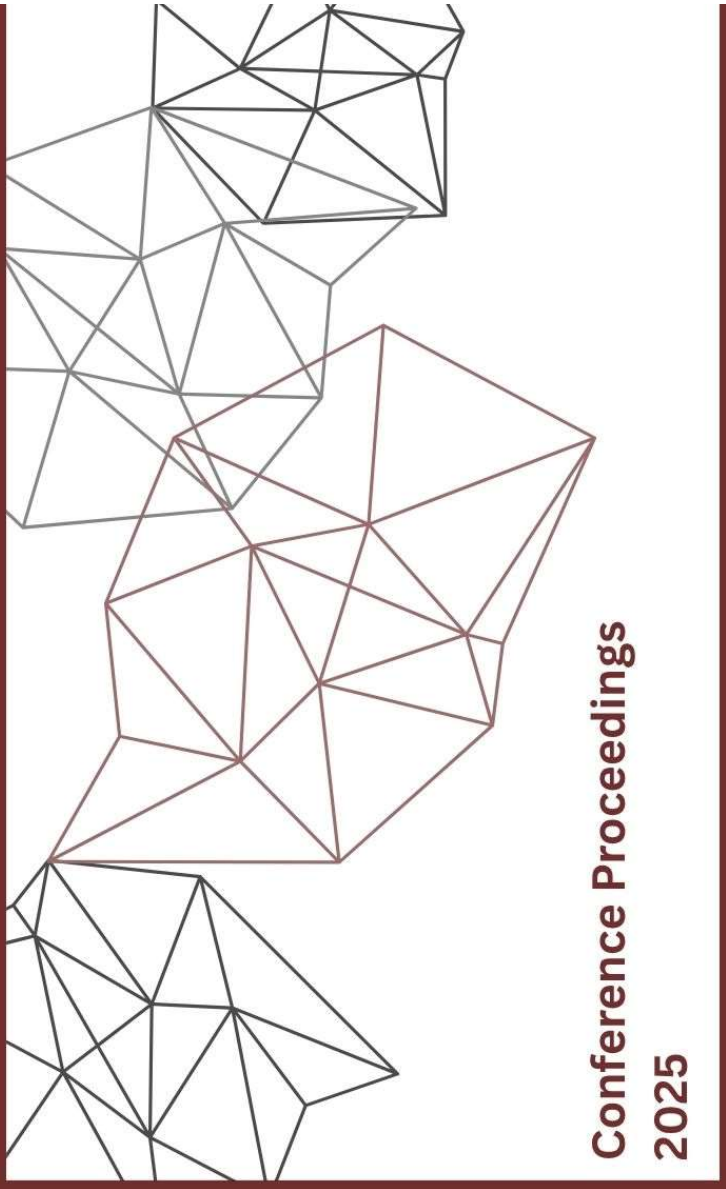


Conference Proceedings
2025

National Conference On Built Environment and Beyond 3.0:

Challenges & Opportunities

Peer Reviewed

(eBook ISBN: 978-81-955887-4-9)

MKSSS's Dr. B.N College of Architecture for Women, Pune
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BNCA Research Hub (BRH)

Built Environment and Beyond 3.0:

Challenges & Opportunities

28th February and 1st March 2025

Conference Proceedings

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Editors

Dr. Vaishali latkar and Dr. Meera Shirolkar

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This Publication is based on the "National conference on Built Environment and Beyond 3.0: Challenges & Opportunities" held on 28th February and 1st of March 2025 at Dr. Bhanuben Nanavati college of Architecture for Women, Pune. The Event was organized by BNCA Research Hub (BRH).

Published in India in 2025 by BNCA Publication cell.

C/o Maharishi karve Stree Shikshan Samstha's (MKSSS)
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Printed in India

Cover Page designed by: Snehal Kinikar
Proof Reading by: Dr Meera Shirolkar
Publication Support: Smita Ogale
Published by: BNCA Publication Cell.

Principal's Note

BNCA (Dr. Bhanuben Nanavati College of Architecture for Women), MKSSS (Maharshi Karve Stree Shikshan Samstha) runs one of the most significant Ph.D. centers in India, affiliated to the state university: SPPU (Savitribai Phule Pune University). To enhance the research component further, in the context of the NEP 2020 (National Education Policy, India), BRH (BNCA Research Hub) was established at BNCA in the year 2021 to create an interdisciplinary and collaborative platform. This platform envisioned to facilitate and encourage research interactions, innovations and interconnections amongst aspiring and established researchers from institutions, practice and industry.

National Conference was one such activity initiated by BRH. The aim of starting the annual conference is to cultivate and nurture the culture of research in the field of architecture and allied disciplines and to encourage students, academicians, and practitioners to write and present their research. The collaborative research platform organized its first Conference titled "Built Environment and Beyond: Theory and Practice" in the year 2022, followed by the second in line titled "Built Environment and Beyond 2.0: Theory, Practice and Pedagogy".

The THIRD National Conference was seen as the successor to the earlier to continue with exploring challenges faced and opportunities identified in Built Environment. BRH conference with its commitment to facilitating research, has set up a systematic and rigorous process of peer-review and at the same time encouraging research through mentoring by domain experts invited at BRH, BNCA. This conference brought together knowledge partners such as the esteemed Council of Architecture (COA), India, and the Architects, Engineers and Surveyors Association (AESA), Pune, along with academic institutions and domain experts, to initiate discussions on the challenges and opportunities in theory, practice, and pedagogy faced by stakeholders in the built environment. Notably, this year, the COA platform provided a valuable opportunity for selected papers to progress to the next stage of peer review for inclusion in the special issue of COA's refereed journal.

Keynote speakers Prof. Dr. Manish Chalana, emphasized 'the balance between preservation and progress, advocating adaptive reuse as a sustainable practice that integrates old and new structures harmoniously' in his first day talk titled *"There is no 'there' there: Paradoxes and Possibilities for the Built Environments in the 21st Century."* Whereas the second day keynote address by Dr. Mohan Siriwardena highlighted the integral role of the built environment in shaping human health, social cohesion, economic prosperity, environmental sustainability, and cultural identity

This volume of Conference Proceedings comprises blind peer-reviewed papers evaluated by a diverse panel of reviewers from across India, each possessing deep expertise in their respective areas. The themes represented reflect a holistic view of the built environment and the evolving discourse within the field of architecture. This compilation is the result of the unwavering commitment and collaborative efforts of the Convener, Co-Convener, and the Advisory Committee, whose contributions have been instrumental in making these endeavours a resounding success.

I am thankful to all mentors, reviewers and experts for their valuable inputs and guidance that made this scientific and academic endeavours a success.



Dr Anurag Kashyap
Principal & Head, Research Center, BNCA

A note from BRH (BNCA RESEARCH HUB)

(BRH National Conference 2024)

The first national conference of BNCA Research Hub (BRH) was held on October 18-19, 2022, on a virtual platform. The theme of the conference was **'Built Environment and Beyond: Theory and Practice'**.

The second national conference of BNCA Research Hub (BRH) was held on November 2-3, 2023, on a virtual platform. The theme of the conference **was 'Built Environment and Beyond 2.0: Theory, Practice and Pedagogy'.** Last year, the theme involved pedagogy as one of its significant sub-themes and deliberated upon the same in the conference.

We, at BRH, BNCA are happy to come up with the proceedings of its third national conference held on 28th February and 1st March, 2025, on **'Built Environment and Beyond 3:0: Challenges and Opportunities'** (in Hybrid Mode) .Being the third consecutive year of organizing this conference, we were immensely grateful to Council of Architecture (COA), India and AESA (Architects, Engineers and Surveyors Association, Pune) for joining hands with BNCA''s BRH. This was a great opportunity for students, academicians, professionals and researchers to share their research, knowledge and innovation perspectives from their own domain and expertise. The interdisciplinary dialogues and exchanges that happened during the sub-theme-based panel discussions with panelists across the nation were full of learnings and idea-exchanges, giving direction to future research for young researchers.

Like every year, to practice the rigor of the research activity, a call for abstract, a call for paper and a blind peer review process was followed for selection and finalizing of the content of the final papers. The manuscripts were received and reviewed by the expert reviewers based on the sub-themes of the conference. Comments and suggestions by panelists of the theme sessions during the conference were incorporated in the final papers. The whole process was carried out systematically pre and post conference with plagiarism checking, peer reviewing and finally publishing the papers in the book in the form of proceedings of the conference. This year the COA platform offered a very valuable opportunity to take selected papers further to next level peer-review process for COA's referred journal. This year's conference too like last two years was very well received and was participated by students, faculty, professionals across India.

We, at BRH-BNCA, look forward to many such meaningful conversations and learning opportunities for researchers and scholars in the field of architecture and alike. Wishing all the best and

Happy researching!



Swati Sahasrabudhe, Ph.D.
Professor, Head, BRH (BNCA Research Hub)

Editor's Note

The built environment plays a pivotal role in shaping the social, economic, and ecological dimensions of our lives. Today, it faces unprecedented challenges—ranging from rapid urbanization and climate change to resource depletion and technological disruption. These call for forward-thinking approaches that are resilient, innovative, and sustainable. At the same time, emerging tools in artificial intelligence, parametric design, and data analytics offer exciting opportunities to reimagine how we conceive, build, and manage our environments.

The third edition of the national conference *"Built Environment and Beyond: Challenges and Opportunities"* was envisioned as a platform to explore the evolving dimensions of the built environment through the interrelated lenses of theory, practice, and pedagogy. In order to encourage wider participation, the conference was conducted in a hybrid format, enabling engagement from participants across diverse geographies.

The thematic structure of the conference was organized into three Tracks—Theory, Practice, and Pedagogy—further divided into seven Domains: *Environment and Landscape; Urbanism, Planning and Management; Technology and Innovation; Culture and Heritage; Education, Ethics and Research; Regenerative Design & AI and Allied Fields.* This categorization allowed for an inclusive and wide-ranging exploration of current issues, innovations, and research directions in the built environment. Within a span of Eight weeks an overwhelming response of paper submissions were received. Every paper underwent a rigorous double-blind peer review and plagiarism check process. Only those that met the required academic standards—including a plagiarism limit of 10%—were accepted for presentation and publication. Selected revised papers, incorporating panel feedback, were included in this Peer-Reviewed Conference Proceedings, while a selected few were further published in the *COA's refereed journal special issue*.

We are both elated and humbled by the diverse and insightful research contributions received from scholars across India. Tracks such as *Environment and Landscape* and *Culture and Heritage* received significant responses, while *Architectural Practice* highlighted contemporary professional challenges and technological innovations. The *Urbanism, Planning and Management* track brought forth nuanced discussions around the broader frameworks of city planning.

This volume reflects the commitment of researchers, academicians, and practitioners to addressing the complex realities of the built environment. We extend our sincere gratitude to all authors, peer reviewers, session panellists, and committee members who contributed to the success of this academic endeavour.



Dr Vaishali Latkar
Convener



Dr Meera Shirolkar
Co-convener



Nishigandha Sakhardande
Co-ordinator

Acknowledgements

We take this opportunity to express our heartfelt gratitude to everyone who contributed to the successful organization and publication of the **Third National Conference on "Built Environment and Beyond"**, hosted by **BNCA Research Hub (BRH), BNCA**. We extend our sincere thanks to **Dr. Anurag Kashyap, Principal, BNCA**, for his visionary leadership, constant encouragement, and unwavering support in strengthening the research culture at the institution. We are grateful to **Ar. Jayashree Deshpande**, Director COA-TRC and Prof. Abhay Purohit, President COA for COA's collaboration as knowledge partner. We are equally grateful to **Dr. Sharvey Dhongde, Vice Principal**, for his continued guidance and administrative support throughout the process. A special note of appreciation to **Dr. Swati Sahasrabudhe, Head, BNCA Research Hub**, for her support. WE sincerely thank Ar. Mahesh Bangad, Chairman, **Architects Engineers and Surveyors Association (AESA)**, AESA for offering the knowledge partnership for this conference.

We would like to express our deep appreciation to the **Advisory Board Members** for their valuable insights, mentorship, and encouragement that shaped the direction of the conference. Our heartfelt thanks to the **esteemed Keynote Speakers**, **Prof. Dr. Manish Chalana** professor, University of Washington (UW), USA**, Ar. Jayashree Deshpande** Director COA-TRC and **Dr. Mohan Siriwardena** Liverpool John Moores University, UK, for their thought-provoking addresses that enriched and inspired all the conference participants. We acknowledge with gratitude the commitment of the **Review Committee Members**, whose meticulous peer review process ensured the academic quality and relevance of the papers published in these proceedings. We thank the **Coordinators** and **Panel Chairs**, for their effective management and facilitation of the conference sessions.

A big thank you to the **IT Department** for providing the necessary technical support, ensuring seamless communication and digital infrastructure during the conference. We also sincerely acknowledge the enthusiastic contributions of our **volunteers**, especially the **student volunteers**, who worked tirelessly behind the scenes to make this event a smooth and successful one.

Lastly, we thank all previous BNCA Conference Converner and Co-Convener for their constant support and guidance throughout whole process. We thank all the authors, presenters, attendees, and well-wishers who were part of this academic endeavours. Your active participation and scholarly contributions have added immense value to this platform for collaborative research and knowledge exchange.

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Dr Vaishali Latkar
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Dr Meera Shirolkar
Conference Co-Convener

DAY O1- 31st Feb 2025

Key Note Speaker - Dr Manish Chalana *Professor, University of Washington (UW), USA*



Dr. Manish Chalana, an esteemed scholar specializing in **urban design, historic preservation, and social justice in urban planning** presented keynote address. He is the founder of the **Center for Preservation and Adaptive Reuse**, and also serves as an adjunct professor in Architecture and Landscape Architecture. A recipient of the **Lionel Pries Distinguished Professor Award**, Dr. Chalana is widely published and has led study abroad programs across India, China, and Japan.

In his **insightful keynote address** by **Prof. Dr. Manish Chalana,** titled ***"There is no 'there' there: Paradoxes and Possibilities for the Built Environments in the 21st Century."*** His address explored critical themes such as **density versus livability, innovative urban density models, and the concept of "Vancouverism" at the neighborhood scale.** He emphasized the **balance between preservation and progress, advocating adaptive reuse as a sustainable practice that integrates old and new structures harmoniously.**

Dr. Chalana also presented compelling case studies, including **Msheireb Downtown Doha,** which reinterprets vernacular elements in contemporary urban design. He further highlighted the **paradox of the "Smart City" versus the "Human City," using Singapore as an example of a Smart Nation,** and underscored that cities are truly "smart" when they adopt a **human-centric approach.** His address provided a **global perspective on alternative urban practices** while addressing the **challenges and opportunities** shaping the future of the built environment. His address set a reflective and globally informed tone for the day's discussions.

