google Earth, n.d.).

3.3 Socio-Economic and Demographic Correlates of Agricultural Land Change

In 2024, the total population of Çanakkale province reached 568,966, with 204,454 residents living in the central district alone. Between 1985 and 2024, the central district of Çanakkale experienced a significant increase in population, accompanied by a notable trend toward urbanization. The total population grew from 73,412 in 1985 to 204,454 in 2024, representing an approximate increase of 178% (Figure 9). This demographic expansion was particularly pronounced in urban areas. While the rural population rose from 25,353 in 1984 to 59,260 in 2024, the urban population surged from 48,059 in 1985 to 204,454 in 2024. These figures highlight a substantial shift from rural to urban living, indicating that the majority of population growth has been absorbed by urban settlements rather than rural areas.

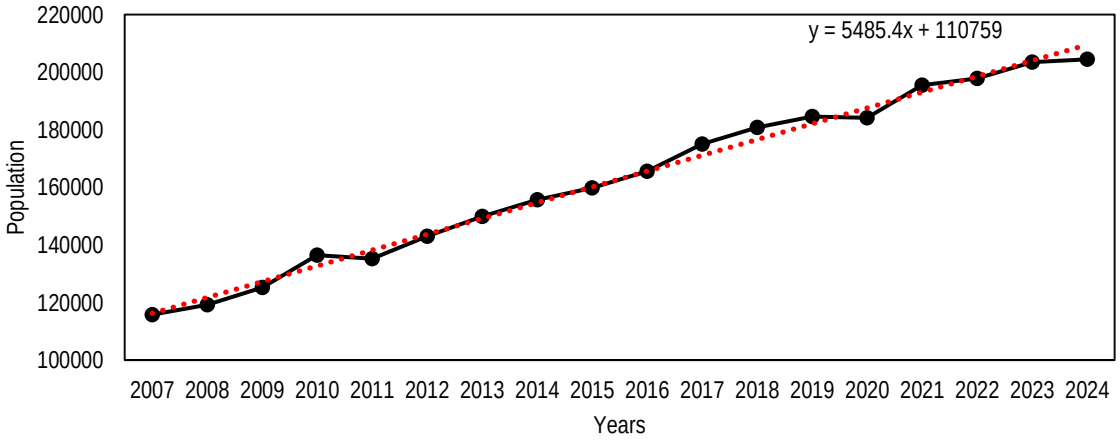

Figure 9. Population Growth of the Study Area (2007-2024) (Turkish Statistical Institute, n.d.).

Statistical analysis of quantitative data from the central district of Çanakkale reveals significant correlations between total agricultural land and various socio-demographic and sectoral indicators (Table 4). In particular, the contraction of agricultural land under the pressure of urban sprawl appears to have a decisive impact on local employment structures and migration dynamics.

A strong positive correlation was found between total agricultural land and the employment rate in the agricultural sector ($r = 0.70$, $p = 0.12$). Similarly, positive relationships were observed with indicators related to agricultural production capacity, such as the total number of trees ($r = 0.30$) and total number of tractors ($r = 0.25$). These findings indicate that the presence of agricultural land is directly associated with production and employment capacity in the agricultural sector.

It was also found that the development of non-agricultural sectors influences agricultural land use. A negative and statistically significant correlation was observed between the employment rate in the service sector and total agricultural land ($r = -0.82$, $p = 0.047$). This suggests that agricultural activities decline in areas where the service sector expands, revealing the transformative effect of urban occupations on rural landscapes. The structural shift from agriculture to services points not only to an economic but also a spatial transformation.

Migration data reveal negative correlations between total agricultural land and the migration of individuals with low educational attainment, particularly primary school graduates (out-migration: $r = -0.57$, $p = 0.02$). This suggests that the reduction in agricultural activities may be prompting low-educated individuals to migrate to urban areas or prevent them from sustaining life in the cities.

There were weaker but positive correlations between agricultural land and the migration behavior of individuals with higher education. For instance, the in-migration of college or university graduates correlated with agricultural land at $r = 0.41$ ($p = 0.12$), while out-migration showed $r = 0.52$ ($p = 0.039$). This implies that the contraction of agricultural land not only affects the rural labor force but also makes urbanizing areas less attractive for highly educated individuals. Master's level out-migration further supports this trend, showing a positive correlation with agricultural land ($r = 0.42$, $p = 0.10$).

Significant and positive correlations were identified between the population of urban neighborhoods [Barbaros ($r = 0.70$, $p = 0.001$), İsmetpaşa ($r = 0.57$, $p = 0.01$), and Hamidiye ($r = 0.60$, $p = 0.02$)] and total agricultural land. These findings indicate that population growth in these neighborhoods has led to the conversion of nearby agricultural areas into built-up land, with urban pressure directly targeting agricultural zones. The particularly high correlation for Barbaros neighborhood suggests it is at the core of this urban expansion.

The analysis of fruit, beverage, and spice crop areas and total number of trees in the central district of Çanakkale revealed a very strong and statistically significant correlation ($r = 0.99$, $p < 0.0001$). This reflects that these crops are largely perennial and tree-based (e.g., olive, cherry, apple), and that such agricultural activities directly affect the increase in tree numbers.

At the spatial level, areas like Kepez Plain which is historically used for fruit cultivation have been increasingly open to urban development, resulting in a noticeable rise in impervious surfaces. Settlements that once had a semi-rural character, with garden houses and detached buildings, have become sites of dense construction over time, limiting opportunities for urban agriculture and contributing to the decline of intra-urban fruit farming.

On a regional scale, the growing demand from metropolitan areas such as Istanbul for products like olives and olive oil has further increased the importance of Çanakkale's fruit-based agriculture. Consequently, agricultural land in the central district appears to have shifted from cereal cultivation toward higher value-added and marketable products such as fruit orchards, a trend particularly observable in rural villages outside the urban core.

These findings illustrate the dual effect of urban sprawl: while exerting pressure on traditional agricultural production areas, it also prompts the spatial reorganization of agricultural activity. Moreover, the results underscore the need for planning policies that account for the spatial sustainability of agricultural production and food security.

Overall, the findings suggest that urban sprawl and associated demographic movements have a determining impact on both the quantity and quality of agricultural land in the central district of

Çanakkale. Notably, neighborhood-level population growth and expansion of the service sector are directly linked to the conversion of agricultural land for urban uses and the dissolution of traditional agricultural practices. This transformation signals not only economic but also social and cultural ruptures within rural areas.

Table 4: Correlation between Total Agricultural Land and Selected Socio-Economic and Demographic Variables.

Variables	**Total Agricultural Land (decare)**	
	r	**P-value**
Employment Rate (%) in Agriculture	0.70	0.12
Employment Rate (%) in Industry	0.49	0.32
Employment Rate (%) in Services	-0.82	0.047
Agricultural Population (Total)	0.25	0.48
Total Number of Tractors	0.30	0.19
Total Number of Trees	0.18	0.43
Total In-Migration	0.28	0.29
Total Out-Migration	0.42	0.10
Primary School (In-Migration)	-0.40	0.12
Primary School (Out-Migration)	-0.57	0.02
University Graduates (In-Migration)	0.41	0.12
University Graduates (Out-Migration)	0.52	0.039
Master's and Doctorate Degree (In-Migration)	0.35	0.17
Master's and Doctorate Degree (Out-Migration)	0.40	0.12
Barbaros Neighbourhood Population	0.70	0.001
İsmetpaşaNeighbourhood Population	0.57	0.01
Hamidiye Neighbourhood Population	0.60	0.02

4. Discussion

4.1 Interpretation of Key Findings

This study evaluates the environmental and socio-economic impacts of urban sprawl in Çanakkale between 1984 and 2024, focusing on land use and land cover (LULC) changes. The findings reveal a significant increase in built-up areas, accompanied by a notable decline in natural lands. Özelkan et al. (2018), in their study conducted in Çanakkale province, found a strong negative correlation ($r = -0.985$) between urban sprawl and agricultural land, emphasizing that urbanization exerts pressure particularly on agricultural areas adjacent to urban boundaries. Although agricultural lands on the periphery of the urban core have been opened to development, there has been a continuous expansion in agricultural zones in other parts of the province, particularly those associated with fruit cultivation. This dual trend highlights the spatial complexity of urban expansion, emphasizing both the contraction of farmland around the city and the intensification of agricultural production in some rural regions.

The increase in urban construction mirrors the forms of continuous and edge expansion described by Harvey and Clark (1965) as well as Wilson et al. (2003), while also indicating the formation of growth corridors, especially along transportation routes and strategic infrastructure investments. Additionally, other studies have emphasized that public investments (e.g., hospitals, ring roads) made outside city centers tend to accelerate urban sprawl (Kilinc et al., 2023; Pratama et al., 2022). The urban expansion observed along coastal zones and peripheral roads underscores the decisive role of physical geography and socio-political decisions in shaping urban development (Khan et al., 2024). As Sudhira and Ramachandra (2007) and Nemouchi (2023) assert, urban sprawl in our study area has also occurred on the periphery of urban areas, particularly along the highways and arterial roads. This study reveals the direct influence of public investments on urban expansion. Tong et al. (2022), in their study in China,

found that public finance factors based on land financing, rather than market-oriented economic drivers, played a more decisive role in shaping urban development. Hantalo and Dube (2023) demonstrate that fringe settlement on unserved public lands is shaped by factors such as population growth, migration, weak land governance, and the influence of socio-political actors, exemplifying how urban sprawl is deeply intertwined with socio-economic dynamics. The unplanned expansion observed in the urban periphery is also consistent with findings in the literature (Daunt et al., 2021).

Moreover, the encroachment of urban areas on agricultural lands aligns with patterns of land use and socio-economic transformation observed in other Turkish cities such as Ankara, Konya, and Samsun (Basara et al., 2022; Gurbuz & Cilek, 2023; Yavuz, 2021). Research conducted in Europe and the Mediterranean basin has similarly demonstrated that agricultural lands are increasingly encroached upon by urban expansion and that environmental pressures are intensifying at urban fringes (Salem et al., 2020). Socio-economic analyses further elucidate the multi-layered impacts of urban sprawl. The strong positive correlation between agricultural land and employment in the agricultural sector reveals the direct relationship between land use and rural livelihoods. However, the inverse and statistically significant relationship between agricultural land and employment in the service sector indicates a spatial transformation of the economic structure. This finding is consistent with literature suggesting that urban economic diversification often leads to a decline in agricultural activities, particularly in peri-urban areas (Mosammam et al., 2017). On the other hand, the study finds that tourism-driven development, rather than demographic variables, plays a more influential role in urban expansion in coastal cities such as the study area (Mihalach & Dumitrașcu, 2025).

Migration data show that individuals with lower levels of education tend to migrate to cities as agricultural land decreases, whereas those with higher levels of education exhibit more complex migration patterns. It is also known that individuals migrating for educational purposes contribute more to urbanization and economic growth compared to those migrating for employment reasons (Liao et al., 2022).

Environmental issues are deeply intertwined with these socio-economic dynamics. The wildfires of 2023 demonstrated the high vulnerability of natural areas surrounding urban zones to both climatic and anthropogenic pressures (Godoy et al., 2022; Guo et al., 2024). This highlights the necessity of integrated urban planning approaches that preserve ecosystem services and reduce disaster risks. The wildfires underscore that urban sprawl poses not only land use challenges but also serious threats to environmental sustainability.

4.2 Strengths and Limitations

This study benefits from a robust methodological framework that combines long-term remote sensing data with socio-demographic and sectoral statistics, allowing for a comprehensive examination of urban sprawl and its impact on agricultural land in Çanakkale's central district over a 40-year period. The use of multiple spectral indices together with Support Vector Machine (SVM) classification contributed to the production of accurate land use and land cover maps, with overall accuracies ranging from 86 percent to 90 percent. Furthermore, integrating spatial analysis with socio-economic indicators provided a nuanced understanding of the complex interactions between urban expansion, migration patterns, and changes in agricultural activity.

However, there are limitations inherent in the remote sensing classification process, particularly due to the spectral similarity among certain land cover classes such as fallow agricultural lands, built-up areas, and burnt areas. This spectral overlap sometimes leads to misclassification or mixing of these classes, which may affect the consistency and reliability of land cover change detection over time. Additionally, the availability and resolution of socio-economic data sometimes limits the precision of correlation analyses because some datasets had missing or aggregated values that could affect detailed spatial interpretations. Remote sensing techniques, while powerful for detecting land cover changes, are less effective in capturing informal land uses and qualitative aspects of land management practices. The impact of sudden events such as the 2023 forest fires also introduces variability that complicates

the assessment of long-term trends. Lastly, the study's focus on a single urban district limits the broader applicability of the results, suggesting the need for comparative studies across diverse regions to generalize findings.

4.3 Implications and Future Directions

The findings of this study contribute to a deeper understanding of the impacts of urban sprawl on agricultural lands and local demographic dynamics, offering important insights for both theory and practice. These results highlight the need for sustainable urban development and agricultural land management policies. Local authorities are encouraged to develop strategies that mitigate the negative effects of urban expansion and protect agricultural production areas.

Future research should be conducted across cities of different scales to broaden the applicability of findings. Utilizing more comprehensive socio-economic data, especially detailed information on economic transformations, will enable a better understanding of these processes. Investigating migration patterns both quantitatively and qualitatively at the neighborhood and village levels, and establishing their relationship with spatial urban sprawl, is critical to fully capture the socio-economic implications of urban growth.

Furthermore, developing recommendations for policymakers based on such studies will enhance their practical relevance. Strategies informed by scientific evidence should be formulated to preserve agricultural lands, promote sustainable urban growth, and improve spatial planning. Future research incorporating multidisciplinary approaches and field studies will further deepen the knowledge base, allowing for a more effective examination of the environmental, social, and economic dimensions of urban sprawl.

5. Conclusion

In this study, urban sprawl patterns and land use and land cover changes in the examined region between 1984 and 2024 were mapped and evaluated using satellite imagery and spatial analysis methods. The findings reveal that urban expansion has exerted significant pressure on natural and agricultural areas. In particular, the conversion of agricultural lands around the city into built-up areas has not only resulted in the physical loss of land but has also led to a transformation in rural lifestyles and triggered significant socio-economic changes at the local scale.

The examples discussed in the study show that urban sprawl is not limited to residential areas alone; public investments such as airports, hospitals, and ring roads have also accelerated this process. The spatial orientation of these investments has not only shaped the direction of urban growth but has also intensified the transformation of rural and natural areas into developed land, highlighting the critical role of infrastructure planning in sustainable land management. Additionally, it was found that the loss of forested areas was largely due to wildfires. The large-scale fires that occurred in the summer of 2023 have increased environmental risks due to the expansion of urbanization into natural areas. These findings underline that spatial sprawl threatens not only the built environment but also the ecological integrity of natural systems, a challenge increasingly observed in other medium-sized and coastal cities worldwide.

One of the main limitations of this study is the confusion between classes with similar spectral characteristics (such as fallow agricultural lands, built-up areas, and post-fire zones), which prevents a fully consistent representation of all aspects of land cover change. Nevertheless, the overall classification accuracy remained above 85%, ensuring that the identified trends and patterns are robust and reliable. From a policy perspective, the results highlight the need for stricter protection of agricultural lands, the strategic coordination of public investments with spatial plans, and the implementation of green infrastructure strategies to mitigate wildfire risk and protect ecological corridors. Future research is recommended to include comparative analyses of cities at different scales, the integration of broader socio-economic datasets, and the use of detailed micro-scale data to identify processes of economic transformation. Overall, the study contributes to understanding how rapid

urbanization interacts with socio-economic change, providing insights that can support the development of more inclusive, resilient, and sustainable urban environments.

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Conflicts of Interest
The author(s) declare(s) no conflicts of interest.

Data availability statement
The original contributions presented in the study are included in the article; further inquiries can be directed to the corresponding author.

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CRediT author statement
Emre Özelkan: Conceptualization, Methodology, Investigation, Formal analysis, Writing – review & editing, Validation, Supervision, Project administration. Esra Eren: Conceptualization, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing, Validation. All authors contributed equally to the study, reviewed and approved the final version of the manuscript.

References

AlQadhi, S., Mallick, J., Talukdar, S., Bindajam, A. A., Shohan, A. A. A., & Shahfahad. (2021). Quantification of urban sprawl for past-to-future in Abha City, Saudi Arabia. *Comput Model Eng Sci*, *129*(2), 755-786. https://doi.org/10.32604/cmes.2021.016640

Antalyn, B., & Weerasinghe, V. P. A. (2020). Assessment of urban sprawl and its impacts on rural landmasses of Colombo District: a study based on remote sensing and GIS techniques. *Asia-Pacific Journal of Rural Development*, *30*(1-2), 139-154. https://doi.org/10.1177/1018529120946245

Balha, A., Mallick, J., Pandey, S., Gupta, S., & Singh, C. K. (2021). A comparative analysis of different pixel and object-based classification algorithms using multi-source high spatial resolution satellite data for LULC mapping. *Earth Science Informatics*, *14*(4), 2231-2247. https://doi.org/10.1007/s12145-021-00685-4

Basara, A. C., Tabar, M. E., Gulsun, S., & Sisman, Y. (2022). Monitoring urban sprawl in Atakum district using CORINE data. *Advanced Geomatics*, *2*(2), 49-56.

Bose, A., & Chowdhury, I. R. (2020). Monitoring and modeling of spatio-temporal urban expansion and land-use/land-cover change using markov chain model: a case study in Siliguri Metropolitan area, West Bengal, India. *Modeling Earth Systems and Environment*, *6*(4), 2235-2249. https://doi.org/10.1007/s40808-020-00842-6

Burges, C. J. (1998). A tutorial on support vector machines for pattern recognition. *Data mining and knowledge discovery*, *2*(2), 121-167. https://doi.org/10.1023/A:1009715923555

Chen, G., Li, X., Liu, X., Chen, Y., Liang, X., Leng, J., ... Huang, K. (2020). Global projections of future urban land expansion under shared socioeconomic pathways. *Nature communications*, *11*(1), 537. https://doi.org/10.1038/s41467-020-14386-x

Chettry, V. (2023). A critical review of urban sprawl studies. *Journal of Geovisualization and Spatial Analysis*, *7*(2), 28. https://doi.org/10.1007/s41651-023-00158-w

Crist, E. P., & Cicone, R. C. (2007). A physically-based transformation of Thematic Mapper data---The TM Tasseled Cap. *IEEE Transactions on Geoscience and Remote sensing*, *GE-22*(3), 256-263. https://doi.org/10.1109/TGRS.1984.350619

Cruz-Sandoval, M., Gómez-Zaldívar, F., Peraza-Mues, G., & Ponce-López, R. (2025). The interplay of economic complexity and urban sprawl in shaping socio-spatial segregation in Mexico. *Applied Geography*, *181*, 103690. https://doi.org/10.1016/j.apgeog.2025.103690

da Silva, V. S., Salami, G., da Silva, M. I. O., Silva, E. A., Monteiro Junior, J. J., & Alba, E. (2020). Methodological evaluation of vegetation indexes in land use and land cover (LULC) classification. *Geology, Ecology, and Landscapes*, *4*(2), 159-169. https://doi.org/10.1080/24749508.2019.1608409

Daunt, A. B. P., Silva, T. S. F., Bürgi, M., & Hersperger, A. M. (2021). Urban expansion and forest reserves: Drivers of change and persistence on the coast of São Paulo State (Brazil). *Land use policy*, *101*, 105189. https://doi.org/10.1016/j.landusepol.2020.105189

de Sousa, C. A. F., da Silveira, J. A. R., Santos, C. A. G., & da Silva, R. M. (2023). A methodological proposal to analyze urban sprawl, negative environmental impacts, and land degradation in the case of João Pessoa City (Brazil) between 1991 and 2018. *Environmental Monitoring and Assessment*, *195*(6), 738. https://doi.org/10.1007/s10661-023-11325-3

Deng, F. F., & Huang, Y. (2004). Uneven land reform and urban sprawl in China: the case of Beijing. *Progress in planning*, *61*(3), 211-236. https://doi.org/10.1016/j.progress.2003.10.004

Ewing, R. (1997). Is Los Angeles-style sprawl desirable?. *Journal of the American planning association*, *63*(1), 107-126. https://doi.org/10.1080/01944369708975728

Festus, I. A., Omoboye, I. F., & Andrew, O. B. (2020). Urban sprawl: environmental consequence of rapid urban expansion. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, *5*(6), 110-118. https://doi.org/10.47405/mjssh.v5i6.411

Fragou, S., Kalogeropoulos, K., Stathopoulos, N., Louka, P., Srivastava, P. K., Karpouzas, S., ... P. Petropoulos, G. (2020). Quantifying land cover changes in a Mediterranean environment using landsat TM and support vector machines. *Forests*, *11*(7), 750. https://doi.org/10.3390/f11070750

Gao, B. C. (1996). NDWI—A normalized difference water index for remote sensing of vegetation liquid water from space. *Remote Sensing of Environment, 58*(3), 257–266. https://doi.org/10.1016/S0034-4257(96)00067-3

Genovese, D., Candiloro, S., D'Anna, A., Dettori, M., Restivo, V., Amodio, E., & Casuccio, A. (2023). Urban sprawl and health: A review of the scientific literature. *Environmental Research Letters*, *18*(8), 083004. https://doi.org/10.1088/1748-9326/ace986

Glockmann, M., Li, Y., Lakes, T., Kropp, J. P., & Rybski, D. (2022). Quantitative evidence for leapfrogging in urban growth. *Environment and Planning B: Urban Analytics and City Science*, *49*(1), 352-367. https://doi.org/10.1177/2399808321998713

Godoy, M. M., Martinuzzi, S., Masera, P., & Defossé, G. E. (2022). Forty years of wildland urban interface growth and its relation with wildfires in central-western Chubut, Argentina. *Frontiers in Forests and Global Change*, *5*, 850543. https://doi.org/10.3389/ffgc.2022.850543

Google Earth. (n.d). *Çanakkale, Turkey* [Satellite image]. Google Earth Pro. https://earth.google.com/ (Accessed: May 6, 2025)

Gumma, M. K., Mohammad, I., Nedumaran, S., Whitbread, A., & Lagerkvist, C. J. (2017). Urban sprawl and adverse impacts on agricultural land: A case study on Hyderabad, India. *Remote sensing*, *9*(11), 1136. https://doi.org/10.3390/rs9111136

Guo, Y., Wang, J., Ge, Y., & Zhou, C. (2024). Global expansion of wildland-urban interface intensifies human exposure to wildfire risk in the 21st century. *Science Advances*, *10*(45), eado9587. https://doi.org/10.1126/sciadv.ado9587

Gurbuz, M., & Cilek, A. (2023). Analysis of Urban Land Use Change Using Remote Sensing and Different Change Detection Techniques: the Case of Ankara Province. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *48*, 515-520. https://doi.org/10.5194/isprs-archives-XLVIII-M-1-2023-515-2023

Hajilou, M., Meshkini, A., Mirehei, M., & Ghaedrahmati, S. (2023). Urban sprawl: Do its financial and economic benefits outweigh its costs for local governments?. *GeoJournal*, *88*(2), 2325-2343. https://doi.org/10.1007/s10708-022-10747-9

Halder, B., Haghbin, M., & Farooque, A. A. (2021). An assessment of urban expansion impacts on land transformation of Rajpur-Sonarpur Municipality. *Knowledge-Based Engineering and Sciences*, *2*(3), 34-53. https://doi.org/10.51526/kbes.2021.2.3.34-53

Hantalo, A. H., & Dube, E. E. (2023). Dynamics of informal settlement expansion on the urban fringe: the case of birbir town, southern Ethiopia. *Journal of Contemporary Urban Affairs*, *7*(1), 86-102. https://doi.org/10.25034/ijcua.2023.v7n1-6

Harvey, R. O., & Clark, W. A. (1965). The nature and economics of urban sprawl. *Land Economics*, *41*(1), 1-9. https://doi.org/10.2307/3144884

Huete, A. R. (1988). A soil-adjusted vegetation index (SAVI). *Remote Sensing of Environment*, *25*(3), 295–309. https://doi.org/10.1016/0034-4257(88)90106-X

Hussain, M., & Imitiyaz, I. (2018). Urbanization concepts, dimensions and factors. *International Journal of Recent Scientific Research*, *9*(1), 23513-23523.

Imbrenda, V., Quaranta, G., Salvia, R., Egidi, G., Salvati, L., Prokopovà, M., ... Lanfredi, M. (2021). Land degradation and metropolitan expansion in a peri-urban environment. *Geomatics, Natural Hazards and Risk*, *12*(1), 1797-1818. https://doi.org/10.1080/19475705.2021.1951363

Kavzoglu, T., Bilucan, F., & Teke, A. (2020, November). *Comparison of support vector machines, random forest and decision tree methods for classification of Sentinel-2A image using different band combinations* (Vol. 41, pp. 1–8). In *41st Asian Conference on Remote Sensing (ACRS 2020)*. Deqing, China.

Kaya, Z., & Dervisoglu, A. (2023). Determination of urban areas using Google Earth Engine and spectral indices; Esenyurt case study. *International Journal of Environment and Geoinformatics*, *10*(1), 1-8. https://doi.org/10.30897/ijegeo.1214001

Khan, D., Khan, N., Choudhury, U., Singh, S. K., Kanga, S., Kumar, P., & Meraj, G. (2024). Urban expansion and spatial growth patterns in Lucknow: implications for Sustainable Development (1991–2021). *Sustainability*, *17*(1), 227. https://doi.org/10.3390/su17010227

Kilinc, N., Yilmaz, M., & Turk, S. S. (2023). Understanding the spatial relationship between large investment decisions and plan changes: a case study of Istanbul. *Journal of Urban Planning and Development*, *149*(4), 05023039. https://doi.org/10.1061/JUPDDM.UPENG-4489

Kraus, K., Kraus, N., & Buzhdyhan, K. (2022). Fourth industrial revolution as a driver of the digitalization of production and urbanization. *VUZF review*, *7*(1), 177-191.

Li, G., Fang, C., Li, Y., Wang, Z., Sun, S., He, S., ... Liu, X. (2022). Global impacts of future urban expansion on terrestrial vertebrate diversity. *Nature communications*, *13*(1), 1628. https://doi.org/10.1038/s41467-022-29324-2

Liao, P. J., Wang, P., Wang, Y. C., & Yip, C. K. (2022). Educational choice, rural–urban migration and economic development. *Economic Theory*, *74*(1), 1-67. https://doi.org/10.1007/s00199-021-01369-2

Lovera, C. A. S. (2015). Urban sprawl and infrastructural lands: Revamping internal spaces in Santiago de Chile. *Geoforum*, *67*(2015), 36-40. https://doi.org/10.1016/j.geoforum.2015.10.004

Lu, H., Shang, Z., Ruan, Y., & Jiang, L. (2023). Study on urban expansion and population density changes based on the inverse S-shaped function. *Sustainability*, *15*(13), 10464. https://doi.org/10.3390/su151310464

Magidi, J., & Ahmed, F. (2019). Assessing urban sprawl using remote sensing and landscape metrics: A case study of City of Tshwane, South Africa (1984–2015). *The Egyptian Journal of Remote Sensing and Space Science*, *22*(3), 335-346. https://doi.org/10.1016/j.ejrs.2018.07.003

Maryati, S., & Humaira, A. N. S. (2015). Increasing the infrastructure access of low-income people in peri-urban of Bandung Metropolitan Area. *International Journal of Built Environment and Sustainability*, *2*(3), 219-226. https://doi.org/10.11113/ijbes.v2.n3.84

Mihalache, C. E., & Dumitrașcu, M. (2025). Urban Expansion and Landscape Transformation in Năvodari, Romania: An Integrated Geospatial and Socio-Economic Perspective. *Land*, *14*(7), 1496. https://doi.org/10.3390/land14071496

Moazzam, M. F. U., Doh, Y. H., & Lee, B. G. (2022). Impact of urbanization on land surface temperature and surface urban heat Island using optical remote sensing data: A case study of Jeju Island, Republic of Korea. *Building and Environment*, *222*(2022), 109368. https://doi.org/10.1016/j.buildenv.2022.109368

Mohammadyari, F., Zarandian, A., Mirsanjari, M. M., Suziedelyte Visockiene, J., & Tumeliene, E. (2023). Modelling impact of urban expansion on ecosystem services: a scenario-based approach in a mixed natural/urbanised landscape. *Land*, *12*(2), 291. https://doi.org/10.3390/land12020291

Mosammam, H. M., Nia, J. T., Khani, H., Teymouri, A., & Kazemi, M. (2017). Monitoring land use change and measuring urban sprawl based on its spatial forms: The case of Qom city. *The Egyptian Journal of Remote Sensing and Space Science*, *20*(1), 103-116. https://doi.org/10.1016/j.ejrs.2016.08.002

Nemouchi, H. (2023). Peri-Urban Pressures: The Interplay of Land Strategies and Urbanization in Algeria's Oran Metropolis. Journal of Contemporary Urban Affairs, 7(2), 1-19. https://doi.org/10.25034/ijcua.2023.v7n2-1

Obregón-Biosca, S. A., Romero-Navarrete, J. A., Mendoza-Sanchez, J. F., & Betanzo-Quezada, E. (2016). Impact of mobility induced by urban sprawl: Case study of the Querétaro metropolitan area. *Journal of Urban Planning and Development*, *142*(2), 05015005. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000295

Oyalowo, B. (2022). Implications of urban expansion: land, planning and housing in Lagos. *Buildings & Cities*, *3*(1), 692-708. https://doi.org/10.5334/bc.243

Özelkan, E., Sağlık, A., Sümer, S. K., Bedir, M., & Kelkit, A. (2018). Kentleşmenin tarım alanları üzerine etkisinin uzaktan algılama ile incelenmesi–Çanakkale örneği [Examination of the Effect of Urbanization on Agricultural Areas Using Remote Sensing – A Case Study in Çanakkale]. *ÇOMÜ Ziraat Fakültesi Dergisi*, *6*(1), 123-135.

Pratama, A. P., Yudhistira, M. H., & Koomen, E. (2022). Highway expansion and urban sprawl in the Jakarta Metropolitan Area. *Land use policy*, *112* (2022), 105856. https://doi.org/10.1016/j.landusepol.2021.105856

Qi, J., Chehbouni, A., Huete, A. R., Kerr, Y. H., & Sorooshian, S. (1994). A modified soil adjusted vegetation index. *Remote Sensing of Environment*, *48*(2), 119–126. https://doi.org/10.1016/0034-4257(94)90134-1

Ren, Q., He, C., Huang, Q., Zhang, D., Shi, P., & Lu, W. (2023). Impacts of global urban expansion on natural habitats undermine the 2050 vision for biodiversity. *Resources, Conservation and Recycling*, *190*(2023), 106834. https://doi.org/10.1016/j.resconrec.2022.106834

Rizkiya, P., Haikal, N., Hasan, Z., Aulia, F., Gunawan, A., & Fuady, Z. (2023, December). The Urban Sprawl Typology and The Urban Growth Pattern of Peri-Urban Area in Aceh Besar Regency, Aceh. In *IOP Conference Series: Earth and Environmental Science*, *1276*(1), 012041. IOP Publishing. https://doi.org/10.1088/1755-1315/1276/1/012041

Salem, M., Tsurusaki, N., & Divigalpitiya, P. (2020). Land use/land cover change detection and urban sprawl in the peri-urban area of greater Cairo since the Egyptian revolution of 2011. *Journal of Land Use Science*, *15*(5), 592-606. https://doi.org/10.1080/1747423X.2020.1765425

Scheba, A., Turok, I., & Visagie, J. (2021). Inequality and urban density: socio-economic drivers of uneven densification in Cape Town. *Environment and Urbanization ASIA*, *12*(1_suppl), 107-126. https://doi.org/10.1177/0975425321998026

Scott, A. J. (2017). Urbanization, work and community: The logic of city life in the contemporary world. *Quality Innovation Prosperity*, *21*(1), 9-30. https://doi.org/10.12776/qip.v21i1.785

Singh, R. P., Singh, N., Singh, S., & Mukherjee, S. (2016). Normalized difference vegetation index (NDVI) based classification to assess the change in land use/land cover (LULC) in Lower Assam, India. International Journal of Advanced Remote Sensing and GIS, 5(10), 1963-1970. https://doi.org/10.23953/cloud.ijarsg.74

Sharma, M., Kumar, V., & Kumar, S. (2024). A systematic review of urban sprawl and land use/land cover change studies in India. *Sustainable Environment*, *10*(1), 2331269. https://doi.org/10.1080/27658511.2024.2331269

Sheykhmousa, M., Mahdianpari, M., Ghanbari, H., Mohammadimanesh, F., Ghamisi, P., & Homayouni, S. (2020). Support vector machine versus random forest for remote sensing image classification: A meta-analysis and systematic review. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *13*, 6308-6325. https://doi.org/10.1109/JSTARS.2020.3026724

Simkin, R. D., Seto, K. C., McDonald, R. I., & Jetz, W. (2022). Biodiversity impacts and conservation implications of urban land expansion projected to 2050. *Proceedings of the National Academy of Sciences*, *119*(12), e2117297119. https://doi.org/10.1073/pnas.2117297119

Sudhira, H. S., & Ramachandra, T. V. (2007, July). *Characterising urban sprawl from remote sensing data and using landscape metrics*. In *Proceedings of the 10th International Conference on Computers in Urban Planning and Urban Management* (pp. 11–13), Iguassu Falls, PR, Brazil.

Tong, D., Chu, J., Han, Q., & Liu, X. (2022). How land finance drives urban expansion under fiscal pressure: Evidence from Chinese cities. *Land*, *11*(2), 253. https://doi.org/10.3390/land11020253

Tu, J., Xia, Z. G., Clarke, K. C., & Frei, A. (2007). Impact of urban sprawl on water quality in eastern Massachusetts, USA. *Environmental Management*, *40*, 183-200. https://doi.org/10.1007/s00267-006-0097-x

Turkish Statistical Institute. (n.d.). *Various statistical datasets [Data file]*. Available from the Turkish Statistical Institute website, https://www.tuik.gov.tr

Vapnik, V. N. (1999). An overview of statistical learning theory. *IEEE transactions on neural networks*, *10*(5), 988-999. https://doi.org/10.1109/72.788640

Wilson, E. H., Hurd, J. D., Civco, D. L., Prisloe, M. P., & Arnold, C. (2003). Development of a geospatial model to quantify, describe and map urban growth. *Remote sensing of environment*, *86*(3), 275-285. https://doi.org/10.1016/S0034-4257(03)00074-9

Wu, R., Li, Z., & Wang, S. (2021). The varying driving forces of urban land expansion in China: Insights from a spatial-temporal analysis. *Science of The Total Environment*, *766*(2021), 142591. https://doi.org/10.1016/j.scitotenv.2020.142591

Yasin, M. Y., Yusof, M. M., & Noor, N. M. (2019). Urban sprawl assessment using time-series LULC and NDVI variation: a case study of Sepang, Malaysia. *Applied Ecology & Environmental Research*, *17*(3), 5583-5602. https://doi.org/10.15666/aeer/1703_55835602

Yavuz, F. (2021). Urban sprawl: An empirical analysis for Konya Province-Turkey. *A/Z ITU Journal of Faculty of Architecture*, *18*(1), 79-97. https://doi.org/10.5505/itujfa.2020.04834

Yuan, M., Huang, Y., Shen, H., & Li, T. (2018). Effects of urban form on haze pollution in China: Spatial regression analysis based on PM2. 5 remote sensing data. *Applied geography*, *98*(2018), 215-223. https://doi.org/10.1016/j.apgeog.2018.07.018

Yussif, K., Dompreh, E. B., & Gasparatos, A. (2023). Sustainability of urban expansion in Africa: a systematic literature review using the Drivers–Pressures–State–Impact–Responses (DPSIR) framework. *Sustainability Science*, *18*(3), 1459-1479. https://doi.org/10.1007/s11625-022-01260-6

Zha, Y., Gao, J., & Ni, S. (2003). Use of normalized difference built-up index in automatically mapping urban areas from TM imagery. *International Journal of Remote Sensing, 24*(3), 583–594. https://doi.org/10.1080/01431160304987

Zhang, H., Li, S., & Chang, J. (2025). Spatiotemporal Evolution and Driving Factors of Coupling Coordination Degree Between New Urbanization and Urban Resilience: A Case of Huaihai Economic Zone. *ISPRS International Journal of Geo-Information, 14*(7), 271. https://doi.org/10.3390/ijgi14070271

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Comparative Analysis of Informal Vendors around Dhaka Metro Stations through a Sustainable Livelihood Framework

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ABSTRACT

Dhaka's urban landscape is undergoing rapid transformation with the introduction of the Metro Rail, reshaping mobility patterns and influencing informal economies. This study investigates how the establishment of Farmgate and Mirpur-10 metro stations has affected the livelihoods of informal vendors, applying the Sustainable Livelihood Framework (SLF) as an analytical lens. A mixed-method research design was adopted, combining structured questionnaires, semi-structured interviews, field observations, and photographic documentation with statistical analyses. Fifty vendors were surveyed across the two sites, and independent sample t-tests were performed to compare livelihood outcomes. Results indicate that vendors who relocated their vending spaces after the opening of metro stations achieved significantly higher SLF scores ($p < .01$), reflecting improved access to financial and social capital. In contrast, vendors who started business after the metro inauguration reported comparatively lower livelihood scores, suggesting vulnerabilities linked to competition, limited infrastructure, and regulatory constraints. Findings underscore the dual role of transport infrastructure as both an enabler of opportunity and a source of precarity for informal workers. The study highlights the necessity of inclusive urban policies, particularly through designated vending zones and supportive planning strategies, to enhance resilience and ensure equitable benefits from infrastructure-led urban transformation.

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Highlights:	Contribution to the field statement:
- Integration of new metro stations in the urban landscape and their Impact on the livelihoods of Informal vendors in the surrounding areas. - Examination of spatial implications of the Farmgate and Mirpur-10 metro stations on the livelihoods of nearby small-scale vendors. -Employment of Sustainable Livelihoods Framework (SLF) to realize the livelihood conditions of the informal vendors impacted by metro stations.	This study contributes to discourses on informal economies, urban mobility, urban transformations, and inclusive development, advocating policies that integrate vendors into transit-oriented development while ensuring their role in rapidly transforming cities.

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1. Introduction

Dhaka, the capital of Bangladesh, has experienced dynamic transformations over the past four centuries, with growth evident in its spatial, physical, economic, and social structures. As the city expanded, it attracted diverse populations from different backgrounds, while its organic morphology continuously shaped an urban core aligned with shifting functional centres across historical stages (Nilufar, 2011). Urban transportation infrastructure plays a pivotal role in influencing these transformations by restructuring spatial, social, and economic dynamics. Large-scale projects such as Metro Rail Systems are often introduced to reduce congestion, shorten travel times, and enhance mobility. Yet these developments also generate ripple effects on surrounding urban fabrics, particularly for informal economic stakeholders such as small-scale vendors, who remain highly sensitive to spatial and regulatory shifts (Donovan, 2008). In many developing cities, informal vending forms an indispensable component of local economies, providing affordable goods and services in areas of high pedestrian footfall such as transport hubs (Bromley, 2000). In Dhaka, vendors are ubiquitous across public spaces, contributing significantly to the urban economy, both in stationary and mobile forms (Husain et al., 2015).

The inauguration of the Dhaka Metro Rail Project—Mass Rapid Transit (MRT) Line-6, beginning in December 2022—marks a radical restructuring of the city's transport system (Raj et al., 2024). Among its key nodes, Farmgate and Mirpur-10 have long been characterised by intense pedestrian flows, dense informal economies, and complex social interactions. Farmgate serves as a central commercial and transport hub with a diverse mix of activities, while Mirpur-10 operates as both a residential and commercial sub-centre supported by vibrant vendor networks (RAJUK, 2021). The introduction of metro stations in these areas has reconfigured mobility patterns and spatial practices, presenting new opportunities for vendors through increased pedestrian circulation (Tariquzzaman, 2019). At the same time, it has introduced risks in the form of stricter regulations, displacement pressures, and intensified competition from formalised businesses (Bhowmik, 2010). Informal vendors, despite their integral role in the everyday life of transit-oriented spaces, are frequently marginalised in urban planning discourses (Crossa, 2009). These dynamics foreground critical questions concerning inclusivity in urban development and the resilience of informal economies under conditions of rapid infrastructural change.

Existing literature highlights the precarity of informal vendors when confronted with urban transformation and formalisation processes (Bhowmik, 2005). However, research remains limited regarding how large-scale transport infrastructure projects directly shape vendors' livelihoods in the Bangladeshi context. Addressing this gap, the present study examines the socio-economic conditions and spatial implications of the Farmgate and Mirpur-10 metro stations for small-scale vendors. It situates informal vending within broader debates on urban transformation, resilience, and equity, thereby contributing to an enhanced understanding of how infrastructure-led development reshapes opportunities, vulnerabilities, and inequalities in rapidly urbanising cities.

The study specifically aims to analyse how metro-induced changes affect vendors' income, access to space, customer flows, and regulatory challenges. Accordingly, it asks: (i) how has the opening of metro stations in Dhaka impacted the livelihood conditions of informal vendors in adjacent areas? and (ii) how do the livelihood outcomes of vendors who began operations before the stations' inauguration differ from those who started afterwards? By addressing these questions, the research highlights the need for inclusive planning frameworks that recognise the socio-economic significance of informal vendors and integrate their roles within evolving transit-oriented urban landscapes.

2. Literature Review

2.1 The Impact of MRT Projects on Informal Vendors

Informal vendors who work in areas where new transport infrastructure projects reform urban dynamics, such as Mass Rapid Transit (MRT) projects, often find their livelihoods radically transformed (Choi, 2015). Although these developments seek to improve mobility, reduce congestion, and develop urban landscape (Man et al., 2024), the displacement of these vendors is a common

consequence of these initiatives due to construction, zoning modifications, and the formalization of urban areas (Spire & Choplin, 2018). Nevertheless, when combined with inclusive urban planning strategies, these MRT projects provide chances to rethink vendor integration through the defined vending zones, better accessibility, and increased pedestrian traffic (Selwyn, 2018).

In Jakarta, even though the development of the MRT project initially displaced the majority of the vendors along Jalan Sudirman and Thamrin (Silver, 2016), subsequent programs such as Jakpreneur and designated micro-business zones have significantly supported business success among new vendors (Wijaya & Nuringsih, 2022). Moreover, while the extension of Delhi's Metro caused displacement at first, it subsequently worked with the National Association of Street Vendors of India (NASVI) to include defined vending zones near stations, in compliance with the Street Vendors Act, 2014 (Bose & Saxena, 2017). Conversely, the extensions of Manila's LRT and MRT have resulted in recurrent vendor evictions in locations like EDSA and Cubao, with inadequate enforcement measures facilitating cycles of informal reoccupation and eviction (Boquet, 2017). However, working along with vendor unions, São Paulo, Brazil, established inclusive regulations for regulated vending around metro stations, which helped to prevent early displacement and encourage negotiated reintegration (Nogueira & Shin, 2022). Following these examples of a wide spectrum ranging from exclusionary modernization in Manila to contested negotiation in Jakarta and Delhi and, finally, progressive inclusion in São Paulo, this research seeks to investigate the impact of metro-induced urban transformations on vendors' income, access to space, customer flow, and regulatory challenges in the post-construction of the Dhaka MRT.

2.2 Informal Vendors in Dhaka

Informal vendors in Dhaka, without a recognized enterprise framework, sell their products and services directly in public places like streets, marketplaces, and transportation hubs (Lata et al., 2019). This informal economy provides livelihoods to millions and helps the urban poor (Chen, 2016). However, informal vendors face challenges like evictions, police interference, lack of designated vending zones, and poor infrastructure (Ankhi et al., 2024)

As street hawkers are not officially recognized as part of the formal workforce, and their working conditions are often overlooked by authorities. Nonetheless, the government undertakes periodic interventions, including evictions, aimed at improving urban environments and facilitating better traffic and pedestrian movement. However, many renovation efforts have been undermined by market syndicates, local criminal groups, and corrupt law enforcement officials. Challenges to successful relocation are not solely external; hawkers themselves often resist moving from their established vending sites despite verbal assurances from officials, even when formal plans exist to relocate them to renovated spaces (Rayhan et al., 2019) . Authorities also fail to adequately consider the negative impacts on vendors' livelihoods caused by such relocations and evictions.

Conversely, Dhaka's informal vendors face numerous obstacles due to insufficient resources, unsafe working conditions, and inadequate infrastructure (Habib, 2016). Working in open areas with minimum shade exposes them to harsh weather conditions and also weather-related health risks. Inadequate waste management and toilet facilities contribute to an already unhygienic working environment (Habib, 2016). Moreover, vendors have to bribe municipal authorities and political personnel to secure their positions and escape legal consequences. Informal vendors are vulnerable to financial upsets and health problems since they do not have access to social security benefits such as health insurance and health-related facilities (Lata et al., 2019). While registration and licensing have been recommended as efforts to formalize informal vending, their application is still limited. They are particularly vulnerable to economic emergencies and health problems due to the informal nature of their work (Husain et al., 2015).

Due to their necessary services and support in the local economy, informal vendors are common characters in Dhaka's urban environment. To address the challenges that informal vendors face, city planners must take several measures, including setting up designated vending zones, supplying essential facilities and infrastructure, defending against extortion, and enrolling in social-support

programs (Etzold et al., 2013). To ensure an inclusive and urban environment, sustainable solutions must reintegrate the vendors' demands with the urban planning goals.

2.3 Sustainable Livelihood Framework for Informal Vendors

This study accepts the Sustainable Livelihoods Framework (SLF) to understand the livelihood conditions of the informal vendors impacted by the development of the Dhaka MRT. The SLF, developed by the UK's Department for International Development (DFID), provides a general perspective on poverty, highlighting the complex nature of livelihood choices and the importance of various forms of capital—human, social, natural, physical, and financial (DFID, 2001) (Figure 1). Serrat (2008) elaborated on the livelihood assets that include health, education, knowledge, and skills, etc., as human capital; networks and connections, etc., as social capital; environmental services, etc., as natural capital; infrastructure, tools, and technology, etc., as physical capital; and savings, wages, etc., as financial capital.

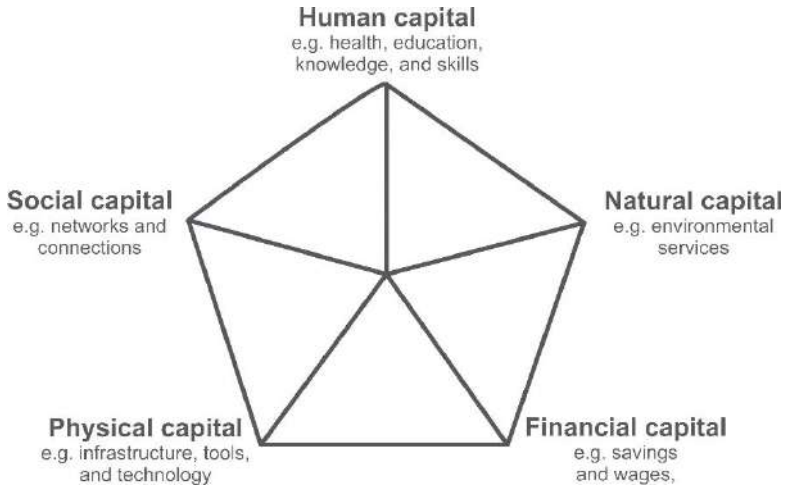

Figure 1. The five core assets identified by the Sustainable Livelihood Framework.
Source: Modified by Authors after DFID (2001) and Serrat (2008).

This framework provides a valuable lens for analyzing the situation of informal vendors around Dhaka metro stations by focusing on their assets, vulnerabilities, and coping strategies that shape their livelihoods through an "environmentally, economically, and socially sustainable" process. Among the five capitals (Figure 1), social capital has the most impact on vendors' access to capital as a whole, through its effects on financial and human capital (Mondal, 2017). Hossain et al. (2022) explained that a higher surplus income per day allows them to put more money into financial capital and gives them more chances to increase human capital by providing better education and living conditions for their children. Moreover, Peña (1999) emphasized that the informal vendors struggle to gain more control over their physical assets by collective collaboration and periodic confrontation. Hence, this research adopts the Sustainable Livelihoods Framework (SLF) to seek the impacts of monitoring environments on the various forms of core assets and to analyze the livelihoods of the informal vendors through this framework. Thus, the study hypothesizes:

- Primary Hypothesis (H_1):

Informal vendors who changed their vending location after the opening of the metro station have significantly better Sustainable Livelihood Framework (SLF) scores compared to those who did not.

- Null Hypothesis (H_0):

There is no significant difference in SLF scores between vendors who changed their vending location and those who did not after the metro station opened.

3. Methodology

3.1 Research Design

This study employs a mixed-method research design, integrating quantitative and qualitative approaches to examine the impact of Dhaka Metro Rail Transit (MRT) on informal vendors' livelihoods through the Sustainable Livelihood Framework (SLF). Two high-footfall MRT stations—Farmgate and Mirpur-10—were selected for their strategic significance and concentration of vending activities. Figure 2, illustrates the Research Methodology Framework

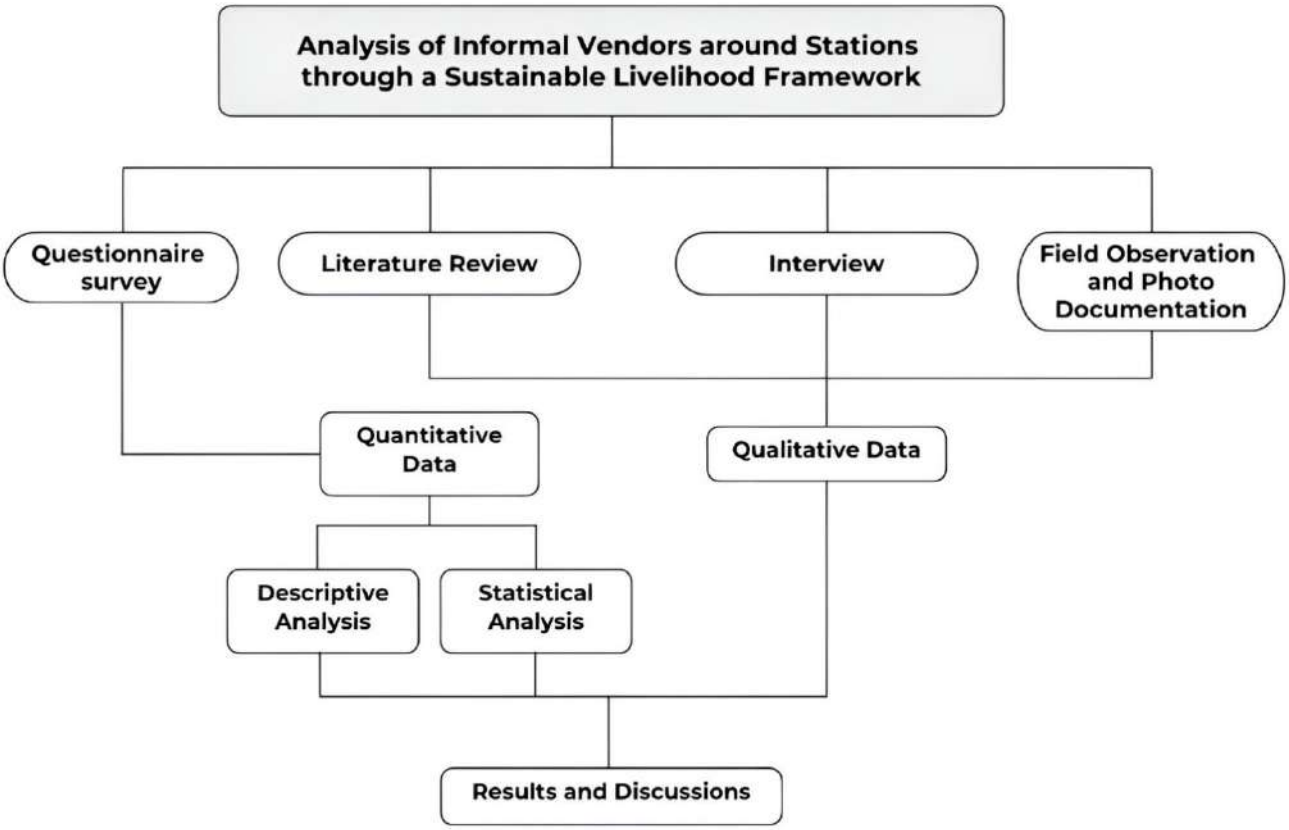

Figure 2. Research Methodology Framework.

3.2 Data Collection Methods

Primary data was gathered through site observations, transect walks, photographic documentation, user pattern analysis, and structured questionnaires, supported by contextual analysis using land-use maps and relevant literature.

3.2.1 Sample size:

A total of 50 vendors (25 from each site) were selected using purposive sampling to ensure diversity in vending types and experiences.

3.2.2 Questionnaire Design

The questionnaire was designed to reflect the components of the SLF, structured into five main sections:

- Human Capital – education level, skills, and health;
- Social Capital – support networks, peer relations, and customer base;
- Natural and Physical Capital – access to infrastructure, vending space, and weather impact;
- Financial Capital – income level, savings, credit access;
- Livelihood Strategies and Outcomes – coping mechanisms, changes in earnings, and perception of business sustainability.

The questionnaire included both closed-ended and Likert-scale questions to quantify the SLF dimensions, alongside open-ended questions to capture vendors' perspectives in their own words.

3.3 Data Analysis

3.3.1 Quantitative Analysis

Descriptive and statistical analyses were used to outline vendor demographics, livelihood strategies, and business conditions. To test the research hypothesis, two two-tailed independent sample t-tests were conducted:

- Comparing the mean SLF scores of vendors who started vending before vs. after the metro station opening.
- Comparing vendors who changed vs. did not change their vending location after the station became operational.

In addition, a Spearman's rho correlation assessed the relationship between location satisfaction and weather impact. These tests provided insight into how spatial changes, adaptive strategies, and environmental perceptions relate to livelihood sustainability.

3.3.2 Qualitative Analysis

Open-ended responses, observations, and photos were thematically analyzed to capture vendor narratives on customer flow, enforcement, and peer support.

3.3.3 Ethical Considerations

The research adhered to basic ethical standards. Participation was voluntary, and informed consent was obtained from all respondents before data collection. Vendors were assured of confidentiality and anonymity, and no identifying personal data was recorded. Sensitive topics were handled with care.

This integrated methodology allowed for a robust, comparative understanding of the impacts of metro station development on informal vendors, capturing both quantifiable livelihood indicators and lived, context-specific experiences.

3.4 Research Area

This research was conducted in two of the most dynamic areas of Dhaka—Farmgate and Mirpur 10 stations (Figure 3)—due to their strategic locations, role in transportation and connectivity, and socioeconomic activities.

3.4.1 Farmgate Area

Farmgate, located in the central part of Dhaka, Bangladesh, has undergone a significant transformation from its early 20th-century agricultural origins to become a vibrant commercial and transportation hub. It serves as a central traffic hub in Dhaka where several major routes (e.g., Green Road, Panthapath, and Kazi Nazrul Islam Avenue) intersect (Figure 4). The area is marked by a juxtaposition of formally planned residential blocks and spontaneously developed commercial zones, illustrating the complex, layered development of Dhaka's urban landscape. A footbridge facilitates pedestrian mobility across the four major intersecting roads, further reinforcing the area's role as a central hub for circulation and commercial activity. Despite recent infrastructural advancements, including the integration of a Metro Rail Station, Farmgate continues to experience severe traffic congestion and overcrowding, indicative of the overarching issues associated with the rapid urbanization of the city (Ahmed, 2024). Located within Dhaka North City Corporation (DNCC), Farmgate encompasses Indira Road, a corridor characterized by intense pedestrian traffic and vehicular flow. This route also hosts a high concentration of informal vendors, who contribute to the local economy while facing limitations in spatial and legal recognition.

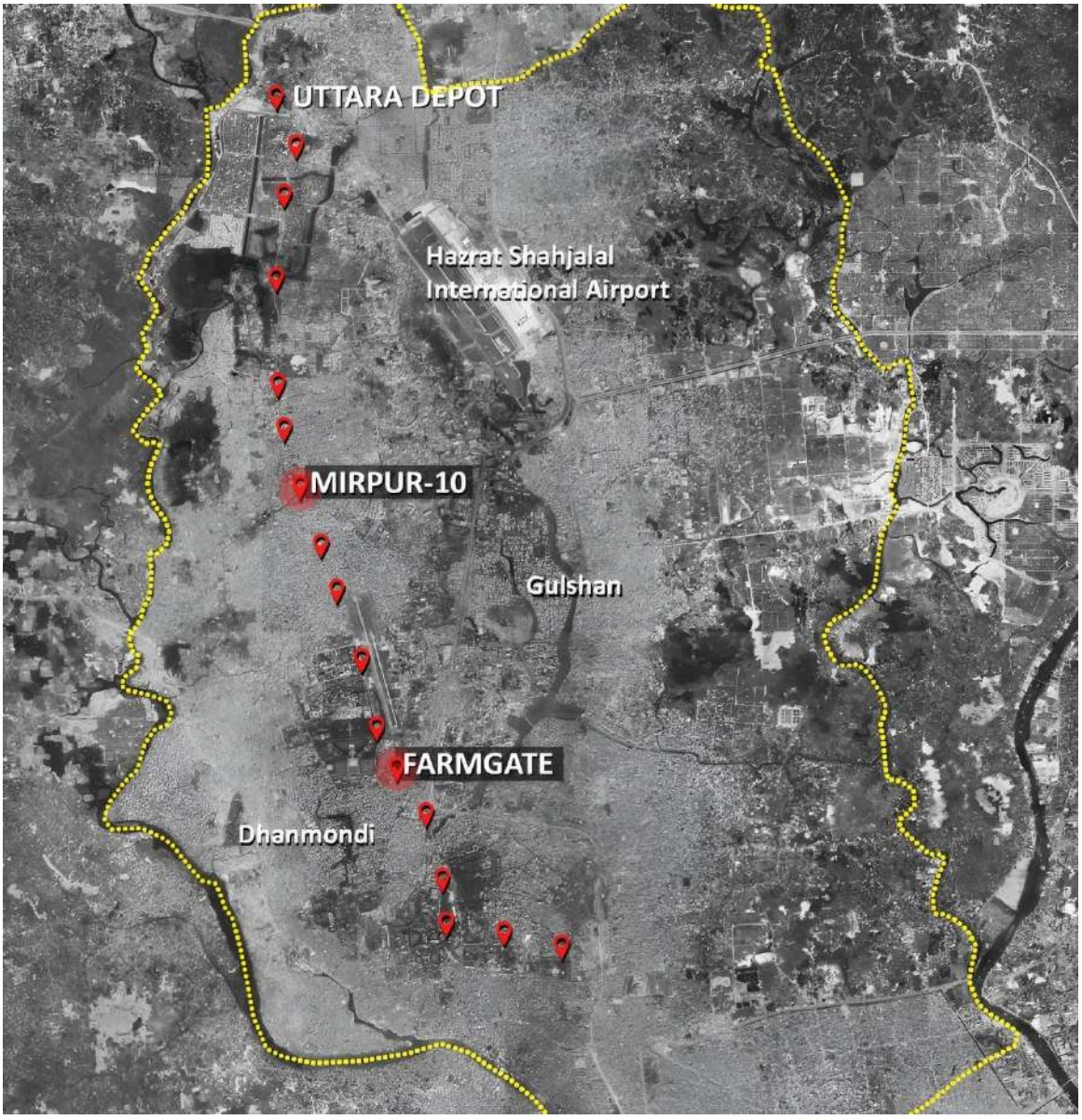

Figure 3. Dhaka Metro Line -6 route and study stations (Farmgate and Mirpur 10).

3.4.2 Mirpur Area

Mirpur, originally established as a riverside village around 1610, developed gradually around the Shah Ali Mazar shrine. The area derives its name from the Mughal-era elite class known as the "Mirs." In the aftermath of the 1971 Liberation War, Mirpur experienced substantial urban growth, facilitated by government-led land allotments and planned housing initiatives. The establishment of key institutions such as the National Botanical Garden (1962), the Bangladesh National Zoo (1974), and the Sher-e-Bangla National Cricket Stadium (2006) further enhanced the area's visibility and appeal. The Dhaka Metro Rail (2022–2023) has significantly improved connectivity and accelerated economic and social transformation in the Mirpur area, transforming it from an underdeveloped area to a dynamic urban zone with over 1.8 million residents (Hossain, 2024). Mirpur-10 is a key node along MRT Line 6 and functions as a sub-center, linking various sectors of Mirpur with greater Dhaka (Figure 4). The area exhibits a blend of formally planned residential blocks and spontaneously developed commercial corridors. The central roundabout serves as a prominent urban landmark, frequently congested with both vehicular and pedestrian traffic. A footbridge facilitates pedestrian movement across the four intersecting roads, contributing to the area's high volume of circulation and commercial activity, along with several bus stops, resulting in heavy traffic as well.

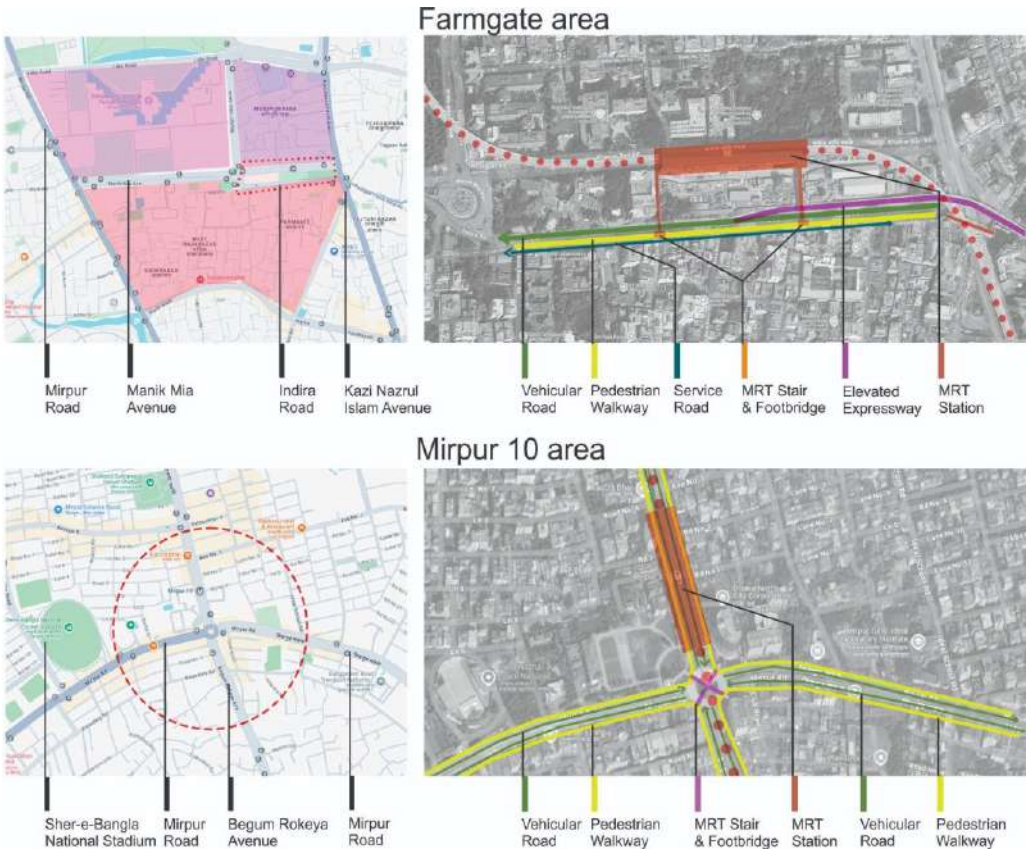

Figure 4. Farmgate and Mirpur 10 area: MRT station, surrounding routes, and connectivity.

The selected areas, Farmgate and Mirpur-10, both illustrate the dynamic interplay between historical legacy and contemporary urban development in Dhaka. While Farmgate reflects a transition from agricultural roots to a central urban hub, Mirpur-10 embodies a narrative of historical resilience and rapid modernization. Together, they highlight the diversity that drives Dhaka's urban evolution.

4. Findings

4.1 Overview

Table 1 presents a comprehensive assessment of small-scale vendors operating around metro station areas of Farmgate and Mirpur, focusing on business dynamics, challenges, and adaptations since the introduction of the Dhaka Metro Rail. The findings are elaborated below.

4.1.1 Demographic Profile and Business Tenure

The vast majority of respondents are male (94%), with only 6% identifying as female, highlighting the gender disparity within the informal vending sector in the study area. Regarding business experience, 38% of the vendors have been in business for less than one year, and 36% have been operating for 1–3 years. These statistics indicate a recent influx of new vendors, likely influenced by the increased foot traffic and economic opportunities surrounding the metro stations. Only 10% have sustained their business for over six years.

4.1.2 Impact on Business Dynamics

A significant portion (42%) of vendors began their businesses before the metro station became operational, while 58% entered the market afterwards, suggesting the metro acted as a catalyst for new vendors. The influence of the metro on customer behaviour and sales is clear: 90% of respondents reported an increase in both customer numbers and sales since the station's opening. Additionally, when asked to rate the metro station's effect on their business, 40% indicated a “significant” impact, followed by 30% selecting “very significant” and another 30% “somewhat” changed—none reported no change, reinforcing the metro’s pivotal role in enhancing business potential.

Table 1: Vendor profile in the study area.

Variables	Categories	Frequency	Percentage (%)
Gender	Male	47	94
	Female	3	6
Years in business	Less than a year	19	38
	1-3 years	18	36
	4-6 years	8	16
	More than 6 years	5	10
Start of business after the opening of the metro station	Yes	29	58
	No	21	42
Perception of the change in customer numbers after the opening of the metro station	Increased	45	90
	Decreased	5	10
How much will you rate the metro station for changing your business?	Somewhat change	15	30
	Significant change	20	40
	Very significant change	15	30
Have you ever faced any regulatory actions (e.g., eviction, fines)?	Never	15	30
	Frequently	27	54
	Always	8	16
If yes, how did you adapt?	Relocate	34	68
	Wait	10	20
	Mediate	6	12
What will you do if you are displaced from this current location?	Relocate	29	58
	Wait	20	40
	Mediate	1	2
What are the biggest challenges that you experience?	Reduced customer	1	2
	High competition	5	10
	Police intervention	14	28
	Lack of facilities (water, shading, etc.)	20	40
	Other	5	10
	None	5	10
What support do you think would improve the business environment?	Designated vending area	23	46
	Access to microfinance	9	18
	Training program	5	10
	Improve infrastructure (waste bin, shaded area)	13	26

4.1.3 Regulatory Challenges and Adaptation Strategies

Despite the opportunities presented, regulatory challenges persist. Over half of the respondents (54%) reported frequently facing regulatory actions such as eviction or fines, while 16% stated they are always subjected to such interventions. Only 30% reported never encountering these issues. In terms of adaptation, a majority (68%) chose to relocate as a response to regulatory or environmental pressures, with 20% opting to wait and 12% attempting mediation.

4.1.4 Additional Daily Challenges

When identifying their biggest challenges, 40% of respondents reported the lack of basic facilities such as water and shade, followed by 28% vendors mentioning police intervention. High competition (10%) and customer reduction (2%) were also noted, while 10% mentioned other factors.

4.1.5 Suggested Support Measures

When asked what forms of support would enhance their business viability, 46% of vendors complained about the absence of designated vending zones, reflecting a demand for legal recognition and spatial security. Infrastructure improvements (e.g., waste bins, shaded areas) were the second most desired support (26%), followed by access to microfinance (18%) and training programs (10%).

4.2 Comparative Analysis of Vendors

This section analyzes the working conditions and resilience of small-scale vendors operating around the Farmgate and Mirpur-10 metro stations in Dhaka. By applying the Sustainable Livelihood

Framework (SLF), the data is organized into five capitals—human, social, natural, physical, and financial—to portray how Metro Rail Development is influencing the everyday lives and business sustainability of informal vendors in the two urban contexts. Table 2 presents the findings.

Table 2: Comparative survey of the Sustainable Livelihood Assets of vendors at two different sites.

Capitals	Variables	Categories	Frequency in Percentage (%)	
			Farmgate	**Mirpur**
Human capital	What type of skills or training have you received for your work?	None	80	100
		Professional experience	20	0
		Training/ academic knowledge	0	0
	How do you protect yourself for health issues while working?	Do nothing	80	56
		Wear mask	20	44
	Do you send your children to school?	Yes	20	44
		No	80	56
Social capital	Are you a member of any vendor association or groups?	Yes	40	0
		No	60	100
	How much will you rate the effectiveness of those groups for business?	Very slightly effective	0	16
		Slightly effective	40	0
		Somewhat effective	20	0
		Significantly effective	20	0
		Very significantly effective	20	84
	What support system do you rely on?	Family/ friend	60	48
		Loans from NGOs and cooperatives	10	0
		Microcredit from banks	10	0
		Personal savings	20	52
Natural capital	What environmental challenges do you face while working?	Heatwaves	56	32
		Excessive rainfall	44	20
		Water logging	0	36
		Air pollution	0	12
	How much the weather impacts your daily business?	Very slight impact	20	0
		Slight impact	20	0
		Moderate impact	0	16
		Significant impact	60	20
		Very significant impact	0	64
	How do you adapt to weather? (Such as heavy rain, heatwave)	Temporary closure of shops and wait	80	64
		Coping mechanism (install fan, shade)	20	20
		Sell less	0	16
Physical capital	Do you own the cart/stall/table?	Yes	100	100
		No	0	0
	How much space do you use for vending?	No need	0	16
		15 ft^2	25	44
		20 ft^2	25	40
		25 ft^2	20	0
		30 ft^2	15	0
		50 ft^2	15	0
	Which services can you access from your work place?	None	0	36
		Only electricity	0	64

		Electricity, water, and sanitation	100	0
		Shared services from nearby shopping mall and public toilets	100	100
Financial capital	Changes in sales due to metro station	Increased	80	100
		Decreased	20	0
	Monthly savings (in BDT)	None	0	44
		1-2000	80	0
		2001-5000	0	56
		More than 5000	20	0
	Which financial supports can you access?	No support system	20	0
		Loans from family/ friend	40	64
		Microcredit from bank	0	8
		Personal savings	40	28

4.2.1 Human Capital

In terms of training, a striking majority of vendors from both Farmgate and Mirpur have not received any form of formal skills training for their work. While 20% of Farmgate respondents claim to have some professional experience, none of the Mirpur vendors reported the same, highlighting a broader gap in capacity-building opportunities for informal workers. Health management practices during work also reveal a disparity between the two areas. In Farmgate, 80% of vendors do nothing to manage health issues, whereas in Mirpur, 44% take the minimal precaution of wearing masks. The data also shows that most vendors do not send their children to school. In Farmgate, 80% of respondents said their children do not attend school, while the figure in Mirpur is slightly lower at 56%.