DAY O2- 1st March 2025

Guest of Honour - Ms. Jayashree Deshpande, *Director, COA-TRC, Pune.*

Ms. Deshpande is a highly respected academician and administrator, with over two decades of experience in architectural education and policy implementation. As Director of COA-TRC, she has played a pivotal role in shaping training modules, conducting faculty development programs, and strengthening the pedagogical framework across architecture institutions in India. Under her leadership, COA-TRC has initiated several capacity-building workshops, technical seminars, and collaborative programs that aim to bridge the gap between academic learning and real-world architectural practice. Her vision is aligned with creating a **resilient, responsible, and future-ready architectural education system** in India.



Ms. Deshpande, in her address, underscored the vital role of **architectural education in addressing contemporary challenges** such as climate change, urbanisation, and heritage preservation. She emphasized the need for **contextually grounded and research-driven academic practices**, encouraging institutions to foster **interdisciplinary thinking, innovation, and ethical responsibility** in both pedagogy and practice.

Key Note speaker – Dr Mohan Siriwardena, *Senior Lecturer at Liverpool John Moores* University, UK



Day 2 keynote address was presented by **Dr. Mohan Siriwardena**, **Senior Lecturer** at **Liverpool John Moores University, UK**, and **President of the Association of Professional Sri Lankans (APSL) in the UK**. Dr. Siriwardena has over **18 years of academic and research experience**, with a PhD from the **University of Salford**, and a robust background in **construction management, ICT integration**, and **disaster resilience**. He has contributed to several **EPSRC and EU-funded projects**, published over **40 peer-reviewed articles**, and actively collaborates with the UK's leading construction firms.

Dr. Siriwardena's keynote on **"Futureproofing the Built Environment: Knowledge, Skills and Behaviours"** addressed the urgent need to align architectural and construction education with the **dynamic demands of climate resilience, technological change, and global uncertainty**. He emphasized that futureproofing is not solely about materials and technologies, but equally about developing **critical thinking, collaborative skills, and ethical awareness** among built environment professionals.

Conference session chairs



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Principal | Chitkara University.



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01



CULTURE AND HERITAGE

Shaping Public Realms: The Intersection of Multifunctionality, Thinnai Architecture and Nomadic Ideals

Nilany Senthilnathan*
nilanysenthilnathan@gmail.com

Abstract: *This study explores the intersection of nomadic culture, traditional architectural elements like the Thinnai, and the development of multifunctional public spaces. It investigates how adaptable, inclusive, and culturally rooted design approaches can create sustainable environments for nomadic communities and rural villages. The research focuses on two prominent nomadic groups in Tamil Nadu—Boom Boom Mattukaran and Narikuravar communities—and their unique lifestyles, cultural practices, and challenges. It also examines the architectural and social potential of the Thinnai, a versatile verandah space in Tamil homes, as a basis for creating multifunctional public spaces.*

The research adopts a qualitative approach, utilizing ethnographic studies, spatial analysis, and participatory design techniques to understand user needs and cultural contexts. Case studies, site observations, and mapping exercises are employed to analyze movement patterns, social interactions, and resource usage in nomadic and rural settings.

The findings highlight the adaptability of nomadic construction techniques and the enduring relevance of Thinnai-inspired spaces. The proposed design model for Ponveli, a rural settlement, integrates permanent elements like plinths and walls with temporary, flexible installations, reflecting the fluidity of nomadic lifestyles. It accommodates diverse functions, including agricultural activities, social gatherings, temporary shelters, and religious rituals, ensuring inclusivity and resource efficiency.

This research demonstrates that architecture can bridge tradition and modernity by creating adaptable and culturally significant spaces. The proposed prototype catalyzes sustainable development, addressing the needs of villagers, nomads, and the community at large while preserving their unique cultural identities.

Keywords: Thinnai; Collage of Cultures; Nomadic Communities; Makeshift Logic of Architecture; Inclusivity and Multifunctionality.



Figure 1. Cover image showing the *Collage of Cultures,* (Source: Author)

© BNCA Publication cell | E - book ISBN 978-81-955887-4-9Peer reviewed Conference Proceedings of National Conference on Built Environment and Beyond 3.0: Challenges and Opportunities 2024

1.Introduction:

Nomadic communities, like the Narikuravar and Boom Boom Maatukaran, are deeply connected to nature and have a unique way of life centered around movement and adaptability. Despite their cultural richness and resilience, they often face neglect and discrimination, particularly in accessing basic amenities and public spaces.

This project prioritizes creating inclusive, multi-functional public spaces that cater to the unique needs of nomadic groups while also benefiting rural communities. By using local materials, traditional crafts, and adaptable designs, these spaces aim to provide a sense of belonging and utility for nomadic communities without disrupting their way of life.

Villages, often the frontier for nomadic settlements, can act as a bridge between traditional lifestyles and modern development. This initiative seeks to foster harmony by offering nomads the freedom to stay temporarily without bias and creating shared spaces that celebrate their culture while supporting their integration into rural life.

2.Nomad culture:

Vanavil Trust is an NGO working for the welfare of the Narikuravar and Boom Boom Maatukaran nomadic communities in Nagapattinam since 2005. As the open resources from the trust suggest (Vanavil Trust, 2005), these nomadic communities have an interesting culture that prefers traveling throughout their lives to settling down. They are well-known for their strong sense of community, have good hands in using tools, sharp observation, and better emotional intelligence. They are open and flexible in their needs and have an immense connection to nature. They have enormous ease with physical activity and do not possess much. Unfortunately, they are neglected and discriminated against in these public places, and gatherings. Boom Boom Maatukaran and Narikuravar Communities are notable gypsy cultures in Tamilnadu, that undergo the disadvantages. In the present situation, their lifestyle is questioned as their practices such as hunting, begging, child marriage, and child labor are prohibited by the government (Socio-Cultural Awareness of Gypsies: An Analytical Study, 2021). Several government programs and NGO initiatives aim to provide the underprivileged gypsy communities access to basic facilities like education, health care, and support during social and environmental crises. Many families from these communities still cannot be recognized by the government which hinders the developmental schemes and programs for their upliftment. This condition prohibits equal opportunity. However, these communities still prefer a nomadic lifestyle over staying in one place (Dragomir, C. & Zafiu, M. 2019).

The research studies their movement and pictures the pattern below:



Figure 2: *Mapping of Boom Boom Matturkarar and Narikuravar Community Movement and their Major Dwelling Locations* (Source: Author)

Certain concerns lead the research to investigate the dynamics of these communities and places.

1. Why do these communities still opt for a nomadic lifestyle even if it is challenging?
2. Is it still a relevant and sustainable way of living in the present generation?
3. How can a social infrastructure be relevant in the future, growing on its cultural roots?

2.1. Boom Boom Maatukaran Community:

In Tamil Nadu and South India, the "Boom Boom Mattukaran" or "Poo Idaiyar" tradition is a prominent cultural performance featuring bulls, thrives in rural areas and is mainly seen during festivals like Pongal (A festival celebrated in January) and Dussehra (A festival celebrated in October). The tradition, lasting six to eight months annually, entertains and preserves cultural heritage.

Decorated bulls, adorned with cloth, bells, and ornaments, are led by owners playing traditional instruments like the Nadaswaram (A musical wind instrument). Belonging to the Yadava community, known for cattle rearing and dairy farming, these performers have mastered training bulls to dance, nod, bow, and kneel. In return, they receive money, food, and clothes from the audience as appreciation.

A widely held belief links this tradition to the "Curse Myth," which explains the origins of the group's nomadic lifestyle. According to the tale (Talking Myths, 2015), the Boom

Boom Mattukkarans were once flower farmers. One day, Lord Vishnu, disguised as an elderly man, visited a farmer's family seeking food. The farmer initially refused, but later attempted to deceive the old man by offering a portion of his crop, asking if he preferred the top or bottom part. The man chose the top, so the farmer planted peanuts, keeping the crop for himself and giving the leaves to the old man. When the man returned during the next harvest, the farmer offered only the husk and grass after planting paddy. Having been tricked twice, the old man revealed his true identity as Lord Vishnu and cursed the family. He declared that they would become nomads, never able to farm successfully. The family was also tasked with tending to the temple's bulls and cattle as part of the curse. The tale, however, does not clarify the duration of the curse, leaving the fate of future generations uncertain. While this way of life may have been sustainable in the past, it is now an unsustainable livelihood, with current generations involved in begging.

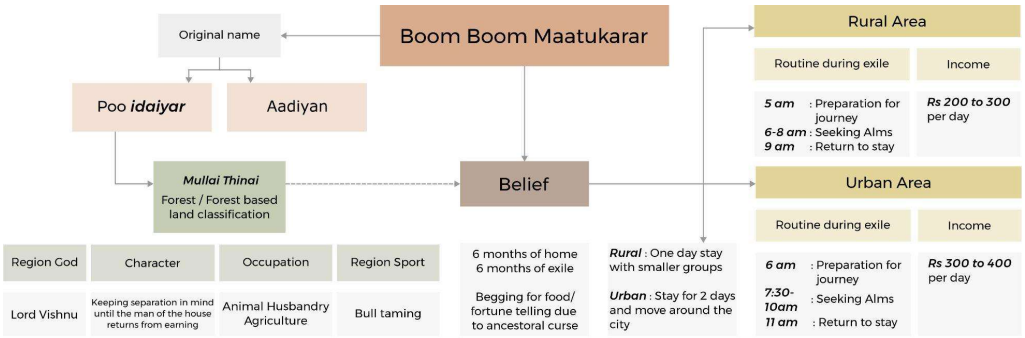


Figure 3: *Mind Map portraying the lifestyle of Boom Boom Maatukaran Community* (Source: Author)

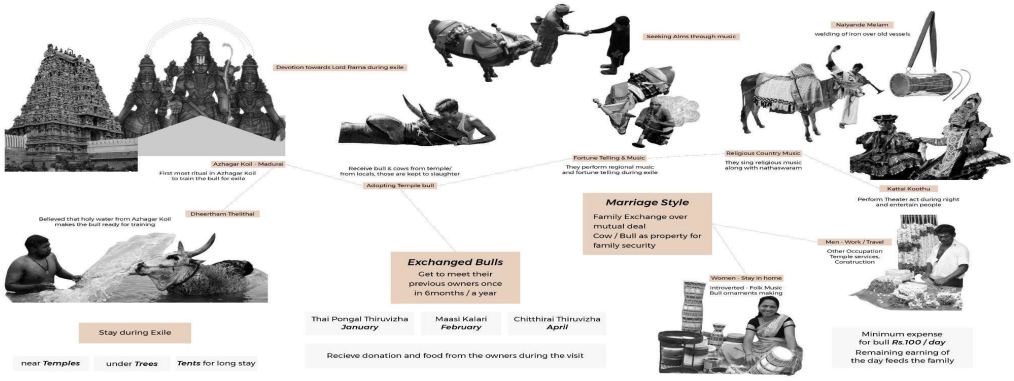


Figure 4 *Mind Map portraying the lifestyle of Boom Boom Maatukaran Community* (Source: Author)

2.2. Narikuravar Community:

The Tamil word *Narikuravar* means "fox or jackal hunters," while another name for this group, *Kuruvikkaran,* means "bird catcher" or "hunter of small birds." In their own language, called *Vagriboli*, the term *Vagri* (an Indo-Aryan word) refers to bird catchers—men who earn their living by trapping birds and small animals using simple traps. The Vagri are a nomadic tribe originally from Gujarat and are one of three such tribes from western India, alongside the Bajanio and Lambadi. Although they share some common traits, the Vagri community is diverse, with various dialects and traditions. Today, some Vagri groups still hunt and sell small animals in Gujarat and Rajasthan.

Vagriboli is an Indo-Aryan language related to Gujarati. However, as nomads, the Narikuravars also speak regional Dravidian languages like Tamil, Telugu, and Kannada. In Tamil Nadu, Narikuravars often live together in small tents or huts made of elephant grass. They continue to hunt birds, rabbits, and, according to rumors, sometimes even stray cats. Women in the community make and sell beaded necklaces, while both men and women wear jewelry made of beads, shells, and coins. The women typically dress in colorful pleated skirts (*ghagro*) that are shorter than sarees (Indian attire for women).

The Narikuravars are known for their independence and fiery yet forgiving nature. Unlike many castes of Hindus, they consume country liquor like toddy or arrack during festivals and rituals. Weddings, which can cost up to a thousand rupees, are often held under trees if no formal venue is available. Despite their hard lives, their incomes are often lower than those of other poverty-stricken groups in India. The Vagri's identity is closely tied to their clan goddess, and the community is divided into four exogamous groups based on the deity they worship (Padma, 2023). These include:

Beka: Worship Goddess Parvati or Vexli with a buffalo sacrifice.

Bokoda: Worship Goddess Meenakshi or Novkod with a goat sacrifice.

Dhabi: Worship Goddess Kali or Durga.

Seliya: Worship Goddess Sel or Kanniamma.

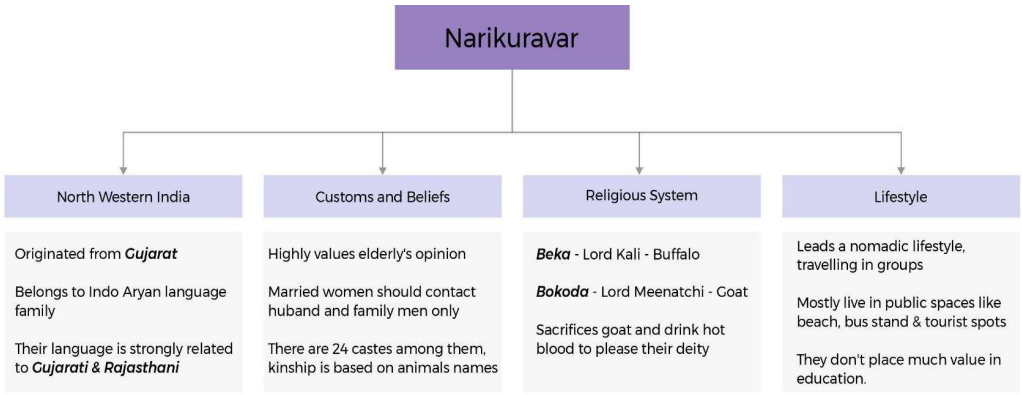


Figure 5: *Mind Map portraying the lifestyle of Narikuravar Community*

(Source: Author)



Figure 6: *Mind Map portraying the lifestyle of Narikuravar Community*

(Source: Author)

3. Thinnai - Traditional Verandah Space - Spatial Study:

The article, A study of transition spaces in traditional houses of Tamil Nadu by P Kalaivani, S Pongomathi, and R Shanthi Priya, focuses on documenting and analyzing thinnai spaces in traditional houses of Mangalrevu village, Tamil Nadu, classifying them based on their thresholds. Through qualitative analysis, the research reveals that these transitional spaces were highly functional and harmonious with the lifestyle of the people. The study emphasizes the need to replicate thinnai in modern dwellings, preserving their cultural and functional essence without compromise.