4.2.2 Social Capital

Farmgate vendors are comparatively more engaged in collective structures. About 40% of vendors here are members of vendor associations or groups, while none of the Mirpur vendors reported any group affiliation. However, even within Farmgate, perceptions of the effectiveness of such groups are mixed—many respondents rated them as only slightly or somewhat effective. In terms of everyday support systems, both groups largely rely on informal sources. In Mirpur, 52% depend on personal savings, while 48% turn to family and friends. Farmgate shows a similar trend, with 60% depending on familial support. Access to institutional credit or microfinance remains virtually non-existent for vendors in both areas.

4.2.3 Natural Capital

Vendors from both sites face a range of environmental challenges. In Mirpur, waterlogging, excessive rainfall, and heatwaves are the most common issues. Farmgate vendors also reported heat waves and air pollution as prominent problems. These weather and environmental disruptions significantly affect daily business operations. The perceived impact of the weather is greater in Mirpur. Around 64% of Mirpur vendors consider the weather to have a very significant impact on their business, compared to only 20% in Farmgate. When dealing with harsh weather, most vendors resort to temporarily halting operations. About 80% of Farmgate vendors and 64% in Mirpur choose to close their shops and wait rather than make infrastructural adjustments such as adding fans or shades.

4.2.4 Physical Capital

Ownership of vending units is universal—every respondent from both Farmgate and Mirpur owns their cart, stall, or table. However, the amount of space used for vending varies. While 25% of Farmgate vendors use 20 square feet of space, 44% of Mirpur vendors operate within 15 square feet, indicating more compact operations in Mirpur. A notable difference appears in access to utilities. All Farmgate vendors reported access to electricity, water, and sanitation facilities, while in Mirpur, 36% have no access to utilities at all and 64% have only electricity. Both groups reported using shared services from nearby shops and malls.

4.2.5 Financial Capital

The opening of the metro station has influenced vendor incomes positively in both locations, but more so in Mirpur. All vendors from Mirpur reported increased sales, while 20% of Farmgate vendors saw a decrease. The difference might suggest that metro expansion brought more customers to Mirpur or that Farmgate vendors are facing crowding and competition due to older market saturation. When asked about savings, 56% of Mirpur vendors can save between 2,000 and 5,000 BDT monthly, and 44% do not have any savings. In contrast, only 20% of Farmgate vendors save more than 5000BDT. As for financial support systems, most vendors across both areas rely on personal savings and family assistance. Microcredit and bank loans are virtually unused.

4.2.6 Challenges and Support

Data presented in Figure 5 illustrates both the support mechanisms vendors consider critical to improving their businesses and the most pressing challenges they face in their daily operations in the selected research areas.

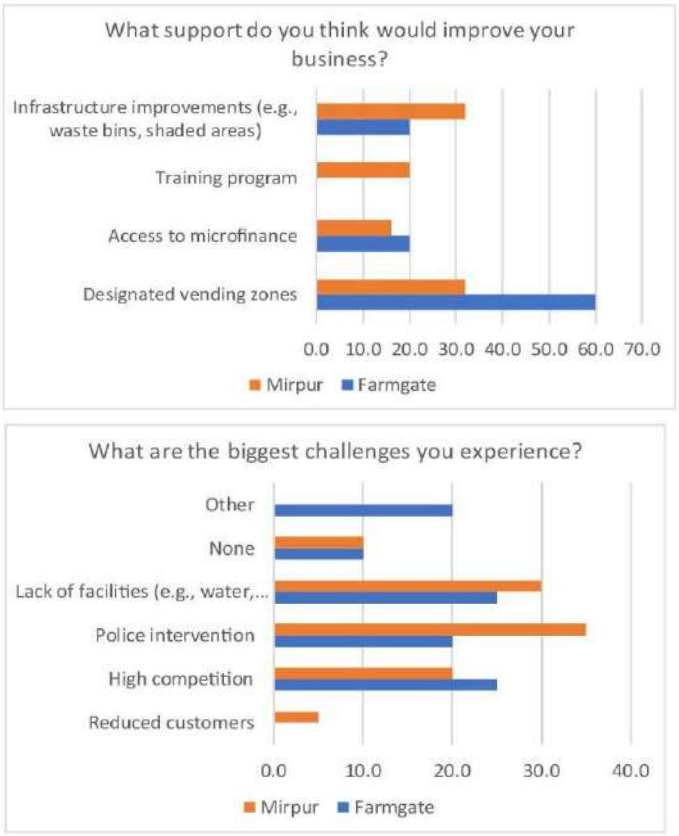

Figure 5. Support and Challenges in Mirpur-10 and Farmgate.

The establishment of designated vending zones emerged as the most strongly endorsed form of support, particularly in Farmgate, where approximately 60% of respondents indicated this as a priority. In contrast, a comparatively lower proportion of vendors in Mirpur (around 35%) emphasized this need. Infrastructure improvements—including waste management and provision of shaded areas—were also significant, particularly in Mirpur, where 35% of vendors expressed this need, followed closely by 20% in Farmgate. Training programs and access to microfinance were noted with moderate but consistent interest by vendors in both areas. Approximately 15–20% of respondents at each location indicated these as supportive measures, although these were considered as secondary to more immediate spatial and infrastructural needs.

The data also reveals key differences in the challenges faced by vendors at each location. In Mirpur, police intervention stood out as the most prominent issue, cited by around 35% of respondents. In

Farmgate, high competition (25%) and lack of facilities (nearly 30%) were the dominant concerns. A smaller proportion of respondents in Mirpur also identified reduced customer flow as a concern.

4.3 Customer Perspective

The data presented in Table 03 of the customer survey conducted near Farmgate and Mirpur-10 metro stations reveals critical insights into the role of consumer behaviour in shaping the livelihood outcomes of informal vendors. From a Sustainable Livelihood Framework (SLF) perspective, customer engagement serves as an essential external influence on vendors' financial capital and contributes indirectly to the formation of social and human capital. The majority of respondents (57%) reported using the metro daily, while 29% used it occasionally and 14% weekly. Importantly, 90% of these metro users buy goods or services from vendors near the station, indicating a strong consumer-vendor relationship at transit nodes. Among them, 38% make purchases daily and 42% weekly, confirming that vendors form an integral part of the metro station ecosystem and are relied upon for everyday needs. This finding highlights the economic capital component of the SLF—vendors are integrated into local livelihoods by catering to high-volume daily transit populations.

A large proportion of customers (76%) were satisfied, while 5% were fully satisfied, showing a generally favorable perception of vendor services. This satisfaction correlates with the motivations cited: 39% valued convenience, and 37% emphasized affordable prices, followed by quality of goods (13%) and variety (11%).

Table 3: Customer perception of vendors around metro stations.

Variables	Categories	Frequency	Percentage (%)
Frequency of Metro use	Daily	12	57
	Weekly	3	14
	Occasionally	6	29
Do you buy goods/services from vendors near the station?	Yes	19	90
	No	2	10
If yes, how often?	Daily	8	38
	Weekly	9	42
	Occasionally	2	10
	Never	2	10
How would you rate your level of satisfaction on these vendors?	Unsatisfactory	1	5
	Somewhat Satisfied	3	14
	Satisfied	16	76
	Maximum Satisfaction	1	5
What motivates you to purchase from these vendors?	Affordable prices	14	37
	Convenience	15	39
	Quality of goods	4	13
	Variety	5	11
Have you noticed any changes in the number of vendors recently?	Increased	20	95
	Decreased	0	0
	No change	1	5
What challenges do you experience from these vendors?	Inadequate waste management	11	22
	Congestion	19	38
	Lack of walkability	20	40
	Others	0	0
What improvements would enhance your experience?	Better waste management	16	35
	Organized vendor spaces	21	47
	Improved safety	8	18
Do you think vendor space should be incorporated in the design of metro stations?	Yes	11	52
	No	10	48
Should urban development plans formally allocate designated spaces for street vendors?	Yes	18	86
	No	0	0
	Not sure	3	14

Interestingly, 95% of respondents noticed an increase in the number of vendors near metro stations. While this increase reflects economic opportunity and the attractiveness of metro-linked zones for small-scale commerce, it also brings challenges. 40% cited lack of walkability, 38% identified

congestion, and 22% mentioned inadequate waste management. This points to a pressing need to address issues related to physical capital (infrastructure, mobility) and natural capital (cleanliness, waste control). When asked about potential improvements, 47% wanted more organized vendor spaces, 35% sought better waste management, and 18% prioritized improved safety. These responses emphasize public support for structured, well-managed vending environments. Furthermore, 86% of respondents agreed that urban development plans should formally allocate vendor spaces, reinforcing the argument for integrating informal vendors into urban governance and planning frameworks, aligning with the institutional context of the SLF. Notably, 52% supported incorporating vendor spaces in the design of metro stations, specifically, a sign of growing public consciousness about inclusive infrastructure.

4.4 Quantitative Analysis of Results

4.4.1 T-test to find the relationship between the mean SLF score and changing the vending location

An independent samples t-test showed that there was a difference in the mean SLF score between the 25 vendors who changed location after the opening of metro station (M = 2.84, SD = 1.12) and another 25 vendors those who did not change (M = 2.00, SD = .75), with t (48) = 3.125, and p = .003 indicating that the difference was statistically significant, shown in table 4.

Table 4: Mean difference of SLF score between vendors who have and have not changed vending locations after the opening of the metro station.

	Change of vending location after the metro station opening	N	Mean	SD	t
SLF Score	No	25	2.00	1.118	3.125
	Yes	25	2.84	.746	
**P=.003*					

According to these findings, the vendors who have changed their vending locations have a higher mean SLF score (mean difference = 0.84) than the vendors who did not change their location after the opening of the metro station.

4.4.2 T-test to find a relationship between the mean SLF score and the opening of the business before or after the metro station

Another independent samples t-test showed that there was a difference in the mean SLF score between the 21 vendors who have started business before the opening of metro station (M = 3.48, SD = 0.51) and another 29 vendors those who have started after the opening of metro station (M = 1.66, SD = 0.48), with t (48) = -12.823, and p < .001 indicating that the difference was statistically significant, shown in table 5.

According to these findings, the vendors who have started business in that location before the opening of the metro station have a higher mean SLF score (mean difference = 1.821) than the vendors who started business afterwards.

Table 5: Mean difference of SLF score between vendors who have started business before or after the opening of the metro station.

	Started business after metro station opening	N	Mean	SD	t
SLF Score	No	21	3.48	.512	-12.823
	Yes	29	1.66	.484	
**P<.001*					

4.4.3 Spearman's rho correlation test between the rating of the current location for best profit and the perception of weather impact on daily business

Spearman's rank order correlation was used to explore the relationship between the rating of the current location for best profit of the vendors and their perception of weather impact on daily business (Table 6). The correlation was found to be positive, strong rs (Spearman's rank correlation coefficient) (48) = 0.849, and highly significant with p<.001. Prior to calculating rs, visual inspection of the scatterplot confirmed that the relationship between these variables was non-linear and monotonic.

Table 6: Spearman's rho correlation test between the rating of the current location for best profit and the perception of weather impact on daily business.

		How much will you rate your current location as suitable for the best profit?	**How much does the weather impact your daily business?**
How much will you rate your current location as suitable for the best profit?	**Correlation Coefficient**	1.000	.849**
	Sig. (2-tailed)	.	.000
	N	50	50
How much does the weather impact your daily business?	**Correlation Coefficient**	.849**	1.000
	Sig. (2-tailed)	.000	.
	N	50	50

***Correlation is significant at the 0.001 level (2-tailed).*

4.5 Observational Findings

The observational survey of Farmgate and Mirpur-10 metro stations reveals contrasting spatial dynamics in how informal vendors adapt to urban constraints. Figure 6 portrays the findings of how vendors occupy the streets in Farmgate and Mirpur-10 around metro stations.

At Farmgate, vendors are densely clustered along service roads and narrow pedestrian paths, as well as occupying the vehicular road along the pedestrian route, creating significant congestion. Three distinguished patterns can be seen in how they occupy the space, but in all cases, they occupy the vehicular street; however, it can be observed that they leave breathing space for pedestrian flow around the MRT Bridge entrance/exit. Their setups—often including shaded mobile/semi carts and waste bins—reflect an attempt to balance business needs with limited space and hygiene concerns. The spatial tension between pedestrian flow and vending activity is pronounced, as vendors rely on high footfall from nearby commercial zones, bus stoppages, and the metro station bridge entrance or exit.

In contrast, Mirpur-10 displays a more dispersed pattern. Vendors operate across sidewalks, medians, and spaces beneath the elevated MRT station, as well as occupy the vehicular Mirpur Road, hampering the pedestrian flow and creating traffic congestion. Vendors in this zone appear to depend heavily on the steady commuter traffic generated by the metro station as well as the bus stoppages, positioning themselves for maximum visibility and footfall, but at the cost of pedestrian comfort and mobility. The three distinguished patterns shown in Figure 6 show how, in each route, the vendors occupy the pedestrian and vehicular roads.

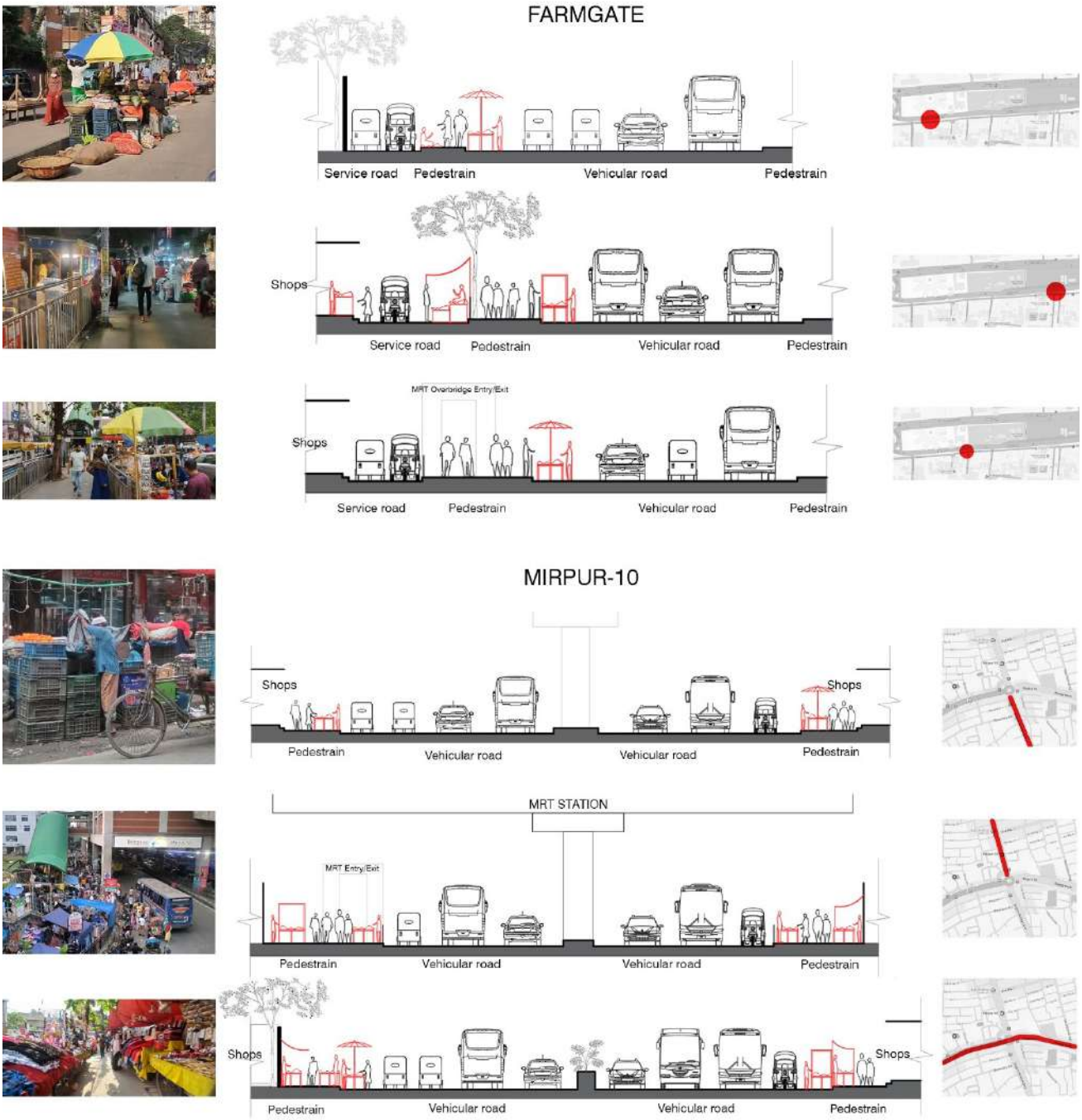

Figure 6. Observational Survey: vendors occupy the streets in Farmgate and Mirpur-10 around metro stations.

The field survey revealed that vendors have made a few adaptations. Figure 7 illustrates how some informal vendors in Dhaka have innovatively modified their physical environments and tools to adapt to infrastructural, climatic, and operational challenges. Often, mobile vendor carts are now equipped with light sources powered by batteries, allowing vendors to extend their working hours into the evening or operate in poorly lit urban areas. This adaptation not only increases potential income but also highlights the creativity and resourcefulness of vendors in utilizing alternative energy sources in the absence of reliable access to electricity. It reflects how informal vendors transform within infrastructural constraints to sustain livelihoods.

The second image of Figure 7 finding shows a semi-permanent stall equipped with built-in storage compartments for goods and a dedicated waste bin. These cart modifications represent vendor-led

innovations that improve functioning efficiency, enabling better inventory management and the ability to store goods, an essential strategy in areas with irregular supply chains or under the constant threat of eviction. The inclusion of waste bins further recommends an effort to maintain hygiene and order.
The third image of Figure 7 shows a vendor arrangement that introduces temporary shading structures and a fan, which serve dual purposes: protecting workers from environmental stress (heat, sun) and enhancing customer comfort. These adjustments are particularly important in Dhaka's hot and humid climate, showing how vendors use limited means to create hospitable micro-environments. These physical adaptations are strategic modifications that enhance resilience, customer service, and operational sustainability in an unsupportive urban context.

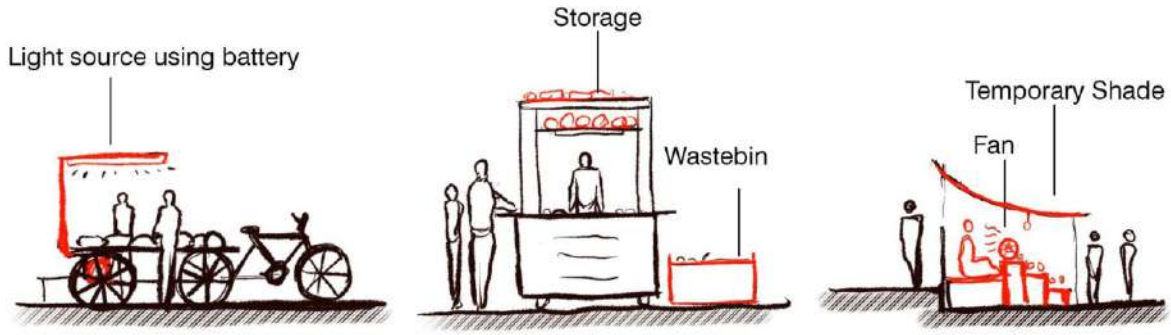

Figure 7. Vendors' adaptations to their physical capital.

5. Discussion

The integration of findings offers a comprehensive perspective on how the Dhaka Metro Rail—specifically around Farmgate and Mirpur-10 stations—has impacted the livelihood dynamics of informal vendors. By combining vendor-specific business outcomes with the Sustainable Livelihood Framework (SLF), this study reveals the impacts and broader vulnerabilities faced by these urban workers.
From Table 3, the findings underscore how informal vendors fulfil critical needs, especially for urban commuters, and are therefore a key part of the human and financial capital in SLF, offering practical, cost-effective alternatives in a dense urban economy. The data from Table 1 and 2 make it evident that the opening of metro stations has significantly altered the urban mobility landscape, catalyzing informal economic activities, especially for street vendors. The increased foot traffic around metro stations has translated into higher customer volumes for vendors. A notable 90% of surveyed vendors reported increased customer traffic and improved sales, indicating that the metro has positively impacted footfall-dependent businesses. Similarly, the t-test result on the changing of vending location (Table 4) also confirms that, based on the spatial position of the metro station, changing the vending location has positive impacts on the livelihood of vendors. The possible reason can be their connectedness with peers and awareness of changing pedestrian flow due to the integration of the metro station. This aligns with global literature suggesting that improved public transit infrastructure tends to boost pedestrian activity, which in turn benefits micro-entrepreneurs and footfall-dependent businesses (Cervero & Golub, 2007; Niger & Sinthia, 2025). Within the Sustainable Livelihood Framework (SLF), this improvement also reflects an increase in financial capital through enhanced income streams (DFID, 2001).
Despite increased sales and foot traffic, informal vendors continue to face structural vulnerabilities stemming from their precarious legal and spatial status. These statistics reflect the broader marginalization of informal economies in cities of the Global South, where vendors often operate in "zones of exception" that lack legal protection or integration into urban planning (Roy, 2005). Islam et al. (2019) also highlight that informal vendors face challenges such as evictions, police hindrance, the absence of specified vending zones, and inadequate infrastructure—findings that are clearly reflected in this research. Thus, the t-test result on the opening of the business before or after the metro

station (Table 5) shows the hypothesis is rejected since the vendors starting business after the opening of the station have a lower mean score. The rapid increase of vendors and their substandard vending management, along with a lack of adequate space and utilities, might be the causes. Therefore, there remains an opportunity to improve their standard of livelihood by providing the essential services and ensuring appropriate spatial integration in metro station design.

Moreover, the Sustainable Livelihoods Framework (SLF) reveals that this vulnerability manifests as frequent disruptions to business operations, either through legal harassment or environmental threats (DFID, 2001). To comprehend the environmental threats, Spearman's rho correlation test has been performed (Table 6) to analyze how the weather affected the business profit of these vendors. This correlation test shows a strong positive relation between the rating of the current location for the best profit of the vendors and their perception of the weather's impact on daily business. Since the vendors are vending under the open sky in a tropical city, weather impacts such as rainfall, heatwaves, and waterlogging are common challenges for them. Designated space within stations, protecting their business from these weather impacts, can significantly improve their livelihood.

However, in response to those environmental and administrative challenges, vendors have adopted various coping mechanisms. These adaptive behaviors show how people mobilize various forms of capital to maintain livelihoods according to the SLF. From the data, 68% of vendors reported relocating as a strategy to manage regulatory pressure, while others temporarily suspended their operations during environmental threats such as heavy rainfall or heat waves. These reflect a wider pattern of adaptive resilience commonly observed in informal economies, where vendors innovate plans under regulatory uncertainty, as highlighted by Brown et al. (2010). Additionally, the lack of access to stable utilities, described more frequently in Mirpur, forces vendors to rely on improvised solutions. Figure 7 illustrates how vendors have adopted various strategies to address utility-related challenges. Therefore, these responses also highlight the absence of formal support systems, reinforcing the vulnerability of informal livelihoods.

Social capital, a key component in the SLF, is noticeably underdeveloped among the surveyed vendors, particularly in Mirpur. None of the informal vendors from Mirpur-10 reported being part of any vendor organization or cooperative, compared to 40% in Farmgate. This difference suggests a spatial inequality in institutional engagement and collective capacity. As Skinner (2008) and Chen (2012) argue, the invisibility of the informal sector in policy discourse severely limits its ability to claim rights or negotiate protections. Vendor organizations can provide mutual support, advocacy, and protection, yet such networks remain absent in the research metro zones.

The comparative analysis between Farmgate and Mirpur-10 reveals complete contrasts in capital endowments across the SLF dimensions. Farmgate vendors benefit from better access to physical infrastructure, such as water and sanitation facilities, and exhibit stronger organizational ties. Conversely, Mirpur vendors, despite achieving higher income levels, face greater infrastructural and institutional neglect. This disparity in distribution of assets suggests that financial capital alone cannot ensure livelihood sustainability; robust physical and social infrastructure is equally essential (Scoones, 1998).

6. Conclusion

This study applied the Sustainable Livelihoods Framework (SLF) to evaluate the livelihood dynamics of informal vendors around Dhaka Metro Rail stations, focusing on Farmgate and Mirpur-10. The findings show that the introduction of the metro has altered vendors' economic opportunities by increasing customer flows and sales, although these benefits are unevenly distributed. Vendors who changed their vending locations after the metro's inauguration reported significantly higher SLF scores, underscoring the role of spatial adaptability in shaping livelihood outcomes. Conversely, those who established businesses after the metro opening achieved lower scores, revealing the vulnerability of late entrants in an increasingly competitive vending environment.

Despite the opportunities created by enhanced pedestrian mobility, vendors continue to experience structural vulnerabilities, including frequent evictions, lack of designated vending zones, limited

access to infrastructure, and exposure to adverse weather. Statistical analyses further highlight a strong correlation between perceived location profitability and vulnerability to climatic impacts, pointing to the precarious nature of vending in open urban environments. These findings demonstrate that while new transport infrastructure can stimulate economic opportunities, without supportive policy frameworks vendors remain trapped in cycles of insecurity.

The comparative analysis between Farmgate and Mirpur-10 highlights spatial inequities in access to assets and support systems. Farmgate vendors benefit from stronger organizational networks and better access to utilities, while Mirpur vendors enjoy relatively higher incomes but face inadequate infrastructure and institutional neglect. These disparities reveal that financial gains alone are insufficient to secure sustainable livelihoods; rather, integrated strategies that strengthen social, physical, and institutional capital are essential. This research contributes to broader discourses on inclusive urban development, demonstrating how metro-induced urban transformations intersect with informality, resilience, and inequality.

The study is limited to two metro stations, which constrains the generalisability of its findings across the wider Dhaka Metro Rail network. Future research should expand the scope to multiple stations, employ longitudinal methods to track changes over time, and incorporate gender-sensitive analyses to address the underrepresentation of women in informal vending. Strengthening the role of vendor associations, integrating designated vending spaces into transit-oriented planning, and addressing infrastructural deficits are critical for ensuring that informal vendors are not marginalised by urban transformation. By situating informal livelihoods within metro development strategies, policymakers can move towards more inclusive, resilient, and sustainable urban futures.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

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References

Ankhi, N.-E. F., Al Mujtabe, A., Chowdhury, N., Alam, S., Rahman, M., Akther, M., Adri, N., & Farha, F. (2024). Formal Management Structure of Informal Market: A Case Study of Bou Bazar, Dhaka. https://doi.org/http://dx.doi.org/10.2139/ssrn.5019778

Bhowmik, S. (2005). Street Vendors in Asia: A Review. *Economic and Political Weekly*, *40*(22), 2256-2264. https://www.jstor.org/stable/4416705

Bhowmik, S. (2010). *Street vendors in the global urban economy*. Routledge. https://doi.org/https://doi.org/10.4324/9780203150542

Boquet, Y. (2017). Managing Metro Manila. In *the Philippine archipelago* (pp. 567–615). Springer. https://doi.org/10.1007/978-3-319-51926-5_17

Bose, R., & Saxena, N. C. (2017). Strife in a Metro: Affirming Rights to Admission in the City of Delhi. In *India Exclusion Report 2016* (pp. 270-297). Yoda Press.

Bromley, R. (2000). Street vending and public policy: a global review. *International Journal of Sociology and Social Policy*, *20*(1/2), 1-28. https://doi.org/https://doi.org/10.1108/01443330010789052

Brown, A., Lyons, M., & Dankoco, I. (2010). Street traders and the emerging spaces for urban voice and citizenship in African cities. *Urban Studies*, *47*(3), 666-683. https://doi.org/10.1177/0042098009351187

Cervero, R., & Golub, A. (2007). Informal transport: A global perspective. Transport Policy, 14(6), 445–457. https://doi.org/10.1016/j.tranpol.2007.04.011

Chen, M. (2012). The Informal Economy: Definitions, Theories and Policies. *WIEGO Working Paper*.

Chen, M. (2016). The urban informal economy: Towards more inclusive cities. *URBANET: News and debates on municipal and local governance, sustainable urban development and decentralization.* Retrieved from www.urbanet.info

Choi, N. (2015). Impacts of displacement on urban livelihoods: a railway project in Metro Manila. *Development in Practice*, 25(5), 643-654. https://doi.org/10.1080/09614524.2015.1051948

Crossa, V. (2009). Resisting the Entrepreneurial City: Street Vendors' Struggle in Mexico City's Historic Center. *International Journal of Urban and Regional Research*, *33*(1), 43-63. https://doi.org/10.1111/j.1468-2427.2008.00823.x

Department for International Development-DFID. (2001). *Sustainable livelihoods guidance sheets* (Numbers 1–8). London, United Kingdom.

Donovan, M. G. (2008). Informal Cities and the Contestation of Public Space: The Case of Bogota's Street Vendors. *Urban Studies*, *45*(1), 29-51. https://doi.org/10.1177/0042098007085100

Etzold, B., Hossain, M. A., & Rahman, S. (2013). Street food vending in Dhaka: Livelihoods of the urban poor and the encroachment of public space. In S. Jahan & A. K. M. A. Kalam (Eds.), *Dhaka Metropolitan Development Area and its planning: Problems, issues and policies* (pp. 1–15). Bangladesh Institute of Planners (BIP).

Habib, K. R. (2016). Understanding Challenges Faced by Street Food Vendors to Maintain Street Food Hygiene in Dhaka City. *4*(4), 78. https://doi.org/10.11648/j.jfns.20160404.11

Hossain, M. (2024). Rise of Mirpur. *The Business Standard*. Retrieved from https://www.tbsnews.net/features/panorama/rise-mirpur-794098

Hossain, S. R., Melles, G. B., & Bailey, A. (2022). Designing sustainable livelihoods for informal markets in Dhaka. In *Designing Social Innovation for Sustainable Livelihoods*, eds. G. B. Melles (pp. 13-36). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-16-8452-4_2

Husain, S., Yasmin, S., & Islam, M. S. (2015). Assessment of the Socioeconomic Aspects of Street Vendors in Dhaka City: Evidence from Bangladesh. *Asian Social Science*, 11(26), 1-10. https://doi.org/10.5539/ass.v11n26p1

Lata, L., Walters, P., & Roitman, S. (2019). A Marriage of Convenience: Street Vendors' Everyday Accommodation of Power in Dhaka, Bangladesh. *Cities: The International Journal of Urban Policy and Planning*, *84*, 143-150. https://doi.org/10.1016/j.cities.2018.08.002

Man, N. I., Majid, N. A., Rainis, R., & Ahmed, M. F. (2024). Mass Rapid Transit (MRT) and Urban Transformation: A Case Study of Kuala Lumpur's Damansara. *International Journal of Academic Research in Business and Social Sciences*, 14(4), 1759-1769. https://doi.org/10.6007/IJARBSS/v14-i4/21221

Mondal, M. S. H. (2017). Urban Informal Economy in Bangladesh: A Case Study on a Mobile Vegetable Vendor in Dhaka City. *The Qualitative Report*, 22(11), 2893-2903. https://doi.org/10.46743/2160-3715/2017.3106

Niger, M., & Sinthia, S. A. (2025). Integrating Metro Stations with the Adjacent Urban Fabric Using TOD Principles: A Case of Agargaon Metro Station, Dhaka. *Journal of Contemporary Urban Affairs*, 9(1), 95-114. https://doi.org/10.25034/ijcua.2025.v9n1-6

Nilufar, F. (2011). Urban Morphology of Dhaka City: Spatial Dynamics of Growing City and the Urban Core. In *400 Years of Capital Dhaka and Beyond - Volume III, Urbanization and Urban Development* (pp. 396-414). Asiatic Society of Bangladesh.

Nogueira, M., & Shin, H. B. (2022). The "Right to the City Centre": Political Struggles of Street Vendors in Belo Horizonte, Brazil. *City*, 26(5-6), 1012-1028. https://doi.org/10.1080/13604813.2022.2126208

Peña, S. (1999). Informal Markets: Street Vendors in Mexico City. *Habitat International*, *23*(3), 363-372. https://doi.org/10.1016/S0197-3975(99)00012-0

Raj, S. I., Mohino, I., & Khatun, F. (2024). Socio-Economic Impact of the Mass Rapid Transit (MRT) System in Dhaka: A Case Study of Mirpur Stations. *Journal of Contemporary Urban Affairs*, 8(2), 436-459. https://doi.org/10.25034/ijcua.2024.v8n2-9

Rajdhani Unnayan Kartripakkha (RAJUK). (2021). *Dhaka structure plan 2016–2035*. Rajdhani Unnayan Kartripakkha.

Rayhan, I., Tanvir, A., & Mazumder, B. (2019). Investigating the Working Environment and the Hindrance Faced by Street Hawkers in Bangladesh: An Empirical investigation in Dhaka City. *Journal of Economics and Sustainable Development*, 10(2), 78-88. https://doi.org/10.7176/JESD/10-2-09

Roy, A. (2005). Urban Informality: Toward an Epistemology of Planning. *Journal of the American Planning Association*, 71(2), 147–158. https://doi.org/10.1080/01944360508976689

Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis* (IDS Working Paper No. 72). Institute of Development Studies.

Selwyn, M. X. (2018). *Inclusive urban management and changing spatial arrangements: The case of street vendors in Warwick Junction, Durban, South Africa* (Master's thesis). Graduate School of Regional Development Studies, Toyo University, Tokyo, Japan.

Serrat, O. (2008). The Sustainable Livelihoods Approach. *Knowledge Solutions: Tools, Methods, and Approaches to Drive Organizational Performance*, ed. O. Serrat (pp. 21-26). Springer Singapore, Singapore. https://doi.org/10.1007/978-981-10-0983-9_5

Silver, C. (2016). Distressed city: The challenges of planning and managing megacity Jakarta. In *Transforming distressed global communities*, eds. F. Wagner, R. Mahayni, A. Piller. (pp. 183-210). Routledge.

Skinner, C. (2008). *Street trade in Africa: A review* (WIEGO Working Paper No. 5). Women in Informal Employment: Globalizing and Organizing (WIEGO).

Spire, A., & Choplin, A. (2018). Street Vendors Facing Urban Beautification in Accra (Ghana): Eviction, Relocation and Formalization. *Articulo-Journal of Urban Research*, (17-18). https://doi.org/10.4000/articulo.3443

Tariquzzaman, M. (2019). *Study on the Accessibility of Proposed Metro Stations in CBD Areas of Dhaka City in Relation to the Spatial Structure of Local Urban Grid.* Master's Thesis, Department of Architecture, Bangladesh University of Engineering and Technology. Dhaka, Bangladesh. http://lib.buet.ac.bd:8080/xmlui/handle/123456789/5527

Wijaya, Y., & Nuringsih, K. (2022). The role of government support and networking on business success among beginner entrepreneurs fostered by Jakpreneur. In *Proceedings of the Tenth International Conference on Entrepreneurship and Business Management (ICEBM 2021)*. Atlantis Press. https://doi.org/10.2991/aebmr.k.220501.028

Yamada, E., & Jiang, Y. (2025, February). *The impact of Dhaka mass rapid transit on road congestion* (Discussion Paper No. 35). Tokyo: JICA Ogata Sadako Research Institute for Peace and Development.

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Original scientific paper

How Do Socio-Cultural and Built Environment Characteristics Influence Urban Vitality and Walkability in Bahrain's Commercial Streets? Insights from Muharraq

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ABSTRACT

Shopping streets serve as vital socio-economic and cultural hubs, fostering urban vitality and enhancing liveability. In Bahrain, however, limited attention has been paid to how socio-cultural dynamics and built environment characteristics shape walkability within commercial avenues. This study investigates these interrelationships through a case study of Shaikh Hamad Avenue in Muharraq, one of Bahrain's oldest shopping streets. Employing a qualitative research design, data were collected via 135 structured questionnaires, systematic on-site observations, and GIS-based mapping of pedestrian movement patterns. The findings reveal that walkability perceptions are significantly influenced by five determinants: imageability, enclosure, human scale, complexity, and safety. Elements such as shade provision, shop diversity, and spatial connectivity were found to encourage pedestrian activity, whereas inadequate crossings and climatic constraints hinder walkability. Results highlight the importance of integrating culturally sensitive design, pedestrian-oriented infrastructure, and micro-scale amenities into planning strategies. The study contributes evidence-based insights for policymakers and urban designers to enhance commercial street environments, promoting inclusive, dynamic, and sustainable urban spaces in Bahrain and similar Gulf contexts.

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Highlights:	Contribution to the field statement:
- User satisfaction with commercial streets increases with diversity of shop types and human-scale design features. - Overall urban vitality is enhanced by integration of socio-cultural activities and pedestrian-oriented infrastructure. - Pedestrian perception of walkability is strongly influenced by shade provision and climatic responsiveness. - Pedestrian movement patterns vary significantly with spatial arrangement, connectivity, and street enclosure. - Perceived safety and willingness to walk are affected by the availability of crossings, pedestrian signals, and traffic management.	By identifying key walkability characteristics that are driven by local needs and behaviours, the study offers evidence-based recommendations for planners and designers to create inclusive, dynamic, and sustainable commercial streets. The results would contribute to the ongoing discussions about urban vitality and have an impact on Bahrain's future urban planning regulations.

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1. Introduction

Shopping streets are community interaction spaces, cultural hubs and business corridors within the spatial structure of the cities (Bertolini, 2020). The dynamism of shopping streets is among the features that characterize most of the process of urban evolution (El Hama & Helmy, 2024). Bahrain's economy is currently becoming more diverse and urbanized (Ministry of Sustainable Development, 2025); therefore focusing on user engagement and interaction is the foundation for raising local businesses' sales, attracting tourists, and improving the standard of living for kingdom dwellers. Finding all the components that characterize the vibrancy of commercial streets is the responsibility of the urban planner and policymaker in their endeavour to establish an environment that is appropriate for various demographics.

This study explores the vitality of shopping streets in Bahrain by investigating how the socio-cultural and built environment factors affect the walkability of these streets, which is a vital attribute of urban liveliness (Q. Li et al., 2022). The aim is to establish standards for the design of Bahrain's retail avenues in order to provide a more sustainable environment for users and enhance the socio-economic context of the urban environment in Bahrain. This is accomplished by thoroughly investigating the literature on what constitutes "life" in cities and the different elements that give shopping streets their socio-economic vibrancy. The research is driven by the following inquiries, which are incorporated into its primary goal:

a) How do the sociocultural traits of Bahraini citizens affect how walkable the country's business streets are?
b) Which aspects of the built environment have the biggest impact on whether or not these streets are considered walkable?
c) What aspects of walkability might be used as helpful guidelines for Bahrain's dynamic commercial planning and design?

In order to address these issues, the study used Shaikh Hamad Avenue in Muharraq, one of Bahrain's oldest and busiest commercial areas, as a case study. By examining user sociocultural behaviours and the physical architecture of the area, the study investigates pedestrian perception levels of walkability and how it reflects larger urban dynamics.

The street's vitality is thoroughly examined using a qualitative approach that entails comparing observable spatial qualities evaluated by on-site observation with user impressions obtained through questionnaires. Visualizing pedestrian activity and identifying spatial patterns linked to walkability are accomplished by GIS mapping. When combined, these techniques allow for the comparison of many factors and reveal the advantages and disadvantages that affect the street's general activity. In addition to assessing pedestrian mobility levels and physical settings, the research technique looks at the "human element" of street use, which includes user engagement, behaviours, and perceptions. A more thorough knowledge of how lived experience and urban design interact to create walkable settings is made possible by this dual viewpoint.

The ultimate goal of this research is to close the gap between academic knowledge and practical planning by offering recommendations that are based on empirical evidence and customized for Bahrain's urban setting. The study provides evidence-based recommendations for planners and designers to construct more inclusive, engaging, and sustainable commercial streets by identifying important walkability variables that are motivated by local needs and behaviours. It is anticipated that the results would influence future urban planning laws and commercial street restrictions in Bahrain and add to the current conversations regarding urban vibrancy. Figure 1 demonstrates the structure of the research.

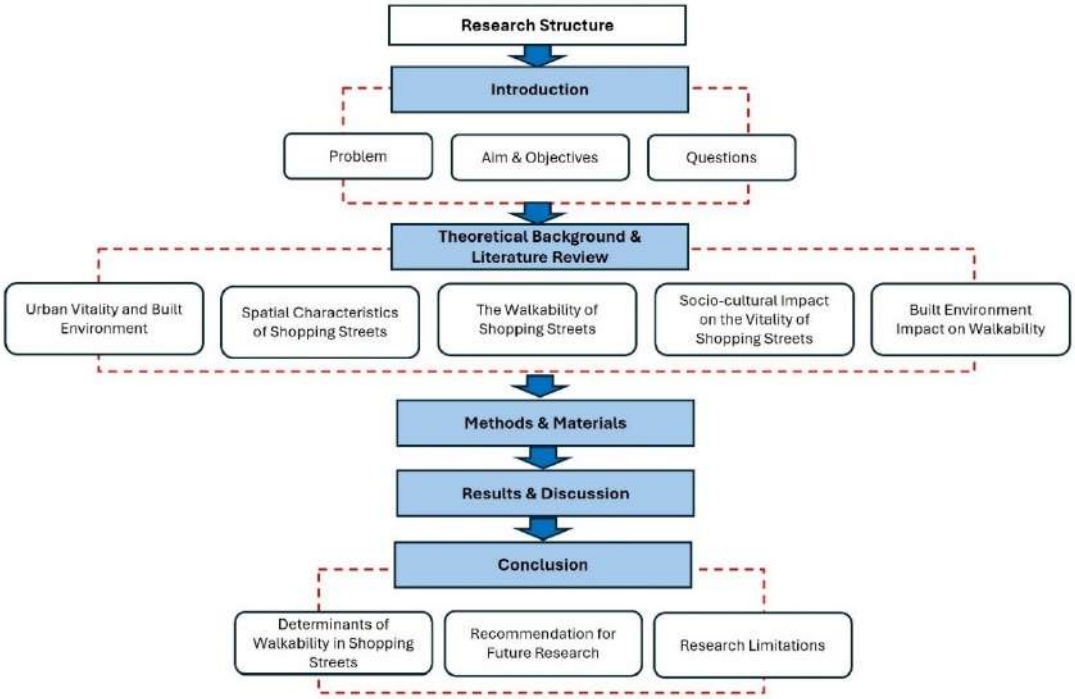

Figure 1. Structure of Research.

1.1 Background and Context

This review seeks to identify gaps and work to provide insight for further research and utilitarian implications for the development of urban environments by critically evaluating this body of existing knowledge. The co-occurrence map on bibliometric data from studies on walkability and urban vitality in cities is presented in Figure 2.

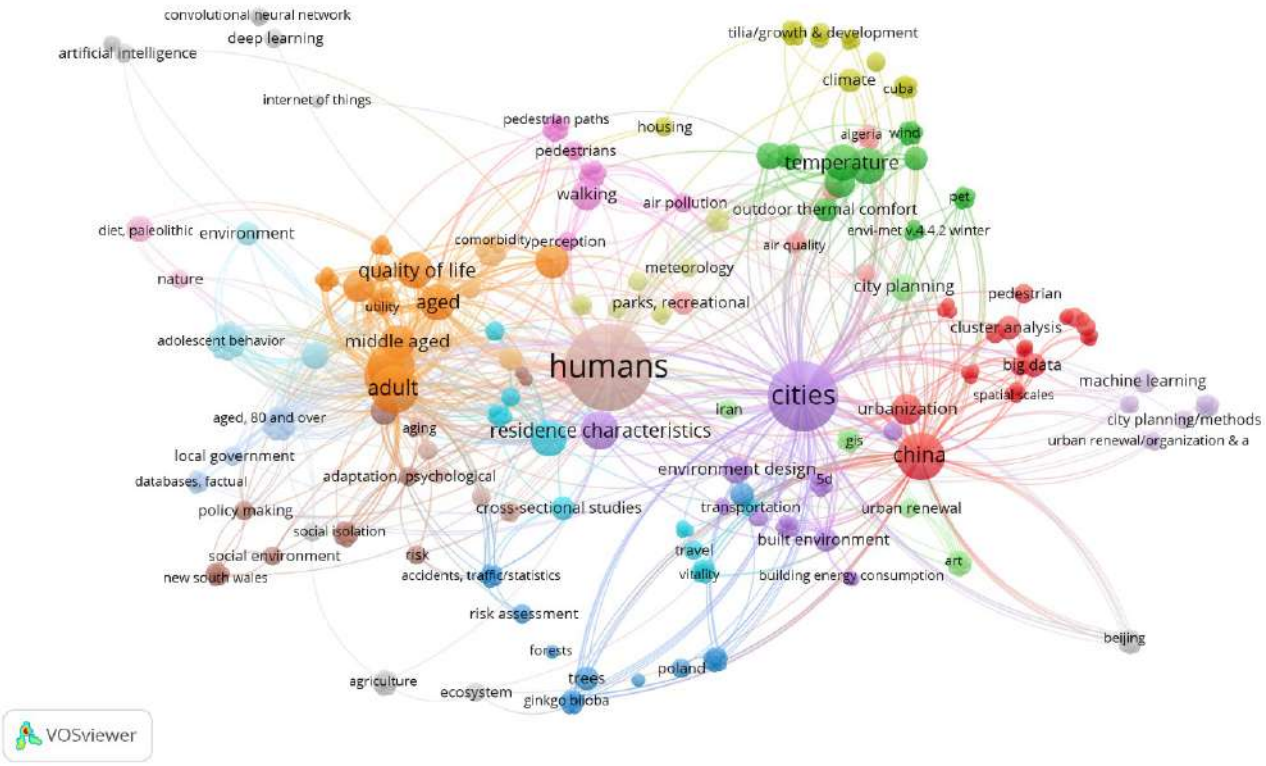

Figure 2. Co-occurrence analysis of bibliometric data from studies on walkability and urban vitality using VOSviewer.

1.2 Urban Vitality and Built Environment

The 2030 Agenda for Sustainable Development (United Nations, 2015) points towards sustainable urban transformation, particularly SDG 11. Overall health is probably going to gradually improve in modern cities. Compact infill development, as opposed to sprawl, is the goal in order to be more sustainable. Defined by several centres and population density, a revitalized built environment, rather than new construction, and pedestrian and multipurpose transportation are its main characteristics. Enhanced usage of digital technologies is integrated into all facets of cities, and modified activity indicator profiles (Guimarães, 2023).

As pointed out by Lee & Kang (2022), urban vitality is an index that reflects a given city's quality of development. This indicator is often employed to define various meanings of vitality in architecture, city planning and design, sociology, and environmental psychology (Xia et al., 2022). According to Jacobs (1961), interactions between individuals or between people and places generate life, and she defines it based on the interactions between people on the streets. This is known as vitality, which Lynch (1961) defined as the degree to which a person may draw from the immediate environment the nourishment, protection, and tools he needs most, above all, his bare existence. Locations, activities, and people - the basic fabric of the urban environment - are revealed as the sources of spatial dynamics, as Gehl (1987) suggests. Kordi & Galal Ahmed (2023) mention that a vibrant urban environment contributes to the availability of multifunctional human activities, social interaction, and communication among residents, as well as improving their level of security and perceptions of place. All these help to support the lives of people living in cities and promote sustainable urban development. It is, as a result, important to identify that urban vitality entails several aspects, including the economic, social, and cultural life of people (Wang et al., 2025). The characteristics of urban dynamics are now significantly useful for measurement and analysis for urban designers and policymakers and are emerging as a significant part of national agendas for city health and quality of life enhancement (Mohamed et al., 2022). The analysis also established by Jabbari et al. (2023) was useful identification of the fact that the overall street vitality results in elevated activity by pedestrians. Urban dynamics have been primarily measured in terms of pedestrians and activities they make on streets, which can be distinguished by quantity, variety, or spatial density/attraction (X. Li et al., 2022). Therefore, there is no absolute measure of street activity intensity. Jacobs (1961) defined socio-economic as the capacity of a place to generate and support appropriate socio-economic activities across the diverse categories for collective use. According to the findings of the study by Istrate (2023), pedestrian interaction with the built surroundings becomes crucial in studies of vitality; nevertheless, greater specificity and clarity regarding the patterns that are established are still required, particularly in environments with various cultural backgrounds.

Fewer studies have examined the micro-level vitality of street spaces in urban areas; instead, most research on urban spatial vitality has concentrated on the macro-urban level (Zhang et al., 2024). However, inhabitants' daily experiences are closely connected to smaller street spaces (Bertolini, 2020). Commercial pedestrian streets, being highly active micro-urban contexts, are placing more emphasis in their spatial renewal plans on promoting street life (Liang et al., 2022). It is now acknowledged that boosting street vitality is an essential tactic for enhancing spatial quality. Several empirical studies have shown that the functional characteristics, spatial shape, and amenities of streets can attract activities (Wu et al., 2021). In these studies, subjective assessments and qualitative descriptions were the main sources of information used on spatial vitality in small-scale urban settings. Zhang et al. (2024) state that improved awareness of the impact of spatial features on the vitality of retail pedestrian streets is gained by considering a variety of spatiotemporal attributes and analysing these elements' effects on street space vitality. This understanding is important when planning commercial street environments and improving the standard of street experiences. Using the shopping activity density, which assesses vitality by considering human perception, and land use diversity, is paid considerable attention at the macro scale in order to investigate elements that influence and comprehend the significance of street vitality (Guo et al., 2021).

Through the application of well-established research methodologies, researchers are still examining the impact of street features on spatial vibrancy. Zhang et al. (2024) developed a street vitality rating index for commercial areas using field surveys and open-source networks. Shop types, shop density, ground floor interface permeability, and pedestrian width are among the critical variables they found to have a major impact on spatial liveliness in the micro-spaces of commercial streets. Research on the macro-level vitality of commercial districts has generally reached a reasonable degree of maturity; nevertheless, further development is still required for the micro-level vitality of commercial streets.

1.3 Spatial Characteristics of Shopping Streets

It is in realizing the various street features that the demands of the users must be considered. It should be accessible to everyone of different ages, genders, and classes of the user. The majority of research studies substantiated the fact that the core values and principles of commercial streets should inform the arrangement of the physical features of streets. Rui & Othengrafen (2023) state that innovative urban streets make provision for 'intense interaction' between the automobile and the pedestrian. Therefore, shopping streets should also accommodate both to cater to pedestrian needs. As a result, car lanes should be designed in accordance with standards to enable "enlightening travels for the drivers or passengers." However, to encourage walking and foster direct communication between all road segments and functions, pedestrian pathways must also be created (Mu et al., 2024). It was also demonstrated that a common pattern of commercial streets was a linear layout of shops encircling central vehicular lanes (Huang et al., 2023). Accessibility and visibility of commercial spaces for a range of people along the whole street are other important characteristics of shopping streets. Lian & Li (2023) also underlined in their study the significance of these components for enhancing a business street's performance, attractiveness, and visibility in addition to streamlining traffic flow and providing a range of enjoyable experiences.

Mohamed (2023) categorizes the street as an urban unit and divides it into three segments, known as the composition of the street. First, street features are mostly related to the look and appearance of the street and the surrounding buildings (LI et al., 2021). Second, this intangible portion comprises the culture, society, and economic functions of the land use and activities, adjacent usages, and behavioural patterns that define the street (Gerike et al., 2021). Third, people's past and present impressions or reactions to its material and non-material attributes shape how they use the street (Rezvanipour et al., 2021). Thus, the street reflects the quality of living in the city; it is a current that supports and permeates the life streams in the city. If this is not achieved, then the general population is left with a perception of the street as being ugly and insufficient for habitation, for providing inhabitants with liveliness, attractiveness, and satisfaction feeling of happiness (Alamoush et al., 2022).

1.4 The walkability of Shopping Streets

One component of a larger set of urban traits is walkability; however, this term excludes several environmental traits that may have negative health effects. Numerous variations in the literature indicate that there is currently no widely accepted theoretical concept of walkability. According to the review and bibliometric analysis conducted by C. Fang et al. (2024), Walkability is the extent to which cities' built environment promotes, improves the lives in the city and the health of citizens through encouraging walking. Although some of these definitions may be valid, none capture all essential environmental components that might promote active living and provide suggestions on how they can be measured. In addition to promoting physical activities like recreational walking, cycling, and skating, qualities that make a community "walkable" can also support behaviours connected to health, including socializing and eating healthily (Tobin et al., 2022).

According to De Vos et al. (2023), walkability is the degree to which a location is pedestrian-friendly within a city setting. They asserted that the standard of the walkway environment may be examined quantitatively by planners to have more objective, effective, and comprehensive walking-related policies and measures. Other than that, walking is also a way to get to activities that most people use to get to by car, thus it can also be seen as a foundation for a sustainable city because of social,

environmental, and economic benefits. Additionally, it gives streets life, and safe streets lead to safer urban areas. Given that pedestrian access has continuously decreased in most cities over the past century, the role that walking plays in promoting community safety, accessibility, and social inclusion has become increasingly important in urban environment design.

1.5 Socio-cultural Impact on the Vitality of Shopping Streets

Retailing, as one of the main reasons people flock to cities, also influences citizens' well-being and triggers city evolution (A. E. Mohamed & Allani, 2024). The continuing trends of city growth and change, however, have produced significant alterations over time to the industries, sizes, and varieties of both cities and of the industries to which they are home. A retail store is one of the easiest places for residents to quickly and freely access goods and services, and the characteristics of these environments either make residents happy and content with their lives or not (Lu et al., 2023). Consequently, the examination of layouts and development in the urban retail sector can be a crucial element of the urban retail model, contributing to the improvement of the urban spatial framework and the optimization of economic gains (Y. Fang et al., 2021).

Individuals of different cultures interact with the architectural environment in as many ways as they develop (Han et al., 2022). Ethnic variation in social interactions can also affect other aspects of life, including the street and walking. The cultural differences and the kind of activities that people in different cultures engage in are the key to the intriguing and pertinent look of urban areas. Due to the many impacts observed in the social context, relating to community affiliation and interaction, the behaviour of people in public areas has been studied (Fonseca, Papageorgiou, et al., 2022), in addition to the sociocultural context, which influences people's behaviour and limitations in space (Yunitsyna & Shtepani, 2023).

Cities were planned for the conventional environment, for the provision of the physiological, social, cultural, and spatial requirements and needs of the community, and for the dynamic street configuration compatible with social and cultural behaviour (Zhao et al., 2023). In Bahrain, the urban setting has evolved from a similar idea to Arab Cities. In addition to the other features that shaped people's activities in open areas in particular using walking, a range of socio-cultural factors, including geographical context, religious beliefs, demographics, and history, affected urban development and streets (Al Hammadi, 2023). Urban real estate projects concerning foreign users of the urban built environment are influenced by the social agreement between the state, the citizen, and the expatriate. These foreigners come with their own cultural beliefs and practices. Several attributes, such as gender, age, income, location, education level, and employment status, are important in the roles they play in explaining the uses of urban spaces (Rausell-Köster et al., 2022). In Arab countries, gender is a social attribute that influences users' behaviors. In Muslim countries, Women are restrained more than men in going out and socializing (Almatar, 2024). (Jalalkamali & Doratli, 2022) examined the effects of the presence of women in urban environments or other organized congregations in as inasmuch as they help to 'animate' the physical sphere they occupy. They came to know that women are less present in the new Iranian urban environment when the relation between environmental and spatial context to the voluntary women's social interactions is given a minor importance. Hence, the research priorities of their study were the examination and comparison of the communal and shared living spaces of the women in traditional Iranian bazaars, the identification of the design values of the related communal contexts associated with women, and the presentation of some recommendations that can be applied to current markets.

1.6 Built Environment Impact on Walkability

In a study by Vichiensan & Nakamura (2021), an understanding of the comparison of walking requirements within the Asian setting between Bangkok and Nagoya is offered. The research proved that convenience is a fundamental necessity of walking, while comfort and fun, as well as safety, are secondary traits; whereas in Bangkok, safety is a multifaceted need. This may be attributable to Bangkok's even worse street conditions, where poor quality and narrow sidewalks remain a problem,

while pedestrian-car encounters are made unpleasant by the city's sharp traffic congestion. A general requirement for walking is attained through enhancements on the streets because activities may be associated with higher-level demands, and therefore encourage more walking within the city (Fonseca, Ribeiro, et al., 2022).

In his study, Almatar (2024) found that Tahlia Street in Riyadh, Saudi Arabia, complies with the majority of the aspects of the comprehensive street regulation, except for the deficiency concerned with the lamentable absence of aesthetic landscaping and protection from severe weather. The study conducted by Alnaim et al. (2025) also confirms that the quality and the extent of the walkable street space affect the quality of the environment. Therefore, future designs should clearly indicate how important greenery is to improve the thermal comfort of pedestrians in hot temperature regions.

Due to changes in lifestyle brought on by globalisation and other associated socioeconomic shifts, many Bahraini extended families now require large homes. The country is extremely densely populated, with approximately 90 out of 100 inhabitants living in the cities and a population density of 1627 people per km^2 (Bahrain National Portal, 2024). The face and imageability of the urban space were given a new perception when low-income immigrants, particularly single Asian males, occupied the traditional areas. Mohamed (2023) explains that Bahrain's cultural and economic setting makes physical activity challenging.The relationship between walkability and vitality in small-scale, commercial street situations that are culturally distinct, especially in Gulf nations like Bahrain, is still little understood, despite growing study interest. Local sociocultural dynamics and climatic variables that characterize urban life in the Gulf region are frequently overlooked in existing literature, which has a tendency to generalize findings from other cities in the world. This study highlights the significance of accessible, high-quality retail spaces and essential public streets as components of prosperous commercial city marketplaces.

2. Materials and Methods

Due to the contextual complexity that characterizes shopping streets, there is a need to go further than quantifying particular characteristics and observing patterns of behaviours to get a full sense of or understand the diverse experiences and the specific behaviours happening in these commercial settings (Creswell & Guetterman, 2024). This research utilizes a qualitative approach, exploring the impact of socio-cultural and built environment factors on walkability in commercial streets in Bahrain (Figure 3).

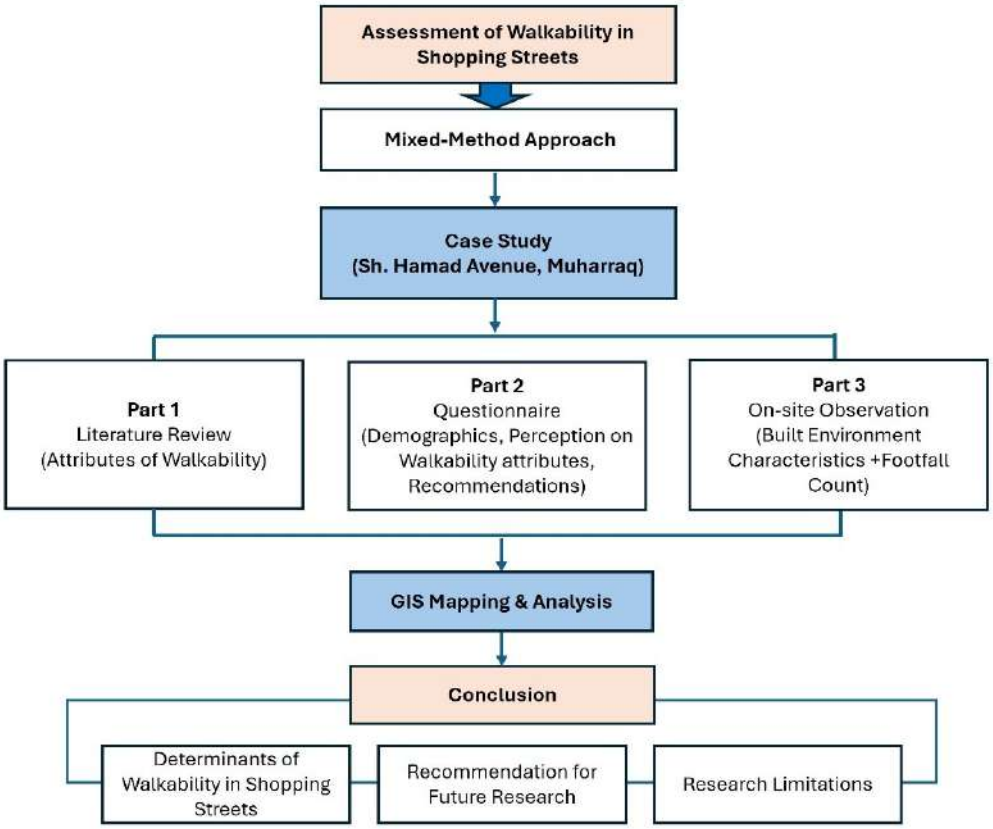

Figure 3. Research Methodology.

The study aims to assess shopping streets in Bahrain to gain insight and perception into commercial street walkability in relation to the existing built environment characteristics. Therefore, Shaikh Hamad Avenue in Muharraq city was chosen to be a case study in this research. The avenue is a historic shopping street (Souq) in Muharraq (BACA, 2024), which was recently developed to enhance the infrastructure of the street by upgrading the services, providing wider sidewalks, increasing plantation, for the purpose of enhancing the walking culture in the area (Figure 4).

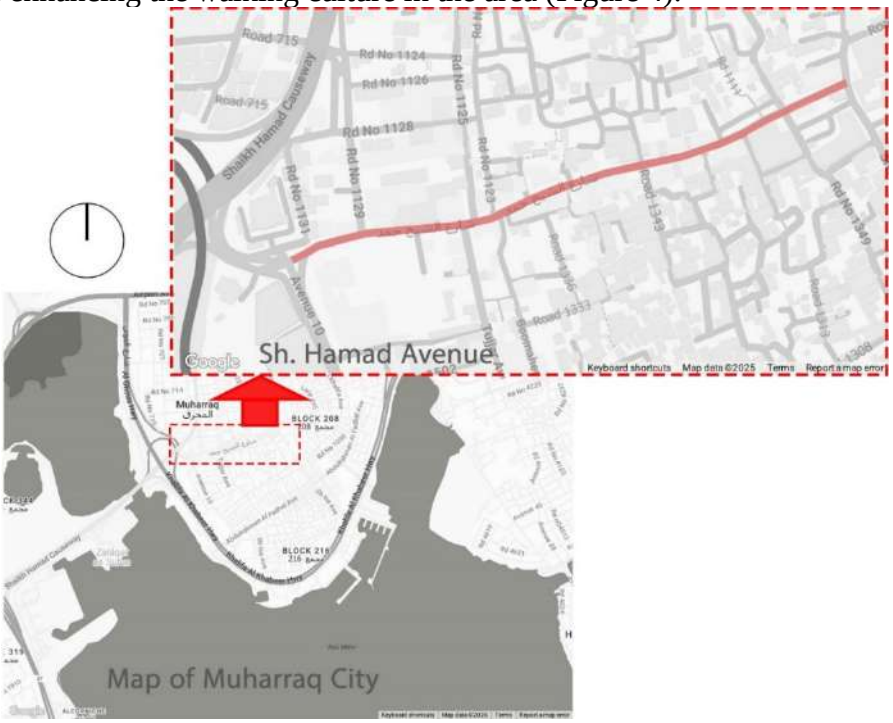

Figure 4. The location of Shaikh Hamad Avenue in Muharraq City.

To achieve the research objectives, the methodology consisted of three parts in this study:

2.1 First part: The idea of walkability and its effect on the vitality of urban environments were the main topics of a thorough literature review. Analysing the many results of earlier research, from which key characteristics and elements influencing street walkability are identified, this phase also examined how cultural background and feelings of place contribute to the understanding of more individualized aspects of walkability and how they relate to Bahraini urban settings.

2.2 Second part: A qualitative technique was used to conduct a survey among a sample of Bahraini citizens aged 18 and older who resided in various governorates and localities in Bahrain. In Arabic and English, the survey was posted through an online link, and the recipients were encouraged to invite their friends and family to participate in the survey. People of different ages, genders, and occupations filled out the survey for a week, and 135 responses were received. Three sections made up the survey instrument: the first included demographic information which were assessed as follows: gender (male and female), governorate of residence (Capital, Northern, Southern, and Muharraq), and age (five age groups: 18–24, 25–34, 35–44, 45–54, and 55 and above). The second section consisted of 14 statements that assessed the residents' beliefs about the five qualities influencing walkability in urban spaces. Five Likert scale was employed, where 1 represents strongly agree and 5 represents strongly disagree to capture the opinion made. These attributes were adapted from prior studies done on factors influencing the walkability of shopping streets (Vural Arslan et al., 2018). Using an open-ended question on the third section, the participants were given a chance to give suggestions and recommendations on how to enhance the walkability of Bahrain's commercial streets.

The investigation of the topic was carried out following closely the requirements of ethical research. Participants' identity and confidentiality were protected since the aim of the questionnaire was explained, and no individual information was exposed.

2.3 Third part: On-site observation was carried out on the selected shopping street. The site was observed on two visits per week based on the Heat Maps generated by Google Maps, a service that maps the data of Google services through the use of mobile devices commonly used in Bahrain, to identify the highest-density timing of the day during the week. The observation visits were conducted during the weekend on Friday between 5:30 pm-6:30 pm (Figure 5a).

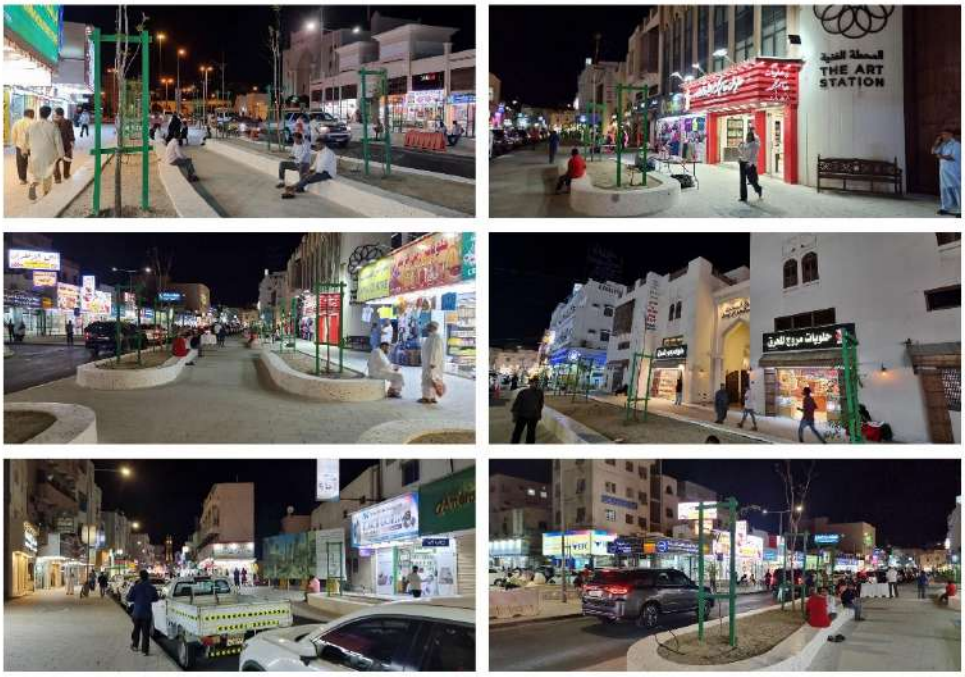

Figure 5a. Pictures of Shaikh Hamad Avenue on Friday (5:30 pm-6:30 pm), Muharraq City.

Another visit was conducted at the same time on Sunday (Figure 5b) to observe the difference in pedestrian movement patterns within these two days. In addition, the built environment characteristics

were noted in terms of sidewalks, vehicle traffic route, street furniture, and types of shops along the 620m avenue. To correlate the various findings, the gathered data was incorporated into the GIS mapping. GIS improves the analysis's precision and effectiveness, allowing for the derivation of significant insights from the spatial data.

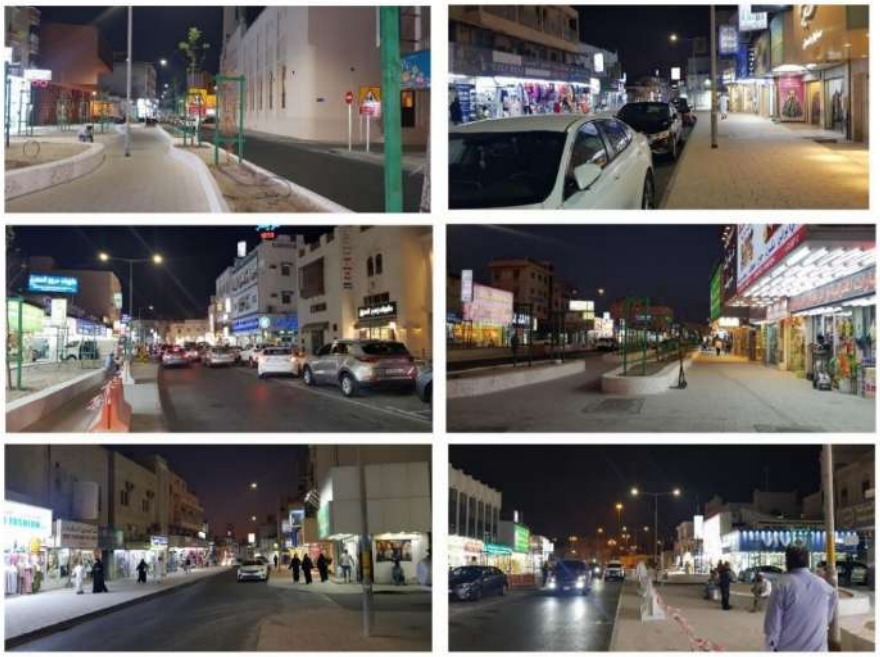

Figure 5b. Pictures of Shaikh Hamad Avenue on Sunday (5:30 pm-6:30 pm), Muharraq City.

3. Results

Based on the findings from the data questionnaire, statistical analysis was performed using the frequency distribution in the SPSS application. A total of 135 respondents completed the survey, as shown in Table 1 below. According to the participants' allocation among Bahrain's five governorates, 20.9% of them resided in the Muharraq Governorate. The majority of the responders were Bahrain nationals, as 86.6% of the participants responded; 37% of the participants were male, while 63% were female. Participants' employment status showed that 49.6% of the respondents are employed citizens. Age distribution indicated majority 26.7% of the participants were between 45 and 54 years. The respondents' age, nationality, and other characteristics showed that the range of interest in the research question has expanded.

Table 1: Demographic Characteristics of the Participants.

Variables	Category	Percentage
Gender	Female	63
	Male	37
Nationality	Bahraini	83.7
	Non-Bahraini	16.3
Age Group	18 - 24	14.8
	25 - 34	20.0
	35 - 44	17.8
	45 - 54	26.7
	55 and above	20.7
Occupation	Employed	49.6
	Retired	21.5
	Self-employed	6.7
	Student	13.3
	Unemployed	8.1
Place of Living	Capital Governorate	29.1
	Muharraq Governorate	20.9
	Northern Governorate	34.3
	Southern Governorate	15.7

The results of the survey show that the respondents frequently use shopping streets in their everyday lives; most of them go there at least once a week, mostly to fulfill their daily product consumption demands (Figure 6a). According to the statistics, 98.5% of people rely on their own cars to get to the shopping districts, while just 6.7% choose to walk (Figure 6b). The majority of participants (80%) found it easier to navigate the shopping streets using Google Maps, whilst 31.9% prefer to use local landmarks. Some participants navigate the commercial streets using verbal instructions and signage (Figure 6c).