The article from Transition Spaces in an Indian Context by Anjali Sadanand and R.V. Nagarajan, highlights the spatial organization of thinnai as a key socio-cultural element in architecture, emphasizing its role in mediating transitions between public and private, sacred and profane, and various functional domains. Architectural spaces reflect social dynamics, with transition spaces playing a pivotal role in articulating relationships and meanings. The study explores the nature, morphology, and social significance of transition spaces, focusing on hierarchy, enclosure, transparency, and materiality. It examines how these spaces shape or merge user identities while reflecting social factors like status, gender, and differentiation. Using examples from traditional South Indian houses, the study analyzes threshold spaces and courtyards, comparing them to contemporary adaptations. Guided by frameworks from Yatin Pandya (spatial elements) and Amos Rapoport (social meaning), it shows how traditions like the thinnai persist in modern contexts. While contemporary life adapts to new conditions, these spaces reinterpret traditional boundaries, blending heritage with modern needs.

The article from The Veranda: A Disappearing Threshold Space in India by Ankitha Gattupalli highlights the climatic response and the decline of the thinnai, a traditional Indian veranda designed to provide a cooler outdoor space. Serving as a bridge between private and public spheres, the thinnai hosted daily activities and fostered community interaction. Variants like the South Indian thinnai, North Indian otla, and Portuguese balcao adapted to regional climates while reflecting cultural values through design and ornamentation. The loss of such transitional spaces has diminished community connections, with organic activity replaced by isolated buildings and mechanical public spaces. While architects incorporate verandas as nostalgic elements, they often lack their original character, raising concerns about whether the charm and purpose of these spaces are lost forever.

This study focuses on Thinnai Architecture from a visitor's perspective, specifically nomads. The thinnai is a shaded verandah or sitting area at the entrance of traditional Tamil Nadu homes. It functions as a flexible space serving residents and visitors, acting as a bridge between the home and the outside world.

For an outsider/traveler, the thinnai offers a place to rest, drink water, or have a quick chat with the homeowner. Vendors such as milkmen and vegetable sellers use it as a convenient spot to set up their goods and wait for residents. Travelers passing by often

find shelter and comfort in this space, highlighting the thinnai's welcoming and inclusive nature.

The thinnai's design is simple yet versatile. It keeps the house cool by shading its walls while providing a comfortable area for social interactions. In the evenings, it becomes a lively gathering spot where neighbors connect. In agricultural homes, it functions as a space for drying crops or storing grains. In priests' homes, it serves as a setting for rituals and teachings, often associated with the concept of the thinnai palli, where educational exchanges and small-scale classes take place. Village chiefs use the thinnai to hold meetings and resolve disputes, emphasizing its role in fostering community life.

This study highlights how the thinnai with its minimal architectural elements and spatial arrangements, adapts to the needs of outsiders, transforming a resting spot into a dynamic communal space. It becomes a space for social and economic exchanges, offering shelter and fostering connections. Its timeless design, responsive to both climate and culture, inspires modern architecture, a practical and potential feature for shaping an inclusive public place.

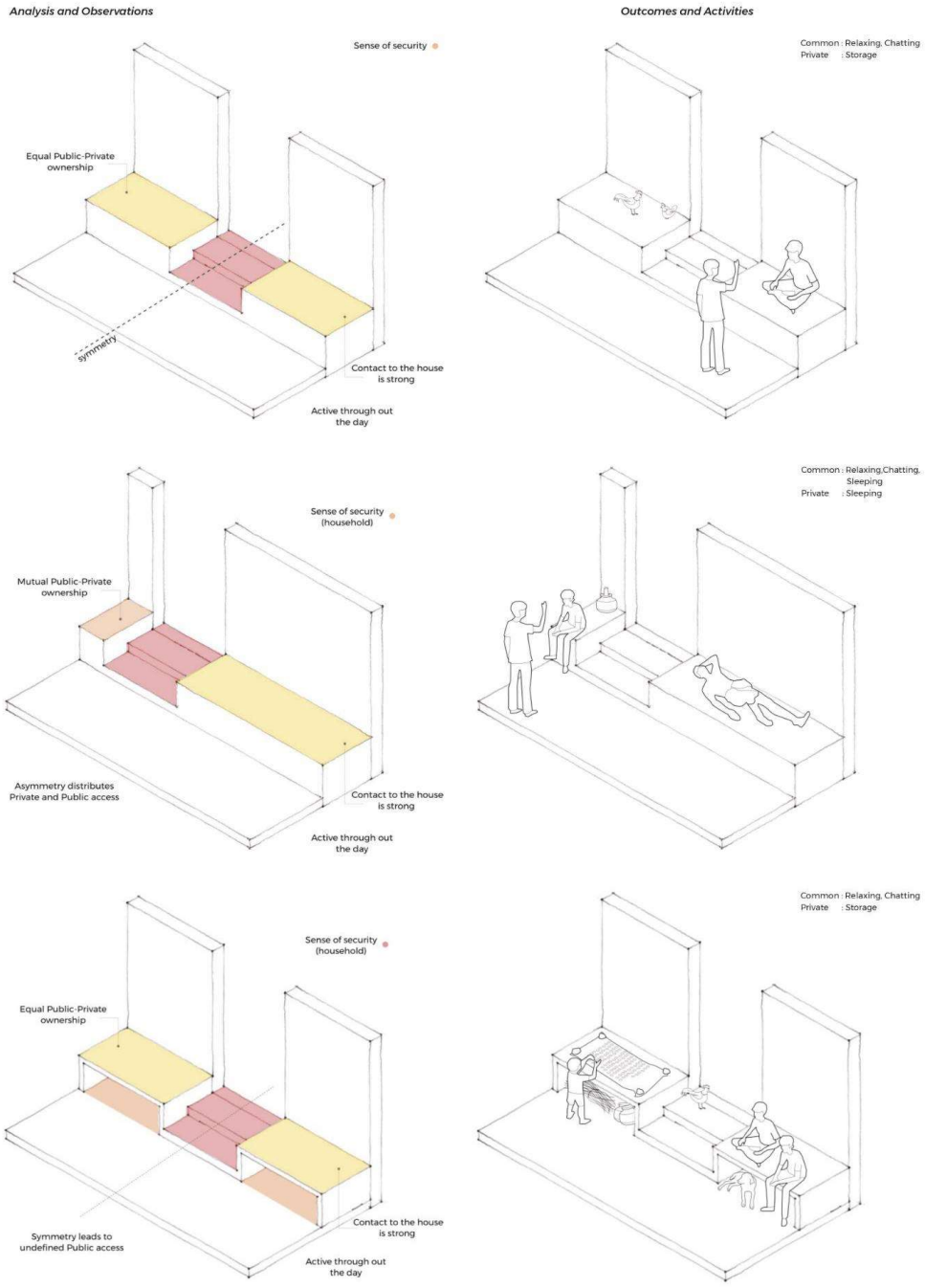


Figure 7 *Thinnai Spatial Study* (Source: Author)

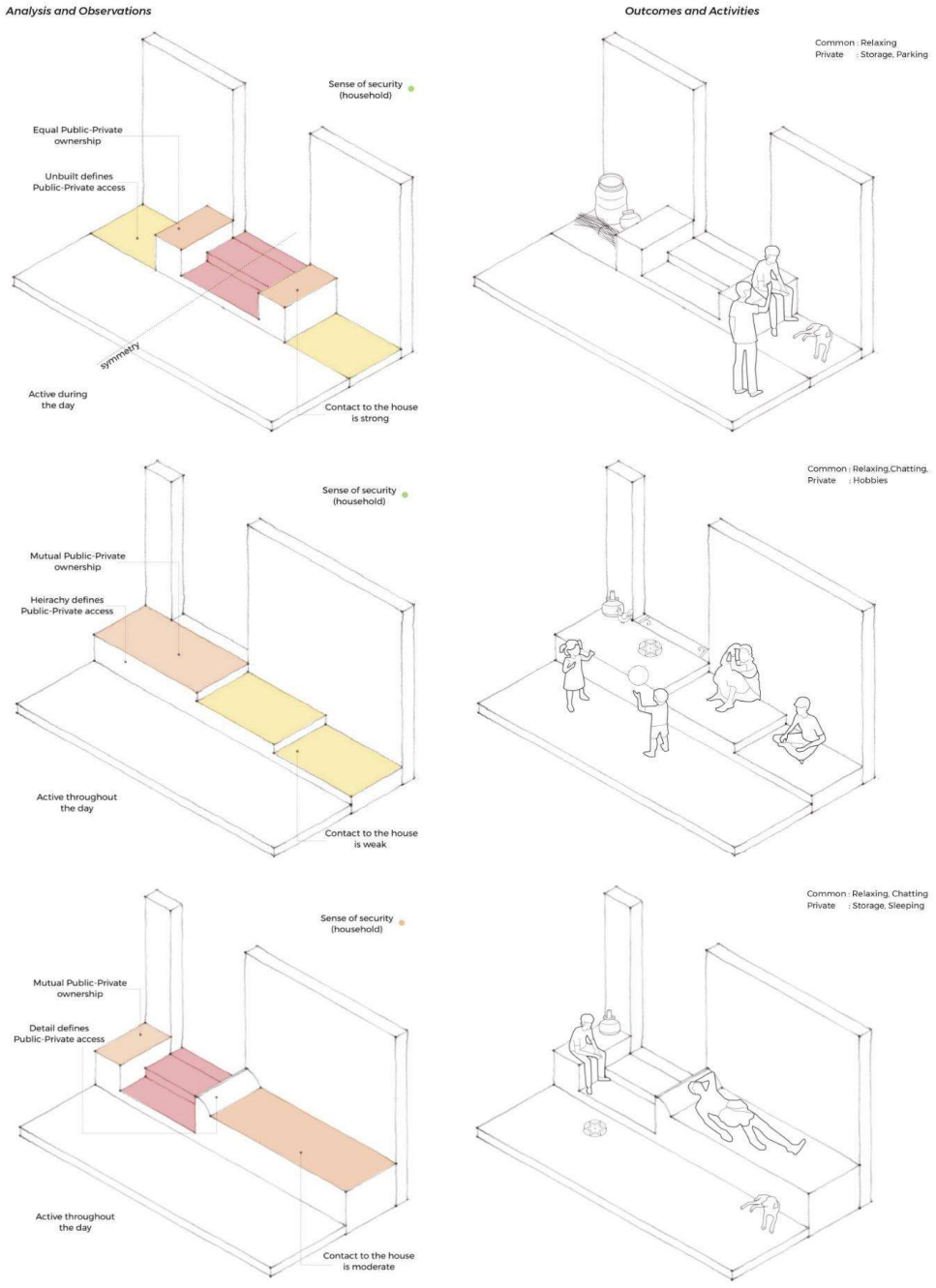


Figure 8 *Thinnai Spatial Study (Source: Author)*

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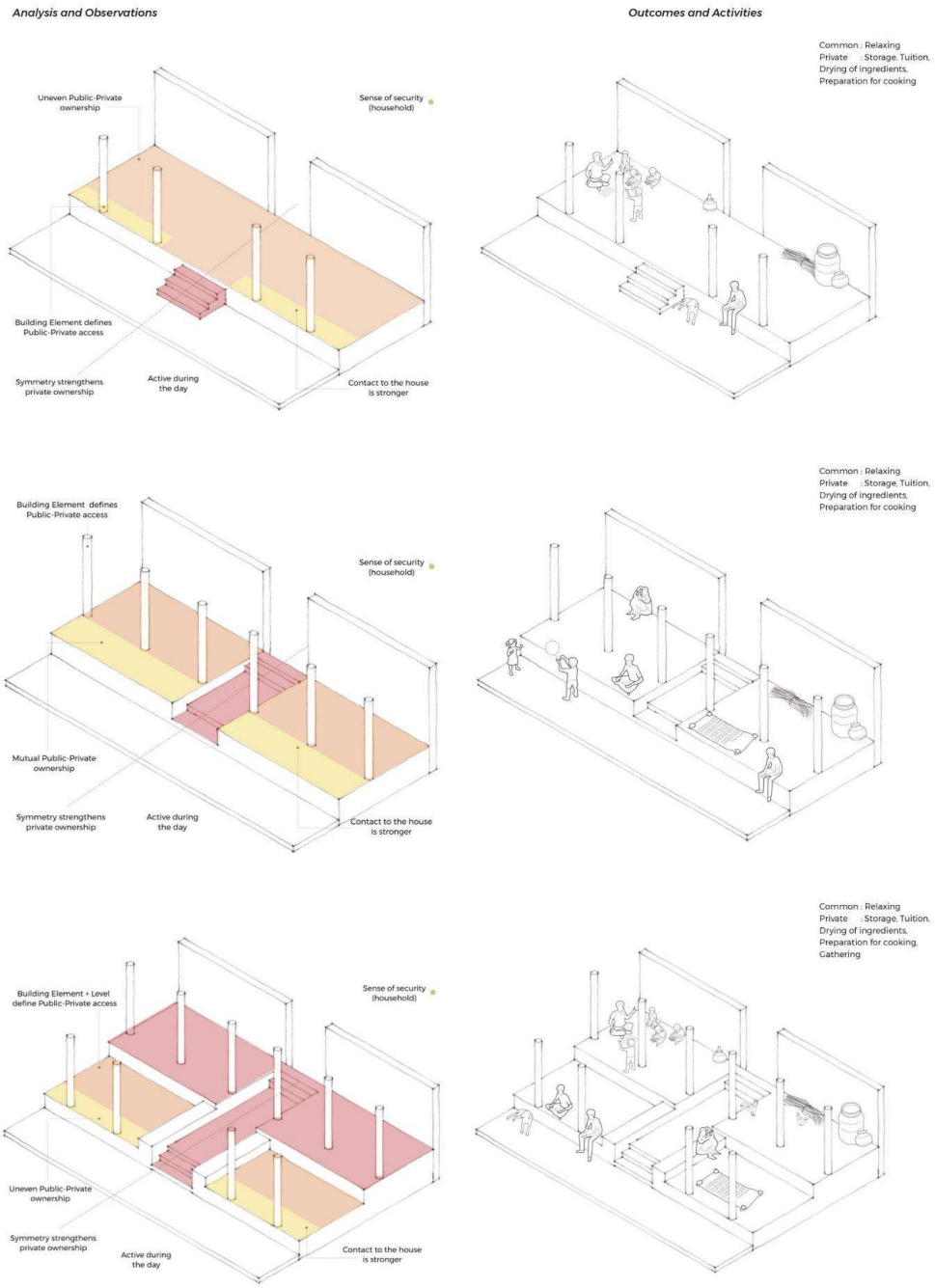


Figure 9 *Thinnai Spatial Study* (Source: Author)

4. The Intersection of Nomadic Culture, Thinnai ideals and Public Architecture:

This research explores the convergence of public architecture, multifunctional spaces, nomadic communities, and Thinnai.