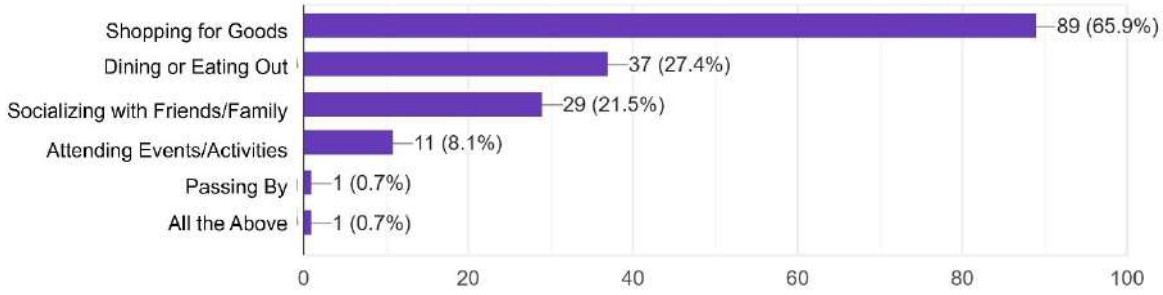

Figure 6a. Reasons for Participants' Visits to the Commercial Streets.

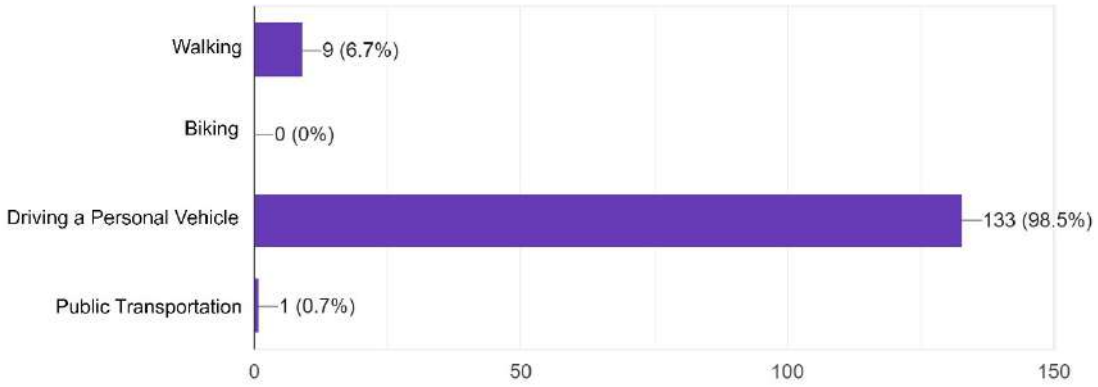

Figure 6b. Participants' Modes of Travel to the Commercial Streets.

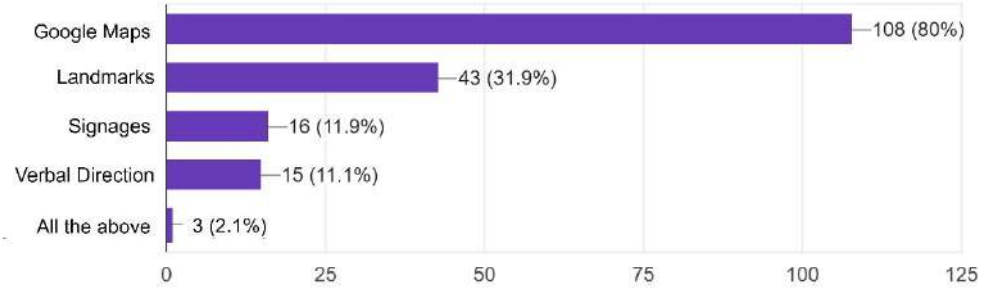

Figure 6c. Means of Wayfinding Used by the Participants in Commercial Streets.

In order to gauge their sense of walkability, the participants answered 14 statements that focused on five key characteristics that influence their choice to walk on commercial routes. The statements were assessed using a 5-point Likert scale. Table 2 displays the responses to each statement from Muharraq residents.

Table 2: Opinions of the Respondents Living in Muharraq Governorate on Statements on Walkability.

#	Statements	Category	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	"I feel safe when walking in shopping streets"	Safety & Security	37.04%	33.33%	22.22%	3.70%	3.70%
2	"Shopping streets are well-maintained and clean."	Built Environment Characteristics	7.14%	39.29%	39.29%	10.71%	3.57%
3	"There are variety of shops and services available on current commercial streets."	Built Environment Characteristics	32.14%	53.57%	7.14%	7.14%	0%
4	"Social events, cultural activities and family entertainment can add vitality to shopping areas and attract pedestrians."	Connectivity	57.14%	32.14%	10.71%	0%	0%
5	"There are enough crosswalks and pedestrian signals in the shopping areas."	Accessibility	3.70%	37.04%	25.93%	29.63%	3.70%
6	"The shopping streets have sufficient seating areas and rest spots for pedestrians."	Comfort	32.14%	28.57%	17.86%	7.14%	14.29%
7	"I believe that improving walkability would enhance my shopping experience."	Connectivity	42.86%	50.00%	7.14%	0%	0%
8	"I believe that shopping streets should prioritize pedestrian access over vehicle traffic."	Safety & Security	44.44%	40.74%	11.11%	3.70%	0%
9	"I prefer walking in areas with close proximity to car parking and public transport stops."	Accessibility	22.22%	37.04%	33.33%	0%	7.41%
10	"I believe that shopping streets should be accessible for wheelchairs and strollers."	Accessibility	64.29%	21.43%	10.71%	3.57%	0%
11	"I believe that shopping streets should be shaded with trees and greenery."	Comfort	75.00%	17.86%	7.14%	0%	0%
12	"Streets with attractive shop front design encourage me to walk on those streets."	Built Environment Characteristics	57.14%	32.14%	10.71%	0%	0%
13	"It's difficult to walk long distances during hot seasons."	Comfort	57.14%	35.71%	7.14%	0%	0%
14	“I believe that promoting walkability has a positive impact on the environment.”	Built Environment Characteristics	71.43%	17.86%	10.71%	0%	0%

The information obtained from the on-site observation is incorporated into the Geographic Information System (GIS) mapping for each visit day on Friday and Sunday in order to show the pedestrian circulation pattern in relation to the distribution of shop types along Shaikh Hamad Avenue (Figure 7a & 7b). The data shows how the number of pedestrians varies between weekdays and weekends. Weekend foot traffic is 180, while weekday foot traffic is 51. Clusters are seen more frequently at food establishments, though, when broader sidewalks with street furniture are available. In the center section of the roadways where parallel parking lots are available, there was less foot traffic near the retail establishments.

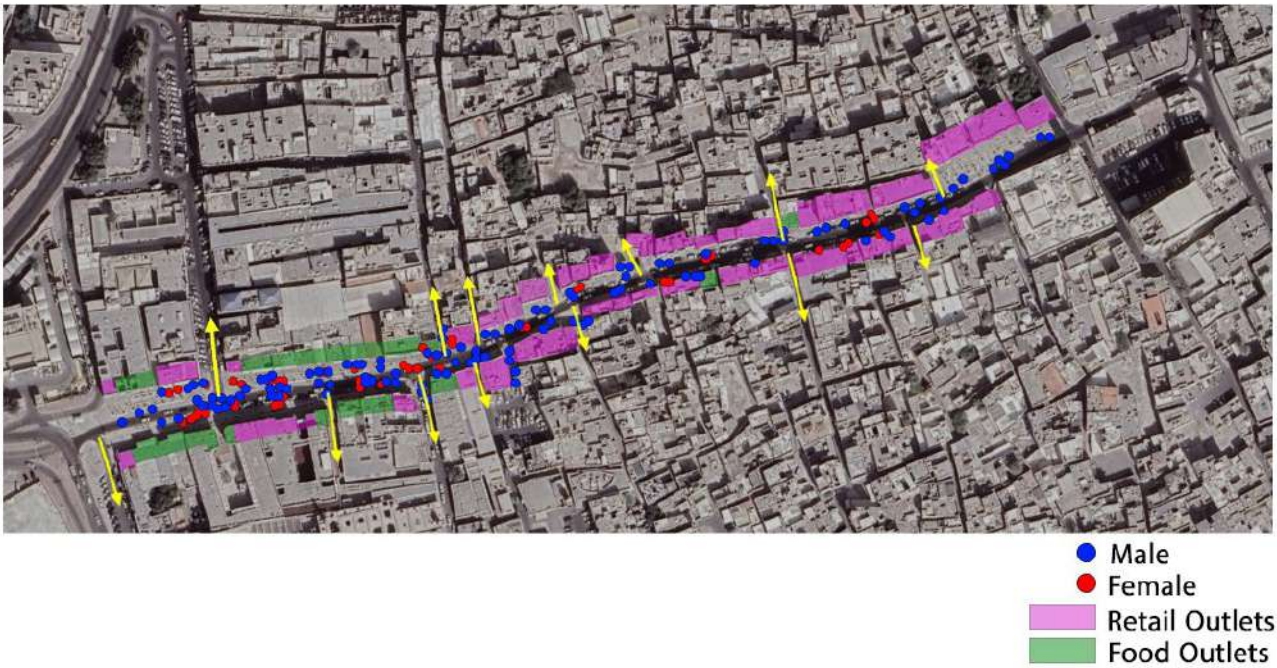

Figure 7a. On-site observation of pedestrian movement pattern on a weekend (Friday at 5:30pm-6:30pm) on Shaikh Hamad Avenue, Muharraq City, using GIS for cluster analysis vs type of shops.

Figure 7b. On-site observation of pedestrian movement pattern on a weekday (Sunday at 5:30 pm-6:30 pm) on Shaikh Hamad Avenue, Muharraq City, using GIS for cluster analysis vs type of shops.

4. Discussion

Residents' opinions on whether Bahrain's bustling urban areas, such as its commercial avenues, are walkable and how this impacts business activity were gathered through questionnaires and interviews. The findings of previous research reveal that commercial opportunities are among the attributes that enhance public participation. For this reason, Jiang et al. (2022) have stressed the importance of understanding how certain characteristics of the built and natural environment cause users to move within the space and, therefore, increase activity in the area. All these attributes are considered by the

Bahrainis who want a powerful change in their society. Table 3 below shows the use of participant replies and the suggestions given by the questionnaire that was developed.

Table 3: Recommendations on Enhancing Walkability Given by the Respondents.

No.	Recommendations
1	Increase greenery and natural shading
2	Provision of Car Parks in close proximity to the shops
3	Provision of services such as well-maintained public toilet facilities
4	Use technology for outdoor cooling.
5	Well-planned land use and distribution of the shop types
6	Wider pedestrian sidewalks
7	Pedestrian-oriented social attractions and more cultural activities
8	Prioritize safety and security for children, elderly people, and people with disabilities.

The five traits that were derived from the literature were examined and correlated with the data that was gathered in this study. Based on the first attribute of built environment aspects, customers are determined to be highly motivated to stroll on the streets instead of driving their cars (Li et al., 2024). As a result of the data analysis, the factors that were found affecting the walkability of the shopping street are summarized as follows (Figure 8):

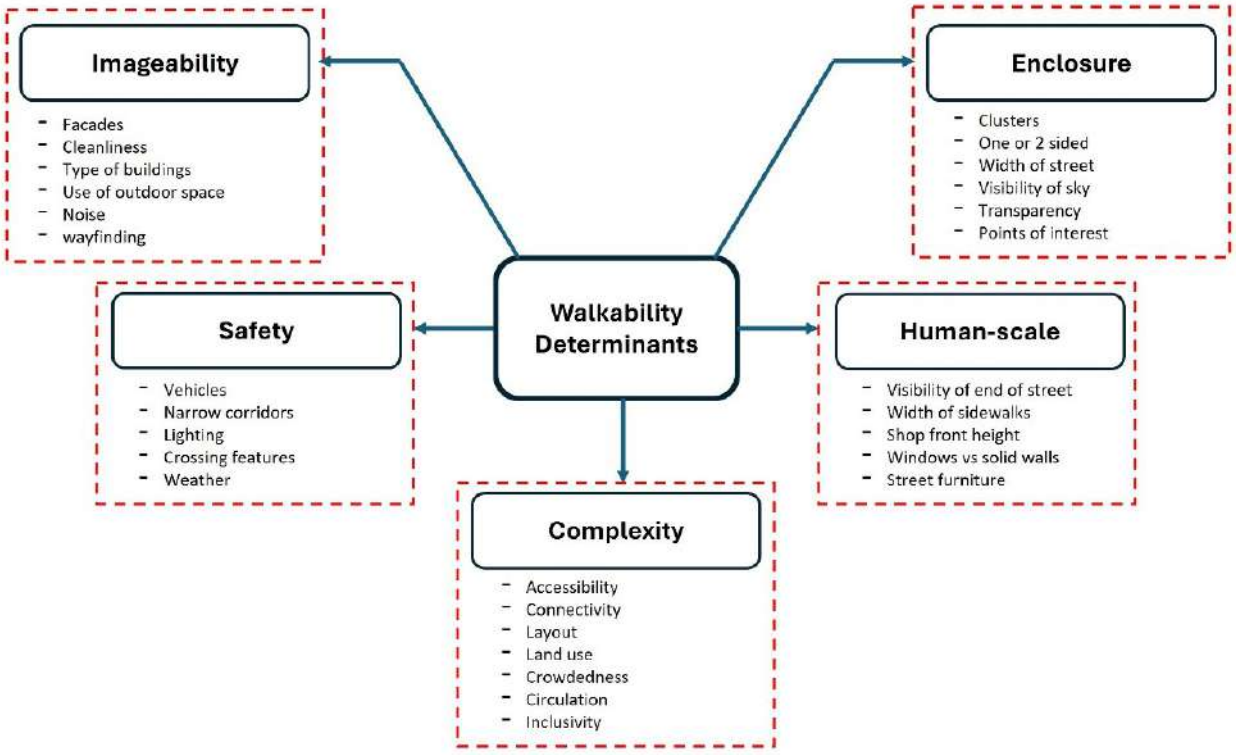

Figure 8. Walkability Determinants of Shopping Streets.

4.1 Imageability: One of the factors determining these street images is how far the street can encourage people to walk around it; a clean street could encourage people to walk around it. Besides the aesthetics of the storefronts, customers in the shopping street also prefer well-distributed stores, diversity of outlets, and the openness of the façade. In addition, other components are the way that pavements and outdoor areas facilitate social integration besides walking. It is acknowledged that the possibility of accessing amenities is critical to the improvement of walkability.

4.2 Enclosure: The perceived convenience of a walk depends on such factors as the relation of the length of the street to the height of the buildings along it or the visibility of the endpoint of the street. Besides, the street is given more dynamics and the sense of choice and mobility by the store's location on both sides of the street. However, the road width may affect the choice of people to cross the road to the other side.

4.3 Human-scale: As found out along Shaikh Hamad Avenue, it is important to note that people love to take their time, especially where the sidewalks are wider and get to spend more time window shopping (Balasubramanian et al., 2022). Also, it is noted that parts with equal distribution of solid and transparent frontages solicit more people traffic than the long continuous solid fronts that make the walk monotonous. The most crowded spots were where the street furniture is found, which facilitates a person sitting down to take a break on a quite extensive shopping street. There are many methods for expressing the level of comfort, such as the length of a commercial strip. Lack of stopovers for longer distances may just discourage shopping by walking.

4.4 Complexity: Basu et al. (2024) argued that the largest barrier to pedestrians' willingness to walk is the warmer temperatures. Hence, either self-shading or planting should be averagely incorporated into the consideration of the urban street layout to facilitate ease of walking when the weather is hot. Analysis of the results also indicated how accessibility influences walkability. The respondents said that as much as possible, the parking lots and buses should be close to the stores so that they would not have to walk long distances, and also to make getting to where they have to get to very easy. Furthermore, attention should be paid to the possibility of walking for different types of users, such as disabled people, children, and the elderly. These findings indicate that if such routes are well linked physically and established aesthetically to structures, social and cultural activities, other crossing points, and other amenities that are important for the life of people, then people can gradually adopt the practice of walking.

4.5 Safety: The respondents explained their perception by strongly agreeing that safety should be provided. Since there was no crossing feature between the two sides of the road and cars were parked along the sidewalk, traffic regulations should be studied for these areas. In general, Bahrain's shopping streets have been shown to be secure and safe, so customers generally feel comfortable moving about and conducting business there.

The findings of the data gathered from the respondents, which significantly correlate with the observations made on site, show that many of these walkability attributes were not applied in the planning of this shopping street. This emphasizes the importance of addressing them by the planning authority to enhance the walkability in these public areas.

5. Conclusion

The study examined how socio-cultural and built environment characteristics shape walkability and urban vitality in Bahrain’s commercial streets, with a focus on Shaikh Hamad Avenue in Muharraq. Findings demonstrated that pedestrian perceptions are significantly influenced by five interrelated determinants: imageability, enclosure, human scale, complexity, and safety. Shade provision, shop diversity, and spatial connectivity emerged as central enablers of walkability, while inadequate pedestrian crossings and harsh climatic conditions presented notable barriers. These results highlight the importance of designing commercial streets that not only accommodate functional movement but also foster social interaction, cultural identity, and environmental comfort.

By integrating local socio-cultural dynamics with human-centred design, the research provides valuable insights for planners and policymakers in Bahrain and the wider Gulf context. The evidence suggests that urban vitality can be enhanced when commercial streets are developed with attention to culturally sensitive design elements, pedestrian-oriented infrastructure, and micro-scale amenities. Such strategies not only strengthen street-level activity but also contribute to broader sustainability goals by promoting inclusivity, liveability, and reduced car dependency. The study reinforces that walkability is not merely a transport concern but a multidimensional concept intertwined with social behaviour, cultural expression, and urban resilience.

Nevertheless, this research acknowledges certain limitations, particularly the modest sample size and the single case study focus, which may limit broader generalisation. Future studies should extend the investigation across diverse urban contexts in Bahrain and other Gulf states to validate and refine the findings. Expanding the scope to include longitudinal data and economic variables could also provide deeper insights into how walkability interacts with commercial performance and long-term urban development. Overall, this study underscores the urgent need for evidence-based urban policies that prioritise pedestrians and cultural dynamics in shaping commercial streets, thereby creating more sustainable, dynamic, and human-centred urban environments.

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References

Al Hammadi, F. A. (2023). *Understanding the impact of socio-cultural, built environment, and policy factors on walkability in Bahrain: The case study of Hidd City* (Doctoral dissertation, Newcastle University, United Kingdom). Newcastle University. http://theses.ncl.ac.uk/jspui/handle/10443/6204

Alamoush, S. J., Ja'afar, N. H., & Kertész, A. (2022). Street character and current practices influence. Pollack Periodica, 17(1), 156–161. https://doi.org/10.1556/606.2021.00433

Almatar, K. M. (2024). Rehumanize the Streets and Make Them More Smart and Livable in Arab Cities: Case Study: Tahlia Street; Riyadh City, Saudi Arabia. Sustainability, 16(8), 3376. https://doi.org/10.3390/su16083376

Alnaim, M. M., Mesloub, A., Alalouch, C., & Noaime, E. (2025). Reclaiming the Urban Streets: Evaluating Accessibility and Walkability in the City of Hail's Streetscapes. Sustainability, 17(7), 3000. https://doi.org/10.3390/su17073000

Bahrain Authority for Culture and Antiquities (BACA). (2024). *Pearling Path: Pearling, Testimony of an Island Economy*. Retrieved 28 August 2025, from https://pearlingpath.bh/en/

Bahrian National Portal. (2024). Bahrain Population Statistics. Bahrain National Portal. https://shorturl.at/CPeK0

Balasubramanian, S., Irulappan, C., & Kitchley, J. L. (2022). Aesthetics of urban commercial streets from the perspective of cognitive memory and user behavior in urban environments. Frontiers of Architectural Research, 11(5), 949–962. https://doi.org/10.1016/j.foar.2022.03.003

Basu, R., Colaninno, N., Alhassan, A., & Sevtsuk, A. (2024). Hot and bothered: Exploring the effect of heat on pedestrian route choice behavior and accessibility. Cities, 155, 105435. https://doi.org/10.1016/j.cities.2024.105435

Bertolini, L. (2020). From "streets for traffic" to "streets for people": can street experiments transform urban mobility? Transport Reviews, 40(6), 734–753. https://doi.org/10.1080/01441647.2020.1761907

Creswell, J. W., & Guetterman, T. C. (2024). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (7th ed.). Pearson.

De Vos, J., Lättman, K., van der Vlugt, A.-L., Welsch, J., & Otsuka, N. (2022). Determinants and effects of perceived walkability: a literature review, conceptual model and research agenda. Transport Reviews, 43(2), 303–324. https://doi.org/10.1080/01441647.2022.2101072

El Hama, N., & Helmy, M. (2024). Humanising Commercial Streets as a Tool for Social Sustainability. IOP Conference Series: Earth and Environmental Science, 1283(1), 012014. https://doi.org/10.1088/1755-1315/1283/1/012014

Fang, C., Homma, R., & Qiu, T. (2024). A Bibliometrics Analysis Related to the Built Environment and Walking. Sustainability, 16(7), 2850. https://doi.org/10.3390/su16072850

Fang, Y., Mao, J., Liu, Q., & Huang, J. (2021). Exploratory space data analysis of spatial patterns of large-scale retail commercial facilities: The case of Gulou District, Nanjing, China. Frontiers of Architectural Research, 10(1), 17–32. https://doi.org/10.1016/j.foar.2020.02.002

FFonseca, F., Papageorgiou, G., Tondelli, S., Ribeiro, P., Conticelli, E., Jabbari, M., & Ramos, R. (2022). Perceived Walkability and Respective Urban Determinants: Insights from Bologna and Porto. Sustainability, 14(15), 9089. https://doi.org/10.3390/su14159089

Fonseca, F., Ribeiro, P. J. G., Conticelli, E., Jabbari, M., Papageorgiou, G., Tondelli, S., & Ramos, R. A. R. (2021). Built environment attributes and their influence on walkability. International Journal of Sustainable Transportation, 16(7), 660–679. https://doi.org/10.1080/15568318.2021.1914793

Gehl, J. (1987). *Life between buildings: Using public space*. Van Nostrand Reinhold.

Gerike, R., Koszowski, C., Schröter, B., Buehler, R., Schepers, P., Weber, J., Wittwer, R., & Jones, P. (2021). Built Environment Determinants of Pedestrian Activities and Their Consideration in Urban Street Design. Sustainability, 13(16), 9362. https://doi.org/10.3390/su13169362

Guimarães, P. (2023). Cities and Retail: Sustainable Transformation of Retail in Urban Environments. Sustainability, 15(17), 12743. https://doi.org/10.3390/su151712743

Guo, X., Chen, H., & Yang, X. (2021). An evaluation of street dynamic vitality and its influential factors based on multi-source big data. *ISPRS International Journal of Geo-Information, 10*(3), 143. https://doi.org/10.3390/ijgi10030143

Han, S., Song, D., Xu, L., Ye, Y., Yan, S., Shi, F., Zhang, Y., Liu, X., & Du, H. (2022). Behaviour in public open spaces: A systematic review of studies with quantitative research methods. *Building and Environment, 223*, 109444. https://doi.org/10.1016/j.buildenv.2022.109444

Huang, Y., Zhang, Z., Fei, J., & Chen, X. (2023). Optimization Strategies of Commercial Layout of Traditional Villages Based on Space Syntax and Space Resistance Model: A Case Study of Anhui Longchuan Village in China. Buildings, 13(4), 1016. https://doi.org/10.3390/buildings13041016

Istrate, A.-L. (2023). Street Vitality: What Predicts Pedestrian Flows and Stationary Activities on Predominantly Residential Chinese Streets, at the Mesoscale? Journal of Planning Education and Research, 45(1), 66–80. https://doi.org/10.1177/0739456x231184607

Jabbari, M., Fonseca, F., Smith, G., Conticelli, E., Tondelli, S., Ribeiro, P., Ahmadi, Z., Papageorgiou, G., & Ramos, R. (2023). The Pedestrian Network Concept: A Systematic Literature Review. Journal of Urban Mobility, 3, 100051. https://doi.org/10.1016/j.urbmob.2023.100051

Jacobs, J. (1961). The Death and Life of Great American Cities. Oxford University Press.

Jalalkamali, A., & Doratli, N. (2022). Public Space Behaviors and Intentions: The Role of Gender through the Window of Culture, Case of Kerman. Behavioral Sciences, 12(10), 388. https://doi.org/10.3390/bs12100388

Jiang, Y., Han, Y., Liu, M., & Ye, Y. (2022). Street vitality and built environment features: A data-informed approach from fourteen Chinese cities. Sustainable Cities and Society, 79, 103724. https://doi.org/10.1016/j.scs.2022.103724

Kordi, A. O., & Galal Ahmed, K. (2023). Towards a socially vibrant city: exploring urban typologies and morphologies of the emerging "CityWalks" in Dubai. City, Territory and Architecture, 10(1). https://doi.org/10.1186/s40410-023-00221-5

Lee, S., & Kang, J. E. (2022). Impact of particulate matter and urban spatial characteristics on urban vitality using spatiotemporal big data. Cities, 131, 104030. https://doi.org/10.1016/j.cities.2022.104030

Li, Q., Cui, C., Liu, F., Wu, Q., Run, Y., & Han, Z. (2021). Multidimensional Urban Vitality on Streets: Spatial Patterns and Influence Factor Identification Using Multisource Urban Data. ISPRS International Journal of Geo-Information, 11(1), 2. https://doi.org/10.3390/ijgi11010002

LI, S., Ma, S., Tong, D., Jia, Z., Li, P., & Long, Y. (2021). Associations between the quality of street space and the attributes of the built environment using large volumes of street view pictures. Environment and Planning B: Urban Analytics and City Science, 49(4), 1197–1211. https://doi.org/10.1177/23998083211056341

Li, X., Kozlowski, M., Salih, S. A., & Ismail, S. B. (2024). Evaluating the vitality of urban public spaces: perspectives on crowd activity and built environment. Archnet-IJAR: International Journal of Architectural Research. https://doi.org/10.1108/arch-01-2024-0009

Li, X., Li, Y., Jia, T., Zhou, L., & Hijazi, I. H. (2022). The six dimensions of built environment on urban vitality: Fusion evidence from multi-source data. Cities, 121, 103482. https://doi.org/10.1016/j.cities.2021.103482

Lian, H., & Li, G. (2023). Correlation Analysis of Retail Space and Shopping Behavior in a Commercial Street Based on Space Syntax: A Case of Shijiazhuang, China. Buildings, 13(11), 2674. https://doi.org/10.3390/buildings13112674

Liang, Y., D'Uva, D., Scandiffio, A., & Rolando, A. (2022). The more walkable, the more livable? -- can urban attractiveness improve urban vitality? Transportation Research Procedia, 60, 322–329. https://doi.org/10.1016/j.trpro.2021.12.042

Lu, C., Yu, C., Xin, Y., & Zhang, W. (2023). Spatial Distribution Characteristics and Influencing Factors on the Retail Industry in the Central Urban Area of Lanzhou City at the Scale of Daily Living Circles. ISPRS International Journal of Geo-Information, 12(8), 344. https://doi.org/10.3390/ijgi12080344

Lynch, K. (1961). The Image of the City. Harvard University Press.

Ministry of Sustainable Development. (2025). The Economic Vision for Bahrain 2030. https://sdgs.gov.bh/

Mohamed, A. (2023). Urban street imageability in Manama old town, Bahrain. In *International Architectural Sciences and Applications Symposium* (pp. 1-12).

Mohamed, A. E., & Allani, N. (2024). The Role of Users' Socio-spatial Behaviour in Fostering Sustainable Retail District Projects in Bahrain. Journal of Contemporary Urban Affairs, 8(2). https://doi.org/10.25034/ijcua.2024.v8n2-2

Mohamed, M., Ibrahim, A., & Fekry, M. (Eds.). (2022). Cities of the Future. Springer International Publishing. https://doi.org/10.1007/978-3-031-15460-7

Mu, X., Mu, L., & Zhang, J. (2024). The Impact of Street Elements on Pedestrian Stopping Behavior in Commercial Pedestrian Streets from the Perspective of Commercial Vitality. Sustainability, 16(17), 7727. https://doi.org/10.3390/su16177727

Rausell-Köster, P., Ghirardi, S., Sanjuán, J., Molinari, F., & Abril, B. (2022). Cultural experiences in the framework of "cultural cities": Measuring the socioeconomic impact of culture in urban

performance. *City, Territory and Architecture, 9*(1), 1–15. https://doi.org/10.1186/s40410-022-00189-8

Rezvanipour, S., Hassan, N., Ghaffarianhoseini, A., & Danaee, M. (2021). Why does the perception of street matter? A dimensional analysis of multisensory social and physical attributes shaping the perception of streets. Architectural Science Review, 64(4), 359–373. https://doi.org/10.1080/00038628.2020.1867818

Rui, J., & Othengrafen, F. (2023). Examining the Role of Innovative Streets in Enhancing Urban Mobility and Livability for Sustainable Urban Transition: A Review. Sustainability, 15(7), 5709. https://doi.org/10.3390/su15075709

Tobin, M., Hajna, S., Orychock, K., Ross, N., DeVries, M., Villeneuve, P. J., Frank, L. D., McCormack, G. R., Wasfi, R., Steinmetz-Wood, M., Gilliland, J., Booth, G. L., Winters, M., Kestens, Y., Manaugh, K., Rainham, D., Gauvin, L., Widener, M. J., Muhajarine, N., … Fuller, D. (2022). Rethinking walkability and developing a conceptual definition of active living environments to guide research and practice. BMC Public Health, 22(1). https://doi.org/10.1186/s12889-022-12747-3

United Nation. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. United Nation General Assembly. https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

Vichiensan, V., & Nakamura, K. (2021). Walkability Perception in Asian Cities: A Comparative Study in Bangkok and Nagoya. Sustainability, 13(12), 6825. https://doi.org/10.3390/su13126825

Vural Arslan, T., Durak, S., Dizdar Gebesce, F., & Balcik, B. (2018). Assessment of factors influencing walkability in shopping streets of tourism cities: case of Bursa, Turkey. International Journal of Tourism Cities, 4(3), 330–341. https://doi.org/10.1108/ijtc-11-2017-0071

Wang, M., Zhao, J., Zhang, D., Xiong, Z., Sun, C., Zhang, M., & Fan, C. (2025). Assessing urban vitality in high-density cities: a spatial accessibility approach using POI reviews and residential data. Humanities and Social Sciences Communications, 12(1). https://doi.org/10.1057/s41599-025-05459-7

Wu, W., Niu, X., & Li, M. (2021). Influence of Built Environment on Street Vitality: A Case Study of West Nanjing Road in Shanghai Based on Mobile Location Data. Sustainability, 13(4), 1840. https://doi.org/10.3390/su13041840

Xia, C., Zhang, A., & Yeh, A. G. O. (2021). The Varying Relationships between Multidimensional Urban Form and Urban Vitality in Chinese Megacities: Insights from a Comparative Analysis. Annals of the American Association of Geographers, 112(1), 141–166. https://doi.org/10.1080/24694452.2021.1919502

Yunitsyna, A., & Shtepani, E. (2023). Investigating the socio-spatial relations of the built environment using the Space Syntax analysis – A case study of Tirana City. Cities, 133, 104147. https://doi.org/10.1016/j.cities.2022.104147

Zhang, J., Zhou, W., Lian, H., & Hu, R. (2024). Research on Optimization Strategy of Commercial Street Spatial Vitality Based on Pedestrian Trajectories. Buildings, 14(5), 1240. https://doi.org/10.3390/buildings14051240

Zhao, J., Hao, X., & Yang, Y. (2023). Research on Urban Sustainability Indicators Based on Urban Grain: A Case Study in Jinan, China. Sustainability, 15(18), 13320. https://doi.org/10.3390/su151813320

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Original scientific paper

Can Cultural Capital and the Right to the City Explain Class-Based Alienation in Thailand's Art Museums?

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ABSTRACT

Contemporary art museums in Thailand often fail to engage working-class communities, revealing a disconnect between institutional narratives and the lived realities of marginalized urban citizens. This study investigates how cultural exclusion reflects broader socio-economic inequality, contributing to the journal's focus on the economic ramifications of urbanization. Through qualitative fieldwork and interviews at four institutions—BACC and MOCA (Thailand), Tate Modern (UK), and Pirelli HangarBicocca (Italy)—it identifies four key dimensions of alienation: psychological, spatial, socio-cultural, and economic. Drawing on Bourdieu's concept of cultural capital and Lefebvre's Right to the City, the research introduces a typology of alienation that functions as both a theoretical contribution and a practical tool. It demonstrates that exclusion stems not only from cost but also from curatorial tone, spatial design, and symbolic inaccessibility. By centering the perspectives of lower-income participants, this study contributes an interdisciplinary framework that bridges museology, urban studies, and critical ethnography. By situating cultural alienation within the socio-economic transformations of contemporary urbanization, the study demonstrates how exclusion from museums parallels broader patterns of economic inequality and urban segregation in Thailand. Ultimately, it argues that inclusive cultural infrastructure is essential for fostering urban resilience and democratic participation.

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Highlights:	Contribution to the field statement:
- Investigates how Thai contemporary art museums reinforce class-based exclusion through spatial and curatorial practices. - Applies Lefebvre's "right to the city" and Bourdieu's cultural capital to cultural infrastructure. - Proposes a new typology of museum-based alienation based on ethnographic evidence. - Challenges dominant Western museological frameworks by cantering Southeast Asian cultural dynamics. - Offers design and policy recommendations for promoting spatial justice and cultural equity in urban settings.	This study contributes to urban inequality and cultural infrastructure discourse by examining how Thai contemporary art museums reinforce class-based exclusion through spatial, curatorial, and institutional practices. Drawing from Lefebvre's Right to the City and Bourdieu's cultural capital, it introduces a new typology of alienation grounded in ethnographic evidence. The paper challenges Western museological models and offers a diagnostic framework for inclusive design and cultural policy. By bridging theory and practice, it provides actionable strategies for museums and urban planners to foster spatial justice, cultural equity, and civic participation in Southeast Asia.

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1. Introduction

As intangible cultural assets, contemporary art museums serve as vital institutions for societal expression, cultural continuity, and civic dialogue (UN-Habitat, 2020; Lefebvre, 1996). They embody the living essence of a city's cultural fabric by offering platforms to interpret evolving social narratives through artistic expression (Duncan, 1995; Hooper-Greenhill, 2000). Far from being mere repositories of aesthetic value, they are dynamic communicative spaces that reflect and shape collective consciousness (Macdonald, 2006; Bourdieu, 1984). Their significance lies in their ability to foster intercultural understanding, promote creative diversity, and enable communities to participate in public life through cultural engagement (UN-Habitat, 2020; Sandell & Nightingale, 2022).

Denying access to these spaces not only excludes marginalised populations from the symbolic life of the city but also undermines the democratic principle of cultural participation (Falk & Dierking, 2013; Lefebvre, 1996). Cultural exclusion—whether spatial, symbolic, or psychological—thus reflects deeper urban fractures and contributes to the reproduction of social inequality (Bourdieu, 1984; Fraser, 2006). Within the framework of sustainable urbanism, art museums are increasingly recognised as agents of regeneration and social inclusion (UN-Habitat, 2020; Bennett, 1995). Their presence can enhance urban identity, stimulate local economies, and nurture social cohesion—particularly when community voices are included in cultural policy formation (Hooper-Greenhill, 2000; Macdonald, 2006). Aligned with Sustainable Development Goal 11.4, safeguarding cultural heritage—both tangible and intangible—through inclusive infrastructure is essential to building equitable, resilient cities (UNESCO, 2022; Galluccio & Giambona, 2024).

Thus, the contemporary art museum is not merely a cultural venue but a civic instrument that can either reinforce or dismantle the invisible boundaries of class-based alienation in urban Thailand (Bourdieu, 1984; Lefebvre, 1996). Despite this transformative potential, cultural institutions often remain structurally inaccessible to working-class publics due to linguistic, architectural, curatorial, and emotional barriers (Fraser, 2006; Iervolino, 2023). To clarify the central concept of this study, alienation refers to the emotional, spatial, and socio-economic distancing experienced by individuals who perceive themselves as outsiders within institutions designed for public benefit. In the context of contemporary art museums, this manifests not only in physical inaccessibility but also in symbolic and psychological forms—such as feeling unwelcome, underrepresented, or culturally disconnected. These forms of alienation resonate with Bourdieu's theory of cultural capital and Lefebvre's notion of spatial rights, positioning museum inaccessibility as a class-coded experience embedded in the urban economy and symbolic order.

Contemporary art museums in Thailand, while often branding themselves as inclusive cultural institutions, remain largely disengaged from the everyday realities of working-class communities. Despite the working class comprising approximately 64% of Thailand's population (World Bank, 2021), these populations are strikingly underrepresented in institutional spaces such as the Bangkok Art and Culture Centre (BACC) and the Museum of Contemporary Art (MOCA). Field observations conducted over two weeks revealed that fewer than 2% of visitors at these museums appeared to come from working-class backgrounds—underscoring a gap between institutional narratives of accessibility and lived socio-cultural participation.

This exclusion cannot be reduced to physical or economic barriers alone. Rather, it is sustained by multidimensional alienation—psychological, spatial, and social—produced through curatorial language, spatial design, institutional tone, and the broader symbolic order that frames contemporary museums as elite cultural spaces. The prevalence of modernist architecture, "white cube" aesthetics, and esoteric curatorial discourse reinforces class-coded expectations of cultural literacy, often rendering working-class individuals as outsiders within these institutions (Bourdieu, 1984; Le Mare & Holden, 2021). Such mechanisms of exclusion are not incidental but structurally embedded in how these museums are spatially and symbolically produced (Lefebvre, 1996).

Although international literature has extensively theorised these dynamics—drawing on concepts such as cultural capital (Bourdieu, 1984), spatial justice (Lefebvre, 1996), and museum engagement (Falk & Dierking, 2013)—there remains a notable gap in empirical research within the Thai context. Existing

Thai studies tend to focus on preservation, tourism, or institutional development, with limited interrogation into how design and discourse contribute to exclusionary experiences for lower-income publics. Furthermore, few studies address how museums might adopt inclusive frameworks that respond to socio-cultural alienation through spatial, psychological, and civic dimensions. By critically examining these issues, this study seeks to theorise museum-based alienation in Thailand and contribute a conceptual and methodological framework for inclusive, socially responsive cultural engagement. It positions exclusion from contemporary museums not merely as a failure of access, but as a failure of institutional imagination—one that must be addressed through intentional design, reflexive curatorial practice, and a commitment to democratising urban cultural life.

In Southeast Asia, urban cultural policies frequently prioritise national identity, tourism, or economic development, while questions of class, participatory equity, and cultural justice remain largely sidelined (Sasitharan, 2023). Despite being centrally located and offering free admission, institutions such as the Bangkok Art and Culture Centre (BACC) remain strikingly disconnected from the working-class communities situated in their immediate urban vicinity. This disconnect extends far beyond material access or financial cost. Participants in this study frequently articulated a deeper, more symbolic form of exclusion, often remarking that museums "aren't for people like me"—underscoring how cultural institutions reproduce social distance through subtle forms of class-based boundary-making.

While international scholarship has extensively examined how cultural capital, institutional habitus, and spatial design reinforce inequality (Bourdieu, 1984; Lefebvre, 1996; Falk & Dierking, 2013), Thai academic discourse has yet to critically interrogate how contemporary art spaces themselves participate in this socio-cultural reproduction. The present study responds directly to this gap by posing the following central research question: Why do public contemporary art spaces in Thailand contribute to social exclusion, and how might art's connection to society be redefined as a cultural value? This question drives the inquiry into how spatial configurations, institutional tone, and curatorial narratives shape patterns of exclusion—both physical and symbolic—for lower-income publics.

Building on this central question, the study aims to reposition contemporary art museums as inclusive and socially sustainable institutions. It investigates the nature and causes of alienation experienced by lower-income communities, focusing on four key dimensions: psychological, spatial, social, and economic. The research is guided by the premise that design, location, institutional narratives, and affordability collectively shape exclusionary experiences within museum spaces. Through comparative analysis of Thai institutions (BACC and MOCA) and international case studies (Tate Modern and Pirelli HangarBicocca), the study seeks to identify curatorial and spatial practices that promote inclusion. A key objective is to develop a diagnostic framework that categorises and maps these four types of alienation, thereby revealing which forms most significantly impact engagement. This framework provides actionable insights for more equitable and accessible museum practices.

The study employs a qualitative research design grounded in critical ethnography, integrating in-depth interviews, observational fieldwork, and thematic analysis. Drawing from a conceptual framework informed by Lefebvre's Right to the City, Bourdieu's theory of cultural capital, and critical museology, the study explores mechanisms and dimensions of alienation in contemporary art spaces. A total of 16 participants from lower-income backgrounds—both visitors and non-visitors—were interviewed across four sites: Bangkok Art and Culture Centre (BACC), the Museum of Contemporary Art (MOCA), Tate Modern (London), and Pirelli HangarBicocca (Milan). Data were triangulated through on-site observation, focusing on spatial design, user behaviour, and institutional atmosphere. Thematic analysis was then used to identify patterns of exclusion across psychological, spatial, socio-cultural, and economic dimensions, guided by a framework that maps these experiences against four mechanisms of exclusion: curation, design, cost, and cultural norms.

This research contributes to urban cultural studies, critical museology, and spatial theory by examining how class influences cultural access in Thailand's contemporary art museums. It proposes practical guidelines for enhancing inclusivity through institutional design, programming, and policy. Grounded in Bourdieu's theory of cultural capital and Lefebvre's Right to the City, the research reconceptualises

art museums as civic infrastructures that both reflect and reproduce social hierarchies. By centring the lived experiences of lower-income communities, it challenges dominant assumptions of cultural neutrality and accessibility. Aligned with Sustainable Development Goal 11.4, the findings support the development of inclusive cultural infrastructure that fosters community participation and protects intangible heritage. Moreover, this study offers a unique contribution to academic discourse by bridging theoretical critique and applied research. Its four-part typology of alienation not only expands current frameworks in urban sociology and museology but also introduces a replicable tool for comparative cultural policy studies. Through this interdisciplinary framework, the study enriches the scholarly understanding of how cultural institutions can either reinforce or dismantle socio-economic barriers in contemporary urban settings. The paper is structured into five sections: Introduction, Materials and Methods, Results, Discussion, and Conclusion. The overall structure of this research, from problem statement to synthesis, is summarized in Figure 1.

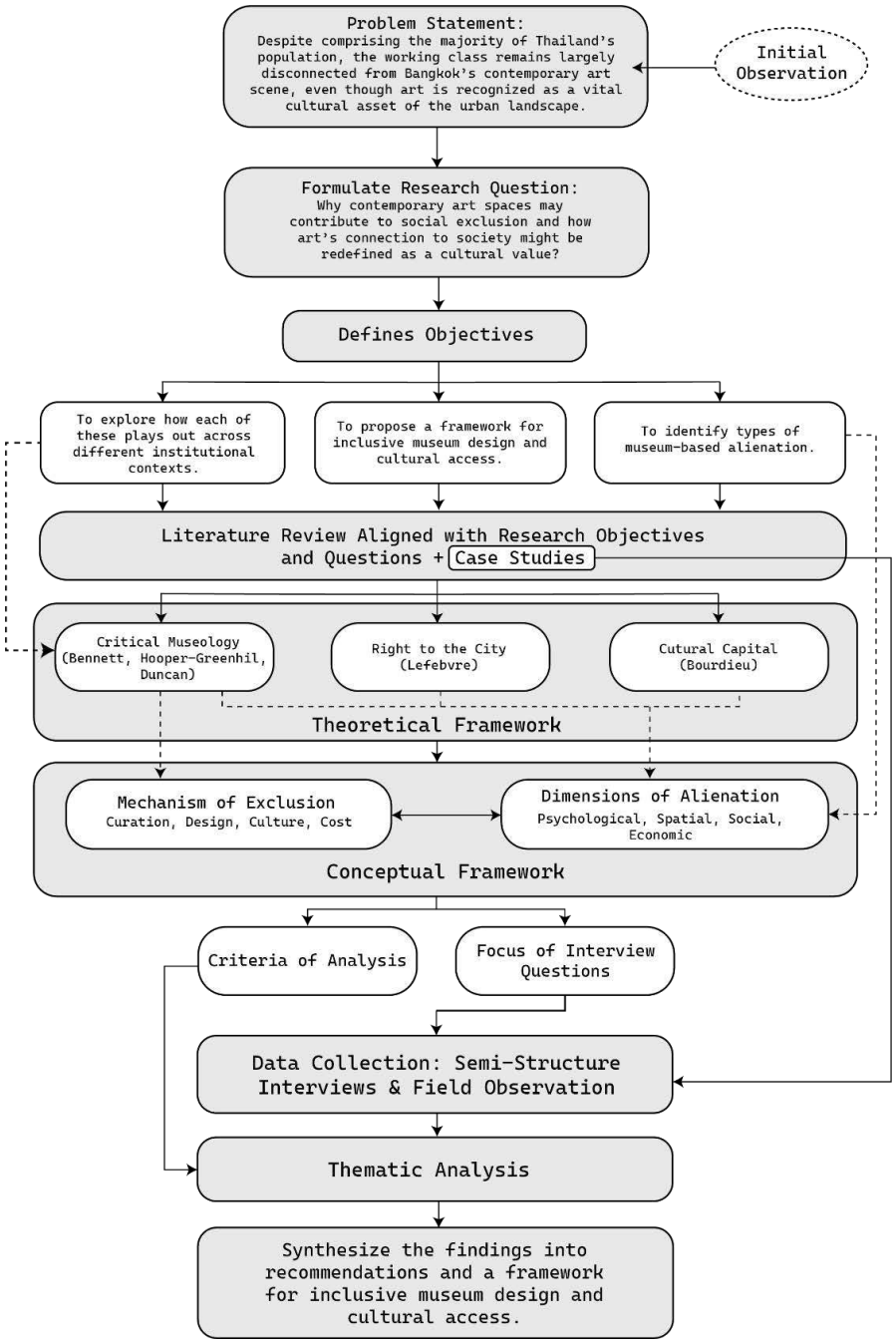

Figure 1. Structure of the study.

2. Review of Literature

2.1 Art and the Right to the City: Cultural Expressions of Urban Claim-Making

Art has long served as a powerful medium through which communities articulate identity, preserve memory, and express collective experience. Far from being mere decoration, artistic expression carries symbolic and political weight—reflecting societal values, hierarchies, and ideologies. As such, art is not only a cultural asset but a form of social communication and historical continuity.

Henri Lefebvre's concept of the Right to the City positions art and culture as central to urban life—not as luxuries but as fundamental to the city's democratic and symbolic production. For Lefebvre, the city is an œuvre—a living artwork shaped by its inhabitants through everyday practices, rituals, and expressions (Lefebvre, 1996, p. 4). In this view, public spaces, monuments, and cultural institutions are never neutral; rather, they carry deep political significance, encoding narratives of inclusion and exclusion that reflect and reproduce urban power relations.

Lefebvre critiques the commodification of the city under capitalism, arguing that space is socially produced and ideologically shaped. "The building is not innocent," he writes, "nor is the void" (Lefebvre, 1996, p. 10). Cultural institutions—including museums—become part of this spatial regime, serving as instruments of ideological power that uphold dominant narratives and reinforce spatial hierarchies (Lefebvre, 1996, pp. 9–10, 15). Although often framed as public spaces, museums are frequently constructed and curated through elite strategies that determine who feels they belong—and who remains invisible.

Lefebvre's famous claim that "the right to the city is like a cry and a demand" (1996, p. 57) underscores the urgency of reclaiming access to symbolic and civic life as a spatial and cultural right. When art is sequestered in formal, alienating institutions, it loses its democratic potential. Museums must therefore be reimagined as civic infrastructures—not repositories of institutional authority, but inclusive public spaces where marginalized voices can assert cultural and spatial agency. In this sense, art becomes not merely a reflection of the city, but a right to claim and reshape it.

This section contributes to the broader literature review by emphasizing the spatial and symbolic dimensions of exclusion in cultural institutions, offering a theoretical foundation for understanding how access to art is intertwined with broader claims to urban rights and social justice.

2.2 Art as Social Classification: The Role of Art as a Marker of Social Stratification

Contemporary museums do not merely exhibit art; they function as institutions of classification that reflect and reproduce social hierarchies. Through a complex interplay of spatial, psychological, economic, and social factors, museums often exclude those without the cultural capital to decode their norms.

2.2.1 Cultural Capital and Production of Alienation in Contemporary Art Museums

A. Cultural Capital and Institutional Legitimacy

Pierre Bourdieu's (1984) theory of cultural capital illustrates how familiarity with particular aesthetic codes—especially the ability to interpret abstract or conceptual art—is shaped by access to education and cultural exposure. Contemporary art museums often function as institutional gatekeepers, legitimizing elite tastes while marginalizing alternative modes of interpretation. Those who lack this cultural capital may experience feelings of exclusion or illegitimacy, as the museum space affirms the knowledge and aesthetic preferences of dominant social classes. Consequently, museums operate as symbolic spaces of power, validating those who possess the "right" forms of cultural literacy while rendering others invisible or peripheral (Bourdieu, 1984; Bourdieu, 1990). Current scholarship notes that museums continue to privilege elite cultural norms, often marginalizing working-class identities (Iervolino, 2023). Recent sociological work emphasizes how class inequality is embedded in everyday practices, shaping not only access to economic resources but also to cultural spaces (Evans & Whiting, 2024)

B. Taste as a Social Classifier

Aesthetic taste, rather than being a matter of personal preference, operates as a marker of social identity and class distinction. Bourdieu (1984) argues that preferences in art are shaped by one's social upbringing and educational background. Within contemporary art institutions, these preferences demarcate who belongs and who does not. Through curatorial choices, exhibition language, and spatial design, museums construct symbolic boundaries that exclude individuals who do not share or understand the dominant cultural codes (Bourdieu, 1984; Prior, 2005).

C. Economic-Spatial Exclusion

Economic-spatial factors also mediate access to museums. Museums often exist in gentrified or affluent neighborhoods, requiring visitors to invest time and effort in transportation. Entry fees, even when moderate, may serve as significant deterrents for lower-income individuals (Wolf, 2024). Even in free institutions, indirect costs—such as transportation, food, and leisure expenses in the area—create barriers. These spatial and economic limitations reinforce broader socio-economic hierarchies and mirror urban patterns of inclusion and exclusion (Fainstein, 2010; Medaković, D. 2024).

D. Epistemological Control

Beyond physical access, museums exercise epistemological control by defining what constitutes "legitimate" art and whose stories are told. By prioritizing specific narratives, media, and artists, they effectively silence alternative cultural perspectives (Lind, 2004). The privileging of Eurocentric, conceptual, or elite-curated work marginalizes forms of expression rooted in local or non-institutional traditions (Fraser, 2006; Raicovich, 2021). Museums thus act not only as physical spaces of display but also as ideological instruments of cultural authority.

These overlapping mechanisms of exclusion create a sense of alienation for many visitors. The following framework categorizes four distinct but interconnected forms of alienation experienced by museum-goers, offering a means to analyze how these institutions contribute to cultural stratification.

2.2.2 Mapping the Four Types of Alienation onto the Cultural Capital Framework

The novelty of this research lies in how it maps Bourdieu's cultural capital theory onto a four-part model of museum alienation: psychological, spatial, economic, and social. This framework helps operationalize how exclusion is experienced in everyday museum interactions.

Psychological Alienation

Psychological alienation closely aligns with Bourdieu's notion of symbolic violence, where individuals internalize feelings of inferiority due to their unfamiliarity with dominant aesthetic codes. Museum visitors without prior exposure to contemporary art may find themselves emotionally or intellectually disconnected from works that appear abstract, elitist, or irrelevant to their lived experiences. The architecture and curation may lack emotional resonance or contextual grounding, amplifying feelings of alienation. According to Falk and Dierking (2013), personal context—including prior experiences and motivations—is central to museum learning. Visitors without such grounding may struggle to find meaning, reinforcing their sense of exclusion.

Spatial/Physical Alienation

Modernist museum architecture—characterized by "white cube" aesthetics and minimalist layouts—may appear neutral but often conveys implicit codes of elitism. These design choices, while intended to focus attention on the art, can instead feel intimidating or disorienting to infrequent or first-time visitors. Research in museum studies emphasizes how poor signage, unclear navigation, and rigid spatial hierarchies reinforce psychological distance and limit ease of movement, especially for those unfamiliar with institutional cultural cues (Medaković, 2024). Recent spatial analysis further confirms that the configuration of movement pathways and visual access fields significantly influences whether visitors perceive a space as open and inclusive—or alienating and exclusive (Wang, 2025).

Economic Alienation

Financial barriers significantly limit access to museums. Even when entry is free, indirect costs such as transportation, parking, or proximity to high-cost areas can deter attendance. Museums located in commercial or gentrified zones are often out of reach for those relying on low-wage jobs or public transportation. Wolf (2024) highlights how perceived elitism and logistical inconvenience contribute to feelings of exclusion, even when direct economic barriers are low. These realities turn "public" institutions into spaces primarily frequented by those who can afford the experience.

Social Alienation

Museums that fail to reflect the diversity of the populations they serve risk socially alienating their audiences. This form of alienation occurs when visitors do not see their languages, cultures, or experiences represented in the exhibitions or among museum staff. Medaković notes that a lack of inclusive programming and staff representation deepens the gap between institutions and marginalized communities. Without intentional engagement strategies, museums become echo chambers of elite narratives, alienating those who may already feel socially distant from the world of contemporary art. (Medaković, 2024)

This framework demonstrates how contemporary art museums, particularly in urban centers like Bangkok, sustain symbolic and material hierarchies. By analyzing alienation through four dimensions—psychological, spatial, economic, and social—we reveal how museums, though nominally public, often function as exclusive spaces shaped by cultural capital. These forms of exclusion underscore the need for inclusive, community-based strategies in institutional design and programming.

While theories of cultural capital (Bourdieu, 1984), spatial politics (Lefebvre, 1996), and critical museology offer valuable insights, few studies have addressed their intersection within the Thai museum context. In particular, the ways in which spatial design, curatorial language, and institutional aesthetics perpetuate class-based exclusion remain underexplored. This study addresses that gap by integrating spatial-cultural theory to investigate how contemporary Thai art institutions reinforce subtle, yet persistent, forms of alienation among lower-income communities.

2.3 Critical Museology and Mechanisms of Exclusion

Critical museology offers a vital framework for understanding how museums function not merely as cultural repositories, but as institutions embedded within broader socio-political systems that sustain social hierarchies through spatial, curatorial, and discursive practices (Bennett, 1995; Duncan, 1995; Hooper-Greenhill, 2000; Fraser, 2006; Lind, 2004; Raicovich, 2021). It challenges the notion of museums as neutral, democratic spaces by highlighting how institutional norms, aesthetics, and governance structures often privilege dominant cultural groups. Bennett (1995) conceptualizes museums as part of the "exhibitionary complex," where visibility, discipline, and order uphold elite cultural narratives through curatorial framing. Duncan (1995) further describes museums as "civilizing rituals," where spatial design subtly dictates visitor behavior, reinforcing class-coded legitimacy and social expectations. Hooper-Greenhill (2000) critiques how institutional pedagogy assumes a culturally literate, middle-class visitor, marginalizing alternative forms of knowing.

Expanding on these foundations, contemporary scholars like Fraser (2006) and Lind (2004) foreground the role of institutional critique in exposing the ideological underpinnings of museum practices. Fraser (2006) encourages critical engagement with museum governance, sponsorship, and representational politics, while Lind (2004) interrogates how the notion of the "public" in public institutions often reflects institutional aspirations more than actual community needs. Raicovich (2021) urges museums to rethink their operational logics, warning that participatory strategies risk becoming tokenistic if they fail to confront structural inequality.

Drawing from Bourdieu's (1984) theory of cultural and economic capital, exclusion is also understood to operate through both visible and invisible costs—including admission fees, transportation barriers,

time poverty, and the emotional labor required to navigate unfamiliar or intimidating cultural spaces. These four mechanisms—curation, design, culture, and cost—constitute the operational core of this study's conceptual framework. Together, they demonstrate that exclusion is not the result of individual disinterest or deficiency, but the outcome of systemic institutional practices. In this context, critical museology becomes the theoretical scaffolding through which to decode how contemporary art museums reinforce, challenge, or reimagine their relationship to class, identity, and access.

2.4 The Meaning of Art in Thai Culture: A Review of Paradigm Shifts in Cultural Interpretation

Historically, Thai art has functioned as a deeply integrated element of religious, moral, and communal life. Temple murals, sculptures, and handicrafts conveyed Buddhist teachings and moral narratives in ways that were accessible to all social classes, fostering cultural continuity and collective memory (Chirapravati, 2005; Ko-Udomvit, 2003). Art was not created for elite contemplation but served as a spiritual and public medium—produced by local artisans and shared in inclusive, everyday spaces. This longstanding tradition situated art as an act of devotion, moral instruction, and shared cultural meaning.

However, this democratic and spiritual role of art shifted dramatically during the modernization campaigns of the 19th century, particularly under the reigns of King Rama IV and Rama V. Western artistic paradigms—such as realism and portraiture—were introduced into Thai visual culture, gradually aligning artistic production with elite patronage and individualized expression (Clarke, 2013). This transformation was institutionalized with the founding of Silpakorn University in 1943 by Italian sculptor Corrado Feroci (Silpa Bhirasri), which formalized art education and professionalized Thai art along Western lines (Clark & Kitiarsa, 2010).

The impact of this transformation continues to shape Thailand's contemporary art institutions. Thai museums and galleries increasingly emulate international norms in exhibition design, curatorial language, and spatial aesthetics. The widespread adoption of the "white cube" model, for example, reflects a global museological standard that privileges minimalist neutrality. Yet critics argue that this model fosters psychological detachment, formal rigidity, and cultural alienation—especially for audiences unfamiliar with conceptually abstract or institutionally coded artistic forms (O'Doherty, 1999).

Unlike Buddhist temples—which remain embedded in urban life and accessible across class lines—contemporary museums often feel spatially detached, behaviorally formal, and cognitively inaccessible. This shift marks a cultural and epistemological rupture: the transition from narrative-driven, inclusive art forms to institutionalized, elite-centered practices. The result is a cultural double bind. Thai institutions seek global validation through Western museological frameworks, yet risk marginalizing the local publics they were intended to serve (Chirapravati, 2005).

This tension underscores the need to critically reassess how museums in non-Western contexts define and communicate cultural value. Bridging global and local paradigms requires more than curatorial translation—it demands a structural reorientation toward inclusivity, cultural plurality, and epistemic justice. Inclusive design strategies, such as "slow museum" experiences, have been proposed to foster greater accessibility, emotional comfort, and cultural resonance for a wider range of visitors (Hall, 2023). Understanding this historical trajectory is essential for reimagining how Thai cultural institutions can re-engage with their inclusive origins while developing context-specific museological frameworks that reflect the region's unique cultural-political dynamics (Cai, 2025).

2.5 Comparative Case Studies: Institutional Forms of Alienation in Bangkok and Beyond

This study draws on case studies of contemporary art museums in Bangkok, particularly the Bangkok Art and Culture Centre (BACC) and the Museum of Contemporary Art (MOCA), to illustrate how spatial design, curatorial language, and institutional culture can contribute to alienation. Despite offering free entry or affordable pricing, these museums often exhibit forms of exclusion through modernist architecture, abstract curation, and limited representation of local or marginalized communities.

For comparative context, the study also considers Western examples such as the Tate Modern in London and the Pirelli HangarBicocca in Milan. These institutions, while operating in different socio-cultural contexts, similarly grapple with questions of accessibility, inclusion, and institutional critique. The comparative analysis helps to illuminate which forms of alienation are culturally specific and which are structurally embedded in the global museum model.

This cross-cultural approach strengthens the argument that alienation is not merely a byproduct of poor outreach or isolated curatorial decisions but is symptomatic of deeper institutional patterns. By situating Bangkok's art institutions within a global discourse of exclusion and reform, the study contributes to a more nuanced understanding of how contemporary museums can either reproduce or challenge cultural stratification.

2.5.1 Case Study: Bangkok Art and Culture Centre (BACC)

Situated in central Bangkok and accessible by public transit, BACC serves as a public cultural venue offering exhibitions and educational programs. Despite its centrality and free admission, spatial and economic alienation persist. Transport costs, confusing architecture inspired by the Guggenheim, and white-cube aesthetics contribute to feelings of exclusivity. Limited Thai cultural references, multilingual signage, and staff engagement further reinforce the perception that BACC caters more to elite audiences than to local working-class communities. Figure 2 illustrates the central location of BACC, highlighting its accessibility yet paradoxical alienation through design and signage.

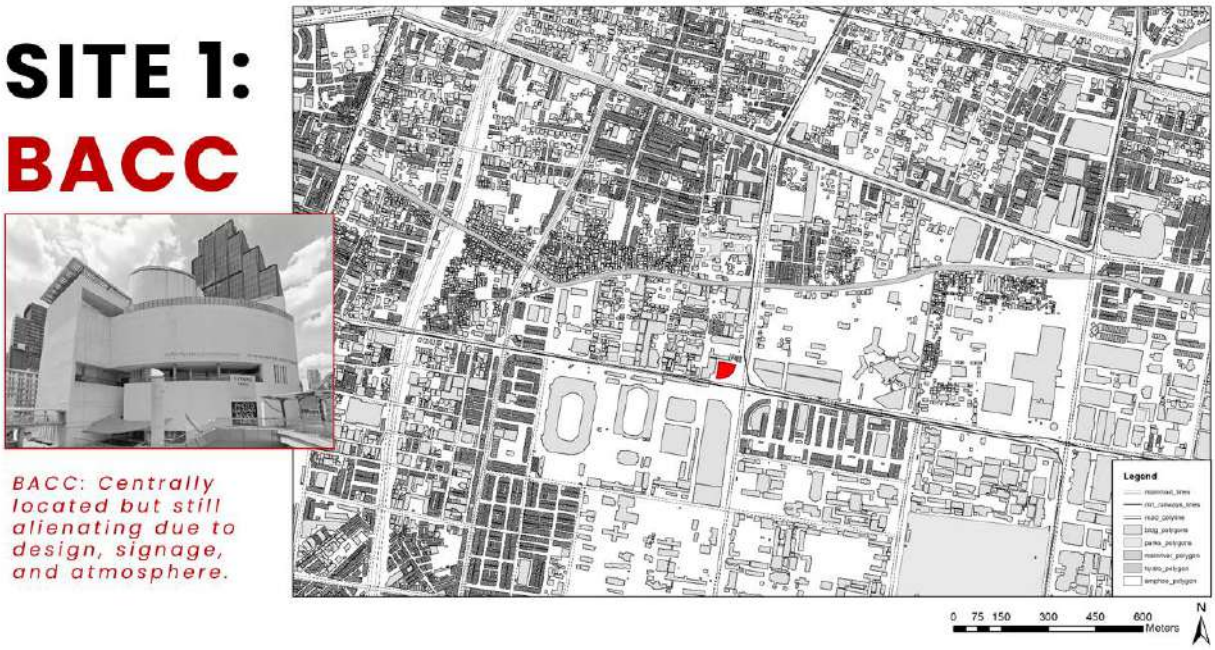

Figure 2. Location of the Bangkok Art and Culture Centre (BACC) within the central city area.

2.5.2 Case Study: Museum of Contemporary Art (MOCA)

Located on the outskirts of Bangkok, MOCA is a privately funded institution that charges standard admission and offers few discounted events, making it less accessible to working-class visitors. Its formal architecture—with high ceilings, polished interiors, and subdued lighting—creates a sense of exclusivity that can alienate those unfamiliar with institutional art spaces. Interviews revealed low awareness and minimal visitation among nearby residents, with many unsure if entry was open to the public. Cost, distance, and a lack of interactive or multilingual programming further reinforce psychological, spatial, and economic barriers to engagement. As shown in Figure 3, MOCA is situated peripherally, reinforcing barriers of cost and formality in its spatial positioning.

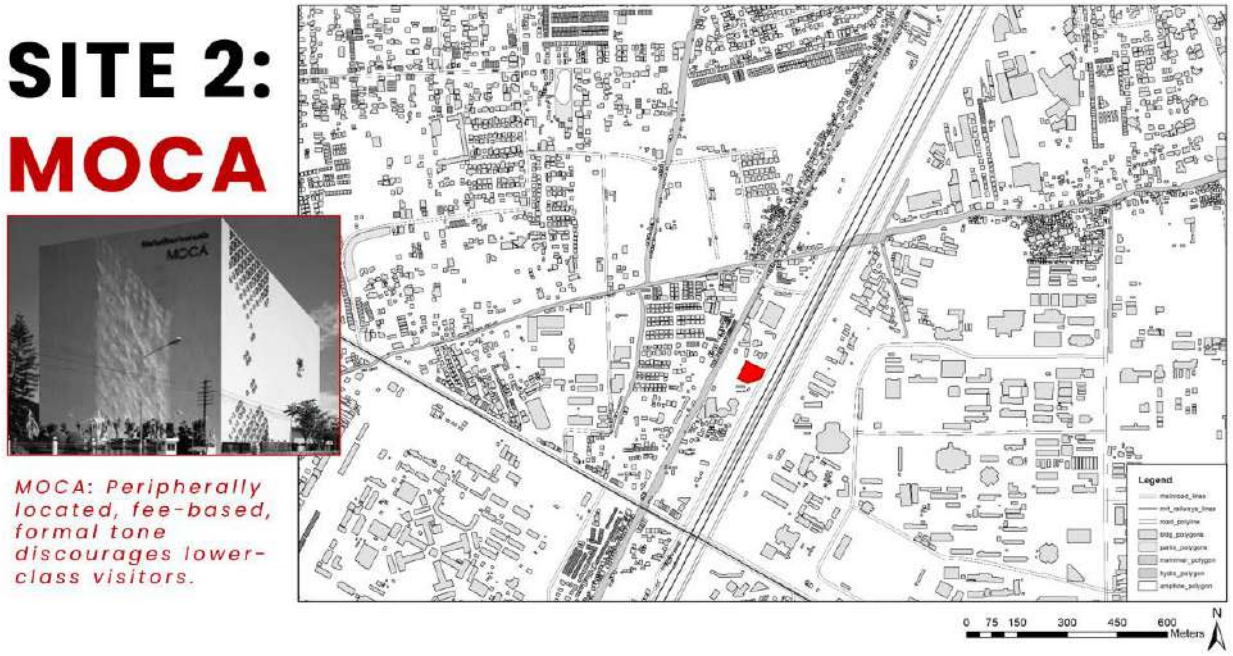

Figure 3. Location of the Museum of Contemporary Art (MOCA) in Bangkok's peripheral urban area.

2.5.3 Comparative Reflections: Tate Modern and Pirelli HangarBicocca

Tate Modern (UK) and Pirelli HangarBicocca (Italy) demonstrate inclusive, community-focused approaches to contemporary museology. Both offer free general admission and use repurposed industrial spaces to foster openness and accessibility. Tate's Turbine Hall functions as a public forum, while Pirelli's immersive design and community partnerships reduce symbolic exclusion. With multilingual signage, participatory programming, and non-hierarchical atmospheres, these institutions actively lower barriers for diverse audiences. Their models show how spatial design, outreach, and cultural inclusion can enhance public engagement—offering valuable insights for Thai museums seeking to address class-based alienation and fulfil their civic role in urban society.

Figure 4. Exterior views of international case studies: Tate Modern (London) and Pirelli HangarBicocca (Milan).

While international scholarship has extensively explored the role of art museums in cultural reproduction and symbolic exclusion—particularly through the lenses of cultural capital (Bourdieu, 1984), spatial production (Lefebvre, 1996), and critical museology (Bennett, 1995; Hooper-Greenhill, 2000)—there is a notable lack of empirical literature that addresses how these dynamics operate in Southeast Asian urban contexts. Studies often focus on Western institutions or national heritage sites, rather than contemporary art spaces and their socio-political functions within rapidly urbanizing, class-stratified societies like Thailand (Sasitharan, 2023; Le Mare & Holden, 2021). Systematic reviews confirm persistent barriers in accessibility and inclusive learning across museum settings worldwide (González-Herrera, 2023) Moreover, research on Thai museums tends to emphasize preservation,

tourism, or institutional growth, without interrogating how spatial design, curatorial language, and institutional tone shape exclusion for lower-income publics. The comparative international sites are represented in Figure 4, showing the exterior architectural character of Tate Modern and Pirelli HangarBicocca.

2.6 Theoretical and Conceptual Framework

This study is grounded in an interdisciplinary framework that integrates urban theory, cultural sociology, and critical museology. Henri Lefebvre's Right to the City positions urban space as a lived, symbolic, and political construct rather than a neutral backdrop (Lefebvre, 1996). Within this view, art is a civic right—integral to urban democracy—and museums are not merely sites of preservation but contested spaces that reflect and reproduce spatial and social hierarchies.

Pierre Bourdieu's (1984) theory of cultural capital further illuminates how art appreciation is socially conditioned, privileging those with prior exposure to elite cultural forms. Contemporary museums often encode these preferences in their curatorial language, spatial design, and institutional tone, resulting in subtle but persistent exclusion of working-class audiences.

Building on this, critical museology interrogates the ideological functions of museums. Scholars such as Duncan (1995), Hooper-Greenhill (2000), and Fraser (2006) argue that museums construct narratives of legitimacy and authority, often omitting marginalized voices. This lens encourages scrutiny of whose stories are prioritized, how exhibitions are framed, and whether institutional norms foster or hinder inclusivity. Museums emerge as spaces that can both reproduce and challenge inequality (Fraser, 2006; Bourdieu, 1984), with accessibility strategies central to reshaping these dynamics (Wolf, 2024) and heritage practices increasingly evaluated not only for cultural but also for socio-economic outcomes (Galluccio & Giambona, 2024). Empirical indicators of urban socio-economic disparity, such as nighttime lighting intensity, offer tangible evidence of uneven urban development (Yu et al., 2024). Private museums, as shown by Kolbe (2024), contribute not just culturally but also economically by promoting urban legitimacy and prosperity in competitive city networks. (Kolbe, 2024). Finally, the framework reflects on the paradigm shift in Thai visual culture. Once rooted in communal, religious, and craft-based traditions (Chirapravati, 2005), art in Thailand has increasingly adopted Western models of abstraction, professionalism, and spatial formality (Clark & Kitiarsa, 2010). This shift mirrors global institutional norms but also risks alienating local publics, reinforcing class-based cultural exclusion. The theoretical foundations informing this study are outlined in Figure 5.

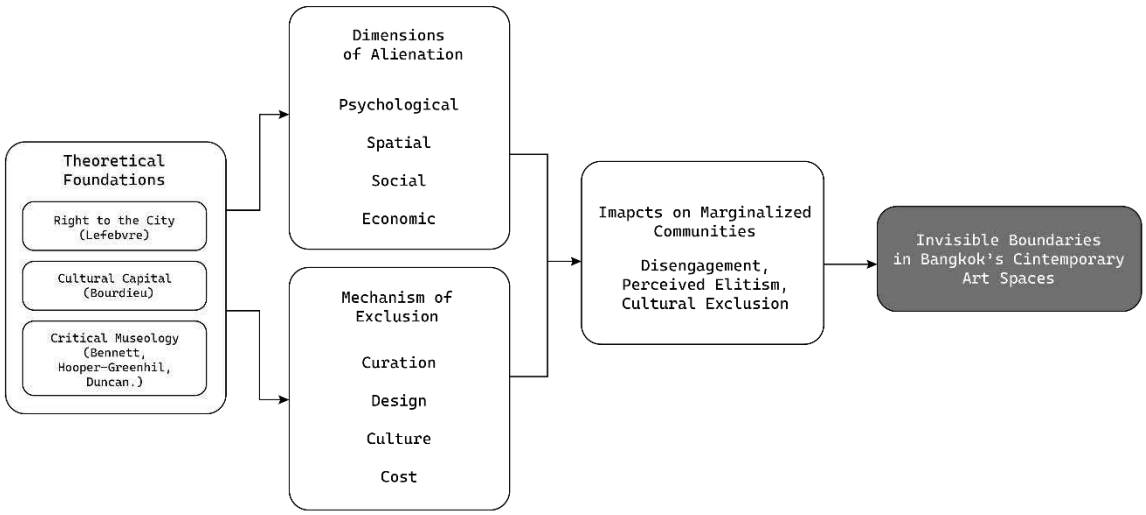

Figure 5. Theoretical framework diagram linking Lefebvre's Right to the City, Bourdieu's Cultural Capital, and Critical Museology to the analysis of Bangkok's contemporary art spaces.

This theoretical grounding, informed by grounded theory methodology, allows the study to identify two overarching forces that drive alienation in museum settings: dimensions and mechanisms. These two categories serve as the analytical pillars of the research. The dimensions of alienation describe the types of disconnection individuals feel—whether emotional, spatial, economic, or social. The mechanisms, however, refer to the operational forces within institutions that reinforce exclusion, such as design, curation, cost, and cultural norms. By focusing on these dual layers, the study is able to explain not only what kinds of alienation exist, but also how they are produced and maintained. Figure 6 maps the conceptual framework, linking mechanisms of exclusion with dimensions of alienation.

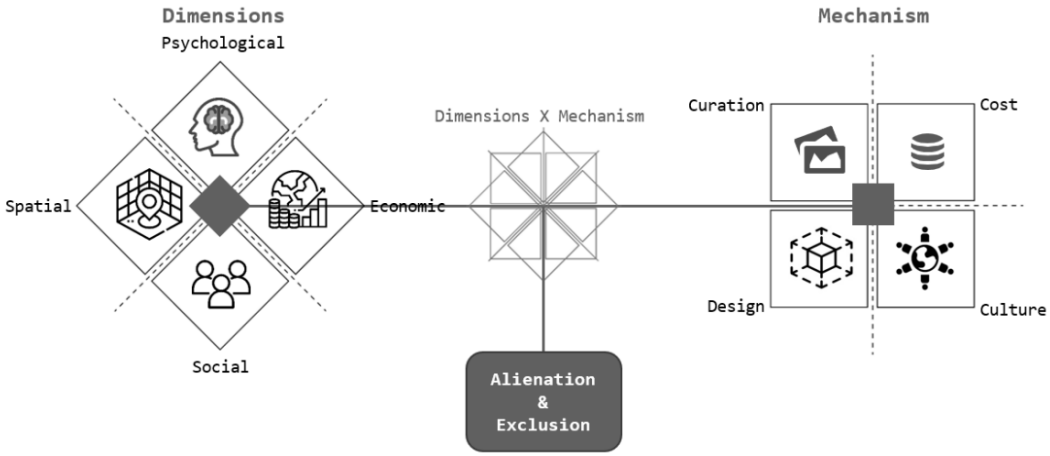

Figure 6. Conceptual framework diagram illustrating the intersection of mechanisms (curation, design, culture, cost) and dimensions (psychological, spatial, social, economic) that shape processes of alienation and exclusion in museum contexts.

By conceptualizing alienation in contemporary art museums through the intersection of two analytical axes—dimensions and mechanisms of exclusion—this study establishes a diagnostic matrix that shapes its research design, including interview construction, field observations, and thematic analysis. Informed by grounded theory and drawing on insights from critical museology, spatial theory, and Bourdieu's concept of cultural capital, the framework identifies four key dimensions of alienation: Psychological (feelings of non-belonging, internalized inadequacy, fear of judgment); Spatial (disorientation from formal design, layout, signage); Economic (barriers from entry fees, transport, and time); and Social (lack of cultural representation or perceived class-based exclusion).

These dimensions are not experienced in isolation but are continually reproduced through four institutional mechanisms: Curation (art selection and framing that privilege dominant cultural narratives); Design (architectural language and spatial organization that signal accessibility or distance); Cost (both visible and hidden financial burdens); and Culture (norms, language, and behaviors aligned with elite expectations). Together, this conceptual framework provides a critical tool for understanding how contemporary museums may inadvertently reinforce class-based exclusion and limit cultural participation.

3. Methods

This study adopts a critical ethnographic methodology as its overarching framework, allowing for an in-depth exploration of class-based alienation in contemporary art museums through lived experience and spatial-symbolic analysis. Under this umbrella, the research integrates two primary qualitative methods: semi-structured interviews and field observations, both of which are aligned with grounded theory and spatial ethnography traditions. At the analytical level, the study applies a hybrid thematic analysis approach—combining deductive (theory-informed) and inductive (data-driven) coding—to extract patterns across four key dimensions of alienation: psychological, spatial, economic, and socio-cultural. These findings are then examined through comparative case analysis to uncover contrasts

between Thai and Western institutions. As a final tactic, the study employs a diagnostic dimensions-mechanisms matrix, which maps exclusionary experiences against institutional forces such as curation, design, cost, and culture. This layered methodology—visualized in the accompanying diagram (Figure X)—ensures coherence between theoretical framing, empirical inquiry, and analytical interpretation, offering a robust and transferable model for cultural research in urban contexts.

This This study employs a qualitative comparative design, drawing on 16 in-depth, semi-structured interviews as the primary dataset. While the sample size is modest, it is not intended as a pilot; rather, it reflects the methodological orientation of qualitative inquiry that prioritizes depth over breadth (Baker & Edwards, 2012). The research investigates class-based alienation in contemporary art museums through the intersecting lenses of Right to the City, Cultural Capital, and Critical Museology. Four key dimensions of alienation—psychological, spatial, economic, and social—were identified as the conceptual criteria guiding both data collection and analysis.

Using a critical spatial ethnographic approach, interviews were conducted with 16 working-class participants (both visitors and non-visitors) across Bangkok, London, and Milan. Field observations at four case study sites—BACC, MOCA, Tate Modern, and Pirelli HangarBicocca—were undertaken to triangulate findings and contextualize narratives. Thematic analysis was then applied to synthesize the data and uncover patterns of exclusion and engagement across institutional settings.

Given the cross-cultural nature of the study, interviews were conducted in participants' native languages and translated into English by the author, a bilingual researcher familiar with all four cultural contexts. While this facilitated nuanced engagement, it also required critical awareness of potential cultural and linguistic bias. Researcher positionality—as an insider-outsider to different sites—was continuously reflected upon to mitigate interpretive distortion and uphold ethical sensitivity (Holstein & Gubrium, 2003; England, 1994). The methodological design of this research, from data collection to analysis, is visualized in Figure 7.

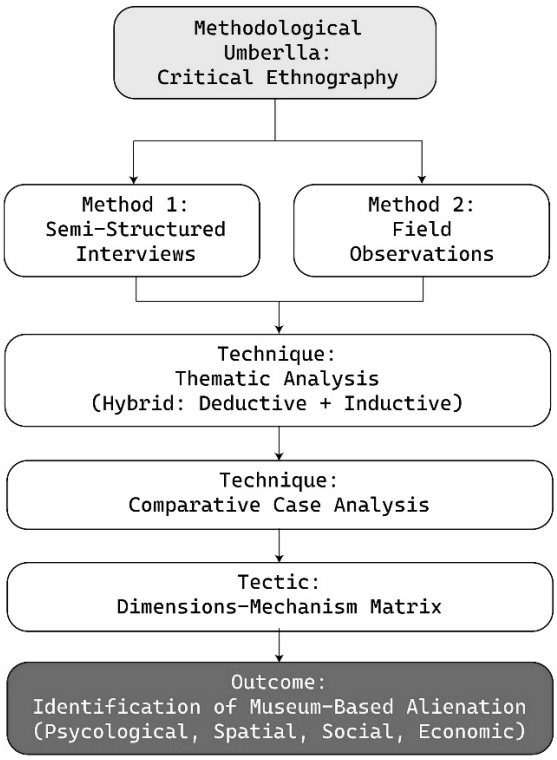

Figure 7. Research methodology diagram showing the sequence from data collection (semi-structured interviews and field observations) to analysis (thematic analysis, comparative case analysis, and dimensions–mechanism matrix) and final outcome.

3.1 Semi-Structure Interview

Semi-structured interview guides were developed in alignment with the four dimensions of alienation—psychological, spatial, economic, and social—to elicit open-ended responses while maintaining thematic consistency across all participant groups. Questions were tailored to reflect each museum's context and whether the participant had previously visited. With participant consent, audio recording equipment was used to ensure accurate capture of responses; recordings were subsequently transcribed and anonymized for analysis.

3.1.1 Guiding Criteria and Interview Design

This study employs qualitative methods, particularly semi-structured interviews, guided by four dimensions of museum-based alienation: psychological, spatial/physical, economic, and social. These dimensions were informed by literature from Bourdieu's theory of cultural capital, Lefebvre's right to the city, and visitor studies such as Falk & Dierking's contextual model of learning. The interview questions were developed to capture perceptions, experiences, and emotional responses of lower-income and working-class individuals interacting with contemporary art museums in Bangkok.

The table below maps sample interview questions to the four types of alienation and the relevant theoretical sources:

Table 1: Sample Interview Questions based on Alienation Types.

Alienation Types	Sample Interviews Question	Theoretical Source
Psychological	How do you feel when you are inside the museum?	Falk & Dierking (2013), Bourdieu (1984)
	Do you understand the art being shown? Why or why not?	
Spatial/Physical	Can you describe how easy or difficult it was to navigate the museum?	Knox (2010), O'Doherty (1999)
	What do you think about the design or layout of the museum space?	
Economic	Have you ever decided not to visit a museum because of cost or transportation?	Wolf (2024), Bourdieu (1984)
	How much do you think a museum visit cost (ticket, food, travel)?	
Social	Did you feel like you belonged in the museum space? Why or why not?	Knox (2010), Bourdieu (1984), Cultural Capital Theory
	Do you see yourself or your community represented in the exhibitions or the program there?	

3.1.2 Ethnographic Methodology and In-Depth Interviews

A critical ethnographic approach was adopted, integrating two primary methods: (1) in-depth interviews and (2) on-site observational studies. These methods enable a multidimensional analysis of how contemporary art institutions include or exclude specific social groups. Interviews provided insight into participants' lived experiences and perceptions of museum space, design, and institutional culture. Through questions focused on their interaction with these environments, the research critically explores how architectural form, economic structures, and curatorial narratives contribute to either the reinforcement or disruption of social stratification in urban settings.

3.1.3 Participants or Subjects

As an exploratory project, this study also serves as a pilot to evaluate the clarity and effectiveness of its interview framework. Pilot studies in qualitative research are essential for refining methodology, identifying obstacles, and validating data collection tools. Existing literature suggests that a sample of 3 to 6 participants is typically adequate for pilot studies (van Teijlingen & Hundley, 2001; Baker & Edwards, 2012). This research expands that range to include 16 participants across four distinct groups, allowing for both methodological refinement and comparative insight.

Although some pilot studies typically involve 3–6 participants (Van Teijlingen & Hundley, 2001), this research was not intended as a pilot but as a full comparative qualitative investigation. The sample size of 16 participants was deliberately selected to ensure a breadth of perspectives across three international case contexts—Bangkok, London, and Milan—while still allowing for the depth of analysis required in thematic inquiry. As Baker and Edwards (2012) argue, qualitative research values the richness of narrative over numerical scale, particularly when exploring complex, situated

experiences like cultural exclusion and spatial alienation. Therefore, the sample size was methodologically appropriate for the research aim and theoretical framework.

Participant Selection:

Participants were selected through purposive sampling based on occupation, income level, and proximity to contemporary art museums. The focus was on individuals whose socio-economic status placed them within marginalized or underserved urban communities.

1. The first group comprises Bangkok-based participants who have visited BACC or MOCA. They work in service or blue-collar sectors, earning around 15,000THB/month. MOCA visitors accessed the museum through group facilitation, while BACC visitors attended independently.
2. The second group includes Bangkok residents earning below 10,000THB/month, primarily employed in informal labor. Despite living within 5 km of either museum, none had previously visited.
3. The third group consists of low-income individuals in London and Milan who have visited Tate Modern or Pirelli HangarBicocca. Employed in part-time or entry-level roles, they live in working-class neighborhoods with accessible public transport.
4. The fourth group includes socio-economically similar individuals from London and Milan who, despite living nearby, have never visited these museums.

Each group consists of two participants, totalling 16 interviewees across all groups. Participants were chosen for their relevance to the study's core question: why do individuals living in close proximity to contemporary art institutions often remain disengaged from them?

3.1.4 Participants or Subjects

A purposive sampling strategy was used to ensure coverage of both visitor and non-visitor experiences within the same socio-economic category. This allowed for meaningful contrasts and a more holistic view of museum engagement and alienation across different cultural contexts.

3.1.5 Ethical Considerations

All participants provided informed consent and were made aware of their rights, including the right to withdraw at any time. Names and identifying details have been anonymized, and all data have been securely stored in accordance with ethical research guidelines.

3.2 Field observation on interview site

Field observations were conducted during site visits to the BACC, MOCA, Tate Modern, and Pirelli HangarBicocca. These notes captured spatial dynamics, visitor behavior, institutional messaging, and the overall atmosphere of each location, providing essential contextual support to the interview data. Observational studies focused on behavioral patterns and the perceived socio-economic status of visitors, as reflected in their movement and interactions within the museum spaces. In addition, spatial mapping was employed to document physical access routes, urban connectivity, and the broader socio-spatial environment surrounding each institution.

3.2.1 Sites Selection Criteria

Four case study sites were selected to investigate how spatial, economic, and cultural dynamics shape inclusion and exclusion in contemporary art institutions. In Bangkok, the BACC is centrally located and offers free admission, yet its formal design, limited signage, and institutional tone contribute to psychological and socio-cultural alienation. In contrast, the MOCA, situated on the city's periphery and operating under a fee-based model, reinforces exclusion through both financial barriers and symbolic distancing.

These two Thai institutions represent contrasting models—public and private—within the same urban setting, allowing for a grounded comparison of accessibility and alienation. Differences in location, governance, architectural language, and audience engagement provide a rich foundation for exploring class-based exclusion in Bangkok's art scene.

For international comparison, the study includes Tate Modern in London and Pirelli HangarBicocca in Milan. Both institutions are known for their inclusive programming, free admission, and use of post-industrial spaces to promote openness and community integration. Tate Modern engages diverse

audiences through educational outreach and civic programming, while Pirelli HangarBicocca fosters accessibility through immersive installations and local partnerships.

Together, these four institutions offer a cross-cultural framework for examining how design, policy, and institutional ethos either reinforce or mitigate alienation. Their selection enables a meaningful comparative analysis of how class-based exclusion is experienced and addressed across different cultural and spatial contexts.

3.3 From Conceptual Framework to Analytical Matrix

The conceptual framework shaped both the interview design and analytical approach, forming a matrix that intersects four dimensions of alienation—psychological, spatial, social, and economic—with four institutional mechanisms—curation, design, culture, and cost. These axes structured the interview guide and served as the coding framework for thematic analysis. By aligning field data with this matrix, the study systematically examined how exclusion is produced within contemporary art museums. This framework also enabled triangulation across interviews, spatial observations, and institutional practices, providing a coherent method for identifying recurring patterns of alienation and assessing institutional accessibility across all case study sites. The integration of the conceptual framework into the methodological matrix is presented in Figure 8.

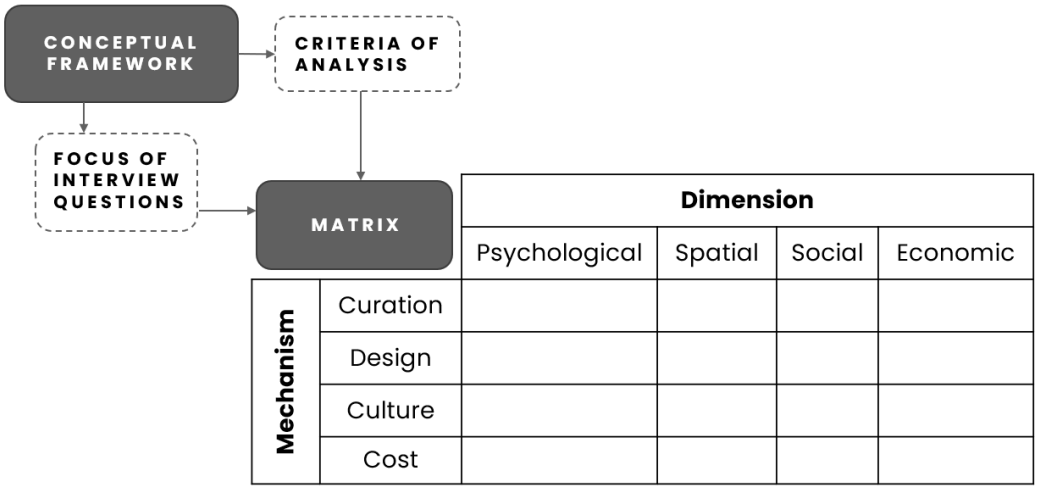

Figure 8. Framework-to-methodology matrix linking mechanisms (curation, design, culture, cost) with dimensions (psychological, spatial, social, economic) of exclusion.

3.4 Thematic Analysis

Interview data were thematically coded based on four dimensions of alienation: psychological, spatial, social, and economic. This process was supported by comparative discourse and spatial analysis to identify symbolic and material exclusion embedded in institutional design and narratives. Findings were triangulated across interview transcripts, field observations, and institutional documents to enhance validity. A hierarchy map was developed to assess the intensity and impact of each alienation type, resulting from comparing case studies that revealed cross-cultural differences in museum accessibility and class-based exclusion.

3.4.1 Thematic Coding Framework

A hybrid inductive-deductive approach was used in coding, allowing pre-existing theoretical categories to guide the process while also remaining responsive to participant-specific language and local nuances. Each main theme—aligned with one form of alienation—was broken down into recurring sub-themes and codes drawn directly from the data.

A. Psychological Alienation included themes such as spatial disorientation, intimidation by institutional architecture, emotional disconnect, and fear of being judged.
B. Socio-Cultural Alienation emerged as the most complex and multi-layered category. Sub-themes encompassed perceptions of elitism, lack of cultural representation, preference for traditional art, absence of relatable visitors or staff, and unfamiliarity with contemporary art.

C. Spatial Alienation focused on the physical design and placement of museums as sources of discomfort or exclusion. Common codes highlighted confusion with layout, architectural intimidation, or lack of visibility in community life.
D. Economic Alienation concerned both direct costs and opportunity. Sub-themes included perceived unaffordability, transport complexity, and class-based associations of museums as "luxury" destinations.

These codes were organized into detailed thematic analysis tables (Tables 2–5), each corresponding to one of the four participant groups. Responses were categorized by theme, sub-theme, and direct quotations from participants, allowing for an unfiltered presentation of lived experience. A visual summary (Figure 1) follows, showing the relative distribution of alienation types across all interviews.

4. Results

4.1 Presentation of Key Findings

Thematic analysis of interviews conducted at BACC and MOCA revealed clear patterns of exclusion among working-class participants. Socio-Cultural Alienation emerged as the most dominant theme, comprising nearly 50% of all coded responses. Participants consistently viewed contemporary art museums as elitist and culturally disconnected, often expressing that "I didn't see people like me" in these spaces. While Psychological, Spatial, and Economic forms of alienation were also evident, they frequently intersected with or were reinforced by broader socio-cultural exclusion. Overall, the findings suggest that the primary barriers to engagement in Bangkok's contemporary art institutions are symbolic rather than logistical—rooted in issues of class representation, cultural relevance, and institutional tone.

Table 2: Thematic Analysis: Visitors to BACC & MOCA.

Main Theme	Sub-Theme	Code	Excerpt	Interpretation
Psychological Alienation	Disorientation and fatigue in museum layout	Feeling lost in spatial layout	I don't even know what floor I am on at one point.	Complex interior design induces spatial confusion and discomfort, discouraging return visits.
	Intimidation by architecture	Overwhelmed by formal design	Too elite... intimidating... formal layout.	Museum scale and design language create a symbolic and emotional distance from visitors.
	Inability to understand contemporary art	Judging art by appearance only	I just know if it's pretty or not pretty.	Art appreciation is based on surface aesthetics, revealing lack of cultural capital to decode meaning.
Socio-Cultural Alienation	Preference for traditional Thai art	Familiarity with traditional forms	Understood traditional crafts, not contemporary works.	Familiar forms are more accessible, highlighting a disconnect between contemporary curation and local cultural knowledge.
	Perception that museums are not for 'people like them'	Perceived elitism	It's for trendy people / younger people.	Museums are perceived as spaces reserved for elites, reinforcing class-based symbolic boundaries.
	Lack of visible representation	Not seeing similar people	Didn't see anyone who looked like them.	Absence of demographic diversity contributes to discomfort and perceived exclusion.
	Attendance driven by others	Visiting due to social context	Went with friends or during a school trip.	Social and institutional contexts are key enablers; individuals rarely self-initiate visits.
	Willingness to engage with guidance	Desire for staff interaction	Would love for staff to explain things.	There is openness to engagement, but staff outreach is absent, reinforcing passive experience.
	Visiting as a 'luxury date'	Museums as prestige symbols	I want to take her somewhere nice.	Museums hold symbolic prestige, but are treated as occasional, not habitual, destinations.
Economic Alienation	Entrance fee as a deterrent	Cost barrier	Wouldn't go in if it cost 100 baht.	Even modest fees prevent attendance, especially without financial or social support.
	Transport and distance barriers	No confidence in navigating to museum.	Wouldn't go without someone taking them.	Lack of personal transportation and confidence in public travel limits access.
Spatial Alienation	Art judged by visual appeal	Surface-level engagement	A good place to take Instagram photos.	Engagement is surface-level, driven by aesthetics rather than conceptual understanding or cultural meaning.

Table 3: Thematic Analysis: Non-Visitors to BACC & MOCA.

Main Theme	Sub-Theme	Code	Excerpt	Interpretation
Psychological Alienation	Emotional disconnection and intimidation	Museums feel unwelcoming or irrelevant	It's not a place for people like me.	Participants feel intellectually and emotionally excluded, associating museums with elitism and discomfort.
	Fear of being judged or out of place	Anxiety about dress, language, and norms	Concerned they'd be silently judged.	Cultural codes and norms within museums contribute to a fear of being visibly 'othered'.
Socio-Cultural Alienation	Limited understanding or exposure to art	Confusion around purpose and content	Described museums as confusing or for art students.	Museums are perceived as intellectually distant and not aligned with everyday cultural experiences.
	Absence of cultural representation	No relatable role models or themes	Expected to see something fun, not abstract.	Lack of cultural alignment reinforces the perception that museums are not for their social group.
	Perceived class exclusivity	Only for the educated or upper class	People from my background don't go to museums.	Museums are seen as spaces for elite social classes, creating symbolic exclusion.
	No social facilitator	Need someone to accompany them	Would go if someone they trust invited them.	Social networks are essential for bridging symbolic and psychological distance to cultural institutions.
	Mismatch with expectations	Want fun or relatable exhibitions	Expected to see crafts or something interactive.	Audience expectations reflect a desire for tangible, entertaining, or culturally rooted content.
Economic Alienation	Associated costs and economic priorities	Time is money	Spend your time making a living	Even free museums are perceived as costly when factoring time, food, transport, and opportunity cost.
	Inaccessible locations and transport	Difficult to reach without private transport	Reaching locations is difficult without private transport.	Public transport is seen as too confusing or expensive, creating structural access barriers.
Spatial Alienation	Lack of outreach or community presence	No visibility in their communities	Suggested museums do outreach in their neighbourhoods.	Absence of visible engagement reinforces their perception of museums as distant or exclusive.

In contrast to the Thai case, participants in London and Milan—both visitors and non-visitors—reported a more balanced distribution of alienation across psychological, socio-cultural, spatial, and economic dimensions. These barriers were largely mitigated by inclusive spatial design, friendly staff, accessible curatorial language, and free entry. Among non-visitors, obstacles were described as soft—rooted in unfamiliarity or lack of habit rather than structural exclusion. Economic alienation was the least prominent theme, suggesting that cost barriers were effectively addressed through policy and infrastructure. Although contemporary art museums were not fully embedded in participants' daily routines, they were perceived as open and approachable rather than elitist or exclusionary.

Table 4: Thematic Analysis: Tate Modern & Pirelli HangarBicocca Visitors.

Main Theme	Sub-Theme	Code	Excerpt	Interpretation
Psychological Alienation	Emotional comfort and inclusivity	Art hits you regardless of background	Art is emotional, and it doesn't matter where you come from. If it hits you, it hits you.	Participants felt emotionally safe and welcomed, showing how inclusive design fosters psychological ease.
	Non-judgmental environment	No shame in not understanding	She never feels judged for not understanding.	Lack of intellectual gatekeeping encourages visitors of all backgrounds to engage without fear.
Socio-Cultural Alienation	Representation and diversity	Seeing people like oneself	Acknowledges seeing people from different age ranges, races, and social backgrounds.	Visibility of diverse audiences reduces social distance and affirms inclusion.
	Interactive and accessible content	Enjoyment without prior knowledge	You don't need to know anything to enjoy it.	Museums welcomed untrained viewers through experiential and accessible curation.
Spatial Alienation	Welcoming spatial design	Museum feels open and intuitive	Designed in a way that makes you feel like you're just allowed to be there.	Intentional spatial design fosters comfort and belonging rather than distance.
	Industrial reuse as familiar space	No 'temple of art' feeling	It doesn't feel elite. More like a warehouse that became a public place.	Industrial architecture evokes everyday familiarity, breaking the formality of traditional museums.
Economic Alienation	Free entry enables access	Wouldn't go if not free	She wouldn't have gone if she had to pay.	Free admission remains critical for lower-income participation.
	Centrally located and easy to reach	Proximity matters	Appreciates that it's free and centrally located.	Physical accessibility—via central locations—reduces barriers for economically disadvantaged visitors.

Table 5. Thematic Analysis: Tate Modern & HangarBicocca Non-Visitors.

Main Theme	Sub-Theme	Code	Excerpt	Interpretation
Psychological Alienation	Overwhelm and disorientation	Fear of getting bored or overwhelmed	Risk of getting bored if there's too much to see without clear guidance.	Lack of clear orientation and cognitive overload deter deeper engagement.
	Need for emotional connection	Wants someone to explain the art	Would feel more comfortable with someone explaining things to her.	Social learning and emotional reassurance are key to building comfort.
Socio-Cultural Alienation	Limited routine exposure	Not part of daily life	It's not my thing or not part of my routine.	Cultural institutions are seen as disconnected from everyday experience.
	Ambiguity about relevance	Doesn't know what to expect	Knows of the museum by name but has no idea where it is or what it's like.	Lack of familiarity prevents initiative and cultural connection.
	Desire for informal interpretation	Wants simple explanation of relevance	Just tell me what I'm looking at and why it matters.	Participants crave relatable storytelling over abstract or academic interpretation.
Spatial Alienation	Uncertainty about access	Poor transport links may deter visits	Poor public transport links could be discouraging.	Physical accessibility through public transit remains a concern.
	Design perceived as intimidating	Modern installations may feel overwhelming.	Modern buildings and large installations are interesting but potentially overwhelming.	Scale and unfamiliar architecture can produce discomfort despite curiosity.
Economic Alienation	Free entry as essential	Wouldn't pay to enter	Wouldn't pay to enter but would definitely go if it's free.	Cost remains a barrier, even if not prohibitive in theory.

4.2 Interpretation of Findings

4.2.1 BACC & MOCA

The percentage diagram below shows the distribution of the four main alienation themes across both BACC/MOCA's visitor and non-visitor interviews. Socio-cultural alienation dominates, highlighting how deeply class, representation, and social norms shape the museum experience. The thematic distribution of interview findings at BACC and MOCA is summarized in Figure 9.

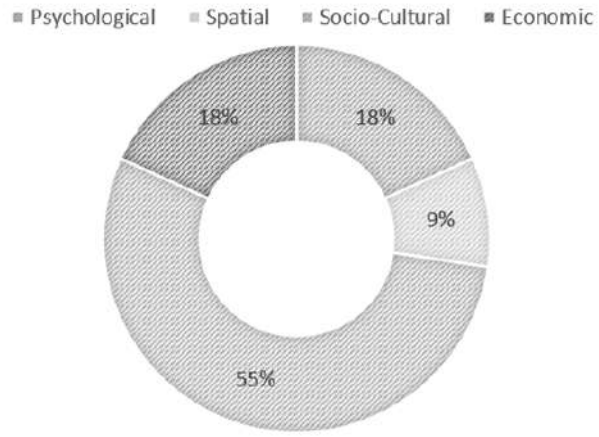

Figure 9. Distribution of thematic occurrences across interviews at BACC and MOCA, categorized by psychological, spatial, socio-cultural, and economic dimensions.

Psychological Alienation

Participants frequently reported emotional discomfort when navigating museum spaces. MOCA's imposing architecture and BACC's formal tone contributed to a sense of intimidation and disorientation. Many felt out of place or feared judgment, especially first-time or non-visiting participants. Visiting alone was rarely considered; instead, attendees often relied on accompaniment from someone more culturally familiar to reduce anxiety.

Socio-Cultural Alienation

Contemporary art was often perceived as confusing or irrelevant. Participants related more to traditional Thai art and crafts, evaluating works by visual appeal rather than meaning. Museums were seen as elite spaces, geared toward students or trend-conscious audiences. The lack of social representation—few visitors dressed or behaved like them—intensified feelings of exclusion. Attendance was generally facilitated by structured invitations (e.g., school trips), rather than individual motivation.

Spatial Alienation

Despite proximity to home or work, many were reluctant to visit BACC or MOCA independently. Wayfinding inside was confusing, and spatial layouts felt impersonal. Participants noted minimal community outreach, rarely encountering museum promotion in their neighbourhoods. Interior signage and design lacked accessibility, reinforcing the impression that these spaces were not intended for them.

Economic Alienation

Financial barriers—both actual and perceived—discouraged attendance. Even modest entry fees were seen as prohibitive, especially when combined with transport, food, or time away from work. For many, time itself was a financial resource, making museum visits feel impractical or indulgent. Cultural engagement was thus deprioritized in favour of economic necessity.

4.2.2 Tate Modern & Pirelli HangarBicocca

The percentage diagram below shows the distribution of thematic occurrences across Western case studies (Tate Modern & Pirelli HangarBicocca). As visualized, Socio-Cultural Alienation remains the most frequently referenced theme, reflecting the importance of familiarity, routine, and interpretation even in inclusive institutions. Figure 10 illustrates the distribution of thematic occurrences across interviews in the Western comparative cases.

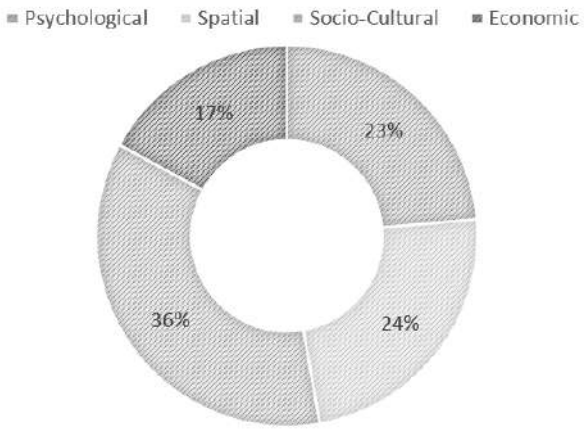

Figure 10. Distribution of thematic occurrences across interviews at Tate Modern and Pirelli HangarBicocca, categorized by psychological, spatial, socio-cultural, and economic dimensions.

Psychological Alienation

Visitors frequently described feeling emotionally at ease within both institutions. Even without fully understanding the art, they felt free to explore without fear of judgment. Non-visitors expressed hesitancy, largely due to unfamiliarity or lack of guidance, but this rarely translated into resistance. Their concerns reflected uncertainty rather than exclusion, and most were open to visiting with support or invitation.

Socio-Cultural Alienation

Inclusive spatial design, informal atmospheres, and visibly diverse audiences helped reduce socio-cultural alienation. Participants noted that these factors softened the museum's institutional tone and made them feel welcome. Non-visitors did not view the institutions as elitist but rather as disconnected from their routines. This suggests alienation stemmed more from cultural distance than perceived exclusion.

Spatial Alienation

The use of repurposed industrial architecture and intuitive layouts contributed to a sense of familiarity and spatial openness. These environments were seen as accessible and community-oriented. However, for non-visitors, unclear transport routes and the scale of the buildings remained obstacles, especially without prior exposure or contextual information.

Economic Alienation

Free entry and central or well-connected locations enhanced accessibility and carried symbolic importance. While cost was rarely a decisive barrier, participants noted that free admission signalled public openness. The absence of a financial threshold made museums feel more inviting and attainable, even for those who had not yet visited.

4.3 Contrasts and Convergences

While socio-cultural alienation emerged as a dominant theme in the Thai context, responses from participants in London and Milan revealed a more complex and varied landscape of exclusion. In these European settings, alienation was often articulated in terms of economic barriers, institutional elitism, or curatorial disengagement—rather than cultural illiteracy alone. Although spatial and psychological discomfort still played a role, many participants demonstrated higher baseline familiarity with museum environments, likely reflecting broader access to arts education and public cultural infrastructure. This section explores these patterns, drawing attention to the ways in which class-based exclusion manifests differently across urban and cultural regimes.

The predominance of socio-cultural alienation in Thai participants' responses can be read through Bourdieu's concept of cultural capital, which frames cultural literacy and symbolic competence as class-mediated assets (Bourdieu, 1984). Lacking these, working-class individuals often experience disorientation or unworthiness in cultural institutions. Simultaneously, this alienation reveals the failure of Thai urban cultural infrastructure to realize Lefebvre's "right to the city", where access to symbolic spaces like museums should be a shared, lived right—not a privilege reserved for the socio-culturally fluent (Lefebvre, 1996). In this context, exclusion from museums reflects deeper structural inequality embedded in the spatial and cultural logic of the city itself.

5. Comparative Analysis: Thai vs. Western Art Museums

Drawing on four key dimensions of exclusion—socio-cultural, psychological, spatial, and economic—the findings illustrate how alienation is experienced differently in the Bangkok-based institutions (BACC and MOCA) compared to their Western counterparts (Tate Modern in London and Pirelli HangarBicocca in Milan). While all four forms of alienation were identified in both contexts, their distribution, intensity, and institutional responses varied significantly. A comparative synthesis between Thai and Western cases is provided in Figure 11, showing differences across psychological, spatial, socio-cultural, and economic dimensions.

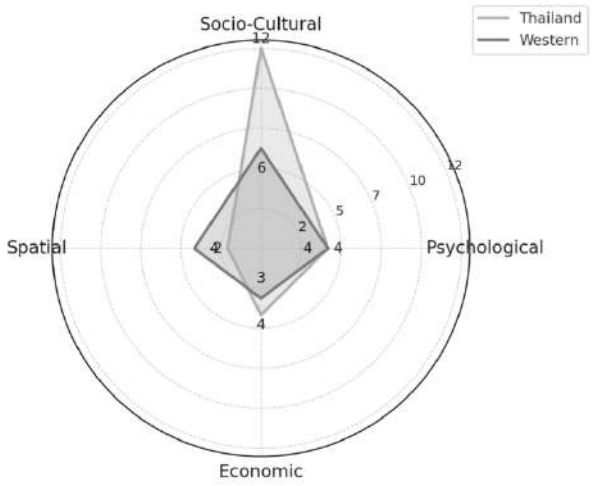

Figure 11. Comparative distribution of thematic occurrences across interviews in Thailand (BACC, MOCA) and Western cases (Tate Modern, Pirelli HangarBicocca), categorized by psychological, spatial, socio-cultural, and economic dimensions.

To summarize the chart data:

1. In the Thai case, there were 4 occurrences of psychological alienation, 12 of socio-cultural, 2 of spatial, and 4 of economic.
2. In the Western case, there were 4 psychological, 6 socio-cultural, 4 spatial, and 3 economic.

The data indicates that socio-cultural alienation is the most dominant exclusionary factor in the Thai context. Thai participants frequently described museums as elitist, disconnected from everyday life, and lacking in cultural relatability. In contrast, Western participants also acknowledged a cultural distance, but often mitigated by inclusive programming, participatory events, and diverse audience representation.

Psychological alienation was reported equally across both contexts. In Thailand, it was closely tied to the formal tone of institutions, intimidating architecture, and participants' fear of judgment or "being a burden" when asking for help. Western participants, in contrast, associated psychological discomfort more with uncertainty or unfamiliarity rather than exclusion. Friendly staff, informal design, and

welcoming atmospheres in Tate Modern and Pirelli HangarBicocca fostered emotional ease and reduced barriers to engagement.

Spatial alienation was more frequently mentioned in the West than in Thailand, though its character varied. Thai participants reported confusion due to BACC's spiraling design and MOCA's imposing architecture, both of which symbolized exclusivity. In contrast, Western institutions mitigated spatial alienation through adaptive reuse of industrial buildings and intuitive layouts. Although some non-visitors still cited difficulty navigating unfamiliar areas, the interior experience was largely seen as accessible and open, underlining how architectural form and signage shape spatial belonging.

Economic alienation was more deeply felt in Thailand compared to Western cases. Thai participants expressed high concerns about both direct and indirect costs. Even free-entry spaces like BACC were seen as financially inaccessible when considering opportunity costs. Western participants, while still acknowledging cost, framed free admission more as a symbolic gesture of openness than a financial necessity, revealing a class-based disparity, where financial access remains structurally constrained in Thailand.

Overall, the findings underscore a sharper divide in Thailand, where socio-cultural alienation is the most frequently cited and deeply felt form of exclusion. Psychological-spatial-economic barriers were also present but compounded by class-coded norms and limited institutional outreach. In contrast, Western institutions demonstrated greater success in softening alienation through thoughtful design, inclusive tone, and symbolic gestures of accessibility. While non-visitors in the West cited unfamiliarity or habit as reasons for non-attendance, these were not framed as structural barriers.

While this study draws from a relatively small and context-specific dataset, it aims for analytical generalizability rather than statistical representativeness. The choice of case study sites—BACC and MOCA in Bangkok, and Tate Modern and Pirelli HangarBicocca in Europe—was designed to reflect contrasting institutional models (public vs private, Southeast Asian vs Western), offering comparative insight into how exclusion mechanisms operate across spatial and cultural contexts. The triangulated qualitative data, grounded in thematic saturation across four alienation dimensions and four institutional mechanisms, supports a conceptual model that is transferable to other museum contexts with similar urban conditions. Rather than claiming universal application, the findings offer a diagnostic framework that can be adapted by cultural institutions, planners, and policy makers concerned with equity and inclusion in urban cultural infrastructure.

In conclusion, this comparative analysis highlights that while exclusionary dynamics exist globally, their intensity and form vary. Thai institutions reinforce class-based alienation through spatial formalism, curatorial language, and symbolic codes, whereas Western counterparts actively mitigate such barriers through cultural signalling and inclusive engagement. Addressing exclusion in museums thus requires more than physical access—it demands institutional reflexivity in shaping narratives, spaces, and expectations that affirm cultural legitimacy for all.

6. Conclusion

This study demonstrates how contemporary art museums can serve both as sites of civic engagement and symbolic exclusion, depending on how their spatial, curatorial, and cultural codes align—or misalign—with the lived realities of working-class publics. Across all case studies, socio-cultural alienation emerged as a pervasive force, particularly in Thailand, where spatial discomfort and symbolic dissonance were most pronounced. By contrast, participants in London and Milan framed exclusion in more institutional and economic terms, underscoring how class-based alienation takes context-specific forms.

These findings suggest that inclusive museology must extend beyond physical accessibility to include emotional, linguistic, and curatorial dimensions. Museums can foster greater cultural equity by adopting more participatory design processes, co-curation models, and "slow" spatial strategies that reduce psychological and symbolic barriers (Hall, 2023; Wolf, 2024). Institutions should also reconsider the semiotic weight of their design choices, from layout to language, to ensure that cultural capital is not a prerequisite for participation. By linking museum exclusion to socio-economic

inequality, this study reveals how cultural participation must be understood as integral to the economic dimensions of urbanization. Inclusive cultural policies are therefore not only symbolic but materially significant for reducing urban socio-economic divides.

While the study offers comparative insight across three global cities, its qualitative scope and modest sample size limit the generalizability of its findings. Translation and researcher positionality, though reflexively addressed, remain interpretive filters that shape the data. Future studies could expand the dataset across more cities, incorporate institutional perspectives, or adopt longitudinal approaches to examine how inclusion efforts evolve over time.

6.1 Implications of Findings: Guidelines for Inclusive Art Museums

Creating truly inclusive art museums requires more than just removing entry fees—it demands a rethinking of how emotional, cultural, spatial, and economic barriers shape access for working-class communities. Based on findings from this research, the following guidelines offer practical strategies for institutions aiming to dismantle invisible boundaries and cultivate belonging.

1. **Embrace Emotional-Psychological Accessibility**
   Art museums should prioritize emotional-psychological comfort, especially for first-time/working-class visitors who may feel intimidated by formal institutional settings. Rather than adopting monumental or sterile aesthetics, design strategies can incorporate culturally familiar elements—such as warm materials or traditional Thai architectural motifs—to promote a sense of belonging. Staff should receive training to proactively offer approachable, non-intrusive support, while curatorial language and signage should emphasize that personal, intuitive responses to art are valid.
2. **Bridge Socio-Cultural Divides**
   To reduce socio-cultural alienation, museums should reflect the lived experiences of communities by including exhibitions on labor, migration, and vernacular aesthetics. Collaborative curatorial practices—such as community advisory panels or co-curated exhibitions—can democratize institutional narratives and elevate underrepresented voices. Additionally, using multilingual, informal language in labels, guides, and programs can dismantle barriers created by academic or elite discourse, fostering a more inclusive and culturally resonant museum experience.
3. **Democratize Spatial Design**
   Inclusive spatial design enhances comfort and orientation for all visitors. Museums should prioritize intuitive layouts, clear signage, and accessible entry points. Repurposing familiar structures—like markets or warehouses—can reduce the formality often associated with traditional museum spaces. Incorporating resting areas and communal zones further supports informal exploration, especially for visitors unfamiliar with conventional gallery environments.
4. **Eliminate Economic Barriers**
   Economic exclusion extends beyond admission fees to include transport, food, and lost time. Museums should adopt free or sliding-scale entry models—especially during weekends and holidays—and collaborate with transit providers to reduce logistical costs.
5. **Build Trust Through Presence and Outreach**
   True inclusive access begins with proactive engagement. Museums should extend their presence into working-class neighborhoods through mobile programs, pop-up exhibitions, and sustained community events. Partnerships with schools, unions, and local groups ensure programming remains relevant and grounded. Employing staff from diverse socio-economic backgrounds further enhances relatability and long-term trust.
6. **Rethink What Counts as Cultural Participation**
   Museums must broaden their cultural definitions to recognize everyday practices—such as cooking, crafts, street art, and storytelling—as legitimate forms of creative expression. Hybrid programming that blends exhibitions with food fairs, performances, or casual gatherings fosters inclusivity. This reframes the museum as a public space for daily life, not an elite venue reserved for the culturally initiated.

6.2 Summary of Research

This discussion returns to the central aim of the study: to investigate how contemporary art museums in Thailand contribute to class-based exclusion and to propose a framework for inclusive cultural infrastructure. Grounded in the hypothesis that institutional design, curatorial language, and socio-cultural codes function as mechanisms of exclusion, the findings confirm that psychological, spatial, economic, and socio-cultural alienation are systematically produced—even in ostensibly public spaces. The study's critical ethnographic methodology proved highly effective in revealing these dynamics. By triangulating semi-structured interviews with field observation and thematic analysis, and mapping insights through the dimensions-mechanisms matrix, the research was able to move beyond surface-level barriers and uncover the symbolic and relational forces that define museum accessibility. This methodological approach not only captured lived experiences but also exposed the institutional logics behind exclusion—thereby validating the conceptual model and supporting the study's original hypothesis.

While this study does not employ statistical testing in the conventional quantitative sense, the research design ensures internal validity through qualitative rigor. By triangulating semi-structured interviews, critical field observation, and a dimension-mechanism coding matrix, the study systematically identifies recurring patterns of exclusion across contexts. The use of thematic analysis, supported by a clear coding framework and comparative case analysis, enhances the trustworthiness of the findings. This approach is appropriate for the study's exploratory and interpretive goals, which seek to understand lived experiences of cultural alienation rather than measure causal relationships.

This research examined how contemporary art museums in Bangkok—namely the BACC and the MOCA—can inadvertently perpetuate exclusion among working-class communities. Using grounded theory and an interdisciplinary framework that integrates Lefebvre's Right to the City, Bourdieu's concept of cultural capital, and insights from critical museology, the study identified four dimensions of alienation: socio-cultural, psychological, spatial, and economic.

Findings from interviews and comparative case studies with Tate Modern and Pirelli HangarBicocca revealed that exclusion in Thai institutions stems less from cost or location and more from institutional tone, formal spatial design, and limited cultural representation. While similar barriers exist globally, Western museums have adopted more inclusive approaches—such as community programming, informal spatial design, and accessible curatorial practices—that help mitigate alienation.

As museums across the world reckon with calls for inclusion, this study contributes to a growing body of scholarship that foregrounds the voices of those most often excluded—and reminds us that the right to culture, like the right to the city, must be actively designed for and defended. Museums must do more than open their doors—they must dismantle the invisible boundaries that signal who belongs. This study offers a conceptual framework for diagnosing exclusion and proposes actionable strategies for fostering inclusive, civic-centered cultural spaces. Rather than placing blame, it calls for a reimagining of public culture that affirms the rights of all citizens to access and contribute to urban cultural life.

6.3 Significance of Findings

Class-based alienation remains a largely overlooked factor in Thai museology, particularly in relation to working-class access to contemporary art institutions. Instead of solely focusing on geographic or educational limitations, this research foregrounds symbolic and structural exclusions that inhibit participation in cultural life.

Echoing Duncan's (1995) and Bourdieu's (1984) critiques, the findings reveal how spatial design, institutional tone, and curatorial practices can reinforce social hierarchies. Evidence from BACC and MOCA illustrates that even centrally located, nominally public spaces can feel exclusionary due to formal aesthetics, minimal staff interaction, and culturally unrelatable content.

Grounded in Lefebvre's (1996) Right to the City and Bourdieu's (1984) concept of cultural capital, the research connects theory to lived experience, showing how class habitus and spatial access shape

cultural participation. Comparative insights from Tate Modern and Pirelli HangarBicocca offer practical models for fostering psychological ease, spatial familiarity, and symbolic openness.

By contextualizing global discussions on inclusion within Thailand's urban reality, the research contributes to critical museology and spatial justice. It affirms that museum accessibility involves more than removing physical barriers—it is a matter of civic equity and cultural democracy (Fraser, 2006; Fainstein, 2010; UNESCO, 2018; UN-Habitat, 2020).

The paper contributes to socio-economic analyses of urbanization by framing cultural exclusion as both a product and a driver of class inequality, thereby linking cultural policy to broader debates on economic justice in cities. Ultimately, the study positions museums as critical arenas in which struggles over cultural capital and access to the city are negotiated. By foregrounding these dynamics, the paper directly contributes to scholarly and policy debates on the socio-economic dimensions of contemporary urbanization.

6.4 Recommendations for Future Research

While this study offers a grounded, comparative exploration of class-based exclusion in contemporary art museums, it is limited by its qualitative scope and small sample size. Future research could expand the dataset across multiple cities or include quantitative visitor analytics to complement lived-experience narratives. Additionally, longitudinal studies tracking the impact of inclusive spatial or curatorial interventions would help validate the diagnostic framework proposed here. There is also a need for further inquiry into how intersectional identities—such as gender, ethnicity, or neurodivergence—interact with spatial and symbolic exclusion in cultural institutions across Southeast Asia. By addressing these dimensions, future studies can deepen our understanding of cultural participation as a multifaceted right to the city.

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Conflicts of Interest

The Authors declare that there is no conflict of interest.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Institutional Review Board Statement

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References

Baker, S. E., & Edwards. (2012, 26 March). *How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research* (Methods Review paper). National Centre for Research Methods, Southampton, UK.

Bennett, T. (1995). *The birth of the museum: History, theory, politics.* Routledge.

Bourdieu, P. (1984). *Distinction: A Social Critique of the Judgement of Taste*. Harvard University Press.

Bourdieu, P. (1990). *The Logic of Practice*. Stanford University Press. https://doi.org/10.1515/9781503621749

Cai, Y. (Ed.). (2025). *The Museum in Asia*. Routledge. https://doi.org/10.4324/9780367815264

Chirapravati, P. (2005). *Votive tablets and the Thai religious imagination*. *Siam Society Journal*, 93(1), 1–22.

Clark, J., & Kitiarsa, P. (2010). *Thai visual culture: The art of Silpa Bhirasri and modern Thai identity*. In *Modern and Contemporary Southeast Asian Art* (pp. 189–203). Cornell Southeast Asia Program.

Clarke, D. (2013). *Art and Place: Site-Specific Art of the Americas*. Phaidon Press.

Duncan, C. (1995). *Civilizing rituals: Inside public art museums*. Routledge.

England, K. V. L. (1994). Getting personal: Reflexivity, positionality, and feminist research. *The Professional Geographer, 46*(1), 80–89. https://doi.org/10.1111/j.0033-0124.1994.00080.x

Evans, S., & Whiting, R. (2024). Everyday constructions of class-based inequality: Field effects in UK museum work. *Sociology*. Advance online publication. https://doi.org/10.1177/00380385241289729

Fainstein, S. S. (2010). *The Just City*. Cornell University Press.

Falk, J. H., & Dierking, L. D. (2013). *The Museum Experience Revisited*. Left Coast Press.

Fraser, A. (2006). From the critique of institutions to an institution of critique. In J. Raunig & G. Ray (Eds.), *Art and Contemporary Critical Practice: Reinventing Institutional Critique* (pp. 123–135). MayFlyBooks.

Galluccio, C., & Giambona, F. (2024). Cultural heritage and economic development: Measuring sustainability over time. *Socio-Economic Planning Sciences, 95,* Article 101998. https://doi.org/10.1016/j.seps.2024.101998

González-Herrera, A. I., Díaz-Herrera, A. B., Hernández-Dionis, P., & Pérez-Jorge, D. (2023). Educational and accessible museums and cultural spaces: systematic review. *Humanities and Social Sciences Communications, 10*(1), 67. https://doi.org/10.1057/s41599-023-01563-8

Hall, J. (2023). Sensation and contemplation: A slow approach to designing inclusive museum experiences. In S. Holmlid, V. Rodrigues, C. Westin, P. G. Krogh, M. Mäkelä, D. Svanaes, & Å. Wikberg-Nilsson (Eds.), *Nordes 2023: This space intentionally left blank* (Nordic Design Research Society Conference Proceedings, exploratory papers). Linköping University, Sweden. https://doi.org/10.21606/nordes.2023.38

Huang, H.-Y., & Liem, C. C. S. (2022). Social inclusion in curated contexts: Insights from museum practices. *Information Processing & Management, 59*(6), 103116. https://doi.org/10.1016/j.ipm.2022.103116

Hooper-Greenhill, E. (2000). *Museums and the interpretation of visual culture*. Routledge.

Holstein, J. A., & Gubrium, J. F. (2003). *Inside interviewing: New lenses, new concerns*. SAGE Publications. https://doi.org/10.4135/9781412984492.n1

Iervolino, S., & Sergi, D. (2023). We Need to Talk about Class: Towards a class-based approach in contemporary museum theory and practice. *Museum Worlds: Advances in Research, 11*(1), 51–63. https://doi.org/10.3167/armw.2023.110105

Kolbe, K. (2024). The art of (self)legitimization: How private museums help their cities prosper. *Socio-Economic Review, 22*(3), 1119–1140. https://doi.org/10.1093/ser/mwad051

Knox, P., & Pinch, S. (2010). Urban social geography: An introduction (6th ed.). *Routledge*. https://doi.org/10.4324/9781315847238

Lefebvre, H. (1996). *Writings on cities* (E. Kofman & E. Lebas, Trans.). Blackwell.

Le Mare, L., & Holden, C. (2021). Barriers to access and the value of museums: Social inclusion and the public good. *Museum Management and Curatorship, 36(3)*, 234–252. https://doi.org/10.1080/09647775.2020.1803116

Lind, M. (2004). Actualisation of space: The case of Oda Projesi. In N. Heinich & M. Pollak (Eds.), *Curating architecture and the politics of display* (pp. 1–8). Rivers Oram Press.

Medaković, D. (2024). Spatial organization and circulation patterns in exhibition design. *Buildings, 14*(7), 2147. https://doi.org/10.3390/buildings14072147

O'Doherty, B. (1999). *Inside the White Cube: The Ideology of the Gallery Space*. University of California Press.

Prior, N. (2005). A question of perception: Bourdieu, art and the postmodern. *The British Journal of Sociology, 56*(1), 123–139. https://doi.org/10.1111/j.1468-4446.2005.00050.x

Raicovich, L. (2021). *Culture Strike: Art and Museums in an Age of Protest*. Verso Books.

Sandell, R., & Nightingale, E. (2022). *Museums, moralities and human rights: Towards a renewed understanding of museum practice.* Routledge. https://doi.org/10.4324/9781315312095

Sasitharan, T. (2023). Performing public: Cultural democracy and access in Southeast Asia. *Asian Theatre Journal, 40*(1), 45–67. https://doi.org/10.1353/atj.2023.0003

UNESCO. (2018). *HLPF 2018—SDG 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.* United Nations Educational, Scientific and Cultural Organization.

UNESCO. (2022). *Culture: A driver and an enabler of sustainable development*. United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000381754

UN-Habitat. (2020). *World cities report 2020: The value of sustainable urbanization.* United Nations Human Settlements Programme.

Van Teijlingen, E. R., & Hundley, V. (2002). The importance of pilot studies. Nursing Standard, 16(40), 33–36. https://doi.org/10.7748/ns2002.06.16.40.33.c3214

Wang, X., Yang, M., Li, W., Yuan, L., Ren, Q., Xie, Q., & Liu, R. (2025). *Natural movement: Measuring optimal pathway configuration of museum layout and pedestrian accessibility through visibility graph analysis and intelligent agent simulation*. *Frontiers of Architectural Research*, *14*(5), 1228–1248. https://doi.org/10.1016/j.foar.2025.03.001

Wolf, M. (2024, 26 April). *Extending the invitation: Strategies for welcoming visitors and reducing barriers to access*. American Alliance of Museums. https://www.aam-us.org/2024/04/26/extending-the-invitation-strategies-for-welcoming-visitors-and-reducing-barriers-to-access/

Yu, J., Liu, L., Ban, Y., & Zhang, Q. (2024). Evaluating urban development and socio-economic disparity in India through nighttime light data. *Journal of Geographical Sciences, 34*(12), 2440–2456. https://doi.org/10.1007/s11442-024-2299-7

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Superblock Urbanism in Dhaka as a Sustainable Redevelopment Strategy for Tejgaon Industrial Area

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ABSTRACT

Dhaka's rapid urbanisation has intensified challenges of fragmented land use, congestion, and environmental decline, particularly in the Tejgaon Industrial Area (TIA), once designated for light industry but now marked by unregulated mixed-use growth. This study examines the superblock model as a sustainable redevelopment framework for TIA, aiming to integrate density management, mobility, and environmental resilience. A mixed-methods approach combined GIS-based spatial analysis, traffic observations, policy review of the Detailed Area Plan (2022–2035) and Building Construction Rules (2008), and participatory design workshops. Insights from 151 residents, workers, and students informed scenario testing across three models: plot-based, block-based, and superblock development. Findings show that superblocks reduce congestion by diverting traffic to peripheral roads, enhance permeability with 44% more permeable surfaces compared to block-based schemes, and allocate nearly 50% of land for open and public spaces. These outcomes highlight the potential of superblock urbanism to support Sustainable Development Goals (SDGs 3, 11, 13, and 15), improving walkability, public health, and climate resilience. The study concludes that superblocks provide a scalable planning strategy for Dhaka's transformation and for other fast-growing urban contexts.

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Highlights:

- Superblock design cut traffic congestion by 82%, confirming mobility gains in Dhaka's sustainable redevelopment.
- Permeable surfaces in superblocks increased by 44%, boosting climate-resilient urban planning.
- Mixed-use zoning improved safety and vibrancy, reducing 47% of night-time insecurity in Tejgaon.
- MRT-linked superblocks raised transit use, with 60% preferring walkable, transit-oriented development.

Contribution to the field statement:

This study extends existing literature by integrating equity-focused frameworks with empirical findings, offering both theoretical insight and practical strategies for inclusive urban design and planning. The work bridges disciplinary gaps and introduces actionable knowledge.

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1.Introduction

Dhaka, the capital of Bangladesh, ranks among the world's most densely populated megacities and continues to experience rapid urban sprawl. Its urban morphology has evolved over more than four centuries, shaped by intersecting drivers such as economic transformations, demographic expansion, spatial dynamics, and political shifts. Collectively, these factors have influenced policies governing

Dhaka's development and underscore the city's complex planning history (Roy et al., 2018). The current pressures are visible in fragmented land use, speculative development, and the widening mismatch between population density and infrastructure provision, challenges that are particularly acute in areas like the Tejgaon Industrial Area (TIA).

Historically, Dhaka's planning trajectory reflects successive periods of intervention and neglect. During its colonial foundations (1608–1947), Dhaka was established as the capital of Bengal (1608–1707) and gained municipal status in 1864. British colonial authorities invested in administrative infrastructure, while systematic planning began with Sir Patrick Geddes' *Dacca Town Planning Report* of 1917. Although this report laid important conceptual foundations, it was never fully implemented, leaving Dhaka to grow organically until independence in 1947 (Roy et al., 2018; Jahan, 1990).

After the partition of India in 1947, Dhaka became the provincial capital of East Pakistan, prompting new institutional frameworks and statutory plans. The Dhaka Improvement Trust (DIT) was established in 1956—later renamed Rajdhani Unnayan Kartripakkha (RAJUK) in 1987—modelled after the Calcutta Improvement Trust (Roy et al., 2018). The British-prepared 1959 Master Plan, for example, sought to organise arterial roads, railway networks, and zoning systems to guide growth over two decades (Ahmed, 2018). Specific areas such as Tejgaon Industrial Area (industrial), Segunbagica (residential), and New Paltan (commercial) were demarcated under the Ministry of Public Works. However, weak enforcement led to unregulated growth, haphazard mixed-use development, and long-term infrastructure deficits.

Today, Dhaka is undergoing a paradigm shift in its urban development trajectory. Expansion is increasingly characterised by new road networks, planned neighbourhoods, and transit-oriented development (TOD), marking a departure from rigid and outdated zoning models. The transformation of TIA epitomises this shift: once envisioned as a hub for light industries, the area has degenerated into an unplanned and congested commercial zone after the relocation of industries to the city's periphery (Hossain, 2020). Although its reclassification in 2015 as a mixed industrial-commercial-residential zone was intended to stimulate regeneration, TIA now suffers from spatial inefficiency, environmental degradation, and a lack of cohesive planning. Figure 1 illustrates the historical spatial growth of Tejgaon, highlighting the pressures of unregulated urbanisation.

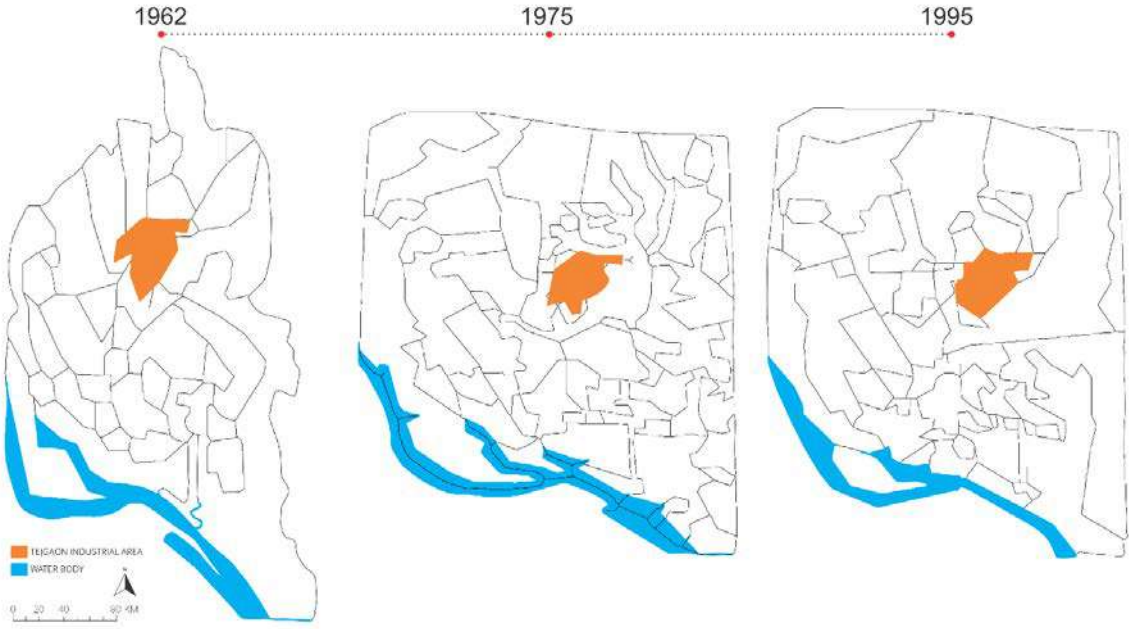

Figure 1. Tejgaon development Process.

Against this backdrop, Dhaka's planning discourse has increasingly turned to innovative frameworks that might reconcile density with liveability. Policy initiatives such as the Dhaka Structure Plan (2016–2035) and the Detailed Area Plan (DAP 2022–2035) highlight the need for block-based development

as an alternative to plot-based growth. These planning efforts are aligned with global discourses that emphasise density optimisation, sustainable land use, and integrated infrastructure systems. Within this framework, the concept of the *superblock*—derived from Barcelona's urban restructuring and adapted across other global contexts—has emerged as a promising model for Dhaka. The superblock approach restructures conventional street grids into larger blocks that reduce through-traffic, create pedestrian-friendly environments, and integrate green and public spaces. Empirical evidence from European cities demonstrates that reorganising streets into superblocks can reclaim between 15% and 25% of urban land for public use, with significant benefits for environmental quality and community well-being (Laurence, 2006).

The theoretical underpinnings of this study are rooted in multiple strands of urban thought. Henri Lefebvre's notion of the "Right to the City" frames urban space as a collective resource that must be democratised to support social equity (King, 2019). Manuel Castells' theory of the network society provides further insights into how globalisation and information flows reconfigure urban space (Castells, 2023). Meanwhile, modernist paradigms represented by Le Corbusier and the human-scale urbanism of Jane Jacobs reveal the tensions between technocratic planning and community-driven design (Laurence, 2006). These frameworks collectively inform the application of superblocks as both a spatial and socio-political instrument for urban transformation in Dhaka.

The Tejgaon Industrial Area is central to this analysis. Originally designated in the 1950s as an industrial hub by the Department of Public Works and later formalised as a light industrial zone in 1968 by the Dhaka Improvement Trust, TIA has gradually transformed into a fragmented mixed-use landscape (Hossain, 2020). This reflects not only the rapid urbanisation of surrounding districts but also the strategic centrality of TIA between Dhaka's historic core and newer residential extensions. The government's ambition to redevelop TIA is consistent with global trends in repurposing former industrial districts to create more liveable, economically vibrant, and socially integrated urban environments (Bredikhina et al., 2023; Pichkalova, 2022). Figure 2 illustrates the proposed land-use reconfiguration for Tejgaon under the DAP (2022–2035), highlighting its intended transformation into a mixed-use commercial and residential area.

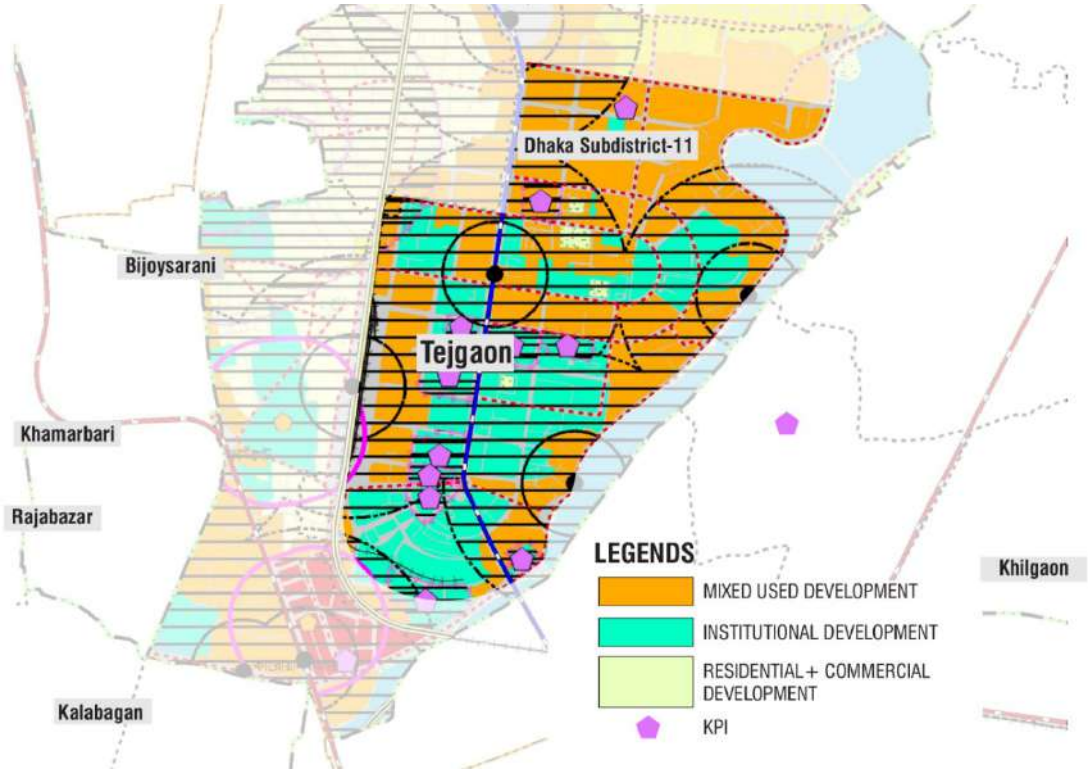

Figure 2. Detail Area Plan proposed Tejgaon Land Use Plan.
Note: GIS Map from DAP-2022-35 (RAJUK, 2022)

A critical gap persists in understanding how such transitions affect commercial activity, land value, spatial connectivity, and socio-economic conditions in TIA. Current approaches often adopt piecemeal land-use changes that fail to address the systemic challenges of fragmented ownership patterns, congestion, and social disparities. Scholars note that land inheritance and subdivision through succession in Dhaka complicate the consolidation of sufficiently large parcels for cohesive block-based redevelopment (Tanvir, 2025). Consequently, without integrated frameworks, redevelopment risks deepening inequalities and failing to achieve sustainable outcomes.

The present study addresses this research gap by examining the feasibility of the superblock model in TIA through a mixed-methods approach, combining GIS-based spatial analysis, traffic simulations, participatory design, and policy review. By evaluating three scenarios—plot-based, block-based, and superblock development—this research proposes an alternative framework for sustainable redevelopment in Dhaka. The methodology is outlined in Figure 3, which demonstrates the integration of spatial diagnostics, policy analysis, and participatory methods into a multi-phase evaluation process.

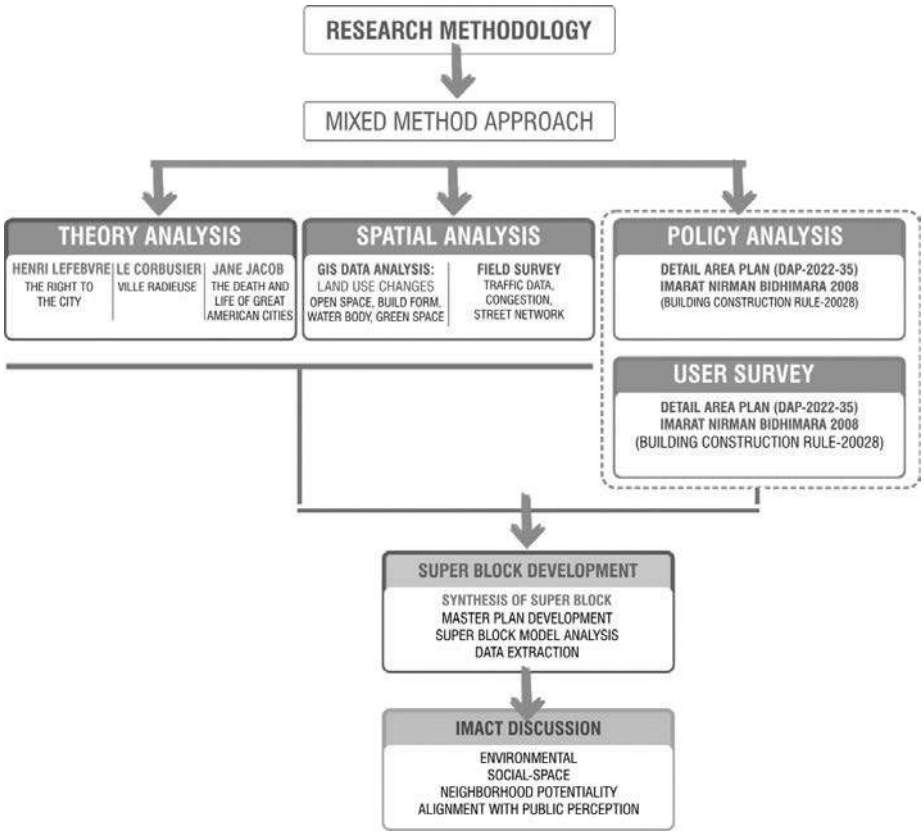

Figure 3. Research methodology-Conceptual Diagram.