4.1 Influence of Nomadic Ideals on Architecture:

Due to their mobile lifestyle, the nomadic communities use the makeshift logic of space-making to create their temporary stay units with materials available in a particular place. These structures are an interesting model exposing sensible responses to context, resource efficiency, and adaptability to their communal needs. The research studies their construction techniques and reflects on creating inclusive and multifunctional public spaces. Some common techniques followed regardless of context are tie techniques and roof-making.

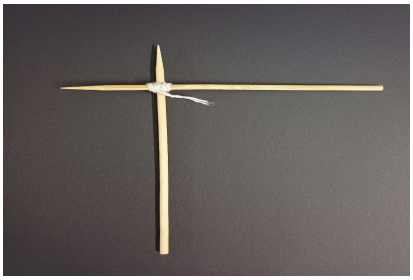


Figure 10a: *Tie at Junction of 2 members*

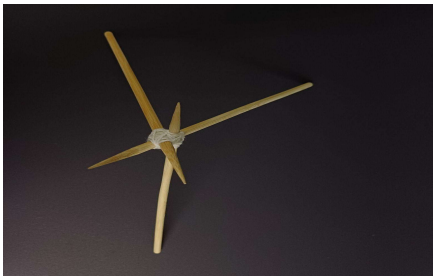


Figure 10b: *Junction of 3 members' plan*

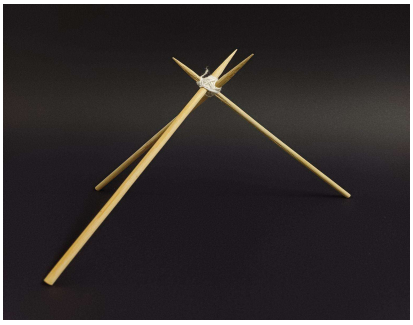


Figure 10c: *Tie at Junction of 2 members*

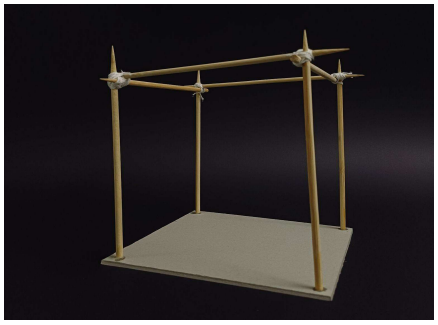


Figure 10d: *Basic Framework using the tie*

(Image Source: Author)

Coconut Leaf Weaving Technique for Roofing:



Figure 11a: *Coconut leaf mat for roof*

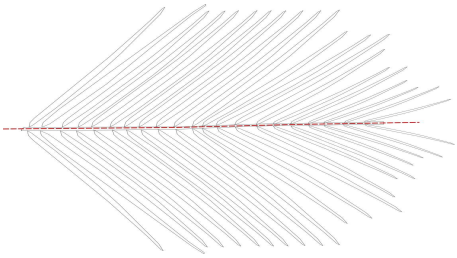


Figure 11b: *Coconut leaf cut into halves*

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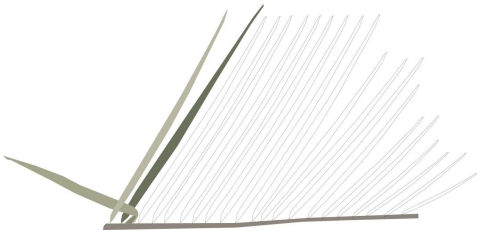


Figure 11c *Leaves weaved in criss-cross*



Figure 11d: *Alternative Leaves are weaved to a mat*

(Image Source: Author)

These methods are versatile, making them suitable for various uses like barns, tents, fences, or temporary shelters. Integrating these techniques with the regional architecture and in public nodes helps nurture the community's heritage, keeping its cultural traditions and identity alive.

4.2 Thematic Intersection:

Gypsy culture is as free as birds. They have no borders. They have a pattern where travel becomes their lifestyle. After a long travel, birds settle in a nest built with the twigs and strings of a tree. The tree fulfills the birds' needs during their stay. The place should be like a tree which bears the people's momentariness. We cannot force a bird to stay in a "birdhouse" even if it is made of gold. Rather, we can build a garden where it decides to stay. The sense of the project is to create a place where it can be open to the demands and patterns of the people with the definition of the place.

In a world of shifting dynamics, multifunctional spaces offer adaptive solutions to modern living, transforming public plazas into performance venues or community halls into disaster relief centers. This approach reflects the spatial pragmatism of nomadic communities. An ideal public architecture, designed for collective needs, thrives on adaptability, inclusivity, and cultural relevance. Adaptable designs become essential, as settlements evolve, particularly in remote and economically constrained areas, providing specialized services becomes isolated facilities and eventually ends up being locked for years. These settlements, lacking the necessary public infrastructure are vulnerable to socio-economic challenges. They should be supported for regional development by retaining the local architecture while integrating modern adaptations. The research suggests identifying key anchor elements within a settlement such as temples or marketplaces and defining their public realm to amplify socio-spatial ecology, fostering dynamic social interactions and resilient communities.

For example, in many villages of Tamil Nadu, temples serve as the primary venue for communal gatherings. These temples are active only during religious practices. When idle, trespassing, and illegal activities encroach on the temple and its grounds, the underutilized temple grounds have the potential to become culturally rich and active social hubs during different times and events.

The project suggests a model for shaping these temple grounds with its regional architecture influenced by the spatial arrangements of thinnai and the lifestyle of nomads.

5. The Design Model: In the case of Ponveli:

Ponveli is a rural settlement of Sikkal Gram Panchayat. The settlement is anchored to "Sri Maha Maari Amman & Sri Maha Kaali Amman Temple." Apart from the cultural background, SOS Children's Village has identified the site for the Family Strengthening Program.

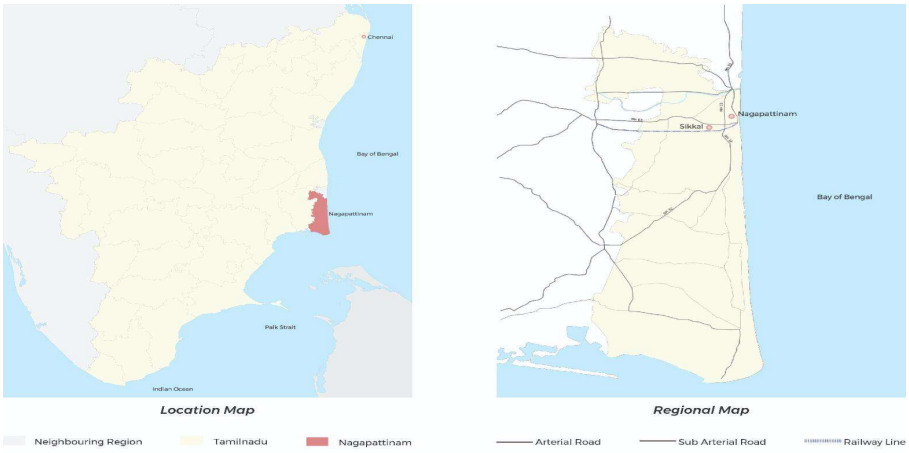


Figure 12. *Site Delineation,* (Source: Author)



Figure 13. (Source: Author)

The people of Ponveli lead a collective living. They are below the poverty line and tend to move from the village for their daily life.

Particulars	Total	Male	Female
Total No. of Houses	129	-	-
Population	471	223	248
Child (0-6)	45	25	20
Schedule Caste	460	218	242
Schedule Tribe	0	0	0
Literacy	69.25 %	78.79 %	60.96 %
Total Workers	251	141	110
Main Worker	178	-	-
Marginal Worker	73	4	69

Figure 14 *Ponveli Data from the 2011 Village Census (Resource: www.census2011.co.in)*

This situation dilutes the communal health. The relationship between the youth and the elderly becomes feeble when the young residents move out for their standard of living. The resourceful environment also turns into an isolated piece of land. The villagers need an identity. They need a facility to improve their quality of life and to extend their time in the environment. The available resources in the village are



Figure 15: *Site Images showing the amenities available on the site.* (Source: Author)



Figure 16: *Pictorial Collage of Ponveli, picturing the characteristics of the Village* ((Source: Author)

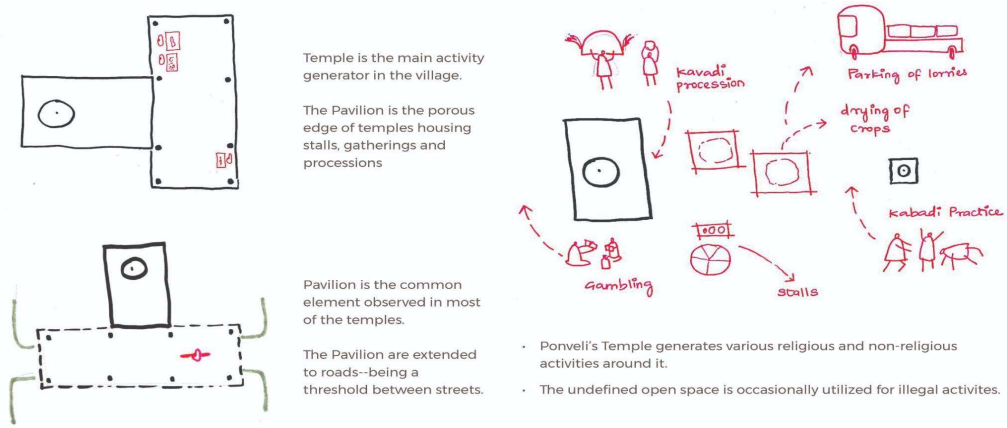


Figure 17: *On-site observations in and around the site*

(Source: Author)

6. The Design Approach:

A developmental design approach to the nomads' architecture is explored. As the dynamics of the natives and nomads vary from time to time, the place should bear the momentariness. The architectural definition of the place will remain constant yet it will be open to transforming itself through time. Consequently, Plinths and Walls will be permanently defined around the temple ground, in which the installations can be employed and deployed in accordance. The existing temple structures remain the same and the Angaadi (Ration Shop) is modified to extend thinnai into it. The proposal becomes an inclusive platform for existing rituals and activities of the gypsies and the villagers.

5-inch dia bamboo is used for columns. The impression of the bamboo is created during the casting of walls, tied into a 1-inch dia pipe, using handmade coconut ropes. A 5-inch dia mold of a minimum of 500 mm is created in the plinth to employ the bamboo. This installation will reflect the essence of Thinnai to create seamless Public and Semi-public spaces. The roof is made of coconut leaf mat (refer to figure 9a) installed on bamboo rafters. Tiled roof can be also installed on this model.

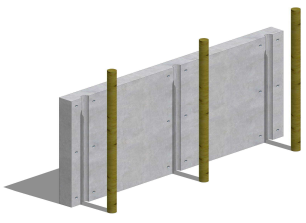


Figure 18a: *Attachment at Wall*

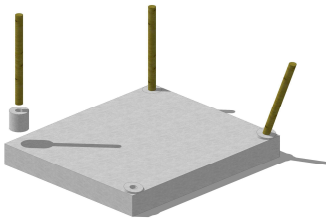


Figure 18b: *Attachment at Plinth*

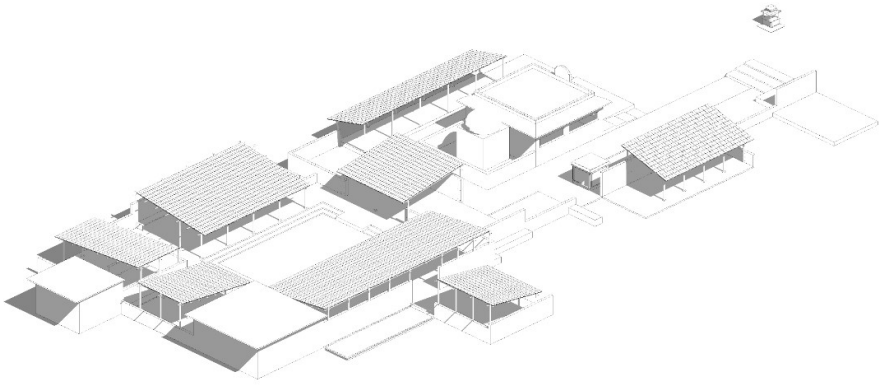


Figure 19: *Thinnai-like installations created around the existing temple*
(Source: Author)



Figure 20 *Thinnai-like installations created around the existing temple*
(Source: Author)



Figure 21 *Thinnai as resting spaces* (Source: Author)

7. Conclusion:

The research attempts to create a place where it can be open to the demands and patterns of the people with the definition of the place. This interplay of cultural roots, diverse user groups, traditional virtues, and modern needs resulted in the amplification of the versatility of public architecture in rural contexts. This prototype becomes a catalyst for

1. Villagers: Agricultural purposes, cattle grazing, Kabaddi ground, resting spaces, and gathering spaces.

2. Nomadic Community: A framework for their temporary shelter, built-in space for their shops/bulls to rest/workplace

3. Religious Activities: Community Kitchen, Kavadi Procession and Pongal Festival

4. Social and Public Activities: A platform for holding Marriages, Dine-in space for large gatherings, Voting Booths, and medical camps.