This study contributes both empirically and theoretically: empirically, by generating evidence on traffic management, land use efficiency, and pedestrian accessibility in TIA; and theoretically, by situating the superblock concept within global debates on urban sustainability and equity. In doing so, it aligns with international commitments such as the Sustainable Development Goals (SDGs) 11 (sustainable cities and communities), 3 (good health and well-being), 13 (climate action), and 15 (life on land). It advances urban design strategies that address air pollution, mitigate heat island effects, and foster biodiversity through climate-resilient infrastructure. Importantly, it also highlights areas for future research, particularly regarding socio-economic dynamics, community adaptation, and the role of TOD in reshaping Dhaka's growth trajectory. By contextualising Dhaka's transformation within its cultural, geographical, and socio-economic realities, this study provides a scalable and adaptable model that may inform both policy and practice in other rapidly urbanising contexts.

2. Literature Review

2.1. The Concepts of Urban Blocks

In planned urban development, the city block functions as the fundamental unit of the built environment. It refers to a land parcel enclosed by both formally planned and spontaneously evolved street networks (Siksna, 1996). The morphology of the block is often defined by distinct zones: the *edge*, which interfaces with streets and represents the public realm, and the *interior*, which remains primarily private (Krier & Rowe, 1991). Moudon (1997) identifies four widely recognised scales of urban form analysis: *building/lot*, *street/block*, *city*, and *region*. Similarly, Canzen's work, as discussed by Whitehand (2001), situates the block within a tripartite composition of the townscape that integrates street systems, plot subdivisions, and block configurations into the broader urban fabric.

The Dhaka Structure Plan (2016–2035) has embraced block-based residential development as a strategic shift from traditional parcel-based zoning. This approach aims to foster Planned Unit Development (PUD), integrating mixed land uses and diverse housing types to create more vibrant and resilient communities (Apatenko & Bezliubchenko, 2024). Such a transition is intended to address Dhaka's pressing challenges of rapid urbanisation and population growth through a more compact, integrated, and sustainable urban form. By structuring neighbourhoods around walkable blocks, this strategy facilitates access to essential services and infrastructure within cycling or walking distance, thereby enhancing social cohesion (Apatenko & Bezliubchenko, 2024).

Research indicates that block-based planning also offers significant transportation benefits. It can improve accessibility and reduce the crippling traffic congestion that remains one of Dhaka's most persistent urban challenges (Rana, 2021). The Dhaka Structure Plan directly addresses this by proposing the decentralisation of activities from the city centre toward peripheral zones such as Savar, thus relieving core congestion and promoting more sustainable metropolitan growth (Rahman, 2024).

Urban blocks are thus dynamic morphological units that evolve in response to design ideologies, planning trends, and societal needs. They may consist of a single building, a cluster of varied structures, standalone developments embedded within green areas, or interconnected complexes forming integrated systems. Regardless of typology, blocks constitute the primary interface between private property and the public realm and are indispensable to shaping the liveability and identity of urban environments (Ghisleni, 2023).

Drawing from the literature, five planning principles are consistently emphasised as the foundations of block-based city design:

- Integration of urban morphology and design
- Multifunctionality and compactness
- Sustainable urban development
- Public participation and design-based planning
- Use of practical tools and frameworks

2.2. Block-Based Development in the Context of Dhaka

The Detailed Area Plan (DAP) 2022–2035 provides Dhaka with a formal framework for implementing block-based development, positioning it as a corrective to the shortcomings of plot-based urbanisation. Under this framework, block development is encouraged across the city when certain planning thresholds are met. Table 1 presents the DAP's proposed block-based development framework, outlining the minimum land requirements, design conditions, infrastructure provisions, and associated incentives.

Table 1: DAP proposed block-based development framework.

Serial No.	Location	Area of the Block	Conditions to be Considered as Block-based Development	Minimum Road Width	Available Incentives
04	Entire City	More than 5 acres	50% of the area must be open space, such as parks or playgrounds	60 ft. existing; proposed in the running or detailed area plan	Net Population Density: +30% Area-based FAR: +30% Plot-based FAR: 1.0

Notes:

- *The width of the front road must be maintained throughout the entire plot; the minimum width condition applies in all directions where a road exists.*
- *For block development, land size must remain consistent with minimum and maximum standards after the dedication of land for proposed roads.*
- *In block-based development, the area-based Floor Area Ratio (FAR) is redefined according to net population density incentives provided in the framework.*

This regulatory framework represents a significant institutional shift in Dhaka's planning practices. By mandating that at least half of the land area in large blocks (over 5 acres) be reserved for open spaces such as parks or playgrounds, the DAP integrates ecological resilience and liveability into its core principles. Furthermore, by linking development rights to incentives such as increased FAR and density allowances, it aligns private sector interests with public policy objectives. This not only ensures compliance but also strengthens the capacity of block-based development to achieve broader goals of sustainability, accessibility, and social inclusivity across the metropolitan region.

2.3 The concepts of Superblocks:

The concept of superblocks involves urban design strategies that accommodate urban growth by creating larger blocks with reduced vehicle access, promoting pedestrian-friendly environments, and improving public spaces for social and environmental benefits (Alawadi et al., 2024). Superblocks have been implemented in various forms across different contexts, each with unique objectives and outcomes.

2.3.1 The concept of the Chinese Superblock:

The superblock urban planning model has been widely adopted in Asian megacities to manage rapid urbanization and infrastructure demands. Originating from the Radburn city design and influenced by Clarence Perry's neighbourhood unit concept, superblocks are expansive urban blocks with smaller clusters inside, surrounded by a super grid of arterial roads (Chen, 2022). In Asian contexts, particularly in China and Japan, superblocks have been adapted to fit cultural and urban development needs, though they face challenges related to connectivity and urban fragmentation.

The morphology and functionality of the Chinese Superblock are very different, and it is found to be a fragmented urban area. Eventually, the improvement of street connectivity had to be rethought (Kan et al., 2017). These blocks are a distinctive urban planning model characterized by large, enclosed areas defined by arterial roads, which have evolved from historical and cultural influences, including Soviet micro districts and modern car-oriented planning (Ge & Han, 2020).

Figure 4. Nanjing, China Super Block Model Note. *Shanghai Roads by Denys Nevozhai* (Nevozhai, 2019).

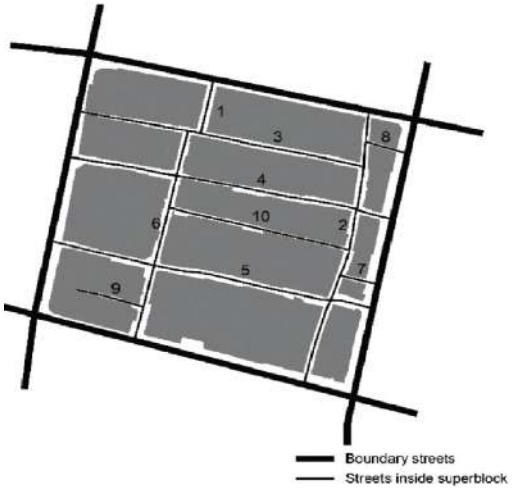

Figure 5. Streets within Hongmiao Nanjing (Ge & Han, 2020).

The Chinese superblocks are the product of a dualistic planning idea, where duality refers to government investment and hard control of boundary trunk roads only, resulting in considerable differences in hierarchy, form, and function between the boundary and the interior. Figures 4 and 5 show the street network of Shanghai and Nanjing. The Superblock's internal street network structure immensely affects people's daily travel and activity patterns. It involves land use distribution, development intensity, and places' diversity and local character. The connections between the internal and boundary streets determine whether global and local movement, the public, and daily space can coexist and interact effectively and collaboratively (Ge & Han, 2020). The Chinese Superblock's primary roads are purposefully designed and connected to an existing network. As an example, the micro network allows small-scale, complex, and dynamic interactions to stay inside the boundaries of the rigid macro urban framework since it often has an unlimited shape, complicated structure, and high spontaneity. When the interior and boundary are intricately linked, as in most historic districts, one can experience local and urban activities within walking distance (Ge & Han, 2020). The ideal interwoven street network of China's superblocks is closely linked to the macro-scale street network and contributes to promoting the sustainable Development of transportation, economy, and society.

2.3.2 The Barcelona Superblock model

In Barcelona, the original Cerdà plan of 1855 laid out a grid of large blocks with intended open spaces, which were later filled with buildings, leading to a lack of open space in Barcelona (Amati et al., 2024). The concept of Superblocks in Barcelona emerged as a transformative urban planning strategy aimed at addressing the challenges posed by the city's historical grid layout. In the previous approach, roadways occupied 15–25% of the land in most European cities, and by changing them into superblocks, the streets can be used for various purposes, making cities more livable. Figure 6 shows how the Superblock model reimagines urban spaces by reducing car traffic, increasing green spaces, and enhancing the quality of life for residents; this concept also contributes to combating climate change and improving urban liveability.

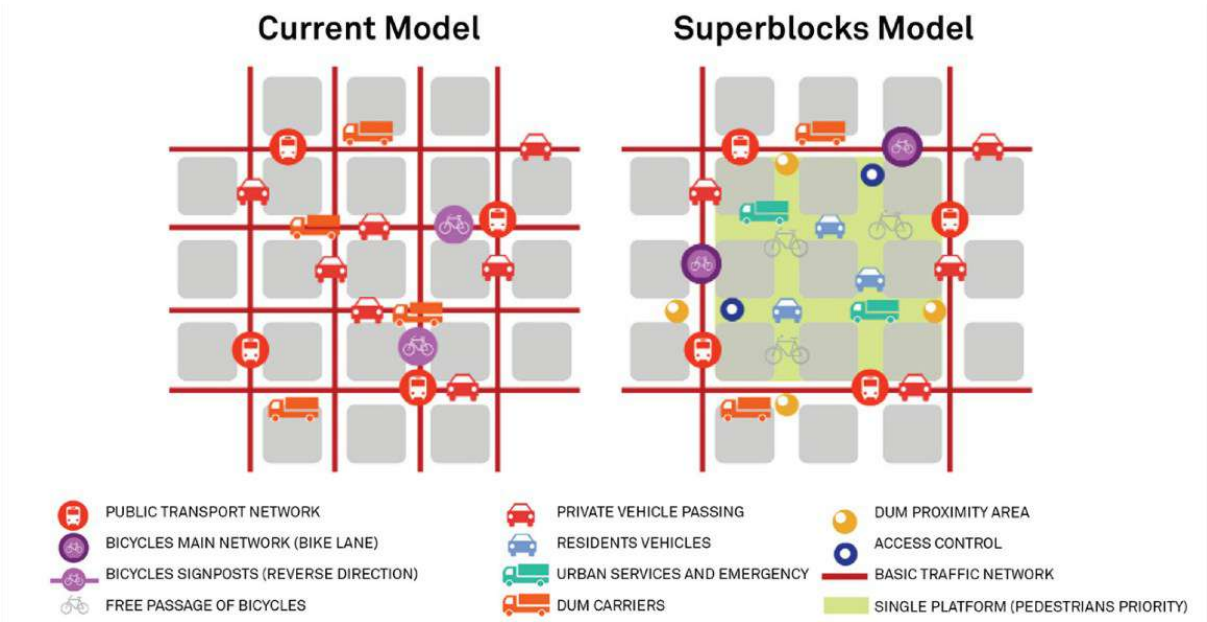

Figure 6. Barcelona Superblock Street network.

Note. Barcelona's 2013-2018 Urban Mobility Plan (PMU) was a strategic planning tool to foster a more sustainable, efficient, safe, and equitable mobility model to support the block development of the city from Barcelona City Council (Barcelona City Council, 2016).

Figure 7. Areial View of Barcelona superblock.

Note. Superblock (Superilla) Barcelona—a city redefined by Ronika Postaria (Postaria, 2021).

Based on the Cerdà grid (400x400 meters), Barcelona's Superblocks reduce private vehicle trips by 15% and free up 70% of public space for public use, making inner streets pedestrian-friendly (Palenzuela, 2021). Streets become neighbourhood hubs with playgrounds, seating for seniors, social spaces, and running tracks—encouraging physical activity and enhancing residents' well-being, local businesses, and the environment (Babic, 2021). Inner "green streets" are closed to through traffic, allowing only limited vehicle access—for residents, public transport, emergency services, disabled users, and recreational cyclists. Speed is restricted to 10 km/h, with one-way motorized movement. These streets become safe public pedestrian spaces (Amati et al., 2024). Revitalization includes curbless paving for accessibility, tactile paving for the visually impaired, and barrier marking pedestrian zones. Boom barriers and spike strips restrict vehicle access. Street design mandates 20% permeable surfaces and 80% tree coverage for shade. Other key measures include removing sidewalk parking, monitoring bike lanes, and providing accessible lifts and escalators (Amati et al., 2024).

2.3.3 Le Corbusier's Ville Rasieuse:

Le Corbusier's belief in social advancement through technology led him to support emerging industrial practices, such as mass production techniques and a car-based transportation culture. Le Corbusier's Ville Rasieuse (figure 8) was designed to increase urban capacity while improving the urban environment and city efficiency. The plan included high-density skyscrapers surrounded by large open spaces intended to enhance daylight and solar performance, as evaluated through computer simulations (Montavon et al., 2006). The ambitious proposal suggested the demolition of central Paris to make way for this new urban form, which was met with significant opposition. However, because of strong resistance, it never materialized. Later, its principles influenced post-war architects and urban planners, contributing to the worldwide Development of modernist urban environments. Examples include the city of Chandigarh in India (Corbusier, 2020). The concept of the "tapis-vert," or green carpet, was central to Le Corbusier's vision, integrating natural surroundings with urban spaces, aimed to create a harmonious alliance between the city and nature, a theme that was prevalent in his urban planning philosophy (Rabaça, 2016).

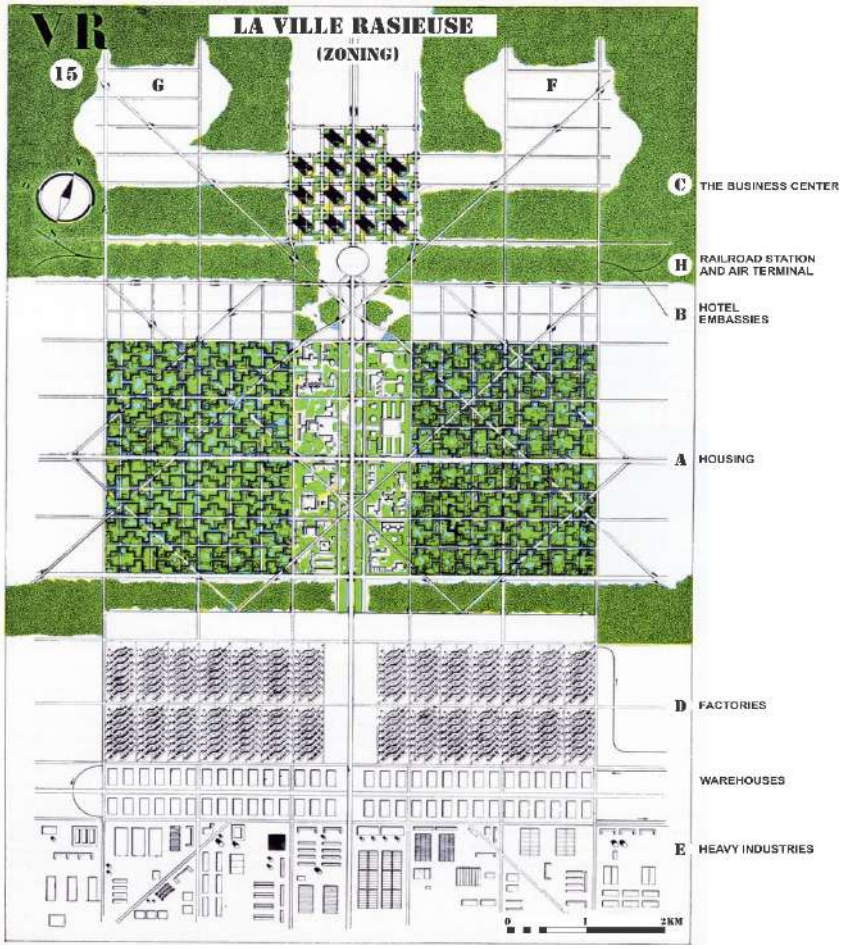

Figure 8. Le Corbusier's "Radiant Cities" (1935) were built around large towers set far apart to provide residents with equal access to light, air and open space.
Note. *From Le Corbusier's "The Radiant City" (1933)* (The Urbanist, 2012).

While Le Corbusier's Ville Rasieuse was a bold and visionary proposal, it also faced criticism for its utopian nature and the potential social implications of its rigid zoning and high-density living. Critics argue that such plans can lead to a loss of cultural and historical context and a lack of consideration for the social dynamics of urban life (Rodríguez-Lora et al., 2021).

2.4. Jane Jacobs and the Critique of Superblocks

In her seminal work *The Death and Life of Great American Cities*, Jane Jacobs developed a strong critique of modernist planning paradigms that prioritised efficiency over vibrancy. Jacobs' theory emphasises the significance of urban diversity and vibrancy, which she argued are sustained by specific urban form conditions. These include the integration of residential, commercial, and cultural functions within close proximity, thereby generating vitality and resilience in neighbourhoods (Fuller & Moore, 2017). By contrast, superblocks often compartmentalise or segregate land uses, resulting in less dynamic and less socially interactive environments.

Jacobs identified four essential conditions for urban vitality: mixed land uses, short blocks, aged buildings of varied conditions, and sufficient density. These conditions collectively foster opportunities for encounter, innovation, and street-level vibrancy. Superblocks, by their very nature, challenge these principles, since they are characterised by larger parcels and reduced street intersections, which may limit pedestrian permeability and diminish spontaneous interactions between different user groups (Fuller & Moore, 2017). This spatial structure risks undermining the fine-grained urban fabric Jacobs celebrated as the cornerstone of successful cities.

Empirical evidence supports these concerns. Studies indicate that superblocks can reduce pedestrian access and connectivity by consolidating multiple smaller blocks into larger, vehicle-restricted zones. While this has advantages for traffic management and open-space provision, it may conflict with Jacobs' advocacy for intimate, mixed-use environments where short blocks facilitate accessibility and enhance street-level vibrancy (Sung et al., 2015). For Jacobs, smaller blocks were not simply a matter of form, but of socio-spatial function—enabling interaction, inclusivity, and resilience within the public realm.

2.5. Henri Lefebvre and the Right to the City

Complementing Jacobs' critique, Henri Lefebvre's concept of the *Right to the City* provides a theoretical framework for the democratization of urban space. Lefebvre argues that the production of urban space is inherently political and should be shaped by its inhabitants rather than by centralised authorities or market-driven actors (Carlos, 2020; Chérrez-Rodas, 2020). This concept situates urban space as a collective right, wherein citizens are entitled not only to inhabit but also to transform their environments.

Lefebvre's vision aligns with Jacobs' bottom-up advocacy, reinforcing the principle that residents' voices must take precedence over technocratic master-planning. As Lefebvre notes, "citizens should have the power to shape the cities they live in," underscoring the emancipatory potential of participatory urbanism (Henri, 2000; LeGates & Stout, 2020). Deeply rooted in Marxist theory, Lefebvre's arguments reveal how the production of space both reflects and reproduces socio-political inequalities, while also providing opportunities for emancipation through collective agency.

In the context of superblock development, Lefebvre's framework raises critical questions about inclusivity and justice. While superblocks may provide environmental and infrastructural benefits, they risk marginalising community participation if conceived solely as top-down interventions. Thus, Lefebvre's work challenges planners to rethink block- and superblock-based development not just in spatial terms, but as arenas for democratic negotiation and socio-political transformation.

2.6. New Urbanism and Block Development

Emerging in the mid-1980s, the New Urbanism movement provides another relevant lens for understanding contemporary block-based development. New Urbanism responds to the failures of post-war suburban sprawl and automobile dependency by advocating for the creation of walkable, human-scale communities that integrate diverse functions and foster social interaction (Talen, 2024). The principles of New Urbanism centre on:

- **Walkability and human scale** – designing neighbourhoods where daily needs are accessible within a five- to ten-minute walk.

- **Mixed-use development** – integrating housing, retail, employment, and cultural amenities within a single urban fabric.
- **Diversity and density** – promoting socio-economic diversity and sufficient urban intensity to support public transit and local economies.

These principles significantly influence block development by encouraging infill projects and compact communities that resist car-oriented sprawl. By promoting coherence in block organisation, New Urbanism complements Jacobs' vision of vibrant city life while operationalising Lefebvre's call for socially inclusive urban spaces. In contexts like Dhaka, where unregulated growth has led to spatial inefficiency, the application of New Urbanism principles in block-based development may provide a path toward more livable, socially equitable, and environmentally resilient urban environments.

3. Analysis of the Study Area

3.1. Location and Spatial Context

The selected study site is located within the Tejgaon Industrial Area (TIA), Dhaka, encompassing approximately 46.5 acres (Figure 9). The site is strategically situated and exhibits high levels of connectivity, bordered by a primary road to the west, secondary roads to the north and south, and a tertiary road to the east. This robust accessibility positions the site favourably for redevelopment into a mixed-use urban block structure, consistent with the DAP's strategic objectives.

Figure 9. Satellite view of the study area *(image adopted by authors using Google Earth map).*

The historical development of TIA (Figures 9 and 10) illustrates a clear trajectory from industrial concentration to gradual diversification. Initially developed as Dhaka's prime industrial hub, the area has, over the past two decades, experienced a rapid transition towards commercial and mixed-use functions. Commercial activity has significantly expanded, with numerous industrial plots repurposed for retail, office, and institutional functions. This transformation accelerated after the establishment of RAJUK (formerly the Dhaka Improvement Trust, DIT) in 1987, whose planning regulations facilitated rezoning initiatives. Tejgaon's proximity to Dhaka's central business district further catalysed this shift, making it an attractive location for commercial and institutional investment (Das, 2018).

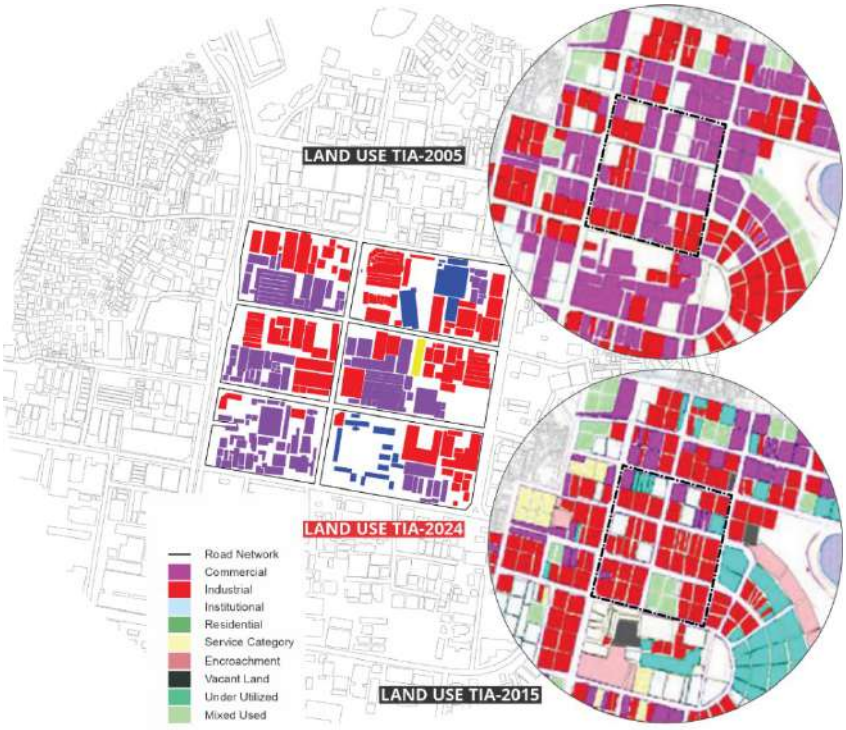

Figure 10. GIS MAP study showing land use change 2005, 2015 and 2025 in Tejgaon Industrial Area (TIA) (image adopted by authors).

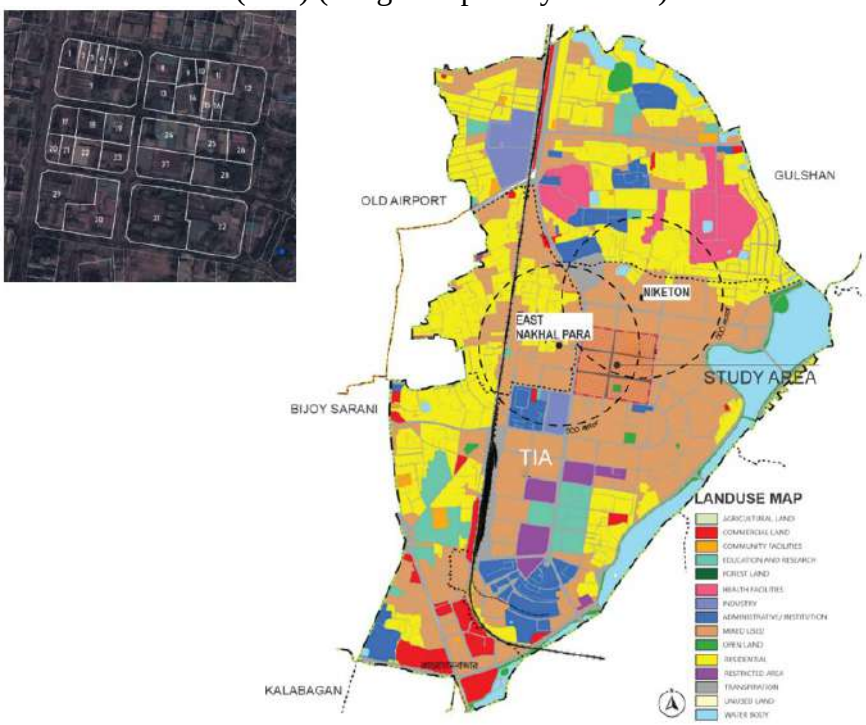

Figure 11. 32-Super imposed segmented plots boundary on Google Earth map & land use map of Tejgaon.

3.2. Adjacent Residential Neighbourhoods

Within a 500-metre radius (approximately a 15-minute walking distance) of the study area, two established residential neighbourhoods, Niketon and East Nakhalpara, are located. These neighbourhoods, being well-planned and developed, represent valuable urban assets that enhance the viability of future mixed-use redevelopment within TIA. The integration of residential and commercial

uses in such proximity offers opportunities for vibrant local economies, reduced commuting distances, and enhanced walkability.

The government's transformative master plan, prepared by the Public Works Department and declared in September 2015, envisions the conversion of the entire TIA into a mixed-use industrial, commercial, and residential zone. This master plan anticipates not only the intensification of commercial and institutional uses but also the emergence of new residential typologies within TIA, thereby reinforcing its mixed-use potential (Das, 2018).

3.3. Land Parcels and Mouza Map

According to the mouza map, the study area comprises 32 plots connected through an internal road network, covering a total area of 46.8 acres. This granular dataset is essential for determining Floor Area Ratio (FAR), Maximum Ground Coverage (MGC), and setback requirements, which form the basis of the three development scenarios analysed in this research. By calibrating these planning parameters, the study can project feasible density levels, land-use allocations, and infrastructural provisions under different urban models.

3.4. Building Typology

The study area currently accommodates 251 structures, representing a variety of typologies including steel-frame buildings, reinforced cement concrete (RCC) structures, and semi-pucca constructions. A significant proportion of these buildings have already surpassed 50 years of continuous use, and many are approaching the end of their functional and structural life cycle. Average building heights range between 15 and 25 feet, reflecting their original industrial functions as factories, warehouses, and workshops. This ageing building stock highlights the urgency of regeneration, as deteriorating structures provide both a challenge and an opportunity: a challenge in terms of safety and functionality, and an opportunity for adaptive reuse, densification, and integration of new mixed-use programmes.

3.5. Traffic and Transport Connectivity

The site is defined by perimeter roads that serve as arterial connections in the broader superblock context (Figure 12). These roads are differentiated by capacity and intensity of traffic flow:

- The primary perimeter road on the western edge carries heavy daily traffic volumes and consists of three lanes in each direction, with a total width of 90 feet.
- The secondary and tertiary perimeter roads on the northern, southern, and eastern edges experience mild to moderate traffic flows. Each of these has two lanes in each direction, with a total width of 40 feet.

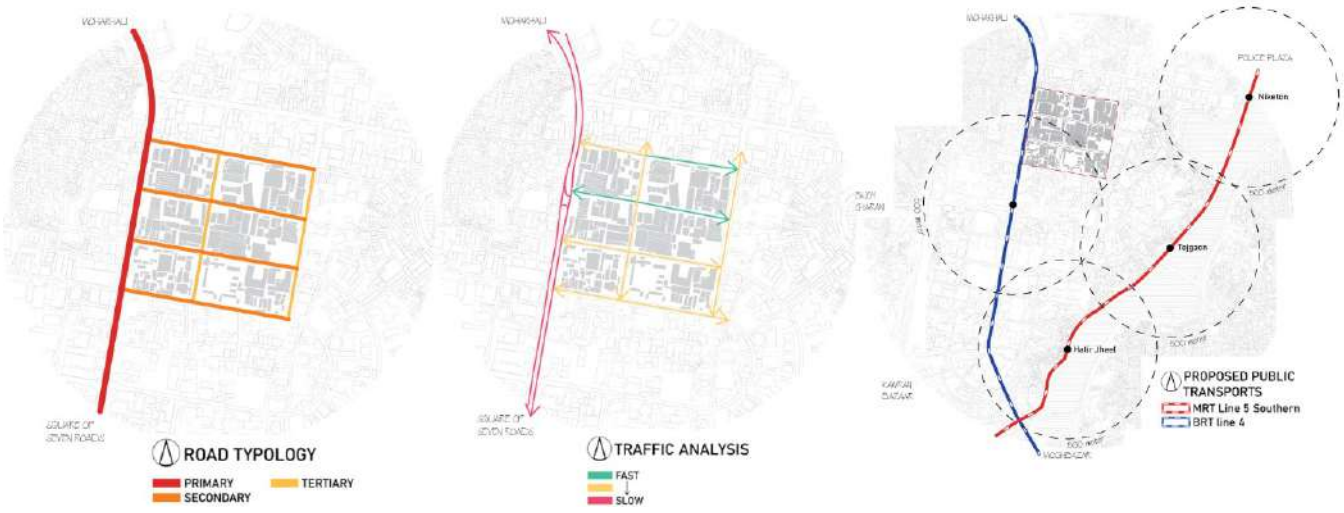

Figure 12. Traffic routes analysis of the study area.

Future public transport integration is expected to enhance connectivity further. According to the DAP (2022–2035), MRT Line 5 (Southern Route) and BRT Line 4 will operate along the eastern and western peripheries of TIA. The inclusion of mass transit infrastructure will transform Tejgaon into a transit-oriented district, supporting higher densities, reduced car dependency, and improved accessibility. This road hierarchy and the planned transit corridors are integral to calculating FAR values for redevelopment scenarios. They also align with the principles of block-based and superblock development, where perimeter roads absorb heavy vehicular flows, freeing internal blocks to prioritise pedestrian-friendly and mixed-use development.

3.6. T-Test Analysis of Green Space Use and Value

The provision and preservation of public green spaces represent one of the most significant contributions of block-based development. In the dense metropolitan environment of Dhaka, where annual urbanisation trends continue to erode open spaces, green infrastructure becomes a critical determinant of environmental sustainability, social well-being, and overall livability. Within this context, gender-based perceptions and use of green spaces provide valuable insights into how inclusive planning models should be structured to respond to diverse user needs.

3.6.1. Methodological Approach

To assess gender-based differences, independent-samples t-tests were conducted. The tests evaluated two key variables: (i) frequency of use (walking activity within green spaces), and (ii) perceived value (importance assigned to proximity and availability of parks/open spaces). The comparison between male and female respondents allows the identification of not only behavioural differences but also attitudinal patterns that can inform equitable planning interventions.

- **Sample Size**: 174 valid responses (Males: 101; Females: 73). Non-binary genders and incomplete responses were excluded to ensure data validity.
- **Variables**:
    - *Use of green space*: coded on a 4-point scale (Daily = 4; Never = 1).
    - *Value of green space*: rated on a 5-point Likert scale regarding importance of "[Parks/Open Spaces] near home."
- **Group Comparison**: Male vs. female respondents.

This methodological approach aligns with previous urban studies that utilise gender-disaggregated analyses to highlight differences in mobility patterns and perceptions of urban amenities (Rafieian & Tabaeian, 2022).

3.6.2. T-Test Results and Interpretation

- **Use (walking frequency)**: Male respondents reported a higher frequency of walking activity in and around the study area than females (mean ≈ 3.14 vs. 2.75 on the 1–4 scale). The difference was statistically significant ($t \approx 2.20$, $p \approx 0.03$).
    - *Interpretation*: The results suggest that men engage in daily or frequent walking activities more than women in the study area. This may be influenced by cultural norms, occupational mobility, or perceived levels of safety. It aligns with prior research indicating that women often face restrictions in mobility due to concerns about harassment or inadequate pedestrian infrastructure (Sung et al., 2015).
- **Value (perceived importance of green space)**: Female respondents placed a higher importance on having accessible parks/open spaces near their homes compared to males (mean ≈ 4.25 vs. 3.42 on the 1–5 scale). The difference was highly significant ($t \approx -3.74$, $p \approx 0.0003$).
    - *Interpretation*: This finding highlights a critical gendered dimension of urban planning. While men demonstrate higher actual use, women assign greater value to the *availability* and *proximity* of green spaces. This suggests that female residents may view green areas as essential extensions of residential life, linked not only to recreation but also to safety, child-rearing, and opportunities for social interaction.

These findings reinforce Jacobs' (1961) principle of "eyes on the street," which underscores the need for safe, accessible, and inclusive spaces to ensure equitable use of public realms. In the absence of such considerations, women's participation in public life risks being structurally constrained.

3.6.3. Analysis of Green Space Importance by Gender

To complement the earlier analysis on walking frequency and perceived value of proximity, an independent-samples t-test was conducted to determine whether statistically significant differences exist between male and female respondents regarding the *overall importance* of green spaces. The results are presented in Table 2.

Table 2: Gender preference regarding green space.

Gender	Sample Size	Mean Importance (M)	Standard Deviation (SD)
Male	101	3.82	1.36
Female	73	3.88	1.26

T-statistic: -0.303, P-value: 0.762

As shown in Table 2, male respondents reported a mean importance score of 3.82 (SD = 1.36), while female respondents reported a nearly identical mean score of 3.88 (SD = 1.26). The difference was not statistically significant ($t = -0.303$, $p = 0.762$), confirming that both genders value green spaces equally. These results provide three important insights:

1. **No Statistically Significant Difference**: The p-value well exceeds the $\alpha = 0.05$ threshold, demonstrating that both male and female respondents attach similar levels of importance to parks and open spaces.
2. **Consistently High Priority**: Both groups rated green spaces highly (M > 3.8/5), indicating strong and consistent demand for parks and open areas. This consensus reinforces the critical role of green infrastructure in shaping inclusive urban design strategies, irrespective of gender differences.
3. **Practical Implications for Planning**: While men tend to use green spaces more frequently (as shown in Section 3.6.2), and women place higher importance on proximity and safety features, the overall importance ratings remain comparable. This suggests that universal provision of green spaces—incorporating features such as shaded walkways, seating, recreational facilities, and natural aesthetics—should be prioritised in planning block-based and superblock developments. Furthermore, gender-sensitive considerations, particularly women's emphasis on safety (e.g., lighting, visibility, secure pathways), should complement these universal provisions to enhance inclusivity.

In summary, Table 2 highlights the convergence of male and female perspectives on the value of green spaces, suggesting that the provision of high-quality, accessible, and safe parks will benefit all demographic groups in the Tejgaon Industrial Area.

3.7. Development Scenarios

The spatial and behavioural analyses described above provided a basis for the development of three distinct scenarios for the Tejgaon Industrial Area. These scenarios are evaluated against the principles of sustainability, inclusivity, and resilience, and align with regulatory guidelines in the Building Construction Rules 2008 and the Detailed Area Plan (DAP) 2022–2035.

Scenario One: Plot-Based Development

This conventional model relies on the existing fragmented plot system, where individual land parcels are developed separately according to current regulatory standards. While offering flexibility to individual landowners, this model perpetuates inefficiency, poor integration of infrastructure, and limited opportunities for large-scale public amenities. *Figure 14* illustrates the master plan and three-dimensional spatial relations for the plot-based scenario, highlighting its fragmented spatial organisation.

Scenario Two: Block-Based Development

In this scenario, the 32 existing plots are consolidated through land readjustment policies into a single, larger development parcel. This approach draws from the DAP's 2022–2025 block development incentives, enabling greater integration of infrastructure, public green spaces, and compact mixed-use typologies. By pooling resources and reorganising land, block-based development offers opportunities for efficient space utilisation, improved pedestrian accessibility, and cohesive urban design. This scenario reflects principles of *Planned Unit Development (PUD)*, which encourage diversity, multifunctionality, and compact growth (Apatenko & Bezliubchenko, 2024).

Scenario Three: Superblock Development

The superblock model adapts global precedents, such as Barcelona's superblocks, to the Dhaka context. It incorporates DAP (2022–2035) regulations, Imarat Nirman Bidhimala (2008), and the design philosophy of *omniplatz*. The latter advocates multifunctionality in built form, ensuring that buildings remain flexible and adaptable to shifting uses over time. Superblocks prioritise pedestrian and cycling movement, restrict through-traffic to perimeter roads, and reserve internal spaces for green infrastructure, communal facilities, and mixed-use clusters. *Figure 13* provides a comparative illustration of the three development scenarios, while the superblock scenario demonstrates potential to deliver climate resilience, reduced congestion, and enhanced livability.

By contrasting these scenarios, the study identifies the relative strengths and limitations of each model. While plot-based development maintains continuity with existing practices, it perpetuates fragmentation. Block-based development introduces efficiency and integration but requires extensive coordination among landowners. Superblock development, though ambitious, offers transformative potential to reshape TIA into a model of sustainable and inclusive urbanism for Dhaka.

Figure 13. Different development scenarios.

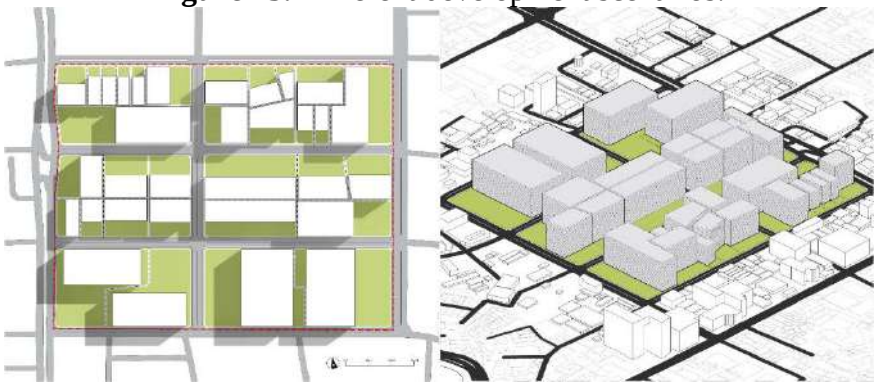

Figure 14. Plot based development- master plan and three-dimensional spatial relation.

3.7.1. Scenario 1 — Plot-Based Development

The first scenario, illustrated in Figure 15, demonstrates the conventional development model based on the *Imarat Nirman Bidhimala (2008)*. In this case, each of the 32 plots within the study area is developed individually and independently, applying regulations related to Floor Area Ratio (FAR), Maximum Ground Coverage (MGC), setbacks, and paved-surface percentages. The orientation of massing is derived from the frontage of each plot facing the existing road network.

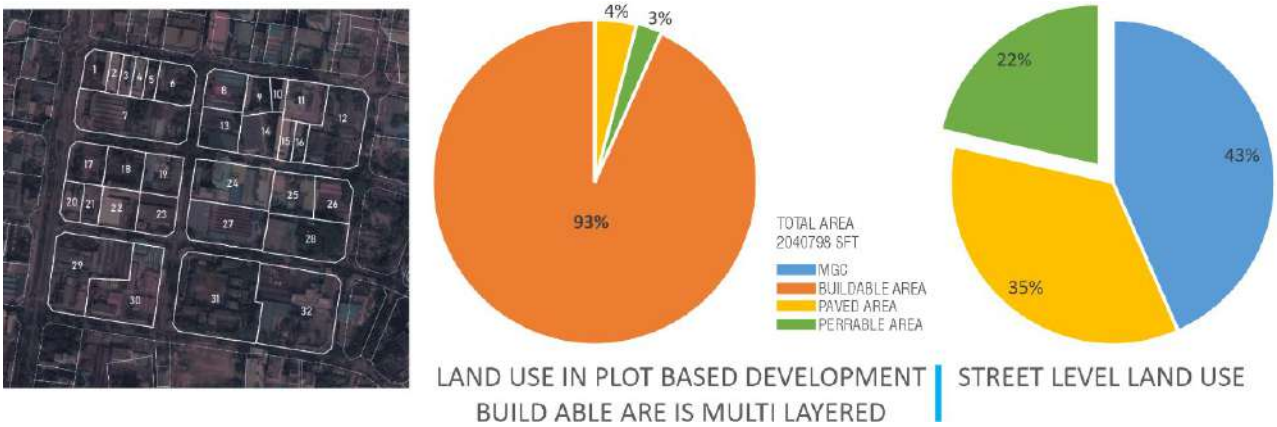

Figure 15. Plot based development-imposed plot divisions on Satellite map and land use pie-chat showing percentage of land use.

Although this scenario accurately reflects Dhaka's prevailing urban development context, several limitations become apparent. First, green spaces are fragmented, existing only in small residual pockets determined by plot boundaries. This discontinuity prevents the creation of meaningful, connected ecological or recreational systems. Second, narrow setbacks between buildings form poorly ventilated and under-lit voids, sometimes referred to as "urban canyons" or "light wells," which contribute little to environmental quality. Third, the pattern of isolated plots reproduces socio-spatial fragmentation, with limited opportunities for integrated amenities or shared public spaces.

Overall, while the plot-based scenario maintains continuity with Dhaka's historic development patterns, it fails to address the quality-of-life deficits identified in earlier analyses (see Section 3.6, Table 2). The fragmented urban form underscores the need for more consolidated, cohesive strategies.

3.7.2. Scenario 2 — Block-Based Development

Block-based development, illustrated in Figure 16 and further detailed in Figure 17, introduces an alternative planning approach proposed in the *Detailed Area Plan (DAP) 2022–2035*. While this concept has not yet been widely implemented in Bangladesh, it seeks to merge multiple plots into larger urban blocks governed by uniform planning rules. The regulatory framework combines provisions from the *DAP (2022–2035)* and the *Imarat Nirman Bidhimala (2008)*, ensuring consistent application of FAR, MGC, and setback requirements.

Figure 16. Three scenarios to determine the block size in different context were studied.

Note. Image based on Google Earth map adopted by authors.

Figure 17. Block development master plan and three-dimensional spatial relation.

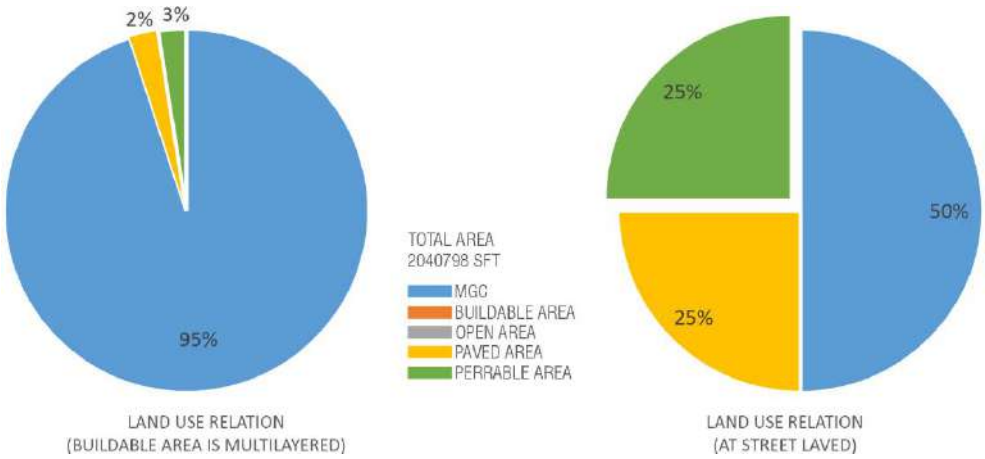

Figure 18. Land use ration in block development.

To determine appropriate block sizes for commercial development, this study reviewed three reference areas in Dhaka: Banani, Uttara, and Motijheel (Figure 16). Across these contexts, commercial and mixed-use blocks typically measured around 1 hectare (2.47 acres). Along major arterial roads, commercial functions dominated, while interior blocks were characterised by mixed uses. These findings support the adoption of 1-hectare block sizes for Scenario 2, balancing accessibility, zoning efficiency, and land-use diversity (Tavassoli, 2020).

Applying this standard to the study site, the 32 plots are reorganised into 16 consolidated blocks, integrated by a central green belt. The master plan (Figure 17) demonstrates the spatial relationship of blocks, while Figure 18 presents the block development land-use ratios.
The scenario offers several advantages over the plot-based model:

- Green spaces are more continuous, enabling the creation of a centralised ecological and social corridor.
- Land consolidation improves efficiency, reducing fragmented ownership challenges.
- Mixed-use and vertical zoning within blocks allow for flexibility—residential blocks can host limited commercial or social functions, and commercial blocks can incorporate social services.

Nevertheless, limitations remain. Internal zoning conflicts persist, as vertical integration often privileges one use over others (e.g., commercial dominance over social functions). Moreover, without additional sustainability measures, permeability and environmental performance remain limited compared to more innovative frameworks.

3.7.3. Scenario 3 — Superblock-Based Development

The third scenario, illustrated in Figure 19, represents the central focus of this study: the Superblock Development model. Building upon the regulatory framework of block-based development, this model integrates additional sustainability and mobility indicators inspired by international precedents, notably the Barcelona superblock model.

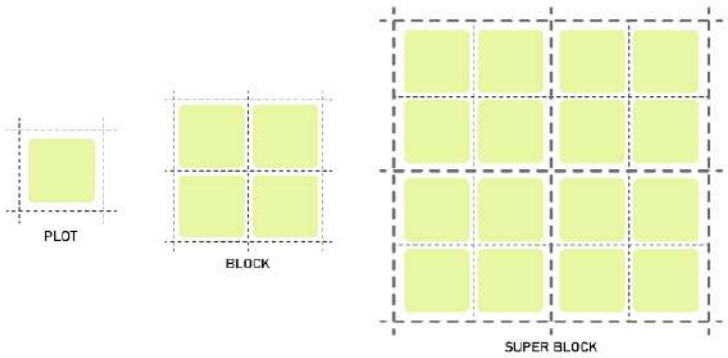

Figure 19. Plot to super block- conceptual framework.

In the proposed layout, the 32 original plots are amalgamated into 16 blocks and further merged into **four superblocks**, linked by a central green belt serving as an ecological corridor and communal public space. The model introduces two additional key indicators:

1. **Increased Permeable Surface Area**: Superblocks incorporate at least 20% more permeable surfaces compared to conventional blocks, replacing paved areas with landscaped green zones. This improves stormwater absorption, reduces flooding risks, and mitigates urban heat island effects (Damnjanović et al., 2024; Nieuwenhuijsen et al., 2024).
2. **Vehicular Traffic Restriction and Internal Circulation**: Traffic is confined to peripheral arterial roads, while internal streets are pedestrian- and micro-mobility-prioritised. Emergency access is retained, but general vehicular intrusion is minimised. This reallocation of road space reduces private car trips by an estimated 15% and liberates up to 70% of internal road area for pedestrian and community use (Palenzuela, 2021).

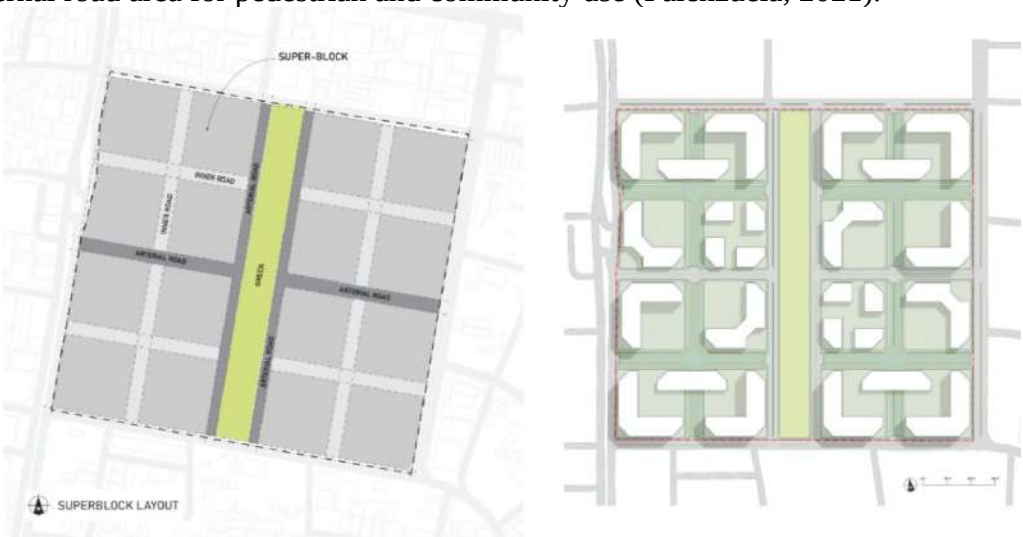

Figure 20. Superblock master plan of showing four large super blocks (left) and master plan with conceptual block spaces (right).

The land-use distribution for the superblock scenario is presented in Table 3.

Table 3: Land use calculation for the Superblock.

Parameter	Value
SITE AREA	2,040,798 sq. ft.
MGC	50%
FAR	9.5
OPEN AREA	50%
PAVED	30%
PERMEABLE	70%
TOTAL MGC	1,020,399 sq. ft.
TOTAL BUILDABLE AREA	19,387,581 sq. ft.
TOTAL OPEN AREA	1,020,399 sq. ft.
TOTAL PAVED	306,120 sq. ft.
TOTAL PERMEABLE	714,279 sq. ft.

Note: *Imarat Nirman Bidhimala 2008, DAP (2022–2035), Superblock Indicator Policies*

The results highlight the superior spatial and ecological efficiency of the superblock model. A FAR of 9.5 facilitates high-density vertical development, generating nearly 19.4 million sq. ft. of buildable floor area while maintaining a balance between constructed and open space. With 50% of the total site area allocated as open space, including 70% permeable surfaces, the model surpasses both plot-based and block-based approaches in terms of environmental resilience. The integration of permeability, open space, and walkability reflects New Urbanism's principles of compact, human-scale communities, while the redistribution of mobility networks aligns with Jacobs' advocacy for vibrant, safe public spaces and Lefebvre's notion of the *Right to the City*. By prioritising collective benefits over individual plot-based interests, the superblock model demonstrates the potential for an inclusive and sustainable urban transformation of Tejgaon.

4. Entropy analysis and comparison with the other two scenarios:

4.1 Change in maximum ground coverage:

This research examined three scenarios, comparing data from each case to observe changes in Maximum Ground Coverage (MGC). Significant variations in MGC were identified, with the graph indicating a 15% increase in MGC from the Plot Base to the Block and Superblock Base scenarios. This increase can be attributed to the Plot Base's 32 individual plots, each with its own MGC. In contrast, in the Block and Superblock Base scenarios, the area is consolidated into a single plot with one MGC value after land use adjustments.

4.2 Buildable area comparison:

The buildable area refers to the total volume that can be constructed on the site. This figure is obtained by multiplying the Floor Area Ratio (FAR) by the site area. Building height can be estimated by dividing the buildable area by the MGC. The analysis reveals a 20% increase in the buildable area when transitioning from the Plot Base to the Block and Superblock Base. This is because individual plots, being smaller, contribute less to the total area, whereas consolidated block or superblock developments allow for higher densities. Higher density facilitates shared services among a larger population, contributing to more sustainable systems and better resource optimization.

4.3 Paved areas analysis:

A key issue associated with paved areas is impermeability, preventing groundwater recharge. In Dhaka, groundwater abstraction has risen by over 700% in the past three decades, resulting in a severe decline in water tables—up to 75 meters in some regions (Parvin, 2019).

In this study, the paved surface area decreased by 29% when moving from Plot Base to Block Base and 57% from Plot to Superblock Base. This is because each of the 32 plots in the Plot Base scenario has its paved area, whereas only one shared paved area is needed in the Block Base. The Superblock Base scenario further reduces this by incorporating soft-paved, permeable inner roads.

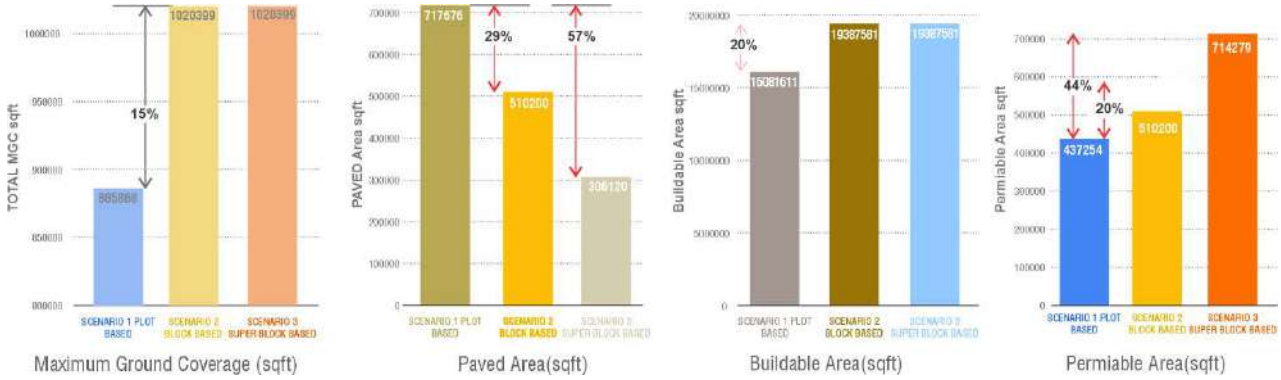

Figure 21. Entropy Analysis comparison chart with three scenarios.

Permeability analysis shows a 16% increase in permeable surface from the Plot Base to the Block Base. This is due to the transition from multiple small, isolated permeable areas to a more open and integrated block structure layout, allowing for a higher proportion of permeable space. From Block to Superblock Base, permeability increases by an additional 44%, primarily because the Superblock model requires at least 20% more permeable area, thus significantly enhancing ground infiltration capacity.

5. Superblock spatial zoning analysis

5.1 Superblock-horizontal spatial zoning analysis:

This research aims to develop a Super Block analysis that fits the Tejgaon Industrial Area well. Data from the entropy analysis of Scenario 3 is the basis for further details of the zoning proposal. The first factor to consider is what the zones on the site will be and how the blocks will sit based on the zone type. After evaluating field data and tracing the building typologies change pattern in TIA, three building typologies are identified.

- COMMERCIAL
- SOCIAL
- RESIDENTIAL

The transformation of land use patterns in Tejgaon towards commercialization is observed in various urban areas, driven by economic growth, urbanization, and strategic location advantages. Proximity to educational institutions, demand for commercial services, and urban planning policies often influence this shift. The incremental commercial uses in Tejgaon can be understood through similar transformations in many parts of Dhaka, where residential areas evolve into commercial hubs due to various socio-economic factors.

The concept of mixed-use zones, as proposed for the social and residential blocks in Superblock at Tejgaon, follows New Urbanism principles from the 1980s and modern urban planning concepts. This type of Mixed-use development aims to integrate functions like residential and recreational spaces within a single area, promoting an interdependent, vibrant, sustainable, and accessible urban environment. The proposed type of mixed-use development is theorized to enhance social integration, improve housing and service distribution, and stimulate local economic Development. It also addresses environmental concerns by reducing transportation needs and promoting sustainable urban growth (Geyer, 2024).

5.2 Commercial blocks:

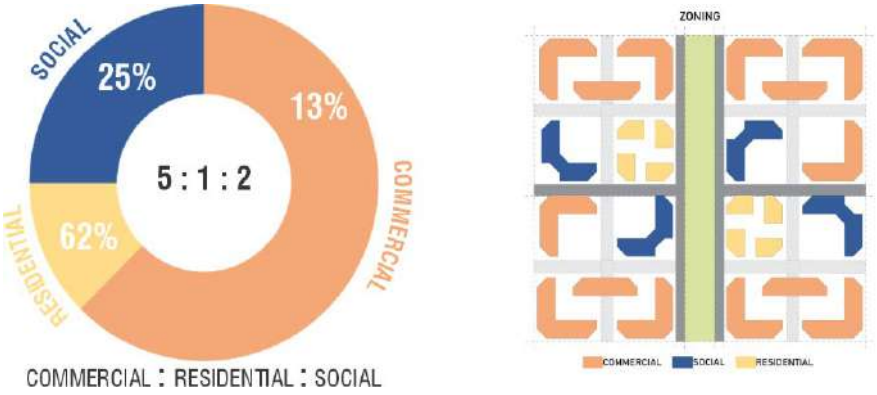

Figure 22. Schematic horizontal spatial distribution of commercial, residential and social spaces.

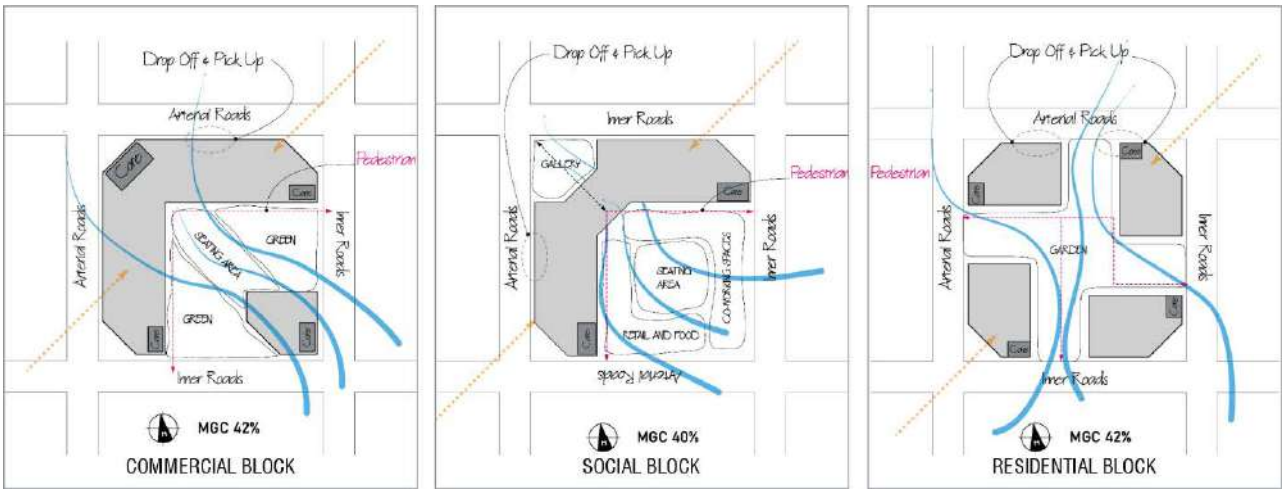

Figure 23. Super block functional distribution.

The commercial blocks' core functional attributes are banks, showrooms, and offices. There is also provision for future expansion, and a schematic plan has been proposed that supports the concept of *Omniplatz*—meaning a building should not have a single, fixed functional identity. Instead, it should be capable of accommodating a broader range of uses. The floor plan is designed to be flexible, allowing adaptation to various user needs and functions. The blocks are vertically expandable, with a static core for vertical and shared circulation. The proposed functional space for commercial blocks is banks, Showrooms, and offices.

5.3 Social blocks:

The Social Block forms a key component of the site's superblock development strategy, acting as a vibrant public space that draws users from the site and surrounding neighbourhoods. The modular open space in front of the block supports a wide range of social and cultural activities, significantly contributing to the urban vitality and quality of life. This configuration aligns with superblock principles by prioritizing walkability, accessibility, and flexible public use. Proposed functions for the Social Block include:

- Art Gallery, Retail Shops, Market, Expo Center, Restaurants

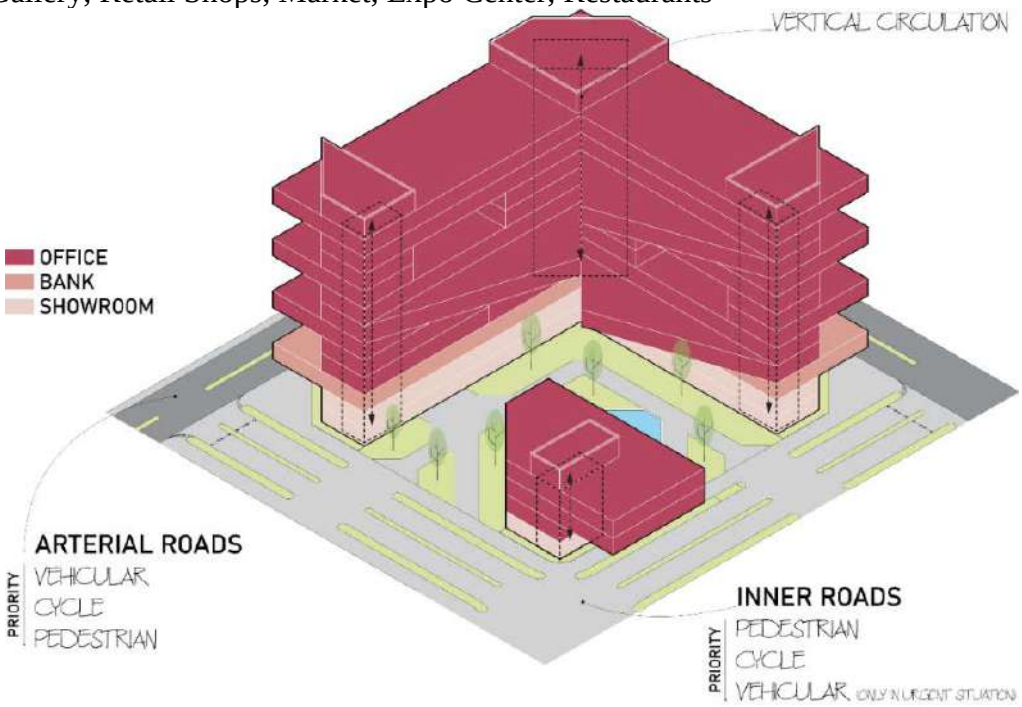

Figure 24. Three-dimensional spatial relation of proposed Commercial blocks.

5.4 Residential block

The residential blocks are primarily for office personnel working in or near the area, so the program list focused on those users. The ground level of the block will retain shops with mixed-use advantages and act as a vertical buffer.

6. How Superblock Development Will Address Acute Urban Issues in TIA: Survey Data Analysis

To understand how superblock development could respond to the acute urban challenges of the Tejgaon Industrial Area (TIA), a structured survey was conducted with 151 respondents. Participants included residents, employees, and regular visitors to the area, many of whom had longstanding ties to TIA, transitioning from its industrial past to current service-sector dynamics.

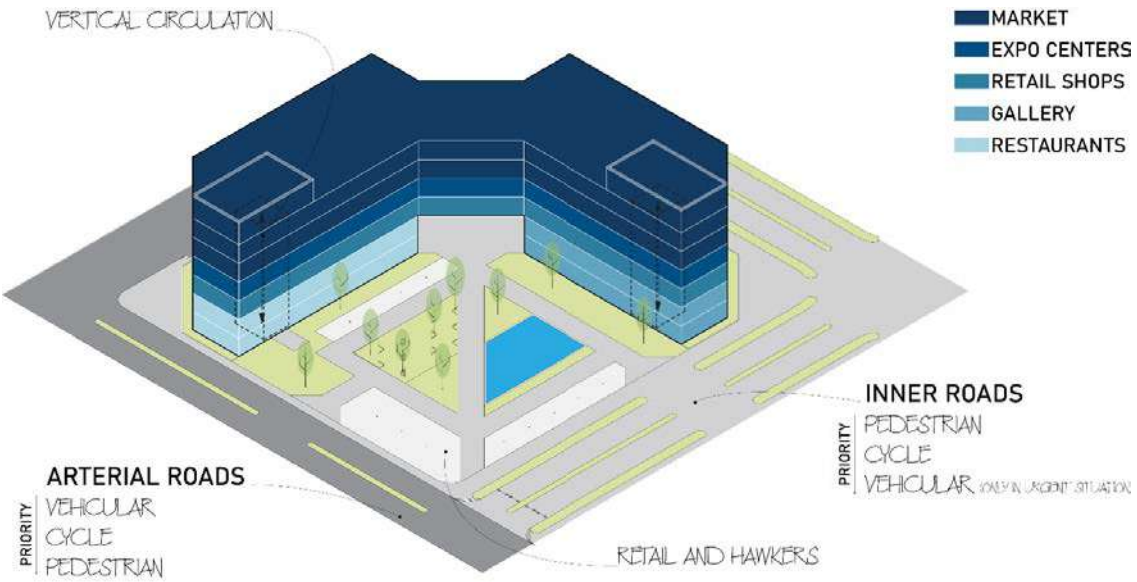

Figure 25. Three-dimensional spatial relation of proposed social block showing public green plaza.

The survey data highlight persistent gaps in mobility, environmental quality, public safety, and economic vibrancy. In parallel, the superblock framework—characterised by integrated open spaces, pedestrian-prioritised mobility, and mixed-use activation—provides targeted strategies to address these challenges. The spatial potential of the superblock model is illustrated in Figure 26, which shows the proposed residential blocks organised around a central green courtyard, ensuring permeability, natural surveillance, and community interaction.

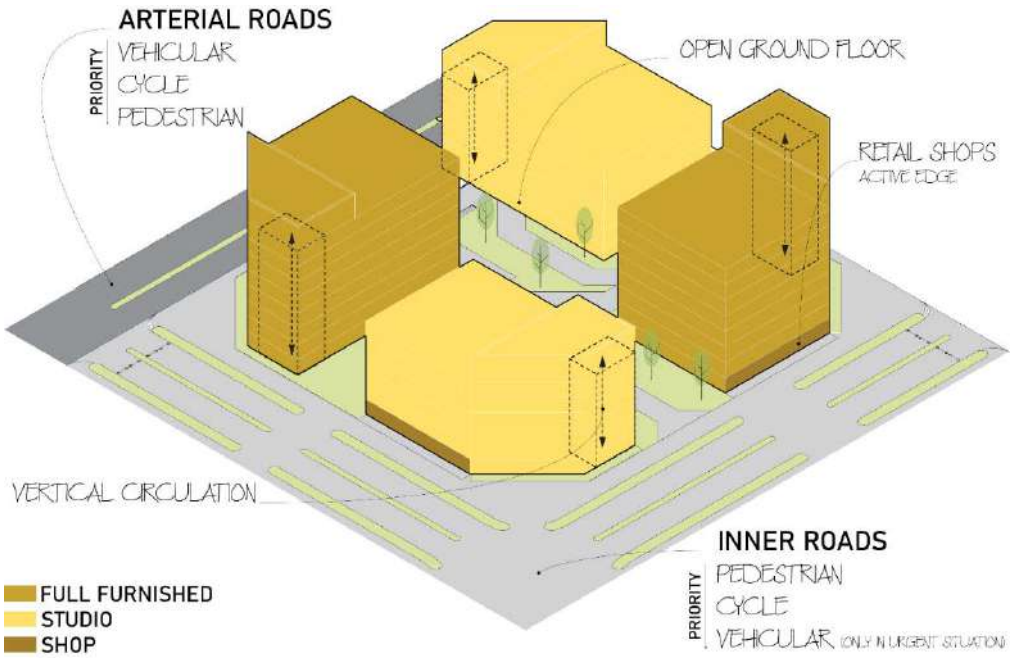

Figure 26. Three-dimensional spatial relation of proposed Residential blocks showing central green courtyard surrounded by residential blocks.

6.1. Mobility and Congestion

Approximately 82% of respondents reported that traffic congestion and inadequate parking are among the most critical issues faced on workdays. The coexistence of diverse vehicle types—manual rickshaws, motorcycles, freight trucks, and private cars—combined with weak enforcement mechanisms intensifies congestion, prolongs travel times, and exacerbates air pollution.

Superblock Solution. By redirecting through-traffic to peripheral arterial roads and converting interior streets into pedestrian and micro-mobility corridors, the superblock strategy reduces congestion and encourages active transport. This design not only enhances mobility efficiency but also contributes to improved air quality and reduced noise levels. Over time, the restructuring of mobility patterns creates safer, healthier, and more inclusive neighbourhoods.

6.2. Public Space and Environment

Over 52% of respondents expressed dissatisfaction with the lack of accessible public spaces such as parks, benches, and community gathering areas. The absence of greenery and recreational amenities has reduced opportunities for relaxation, social interaction, and cultural engagement.

Superblock Solution. Within the superblock model, inner streets are reimagined as green corridors, micro-parks, and public plazas, reinforcing ecological connectivity and providing safe, multifunctional spaces. These public realms foster community identity, encourage cultural exchange, and strengthen social cohesion. Importantly, creating a sense of collective ownership over these spaces also discourages illegal encroachment and antisocial behaviour, enhancing both environmental and social security.

6.3. Safety and Night-Time Experience

Nearly 47% of respondents indicated that they feel unsafe in TIA during evening and night-time hours. After office hours, the area becomes largely inactive, with few open businesses, insufficient lighting, and minimal pedestrian presence. Superblock Solution. To improve night-time safety, the superblock approach integrates human-scaled lighting, visible public amenities, and "active edges" such as cafés, restaurants, bookshops, IT gadget shops, and bakeries. Encouraging late-evening operations of street food vendors and small businesses sustains activity after office hours, increases passive surveillance, and builds social capital. This aligns with Jacobs' (1961) "eyes on the street" principle, where constant visibility and activity in the public realm reinforce safety.

6.4. Economic and Mixed-Use Activation

Respondents also emphasised the lack of cafés, retail shops, and seating areas in TIA, particularly at ground-floor levels accessible to pedestrians. The absence of such amenities limits vibrancy and discourages lingering in the area. Superblock Solution. By reallocating road space from cars to pedestrians, superblocks enhance foot traffic in commercial areas, directly benefiting ground-floor businesses. Flexible zoning encourages live-work-play ecosystems, integrating housing, services, and leisure. Empirical evidence from Barcelona demonstrates that superblock policies not only improve environmental health but also indirectly stimulate local economies by creating more attractive, walkable public environments (Damnjanović et al., 2024; Palenzuela, 2021). Ground-level shops and cafés thrive in such conditions, reinforcing urban vibrancy and economic resilience.

6.5. Superblock Integration with MRT Development

According to the Strategic Transport Plan, MRT Line 5 (Southern Route) will establish a station within a 200-metre radius of the study area, significantly influencing mobility patterns within a 500-metre catchment zone. Survey results reveal that 60% of respondents would prefer to live near the MRT station if walkability is ensured, citing improvements in work-life balance and economic savings.
Superblock Solution. By prioritising walkability and cycling infrastructure, superblocks naturally complement mass rapid transit systems. The integration of superblock principles with MRT access supports Transit-Oriented Development (TOD), reducing first- and last-mile friction. This integration fosters mixed-use, compact urban growth around transit stations, enhancing accessibility to housing, services, and employment opportunities while reducing dependency on private motorised vehicles.

6.6. Frequency Analysis Summary

Table 4 summarises the key survey findings.

General Information

Indicator	Category	Frequency	Percentage (%)
Age Group	Under 18	13	8.6
	18–30	84	55.6
	31–50	39	25.8
	51–70	12	7.9
	70+	3	2.0
Gender	Male	81	53.6
	Female	58	38.4
	Not Willing to Mention	12	7.9
Most Recent Occupation	Student	62	41.1
	Employee at PO	35	23.2
	Government Employee	23	15.2
	Self-employed	20	13.2
	Unemployed	11	7.3
Living Distance (500–1km)	Yes	84	55.6
	No	67	44.4
Duration of Stay/Work	Less than a year	35	23.2
	1–3 years	44	29.1
	3+–5 years	36	23.8
	5+–8 years	12	7.9
	8+ years	24	15.9
Experience & Satisfaction			
Frequency of Visiting on Foot	Daily	57	37.7
	A few times a week	42	27.8
	Rarely	34	22.5
	Never	18	11.9
Perception of Safety	Extremely Unsafe	21	13.9
	Unsafe	27	17.9
	Neutral	41	27.2
	Safe	35	23.2
	Extremely Safe	27	17.9
Green Space Accessibility	Restricted	39	25.8
	Not Accessible	31	20.5
	Neutral	54	35.8
	Accessible	12	7.9
	Very Accessible	15	9.9
Feel Safe at Night	Yes	48	31.8
	No	71	47.0
	Unsure	32	21.2
Enough Green/Public Spaces	Yes	47	31.1
	No	78	51.7
	Not Sure	26	17.2
Visiting Purposes & Preferences			
Purpose of Visit	Work	77	51.0
	Shopping	20	13.2
	Dining	10	6.6
	Visiting Friends/Family	31	20.5
	Leisure	13	8.6
Desired Public Facilities	Toilets	19	12.6
	Open Seating	48	31.8
	Cafés	39	25.8
	ATM	19	12.6
	Information Booth	12	7.9
	Wi-Fi	14	9.3
Mode of Transport	Walking	31	20.5
	Rickshaw	53	35.1
	Car	25	16.6
	Bus	38	25.2
	Train	4	2.6
Traffic/Parking Affected	Yes	124	82.1
	No	27	17.9

MRT-Related Indicators

Indicator	Category	Frequency	Percentage (%)
Housing Choice Due to MRT	Very Likely	24	15.9
	Likely	60	39.7
	Neutral	37	24.5
	Unlikely	21	13.9
	Very Unlikely	9	6.0
Maximum Walking Willingness to MRT	Do not like to walk	24	15.9
	<5 minutes	65	43.0
	5–10 minutes	34	22.5
	10 minutes	23	15.2
	Nearly 30 minutes	2	1.4
	30 minutes	1	0.7
	Not Sure	1	0.7
MRT Use After Completion	Never	18	11.9
	Rarely	44	29.1
	Often	51	33.8
	Regularly	31	20.5
	Primary Transport	7	4.6
MRT Complementary Facilities	Safety/Lighting	55	36.4
	Covered Walkways	30	19.9
	Ride-Sharing Zones	25	16.6
	Bicycle Parking	19	12.6
	Retail Kiosks	22	14.6
MRT Convenience	Yes	72	47.7
	No	33	21.9
	Not Sure	46	30.5
Likelihood to Visit via MRT (Future Dev)	Very Likely	24	15.9
	Likely	60	39.7
	Occasionally	37	24.5
	Rarely	21	13.9
	Never	9	6.0

Summary of Key Findings from Frequency Analysis

Indicator	Insight
Age Group	56% are aged 18–30, indicating a young, mobile base and a powerhouse as a working group
Occupation	41% are students, 23% are local employees.
Transport Mode	35% use rickshaw, 25% use buses, 21% walk
Traffic Congestion	82% feel affected—signalling a major urban flaw
Safety Concerns (at night)	47% feel unsafe at night; 21% are unsure
Public Space Availability	52% say there are not enough parks or open spaces
MRT Usage Willingness	60% are likely to use it if well-integrated
Business Preferences	Favour mixed-use, walkable environments (cafés, retail)

Note. Survey conducted in Tejgaon Industrial Area (n = 151), 2024–2025.

6.7 Synthesis

The survey analysis confirms that TIA faces acute deficits in mobility, public space provision, safety, and economic vitality. The superblock development model addresses these deficits through a holistic reorganisation of space, as demonstrated in Figure 26. By integrating residential, commercial, and recreational functions around a centralised green courtyard, superblocks foster inclusive, vibrant, and climate-resilient communities. Taken together, the solutions identified through both survey data (Table 4) and land-use calculations (Table 3) demonstrate the transformative potential of superblocks for TIA. The integration of public space, ecological corridors, and transit-oriented growth aligns with global best practices while responding to the unique socio-economic realities of Dhaka.

Although this is a conceptual proposal based on facts and presents a hypothetical scenario, it is considered a pilot project that can address the urban issues of a megacity like Dhaka. The impact areas are as follows:

Table 5: Superblocks' impacts on Dhaka's urban Development.

SUPER BLOCK IMPACT - IN THE CONTEXT OF DHAKA	
Urban Mobility	Lower emissions, safer streets, improved last-mile access.
Environmental Quality	More green cover, reduced noise, and air pollution
Public Health	Encourages walking, reduces respiratory risk, improves health quality
Economic Vitality	Boosts small businesses and mixed-use investment
Resilience & Equity	More inclusive access to infrastructure and open space

Table 5 presents the projected impacts of superblock development on Dhaka's urban transformation, with particular emphasis on the Tejgaon Industrial Area (TIA). The analysis highlights how superblocks directly address five critical dimensions of urban sustainability: mobility, environmental quality, public health, economic vitality, and social equity. By restructuring street hierarchies, reducing vehicular dependence, and reallocating space to pedestrians and green infrastructure, superblocks offer systemic benefits that extend beyond traffic management to include environmental resilience and inclusive growth. These impacts align with both local planning goals and global best practices in sustainable urban development.

SDG goals supported by the proposed superblock development for TIA

Table 6 identifies the **Sustainable Development Goals (SDGs)** that are supported through the proposed superblock framework in TIA. The analysis demonstrates that the superblock model contributes to multiple SDGs, ranging from health and well-being (SDG 3) to sustainable cities and communities (SDG 11), climate action (SDG 13), and life on land (SDG 15). Each design intervention—such as pedestrian-prioritised streets, cycling networks, mixed-use zoning, and permeable pavements—is linked to specific SDG targets. This mapping illustrates the integrative potential of superblocks, showing how a single urban design framework can address interconnected challenges in public health, environmental sustainability, and urban equity.

Table 6: SDGs' goals addressed.

SUPER BLOCK SUPPORTED SDG GOALS	SDG 3.6	SDG 3.9	SDG 3.d	SDG 11.1	SDG 11.2	SDG 11.3	SDG 11.5	SDG 11.6	SDG 11.7	SDG 11.a	SDG 13.1	SDG 13.2	SDG 13.3	SDG 15.1	SDG 15.5	SDG 15.9
Pedestrian-prioritized streets																
Cycling networks and MRT connectivity																
Mixed-use zoning (Commercial + Residential + Social)																
Vehicle-free cores																
Green corridors and waste-to-energy systems																
Pocket parks and rooftop gardens																
Permeable pavements and rainwater harvesting																
Solar-powered and energy-efficient buildings																
Urban farming and rooftop gardening																

7. Discussion

The findings of this study demonstrate that the superblock model offers a significant departure from Dhaka's prevailing plot- and block-based urbanism, providing measurable gains in mobility, environmental resilience, and public life within the Tejgaon Industrial Area (TIA). Compared to conventional plot-based development, superblocks reduce paved areas by 57%, increase permeability by 44%, and allocate nearly half of the site (50%) to open and public spaces. These outcomes are particularly important in a megacity where impermeable surface growth has been directly linked to a 700% increase in groundwater extraction over the past three decades, leading to severe aquifer depletion (Parvin, 2019). The capacity of superblocks to enhance infiltration and restore ecological balance positions them as a climate-resilient strategy within the broader framework of sustainable urbanism.

Survey evidence further validates these quantitative improvements by linking them to lived experience. Over 82% of respondents identified traffic congestion and inadequate parking as critical challenges, reflecting Dhaka's dependence on fragmented vehicular networks. By diverting through-traffic to perimeter roads and reorganising inner streets as pedestrian-prioritised corridors, the superblock scenario aligns with global best practices such as Barcelona's Superilla, where private car trips fell by 15% and public space accessibility rose by 70% (Palenzuela, 2021). Importantly, 60% of respondents expressed willingness to relocate near a proposed MRT station if walkability was assured, highlighting the synergy between superblocks and emerging Transit-Oriented Development (TOD) frameworks in Dhaka.

Social and safety dimensions are equally significant. Approximately 47% of survey participants reported feeling unsafe at night within TIA, citing poor lighting and lack of activity after business hours. Superblock zoning that encourages mixed-use activation and "eyes on the street" through cafés, shops, and extended operating hours directly addresses this deficit, echoing Jacobs' (1961) advocacy for continuous, community-driven street life. Similarly, the gendered analysis of green space use revealed that while men reported higher daily walking frequency ($M = 3.14$ vs. 2.75; $p = 0.03$), women placed significantly greater value on accessible green areas ($M = 4.25$ vs. 3.42; $p < 0.001$). These findings emphasise that inclusive public realms must balance ecological design with cultural sensitivity and gender-responsive planning.

From a theoretical perspective, the study situates the superblock model within a synthesis of Le Corbusier's rationalist emphasis on efficiency, Jacobs' insistence on human scale and social diversity, and Lefebvre's "Right to the City." The Tejgaon case demonstrates that while modernist strategies can provide structural clarity and environmental efficiency, they must be tempered by participatory and democratic frameworks that prioritise equity. This echoes global critiques of superblocks in China, where excessive enclosure has led to social fragmentation (Kan et al., 2017), and underscores the need for adaptive, context-sensitive application in Dhaka.

Finally, the alignment of the superblock model with the Sustainable Development Goals (SDGs) reinforces its international relevance. By addressing SDG 3 (health), SDG 11 (sustainable cities), SDG 13 (climate action), and SDG 15 (life on land), superblocks extend beyond urban design to support broader ecological and social agendas. These integrative contributions position the superblock not merely as a planning tool but as a systemic framework capable of addressing Dhaka's intertwined challenges of congestion, environmental degradation, and inequitable growth.

8. Conclusion

This study has shown that superblock urbanism provides a scalable, climate-resilient redevelopment strategy for the Tejgaon Industrial Area, surpassing traditional plot- and block-based models in efficiency, equity, and sustainability. Quantitative analysis demonstrated significant improvements in permeability (+44%), reduced paved surfaces (–57%), and expanded open space allocation (50%), while qualitative findings revealed strong community demand for safer, greener, and more walkable environments. By integrating transport planning, ecological corridors, and mixed-use zoning, the superblock framework directly addresses Dhaka's acute mobility, safety, and environmental deficits.

The research confirms that superblocks are not only feasible within the regulatory context of the DAP (2022–2035) but also synergise with Dhaka's forthcoming MRT and BRT systems, providing a foundation for Transit-Oriented Development. However, successful implementation requires overcoming entrenched barriers, including fragmented land ownership, speculative land markets, and institutional inertia. Without deliberate policy instruments such as land pooling, financial incentives, and inclusive governance mechanisms, the transformative potential of superblocks risks being undermined by piecemeal development.

Future research should focus on piloting superblock prototypes within TIA and other strategic zones of Dhaka to test real-world challenges of financing, governance, and community acceptance. Longitudinal studies are also necessary to evaluate the socio-economic impacts of superblocks, particularly their effects on housing affordability, business vitality, and gender-equitable access to public spaces. By bridging theory and practice, this study argues that superblock urbanism represents more than a physical design solution: it is a pathway towards a more resilient, inclusive, and sustainable Dhaka—one that prioritises collective rights to urban space and sets a precedent for other rapidly urbanising global contexts.

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This research was conducted using internal institutional resources only.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Data availability statement

Data are available upon request due to privacy and ethical restrictions. Raw data were produced at North South University, while processed data can be obtained from the corresponding author, Shahriar Iqbal Raj, upon request.

Institutional Review Board Statement

This study was conducted in accordance with ethical research practices, ensuring voluntary participation, informed consent, and participant confidentiality. Approval was obtained from the NSU Institutional Review Board/Ethics Review Committee (IRB/ERC): https://www.northsouth.edu/research-office/research-committee

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References:

Ahmed, N. (2018, November 9). *When will urban planning get its due importance? The Daily Star.*

Alawadi, K., Alkhaja, N., & Vall, E. M. (2024). Building with superblocks: Study of Gulf corporation cities. *URBAN DESIGN International*. https://doi.org/10.1057/s41289-024-00257-0

Amati, M., Stevens, Q., & Rueda, S. (2024). Taking Play Seriously in Urban Design: The Evolution of Barcelona's Superblocks. *Space and Culture*, *27*(2), 156–171. https://doi.org/10.1177/12063312231159229

Apatenko, T., & Bezliubchenko, O. (2024). Priorities and Disadvantages of City Block Development. *Municipal Economy of Cities*, *1*(182), 35–42. https://doi.org/10.33042/2522-1809-2024-1-182-35-42

Babic, N. (2021). Superblocks—The Future of Walkability in Cities? *Academia Letters*. https://doi.org/10.20935/AL747

Barcelona City Council. (2016). *Superblocks—Architecture Walks and Tours in Barcelona* [Graphic]. Retrieved from https://barcelonarchitecturewalks.com/superblocks/

Bredikhina, N., Bredikhin, V., Los, K. I., & Bredikhin, A. (2023). Redevelopment of Real Estate in Urban Industrial Zones: In N. Cobîrzan, R. Muntean, & R.-A. Felseghi (Eds.), *Advances in Finance, Accounting, and Economics* (pp. 215–241). IGI Global. https://doi.org/10.4018/978-1-6684-8238-4.ch010

Butler, C. (2019). Exploring the contours of the right to the city. In M. E. Leary-Owhin & J. P. McCarthy (Eds.), *The Routledge handbook of Henri Lefebvre, the city and urban society* (1st ed., pp. 457–466). Routledge. https://doi.org/10.4324/9781315266589-48

Carlos, A. F. A. (2020). Henri Lefebvre: O espaço, a cidade e o “direto à cidade” [Henri Lefebvre: Space, the city, and the "right to the city"]. *Revista Direito e Práxis*, *11*(1), 349–369. https://doi.org/10.1590/2179-8966/2020/48199

Castells, M. (2023). The Network Society Revisited. *American Behavioral Scientist*, *67*(7), 940–946.

Chen, X. (2022). An eastern supergrid and superblock urban model. In X. Chen, *Supergrid and superblock* (1st ed., pp. 25–35). Routledge. https://doi.org/10.4324/9781003037194-2

Chérrez-Rodas, K. (2020). Relectura de dos ciudades desde los conceptos de Lefebvre [Rereading two cities through Lefebvre's concepts]. *Diseño Arte y Arquitectura*, *9*, 213–229. https://doi.org/10.33324/daya.v1i9.343

Corbusier, L. (2020). A contemporary city. In R. T. LeGates & F. Stout (Eds.), *The city reader* (7th ed., pp. 392–400). Routledge. https://doi.org/10.4324/9780429261732-46

Damnjanović, N., Jevremović, S., Trpković, A., & Gajić, R. (2024). Superblock: The modern urban traffic concept of sustainable city development. In *Ekološko inženjerstvo – mesto i uloga, stanje i budući razvoj (16): Zbornik radova* [Ecological engineering – place and role, status and future development (16): Proceedings] (pp. 194–206). https://doi.org/10.5937/eko-eng24015d

Das, A. (2018). The changing face of a megacity's key industrial hub in Bangladesh: Towards assessing its emerging transformation pattern for pertinent future urban development. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3641759

Friendly, A. (2024). Right to the City. In A. Friendly, *Urban Studies*. Oxford University Press. https://doi.org/10.1093/obo/9780190922481-0081

Fuller, M., & Moore, R. (2017). *The Death and Life of Great American Cities*. Macat Library. https://doi.org/10.4324/9781912282661

Gasca Salas, J. (2022). El derecho a la ciudad en Henri Lefebvre: Consigna civilizatoria, espacio político y utopía ["The right to the city" in Henri Lefebvre: Civilizing slogan, political space, and utopia]. *Revista de Direito da Cidade*, *14*(3), 2154–2179. https://doi.org/10.12957/rdc.2022.67871

Ge, X., & Han, D. (2020). *Sustainability-oriented configurational analysis of the street network of China's superblocks: Beyond Marshall's model* [Graphic]. Retrieved from https://linkinghub.elsevier.com/retrieve/pii/S2095263520300509

Ge, X., & Han, D. (2020). Sustainability-oriented configurational analysis of the street network of China's superblocks: Beyond Marshall's model. *Frontiers of Architectural Research*, *9*(4), 858–871. https://doi.org/10.1016/j.foar.2020.07.001

Geyer, H. S. (2024). The theory and praxis of mixed-use development—An integrative literature review. *Cities*, *147*, 104774. https://doi.org/10.1016/j.cities.2023.104774

Hossain, S. T. (2020). Critical Review of Street Connectivity Between Tejgaon Industrial Area and Adjacent Hatirjheel Development. *Creative Space*, *8*(1), 1–13. https://doi.org/10.15415/cs.2020.81001 https://doi.org/10.1177/00027642221092803

Jahan, S. (1990). Urban Planning in Bangladesh: A Review. In N. Islam (Ed.), *Urban Research in Bangladesh*. Centre for Urban Studies (CUS).

Kan, H. Y., Forsyth, A., & Rowe, P. (2017). Redesigning China's superblock neighbourhoods: Policies, opportunities and challenges. *Journal of Urban Design*, *22*(6), 757–777. https://doi.org/10.1080/13574809.2017.1337493

Khan, A. M., Hossain, S. M. N., & Reza, F. (2017). Revisiting density concepts for city planning and its implications for Dhaka City. *Journal of Bangladesh Institute of Planners*, *10*(1), 1–13. https://doi.org/10.3329/jbip.v10i1.76761

King, L. (2019). Henri Lefebvre and the right to the city. In S. M. Meagher, S. Noll, & J. S. Biehl (Eds.), *The Routledge handbook of philosophy of the city* (1st ed., pp. 76–86). Routledge. https://doi.org/10.4324/9781315681597-7

Krier, R., & Rowe, C. (1991). *Urban space* (5th ed.). Academy Editions.

Laurence, P. L. (2006). The death and life of urban design: Jane Jacobs, the Rockefeller Foundation and the new research in urbanism, 1955–1965. *Journal of Urban Design*, *11*(2), 145–172. https://doi.org/10.1080/13574800600644001

Lefebvre, H. (2000). *Writings on cities* (E. Kofman & E. Lebas, Eds.; 4th ed.). Blackwell Publishers.

LeGates, R. T., & Stout, F. (Eds.). (2020). *The city reader* (Seventh edition). Routledge. https://doi.org/10.4324/9780429261732

Marchand, B. (2016). La ville radieuse de Le Corbusier: Les paradoxes d'une utopie de la société machiniste [Le Corbusier: The paradoxes of a utopia of machine society]. *Urbia*, *19*, 63–78.

Merrifield, A. (2021). The right to the city and beyond: Notes on a Lefebvrian reconceptualization. In N. Brenner (Ed.), *Implosions / explosions* (pp. 523–532). De Gruyter. https://doi.org/10.1515/9783868598933-032

Montavon, M., Steemers, K., Cheng, V., & Compagnon, R. (2006). *"La Ville Radieuse" by Le Corbusier once again: A case study*. In *PLEA 2006: The 23rd Conference on Passive and Low Energy Architecture*, Geneva, Switzerland.

Moudon, A. V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology*, *1*(1), 3–10. https://doi.org/10.51347/jum.v1i1.4047

Nevozhai, D. (2019). *Building China: Rise of the Superblock* [Graphic]. Retrieved from https://radii.co/article/building-china-rise-of-the-superblock

Nieuwenhuijsen, M., De Nazelle, A., Pradas, M. C., Daher, C., Dzhambov, A. M., Echave, C., Gössling, S., Iungman, T., Khreis, H., Kirby, N., Khomenko, S., Leth, U., Lorenz, F., Matkovic, V., Müller, J., Palència, L., Pereira Barboza, E., Pérez, K., Tatah, L., … Mueller, N. (2024). The superblock model: A review of an innovative urban model for sustainability,

liveability, health and well-being. *Environmental Research, 251*, 118550. https://doi.org/10.1016/j.envres.2024.118550

Palenzuela, S. R. (2021). Superblocks: Base of a new model of mobility and public space. Barcelona as an example. In *International encyclopedia of transportation* (pp. 249–257). Elsevier. https://doi.org/10.1016/B978-0-08-102671-7.10709-2

Pichkalova, A. D. (2022). The emergence of mixed residential and industrial areas. *Chronos*, *7*(5[67]), 4–5. https://doi.org/10.52013/2658-7556-67-5-1

Postaria, R. (2021). *Superblock (Superilla) Barcelona—A city redefined. Public Realm* [Graphic]. Retrieved from https://www.citiesforum.org/news/superblock-superilla-barcelona-a-city-redefined/

Rabaça, A. (2016). *Le Corbusier, the city, and the modern utopia of dwelling*. *Journal of Architecture and Urbanism, 40*(2), 110–120. https://doi.org/10.3846/20297955.2016.1183529

Rahman, M. M. (2024). Measuring Compact Development Potential of an Emerging Urban Area: A Case of Savar. *Journal of Engineering Science*, *14*(2), 107–125. https://doi.org/10.3329/jes.v14i2.71234

Rajdhani Unnayan Kartripakkha (RAJUK). (2022). *Detailed area plan for Dhaka Metropolitan Region, 2022–2035* [Graphic]. Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh.

Rana, M. S. (2021). Tackling Dhaka's planning issues: Philosophical ideologies and planning remedies. *Academia Letters*. https://doi.org/10.20935/AL3736

Rodríguez-Lora, J.-A., Navas-Carrillo, D., & Pérez-Cano, M. T. (2021). Le Corbusier's urbanism: An urban characterisation of his proposals for inner cities. *Frontiers of Architectural Research, 10*(4), 701–714. https://doi.org/10.1016/j.foar.2021.05.002

Roy, S., Sowgat, T., Ahmed, M. U., Islam, S. M. T., Anjum, N., Mondal, J., & Rahman, M. M. (2018). *Bangladesh: National urban policies and city profiles for Dhaka and Khulna* [Research report]. Khulna University.

Siksna, A. (1996). The evolution of block size and form in North American and Australian city centres. *Urban Morphology*, *1*(1), 19–33. https://doi.org/10.51347/jum.v1i1.4048

Sung, H., Lee, S., & Cheon, S. (2015). Operationalizing Jane Jacobs's urban design theory: Empirical verification from the great city of Seoul, Korea. *Journal of Planning Education and Research, 35*(2), 117–130. https://doi.org/10.1177/0739456X14568021

Talen, E. (2024). New urbanism. In E. Talen, *What cities say* (1st ed., pp. 82–84). Oxford University Press. https://doi.org/10.1093/oso/9780197647769.003.0014

Tanvir, H., Paliwal, S., & Soni, S. (2025). Assessing urban transformation and land-use dynamics in unplanned settlements: Case studies of 10 No. Market and Bittan Market. *International Journal of Scientific Research in Engineering and Management, 9*(1), 1–9. https://doi.org/10.55041/IJSREM41129

Tavassoli, M. (2020). Design of urban block. In M. Tavassoli (Ed.), *Form, space and design: From the Persian to the European experience* (pp. 81–97). Springer International Publishing. https://doi.org/10.1007/978-3-030-15831-6_5

Whitehand, J. W. R. (2001). British urban morphology: The Conzenian tradition. *Urban Morphology, 5*(2), 103–109. https://doi.org/10.51347/jum.v5i2.3896

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Landscape of Anonymity: Transforming the Retired COVID-19 Field Medical Facility into A Memorial Park

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ABSTRACT

During the COVID-19 emergency, the escalating number of cases overwhelmed the admission capacity of operating hospitals in many cities. The pandemic thus prompted the rapid construction of temporary field hospitals in cities like Wuhan, China, to relieve pressure on existing health infrastructure. While their operational phase has been well-documented, the post-pandemic reuse of these facilities remains underexplored. This study proposes a novel design paradigm - Anonymity Landscape Memorial Design - to transform the retired Huoshenshan Field Hospital into a public memorial park. Drawing on counter-memorial theory and spatial translation methods, the project reimagines commemorative landscapes through abstraction, emotional disruption, and interactive experience, rather than conventional symbolism. The design unfolds in four stages aligned with the emotional arc of the pandemic: outbreak, lockdown, recovery, and reflection. Methodologically, the study integrates multi-source data analysis, theoretical modeling, and adaptive reuse strategies to address spatial, social, and economic dimensions. Findings demonstrate how this approach fosters inclusive memory-making while yielding 62.5% material recycling and approximately CNY 7.94 million (US$1.10million) in cost savings. The project contributes a replicable framework for converting ephemeral urban infrastructure into resilient civic spaces that blend memory, sustainability, and public use. These outcomes demonstrate how post-pandemic urban transformations can reduce resource waste, strengthen local economies, enhance spatial equity, and expand access to quality civic spaces – offering insightful perspectives to other COVID-19-affected cities on similar issues of contemporary urbanisation.

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Highlights:

- Proposes a new design paradigm - Anonymity Landscape Memorial Design - for post-pandemic public spaces.
- Integrates three memorial theories to address symbolic, emotional, and spatial design challenges.
- Demonstrates 62.5% material reuse and CNY 7.94 million or US$1.10 million in construction cost savings.
- Shifts focus from monumentality to pluralistic, interactive memory ecosystems.
- Offers a transferable model for transforming crisis-response infrastructure into resilient civic landscapes.

Contribution to the field statement:

This study introduces the Anonymity Landscape Memorial Design paradigm, offering a novel theoretical and spatial approach to repurposing retired field hospitals. It integrates memory theory with adaptive reuse, providing both socio-cultural value and economic efficiency. The framework advances memorial landscape discourse and contributes to post-pandemic urban resilience planning.

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1. Introduction

1.1 Global urbanization and pandemic challenges

Following the outbreak of the COVID-19 epidemic in Wuhan, China, in January 2020, the increasing number of confirmed and suspected cases quickly exceeded the admission capacity of designated hospitals in the city. This situation soon expanded to the global level. In response to this crisis, Professor Wang Chen designed a new field hospital concept, the Fangcang (literally 'Square Cabin') Shelter Hospital, in January-February 2020 (Chen et al., 2020). Accordingly, two speciality field hospitals, namely Huoshenshan Hospital and Leishenshan Hospital, were designed, built, and commissioned in record time (9-12 days) to address the outbreak (Luo et al., 2020), thereby saving precious time in providing high-quality medical treatment to over 5,000 patients. These facilities became emblematic of the rapid, large-scale infrastructure mobilisation possible under contemporary urbanisation pressures.

1.2 Post-pandemic dilemma of temporary infrastructure

On April 15, Huoshenshan and Leishenshan sent their final batch of patients to regular hospitals and were officially sealed off and "retired" (Ying et al., 2025). However, the heritage remains in the site according to Google Earth (Figure 1). A certain number of temporary field hospitals have been built in major countries and cities around the world after Wuhan. Typical examples include: Fiocruz Hospital Centre in Rio de Janeiro, Brazil, Golokhvastovo Modular Hospital in Moscow, Russia, and the regeneration of an abandoned hospital in Medellin, Colombia. These facilities are generally characterized by a spatial and temporal pattern of 'high-intensity use-rapid abandonment', creating a unique post-pandemic spatial heritage and posing urgent socio-economic challenges for cities, particularly in contexts of land scarcity, budget constraints, and uneven access to quality public spaces. In rapidly urbanising districts, these pressures intensify inequalities in health, recreation, and cultural participation, making it critical to develop reuse strategies that deliver tangible economic returns and spatial equity.

Figure 1. Site History Map of Study Area.

The field hospital approach was pivotal globally during the COVID-19 pandemic, which significantly reduced the burden on overstretched healthcare systems. After the pandemic, many researchers have focused on the improvements, effects, and contributions of the field-hospitals (Chen et al., 2020; Alhmoud & Çağnan, 2023; Razzak et al., 2023; Costa et al., 2024; Liu et al., 2025; Ying et al., 2025). Some of them noticed the efficacy and cost-effectiveness of field hospitals during the pandemic (Bernardez-Pereira et al., 2025) and the refugee and military value after the pandemic (Gao et al., 2024). However, the strategic reuse of retired field hospitals has received far less scholarly attention, especially approaches that can deliver measurable socio-economic benefits—such as resource efficiency, cost savings, and new public amenities—while preserving cultural memory. From the

perspective of urban sustainability, this study will mainly explore the utilization of retired field hospitals in the post-pandemic period and transforming them into a memorial park.

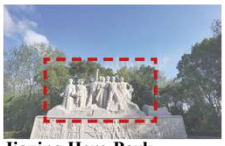
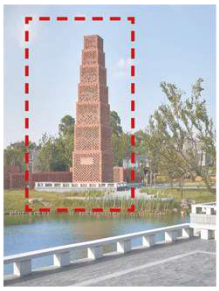
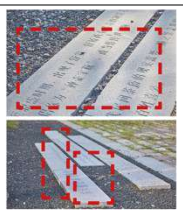
1.3 Literature Review & Research Question

Researchers have focused on the relationship between memory and place for decades. Starting from the French historian Pierre Nora (1989), who is interested in the constructed way of historical process and how they are endowed with meaning and causal power, his research programme is not to establish "what the past was really like," but rather to explore the utilisation of the past and its impact on contemporary present (Nora, 1989). According to James Young (1992) and SueAnne Ware (2008), memory and memorial design should be considered as a periodic process of reassessment and reconstruction in a changing context (Olin, 1995). Meanwhile, diverging from conventional commemorative design paradigms, Young's proposed anti-monumental expressions embody four defining characteristics: 1). articulating opposition to specific beliefs or historical events rather than affirming them; 2). deliberately eschewing traditional monumental forms to achieve near-invisibility through formal inversion; 3). facilitating intimate, multisensory engagement with viewers; and 4). rejecting didacticism to empower viewers to construct meaning for themselves (Stevens et al., 2012). Building on James Young's theory, Ware argues that the focus of memorial design should shift from heroic figures to victims, ordinary citizens, and society's marginalized, as traditional memorial design has limitations in remembering and problem-solving (Ware, 2008).

The counter-memorial theory of Wagoner and Brescó (2022) suggests that abstract and minimalist design engages more participation activities and leaves greater openness for experiencing and appropriating, and individuals perceive and interact with memorials in diverse ways, shaped by the unique personal connections and memories evoked during their exploration of the site. They also indicate that places of remembrance are spaces of shared memory that offer different possibilities for expressing and interpreting individual and collective loss. This process goes beyond mourning and helps individuals and societies to reinterpret the past and, in so doing, construct new directions for the future (Wagoner & Brescó, 2022). Likewise, Kuys et al. (2024) note that memorials must resonate with both the symbolic significance and the functional versatility of the environment in which they are situated, embracing the inherent freedom and diversity of the landscape. Furthermore, from a landscape architecture perspective, Al-azzawi et al. (2024) demonstrate that architectural environments integrating naturalistic beauty significantly enhance users' sense of place, while biophilic design elements foster stronger emotional connections. These theories and findings provide a robust theoretical foundation for developing commemorative landscape parks and enhancing visitor engagement with memorial spaces.

Despite these developments, Chinese monumental landscapes face three major limitations (Table 1): 1). symbolic violence (focusing on traditional monumental vertical structures, sculptures) (Jiaxing Hero Park, Yangtze River National Culture Park, Jizhou Kiln National Archaeological Park); 2). information overload (using tedious Images, documents, and testimonies to represent historical events and people) (The Yuanqiu Ruins park & Jizhou Kiln National Archaeological Park); and 3). affective detachment (Over-protection of heritage lacks interactivity) (Tangshan Earthquake Memorial Park & Erlitou Archaeological Site Park). Consequently, there are gaps in both theory and practice for a contemporary, multifunctional memorial design paradigm that integrates cultural meaning, public use, and socio-economic performance in the Chinese context.

Table 1: Major limitations in Chinese traditional monumental landscapes.

Limitations in the Chinese monumental landscapes	Expressions	Case Images
Symbolic Violence	Focusing on traditional monumental vertical structures, sculptures	 Jiaxing Hero Park  Yangtze River National Culture Park  Yangtze River National Culture Park  Jizhou kiln national archaeological park
Information Overload	Using tedious Images, documents, and testimonies to represent historical events and people	  Jizhou kiln national archaeological park   The Yuanqiu Ruins park
Affective Detachment	Over-protection of heritage lacks interactivity.	 Tangshan Earthquake Memorial Park  Erlitou Archaeological Site Park

This study addresses these gaps by advancing an approach that integrates cultural memory-making with measurable socio-economic benefits, focusing on expanding inclusive public space through urban transformations (by enabling cost-efficient, resource-conscious regeneration). The transformation of retired pandemic infrastructure into multifunctional civic landscapes demonstrates how memorial design can operate simultaneously as a cultural intervention and a socio-economic development strategy.

1.4 Objectives & Hypotheses

Previous studies indicate that Chinese citizens, particularly in Wuhan, now prefer open, spacious outdoor environments over traditional public spaces (Zhang et al., 2022; Ma, 2024). In a dense metropolitan region of over 12 million residents, abandoned field hospital sites represent valuable land assets that, if strategically repurposed, could meet evolving social needs while avoiding resource wastage. Additionally, until 2020, Wuhan has more than 12 million permanent population, and more than 550,000 people lived in the Caidian district (Li et al., 2023). More importantly, this global pandemic event must be remembered. Thus, amidst the convergence of high-density urban agglomeration and post-pandemic societal transformations, there is an urgent need to develop innovative landscape architecture solutions that address both socio-cultural healing and urban economic resilience.

This study proposes the Anonymity Memorial Landscape concept, rooted in Nora's (1989) *Lieux de mémoire*, Young's (1992) and Ware's (2008) anti-memorial theory, and Wagoner and Brescó's (2022) counter-memorial framework. The design aims to: 1) Provide inclusive public spaces that accommodate everyday recreation and reflection, 2) Preserve collective memory without imposing singular narratives, 3) Achieve economic savings by reusing existing materials and infrastructure, and 4) Enhance resilience through flexible, multifunctional design adaptable to future emergencies.

By demonstrating the adaptive reuse of Huoshenshan Field Hospital, this research illustrates how post-crisis spatial transformation can strengthen local economies, promote social cohesion, and reduce spatial and economic inequalities, directly contributing to the journal's focus on the socio-economic dimensions of contemporary urbanisation. The following sections are organised as shown below (Figure 2).

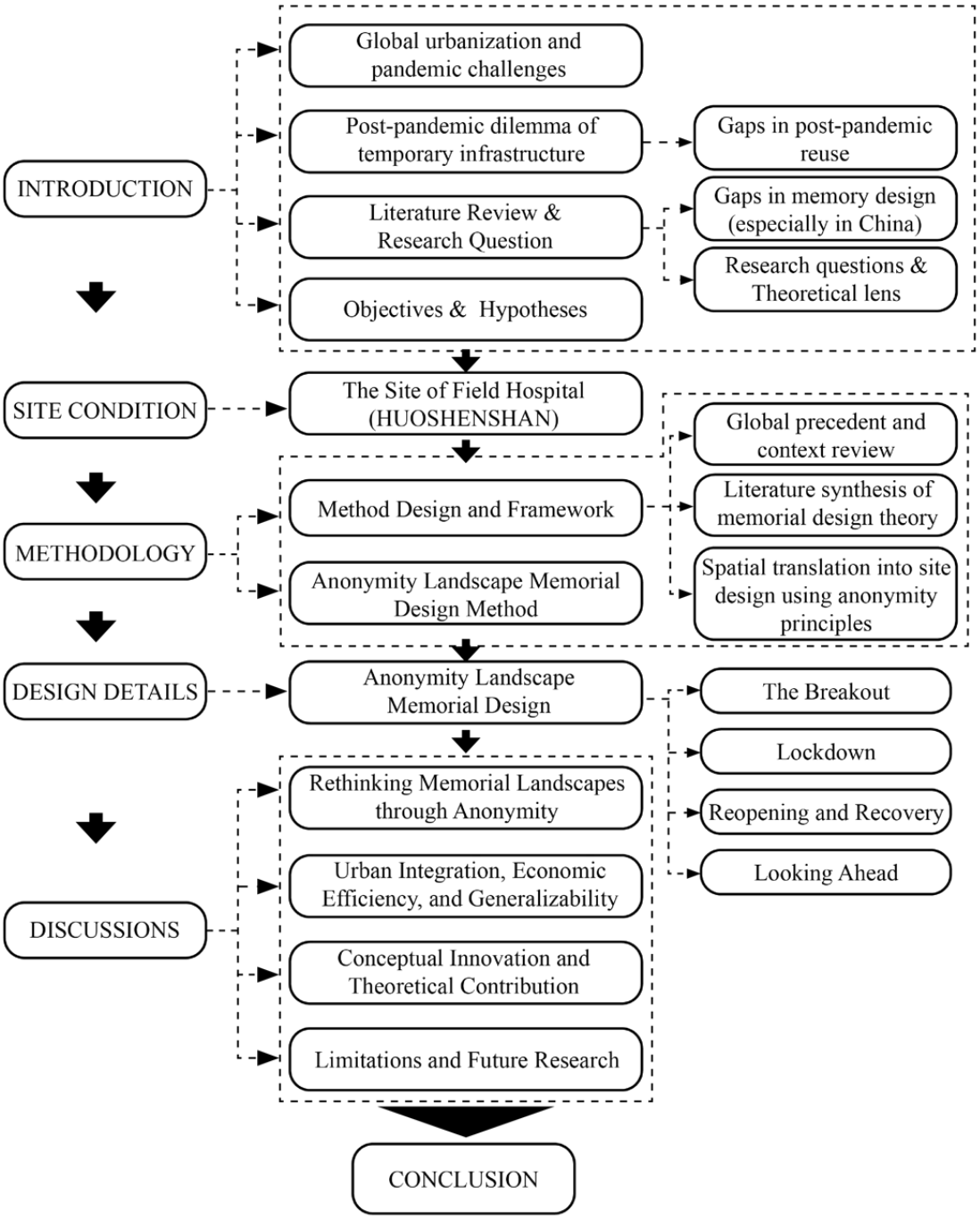


Figure 2. Structure of the Study.

2. The Site of Field Hospital (HUOSHENSHAN)

The 5-hectare Huoshenshan Hospital is located beside Zhiyin Lake in the Caidian District of Wuhan, China (Figure 3). It has been selected as a suitable site for building an emergent medical facility for COVID-19 as it is located in the leeward area of the CBD, thereby reducing the likelihood of the virus spreading due to wind (Chen et al. 2022). Moreover, the Caidian district features a low population density, thereby reducing the likelihood of virus transmission (Li et al., 2023). Additionally, a high-speed beltway (Zhiyin Lake Road) connects the site with the main city, and the relatively low and flat terrain provides suitable conditions for construction. Finally, as a positive influence on recovering patients, the nearby Zhiyin Lake affords good air quality and a pleasant environment (Chen et al. 2022). The site history map shows (Figure 1) that the site area was long-term green space from 1999-2019, the temporary field hospital was built in 2020, and the heritage still exists in 2025. The site condition photos (Figure 3) show that, except for the dominant field hospital preservation, there is a purification station, which is for the treatment of medical waste and the purification of medical sewage, located in the southwest of the site. A storage station, mainly for the storage of medical and living supplies, is built in the east corner of the field hospital site. In the southeast area is a healthcare center that provides living space for doctors and medical staff. Several groups of existing and constructing residential/housing areas are surrounded, and based on Chen et al. (2022) and the WUHAN Territorial Spatial Plan (2021-2035), more residential buildings will be constructed in this area.

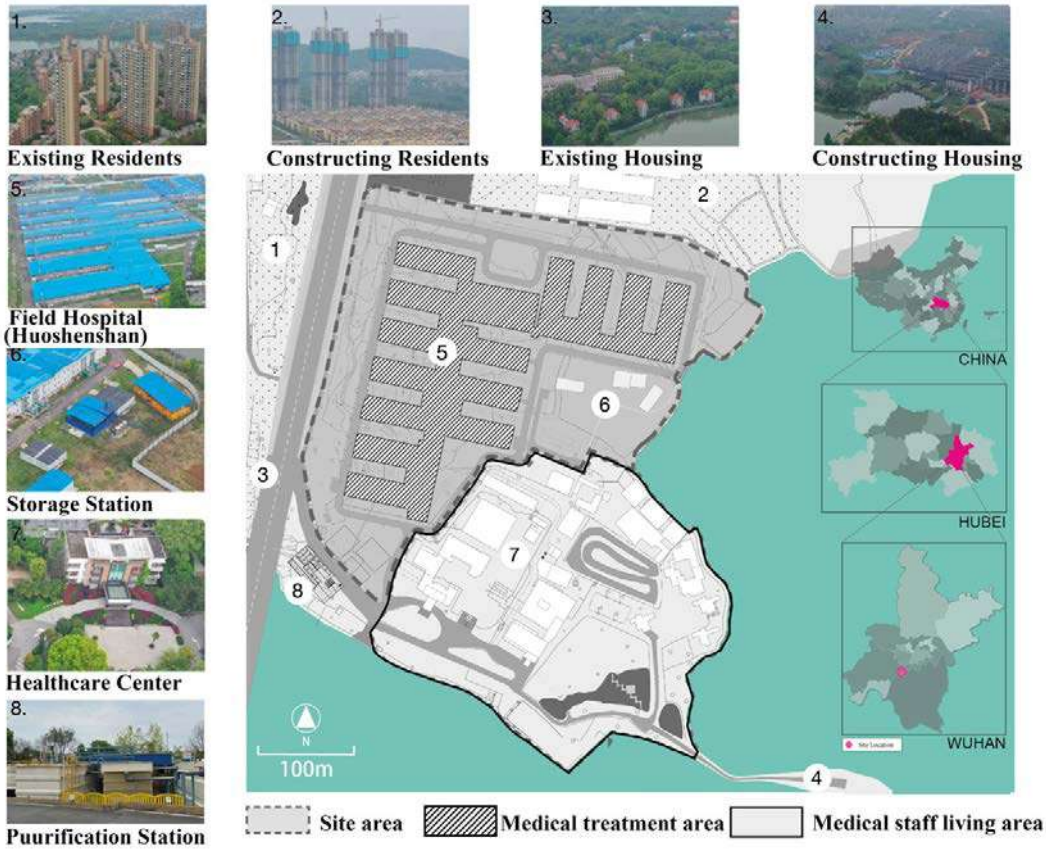


Figure 3. Detailed plan and condition photos of the site location(Drawn & photo by the Authors).

3. Methodology

3.1 Method Design and Framework

This study constructs a design-led qualitative method framework of 'Global precedent and context review, literature synthesis of memorial design theory, and Spatial translation into site design using anonymity principles' to form a monumental landscape design paradigm with spatial ethical value. The research is organised as follows (Figure 4).

First, we conduct a precedent and context review, and the global picture of the transformation of temporary medical facilities in the post-pandemic era is revealed through multi-source data mining and analysis. Since the establishment of the first field hospital in China, Wuhan Huoshenshan Hospital, a certain number of temporary field hospitals have been built in major countries and cities around the world. Typical examples include: Fiocruz Hospital Centre in Rio de Janeiro, Brazil, Golokhvastovo Modular Hospital in Moscow, Russia, and the regeneration of an abandoned hospital in Medellin, Colombia. These facilities are generally characterized by a spatial and temporal pattern of 'high-intensity use-rapid abandonment', creating a unique post-pandemic spatial heritage. According to the research from Zhang et al. (2022) and the site visit conclusion (Figure 3), there are a large number of residential construction areas around the Huoshenshan Hospital. Such a high density of residents needs to be supported by urban green space and public space. In addition, such a public safety event with a global impact has a memorial value. Therefore, the design of a memorial landscape park is selected as the theme of this research.

Next, we synthesize literature on memorial design theories; the literature analysis method is used to systematically deconstruct the research gap of the traditional monumental landscape. On this basis, this study innovatively integrates Pierre Nora's (1989) theory of 'Lieux de mémoire', James Young's (1992), SueAnne Ware's (2008) anti-memorial theory, and Wagoner and Brescó's (2022) framework of counter-memorial. We then propose a theoretical framework, 'Anonymity Landscape Memorial', to guide the design intervention.

Lastly, we apply the 'Anonymity Landscape Memorial' framework to translate the decommissioned field hospital site into a memorial park. Using anonymity principles, the theoretical model is transformed into an operable design system by using the methodology of spatial translation. The memorial space will be transformed from a static 'memory container' to a dynamic 'memory ecosystem'.

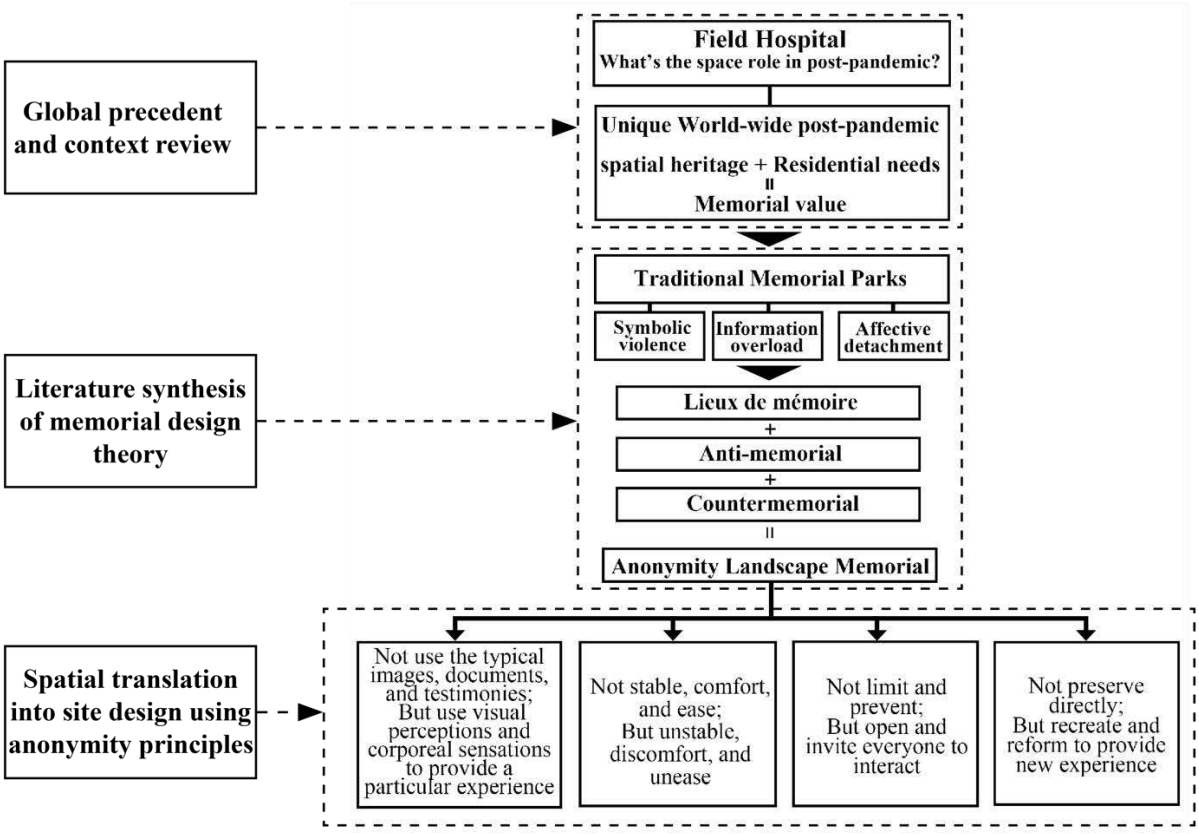


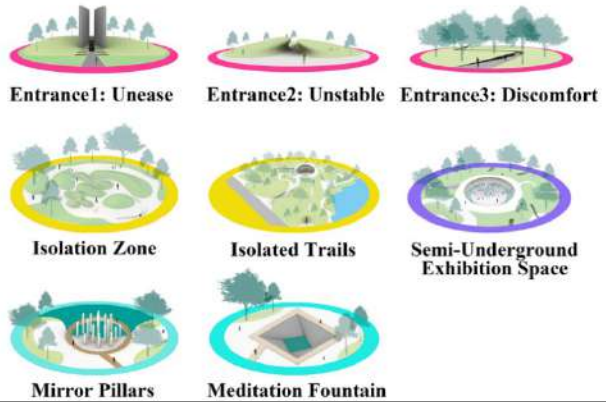
Figure 4. Methodology Framework.

3.2 Anonymity Landscape Memorial Design Method

To achieve the goal of the space of the field hospital transformation and reactivation, we conceptualized the transforming design around the ideas of anonymity. Rooted in James Young's (1992) and SueAnne Ware's (2008) anti-memorial theory, the theoretical framework and method of anonymity landscape memorial design mostly involve the following strategies (Table 2).

Firstly, the typical course of images, documents, and testimonies is sacrificed in favor of visual and corporeal sensations meant to bring about particular experiences. Most traditional memorial parks use monuments, images, documents, and testimonies to represent historical events and people, a practice that limits history and renders events more forgettable (Young, 1992; Olin, 1995). On the other hand, we intend to make use of landscape as a way of transitioning from staid memorials to unique and abstract visual and corporeal sensations. Hence, historical events can grow into specific experiences and feelings. The abstraction offered solutions that accommodate changing, more controversial, and uncertain attitudes toward history and its expression (Stevens & Franck, 2015). Secondly, the presentation of the memorial landscape should not feature stability, comfort, and ease but should evoke a sense of instability, discomfort, and unease, thus activating emotional interaction on the part of visitors, which in turn leads to deeper reflection. By means of a spatial strategy, the factual perspective of a historical event is to be diminished, while an unforgettable experience will be produced, and all these emotions and affections will potentially impact visitors' consciousness and imprint powerful messages upon their spirits (Giunta, 2014). Finally, traditional memorials represent the most essential elements in a great majority of classical memorial parks; however, to protect them, most are restricted and set off by a partition, whereby visitors are forbidden from touching, photographing, or even seeing the artefact at close quarters. In our design, visitors are invited to interact with designed landscapes rather than preventing them from making contact. Therefore, the original preservations in the anonymity memorial landscape necessitate a process by which they may be recreated and reformed, investing them with the capacity to provoke visitors' memories and emotions pertaining to the event, while also providing new experiences.

Table 2: The Theoretical Framework and Method of Anonymity Landscape Memorial Design.

Traditional Memorial Design Limitations	Anonymity Landscape Memorial Design Method	Design Scenarios
Not use the typical images, documents, and testimonies	But use visual perceptions and corporeal sensations to provide a particular experience	
Not stable, comfortable, or easy	But unstable, discomfort, and unease	
Not limit and prevent	But open and invite everyone to interact.	
Not preserve directly	But recreate and reform to provide a new experience.	

The next section will apply these strategies to detailed landscape designs by following the chronological progression of the pandemic.

4. Anonymity Landscape Memorial Design

Considering the fact that when the COVID-19 pandemic hits a country or city, governments have been prompted to order social distancing measures, quarantines, and lockdowns. Aiming for a fluid memorial experience for visitors, the design is informed by the following COVID-19 stages in Wuhan since January 2020.

4.1 The Breakout

This stage represents the fear of the unknown virus and health concerns. At the beginning of the pandemic, because of the rapidly spreading and high rate of infection and rate and the sudden lockdown of the city, a climate of fear took hold among the public.

Based on the anonymity landscape memorial design framework discussed earlier, the designated 3 entrances to the memorial park are meant to evoke this emotion. Each is designed by varying means in accordance with anonymity theory to trigger a sense of unease, instability, and discomfort (Figure 5).

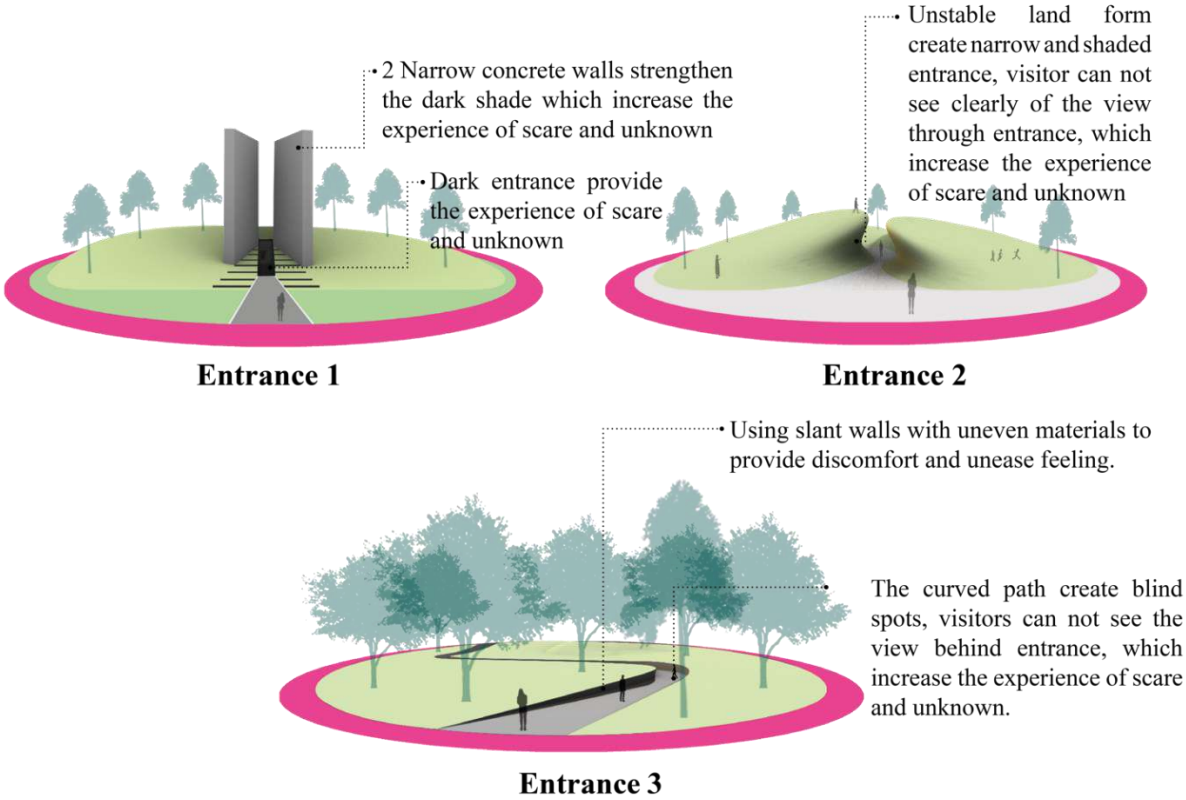


Figure 5. Design development for different entrances in Stage 1.

As a case in point, the entrance demonstrates how the anonymity theory is applied throughout the design project. For example, in designing Entrance 1 (Figure 6, left), the land area is raised to block the view and provide the feeling of the unknown. Thereafter, a dark entrance in the center increases the feeling of apprehension. Subsequently, the addition of two blocks of concrete increases the shady and dark atmosphere (Figure 6, right). The materials selected for this area will comprise concrete and raw stone, and the dominating colors will be grey and dark grey, congruent with fear and pessimism (Jonauskaite & Mohr, 2025), all elements contributing to an uneasy environment. When visitors come to this entrance, the high ridge of earth and concrete blocks will obstruct their view. As they pass through to the entrance, the concrete blocks will narrow their field of vision until they are engulfed in the dark underground space. During this process, the light will be gradually decreased, and visitors will be guided through a dark environment, invoking their fear of the unknown and of death.

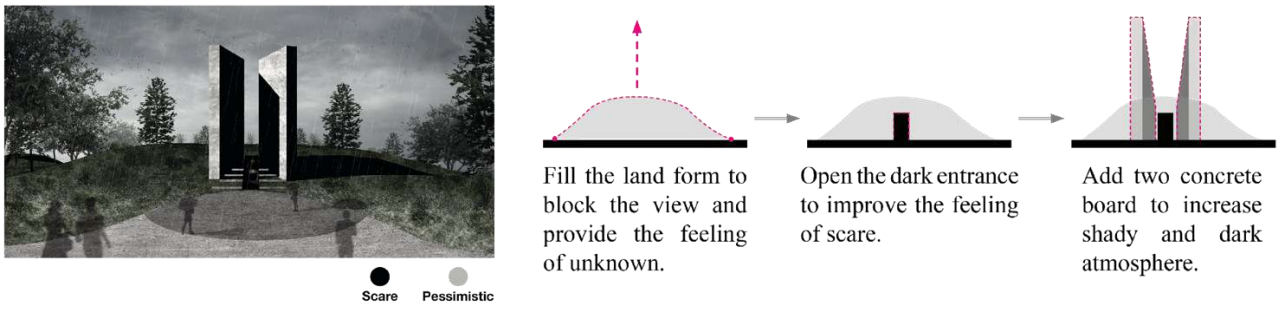


Figure 6. Perspective rendering of entrance 1 in Stage 1 (left) and Shaping diagram of entrance 1 in Stage 1 (right).

4.2 Lockdown

This stage represents the emotion associated with isolation. During this stage, not only those infected, but a great proportion of citizens experienced the isolation of differing degrees, which lasted for several months. Feelings of loneliness and helplessness arising from isolation were experienced during this stage.

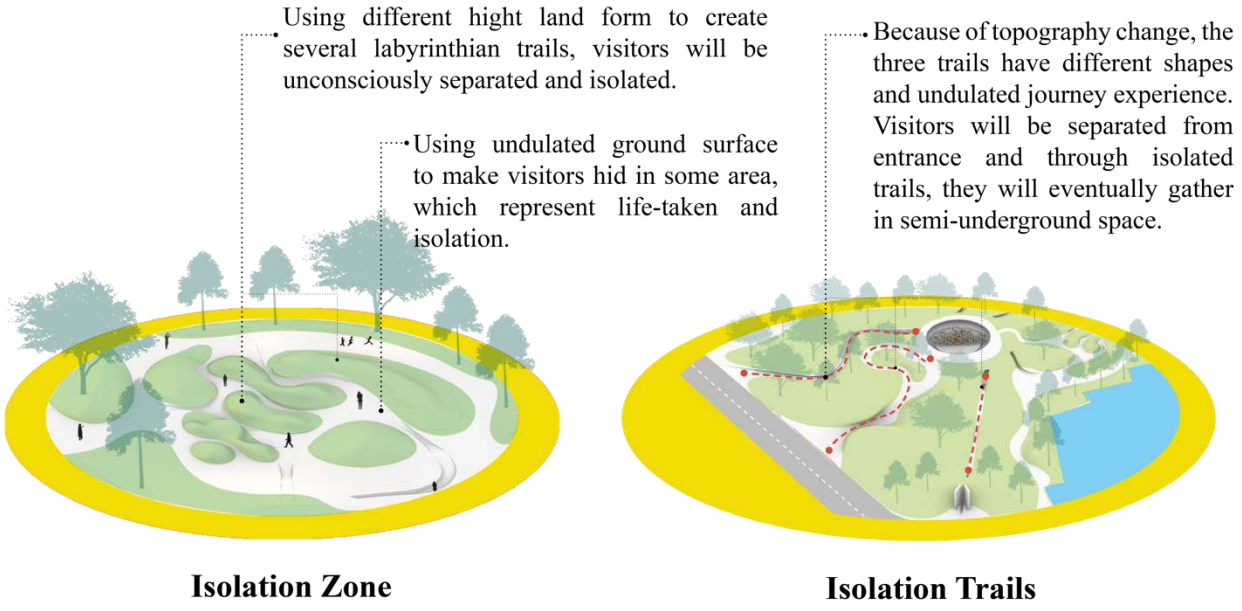


Figure 7. Design development for Stage 2: Isolation Zone and Isolation Trails.

In our design, we used an isolated trail and an isolation zone to represent the emotion associated with the lockdown stage (Figure 7). The isolation zone, as a representative example, is designed with multiple entrances, providing several options. During the conditioning process, the raised earth blocks the view, and then, raised earthworks at differing heights exacerbate the labyrinthine sense of being lost and isolated (Figure 8). In terms of materials, this area will be composed of raw concrete paths and stone and brick walls, providing a cold and labyrinthine feeling (Nakanishi et al., 2024; Zhang et al., 2024). According to Jonauskaite & Mohr (2025), purple and grey accord with lost and confusing feelings, and adding these two colors to stone, brick, and concrete will increase visitors' emotional resonance. As in human experiences, visitors choose different entrances at the beginning of their journey; however, the labyrinth will potentially separate them into various groups, which reinforces the feeling of loss and isolation. The different statues of the earthworks will separate other groups' visitors into areas featured from some other perspective, and this represents life taken during the pandemic. Because visitors will be potentially trapped in an isolation zone for an extended period, the stone brick labyrinth environment will not only provide the feeling of isolation but also encourage visitors to reflect.

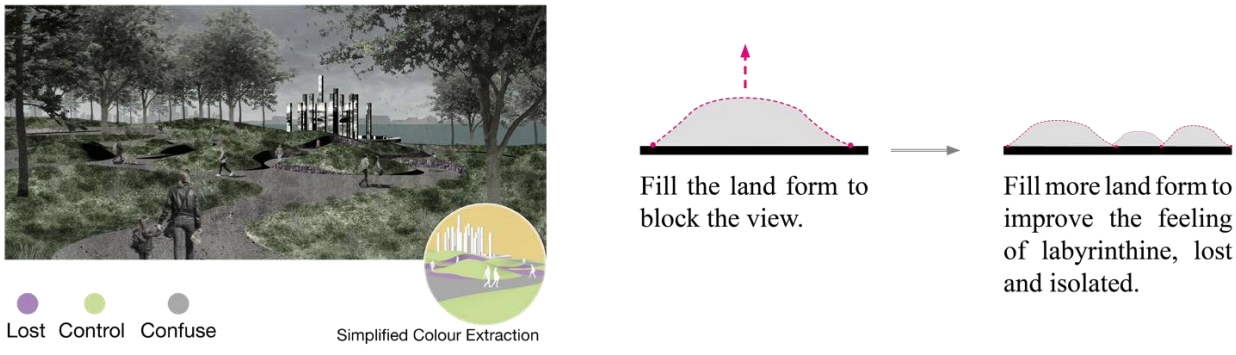


Figure 8. Perspective rendering of the isolated zone (left) and the shaping of the diagram of the isolated zone (right).

4.3 Reopening and Recovery

This stage represents the emotion that took hold as the city returned to the 'New Norm'. However, people were still living in the shadow of a pandemic. During this stage, the city had effectively managed its cases of infection, opened facilities, and allowed the public to return to their normal life, giving rise to a feeling of hope and faith. Nevertheless, with endless new confirmed cases in other cities, the emotion of fear still persists. The reopening-and-recovery concept will not be limited to representing ongoing emotions during the pandemic, but rather, it will present a circumstance that encourages visitors to respond individually, with diverse understandings of the entire space and the event.

Figure 9. Design development for stage 3: Exhibition space diagram (left) and perspective rendering (right).

The design of this stage includes a semi-underground exhibition space (Figure 9, left). In the middle of this space, the recreated temporary hospital structure is discovered. While the hospital was not directly preserved, original materials (color-coated plates and metal columns) recreated a new infrastructure. Visitors will be invited to interact with this structure, provoking negative emotions experienced during pandemics and incurred by temporary hospitals. Meanwhile, an aperture at the top of the sculpture brings natural light into the underground space, a combination of structural elements and light that gives rise to hope and faith (Su et al., 2025) (Figure 9, right). In addition to the materials from the hospital, there are also raw concrete, stone, and brick, which lend a sense of discomfort, meditation, and fascination (Nakanishi et al., 2024; Zhang et al., 2024). The blue color of the color-coated plate will lend visitors a feeling of safety and hope (Jonauskaite & Mohr, 2025). This space is located in the center of the entire park, which connects with all other areas. Every outer entrance will guide people to the underground space. When they come into the underground space, a dark channel will lead them to the middle sculpture area. During their interaction with the infrastructure, they will remember the difficult period of the pandemic until hope is restored by natural light from above. Still, the surrounding areas are relatively dark and shady, as a reminder that the pandemic is ongoing; while people can see the light at the end of the tunnel, they still live in the shadow of the pandemic. Additionally, the water pond in this AOI will connect with the existing purification station by underground pipe and storage system, which can not only reactively preserve the station but also provide a self-circulating water system for the whole park (Figure 10).

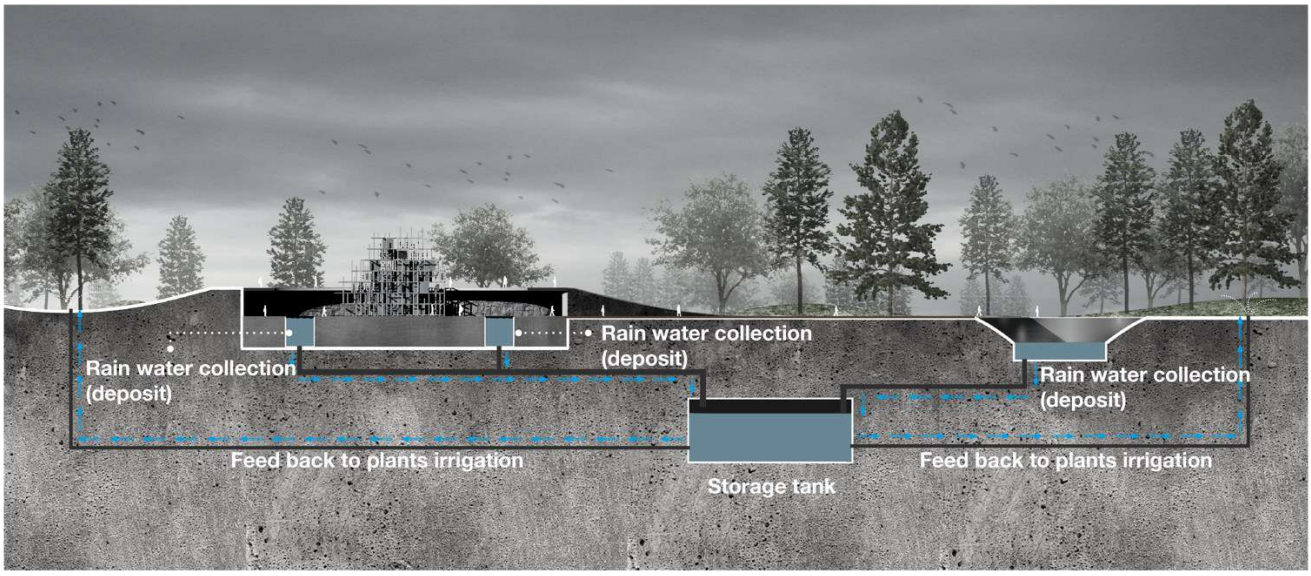


Figure 10. Diagram of the self-circulated water system.

4.4 Looking Ahead

This stage represents the feeling of mindfulness, hope, and expectations for the future. In the post-pandemic times, the public will be encouraged to reconsider the relationships represented by the terms life and death, devastation and salvation, while contemplating a new urban lifestyle. Ultimately, the project in its entirety aims to potentially encourage visitors' meditation and rumination.

The design of this stage includes two areas, mirror pillars and a meditation fountain (Figure 11). Taking the mirror pillars as an example, the whole area uses unlimited entrances to encourage entry from different directions (Figure 12). In the middle of this area, 19 pillars stand for the COVID-19 pandemic. The materials selected are mirrors and concrete, providing a meditative environment. When visitors come to this area, they will first see the mirror pillars, which reflect the back view of the temporary hospital installation, standing for the influence of the pandemic. Through the gap between pillars, visitors catch sight of a nice view of Zhiyin Lake, which represents positive expectations for the future. A concrete loop surrounding the pillars encourages interaction with the installation. As compared with regular paths, the loop provides a longer journey and upturns visitors' direction but immerses them in a quiet and mindful atmosphere. When visitors walk on the loop, they can simultaneously regard their own reflections along with that of the hospital installation, in addition to the natural lake, which encourages them to deeply consider the relationship between human and nature, human and pandemic, post-pandemic, and new urban lifestyle (Zhu et al., 2021).

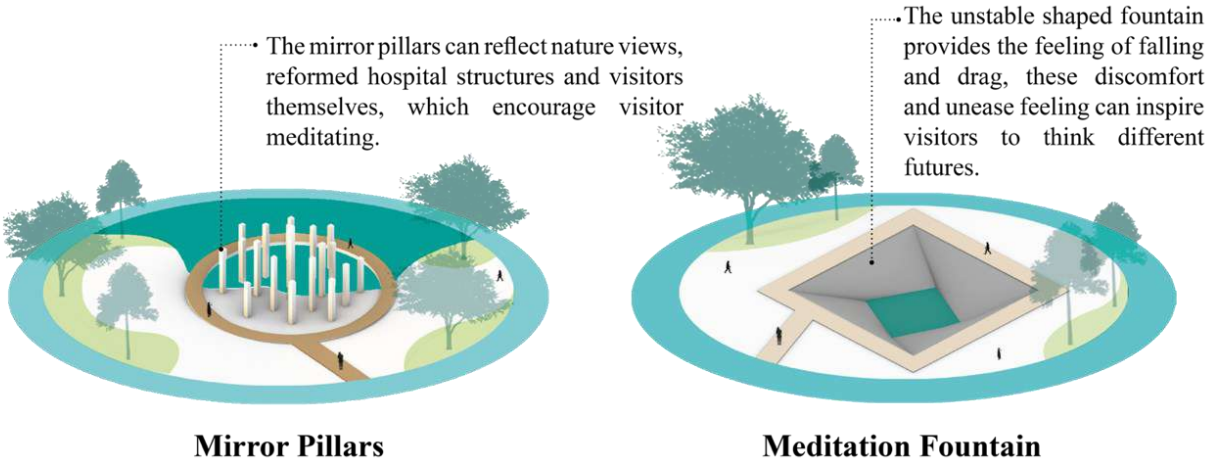


Figure 11. Design development for stage 4: Mirror Pillars and Meditation Fountain.