Figure 22: *During daily life - Agricultural purposes* (Source: Author)



Figure 23: *During special events - Marriages and Gatherings* (Source: Author)



Figure 24: *During religious events - Kavadi Procession* (Source: Author)

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Heritage Conservation and its Socio-Cultural, Economic & Morphological Impacts: A Study of Amer Palace & City Palace, Udaipur

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Abstract: *Heritage conservation plays an important role in preserving cultural identity and the heritage of historical structures. This study examines the socio-cultural, economic and morphological implications of heritage conservation with a focus on two prominent examples in Rajasthan: the heritage precincts of Amer Palace in Jaipur and the City Palace in Udaipur (Approx. Study area - 40 - 45 Acres). The two palaces, with their magnificence and historical significance, stand as a true testament to India's cultural heritage and architectural excellence. However, as society progresses through time, the structures of the past become the only standing testament to the progress of a society through the ages.*

This research delves into how conservation not only preserves heritage, but also contributes to socio-cultural continuity by strengthening a sense of belonging and identity in between local communities. This research utilizes Quantitative and Qualitative methods, using surveys of local businessmen, & owners. Economically, tourism promotes heritage conservation, creates employment opportunities and strengthens the local economy. Morphologically, this study examines how conservation practices have reshaped the urban landscape, balancing modernization with the preservation of historic fabric. Using the Amer Palace and the City Palace as case studies, this study presents the challenges, benefits and how conservation can transform the lifestyle of people through added tourism, higher business opportunities & traditional facades.

Keywords: Heritage Conservation, Socio-Cultural Impact, Economic Impact, Community Engagement, Morphological Impact

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1.Introduction:

As the Society progresses through time, the structures of the past become the only standing testament to the progress of a society through the ages.

The first step to conserve any heritage structure is to understand its Socio-Cultural value and sense of association of its various stakeholders; these stakeholders may be immediate neighbours, owners, users, general masses, politicians, etc. The interests of all stakeholders are equally important and needs to be considered and thus understanding the various roles they all play as a part of the society around the site/project is of key importance, some stakeholders are more important to a site than others, which depends on the type, scope and scale of the project.

While carrying out the conservation, we must also keep in mind the extent of the factors which are governing the project, how much the architects affect these projects and the role they play in the conservation of a project.

Aim: To understand how the conservation of a historical structure creates its own microclimate through the Socio-Culture, Economical & Morphological factors and its impact.

Objectives:

- To identify the various Stakeholders of a project.
- To identify and gauge the socio-cultural impact of a conservation project.
- To analyze the conservation approach and technique of a project.
- To analyze the morphological impact of a conservation project.
- To identify the economic growth and Self-sustainability of the project.

Research questions:

1. How does the Conservation of a project affect the stakeholders?
2. What are the various Socio-Cultural, Economic & Morphological Impacts of a conservation Project?
3. How do the conservation practices at Amer Palace and City Palace, Udaipur; balance the needs for Tourism, Heritage preservation & Community involvement?

2. Literature Review:

Preservation of India's heritage, including famous structures such as the Amer Palace and the City Palace of Udaipur, is a complex field. This section reviews scientific information on conservation approaches and presents their socio-cultural, economic and environmental impacts as presented by various researchers and civil society groups.

1. Objectives of assessment

Heritage management in India presents many challenges as discussed by Gantait et al. (2018). They see that an important issue in preserving Indian heritage is the balance between preserving the originality of the structures while adapting to modern tourism and urban development. The authors note that resource constraints, bureaucratic barriers and local administrative structures prevent adequate care. These challenges are most evident in the management of Amer Palace and Udaipur City Palace, where the influx of tourists and the pace of cities are hampering conservation efforts. Menon (2014) builds on these observations and points to the challenge of applying international conservation models to the Indian context. He argues that new conservation frameworks must take into account local socio-cultural contexts, including religious practices, local heritage and building practices. These aspects are especially relevant in Amer and Udaipur, where tradition and tourism are intertwined.

2. Urbanization and heritage conservation.

The interplay between urbanization and heritage conservation has been explored in various studies. Jaipur's Heritage and Conservation Bylaws (2020) provide a contemporary framework for managing urban heritage, ensuring that preservation aligns with city planning. Smith (2023) studies how rapid urbanization affects heritage conservation in growing cities. His work emphasizes the need for holistic conservation approaches that focus not only on the preservation of physical structures but also take into account socio-economic dynamics. For example, the socio-economic life of Amer and Udaipur is highly dependent on tourism, and it is important to preserve this heritage as the city grows.

3. Social issues of heritage conservation.

Yung et al. (2017) investigate the social factors that influence heritage conservation in the context of urban renewal. Their findings show that community participation and socio-cultural values play an important role in the success of conservation efforts. For the Amer Palace and the City Palace, the relationship between the local communities and these structures as heritage is important. These palaces are not historical monuments but are woven into the cultural and religious fabric of the local population. Therefore, a conservation approach should consider these socio-cultural aspects in order to maintain them in the long term. Guerrieri (2022) provides a post-colonial perspective on heritage conservation in India, emphasizing the need to deconstruct conservation practices by focusing on indigenous education systems and local cultural information. In the context of Amer Palace and City Palace, this approach means involving local artists, historians and cultural artists in the conservation process, rather than relying solely on tradition. protection of the West. This view is consistent with Menon's (2014) argument that conservation strategies should be sensitive to local contexts.

4. The Economic Dimensions of Conservation.

The economic benefits of heritage protection are multifaceted. According to Labadi and Logan (2016) heritage conservation plays an important role in the local economy, especially through tourism. However, they warn that unsustainable commercialization can lead to the destruction of cultural heritage. Amer Palace and Udaipur City Palace, two major tourist attractions, are prime examples of this problem. Although tourism brings in a lot of money, these places will wear and tear more quickly, with careful management. Sharma (2010) focuses on the need for a restoration strategy in Jaipur that can be applied in the conservation context of Udaipur. He says that heritage conservation when integrated into city plans becomes an economic driver, thus benefiting the local economy and heritage conservation. The Rajasthan Heritage Development and Management Authority, as pointed out by Jain (2014), plays an important role in this economic strategy by ensuring that heritage sites are protected and promoted for their economic value.

5. Legislative and Policy Frameworks

The legal frameworks surrounding heritage conservation in India are critical to understanding the conservation efforts at Amer Palace and City Palace. The Ancient

Monuments and Archaeological Sites and Remains Act (1958, amended in 2010) and various state-level policies like the Telangana Heritage Act (2017) provide the legislative backing for heritage preservation. These frameworks, while comprehensive, often face challenges in enforcement and adaptation to local contexts, as noted by the Ministry of Tourism and Culture of India (2010). Fairclough and Pirkovic (2009) argue that heritage conservation policies must evolve to meet the challenges of the 21st century, particularly in rapidly urbanizing regions. They highlight the need for policies that are not only protective but also adaptive, allowing for the dynamic nature of heritage sites, which often serve as living spaces for local communities. This is especially true for Amer and the City Palace, where modern urban development must coexist with centuries-old heritage.

6. Morphological Effects of Conservation

While Sawant's (2010) study on the Lake Pichola region in Udaipur provides insights into conservation impacts, it is outdated. This research updates these findings by assessing morphological changes over the last decade. Likewise, the preservation of the Amer Palace and the City Palace requires consideration of how interventions, such as restoration projects or structural improvements, will affect the historical integrity and beauty of these sites. The handbook on Conservation of Heritage Buildings (n.d.) provides detailed instructions on maintaining the structural integrity of heritage structures. This is especially true in the case of the Amer Palace and the City Palace, where traditional building materials and techniques must be used to ensure the integrity of the conservation process. The conservation of these places is not about preserving their physical appearance, but about preserving the arts and traditions embedded in their structure.

The literature on heritage conservation in India presents a multifaceted context in which social, economic and cultural factors are intertwined. The Conservation of Amer Palace and City Palace in Udaipur had to navigate these difficulties and balance the need for conservation with the pressures of urbanization and tourism. Effective conservation strategies require an integrated approach that includes and adapts to local communities.

3. Research Methods

A mixed-methods approach has been employed to capture the multifaceted nature of Heritage Conservation. A qualitative analysis of architectural precedents will be conducted to identify common design principles and success factors across different case studies. This involves archival research, site visits, and interviews with conservation architects actively engaged in the projects (Dr. Shikha Jain, Ar. Neha Parulekar), and community stakeholders to gain insights into the socio-cultural impacts of selected projects.

Quantitative assessments of Economic activities around the site gave insights into the economic impacts of the conservation project, furthermore quantitative assessments of the morphology of the surrounding area will give insights into the Built-Unbuilt relationships, Built form & Building Heights in the surrounding area.

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To assess the socio-cultural, economic, and morphological impacts of a Conservation Project, Here's a methodological framework of the research.

A. Criteria for selecting the context of research:

- To choose a specific example of a sensitive conservation project. This could be the revitalization of a historic district, the restoration of a monument with community involvement, or the adaptive reuse of a traditional building.

B. Sampling Strategy and Reason:

- The data is collected using On-site surveys & Observations, the surveys are targeted on local residents and business-owners in the study area.

C. Type of Interviews:

- Local residents to gather data for Socio-Cultural aspects.
- Local business-owners to gain insight for economic aspects.
- Conservation Architects as experts with experience and deep knowledge of the site areas.

D. Plan for Data Collection:

- Surveys:

  - Offline (5 days)
  - Online (5 days)

- Interviews: 1 day each.
- No. of Site Visits: Min. 5 days per site.

E. Data Collection Methods:

- On-site Surveys and observations.
- Interviews.
- Archival research.
- Spatial analysis.
- Economic Data analysis through surveys.

F. Parameters

1. Socio-Cultural Aspect:

- Historical Significance and Cultural Identity
- Cultural Practices and Rituals
- Community involvement and perception.

2. Economic Impact:

- Tourism and revenue generation.

- Job creation and employment.
- Cost-Benefit Assessment.

3. Morphological Aspect:

- Architectural Integrity and Aesthetic Value.
- Conservation policies and regulations
- Urban landscape and spatial fabric.

G. Data Analysis:

Used qualitative and quantitative methods to analyze the collected data.

- Identified themes and patterns in the socio-cultural and economic data.
- Assessed the positive and negative impacts of the conservation project on each dimension.
- Analyzed how changes in the physical form of the area have affected its overall character.

By following this methodology, we have gained a comprehensive understanding of the socio-cultural, economic, and morphological impacts of a sensitive conservation approach. The research will contribute valuable insights for future projects that aim to balance heritage preservation with the well-being of communities and the built environment.

Study Area/Context:

The research will focus on two historical sites which have undergone conservation; these sites are of a similar built period and also well within city limits to understand how it has shaped the morphology of the surrounding area. Case studies are selected on the basis of Built Year, built Typology (Palace), Proximity to settlement, and Conservation Status. Selected case studies (Amer Palace & City Palace, Udaipur are located in Rajasthan.

These Case Studies will offer a holistic view and valuable lessons on how architectural Conservation interventions can affect the surrounding environments(built); the society (Socio-Cultural); the economic generation, growth & potential; the morphology of the surrounding built environment.

The choice of the case studies will be validated based on their relevance to the research objectives and their potential to provide insights into effective conservation techniques and resultant socio-cultural, economic, morphological changes.

Case Studies:

City Palace, Udaipur:

Built in 1559, The City Palace in Udaipur takes a holistic approach to conservation, going beyond just fixing the bricks and mortar. Here's a glimpse into their efforts:



Figure 1: *City Palace, Udaipur*



Figure 2: *City Palace, Udaipur*

- Holistic Approach
- In-house Expertise
- State-of-the-Art Lab
- Living Museum Concept
- Sustainable Practices

The City Palace's conservation efforts strive to preserve not just the physical structure, but also the stories and traditions it represents. This multi-faceted approach ensures the City Palace remains a vibrant cultural centre for generations to come.

Amer Palace, Jaipur:

Built in 1592, The Amer Fort, also known as Amber Fort, in Jaipur utilizes a combination of traditional methods and modern technology for its conservation. Here's a quick look:



Figure 3: *Amer Palace, Jaipur*



Figure 4: *Amer Palace, Jaipur*

- Stonework Stabilization
- Mural Restoration
- Laser Cleaning
- Structural Repairs
- Drainage System Maintenance

By combining these methods, Amer Fort conservation strives to preserve its architectural beauty, historical significance, and structural integrity. This ensures the fort remains a captivating piece of Jaipur's heritage for visitors to explore and appreciate.

4. Analysis, Results & Discussion

The research focused on 3 broad aspects wherein the impact assessment due to the conservation project was collected, noted, collated and analyzed. The analysis of heritage conservation at Amer Palace in Jaipur and City Palace in Udaipur provides a comprehensive exploration of how conservation initiatives influence the local community, economy, and urban landscape. These palaces, symbolic of Rajasthan's rich cultural and historical legacy, are not just architectural marvels but also living testaments to the region's past. By examining the socio-cultural, economic, and

morphological dimensions of conservation, this study delves into the multifaceted impacts that such preservation efforts have on both the palaces and their surroundings.

1. *Socio-Cultural Aspect:*

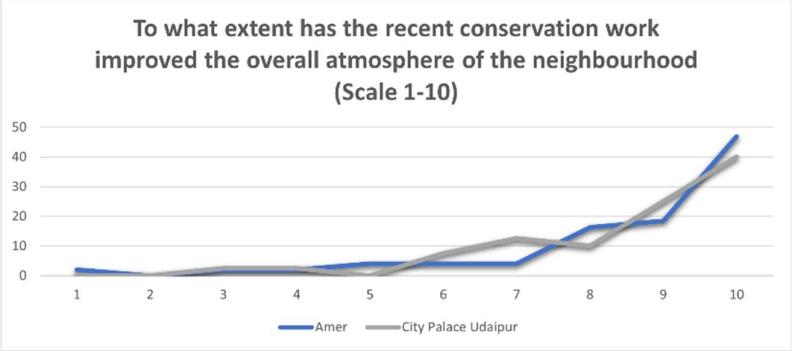


Figure 5: *To what extent has the recent conservation work improved the overall atmosphere of the neighbourhood?*

This dimension was explored by conducting targeted interviews and surveys with people living in close proximity to the palaces. Participants were asked to complete a questionnaire, which helped the author gather data on how the conservation project has impacted their socio-cultural environment.

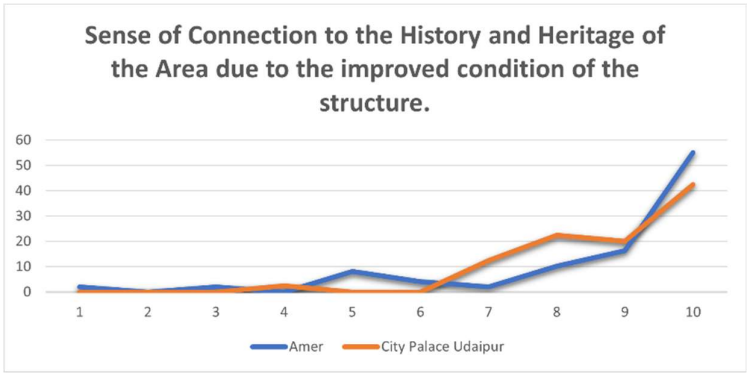


Figure 6: *Sense of Connection to the history and heritage of the area due to the improved condition of the structure.*

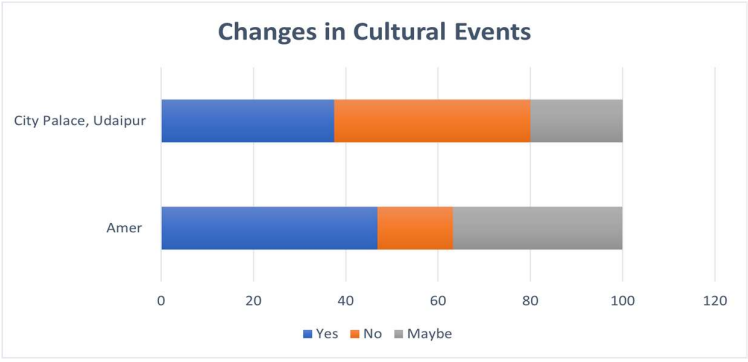


Figure 7: *Stronger Sense of Cultural Pride due to the improved condition of the structure.*

Positive Impacts:

- Community Pride: Residents expressed a heightened sense of pride in both the structure and their city post-conservation. The restoration efforts have significantly enhanced the appearance of the palaces, uplifting the overall aesthetic appeal of the vicinity.
- Cultural Pride and Engagement: The survey revealed a 55% increase in connection with Jaipur's history and a 43% rise in Mewar's heritage pride (Fig. 4). Conservation efforts have fostered a deeper emotional connection between the local residents and their cultural heritage.

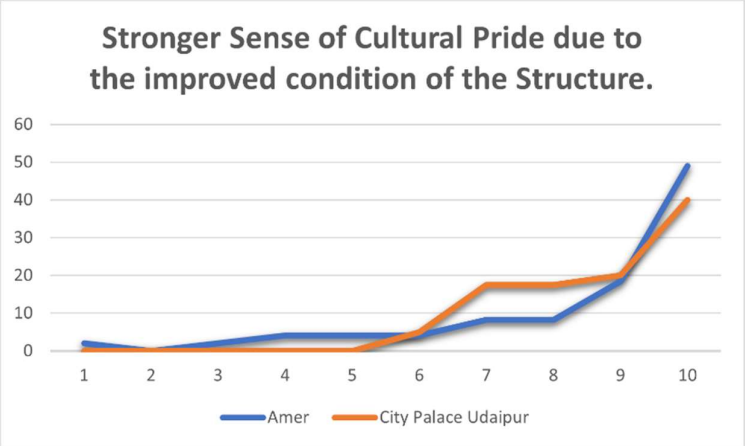


Figure 6: *Changes in Cultural Events.*

- Cultural Events: There has been a marked increase in the number of cultural events and traditions celebrated within the palaces. For instance, the Maharana of Mewar Charitable Foundation (MMCF) organizes cultural programs like Dussehra and Holika Dahan Puja inside City Palace, while Amer Palace features a Light and Sound Show as a major attraction. These events not only preserve traditions but also attract tourists, enriching the cultural fabric of the region (Fig. 5).

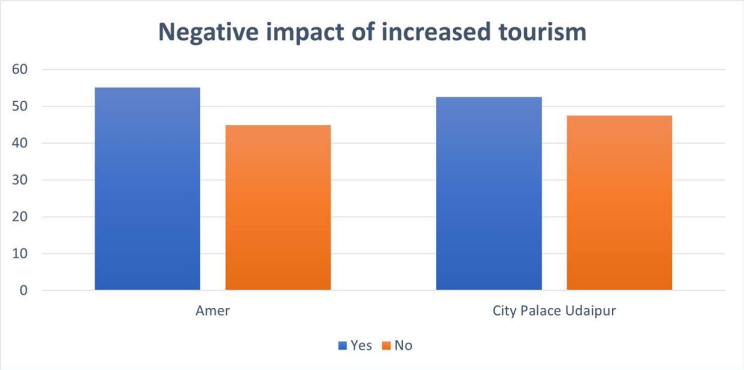


Figure 7: *Negative Impact of Increased Tourism.*

Negative Impacts:

- Traffic Congestion: The influx of tourists due to the conservation projects has led to traffic congestion in the vicinity, which many residents found problematic (Fig. 7). This has created challenges in managing the urban flow and infrastructure.
- Increased Alcohol Consumption: Locals noted the rise in alcohol consumption in tourist-heavy areas. This change in the social environment has caused unease among residents, especially those concerned with the potential for cultural degradation caused by tourism (Fig. 7).

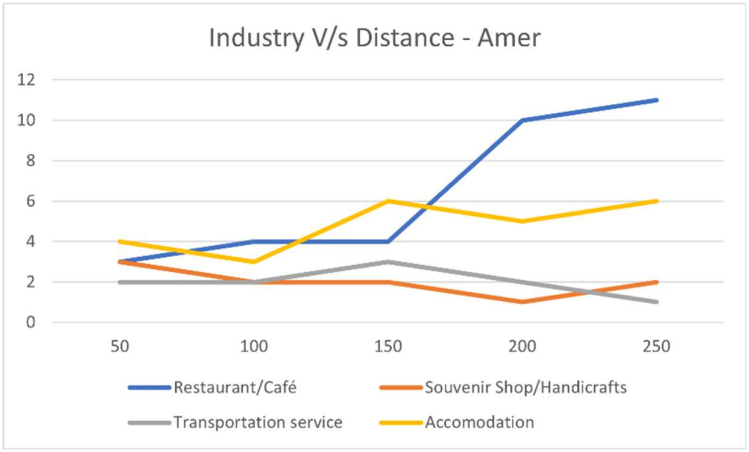


Figure 8: *Industry V/s Distance - Amer.*

2.Economic Aspect:

The economic analysis also employed targeted interviews and surveys, with respondents including both newcomers and individuals who have lived or worked near the palaces for generations. The purpose was to assess the economic impact of conservation projects on local businesses, both old and new.

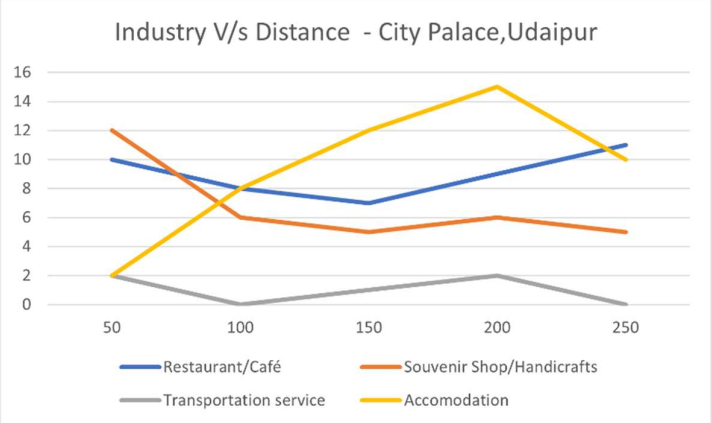


Figure 9: *Industry V/s Distance - City Palace, Udaipur.*

- Business Growth and Revenue Increases:

- Amer Palace: A positive growth trend was observed in businesses around Amer Palace. All surveyed businesses (100%) reported a revenue increase post-conservation, indicating that the restoration has stimulated economic activity in the surrounding area (Fig. 8).
- City Palace: The economic impact in Udaipur was generally positive, though some businesses experienced negative trends in revenue, possibly due to the uneven distribution of tourism benefits or competition (Fig. 9).

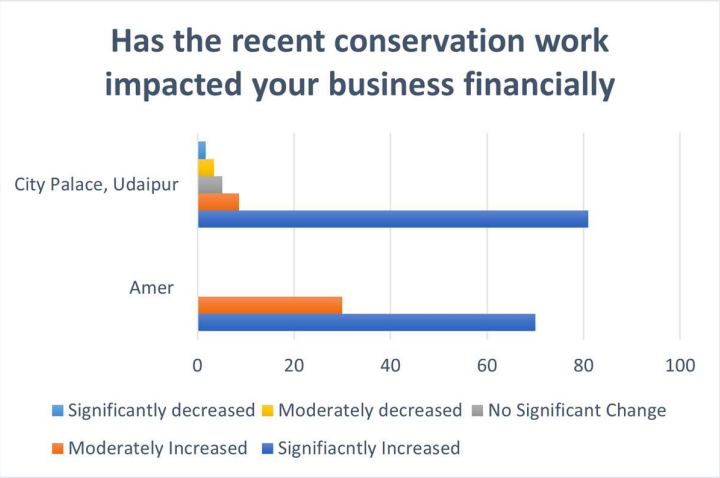


Figure 10: *Has the recent conservation work impacted your business financially?*

- Business Types and Distribution:
- Food and Accommodation Sector: The number of restaurants, hotels, and hostels increased as one move further away from the palace, highlighting that tourists prefer staying and dining in areas at a slight distance from the main attraction (Fig. 8 & Fig. 9). This is likely due to the crowded nature of the immediate vicinity of the palaces.
- Souvenir and Transport-Related Businesses: Interestingly, the number of souvenir shops and transportation-related businesses either remained steady or declined as the distance from the palace increased. This indicates that these businesses thrive closer to the main tourist site, while the demand for restaurants and hotels is spread over a broader area.

3.Morphological Aspect:

The morphological was carried out by analysing the figure ground imagery of the study areas - Figure-ground imagery represents the spatial relationship between built (figure) and unbuilt (ground) spaces in urban design. It highlights how structures and open spaces interact, revealing patterns of density, hierarchy, and connectivity. And creating detailed height maps of the study areas by referring to the on-ground heights and sections created by the author.

This study was carried out using a combination of maps, aerial imagery, questionnaires, and policy documents.

The author analysed the morphological impact on the basis of 3 parameters

- **Architectural integrity and aesthetic value**

Prior to conservation efforts, the rise in modern construction using materials like RCC (reinforced cement concrete) and steel had begun to deteriorate the heritage value of the areas surrounding the palaces. The lack of regulated development led to an aesthetic mismatch between modern and historical structures, diluting the cultural authenticity of the region.

- **Conservation policies and regulations**

To mitigate this, the government implemented strict regulations that restrict modern construction activities within a 300-meter radius of the palaces. These policies aim to safeguard the visual and cultural integrity of the heritage sites by ensuring that any new construction adheres to guidelines that promote heritage-sensitive development. The policies also aim to preserve the skyline by restricting new development and construction. The Maharana of Mewar Charitable Foundation (MMCF) introduced Heritage Walks around City Palace, Udaipur, as part of its conservation efforts. These walks are designed to enhance the heritage experience for visitors and locals alike while promoting architectural heritage conservation. This initiative has been successful in educating the community about the historical significance of the area and has raised awareness about the importance of preserving the region's unique heritage. However, Heritage Walks have not yet been incorporated into the Amer Palace conservation project, leading to a decline in the heritage value of Amer Town. This gap highlights a missed opportunity to engage the local community and visitors in the conservation narrative. Nevertheless, the Amer Development Management Authority (ADMA) has undertaken other initiatives, such as the Hathi Gaon Project, to address urban decay in the town and promote heritage awareness.

- **Urban Landscape and Spatial Fabric**

The research revealed distinct patterns in the urban form and building layouts, as shaped by their historical and geographical contexts:

Amer Palace, Jaipur:

The figure-ground map of the Amer palace area demonstrated a compact and dense urban fabric surrounding the palace complex, indicative of a historic settlement (Amer Town) where the palace serves as a focal point. The built form is characterised by irregular, organic patterns reflecting the hilly terrain and traditional Rajput planning principles. the height map shows a dominance of low-rise structures (1-3 floors) with few taller buildings, ensuring the prominence of the palace within the skyline. The sectional analysis highlights the strong visual hierarchy and the interplay between the palace, its defensive, architecture and the surrounding settlement.

City Palace, Udaipur:

The City Palace figure-ground analysis portrays a more linear and expansive configuration compared to Amer, reflecting its lakeside setting. The urban fabric around the palace shows a mix of compactness and openness, with distinct pathways and public spaces connecting to the waterfront. The building height analysis indicates a relatively uniform height distribution, with most structures being 1-2 floors, ensuring the unobstructed visual and symbolic dominance of the palace. The sectional studies emphasize the integration of the palace with its natural landscape, particularly its relationship with Lake Pichola.

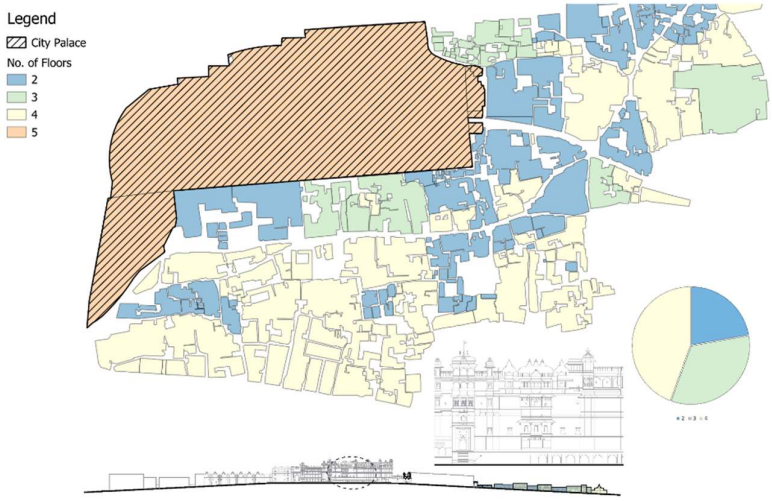


Figure 11: *City Palace, Udaipur height map and section.*



Figure 12: *Amer Palace, Jaipur height map and section.*



Figure 13: *City Palace, Udaipur Figure Ground Image.*



Figure 14: *Amer Palace, Jaipur Figure Ground Image.*

- **Conclusion on Morphological Impacts:**

The lack of heritage awareness and unchecked development initially led to deterioration around both palaces, but conservation projects, along with stricter policies, have helped reclaim much of the lost heritage value. The successful introduction of Heritage Walks in Udaipur offers a potential model for Amer to follow in enhancing its tourism experience and promoting sustainable development.

- **Summary of Impacts:**

In conclusion, the conservation efforts at Amer Palace and City Palace have had far-reaching impacts:

- Socio-culturally, the projects have elevated community pride, promoted cultural continuity, and sparked the revival of local traditions and events.

- Economically, they have boosted local businesses and stimulated growth, though challenges such as traffic congestion and social issues like alcohol consumption due to tourism remain concerns.
- Morphologically, the projects have curbed unregulated development, restored heritage integrity, and promoted the use of sustainable urban planning, though further initiatives like Heritage Walks could enhance the long-term benefits.