Figure 12. Perspective rendering of mirror pillars.

5. Discussions

5.1 Rethinking Memorial Landscapes through Anonymity

The transformation of the Huoshenshan Field Hospital into a memorial park demonstrates the potential of the anonymity landscape paradigm to reconceptualize how public spaces can evoke memory, emotion, and reflection in post-crisis contexts. This design intentionally diverges from traditional monumental practices by shifting away from prescriptive symbolism toward abstraction and experiential engagement. It decentralizes narrative authority, encouraging visitors to construct their own meanings through embodied, multi-sensory interaction.

This approach directly addresses the research aim of developing a new memorial design paradigm that aligns with post-pandemic social needs. By applying theories of *Lieux de mémoire*, anti-memorial, and counter-memorial design, the intervention supports pluralistic memory formation, prioritizing emotional resonance over representational clarity. Visitors encounter discomfort and instability—through narrow paths, enclosed spaces, or fragmented sightlines - which act as catalysts for emotional response and critical reflection.

However, while emotional discomfort may promote deeper reflection for some users, it may alienate others. Responses to ambiguous or affectively charged spaces are likely to vary by age, culture, and trauma experience. Future work should evaluate these differences through empirical methods, such as behavioral observation or post-occupancy surveys, to assess how different groups engage with and interpret the anonymity landscape.

5.2 Urban Integration, Economic Efficiency, and Generalizability

The design not only fulfils commemorative and symbolic purposes but also meets practical needs for urban integration and cost-effective land use. By retaining and reconfiguring existing site infrastructure, the project achieves a material recycling rate of 62.5% and approximately of CNY 7.94 million (US$ 1.10million) in cost savings (Table 3). These figures are not merely indicators of cost efficiency but represent a strategic contribution to urban economic resilience - reducing demand for new construction materials, lowering carbon and financial costs, and freeing municipal budgets for reinvestment in community services. By preserving the site's land value and transforming it into a productive public asset, the project demonstrates how post-crisis design can simultaneously address environmental sustainability and socio-economic stability in rapidly urbanising contexts.

Although rooted in Wuhan's context, the anonymity landscape framework possesses global applicability. Its guiding principles—adaptive reuse, abstraction, emotional provocation, and civic re-engagement—are relevant in other post-crisis contexts, including former disaster shelters, refugee camps, and abandoned emergency facilities. The model thus offers a replicable strategy for transforming sites of trauma into inclusive, healing public realms.

This approach also carries implications for urban policy and practice. It suggests that post-crisis infrastructure should not be demolished or abandoned, but strategically reimagined through spatial narratives that promote social cohesion, memory, and resilience—offering cities an ethically and economically grounded path toward recovery.

Table 3: Estimated Economic Savings in the Reuse of Huoshenshan Field Hospital.

Material Category (Luo et al., 2020; Tong, 2021; Gao et al., 2024)	**Specification/Application**	**Unit Consumption in Huoshenshan Hospital (Luo et al., 2020; Tong, 2021; Gao et al., 2024)**	**Unit Consumption in Anonymity-Landscape Infrastructure**	**Unit Price (2025)**	**Economic Savings (Guo et al., 2025)**
Steel Plate	Galvanized Steel Plate (e.g., Exhibition space in Figure 9, Mirror pillars in Figure 11), Steel doors can be adapted into storage and utility enclosures.	1500 tons	1024.16 /tons	¥4320/ton	¥ 4,424,371.2(CNY)
	Color-Coated Plate (e.g., Exhibition space in Figure 9)	300 tons	174.823 /tons	¥6800/ton	¥ 1,188,796.4(CNY)
Piping Materials	Square/Rectangular Steel Tube (e.g., Exhibition space in Figure 9, Mirror pillars in Figure 11)	420.75 tons	400.88 /tons	¥4000/ton	¥1,603,200(CNY)
	Galvanized Round Steel Tube (e.g., Exhibition space in Figure 9, Mirror pillars in Figure 11, Entrance 1: Unease in Figure 5, Safety rails near water features: Mirror pillars' platform and Meditation fountain in Figure 11).	62.1 tons	60.68 /tons	¥4650/ton	¥282,162(CNY)
Paving Blocks, Curbstones, Vinyl, Composite Panels, Tiles	Pathway surfacing, boundary demarcation (e.g., Isolated trails and isolation zone in Figure 7), Observation platforms near Zhiyin Lake (e.g., mirror pillars platform in Figure 11), and boardwalks (Isolated trails in Figure 7) through landscaped areas.	>5000m^2 (Indoor & Outdoor)	3467m^2	Mean ¥95/m^2	¥329,365(CNY)
Windows Doors	Glass panels could create transparent screening walls for wind protection in seating areas	1650 Glasses	500 Glasses' material (512.4m^2)	¥220/m^2	¥112,728(CNY)
					Total: ¥7,940,622.6(CNY) (US$ 1.10million)

5.3 Conceptual Innovation and Theoretical Contribution

This research makes a distinct theoretical contribution by proposing the Anonymity Landscape Memorial Design as a new memorial typology that uniquely integrates commemorative landscape design with strategies for urban economic regeneration. This linkage is rarely addressed in the current literature, where memorial design is often treated solely as a cultural or symbolic practice. By embedding adaptive reuse and resource efficiency into the memorial design process, the framework demonstrates how memory-making can be an active driver of socio-economic recovery, particularly in post-crisis urban contexts, especially in China.

The conceptual innovation lies in the synthesis of three theoretical traditions—lieux de mémoire, anti-memorial, and counter-memorial—and their translation into a spatial methodology applicable to post-crisis urban conditions. The study bridges the gap between landscape design theory and urban crisis response, offering a framework that is not only emotionally resonant but also operationalizable through specific spatial tactics.

This fusion of theory and practice contributes to the growing interdisciplinary field that intersects landscape architecture, urban resilience, and memory studies. It invites further inquiry into how effective design can operate as both civic infrastructure and cultural narrative. Moreover, the anonymity landscape paradigm may provide a model for other under-theorized areas of spatial reuse, such as temporary refugee camps, vacant industrial lands, or even post-conflict demilitarized zones.

5.4 Limitations and Future Research

While the anonymity landscape approach emphasizes inclusivity and openness, it may also be critiqued as a conceptual design study; this project lacks empirical validation through participatory design, public feedback, or post-occupancy assessment. Emotional and spatial responses remain untested, and the absence of community co-design may limit acceptance or long-term usability. Future research should integrate public consultation into the design process and evaluate how visitors experience and interpret discomfort, abstraction, and interactivity on-site.

Additionally, cultural specificity must be considered. While the theoretical frameworks are broadly applicable, local traditions of mourning, memory, and civic use will shape how such spaces function elsewhere. Comparative international case studies will help assess the scalability and adaptability of the anonymity memorial landscape paradigm.

6. Conclusions

This study advances emerging scholarship on the repurposing of temporary field hospital sites and the reclamation of urban space in the post-pandemic era. It identifies key gaps in Chinese conventional monumental landscape design and proposes a novel theoretical and design paradigm: Anonymity Landscape Memorial Design, which is then applied to the Huoshenshan Field Hospital in Wuhan, China. The design transforms a site of crisis into a resilient, multifunctional civic space, demonstrating how this paradigm enables adaptive reuse, avoids demolition, and activates underutilized land. Economically, the approach achieves a 62.5% material recycling rate and approximately CNY 7.94 million (US$ 1.10million) in cost savings. Beyond material reuse, it offers a socio-cultural benefit by transforming a site of crisis into a resilient public realm.

The anonymity landscape memorial framework offers a replicable model for cities facing similar challenges, particularly those with temporary infrastructure generated during health emergencies or natural disasters. Its flexibility and experiential emphasis position it as a resilient design strategy for future civic space development. However, the conceptual nature of the project presents limitations. Empirical studies are needed to assess how such spaces are perceived, used, and remembered by the public. Future research should evaluate emotional, psychological, and behavioral impacts through post-occupancy analysis and participatory methods. Comparative studies across cultural contexts would further validate the model's transferability. Ultimately, this research bridges landscape architecture, memory studies, and urban planning to address socio-economic inequalities in rapidly urbanising cities. It responds to the urgent need for sustainable, inclusive, and emotionally responsive

public spaces in the aftermath of global crises - demonstrating how design can transform loss into shared civic value. Tthis approach offers a replicable model for delivering both socio-economic and cultural value, advancing more inclusive, resilient, and sustainable urban futures.

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References

Al-azzawi, S., İnalhan, G., & Al-azzawi, N. (2024). The Relationship Between Sense of Place and Nature-based Architectural Beauty: A Comparative Case Study. *Journal of Contemporary Urban Affairs, 8*(1), 102-119. https://doi.org/10.25034/ijcua.2024.v8n1-6

Alhmoud, S. H., & Çağnan, Ç. (2023). Adapting Hospital Interior Architecture Process to Technological Advancement in the Management of Pandemic Cases in Jordan. *Buildings, 13*(10), 2602. https://doi.org/10.3390/buildings13102602

Bernardez-Pereira, S., Schettino, G. P. P., Marra, A. R., Parreira, K. C. J., Racy, F. C. J., Miranda, R. M., Codeço, A. M., Jaures, M., Pagliuso, J. G. D., Neto, M. C., Laselva, C. R., Klajner, S., Teich, V. D., Giliberti, D. N., Kobayashi, T., Edmond, M. B., & Malheiro, D. T. (2025). Cost-effectiveness analysis of implementing a field hospital in a soccer stadium during a pandemic. *Front. Public Health, 13*, 1513709. https://doi.org/10.3389/fpubh.2025.1513709

Chen, S., Zhang, Z., Yang, J., Wang, J., Zhai, X., Bärnighausen, T., & Wang, C. (2020). Fangcang shelter hospitals: A novel concept for responding to public health emergencies. *The Lancet, 395*(10232), 1305–1314. https://doi.org/10.1016/S0140-6736(20)30744-3

Chen, Y., Lei, J., Li, J., Zhang, Z., Yu, Z., & Du, C. (2022). Design characteristics on the indoor and outdoor air environments of the COVID-19 emergency hospital. *Journal of Building Engineering, 45*, 103246. https://doi.org/10.1016/j.jobe.2021.103246

Costa, R. da G.-R., Santos, R. S. da C., & Martire, G. E. (2024). Manguinhos hospitals: reflections on scientific politics and heritage, from tropical diseases to covid-19. *História, Ciências, Saúde-Manguinhos, 31* (Suppl 1), e2024054. https://doi.org/10.1590/S0104-59702024000100054

Gao, M., Guo, Y., Hou, H., Wang, P., & Wang, S. (2024). Assembly process based on supply chain management of prefabricated houses using BIM. *Proceedings of the Institution of Civil Engineers - Structures and Buildings, 177* (5), 385–396. https://doi.org/10.1680/jstbu.22.00153

Giunta, A. (2014). Feeling the Past: Display and the Art of Memory in Latin America. *Journal of Curatorial Studies, 3* (2-3), 320-345. https://doi.org/10.1386/jcs.3.2-3.320_1

Guo, Z., Luo, Y., Yi, T., Jing, X., & Ma, J. (2025). Harnessing the power of improved deep learning for precise building material price predictions. *Buildings 15*(6), 873. https://doi.org/10.3390/BUILDINGS15060873

Jonauskaite, D., & Mohr, C. (2025). Do we feel colours? A systematic review of 128 years of psychological research linking colours and emotions. *Psychonomic Bulletin & Review, 32*(4), 1457–1486. https://doi.org/10.3758/s13423-024-02615-z

Kuys, B., Given, L. M., Kuys, J., & Jackson, S. (2024). Co-designing inclusive war memorials for metaphoric symbolism. *Landscape Research, 50*(1), 168–188. https://doi.org/10.1080/01426397.2024.2387175

Li, F., Zhou, J., Wei, W., & Yin, L. (2023). Spatial Distribution Pattern and Evolution Characteristics of Elderly Population in Wuhan Based on Census Data. *Land, 12*(7), 1350. https://doi.org/10.3390/land12071350

Liu, M., Zhu, X., & Lian, J. (2025). A novel epidemic-logistics optimization model for Fangcang hospital allocation with fairness consideration. *Expert Systems with Applications, 276*, 127143. https://doi.org/10.1016/j.eswa.2025.127143

Luo, H., Liu, J., Li, C., Chen, K., & Zhang, M. (2020). Ultra-rapid delivery of specialty field hospitals to combat COVID-19: Lessons learned from the Leishenshan Hospital project in Wuhan. *Automation in Construction, 119*, 103345. https://doi.org/10.1016/j.autcon.2020.103345

Ma, F. (2024). Assessing immediate and lasting impacts of COVID-19-induced isolation on green space usage patterns. *GeoHealth, 8*(8), e2024GH001062. https://doi.org/10.1029/2024GH001062

Nakanishi, E. Y., Poulin, P., Blanchet, P., Dubuis, M.-E., Drouin, M., Rhéaume, C., & Goupil-Sormany, I. (2024). A systematic review of the implications of construction materials on occupants' physical and psychological health. *Building and Environment, 257*, 111527. https://doi.org/10.1016/j.buildenv.2024.111527

Nora, P. (1989). Between Memory and History: Les Lieux de Mémoire. *Representations, 26*, 7–24. https://doi.org/10.2307/2928520

Olin, M.R. (1995). The Art of Memory: Holocaust Memorials in History. *Modernism/modernity 2*(3), 188-190. https://dx.doi.org/10.1353/mod.1995.0051.

Razzak, R. R., Pribadi, C. B., & Deviantari, U. W. (2023). GIS-Based Emergency Hospital Location Suitability Analysis (Case Study: Surabaya City). *IOP Conference Series: Earth and Environmental Science, 1127*(1), 012045. https://doi.org/10.1088/1755-1315/1127/1/012045

Stevens, Q., Franck, K. A., & Fazakerley, R. (2012). Counter-monuments: the anti-monumental and the dialogic. *The Journal of Architecture, 17*(6), 951–972. https://doi.org/10.1080/13602365.2012.746035

Stevens, Q., & Franck, K. A. (2015). *Memorials as spaces of engagement: Design, use and meaning*, 88-158. https://doi.org/10.4324/9781315747002

Su, H., Wei, W., Liu, X., Wang, Q., & Yang, B. (2025). A pilot study exploring the impact of daylight gradient on occupant in underground space. *Developments in the Built Environment, 22*, 100658. https://doi.org/10.1016/j.dibe.2025.100658

Tong, Y. (2021). Factors for optimizing time performance of Modular Construction: A review and evidence from Huoshenshan Hospital construction. *In 2021 IEEE 12th International Conference on Mechanical and Intelligent Manufacturing Technologies (ICMIMT*）, 45–48. https://doi.org/10.1109/ICMIMT52186.2021.9476172

Ware, S. A. (2008). Anti-memorials and the art of forgetting: Critical reflections on a memorial design practice. *Public History Review*, *15*, 61-76. https://doi.org/10.5130/phrj.v15i0.632

Wagoner, B. & Brescó, I. (2022). Memorials as Healing Places: A Matrix for Bridging Material Design and Visitor Experience. *International Journal of Environmental Research and Public Health*, *19*(11), 6711. https://doi.org/10.3390/ijerph19116711

Ying, W., Dai, X., & Shen, W. (2025). Rapid project delivery through bricolage and planning: A case study of the Huoshenshan Hospital project. *Journal of Construction Engineering and Management*, *151*(8), 05025003. https://doi.org/10.1061/JCEMD4.COENG-15066

Young, J. E. (1992). The counter-monument: Memory against itself in Germany today. *Critical Inquiry*, *18*(2), 267–296. https://doi.org/10.1086/448632

Zhang, N., Zhao, L., Shi, J., & Gao, W. (2024). Impact of visual and textural characteristics of street walls on stress recovery. *Scientific Reports*, *14*, 15115. https://doi.org/10.1038/s41598-024-64618-z

Zhang, S., Yu, P., Chen, Y., Jing, Y., & Zeng, F. (2022). Accessibility of Park Green Space in Wuhan, China: Implications for Spatial Equity in the Post-COVID-19 Era. *International Journal of Environmental Research and Public Health*, *19*(9), 5440. https://doi.org/10.3390/ijerph19095440

Zhu, J. L., Schülke, R., Vatansever, D., Xi, D., Yan, J., Zhao, H., Xie, X., Feng, J., Chen, M. Y., Sahakian, B. J., & Wang, S. (2021). Mindfulness practice for protecting mental health during the COVID-19 pandemic. *Translational Psychiatry*, *11*(1), 329. https://doi.org/10.1038/s41398-021-01459-8

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Ethno-sustainability of an Indigenous Architecture in the Northern Philippines Using Grounded Theory

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ABSTRACT

This study investigates the ethno-sustainability of Itawit architecture as a distinctive indigenous practice in the Cagayan province of Northern Philippines. Employing a qualitative grounded theory approach, data were gathered through ethnographic interviews, field observations, and archival research with building owners, carpenters, shamans, and elders from Middle and Southern Cagayan. Using coding, memoing, and thematic analysis, the research thematised vernacular construction practices and knowledge systems, framing them as integral components of cultural heritage and community resilience. Findings demonstrate that Itawit architecture embodies sustainable principles through locally sourced materials, ritual practices, and collective labour systems such as ivvet (community construction). Despite modernisation pressures and the adoption of permanent materials, traditional ecological knowledge and oral transmission continue to sustain building practices and cultural identity. The study highlights "ethno-sustainability" as a framework wherein spiritual beliefs, environmental sensitivity, and social contracts interconnect to preserve community resilience. Documentation of terms, visual records, and rituals provides a baseline reference for conservationists, policymakers, and urban planners. Integrating these indigenous practices into contemporary planning contributes to culturally inclusive and environmentally sustainable development in the Philippines and beyond.

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Highlights:	Contribution to the field statement:
- Modernisation pressures reduce continuity of Itawit architectural traditions. - Oral transmission and apprenticeship sustain vernacular construction knowledge. - Locally sourced materials enhance environmental sustainability of Itawit architecture. - Community labour systems strengthen social cohesion and resilience. - Ethno-sustainability provides a framework for integrating indigenous heritage into urban planning.	This study contributes to the field by documenting *Itawit architecture* as an expression of ethno-sustainability, bridging indigenous knowledge with sustainable urban development. Using grounded theory, it introduces a methodological framework that positions vernacular traditions within contemporary urbanisation debates, highlighting their socio-economic, cultural, and ecological relevance in shaping resilient urban futures.

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1. Introduction

1.1 Indigenous Architecture in the Philippines

In an era where rapid urbanization and globalization have transformed our cities, the preservation and inclusion of indigenous architecture remain crucial in maintaining cultural diversity and social resilience in modern and contemporary urban environments. Around the world, urbanization has changed landscapes, frequently at the expense of local economies and indigenous cultural practices. Despite this, there is a dearth of empirical studies investigating how vernacular architecture can promote socioeconomic resilience in urbanizing environments (Benslimane & Biara, 2019; Matar, Palaiologou, & Richards, 2023). The studies show potential for how to look at indigenous communities within or immediately along the bounds of urban zones, particularly on potential socio-economic impacts. While there are limited studies on vernacular or indigenous architectural heritage and its sustainability features (Fischl & Teodoro, 2016), the Philippines can learn from these studies to try to bridge the gap on the potential of the former towards more sustainable local landscapes.

The Philippines is a country with many ethnic groups, commonly distinguished by each group's language. All the ethnic groups in the Philippines have their unique architecture, but few have been published, and some are still in manuscript form. The early stages of this documentation in their architecture were in the 1980s and 1990s (Dacanay et al., 1992; Perez et al., 1989). But still, few have been explored when it comes to the vernacular architecture of the Philippines, so much to its (for example) relationship with urbanism and sustainability. This poses a challenge to the study of sustainable architecture in the realm of vernacular or indigenous expressions, versus the wide range of Spanish and American Colonial period architecture published in the past 30 years. Recent studies show potential in trying to understand the role of vernacular architecture and sustainability within or outside urban zones (Benslimane & Biara, 2019; Mazraeh & Pazhouhanfar, 2018), for example, the studies on climate response, environmental integration, efficiency in resource use, and social cohesion (Matar, Palaiologou, & Richards, 2023), and amid pressure from climate change, local wisdom in vernacular architecture could contribute to understanding sustainable living and enhancing community resilience (Prabaswara, Hariyanto, & Arifin, 2021; Qian & Xu, 2025).

This study includes a broader discourse on the potentials of indigenous architecture inside and outside urban settings, and the potential of "ethno-sustainability" in the socio-economic sphere in the Northern Philippines; it will also highlight a larger conversation on urban affairs. The study will offer important insights into how indigenous knowledge systems can be used to promote sustainable urbanization by demonstrating how traditional architectural forms act as both cultural symbols and drivers of local economic development (Dessein, Soini, Fairclough, & Horlings, 2015; Matar, Palaiologou, & Richards, 2023). By showing that indigenous architecture can be in line with contemporary urban planning objectives to support socio-cultural continuity and economic opportunities, this study also closes the gap between cultural preservation and socio-economic inclusion. It increases knowledge of how, within the process of urban transformation, ethno-sustainability can promote socioeconomic well-being, local identity, and resilient community development. This study provides a relevant model for incorporating indigenous architectural practices into modern urban strategies, enhancing the field of urban affairs with culturally sensitive, financially feasible, and environmentally sustainable solutions as cities around the world struggle to strike a balance between modernization and heritage conservation (Leza, 2020; Matar, Palaiologou, & Richards, 2023).

1.2 Background and Context

In the Philippines' vernacular architecture, many have documented (published and some unpublished) local architectural traditions mainly through ethnography, and have been fairly collected, albeit there are still some not yet been fully documented (See Table 1). In particular, one of these architectural traditions can be found in the Northern Philippines, specifically in the Cagayan province, known as the Itawit. The architectural heritage of the Itawit community in the Philippines is still poorly documented, which hinders attempts at culturally sensitive and sustainable development. By

investigating how Itawit architectural traditions support community vitality and economic sustainability in the face of urban growth, this study aims to close this gap.

Indigenous structures are rarely seen in the Cagayan Valley Region in the Northern Philippines. Some have been damaged by strong typhoons (such as Typhoon Lawin in 2016). This makes the owners of these buildings choose more permanent structural materials such as steel and concrete. The existing practices in indigenous knowledge are slowly vanishing along with the construction materials and methods, which is apparent especially in the shift from inferior to more permanent structures (Hoffman, 2009).

Table 1: Existing Literatures in Philippine Indigenous Architecture.

Ethnic group	Location	Architectural style	Notes	Reference
Ifugao, Bontoc, Benguet, Apayao, Kalinga	Cordillera	Elevated cube house (varies depending on geography)	Northern Strain (Ifugao, Bontoc, Benguet) and Southern Strain (Apayao, N. Kalinga)	(Scott, 1962)
Baluga	Zambales-Pampanga	Lean-to (for nomadic), elevated cube house with a low roof (cogon)	The first section presents the group as "living with nature" by narrating how they build their houses using indigenous materials. The last section is heavily focused on the documentation of Tagalog houses, including architectural plans and details.	(Dacanay et al., 1992)
Bontoc & Ifugao	Cordillera	Elevated cube house with a steep roof (cogon)		
Mangyan	N. Oriental Mindoro	Communal longhouse, elevated cube house with low roof, and lean-to		
Badjao	Mindanao	Boat house		
Tagalog	Bulacan, Rizal, Cavite, Batangas, Quezon, Nueva Ecija, Tarlac	Elevated cube house, a.k.a. "Nipa house"		
Isneg, Kalinga, Bontoc, Ifugao, Kankanai	Cordillera	Elevated cube house with a steep roof (varies based on culture)	Includes animist traditions (rituals & legends) with architecture, local art, and architectural and pictorial documentation of their traditional houses. It also highlights the usage of indigenous materials in their houses.	(Perez et al., 1989)
Ivatan	Batanes Islands	Elevated cube house with a steep roof		
Mangyan	N. Oriental Mindoro	Elevated cube house with a steep roof		
Panay	Panay Island	Elevated cube house with a low roof, mainly used bamboo for exterior and interior decorations		
Badjao, Samal, Subanun, Mandaya, Yakan, Tausug, Maranao	Mindanao & Sulu	Elevated longhouses, clustered planning (varies based on culture)		
Ivatan	Batanes Islands	Ethnic and folk architecture (varies per island). See also Ignacio & Alejandrino (2005)	The book treated it in the "Visual Dictionary" style of Ching (2012) in presenting the anatomy of the house of each ethnic group. It includes their locations, a short description of the architectural style, and the building materials used.	(Fernandez, 2015)
Apayao, Bontoc, Ifugao, Kalinga, Kakanay, Ibaloy, Sagada	Cordillera	Varies (typically, an elevated cube house with a steep roof)		
Tagalog	Central Luzon	Elevated cube house with a steep roof		
Badjao, Tausug, Yakan	Mindanao	Elevated rectangular cube house with steep roof		
Mangyan	Mindoro	Single-family dwelling & communal house (no interior divisions). Steep roof, no windows (but opening strip bet. wall and roof)	The writing style and approach are descriptive and encyclopedic, which means that the information is merely used to identify the indigenous architectural style of the Philippine archipelago. No house anatomy is available.	(Tiongson, et al., 2017)
Bugkalot (Ilongot), Tinguian, & Gaddang	N. Luzon	Houses built on trees		
Mandaya, Manobo, Tiruray, & Bukidnon	Mindanao	Houses built on trees		
Ifugao, Mayoyao, Bontok, Sagada, Kalinga, Kankanaey	Cordillera	Description and analysis reveal that Cordillera houses are of the Ifugao prototype		
Tboli	S. Cotabato, Mindanao	Houses on hilltops & rolling land. Large one-room house with centralized space surrounded by functional space		
Tausug	Sulu, Mindanao	Houses are far from the seashore. Houses with 9 posts, each signifying parts of the human body		
Sama & Sama Dilaut (Badjao)	Sulu, Mindanao	Houseboats (lepa, jenging, & dapang) for constant travels.		
Filipino Muslims	Mindanao	Houses with oversized posts resting on large stones against earthquakes. Includes terms kuta (fort), ranggar (Maranao term for small masjid), langar (Tausug & Yakan term for small masjid), and torogan (large & prominent houses for chieftains).		

Initially, this study has few base studies in the culture; it has to use Grounded Theory in trying to thematize as well as document the architecture of the indigenous group. With that, it is the most detailed when it comes to the data gathered so far, as to terminology, rituals, and photos, directly related to the Itawit architecture, and would help identify, preserve/revive (compare Eames, 2019), and encourage these sustainable practices integrated into policies (Acabado & Martin, 2018; Dessein, Soini, Fairclough, & Horlings, 2015; Rapoport, 2005)**.**

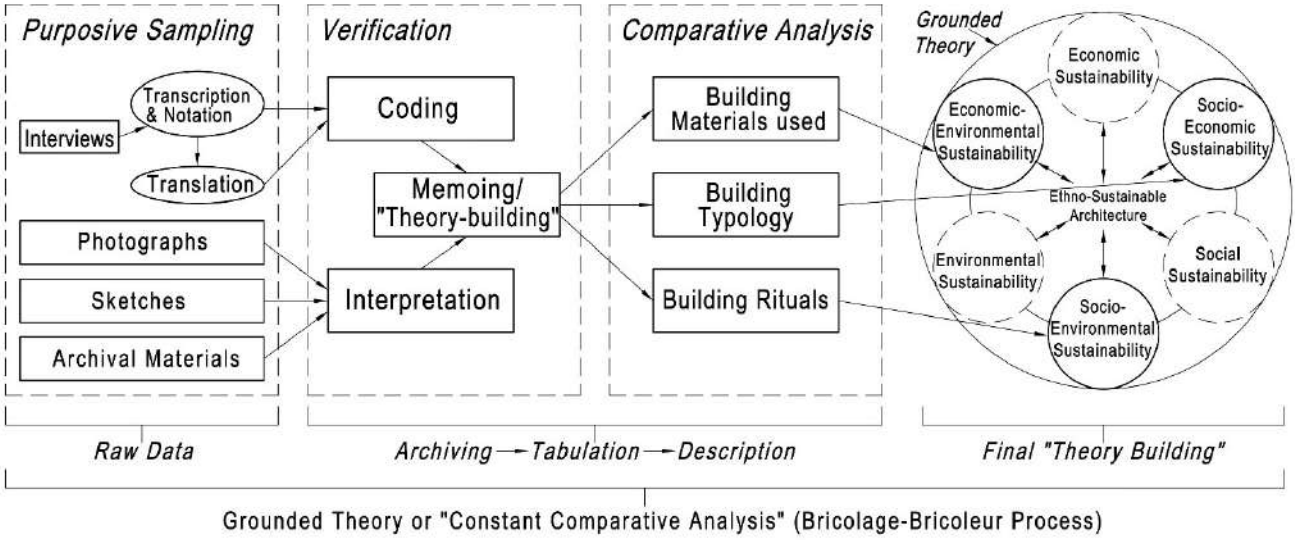

Figure 1. Structure of the study.

This study's goal is practically modest: to (1) define Itawit architecture and identify samples of it in the province, (2) present their sustainable practices using the construct "ethno-sustainable architecture", and (3) propose and recommend actions for the preservation of these indigenous practices.

The gradual loss of their architectural practice can be due to the age or worse, death of carpenters, elders, and shamans, resulting in the less frequent transfer of the knowledge to the younger generations. Nonetheless, the building tradition of bamboo, cogon, and wood is not yet extinct since the financially challenged Itawit of Cagayan is continuing the tradition. By offering a thorough ethnographic and architectural description of the Itawit community in the Northern Philippines, this study adds to the body of knowledge by emphasizing how socioeconomic resilience in the face of urban change can be supported by cultural preservation. It provides a fresh approach to incorporating indigenous practices into sustainable urban development policies through its creative application of grounded theory.

2. Materials and Methods

2.1 Study Design and Setting

The study methodically investigated and interpreted indigenous architectural practices using a qualitative grounded theory approach. Photographs, archival document analysis, and ethnographic interviews were all used in the data collection process. The identification of important themes was made easier by coding and memoing techniques, which were subsequently subjected to inductive analysis to create an ethno-sustainability model. A conceptual flowchart demonstrates this methodical approach (See Figure 1), which guarantees transparency and reproducibility. The main variables to be investigated are (1) building rituals, (2) houses/structures, and (3) building materials. Each was documented and described based on the bearers and practitioners of these building rituals, architectural knowledge, and how the construction materials are gathered.

2.2 Participants or Subjects

The study employed Grounded Theory to collect data from different Itawit communities in the Middle Cagayan (MC) and Southern Cagayan (SC) regions (Groat & Wang, 2013; Aksamija, 2021; Ignatow & Mihalcea, 2018). MC includes the towns of Piat (PT), Tuao (TU), Sto. Niño (SN) and Amulung (AM) – specifically along the Chico River and Pangul Valley; whereas the SC geographical group includes the towns of Iguig (IG), Tuguegarao City (TG), Solana (SL), Enrile (EN), and Peñablanca (PB) – upstream of the Cagayan River. Phase 1 included purposive sampling in locating and preselecting the sites in the mentioned areas (MC and SC). Samples were compared on the variation of architectural styles based on their livelihood from the MC and SC.

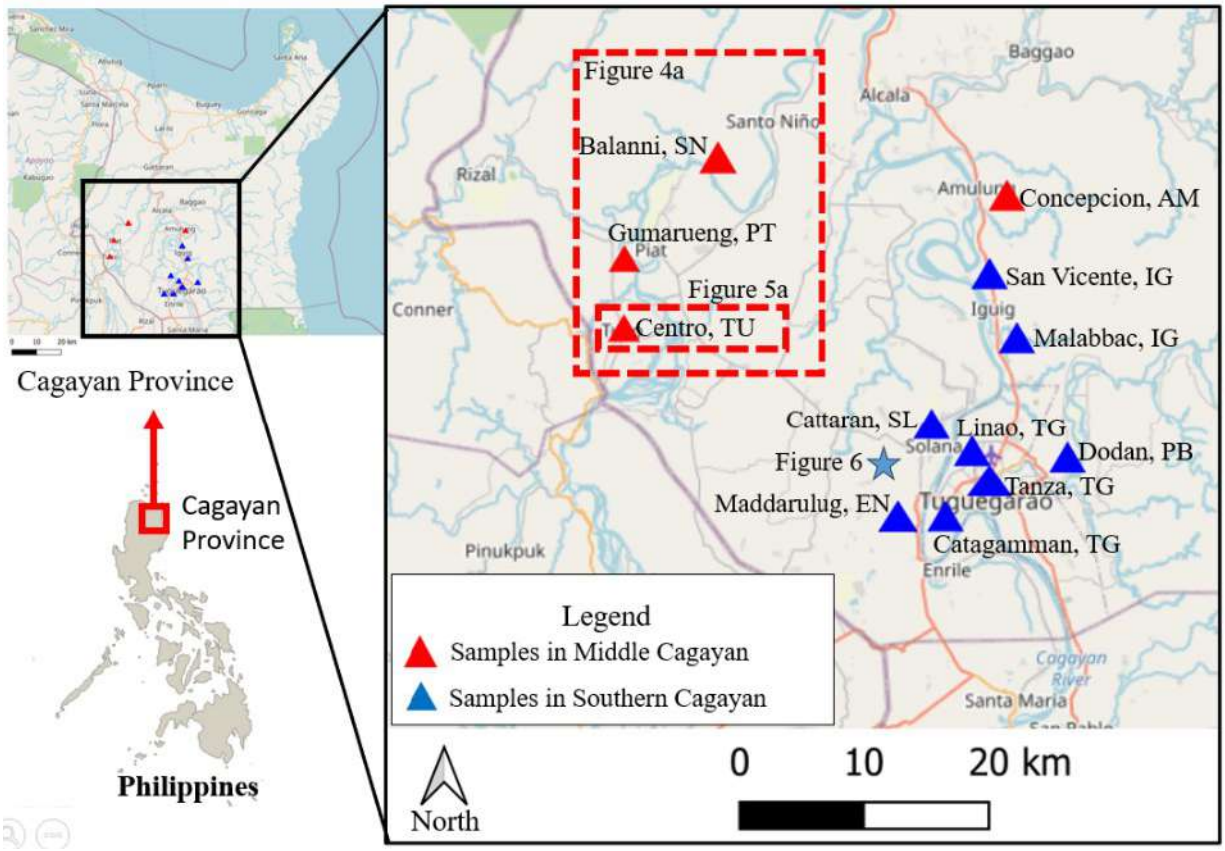

Figure 2. Location of research area in the Northeastern part of Luzon Island, Philippines.

2.3 Materials and Equipment

Phase 2 is the fieldwork proper, where three data gathering collection methods are used: (1) interviews for main correspondents, i.e., building owners, elders, carpenters, and shamans; (2) on-site and archival photographs for the rituals, structures, and materials; and (3) architectural sketches for the plans, elevations, and othersThe journals, digital images, notes, and other gathered data were archived digitally.

2.4 Procedures and Protocols

Free prior informed consent was secured from respondents and elicitation forms (bilingual in English-Itawit, basing on the University of the Philippines elicitation forms for linguistics) are used to collect the ethno-sustainable knowledge based on what they currently practice and what they remember. After these, communications via calls and messages were made to verify and clarify what the respondents meant with the taken interviews.

2.5 Data Analysis

Phase 3 collected ethno-sustainable knowledge and extant samples (initially) elicited from the respondents and grouped them based on the geographic location of the towns in MC and SC. Phase 4 of this study is to compare the ethno-sustainable architecture of the samples being shown, and is based on their geographical areas. Gathered data were memoed, technically described, compared and analyzed, and finally thematized using inductive logic (Groat & Wang, 2013; Aksamija, 2021). Finally, the data gathered were compared based on the geographic areas to build the construct of "Ethno-sustainability."

3. Results

3.1 Presentation of Key Findings

Using the Grounded Theory method, this is divided into two sections: (1) defining Itawit architecture and (2) its ethno-sustainable architecture. First, it will show the samples taken from the fieldwork and interviews, as well as historical and archival documents, drawings, illustrations, and photographs in presenting the unique style of Itawit architecture in the Northern Philippines - this will be it's first architectural report, since most literatures in Philippine architecture presents Batanes and Cordilleran styles in the Northern Philippines (Perez, Encarnacion, Dacanay, Fortin, & Chua, 1989; Fernandez, 2015). Second, with "ethno-sustainable architecture" as a model in the onvestigation, it attempts to the interconnect pillars of "sustainability" in architectural terms: (1) Part 1: Ethno-Sustainable Architecture and Spirituality with the subtopics "Animism" and "Ecological Mediums"; (2) Part 2: Ethno-Sustainable Architecture and Environmental Sensitivity with subtopics "Ritualistic Usage of Plants", "Ethnobotany", and "Craftsmanship and lifeways"; and (3) Part 3: Ethno-Sustainable Architecture and the Social Contracts with subtopics "Intracultural and Intercultural Relationships." The subtopics are the storylines borrowed from Soini and Birkeland (2014).

3.1.1 Defining Itawit Architecture

This definition of Itawit architecture in Northern Luzon is based on and divided into (1) historical data and (2) fieldwork data.

3.1.1.1 Historical data on Itawit architecture

Spanish colonial documents reported late 16th to early 20th century records about Itawit buildings, settlements, and migration. Though very limited in the indigenous architecture strictly by itself, historical and archival documents indicate that Itawit settlements were initially identified mainly along the Chico River from the town of Santo Niño (former pueblo of Tabang) and upstream towards Piat and Tuao (Malumbres, 1918; Keesing, 1962; Blair & Robertson, 1903). Perhaps, one of the oldest maps and depictions of houses of the Itawit is the one drawn in 1719 by the Spaniard Juan Luis Acosta, written shortly after a large-scale rebellion of locals in the province in 1718 (Acosta, 1719). A similar language, Ibanag has a Spanish-period dictionary (Bugarin & Lobato de Santo Tomas, 1854) that can be compared with Itawit as a reference in the definition building parts, for instance, datag (floor) and tarawag (rafter).

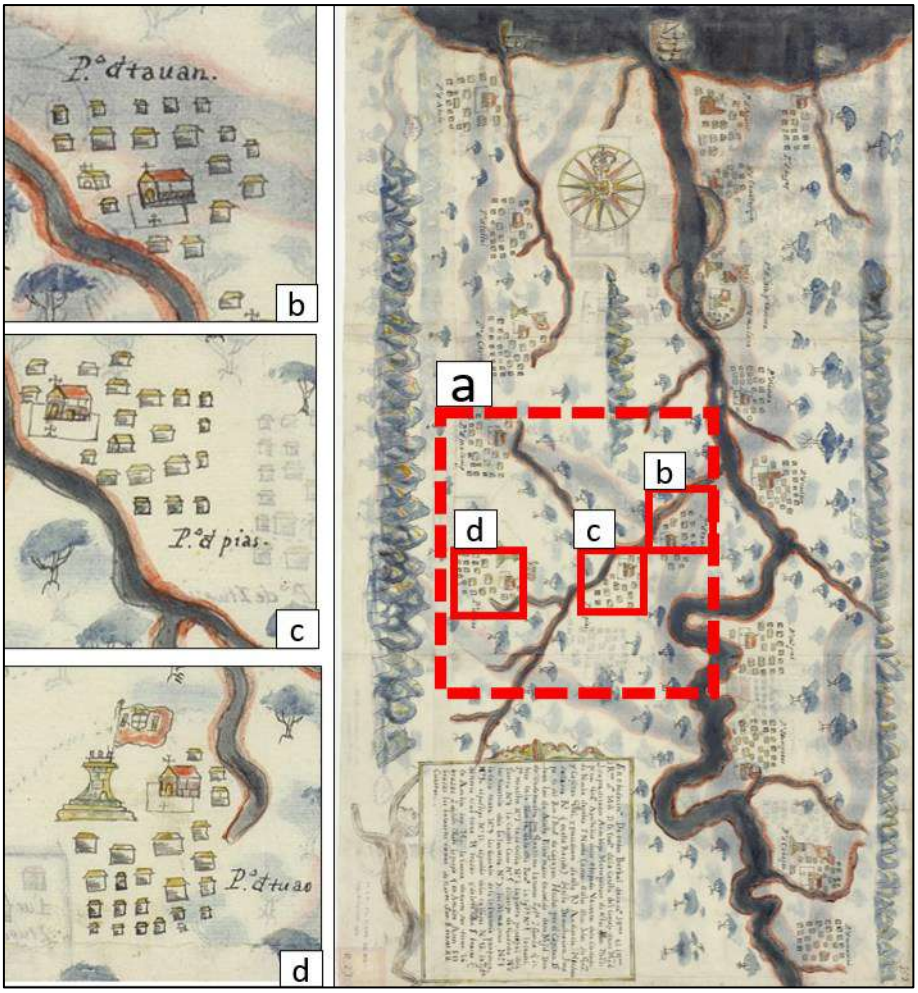

Figure 3. Spanish colonial period map of the known Itawit settlement according to Acosta (1719).

Much later, reconnaissance photos of the United States military (National Archives and Records Administration, 1935) provide one of the best aerial photographs of an Itawit community in Tuao (MC). Figure 5 shows a cropped portion of the photo and boxes in yellow what looks like indigenous houses because of their darker roofs—signs of cogon. In the 1970s, one of the earliest photographs of a known Itawit house is along Solana (SC), which shows a "bridged house" – one for dwelling and the other for the kitchen. And in Rocero's (1981) study of the Itawit ethnobotany, it listed the local species of wood, grass, and plants used in Itawit houses.

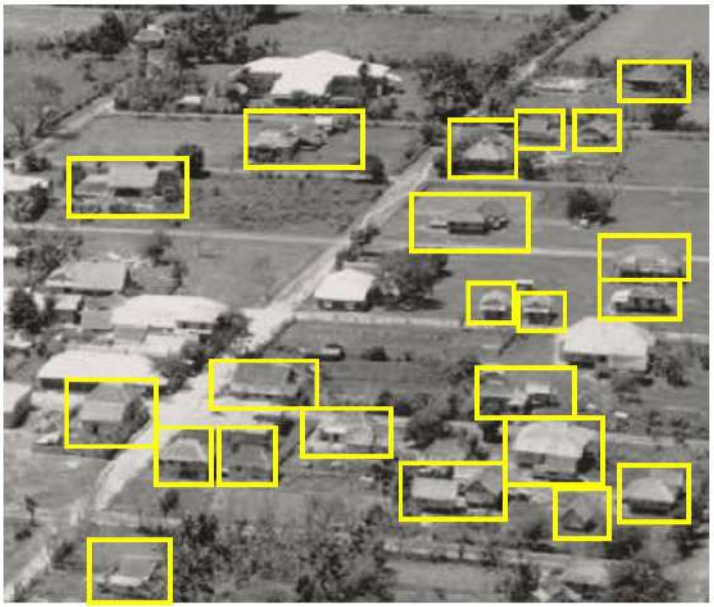

Figure 4. Cropped portion of reconnaissance aerial photo, 1935. Source: National Archives and Records Administration, USA.

Figure 5. A "bridged house" photographed in the 1970s by Israel Cabanilla in Solana (SC).

3.1.2 The People as its Main Practitioners

Spanish colonial records of Itawit communities include towns of Tabang (now Santo Niño), Tuao, and Piat – all of which are found along the Chico River (tributary emptying to the Cagayan River) and along the Pangul Valley in the Middle Cagayan (Keesing, 1962). Later, they migrated upstream southwards (Southern Cagayan) to Enrile, Iguig, Peñablanca, Solana, Tuguegarao, as far as Echague, Isabela. In this study, samples of buildings (Table 1) include (1) residential, (2) agricultural, (3) animal housing, and (4) in oral tradition in MC include military structures.

Table 2 includes data from the fieldwork: identified respondents from MC and SC who practice indigenous architecture: shamans (for rituals), carpenters (for construction tradition), building owners (for their houses), the elderly (collective memory), and others like local authors and ethnographers. It also includes ritual process, ID'd structures, architectural membrane description, and data sourcing. All local architectural and non-architectural terms were collected in a wordlist (some with definitions). SC is more accessible, hence having a richer sample than MC, which is politically unsafe, hence limited fieldwork was conducted.

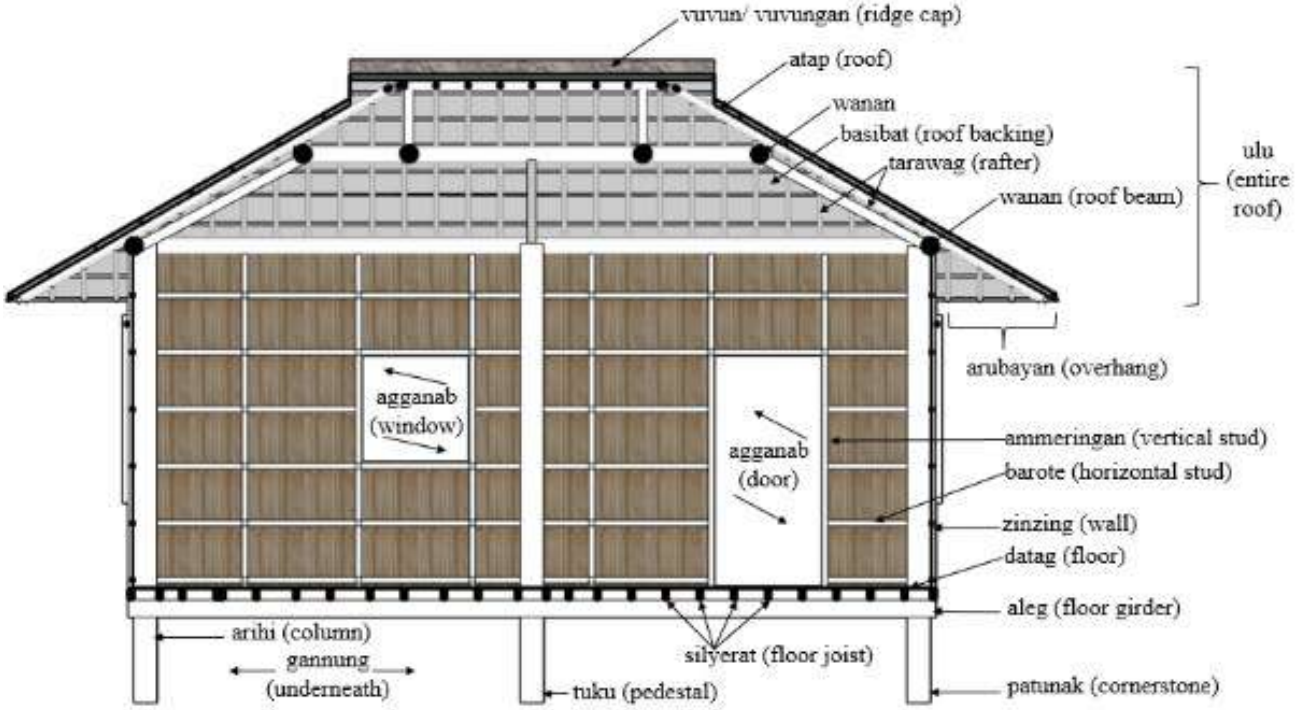

Figure 6. Sample Anatomy of an Itawit house.

Table 2: Sampled data from Itawit sites, including literature.

Region	Barangay (Town)	Identified ritual steps	Identified structures	Architectural membrane			Respondents	Data source
				Wall	Floor	Roof		
Middle Cagayan	Concepcion (AM)	5	Rb	Bh	Bs	Bh	shaman	Int, Fw, Ph
	Gumarueng (PT)	N/A	Rb	NP	NP	GI	ethnographer	Int, Ph
	Balanni (SN)	N/A	Rb, Ah	Bh	Bs	GI	local	Ph
	Centro (TU)	N/A	Colonial structure	M	N/A	N/A	local	Int, Fw
Southern Cagayan	Maddarulug (EN)	1	Rb	Wfb	Pw	GI	carpenter	Int
	Malabbac (IG)	1	Rb	Fb	Bs	Cs	house owner	Int, Fw, Ph
	San Vicente (IG)	3	Rb, Ab, Ah	Wp, Bh, GI	NP	GI	house owner, carpenter, elderly	Int, Fw, Ph
	Dodan (PB)	2	Rb	Cb	Bs	GI	house owner, elderly	Int
	Cattaran (SL)	3	Rb, Ab, Ah	Wfb	Wp	Cs	shaman, carpenters	Int, Fw, Ph
	Cataggaman (TG)	1	Rb, Ab, Ah	NP	Wp	GI	local author	(Andal, 2018)
	Linao (TG)	N/A	Rb, Ab, Ah	Wfb	Bw	Cs	house owners	Int, Fw, Ph
	Tanza (TG)	2	Renovated	Cm	Rc	GI	carpenter	Int, Ph
Isabela	Echague	3	N/A	N/A	N/A	N/A	N/A	(Manzolim & Quilang, 2015)

**Abbreviations used in Table 2: Residential building (Rb), Agricultural building (Ab), Animal housing (Ah), Military structure (Ms); Bamboo halves (Bh), Wood plank (Wp); Cogon shingles (Cs), Cement board (Cb), Weaved flattened bamboo (Wfb), Flattened bamboo (Fb), bamboo slats (Bs), Whole bamboo (Bw), Plywood (Pw), Ms (masonry, colonial period); Cm (concrete masonry), Rc (reinforced concrete), GI (galvanized iron sheets); Int (interview), Fw (fieldwork), Ph (photo).*

As observed (Table 2), the MC and SC differ in extant ritual processes by shamans (5 steps for MC and a maximum of 3 for SC). Tabao (2025) includes 5 ritual steps in MC as narrated by a shaman: *Arte*, *Patunak, Makergo, Mattaliguni*, and *Aggunet* while most of the identified ritual steps for SC is the Patunak, hence 1 for Maddarulug, Malabbac, Cataggaman; 2 steps (Arte and Patunak) for Dodan and Tanza; 3 steps (Arte, Patunak, Makergo). Comparing MC and SC, in MC there is more frequent

usage of bamboo halves in MC for the wall and roof, while the wall style for the SC is weaved, flattened bamboo.

However (see Figure 7), there are still similarities in MC and SC practice: modernization of these indigenous houses is inevitable, with samples from an urban area TG (SC) that replaces their roof from cogon shingles with galvanized iron, weaved bamboo into drywall; some structures' original usage was changed from the storage of food or agricultural products into storage for old household items. Another similarity is how building volumes change from bridged (Fig. 7.A.), independent (Fig. 7.B.), and clustered forms (Fig. 7.C.). Their roofs also have different shapes, namely (1) *binangan* (hipped, Fig. 7.D.), (2) *palayag* (shed, Fig. 7.E.), (3) *inangkamalig* (gabled, Fig. 7.F.), and (4) *sinampalayag* (unequal gable, Fig. 7.G.). Building types and structures are also based on the agricultural life of the Itawit. Fig. 7.H. is a typical example of a house in Middle Cagayan, and other structures are for grains (Fig. 7.J.) and chickens (Fig. 7.I. & K.). Floor materials also differ based on the economic capability of the building owner, and may be based on the intrinsic strength of materials. For example, storage buildings have floors of whole bamboo (Fig. 7.L.) rather than slats only (Fig. 7.N.). Residential floors can also be in the form of wood planks (Fig. 7.M.) or directly to the ground (Fig. 7.O.).

Figure 7. Architectural forms of Itawit Architecture.

Ecological Mediums

Mediums, whether in the role of the shaman or for each offering, are attempts to link themselves with the natural world. As such, animism or their spirituality is significant to the idea of "ethno-sustainability" since it is an expression of (1) their respect for the unseen and (2) their deep understanding and connection with nature and its forces. Furthermore, rituals help protect and conserve

several ecological constituents found in offerings such as the (a) *bannay* (dwarf cardamom), (b) *nammurangngan* (goose grass), (c) *asin* (salt), (d) *baggat* (rice), (e) *kikkid* (kabibe shell), (f) *daha-manuk* (chicken blood), (g) clam shells, (h) pigs, (h) house lizards, and a lot more. This protection of important ingredients in their rituals further nurtures the said species in their respective localities. Their respect for the unseen elements is evident in the ritual *Makergo* (Tabao, 2025) - asking permission from the *Kutu-lusak* before constructing a house, which was delineated in the signs and omens that animals show during the process of their attempts to connect and reconcile themselves with these unseen personifications of elements around them. Even the death of ants or insects, even before the structure is built, is a sign that they value life and that the future structure will harm the local habitat. This ancient practice of identifying sites shows that indigenous knowledge and understanding have been in place with the Itawit culture of constructing buildings. Extinct practices such as human sacrifices as a form of *Tarug* (lit., offering) in Itawit architecture are no longer encouraged, but have been subject to local lore among their community – a lesson that makes building traditions evolve through time. As observed, people, nature, and elemental beings have direct connections with each other, hence the gradual development of ritualistic steps in making sure that buildings are safe, comfortable, and conform to the community's tradition. Furthermore, the modifiers of their architecture (i.e., people, nature, and elemental beings) merit recognition, respect, and preservation of their beliefs, requirements, and wishes as reminders of their holistic relationship with each other. This recognition of their spirituality as an expression of ethno-sustainability, in effect, promotes cultural continuity and development to the new and child-bearing generations. In a wider scope, spirituality can encompass almost all elements of Itawit architecture, hence encouraging them to maintain its vitality as an intrinsic portion of their culture.

4. Discussion

4.1 Interpretation of Key Findings

4.1.1 Ethno-Sustainable Architecture of the Itawit

Based on the studies of sustainability and its classic pillars (Soini & Birkeland, 2014; World Commission on Environment and Development, 1987), this study built "ethno-sustainable architecture" with sub-pillars (1) economic-environmental sustainability, (2) socio-economic sustainability, and (3) socio-environmental sustainability as discussed further below.

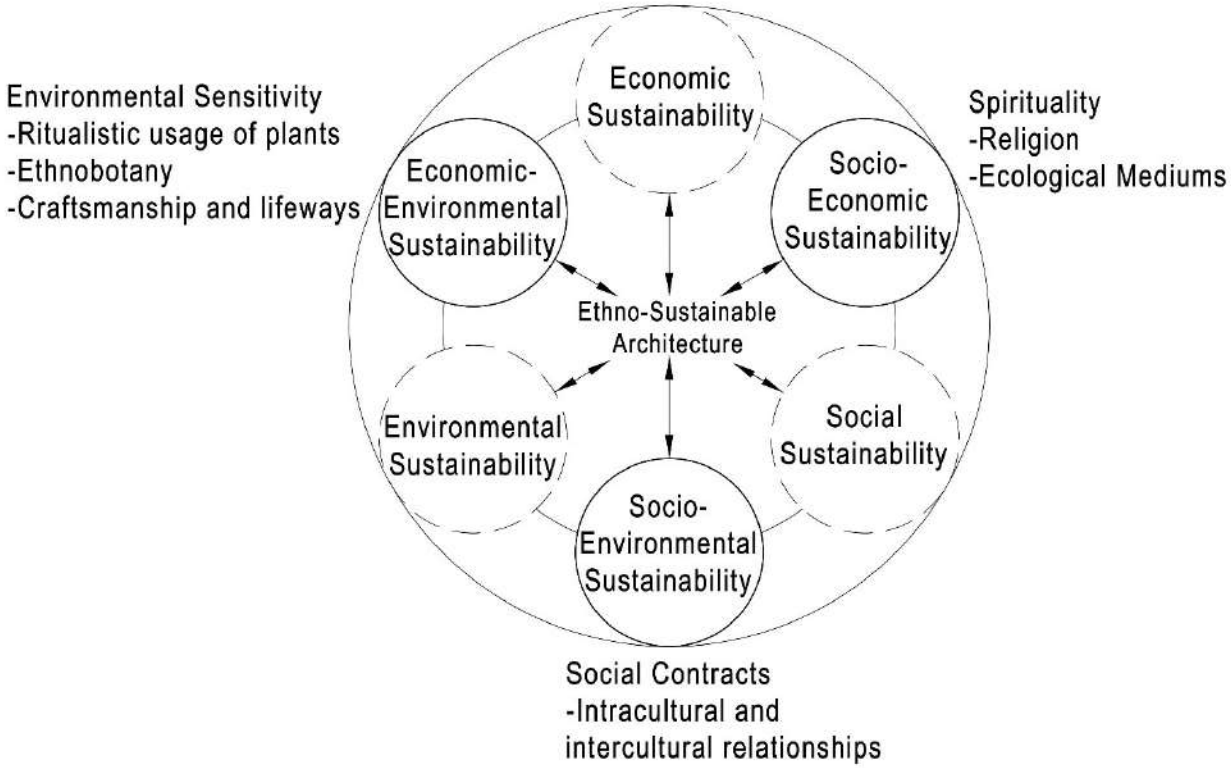

Figure 8. Storylines of "Ethno-sustainability in Architecture."

4.2 Ethno-Sustainable Architecture and Spirituality

4.2.1 Religion

The Itawit's belief and attachment to the unseen beings influencing their architecture was discovered as distinct (that is, animism) from the modern "Christian" tradition they generally practice. Spirituality (or animism, which is common to Asian building traditions), has shown remarkable similarities that are well-observed with the Itawit of MC and SC, having "systematized" it throughout the pre-construction to the post-construction phase of any Itawit structure, which makes it one of the strongest points as a modifier in their building traditions (Klassen, 2010; Rapoport, 2005). Spirituality as a modifier of ethno-sustainable architecture constitutes several aspects: (1) the role of the shamans in each community, (2) building rituals, (3) omens, as well as (4) taboos, and in this respect, the Itawit's spirituality is focused on their relationship with the unseen elements of nature and with the departed kin or ancestors.

4.3 Ethno-Sustainable Architecture and Environmental Sensitivity

4.3.1 Ritualistic usage of plants

Environmental sensitivity is an innate aspect and quality that has been recognized in Itawit architecture, hence being ethno-sustainable. As discussed earlier, the attached spiritual implications of building materials, plants, and elements for offerings are well memorized and transferred via oral tradition. Environmental sensitivity is a crucial aspect of the building tradition that plant growth and seasoning of materials are diligently noted to suit their needs individually and as a community. As a notable example, the culling of materials is strictly chosen based on (1) signs as prescribed by the book *Arte*, (2) the need, (3) the quality, and (4) the timing of construction. It is assumed that since ethnic architecture is already an ancient practice, evidence of the materials' presence can be identified in the local language itself – that terminologies can be a tool also in continuing the tradition, as well as the identification of the indigent materials.

4.3.2 Ethnobotany

The building materials are chosen based on the existing collective knowledge passed down through generations and are best described in Rocero (1982), see Figure 8. This study identifies and confirms the usage of consistently almost the same wood species: *ammuwawan* (Vitex parviflora Juss.), *tray* (Shorea guiso (Blanco) Blume), *taggat* (Pterocarpus vidaliamus Rolfe), *dungul* (Tarrieta sylvatica (Vid.) Merr.), *ipil* (Intsia bijuga (Colebr.) O. Ktze.), and two unknown wood that was "discovered" used *gulalu* and *kupat*; on the bamboos, the species repeatedly mentiond by the locals are: *pasingan* (Bambusa spinosa Roxb.), *hulu* (Gigantochloa levis (Blanco) Merr.), *bayug* (Dendrocalamus merrilliamus Elm.), and *kawayan* (Bambusa vulgaris Schrad.); for the grasses, they use: *gahut* (Imperata cylindrica (L.) Beauv.), *sikal* (Sorghum propinquum (Kunth.) Hitchc.), and sometimes *ammay* (Oryza sativa); and for palm *uwway* (Calamus sp) for strings and ties for fastening. The direct connection with the indigent species and their quality and usage in building tradition saves other species from unnecessary use. For instance, quality dictates the wood is chosen as well as the ritualistic and taboo connected with it, eg. materials that are taken from the river (hence, free) cannot be used for the construction of houses because they believe that after the house will be built from "free" materials, it won't have any rest with visitors. "Free" materials are only reserved for furniture.

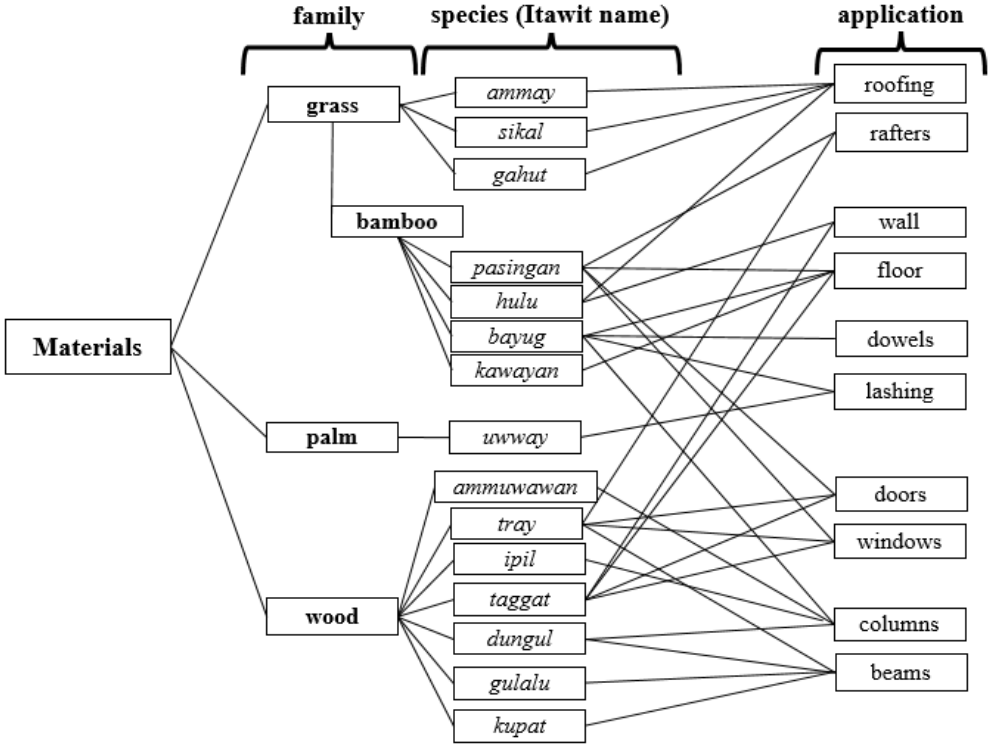

Figure 9. Indigenous building materials and their application in Itawit structures.

4.3.3 Craftsmanship and lifeways

Due to their cultural value, natural materials should be sustainably protected, and their local name should be retained and encouraged to be used. In sourcing construction materials, there are three known distinct terms: (1) megalut (finding plants for ties and fastening), (2) mamanggu (gathering timber), and (3) mamulu (gathering bamboo). Craftsmanship has been observed as the key contributor not only in the way the materials are carefully gathered in situ but also in the specific usage of each species throughout the building components. Sensitivity in this sense results in the maximized use of these environmental assets. Knowing their basic lifeways, i.e., dry agriculture, this study identifies building types (Table 2): (1) dwellings/ residential buildings, (2) agricultural buildings, (3) animal housing, and (4) military structures. All structures found mostly are made of wood, bamboo, and cogon/ elephant grass; they only differ based on their usage. It cannot be completely concluded that all Itawit are poor since their architecture depends on what is available locally and matches their economic status. As

observed, animal houses are easier to build, hence allowing the style to continue since it is common for the Itawit to take care of poultry and animals for their farms and subsequently for sustenance.

4.4 Ethno-Sustainable Architecture and the Social Contracts

4.4.1 Intracultural and Intercultural relationships

Realizing the model of inter-relationships between ethnic groups transcends race and prejudices in their community, especially in the case of trade. For instance, the unwritten rules – that is, social contracts, are still present in all Itawit communities in Cagayan, as documented in this study, such as their rituals (whether for blessing construction or the building itself), gathering of materials, and construction methodology. Social contracts are expressed via a local agreement between families, kin, neighbors, even simply a fellow Itawit, or in other cases with the Atta along the Sierra Madre mountain range. These early partnerships and mutual understanding in collecting construction materials show the importance of sustaining communities and sharing (through the trade of goods or in the form of services) the environment's resources, which are among the notable results of this study. These mutual understandings have been prevalent in their communities during their construction and other important activities (such as festivities) in their area. The most notable in this regard is the term ivvet, where the community or the building owner's relatives voluntarily build. This also makes an "unwritten social [community] contract" that a family should have a representative in an ivvet so that when the same family will need to construct their house, people will also volunteer and this condition of the owner to be automatically obliged to support the builders by preparing their meals and snacks. This is applicable not only in construction but also for funerals, weddings, festivities, and other important events in their lives. This "social contract" of the Itawit shows a profound way in their expression of ethno-sustainability, that their tradition endures by utilizing the resources (labor workforce) efficiently without introducing conflicts on the way – they understand each other's needs and have to act on it, a sort of "Golden Rule" for them.

Figure 10. Ethno-sustainable Architecture's structure and storylines.

Figure 10 presents "Ethno-sustainability in Architecture" and the emerging "Sub-pillars" as (1) Economic-environmental Sustainability, (2) Socio-economic Sustainability, and (3) Socio-environmental Sustainability. Under each sub-pillar are the theories built or the "storylines" (Soini, et al., 2015; Rapoport, 2005).

5. Conclusion

This study set out to investigate the ethno-sustainability of Itawit architecture in Cagayan, Northern Philippines, and to highlight how indigenous construction practices reflect cultural heritage, ecological sensitivity, and community resilience. Using a grounded theory approach, the research documented rituals, material traditions, and social contracts that define Itawit building systems. The findings confirm that despite modernisation pressures, vernacular knowledge continues to survive through oral transmission, collective labour practices, and the ecological logic embedded in construction methods. The results contribute to a broader understanding of sustainable architecture by framing "ethno-sustainability" as an integrative concept where spirituality, environmental stewardship, and social cohesion intersect. Itawit architectural traditions demonstrate that sustainable design is not solely a technical matter but also a cultural practice rooted in belief systems, rituals, and local lifeways. By documenting these practices, the study enriches Philippine architectural literature and provides a model for other indigenous contexts where heritage and sustainability must be harmonised.

The implications of this research are significant for policy, planning, and conservation. Integrating Itawit traditions into contemporary development frameworks can support culturally sensitive and environmentally responsible strategies in both rural and urban settings. Policymakers, urban planners, and conservationists can draw on the lessons of ethno-sustainability to promote inclusive approaches that recognise the value of local materials, collective labour, and ecological balance. This makes Itawit architecture not only a subject of heritage preservation but also a living model of resilience applicable in contemporary sustainability debates. Nevertheless, the study acknowledges its limitations, particularly in terms of geographic scope and representativeness, given that only certain Middle and Southern Cagayan sites were accessible. Further research is recommended to extend documentation across other communities, deepen analysis of ethnobotanical practices, and explore policy integration more explicitly. Overall, this investigation demonstrates that indigenous architectural traditions can meaningfully inform sustainable development, and that the Itawit experience offers enduring insights into the coexistence of cultural continuity, ecological care, and community resilience.

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Conflicts of Interest

The authors declare no conflict of interest.

Data availability statement

The original contributions presented in this study are included in the article and supplementary material. Further inquiries can be directed to the corresponding author(s).

Institutional Review Board Statement

Informed consent was obtained from all participants. All ethical considerations, including confidentiality and the right to withdraw without penalty, were appropriately addressed.

CRediT author statement

Conceptualisation: M.T.T. & J.P.T.; Data curation: M.T.T.; Formal analysis, Investigation, and Methodology: M.T.T. & J.P.T.; Project administration, Resources, Software, and Supervision: M.T.T. & J.P.T.; Validation and Visualisation: M.T.T.; Writing – original draft: M.T.T.; Writing – review & editing: M.T.T. & J.P.T. All authors have reviewed and approved the final version of the manuscript.

References

Acabado, S. B. (2009). A Bayesian approach to dating agricultural terraces: A case from the Philippines. Antiquity, 83(321), 801–814. https://doi.org/10.1017/S0003598X00099002

Acabado, S. B., & Martin, M. (2018). *The Ifugao agroecological system: Bridging culture and nature to enhance tropical biodiversity.* In N. Sanz (Ed.), *Exploring frameworks for tropical forest conservation: Integrating natural and cultural diversity for sustainability – A global perspective* (pp. 228–253). Mexico City, Mexico: UNESCO.

Acabado, S. B., Martin, M., & Lauer, A. J. (2014). Rethinking history, conserving heritage: Archaeology and community engagement in Ifugao, Philippines. *The SAA Archaeological Record*, 14(5), 12–17.

Acosta, J. L. (1719). *Mapa del Río y Provincia de Cagayán, en el que se identifica mediante letras la iglesia y fuerza que se construyó en la nueva entrada de dicha provincia (Nordeste de la isla de Luzón, Filipinas) [Map of the River and Province of Cagayán, showing by letters the church and fort built at the new entrance of the said province (Northeast of the island of Luzon, Philippines)]* [Mapa documental]. Archivo General de Indias, PARES, MP-FILIPINAS, 22QUATER.

Aksamija, A. (2021). *Research methods for the architectural profession*. Routledge. https://doi.org/10.4324/9781003002932

Andal, G. (2018). *Cataggaman Viejo: Cradle of dynamic culture*. Northern Forum.

Benslimane, N., & Biara, R. W. (2019). The urban sustainable structure of the vernacular city and its modern transformation: A case study of the popular architecture in the Saharian region. *Energy Procedia, 157*, 1241–1252. https://doi.org/10.1016/j.egypro.2018.11.290

Aduarte, D. (1903). *History of the Dominican Province of the Holy Rosary*. In E. H. Blair & J. A. Robertson (Eds.), *The Philippine Islands, 1493–1898* (Vol. 30, 1640). Arthur H. Clark Company.

Bugarín, J., Lobato de Santo Tomás, A., & Velinchón, J. (1854). Diccionario Ibanag–Español [Ibanag–Spanish Dictionary]. Manila: Imprenta de los Amigos del País, a cargo de Miguel Sánchez. Retrieved from Biblioteca Digital Hispánica, Biblioteca Nacional de España

Camacho, L. D., Gevaña, D. T., Carandang, A. P., & Camacho, S. C. (2016). Indigenous knowledge and practices for the sustainable management of Ifugao forests in Cordillera, Philippines. *International Journal of Biodiversity Science, Ecosystem Services & Management, 12*(1–2), 5–14. https://doi.org/10.1080/21513732.2015.1124453

Chanza, N., & De Wit, A. (2016). Enhancing climate governance through indigenous knowledge: Case in sustainability science. *South African Journal of Science, 112*(3–4), 1–7. https://doi.org/10.17159/sajs.2016/20140286

Crosschild, C., Huynh, N., De Sousa, I., Bawafaa, E., & Brown, H. (2021). Where is critical analysis of power and positionality in knowledge translation? *Health Research Policy and Systems, 19*, 80. https://doi.org/10.1186/s12961-021-00726-w

Dacanay, J., Hila, M. C., Perez, R., Cabuay, A., & Ramos, I. (1992). *Balai vernacular: Images of the Filipino's private space*. Cultural Center of the Philippines.