The study highlights the importance of balancing heritage conservation with community needs and sustainable development, ensuring that both the historical significance of these palaces and the well-being of local residents are preserved for future generations.

5. Inference/ Conclusion

The results of this study indicate that heritage conservation projects have a significant impact on both the local environment (microclimate) and the urban context (macroclimate). Not only will the visual quality and physical quality of the area increase, but it will have a ripple effect that benefits the local cultural and economic fabric. By restoring historic sites, local businesses benefit from increased tourism and generate new revenue. By participating in these initiatives, craftsmen and artisans can exhibit their traditional skills and help preserve traditional practices and expand local commerce. This combination of legacy conservation and financial advancement reinforces the city's personality and advances economic development.

Apart from the financial benefits, the projects maintain pride and prestige among the residents. People feel more connected to their cultural roots and history, thus creating vibrant and engaged communities. This partnership contributes to safer, more inclusive living spaces and creates a better environment for residents and visitors alike. Improved public spaces encourage social interaction, increase quality of life and provide opportunities to participate in urban living. These revitalized areas become centres of activity and attract not only tourists but also residents, strengthening local identity and community participation.

The tourism activities stimulated by these projects have the potential to boost the city's economy and create a variety of jobs and business opportunities in hospitality, commerce and culture. However, the success of conservation must be carefully managed to avoid excessive commercialization or destruction of heritage values. It is important to maintain the authenticity and integrity of the updated sites because too many changes and neglect can reduce their meaning. A major challenge is balancing the influx of visitors with the need to protect the sites. If not properly planned, tourism can lead to degradation, pollution and structural difficulties, especially when it comes to traffic - pedestrians and vehicles.

To meet these challenges, traffic management strategies are essential to improve mobility and reduce the impact of tourism on the daily lives of residents. Activities such as pedestrian crossings, parking services and parking restrictions will help reduce congestion and improve the visitor experience. At the same time, efforts must be made to inform the local population and tourists of the importance of respecting cultural symbols. Public participation in conservation efforts can promote a sense of shared

responsibility and encourage sustainable action that protects these areas for future generations.

Guaranteeing the results of conservation programs with continuous monitoring, stakeholder cooperation and community participation. Partnerships between local authorities, businesses and residents are essential to ensure that conservation efforts are consistent with the city's overall development goals. Regular maintenance, including restoration, when necessary, helps maintain the integrity of cultural markers. Conservation programs, education programs and community engagement activities can strengthen the connection between people and their heritage, and ensure continued support for conservation projects.

As a result, heritage conservation not only restores historic sites but also provides economic opportunities, promotes social cohesion and improves urban environments. The positive effect will come from the physical renewal of the buildings and contribute to the overall development and identity of the city. However, sustainable management practices are essential to sustain these benefits over time and ensure that the local community and future generations enjoy the cultural and economic value of these heritage sites.

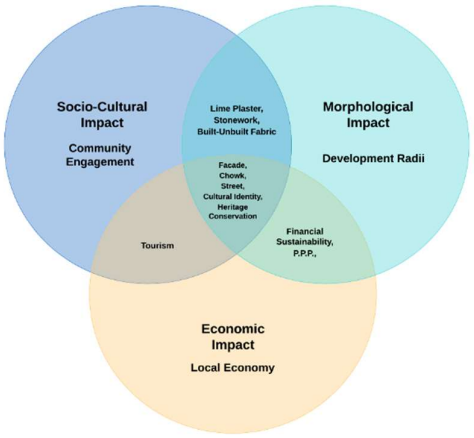


Figure 15: *Conclusion/ Inference Venn-Diagram.*

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Sri Rangnathji Temple, Vrindavan: A Study of South Indian Temple in North India

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Abstract: *Vrindavan, a temple town located on banks of river Yamuna in the Braj Region covering parts of Uttar Pradesh, Rajasthan and Haryana in Northern part of India, is popular for Lord Krishna's childhood play deeds (lila). Over a period of time, Vrindavan evolved as a pilgrim town consisting of temple clusters built since the sixteenth century. The Vrindavan temple typology evolved from the shikhara style to the haveli temple; however, Rangji / Sri Rangnathji temple differes from the typical Vrindavan templetemple typology. This paper aims to study the architecture and landscape of Rangji temple / Sri Rangnathji Temple, the largest Vishnu temple in Vrindavan withrich cultural heritage and history. This study documents the temple complex and the settlement around it including its layout, vegetation, and architectural features, and the associated intangible aspects of the cultural heritage--embodied in daily rituals and festivals associated with the temple Rangji Temples a remarkable example of design confluence displaying amalgamation of South Indian and Rajputana styles in its planning, design, architectural elements and festivities.*

Keywords: Architectural style; Design Confluence; Sacred ; Walled temple complex; Heritage

1. Introduction:

Vrindavan, a historic and pilgrim town on the banks of the Yamuna River, is central to the Braj region and deeply associated with the life and legends of Lord Krishna. Known as the "Land of Temples," Vrindavan is home to numerous sacred shrines, each narrating the divine pastimes of Krishna and Radha. The town's sacred sites, parikrama paths, and vibrant festivals, such as Holi and Janmashtami, attract pilgrims and devotees worldwide. Vrindavan, in addition to its temples, is renowned for its maths (monasteries), ghats along the Yamuna River, sacred groves, local cuisine, and local art and crafts.

The town's urban fabric is structured around eight historic "*Gheras*" (neighborhoods), with temples at their core surrounded by settlements, reflecting the town's unique religious and cultural planning. (Sinha and Dhariwal,2025).

Following is a brief description of each *ghera*:

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Madan Mohan Ghera:

Also known by the Shri Radha Madan Mohan Temple, located near the Yamuna River, this ghera is home to one of Vrindavan's oldest temples. The temple features a 50-foot shikhara and is architecturally influenced by both Mughal and Kalinga-Nagara styles, showcasing Vrindavan's diverse cultural heritage.

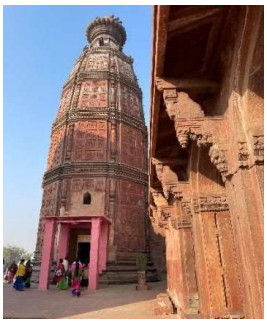


Figure 1. *Madan Mohan Temple*

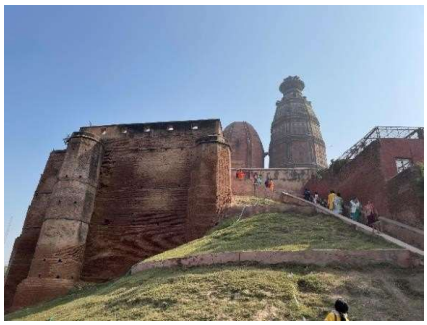


Figure 2. *Approach and Landscape*

Radha Vallabh Ghera:

At the heart of this ghera stands the Radha Vallabh Temple, dedicated to Radha and Krishna. Constructed in the 16th century by Hith Harivansha Mahaprabhu, it remains an active center for the Radha Vallabh Sampradaya, preserving both religious practices and cultural traditions of the community.



Figure 3. *Entrance of Radha Vallabhji Maharaj*

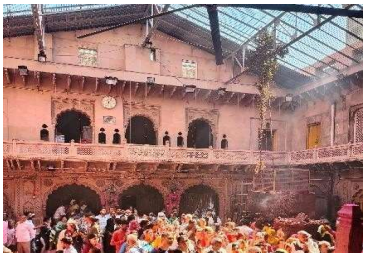


Figure 4. *Interiors of the Temple*

Vyasji Ghera:

Known for the sacred Kishor Van, this area is closely associated with Shri Hariram Vyas, a revered Braj religious saint. The ghera also contains his Samadhi Mandir and Bhajan Kutir, highlighting the devotion-centered heritage of Vrindavan and its connection to Sewa Kunj.



Figure 5. *Vyasji Ghera temple interiors*



Figure 6. *Temple garden feature*

Radha Raman Ghera:

This ghera is home to the Shri Radha Raman Temple, that enshrines a deity manifested from a *shila* (black stone) in 1542. Built by Gopal Bhatt Goswami, the temple remains one of the most revered sites in Vrindavan, preserving the authenticity of its original form and worship practices.

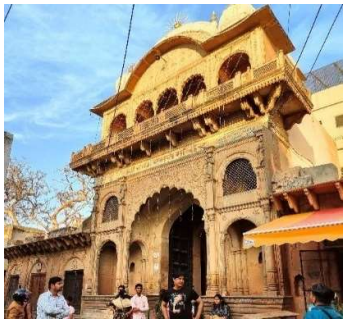


Figure 7. *Radha Raman temple*



Figure 8. *Radha Raman temple interiors*

Gopinath Ghera:

The Gopinath Temple, located within this ghera, is a prominent example of medieval architecture. It houses the deity Gopinath discovered near the iconic Vanshivat, adding spiritual significance to this ghera.



Figure 9. *Sri Sri Gopi Nathji temple*



Figure 10. *Temple Entrance*

Jaisingh Ghera:

This area features the Jaisingh Temple, dedicated to Lord Krishna, adding to the diversity of temple traditions and architectural styles found throughout Vrindavan.



Figure 11. *Jaisingh Ghera Ashram*



Figure 12. *Jaisingh ghera landscape*

Dheer Sameer Ghera:

Named for the gentle, refreshing breeze (dheer sameer) that flows through its gardens (kunj), this ghera offers a peaceful retreat within Vrindavan, embodying the serene and contemplative qualities associated with the town's spiritual essence.



Figure 13. *Entrance of the Dheer Sameer Ghera*



Figure 14. *Dheer Sameer Kunj*

Govind Dev Ghera:

Constructed in 1590 by King Man Singh of Amer, Govind Dev Temple is a grand example of red sandstone architecture adorned with intricate carvings. It stands as a monumental representation of Vrindavan's architectural splendor and devotional significance.



Figure 15. *Govind Devji Ghera temple entrance*



Figure 16. *Govind Devji temple interiors*

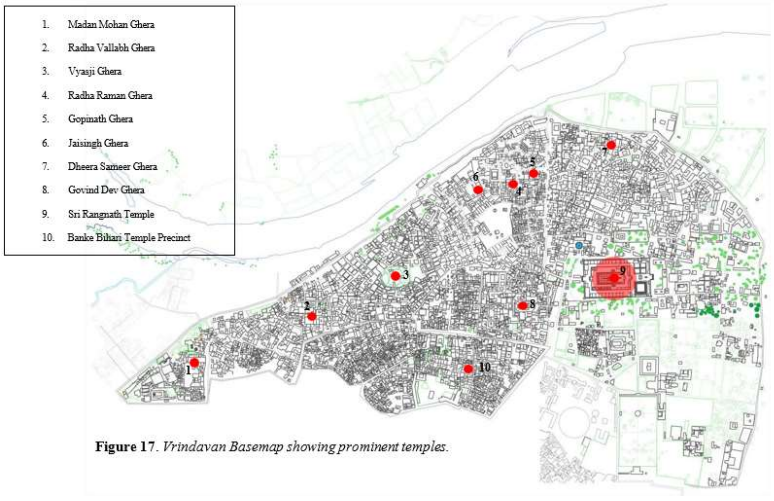


Figure 17. *Vrindavan Basemap showing prominent temples.*

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Sri Rangji Mandir, located in the temple town of Vrindavan is dedicated to Lord Sri Goda Rangamannar, the temple honors the divine union of Andal (Goda), an 8th-century Vaishnava saint and Alwar, with Lord Ranganatha, a manifestation of Krishna. Built between 1845 and 1851 under the guidance of Sri Rangadeshik Swamiji and with the patronage of Seth Radhakrishnaji and Govind Dasji of Chennai, the temple is inspired by the Sri Ranganatha Swami Temple of Srirangam while incorporating local craftsmanship and elements.

It is dedicated to Lord Vishnu and Lakshmi.It is one of Vrindavan's largest temples surrounded by high walls.

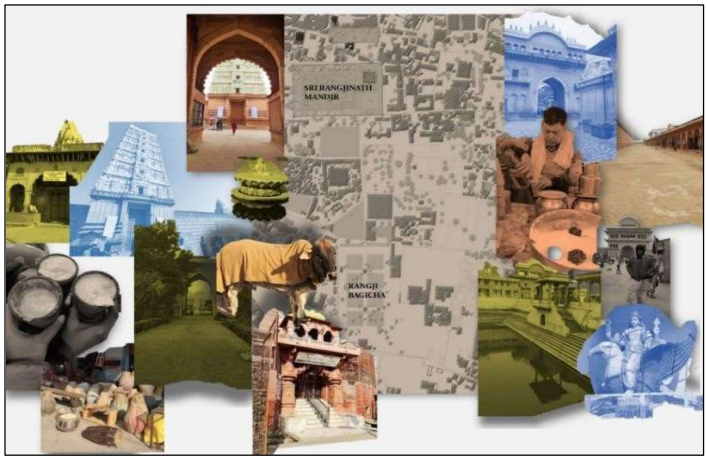


Figure 18. *The tangible and the intangible aspects of Rangji temple and its surrounds*

This temple not only serves as a religious center but also as a cultural landmark, reflecting the synthesis of many architectural traditions and the devotion that defines Vrindavan's sacred heritage.

2. Objectives and Method:

The objective of the study is to document the contextual, architectural and cultural aspects of Sri Rangnathji Temple complex and its surroundings. Using the descriptive research method, an exhaustive visual survey and documentation of built structures and open spaces was conducted in a site visit followed by four months of studio work in 2024.

3. Literature Review:

Architectural and Cultural Significance of Historic Cities

Charlie Gupta (2024) discusses India's rich and diverse heritage, shaped by the multitude of ethnicities and religions that have thrived in the region over millennia. It highlights the architectural and cultural significance of historic cities, which attract millions of tourists worldwide, but are increasingly threatened by rapid urbanization and unchecked development. Gupta (2024) emphasizes the importance of heritage-

sensitive development and raising awareness about preservation efforts. Using Vrindavan, a prominent heritage city in northern India, as a case study, it examines the challenges posed by rapid expansion and proposes a methodological approach to safeguard the city's cultural identity.

Spatial transformations in Religious – Historic Cities

Sunanda K (2022) examines the spatial transformations occurring in India's religious-historic towns due to urbanization. She highlights the substantial changes in the built environment brought about by these transformations and acknowledges that modernization

of functions and spatial layouts is an inevitable process for historic towns. The study focuses on various components of urban historic conservation, including the appearance of historic buildings, their original functions, and their immediate surroundings, aiming to enhance the built environment of these towns.