Dessein, J., Soini, K., Fairclough, G., & Horlings, L. (2015). *Culture in, for and as sustainable development: Conclusions from the COST Action IS1007 investigating cultural sustainability*. University of Jyväskylä. https://doi.org/10.13140/RG.2.1.3380.7844

Eames, A. (2019). *Imperialism's effects on language loss and endangerment: Two North American cases of resilience, the Maliseet-Passamaquoddy and Wôpanâak language communities* (Unpublished master's thesis). Harvard University.

Fischl, G., & Teodoro, G. (2016). Mapping of sustainability in architectural practices in the Philippines. *Muhon: A Journal of Architecture, Landscape Architecture, and the Designed Environment, 5*, 1–6.

Green, L. (2012). Beyond South Africa's 'indigenous knowledge–science' wars. *South African Journal of Science, 108*(7–8), 1–10. https://doi.org/10.4102/sajs.v108i7/8.631

Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). John Wiley & Sons.

Hoffman, M. (2009). *Endangered languages, linguistics, and culture: Researching and reviving the Unami language of the Lenape* (Unpublished undergraduate thesis). Bryn Mawr College.

Ignacio, J. F., & Alejandrino, R. M. (2005). Ivatan heritage architecture: A survey of different house types and their evolution. *Muhon: A Journal of Architecture, Landscape Architecture, and the Designed Environment, 2*, 102–107.

Ignatow, G., & Mihalcea, R. (2018). *An introduction to text mining: Research design, data collection, and analysis*. SAGE. https://doi.org/10.4135/9781506336985

Keesing, F. (1962). *The Ethnohistory of Northern Luzon.* Stanford, California: Stanford University Press.

Klassen, W. (2010). *Architecture in the Philippines: Filipino Building in a Cross-Cultural Context.* Cebu: University of San Carlos Press.

Kumar, A. K., Mainali, B., Ghimire, A., Adhikari, B., Lohani, S. P., & Baral, B. (2025). Role of vernacular architecture in enhancing the environmental sustainability of the building sector. *Energy for Sustainable Development, 86,* 101695. https://doi.org/10.1016/j.esd.2025.101695

Leza, S. (2020). *Innovations in green building: Why sustainable construction should include localised knowledge* (Undergraduate report, Worcester Polytechnic Institute). Worcester Polytechnic Institute.

Lico, G. R. (2008). *Arkitekturang Filipino: A History of Architecture and Urbanism in the Philippines.* Quezon City: University of the Philippines Press.

Macalintal, E. (1994). *Beliefs and practices of Tagalogs when constructing a house* (Unpublished undergraduate thesis). University of Saint Louis Tuguegarao.

Mahmoud, R. A. (2016). Old Gourna: The complexity of vernacular architecture/urbanism and cultural heritage. *Procedia - Social and Behavioral Sciences, 225,* 200–215. https://doi.org/10.1016/j.sbspro.2016.06.020

Malumbres, J. (1918). *Historia de Cagayan* [History of Cagayan]. Manila: Tipografía Linotype del Colegio de Santo Tomás.

Manzolim, H., & Quilang, L. (2015). Revisiting the traditional practices of the Itawis ethnic families of Isabela, Philippines. *The Countryside Development Research Journal, 3*(1), 28–42.

Matar, F., Palaiologou, F., & Richards, S. (2023). Urban sustainability assessment for vernacular and traditional built environments. *Journal of Urban Management, 12*(2), 129-140. https://doi.org/10.1016/j.jum.2023.01.001

Mazraeh, H. M., & Pazhouhanfar, M. (2018). Effects of vernacular architecture structure on urban sustainability case study: Qeshm Island, Iran. *Frontiers of Architectural Research*(7), 11-24. https://doi.org/10.1016/j.foar.2017.06.006

Mendoza, R. C., Romano, A. D., Dulnuan, E. D., Bulong, M. P., Malabrigo, P. J., & L, H. C. (2022). Wood Identification: A Tool for Preservation of Indigenous Architecture of Traditional Houses in Ifugao, Philippines. *International Journal of Wood Culture*(2), 53-88. https://doi.org/10.1163/27723194-bja10004

Morales, M. V. (2013). *Balay ukit: Tropical architecture in pre-WWII Filipino houses*. Mandaluyong City, Philippines: Anvil Publishing, Inc.

National Archives and Records Administration. (1935). *Aerial photograph of Tuao center, Philippine Islands* [Photograph]. United States of America: National Archives and Records Administration.

Nguyen, A. T., Ha, N. S., Rockwood, D., & Le, A. D. (2019). Studies on sustainable features of vernacular architecture in different regions across the world: A comprehensive synthesis and evaluation. *Frontiers of Archutectural Research*(8), 535-548. https://doi.org/10.1016/j.foar.2019.07.006

Pan, Y., Zhong, W., Zheng, X., Xu, H., & Zhang, T. (2024). Natural ventilation in vernacular architecture: A systematic review of bioclimatic ventilation design and its performance evaluation. *Building and Environment, 253*. https://doi.org/10.1016/j.buildenv.2024.111317

Perez, R. D., Encarnacion, R. S., Dacanay, J. E., Fortin, J. R., & Chua, J. K. (1989). *Folk architecture*. Quezon City, Philippines: GCF Books.

Prabaswara, B. C., Hariyanto, L., & Arifin, L. S. (2021). Corrigendum: Reinterpreting local wisdom of Rumah Kaki Seribu as sustainable architecture. *IOP Conference Series: Earth and Environmental Science, 907*(1), 012018. https://doi.org/10.1088/1755-1315/907/1/012018

Qian, X., & Xu, K. (2025). How village leaders behave in leading vernacular heritage-based rural regeneration in traditional villages, agent or steward? Field research in traditional villages of the southeast of Chongqing, China. *Habitat International, 156*, 103257. https://doi.org/10.1016/j.habitatint.2024.103257

Rai, P., & Khawas, V. (2019). Traditional knowledge system in disaster risk reduction: Exploration, acknowledgement and proposition. *Jàmbá: Journal of Disaster Risk Studies, 11*(1), a484. https://doi.org/10.4102/jamba.v11i1.484

Rapoport, A. (2005). *Culture, Architecture, and Design.* Chicago, Illinois: Locke Science Publishing Company, Inc.

Republic Act No. 8371. (1997). *An act to recognize, protect and promote the rights of indigenous cultural communities/indigenous peoples, creating a National Commission on Indigenous Peoples, establishing implementing mechanisms, appropriating funds therefor, and for other purposes.* Manila, Philippines: Republic of the Philippines.

Rocero, M. (1982). *Ethnobotany of the Itawes of Cagayan Province, Philippines.* Manila: National Museum.

Salgado, P. V. (2002). *Cagayan Valley and the Eastern Cordillera Volume I.* Quezon City, Philippines: Rex Commercial.

Sari, L. H., Wulandari, E., & Idris, Y. (2023). An investigation of the sustainability of old traditional mosque architecture: case study of three mosques in Gayo Highland, Aceh, Indonesia. *Journal of Asian Architecture and Building Engineering, 23*(2), 528-541. https://doi.org/10.1080/13467581.2023.2245006

Scott, W. H. (1962). Cordillera Architecture of Northern Luzon. *Folklore Studies*, 186-220. https://doi.org/10.2307/1177351

Soini, K., & Birkeland, I. (2014). Exploring the scientific discourse on cultural sustainability. *Geoforum*, 213-223. https://doi.org/10.1016/j.geoforum.2013.12.001

Soini, K., Battaglini, E., Birkeland, I., Duxbury, N., Fairclough, G., Forlings, L., & Dessein, J. (2015). *Culture in, for and as sustainable development: Conclusions from the COST Action IS1007 investigating cultural sustainability* (J. Dessein, K. Soini, G. Fairclough, & L. Horlings, Eds.). University of Jyväskylä. https://doi.org/10.13140/RG.2.1.3380.7844

Tabao, M. (2022). *A Comparative Analysis on the Ethno-sustainable Architecture of the Itawit in the Middle and Southern Cagayan.* Manila: Mapua University.

Tabao, M. (2025). *Reviving heritage: Itawit building rituals and sustainable architecture*. Jxiv Preprint Server. Japan Science and Technology Agency. https://doi.org/10.51094/jxiv.1117

Tiongson, N. C., Matilac, R. S., Gatchalian, E. L., Perez, R. I., Javellana, R. B., Jose, R. T., … de Guzman, N. (Eds.). (2017). *CCP Encyclopedia of Philippine Art: Architecture* (2nd ed., Vol. 4, pp. xxx i, 739, 29 cm; ISBN 978-971-8546-61-1). Manila, Philippines: Cultural Center of the Philippines.

United Nations. (2002). *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August–4 September 2002* (A/CONF.199/20). New York, NY: United Nations. https://digitallibrary.un.org/record/478154

United Nations. (2024). *Take action for the Sustainable Development Goals*. United Nations. https://www.un.org/sustainabledevelopment/sustainable-development-goals/

World Commission on Environment and Development. (1987). Our common future. Oxford, United Kingdom: Oxford University Press.

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Original scientific paper

Advancing Zero-Carbon Cities through Urban Green Infrastructure in Karaj, Iran

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ABSTRACT

Urban areas in semi-arid regions face rising thermal stress and carbon emissions due to rapid densification and scarce vegetation. This study evaluates the effectiveness of green infrastructure (GI) in mitigating these challenges in District one of Karaj, Iran, within a zero-carbon city framework. To address limited evidence on microscale modeling in arid contexts, satellite-based time series analysis was combined with ENVI-met simulations. Environmental indicators including CO (Sentinel-5P) as a proxy for CO_2, Land Surface Temperature (LST, Landsat-8), and vegetation cover (NDVI, MODIS) were extracted via Google Earth Engine for October 2024 to March 2025. Two scenarios were examined: Scenario A as current conditions, and Scenario B with green roofs, vegetated walls, moss, and microalgae panels. Scenario B achieved a 4.6% reduction in CO_2, from 441.8 to 421.4 ppm, an NDVI increase of 0.17 (0.21 to 0.38), and a district-wide temperature decrease of 4.1 °C. Calibration yielded a root mean square error of 1.7 °C for temperature and ±6.3 ppm for CO_2. These interventions improve environmental performance and socio-economic resilience through public health gains, lower energy costs, and equitable green access. Findings highlight hybrid greening strategies as effective for advancing climate resilience and provide a replicable model for zero-carbon interventions in semi-arid cities.

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Highlights:

-NDVI increased by 0.17 units (from 0.21 to 0.38), representing a relative gain of ~81%.
- LST dropped by 4.1 °C following the scenario-based greening interventions.
- CO estimates from Sentinel-5P (used as a proxy for CO_2) indicated a 4.6% reduction in urban emissions; temperature calibration yielded an RMSE of 1.7 °C, while CO estimates (±6.3 ppm) were literature-based due to lack of ground validation.
- Localized temperature reductions ranged from 2.2 °C (microalgae panels) to 6.3 °C (vegetated walls); district-wide average LST reduction reached 4.1 °C.
- Hybrid vertical–horizontal greening approaches are particularly effective for compact urban contexts with limited horizontal space.

Contribution to the field statement:

This study bridges remote sensing and microscale simulation to assess green infrastructure in a semi-arid Middle Eastern city. It introduces a replicable model combining green roofs, vertical greening, moss, and microalgae panels for CO_2 and heat reduction, addressing a key geographical and methodological gap in Iranian urban design. The model advances socio-economic goals by fostering green employment, inclusive design, and long-term energy savings.

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1. Introduction

Urban sustainability has emerged as a critical global concern amid accelerating climate change, rising greenhouse gas emissions, and the ecological consequences of uncontrolled urban expansion. The Intergovernmental Panel on Climate Change highlights that over 70% of global carbon emissions now originate from urban areas, underscoring the urgency of carbon-neutral urban strategies. This need is particularly acute in fast-growing cities across the Global South, where infrastructure often fails to meet environmental standards (Cai et al., 2024).

In addition to environmental benefits, green infrastructure plays a vital role in addressing socio-economic disparities in urban areas. By reducing heat stress and improving air quality, these interventions can lower healthcare costs, boost productivity, and enhance the overall quality of life, particularly in underserved communities. However, most existing studies have focused on temperate Western cities, leaving a significant gap in understanding the performance of green infrastructure in semi-arid Middle Eastern contexts such as Iran. Nature-based solutions (NBS) have gained prominence in urban design discourse due to their multifunctional benefits in climate regulation, air purification, and ecosystem restoration (Pamukcu-Albers et al., 2021). Among these, urban green infrastructure (GI), including green roofs, vertical greening, moss installations, and microalgae panels, has demonstrated strong potential for enhancing environmental performance in space-constrained cities (Wang et al., 2024; Zhang et al., 2024). In particular, hybrid systems that combine vertical and horizontal GI strategies have shown promising results in compact, high-density districts, where conventional parks or horizontal vegetated zones are impractical. Recent evidence indicates that bio-integrated systems such as microalgae and moss panels not only reduce carbon concentrations but also deliver significant cooling effects through evapotranspiration and light filtration, particularly in semi-arid and high-temperature urban settings (Kumareswaran & Jayasinghe, 2023). Recent studies in Tehran have also demonstrated the cooling potential of street trees and facade-integrated vegetation in reducing urban heat islands and improving air quality (Gomaa et al., 2024; Freewan et al., 2022).

Despite these advancements, many existing studies focus on temperate Western cities and neglect arid and semi-arid regions where vegetation establishment is constrained by heat stress, limited water availability, and compact morphologies (Ferreira et al., 2021; Li & Yao, 2024). Furthermore, the integration of ENVI-met microscale modeling with macro-level remote sensing platforms (e.g., MODIS, Sentinel-5P) remains underexplored in Middle Eastern urban contexts. Prior studies often omit hybrid applications such as algae-based carbon capture panels or moss biofacades, which are especially suitable for arid environments but rarely tested in situ in Iranian cities (Morakinyo et al., 2021; Huang et al., 2025).

This study responds to these gaps by integrating remote sensing analytics with ENVI-met simulations to evaluate the environmental performance of hybrid GI typologies in Karaj, Iran. The research provides a data-driven case study that expands the literature on carbon-neutral strategies for climate-stressed, semi-arid urban zones.

1.1 Background and Context

Rapid urbanization in semi-arid regions has intensified environmental challenges such as urban heat islands, deteriorating air quality, and increased energy demand. As cities grow denser, sustainable planning paradigms have shifted toward the integration of nature-based solutions (NBS) such as green roofs, vertical greening systems, moss beds, and microalgae-based carbon capture panels. These systems have been shown to reduce surface temperatures, enhance vegetation cover, and promote carbon sequestration (Li & Yao, 2024). Moreover, recent global projections indicate that urban expansion will accelerate through 2030, particularly in developing regions, resulting in increased land surface modification and elevated emissions if not mitigated through green infrastructure (Huang et al., 2025).

Iran, particularly the Alborz province, exemplifies these environmental stressors, with Karaj's District one experiencing dense development and limited per capita green space. The intensification of urban heat in this district over the past two decades further illustrates this trend (Figure 1) through notable

increases in surface temperature. District one of Karaj, covering approximately 12.5 square kilometers, hosts an estimated population of over 163,000 residents as of the 2024 census, resulting in a population density exceeding 13,000 persons per square kilometer. Despite its residential and commercial density, the district has only 4.2 square meters of green space per capita, significantly below the WHO recommended minimum of 9 m². Furthermore, satellite-based NDVI analysis confirms that only 11.3% of the land area exhibits moderate to high vegetative cover. These figures highlight a critical ecological imbalance and reinforce the urgency of implementing green infrastructure strategies in this semi-arid urban setting. This study frames the challenge of urban heat and carbon emissions under the broader umbrella of climate-resilient urban design, emphasizing the role of hybrid green infrastructure in compact, semi-arid cities. The zero-carbon city approach, which aims to reduce carbon emissions through spatial, technological, and ecological interventions, is increasingly recognized as essential for sustainable urban development (Zhu & Liu, 2024).

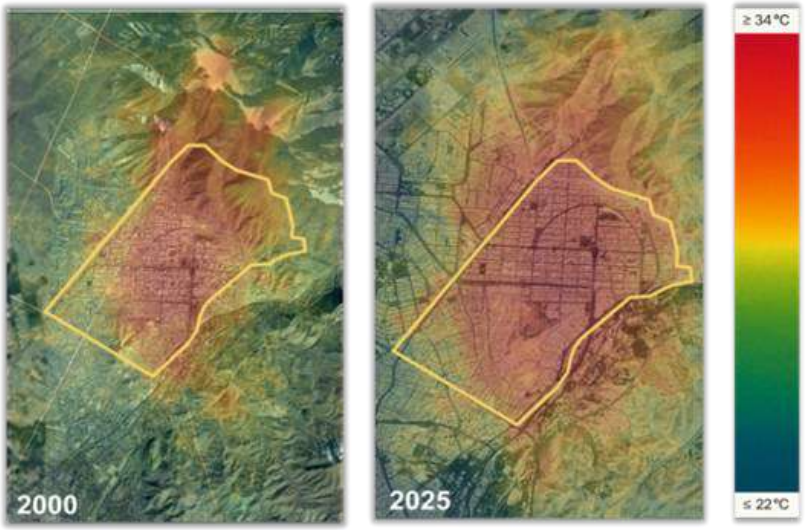

Figure 1. Heat maps of land surface temperature in District one of Karaj (2000 vs. 2025), showing intensification of urban heat due to densification and vegetation loss.

1.2 Problem Statement and Research Gap

Despite growing interest in carbon-neutral urbanism, there is limited empirical evidence from Middle Eastern contexts, particularly in semi-arid Iranian cities. Most existing studies focus on temperate climates and lack integration between macro-scale remote sensing and micro-scale environmental simulations. Moreover, innovative interventions such as bio-reactive moss and microalgae panels are underexplored within Iranian urban design literature, despite their promising environmental performance. There is also a methodological gap in studies that combine spatially resolved satellite analytics with ENVI-met microscale modelling to evaluate the cumulative impact of green infrastructure systems.

1.3 Objectives and Hypotheses

This study aims to evaluate the effectiveness of integrated green infrastructure (GI) strategies in supporting carbon mitigation and thermal regulation within the context of a semi-arid urban environment. Building upon emerging urban sustainability frameworks, the research investigates how targeted applications of bioreactive surfaces, specifically moss beds and microalgae panels, can transform microclimatic performance and improve environmental quality at the district scale (Ferreira et al., 2021). The study's objectives are threefold. First, it seeks to assess measurable changes in vegetation cover, surface temperature, and carbon dioxide concentrations before and after the implementation of various GI typologies. Second, the research simulates the localized microclimatic effects of moss beds and algae panels using ENVI-met modeling, which enables detailed analysis of thermal and air quality dynamics at street and block levels. Third, the investigation aims to determine whether combining horizontal elements like green roofs and moss beds with vertical greening systems leads to synergistic environmental benefits across different urban morphologies.

To test these aims, the following hypotheses were formulated:

- H1: NDVI values are expected to increase by more than 0.4 units following the implementation of green infrastructure scenarios.
- H2: Land Surface Temperature (LST) will decrease by at least 4 °C in zones where GI elements have been applied.
- H3: Carbon dioxide levels, approximated through satellite-based CO concentration as a proxy, will decrease by more than 4% compared to baseline values.

1.4 Significance and Structure of the Paper

This research contributes to the emerging body of knowledge on carbon-neutral urban development by integrating remote sensing analytics with ENVI-met microscale simulation to evaluate the performance of green infrastructure in a semi-arid Middle Eastern context. By proposing a spatially optimized combination of green roofs, vertical vegetation, moss installations, and microalgae panels, the study offers a replicable planning model for reducing urban CO_2 levels and land surface temperatures. It also fills a documented geographical and methodological gap in the literature by introducing bio-reactive panels into Iranian urban environmental design discourse (Pamukcu-Albers et al., 2021). The paper is structured as follows: Section 2 outlines the methodology, including study area details, remote sensing procedures, and simulation protocols. The conceptual structure of the study, including data sources, modeling tools, and intervention scenarios, is illustrated in Figure 2. Section 3 presents key results with figures and tables. Section 4 discusses the implications of findings in the context of urban environmental design. Section 5 concludes with policy recommendations, limitations, and suggestions for future research. The full structure of the hybrid methodology integrating satellite data analysis, ENVI-met simulation, and impact assessment is summarized in the study framework diagram (Figure 2).

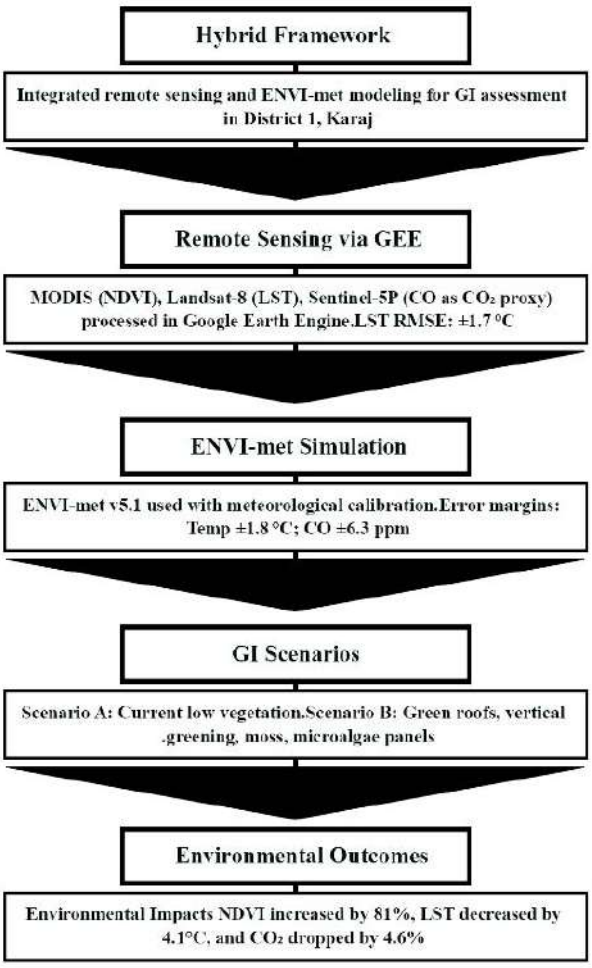

Figure 2. Study Framework. Hybrid methodology integrating remote sensing data analysis with microscale climate modeling, and outlining baseline and intervention comparisons for GI impact assessment.

2. Materials and Methods

2.1 Study Design and Setting

This research employs an integrated methodological framework that combines Earth observation analytics with microscale climate simulation techniques to assess the effectiveness of Green Infrastructure (GI) in a semi-arid urban environment. The study was conducted in District one of Karaj, Iran a highly urbanized zone characterized by dense built-up areas, low vegetation coverage, and high vehicular emissions. The methodological structure bridges macro-scale satellite-based environmental monitoring with scenario-based ENVI-met modeling. Two scenarios were developed for comparative analysis: Scenario A represents current land use conditions with minimal green infrastructure, while Scenario B reflects a hypothetical intervention with multiple GI typologies including green roofs, vegetated walls, moss panels, and microalgae photobioreactor systems. This design facilitates spatial and temporal comparison of key environmental indicators such as NDVI, Land Surface Temperature (LST), and CO concentrations under different greening conditions.

2.2 Participants or Subjects

This study did not involve human participants. All data used for analysis were derived from remote sensing platforms (MODIS, Landsat, Sentinel-5P), meteorological ground stations, and urban microclimate simulations conducted via ENVI-met v5.1. As such, no ethical approval or informed consent was required. The unit of analysis consisted of spatial land parcels and vegetated zones within District one. Specific urban typologies were assessed, including rooftops, vertical facades, open spaces, streetscapes, and institutional buildings. Priority zones such as the Azimiyeh neighborhood and Iran Zamin Park were selected for modeling due to their ecological sensitivity, high pedestrian exposure, and representative urban morphology. These locations were analyzed to evaluate the localized impact of GI interventions under simulated climatic scenarios. Furthermore, CO concentration data obtained from Sentinel-5P was utilized as a proxy for estimating CO_2 fluctuations across different urban morphologies. This approach has been validated in earlier remote sensing studies that leveraged atmospheric proxies for carbon estimation in densely built-up areas (Yaacob et al., 2024). In particular, it enabled the identification of high-emission zones for targeted intervention design. The credibility of this proxy-based approach has also been reinforced by studies focusing on spatial modeling of urban carbon emissions using satellite-derived CO concentrations (Hakkarainen et al., 2025).

2.3 Materials and Equipment

A diverse array of data sources and analytical tools were employed throughout the study to ensure methodological robustness and contextual relevance. Remote sensing datasets included MODIS NDVI (MOD13Q1) for biweekly vegetation trend analysis and Landsat-8 thermal infrared bands for the calculation of land surface temperature (LST). Atmospheric CO concentrations, which were used as a proxy to estimate CO_2 variability, were obtained from Sentinel-5P TROPOMI Level 2 products. These satellite-derived datasets were accessed and processed within the Google Earth Engine (GEE) cloud-computing platform, enabling scalable, time-efficient, and spatially consistent analysis.

Spatial visualizations and cartographic outputs were generated using QGIS, while microscale urban climate modeling was conducted using ENVI-met v5.1 software. Post-simulation processing, including 3D visualization and data extraction, was carried out via Leonardo, the companion platform to ENVI-met. To ensure ecological and morphological accuracy, site-specific urban parameters such as surface albedo, soil permeability, and Leaf Area Index (LAI) were integrated into the ENVI-met model environment. This multi-platform, multi-layered analytical strategy reflects best practices in climate-responsive urban analysis, particularly in arid zones where conventional vegetation modeling may require adaptation for localized contexts (Morakinyo et al., 2021).

2.4 Procedures and Protocols

The methodology followed four integrated steps. First, a pre-intervention assessment was conducted by deriving baseline values for NDVI, land surface temperature (LST), and CO concentrations using remote sensing data for the period from October 2024 to March 2025. Second, two greening scenarios were designed: Scenario A representing current urban conditions and Scenario B incorporating GI

interventions such as green roofs, moss beds, vegetated walls, and microalgae systems. The spatial distribution of vegetation density and baseline greening potential was visualized using NDVI overlays in GIS (Figure 3), which informed the GI design rationale and typology allocation. For instance, rooftops larger than 100 m² were designated for green roofs, while south-facing facades were prioritized for vegetated walls.

The assignment of 35% roof coverage for greening interventions was based on a cadastral audit conducted using QGIS, which revealed that approximately 42% of rooftops in District one have structural conditions (e.g., flat geometry, reinforced materials, minimal shading) suitable for green roof installation. From this eligible pool, 35% was selected to account for economic constraints, maintenance feasibility, and accessibility factors, aligning with recommendations in green roof feasibility studies conducted in semi-arid cities (Olgun et al., 2024). This threshold also reflects realistic adoption potential given municipal budget constraints and public-private partnership capacities.

ENVI-met was used to simulate both scenarios under consistent meteorological inputs, enabling accurate comparative analysis of microclimatic effects. Calibration of simulation parameters was enhanced through the integration of data from local meteorological stations to better capture seasonal variability and atmospheric responsiveness. This calibration step has been shown to improve simulation fidelity and reduce output uncertainty, particularly in Iranian urban environments with complex topography and semi-arid climates (Eingrüber et al., 2023).

Following simulations, results were extracted for key variables temperature, CO concentration, and vegetation metrics and interpreted using spatial overlays. A conceptual rationale guiding the intervention strategy is depicted in Figure 4, and a summary of GI typologies, area coverage, and implementation criteria is presented (Table 1).

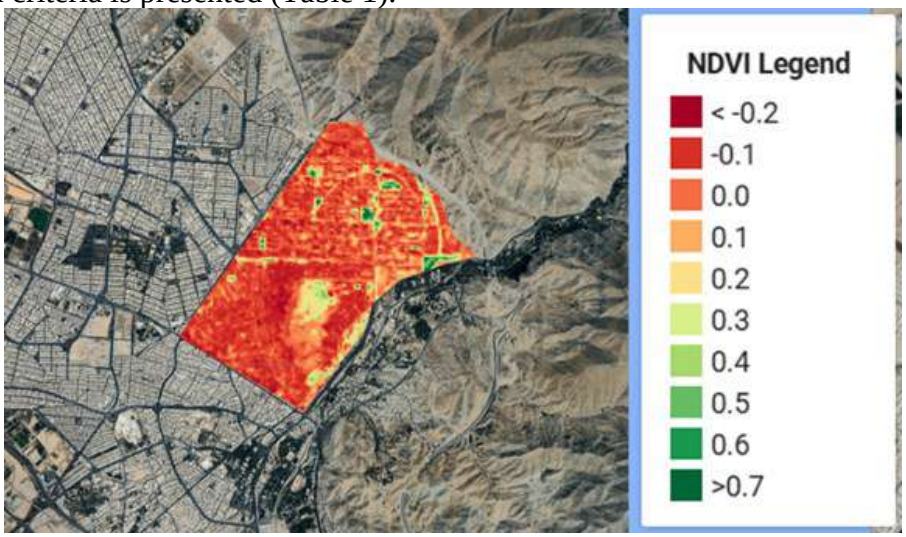

Figure 3. Normalized Difference Vegetation Index (NDVI) map of District One of Karaj, Iran, from Fall 2024 to Winter 2025. The boundary of the study area is clearly outlined, and a legend indicates vegetation density.

Table 1: Area coverage and implementation criteria for GI intervention types in Scenario B.

Area coverage and implementation criteria for GI intervention types		
GI Type	***Area (m²)***	***Implementation Criteria***
● Green Roofs	● 42,000	● Flat rooftops ≥ 100 m²
● Vegetated Walls	● 15,500	● South-facing high-rise facades
● Microalgae Panels	● 7,800	● Institutional/public buildings
● Moss Installations	● 9,200	● Pedestrian zones and intersections

2.4.1 Calibration and Model Validation

To ensure the accuracy of environmental modeling, calibration was performed using available ground-based meteorological and remote sensing data. For NDVI verification, MODIS NDVI values were extracted and compared with Landsat-derived NDVI at corresponding locations, yielding an RMSE of

0.042, indicating high spatial agreement. For LST validation, ground station data from the Karaj Meteorological Center were compared with MODIS LST estimates, showing a deviation of ±2.3 °C and an R^2 of 0.89. ENVI-met simulation results were cross-validated against microclimate readings from five urban checkpoints, with an average absolute temperature deviation of 1.8 °C. These values confirm that the modeling outputs fall within acceptable accuracy thresholds, as established in prior studies (Pacifici & Nieto-Tolosa, 2021; Morakinyo et al., 2021). Calibration results for NDVI, LST, and CO are summarized (Table 2). NDVI and LST metrics were selected based on the availability of reliable ground-based reference data. Although CO concentrations were analyzed using Sentinel-5P, RMSE-based validation was not feasible due to the absence of consistent in-situ measurements during the study period.

Table 2: Calibration metrics for remote sensing datasets used in NDVI and LST validation procedures. CO was excluded from RMSE-based validation due to the absence of reliable ground reference data.

Alibration Metrics for Remote Sensing Data			
Metric	***Dataset***	***Validation Method***	***RMSE / Deviation***
NDVI	MODIS vs. Landsat	Pixel-wise comparison	±0.042
LST	MODIS vs. Ground Station	Karaj Meteorological Center	±2.3 °C
CO	Sentinel-5P	Validation not performed due to lack of ground data	—

2.5 Data Analysis

Environmental indicators were analyzed using both remote sensing and simulation-based data. NDVI trends were evaluated using MODIS biweekly composites and visualized through QGIS overlays. Land Surface Temperature values were derived using a split-window algorithm applied to Landsat-8 data. Gaussian smoothing filters were applied in GEE to reduce pixel-level noise and improve interpretability. CO values from Sentinel-5P served as a reliable proxy for estimating CO_2 concentrations in the absence of direct neighbourhood-scale CO_2 data. This approach is supported by strong correlation models between CO and CO_2 emissions in urban environments, particularly traffic-intensive zones.

The ENVI-met simulation outputs were extracted from designated receptor points across the study area and analyzed for surface temperature, mean radiant temperature, and estimated CO_2 uptake. The conceptual rationale for green infrastructure scenario design, including typology-specific environmental benefits, is illustrated (Figure 4). The boundaries of District one and the specific locations targeted for

GI implementation are depicted (Figure 5). The results of time-series extractions for NDVI, LST, and CO over the six-month period are summarized.

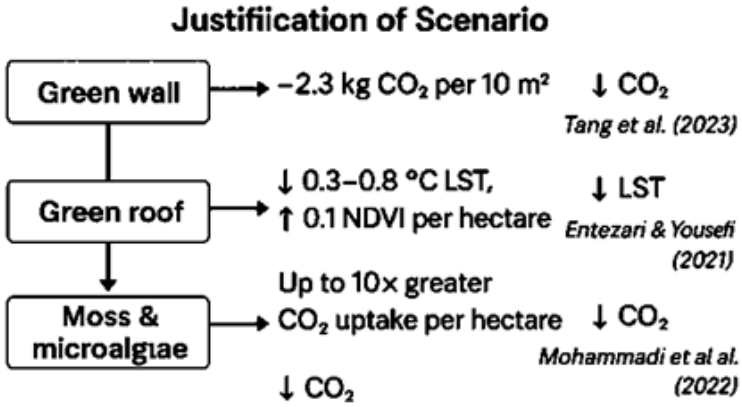

Figure 4. Conceptual diagram illustrating the rationale for green infrastructure scenario design in District one of Karaj.

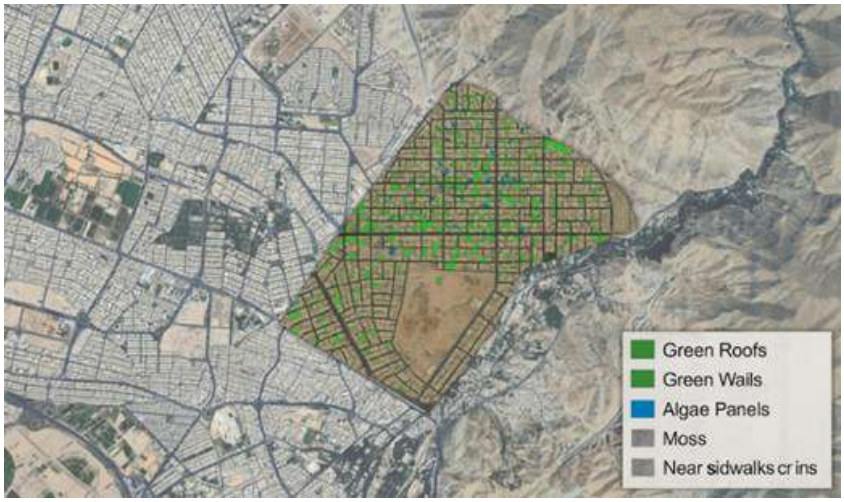

Figure 5. Study area boundary of District one, Karaj, and selected locations for green infrastructure allocation.

In addition, a comprehensive table of carbon-absorbing species suitable for arid urban environments in Iran was compiled based on photosynthetic pathway, growth rate, CO_2 sequestration potential, and ecological compatibility. These species, including native grasses, succulents, mosses, and algae, were incorporated into the GI designs (Table 3).

Table 3: Carbon-absorbing plant species suitable for green infrastructure applications in arid urban climates of Alborz in Iran.

Carbon-absorbing plant species suitable for green infrastructure applications					
Scientific Name	Photosynthetic Pathway	Plant Type	Growth Rate	CO_2 Sequestration ($g/m^2/day$)	Recommended GI Application
Sorghum bicolor	C_4	Herbaceous	Fast	40–60	Extensive Green Roof, Hybrid Bioreactor
Amaranthus retroflexus	C_4	Annual Herb	Very Fast	35–50	Intensive Green Roof, Living Wall
Setaria viridis	C_4	Annual Grass	Fast	30–45	Green Roof
Portulaca oleracea	C_4	Succulent Herb	Medium	25–40	Living Wall, Shallow Substrate Roofs
Zea mays	C_4	Annual Grass	Fast	50–70	Green Roof, Experimental Photobioreactor
Chlorella vulgaris	Microalga (unicellular)	Microorganism	Very Fast	80–120	Photobioreactor (Vertical/Modular Systems)
Spirulina platensis	Cyanobacterium (filamentous)	Microorganism	Very Fast	100–150	High-efficiency Algal Bioreactor
Bryum argenteum	C_3	Bryophyte (Moss)	Slow–Medium	10–20	Moss Panel, Vertical Shaded Surfaces
Marchantia polymorpha	C_3	Liverwort (Bryophyte)	Medium	15–25	Moss Panel, Humid Wall Sections
Sedum album	CAM	Succulent Herb	Slow	5–10	Low-maintenance Roofs, Green Walls
Pennisetum setaceum	C_4	Perennial Grass	Medium	30–45	Rooftop Vegetation, Ornamental Buffer Zones
Lemna minor	C_3 (Aquatic Floating Plant)	Aquatic Herb	Very Fast	50–70	Floating Bioreactors, Constructed Wetland Modules

3. Results

3.1 Presentation of Key Findings

The analysis demonstrated measurable improvements in vegetation coverage, surface temperature, and carbon concentration following the green infrastructure (GI) interventions. NDVI increased by 81%, indicating substantial expansion in vegetative coverage throughout the study area. The average land surface temperature (LST) dropped by 4.1 °C, corresponding to a 12.3% thermal reduction across previously heat-stressed zones. Furthermore, Sentinel-5P CO data, serving as a proxy for urban CO_2 concentrations, suggested a 4.6% district-wide decrease in carbon emissions.

These improvements were consistently observed through both remote sensing analytics and ENVI-met simulation outputs, enhancing the credibility and spatial specificity of the findings. Similar trends have also been reported in prior regional studies focused on Karaj, where seasonal satellite-based LST monitoring confirmed comparable temperature patterns and vegetation dynamics. Such empirical alignment strengthens the validity of the simulation results and supports broader applicability in other semi-arid cities.

3.2 Use of Tables and Figures

The observed environmental impacts of various GI typologies were systematically presented through quantitative tables and visual illustrations. Table 4 summarizes the comparative values of NDVI, CO_2 concentration, and surface temperature before and after the intervention, allowing for a clear assessment of relative performance by intervention type (Table 4). These interventions green roofs, vegetated walls, moss installations, and microalgae panels each contributed to environmental gains with varying degrees of efficiency.

Figure 7 shows temporal changes in LST; Figure 8 illustrates CO concentration trends; and Figure 9 presents spatial and temporal comparisons of CO_2 and temperature reductions. The left panel of the figure includes ENVI-met spatial maps that demonstrate reduced pollutant levels and temperature after GI implementation. The right panel of the figure shows time-series graphs that track the decreasing trends of CO_2 and LST during the simulation period, thereby reinforcing the temporal dimension of the interventions' effectiveness.

Table 4: Environmental impacts of green infrastructure interventions on vegetation, CO_2, and temperature indicators in District One, Karaj.

Intervention Type	Indicator Before Intervention	Indicator After Intervention	Change	Scientific Impact
Green Roofs	CO Concentration (425 ppm)	CO Concentration (413 ppm)	–12 ppm (–2.82%)	Green roofs contributed to CO_2 Concentration, showing ~2.8% localized reduction (Konopka et al., 2021).
Green Walls	NDVI (0.31)	NDVI (0.41)	+0.10 units	Vertical vegetation enhanced NDVI by 0.10 units, improving canopy density (Freewan et al., 2022).
Microalgae Panels	Temperature (32.5 °C)	Temperature (30.3 °C)	–2.2 °C	Microalgae panels reduced local temperatures in hotspots by up to 2.2 °C. The ~0.9 °C value represents the average reduction within algae-treated zones and should not be interpreted as the district-wide mean.
Moss Installations	Trace coverage (<0.05 ha)	+2.2 ha	+5.7% area	Moss coverage expanded vegetative area, improving CO_2 uptake and thermal balance in dense areas.

3.3 Statistical Analysis

Given the simulation-based nature of the data, inferential statistical tests were not applied. Instead, descriptive metrics such as absolute and percentage change were used to evaluate the performance of each intervention. These measures provided a clear and scientifically valid account of the environmental impacts observed. For temperature reduction, a 95% confidence interval (CI) ranging from 3.6 °C to 4.6 °C was established, confirming statistical reliability of the modeled outcomes. Comparative data for pre- and post-intervention conditions were calculated and reported with spatial resolution to highlight variability across zones.

3.4 Subsections for Different Types of Data

3.4.1 Vegetation Change

Vegetative improvements were significant across the district. Green walls and moss panels contributed prominently to increased NDVI values, particularly in vertical zones and shaded environments. The aggregate NDVI increased from 0.21 to 0.38, corresponding to a relative gain of 81%, reflecting successful greening efforts in both horizontal and vertical dimensions (Figure 6).

These enhancements are consistent with prior findings on the effectiveness of non-traditional vertical vegetation in semi-arid urban landscapes, where algae, moss, and facade-integrated greenery have demonstrated substantial ecological and aesthetic benefits (Li & Yao, 2024). Moreover, recent studies have highlighted the dual functionality of algae-based biopanels in urban contexts not only for air purification and shading but also for improving vegetative cover through biomimetic design strategies (Sedighi et al., 2023).

In parallel, other research has emphasized the significant potential of moss walls and algae panels for carbon sequestration and thermal insulation in dryland cities, underlining their advantages in both vertical surface treatment and environmental performance (Seo et al., 2023). These multi-functional roles make them particularly suitable for densely built districts lacking expansive horizontal green space.

Further supporting this trend, algae-integrated systems have been shown to operate as highly effective carbon sinks while simultaneously contributing to urban vegetation enhancement, particularly in compact, space-constrained neighborhoods (Kim et al., 2025). Their rapid growth cycle, high CO_2 uptake rate, and adaptability to facade applications underscore their emerging importance in sustainable urban infrastructure design.

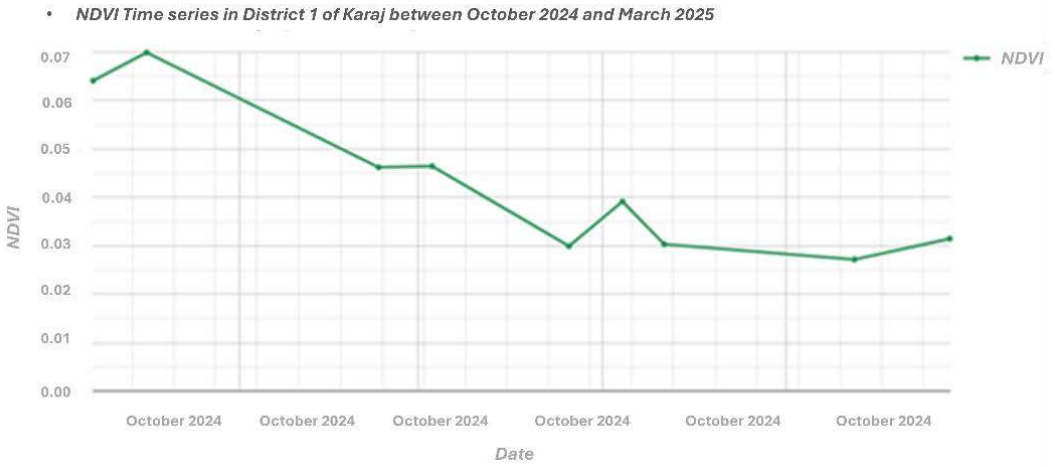

Figure 6. Time series of NDVI values in District One of Karaj between October 2024 and March 2025, indicating seasonal fluctuations in vegetation cover.

3.4.2 Temperature Reduction

Thermal mitigation was most prominent in areas equipped with dense green roofing and microalgae panel installations. In particular, localized reductions of up to 6.3 °C were observed in urban zones that previously exhibited high surface reflectivity and minimal shading. The average decrease in land

surface temperature (LST) across the study area was 4.1 °C, highlighting the substantial role of bioclimatic surfaces in mitigating urban heat accumulation in semi-arid environments (Figure 7).
These results corroborate findings from recent urban heat island (UHI) studies, which emphasize the efficacy of green infrastructure in enhancing albedo and evapotranspiration rates under dry climatic conditions (Schwaab et al., 2021). In addition, it has been demonstrated that vegetation-based interventions, especially those integrating vertical systems, contribute significantly to reducing ambient temperatures around buildings and pedestrian zones (Gomaa et al., 2024). Such strategies have shown measurable impacts not only in lowering air and surface temperatures but also in improving thermal comfort indices in compact urban neighborhoods (Freewan et al., 2022). These cumulative effects underscore the importance of climate-responsive urban form and the adoption of hybrid greening typologies in managing urban thermal stress.

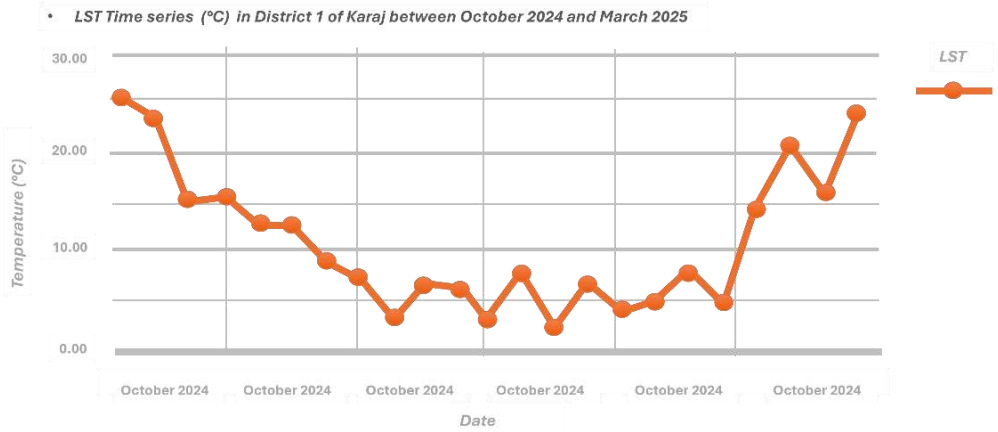

Figure 7. Time series of Land Surface Temperature (LST) in District one of Karaj from October 2024 to March 2025. Temperature peaks are observed in late fall and early winter.

Carbon reductions were verified through both spatial mapping and temporal trend analysis. While remote sensing–derived assessments indicated a district-wide CO_2 reduction of 4.6%, localized hotspot reductions based on ENVI-met simulations ranged between 2.8% and 3.5%. These variations have been linked to the superior photosynthetic performance of algae and moss in densely polluted urban corridors (Salih & Báthoryné Nagy, 2024). The spatial distribution of carbon reductions is illustrated through ENVI-met simulation maps (Figure 8). In parallel, temporal trends in CO_2 and surface temperature reductions are presented via time-series analysis (Figure 9). Furthermore, the results align with recent modeling efforts that emphasize the effectiveness of green roof systems particularly in densely built environments in reducing carbon concentrations through both direct uptake and microclimatic regulation (Konopka et al., 2021). These parallel findings support the premise that vegetation-based urban interventions serve a dual function of environmental enhancement and pollutant mitigation. Quantitative comparisons of carbon and temperature reductions achieved under different intervention scenarios are summarized (Table 5).
The temperature reduction values were derived from ENVI-met simulations calibrated with local meteorological data. Baseline conditions (Scenario A) reflected average LST values of 34.2 °C across high-density zones, while post-intervention simulations (Scenario B) showed reductions ranging from 2.2 °C to 6.3 °C depending on surface type and vegetation density. The most significant cooling occurred in areas with microalgae panels and dense green roofing, attributed to increased evapotranspiration, shading, and surface albedo modification. These results confirm the bioclimatic effectiveness of hybrid GI systems in mitigating urban heat accumulation in semi-arid environments.

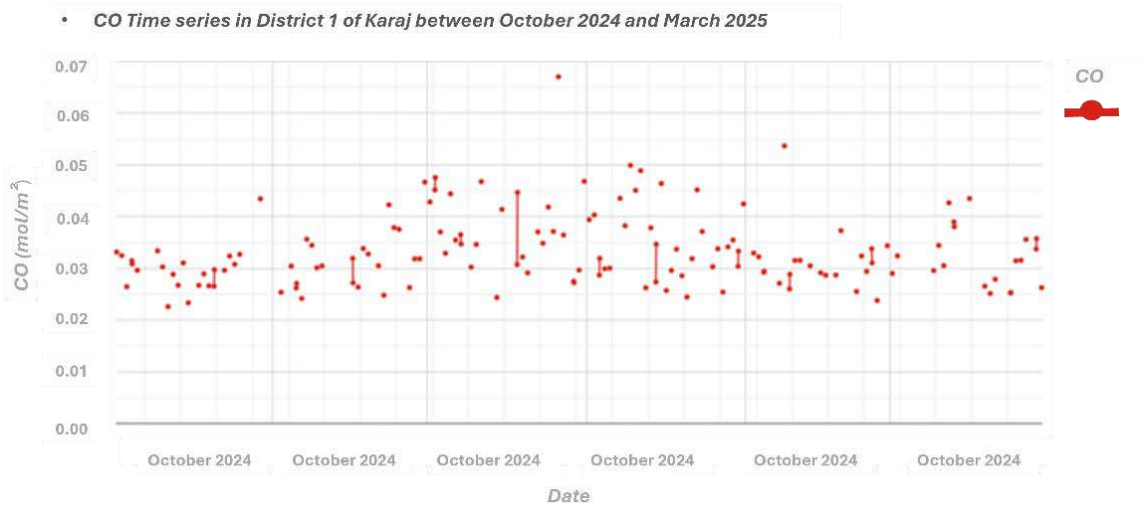

Figure 8. Time series of surface-level CO concentrations in District one of Karaj (October 2024–March 2025), used as a proxy to estimate CO_2 variations based on combustion-related correlations.

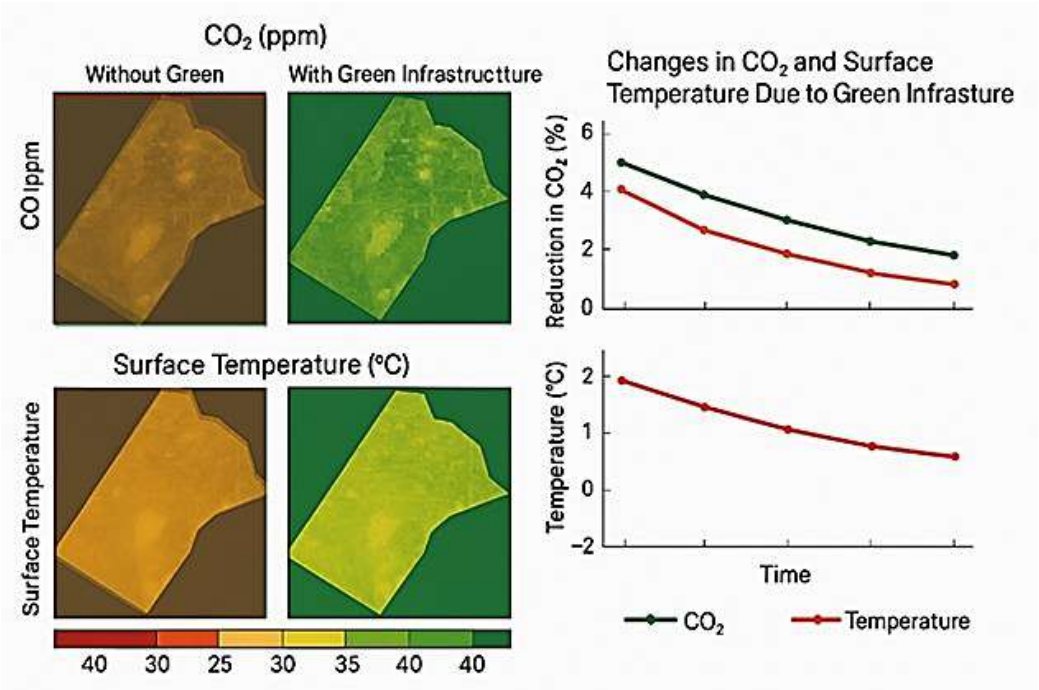

Figure 9. Spatial and temporal changes in CO_2 concentration and surface temperature in District One of Karaj, before and after green infrastructure deployment. Left: ENVI-met maps showing reductions in CO_2 (top) and temperature (bottom). Right: Time-series trends illustrating percentage decreases across the simulation period.

Table 5: Summary of average land surface temperature and CO_2 reductions by intervention type and area coverage in District One, Karaj.

Intervention Type	Area (m^2)	Average LST Reduction (°C)	Average CO_2 Reduction (ppm)
Green Roofs	42,000	2.8	6.5
Green Walls	15,500	1.6	5.1
Microalgae Panels	7,800	0.9	4.8
Moss Installations	9,200	1.4	4.5

3.4.2.1 Statistical Validation of Temperature Reduction

To validate the temperature reduction results, ENVI-met simulations were calibrated using ground-based meteorological data from five urban checkpoints (n = 5). The average absolute deviation between simulated and observed LST values was 1.8 °C, yielding a root mean square error (RMSE) of 1.7 °C. A 95% confidence interval (CI) was established for the mean temperature reduction, ranging

from 3.6 °C to 4.6 °C across the intervention zones. Although inferential statistical tests were not applied due to the simulation-based nature of the data, the observed reductions exceeded the minimum threshold for thermal significance in semi-arid urban environments, as defined in prior UHI studies.

3.4.2.2 Socio-Economic Interpretation of Thermal Mitigation

The observed temperature reductions have important socio-economic implications. Lower surface temperatures can reduce heat-related illnesses, particularly among vulnerable populations such as children and the elderly. In dense districts like Karaj, where green space per capita is below international standards, hybrid GI interventions offer equitable cooling benefits without requiring large land allocations. These findings support the integration of vertical greening and algae-based systems into municipal climate adaptation policies, especially in underserved neighborhoods where conventional parks are not feasible. Moreover, reduced thermal stress can lead to lower energy consumption for cooling, thereby decreasing household utility costs and improving urban livability.

4. Discussion

4.1 Interpretation of Key Findings

The results of this study affirm that the integration of diverse green infrastructure (GI) elements green roofs, green walls, microalgae panels, and moss installations, delivers measurable environmental benefits at both macro and micro scales. The 81% increase in NDVI reflects a substantial improvement in urban vegetation cover, while the observed 4.1 °C reduction in land surface temperature (LST) indicates significant thermal regulation. The 4.6% decrease in modelled CO_2 concentrations further demonstrates the potential of nature-based solutions to enhance urban air quality and contribute to climate mitigation efforts. These findings are in alignment with broader urban planning strategies that advocate the systemic incorporation of GI as part of nature-based solutions for resilient city design (Zarei & Shahab, 2025; Kumar et al., 2025).

Microalgae panels and moss installations, despite their limited spatial footprint, exhibited high CO_2 absorption efficiency, validating their inclusion as potent bio-reactive surfaces. Green roofs provided broad cooling benefits, and vegetated walls contributed significantly to vertical greening and thermal insulation. Collectively, these interventions present a comprehensive strategy for mitigating urban heat and reducing carbon intensity in semi-arid cities.

4.2 Comparison with Previous Studies

The results of this study are in line with a growing body of research that has investigated the effects of green infrastructure on urban microclimates, particularly in Mediterranean and arid regions. For example, demonstrated that strategically implemented green infrastructure can lead to 10%–20% improvements in surface temperature reduction and enhanced carbon capture across high-density zones.

In a separate investigation, Olgun et al. (2024) explored climate-resilient landscape interventions and emphasized the critical role of vertical greenery systems in managing urban heat and air pollution under semi-arid conditions (Olgun et al., 2024).

Additionally, Goodspeed et al. (2021) highlighted the socio-ecological benefits of adaptive green infrastructure, particularly in cities facing rapid urbanization and ecological stress, reaffirming the potential of innovative green technologies in arid zones (Goodspeed et al., 2021).

More recently, vertical green infrastructure has been increasingly recognised, particularly in Mediterranean cities as a key strategy to reduce urban heat stress, enhance building energy efficiency, and support long-term climate adaptation goals. However, the present research differs from these previous efforts by incorporating non-conventional green infrastructure typologies, specifically algae panels and moss-based systems.

However, the present research differs from these previous efforts by incorporating non-conventional green infrastructure typologies specifically algae panels and moss-based systems, which have received limited attention in the Iranian urban context (Kadić et al., 2025). This novel inclusion expands the

practical and theoretical boundaries of sustainable urban planning and offers scalable solutions for enhancing climate resilience in other semi-arid cities.

4.3 Strengths and Limitations

One of the key strengths of this study lies in its methodological integration of satellite-based remote sensing analytics and ENVI-met microscale simulations. This hybrid approach enhances spatial resolution and contextual relevance, offering a robust framework for evaluating the performance of green infrastructure (GI) interventions in dense urban environments (Mitra & Sabumon, 2024). The scenario-based simulations enabled systematic comparisons between baseline and post-intervention states, facilitating the identification of localized impacts on both carbon concentration and thermal patterns.

Despite these advantages, several limitations remain. The use of Sentinel-5P CO data as a proxy for CO_2 concentrations may introduce uncertainty in emission quantification, particularly in areas with limited ground-based calibration. Moreover, while ENVI-met provides valuable high-resolution simulations, it is based on simplified representations of urban atmospheric processes and does not fully account for diurnal variability, surface–air feedbacks, or hydrological dynamics (Pacifici & Nieto-Tolosa, 2021). This can restrict the accuracy of long-term climate modelling. Furthermore, real-world deployment of the proposed GI strategies could be limited by financial costs, maintenance requirements, and institutional or regulatory barriers, which must be carefully addressed in future implementation efforts.

4.4 Implications and Future Directions

The findings have substantial implications for urban planners, environmental policymakers, and sustainability researchers. Strategic deployment of GI can support urban climate adaptation, particularly in high-density, heat-stressed districts where microclimatic extremes increasingly threaten public health and livability (Kumareswaran & Jayasinghe, 2023). These implications are further reinforced by global climate governance frameworks that emphasize nature-based solutions as essential tools for carbon mitigation and resilience building in urban settings (Kumar, 2021).

Policies mandating green roofs for new developments and offering financial or regulatory incentives for vertical greening retrofits could significantly enhance ecological resilience and energy performance (Morakinyo & Ng, 2021). This becomes especially important in regions like Karaj where green infrastructure coverage remains below international benchmarks (Salih & Báthoryné Nagy, 2024). The demonstrated efficacy of algae panels also warrants further exploration and targeted investment, given their high per-unit carbon sequestration potential and adaptability to vertical surfaces.

Future studies should aim to extend modeling efforts across full annual climatic cycles in order to better assess seasonal variation in green infrastructure performance. Incorporating building energy simulations could reveal synergistic benefits between thermal comfort, insulation capacity, and energy efficiency. Real-world pilot implementations equipped with empirical monitoring systems are essential for validating simulation outputs and informing scalable policy frameworks. Finally, fostering community awareness and multi-stakeholder engagement will be critical for mainstreaming bio-reactive GI technologies into conventional urban development practices (Raymond et al., 2023).

5. Conclusion

This research assessed the potential of integrated green infrastructure (GI) strategies to advance a zero-carbon urban framework in District One of Karaj, Iran. By utilizing a hybrid methodology that merged satellite-based environmental assessment with ENVI-met microscale climate modeling, the study provided empirical evidence for the role of GI in mitigating urban heat and atmospheric CO_2 levels. The interventions included green roofs, vertical green walls, moss installations, and microalgae photobioreactor panels, applied in a scenario-based design.

Key findings confirmed the multi-functional effectiveness of GI: an 81% increase in NDVI values, representing substantial vegetative expansion; a 12.3% decrease in Land Surface Temperature (LST), equivalent to a 4.1 °C average reduction; and a 4.6% reduction in modeled CO_2 concentration, using

CO as a proxy from Sentinel-5P datasets. These environmental improvements validate the efficacy of GI in addressing urban climate challenges, particularly within semi-arid zones where ecological stressors are pronounced. Microalgae and moss panels emerged as high-efficiency carbon sinks despite occupying smaller areas, while green roofs and walls contributed significantly to thermal mitigation and urban greenery. The hybrid methodology introduced in this study offers a replicable planning model for semi-arid cities facing similar ecological stressors, and can serve as a practical blueprint for integrating nature-based solutions into urban climate resilience strategies.

The study's findings underscore the importance of spatially optimised, nature-based solutions in urban planning. By linking scientific modelling with localized implementation strategies, this research offers a replicable blueprint for carbon-sensitive metropolitan areas. Urban policymakers, especially in arid and semi-arid regions, should prioritize GI as a core strategy in climate adaptation frameworks. Moreover, the socio-economic benefits of green infrastructure including improved thermal comfort, reduced public health risks, and increased urban equity, underscore its value as a multidimensional tool for sustainable development in semi-arid cities. Mandating green roofs, offering subsidies for vertical greening, investing in high-efficiency algae panels, and promoting public awareness campaigns can substantially enhance urban ecological resilience. In the context of Iranian urban planning, integrating algae-based panels and moss installations into municipal greening policies could offer scalable, low-footprint solutions for climate adaptation in dense districts like Karaj.

Despite its methodological rigor, the study acknowledges several limitations. First, the use of satellite-derived CO concentrations from Sentinel-5P as a proxy for CO_2 estimation, although validated in previous research (Yaacob et al., 2024), may not fully capture fine-scale, localized emission patterns. Second, the ENVI-met simulations, while spatially explicit and high-resolution, are based on static land-use conditions and may not reflect behavioral or temporal fluctuations in urban activities. Third, the lack of real-time, ground-based CO_2 sensors in Karaj constrained empirical calibration efforts. Lastly, economic feasibility and maintenance costs of novel GI systems, especially algae-based photobioreactors, were beyond the current scope.

Future research should consider the integration of high-resolution ground monitoring stations for CO_2, as well as life-cycle cost-benefit analyses of various GI typologies to better inform urban planning policies. Expanding simulation timelines to include full annual climate cycles and integrating building energy demand modeling, would provide a more holistic understanding of GI-environment interactions. Additionally, real-world implementation trials across diverse urban morphologies are strongly recommended to validate model projections, assess maintenance challenges, and refine design practices under context-specific constraints.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Institutional Review Board Statement
Not applicable.

CRediT author statement
M. Salimi: Conceptualization; Methodology; Writing – Original Draft; Data Curation. M. Kafi: Supervision; Review & Editing; Validation; Resources. M. Khansefid: Supervision; Review & Editing; Validation; Resources. All authors have read and approved the final version of the manuscript.

References

Cai, R., Wang, X., Vong, C. C., Zhao, S., & Zhang, T. (2024). Low-carbon urban development hot topics and frontier evolution: A bibliometric study from a global perspective. *Frontiers in Built Environment, 10*, 1464529. https://doi.org/10.3389/fbuil.2024.1464529

Eingrüber, N., Korres, W., Löhnert, U., & Schneider, K. (2023). Investigation of the ENVI-met model sensitivity to different wind direction forcing data in a heterogeneous urban environment. *Advances in Science and Research*, 20, 65–71. https://doi.org/10.5194/asr-20-65-2023

Ferreira, J. C., Monteiro, R., & Silva, V. R. (2021). Planning a green infrastructure network from theory to practice: The case study of Setúbal, Portugal. *Sustainability, 13*(15), 8432. https://doi.org/10.3390/su13158432

Freewan, A. A., Jaradat, N. M., & Amaireh, I. A. (2022). Optimizing shading and thermal performances of vertical green wall on buildings in a hot arid region. *Buildings, 12*(2), 216. https://doi.org/10.3390/buildings12020216

Gomaa, M. M., Othman, E., Mohamed, A. F., & Ragab, A. (2024). Quantifying the impacts of courtyard vegetation on thermal and energy performance of university buildings in hot arid regions. *Urban Science, 8*(3), 136. https://doi.org/10.3390/urbansci8030136

Goodspeed, R., Liu, R., Gounaridis, D., Lizundia, C., & Newell, J. (2021). A regional spatial planning model for multifunctional green infrastructure. *Environment and Planning B: Urban Analytics and City Science, 49*(3), 815–833. https://doi.org/10.1177/23998083211033610

Hakkarainen, J., Ialongo, I., Oda, T., & Crisp, D. (2025). A robust method for calculating carbon dioxide emissions from cities and power stations using OCO-2 and S5P/TROPOMI observations. *Journal of Geophysical Research: Atmospheres, 130*, e2025JD043358. https://doi.org/10.1029/2025JD043358

Huang, Z., Su, K., Yu, S., Jiang, X., Li, C., Chang, S., & You, Y. (2025). Reconciling urban expansion with biodiversity: Habitat dynamics and ecological connectivity in Xiong'an New Area's full-cycle development. *Land, 14*(3), 533. https://doi.org/10.3390/land14030533

Kadić, A., Maljković, B., Rogulj, K., & Kilić Pamuković, J. (2025). Green infrastructure's role in climate change adaptation: Summarizing the existing research in the most benefited policy sectors. *Sustainability, 17*(9), 4178. https://doi.org/10.3390/su17094178

Kim, K. H., Parrow, M. W., & Kheirkhah Sangdeh, P. (2025). Microalgae-integrated building enclosures: A nature-based solution for carbon sequestration. *Frontiers in Built Environment, 11*, 1574582. https://doi.org/10.3389/fbuil.2025.1574582

Konopka, J., Heusinger, J., & Weber, S. (2021). Extensive urban green roof shows consistent annual net uptake of carbon as documented by 5 years of eddy-covariance flux measurements. *Journal of Geophysical Research: Biogeosciences, 126*(4), e2020JG005879. https://doi.org/10.1029/2020JG005879

Kumar, P. (2021). Climate change and cities: Challenges ahead. *Frontiers in Sustainable Cities, 3*, 645613. https://doi.org/10.3389/frsc.2021.645613

Kumar, P., Sahani, J., Perez, K. C., Ahlawat, A., Andrade, M. F., Athanassiadou, M., Cao, S.-J., Collins, L., Dey, S., Di Sabatino, S., Halios, C. H., Harris, F., Horton, C., Inostroza, L., Jones, L., Kjeldsen, T. R., McCallan, B., McNabola, A., Mishra, R. K., ... Yao, R. (2025). *Urban greening for climate resilient and sustainable cities: Grand challenges and opportunities. Frontiers in Sustainable Cities, 7*, 1595280. https://doi.org/10.3389/frsc.2025.1595280

Kumareswaran, K., & Jayasinghe, G. Y. (2023). *Green Infrastructure and Urban Climate Resilience*. Springer. https://doi.org/10.1007/978-3-031-37081-6

Li, G., & Yao, J. (2024). A Review of Algae-Based Carbon Capture, Utilization, and Storage (Algae-Based CCUS). *Gases*, *4*(4), 468–503. https://doi.org/10.3390/gases4040024

Mitra, S., Madhuvanthi, S., & Sabumon, P. C. (2024). Nature-based urban resilience: Integrating green infrastructure. In P. Singh, P. Srivastava, & A. Sorokin (Eds.), *Nature-based solutions in achieving sustainable development goals: Harmonizing nature and progress* (pp. 167–205). Springer. https://doi.org/10.1007/978-3-031-76128-7_6

Morakinyo, T. E., Dahanayake, K. K. C., & Ng, E. (2021). Urban heat island mitigation by green infrastructure in European cities. *Sustainable Cities and Society*, *70*, 103564. https://doi.org/10.1016/j.scs.2021.103564

Olgun, R., Cheng, C., & Coseo, P. (2024). Nature-Based Solutions Scenario Planning for Climate Change Adaptation in Arid and Semi-Arid Regions. *Land*, *13*(9), 1464. https://doi.org/10.3390/land13091464

Pacifici, M., & Nieto-Tolosa, M. (2021). Comparing ENVI-Met and Grasshopper modelling strategies to assess local thermal stress and urban heat island effects. In M. Palme & A. Salvati (Eds.), *Urban microclimate modelling for comfort and energy studies* (pp. 293–316). Springer. https://doi.org/10.1007/978-3-030-65421-4_14

Pamukcu-Albers, P., Ugolini, F., La Rosa, D., Grădinaru, S. R., Azevedo, J. C., & Wu, J. (2021). Building green infrastructure to enhance urban resilience to climate change and pandemics. *Landscape Ecology*, *36*, 665–673. https://doi.org/10.1007/s10980-021-01212-y

Raymond, C. M., Stedman, R. C., & Frantzeskaki, N. (2023). The role of nature-based solutions and senses of place in enabling just city transitions. *Environmental Science & Policy*, *144*, 10–19. https://doi.org/10.1016/j.envsci.2023.02.021

Salih, K., & Báthoryné Nagy, I. R. (2024). Review of the Role of Urban Green Infrastructure on Climate Resiliency: A Focus on Heat Mitigation Modelling Scenario on the Microclimate and Building Scale. *Urban Science*, *8*(4), 220. https://doi.org/10.3390/urbansci8040220

Schwaab, J., Meier, R., Mussetti, G., Seneviratne, S., Bürgi, C., & Davin, E. L. (2021). The role of urban trees in reducing land surface temperatures in European cities. *Nature Communications*, *12*, 6358. https://doi.org/10.1038/s41467-021-26768-w

Sedighi, M., Pourmoghaddam Qhazvini, P., & Amidpour, M. (2023). Algae-powered buildings: A review of an innovative, sustainable approach in the built environment. *Sustainability*, *15*(4), 3729. https://doi.org/10.3390/su15043729

Seo, Y.-B., Dinh, T.-V., Kim, S., Baek, D.-H., Jung, K., & Kim, J.-C. (2023). CO_2 removal characteristics of a novel type of moss and its potential for urban green roof applications. *Asian Journal of Atmospheric Environment*, *17*, 22. https://doi.org/10.1007/s44273-023-00022-9

Wang, D., Xu, P.-Y., An, B.-W., & Guo, Q.-P. (2024). Urban green infrastructure: Bridging biodiversity conservation and sustainable urban development through adaptive management. *Frontiers in Ecology and Evolution*, *12*, 1440477. https://doi.org/10.3389/fevo.2024.1440477

Yaacob, N. F. F., Mat Yazid, M. R., Abdul Maulud, K. N., Khahro, S. H., & Javed, Y. (2024). Spatio-temporal analysis of CO_2 emissions from vehicles in urban areas: A satellite imagery approach. *Sustainability*, *16*(23), 10765. https://doi.org/10.3390/su162310765

Zarei, M., & Shahab, S. (2025). Nature-Based Solutions in Urban Green Infrastructure: A Systematic Review of Success Factors and Implementation Challenges. *Land*, *14*(4), 818. https://doi.org/10.3390/land14040818

Zhang, Y., Xu, W., Zhu, X., Maboudian, R., Ok, Y. S., & Tsang, D. C. W. (2024). Scaling biochar solutions for urban carbon dioxide removal. *One Earth*, *7*(9), 1481-1486 https://doi.org/10.1016/j.oneear.2024.08.008

Zhu, S., Ma, C., Wu, Z., Huang, Y., & Liu, X. (2024). Exploring the impact of urban morphology on building energy consumption and outdoor comfort: A comparative study in hot-humid climates. *Buildings*, *14*(5), 1381. https://doi.org/10.3390/buildings14051381

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