Empirical approach to study of Historic Structures in Religious - Historic Cities

Kiruthiga (2017) has analysed Kumbakonam town in South India using empirical model. He presents an investigation of changes in the virtual perception of the built heritage at the traditional core settlement of Kumbakonam Town at Tamilnadu. 373 buildings were observed and documented to collect the data. Direct observation and documentation of 373 buildings is used to understand how these elements contribute to the changes in the visual perception on the built heritage of Kumbakonam Town. These include various elements like: pilasters, cornices, windows, arches, parapets.

Vrindavan's scriptures and Ecological Perspective

Nash (2015) talks about Vrindavan and the key ideas associated with it. He hypothesizes Vrindavan as a human sanctuary and explains the philosophy of Vrindavan Ecological Concept (VEC). Vrindavan in ancient scriptures emphasizes on the ecological perspective whereas the reality of Vrindavan today is very different from that written in the devotional texts making it difficult for pilgrims to connect.

3.Temples in Vrindavan

Growse (1874) talks about the history of Braj Bhoomi, temples of Mathura and Vrindavan. their history and architectural styles. According to him, all temples have different characteristics but are predominantly North India style with features like mandapa, Garbhagriha and shikara. But Sri Rangnathji Temple stands out due to its south Indian influence. Features like concentric planning, tall gopurams, dhwaja stambha, etc adds uniqueness to the temple structure.

Rangnath ji temple of Vrindavan

Growse (1874) mentions the history and architecture of Sri Rangnathji Temple of Vrindavan in detail. The construction of the Rangnathji temple commenced in 1845 and was completed in 1851 at an estimated cost of 45 lakhs of rupees. The outer walls of the temple complex measure 773 feet in length and 440 feet in breadth, enclosing not only the temple courtyard but also a large tank and a garden. The principal entrance to the outer court, located on the western side, is crowned by a pavilion designed in the Mathura architectural style by a local artist. This pavilion, standing 93 feet tall, Adjacent to the entrance, a detached shed houses the rath or ceremonial chariot of the deity. This towering wooden structure, composed of multiple tiers and embellished with large effigies at its corners, is brought out annually during the Brahmotsav festival in the month of Chaitra.

Vaishnava Havelis In Rajasthan Origin and Continuity of a Temple Typology

Jain (2018) has analyzed the Haveli temple typology of Rajasthan from its emergence to its replacement by modern shikhara temples. It briefly explains the history of North Indian temples, Vishnava philosophy and how idols of deities were transported from Vrindavan to Rajasthan due to fear of attacks by the Mughals. In that period, temples in Rajasthan were designed as places for rest. This led to the emergence of Haveli temples in Rajputana architecture. Pushti Marg sect being known the creators of this style of temple architecture. The architectural style had spread all over Jaipur and other cities of Rajasthan with flat roofs and courtyards being its main features. In the twentieth century, during the post-independence period, there was the shift from Haveli style of temple to the traditional Shikara temples in Rajasthan. The trends changed over the year but a sect of the Vaishnava community still follow the rituals and construction techniques of Haveli temples.

Haveli temples as one of the temple typologies are also seen in Vrindavan.

4.Analysis:

4.1 Built form and Road network around Rangji Temple:

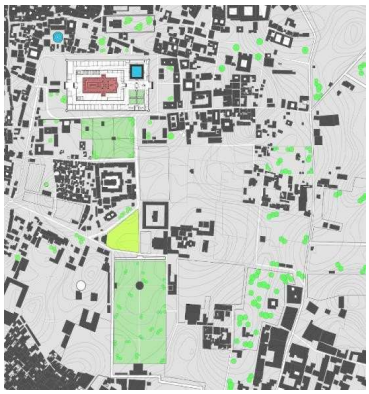


Figure 19. *Built and Unbuilt Mapping*

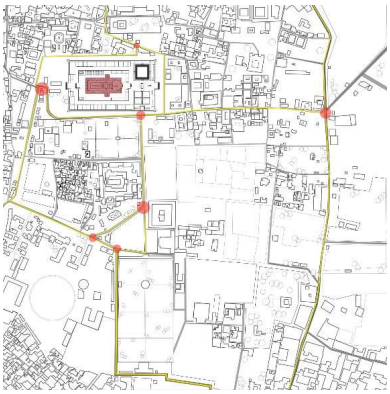


Figure 20. *Road Hierarchy and Traffic Congestion points*

A deeper understanding of site was achieved through mapping various aspects such as built and unbuilt spaces, vegetation, road networks.

The temple complex stands out amongst the other built form. A large amount of unbuilt spaces are seen around the temple complex of Rangji temple. Rangji , unlike South Indian temples is located not at the centre of the town around which entire town is planned, rather it stands at the edge , but within the Parikrama path. In the figure ground one can see concentric rectangular planning , which occupies a big piece of land.

Mapping of built and unbuilt revealed the untapped potential of the temple complex and its surroundings . Some gardens are seen in close proximity to the temple. There is also a kund seen within the temple complex. Peepal and Kadamba trees were mainly spotted in this area.

The temple complex has accessibility from both sides. However, unlike south Indian temples, concentric road and settlement pattern is not seen around Rangji temple. There are pathways connecting the temple complex to the Bagicha /Garden – the Bada Bagicha and the Chota Bagicha, which is much a north Indian concept of Landscape.

4.2 Temple Planning:

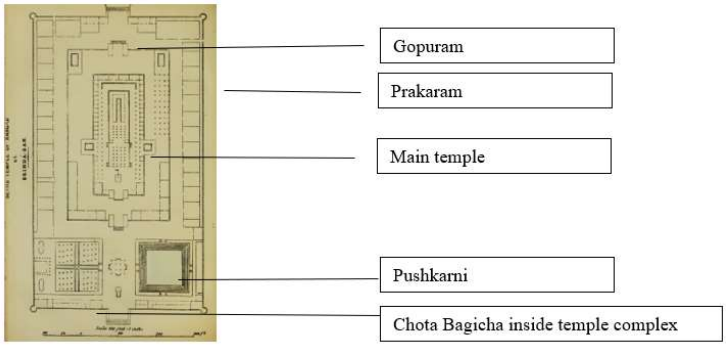


Figure 21. *Plan of Sri Rangnathji Temple* *Source: Growse (1874)*

Typical features of South Indian temple: case of Srirangam temple

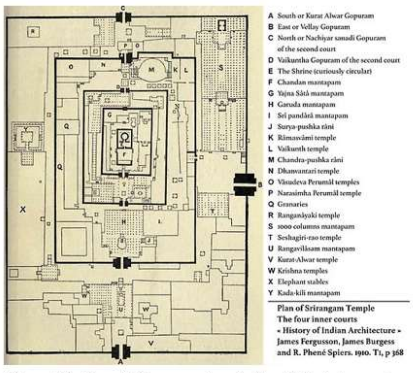


Figure 22. *Plan of Srirangam temple, Tamil Nadu (source: https://commons.wikimedia.org/)*



Figure 23. *Gopuram of Srirangam temple, Tamil Nadu (source: https://commons.wikimedia.org/)*

Plan of Srirangam temple, Tiruchirapalli. (1910) Explicitly shows sacred concentric layout with series of Gopurams signifying the entrance to the temple, typically denotes south Indian temple architectural style which resembles to that of Shri Rangnathji Temple.

Temple plan of Rangji and Other important temples of Vrindavan:

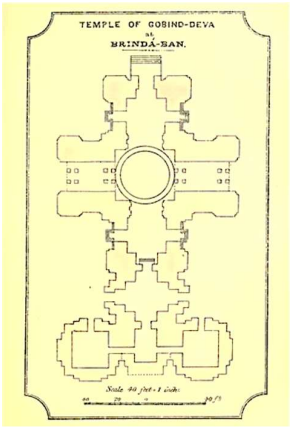


Figure 24. *Plan of Govind Devji Temple*

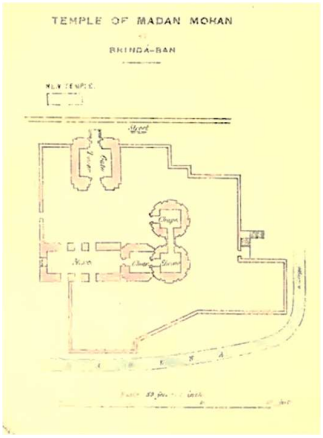


Figure 25. *Plan of Madan Mohan Temple*

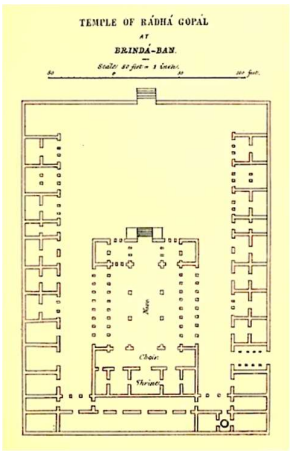


Figure 26. *Plan of Radha Gopal Temple*

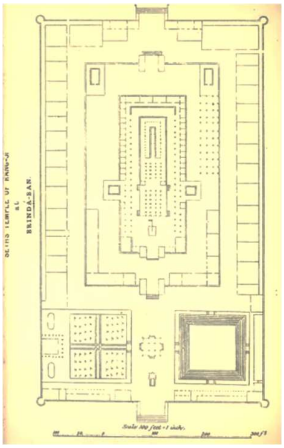


Figure 27. *Plan of Sri Rangnathji Temple*

Fig 7. Plans of Govinddevji, Madan Mohan, Radha Gopal and Sri Rangnathji temples

(Source: Growse (1874)

From the plans of other notable temples of Vrindavan, it can be seen that Rangnathji temple planning stands out distinctly with its concentric pattern, than the other temples in Vrindavan.

Typical features of North Indian style temple architecture:

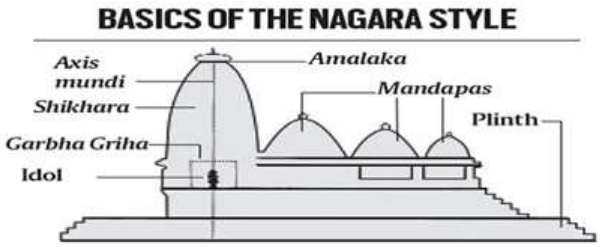


Fig 28. *Basics of Nagara Style temple*
(Source : http:// optimizeias.com)

- **Compact Garbhagriha**: The sanctum follows the Nagara style, with a focus on simplicity and divinity.
- **Mandapas**: The open and pillared halls for rituals and congregational activities are common in both Nagara and Dravidian styles but are especially prominent in Nagara temples in North India.
- **Ornamental Carvings**: The intricate floral and geometrical designs on the walls and pillars resonate with North Indian craftsmanship.
- These features of North Indian temple are seen in the main temple of the Shri Rangji.

Typical features of Rajputana style Haveli temples of Jaisalmer

The influence of typical Rajputana style Haveli temples can be seen in the East and West entry gates of Sri Rangnathji Temple. The scale of the gate, semicircular chatris and intricately carved pillars are some of the main features of Rajputana architecture. The architectural vocabulary resembles to the havelis of Rajasthan



Figure 29. *Haveli temple of Jaisalmer*

(Source: https://commons.wikimedia.org/)

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4.3 Architectural Features:

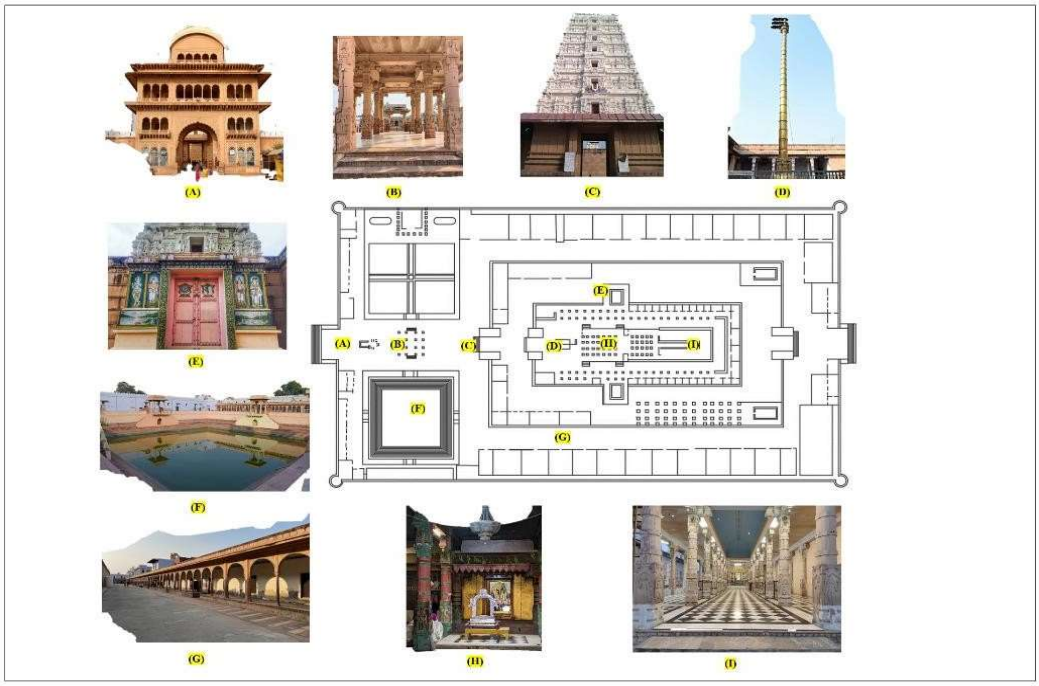


Figure 30. *Architectural details of Rangji temple*

Gopuram:

The seven-tiered Raja gopuram (entrance tower), typical of Dravidian architecture, is an imposing feature at the entrance, drawing from the architectural language of the famous Sri Ranganatha Swami Temple in Srirangam, Tamil Nadu.



Figure 31. *Gopuram of Sri Rangnathji Temple, A South Indian feature*

Stone gates:

The **two stone gates** (Eastern and Western) exhibit **Rajasthani-style carvings**, blending intricate stonework with symbolic motifs and archways typical of North Indian temple gateways.

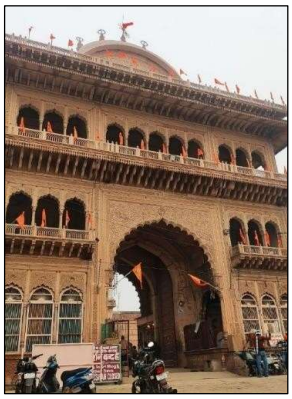


Figure 32. *West Gate of the temple*



Figure 33. *East Gate of the temple*

Dwaja Stambh:



Figure 34. *Dhwaja Stambha*

A **50-foot-high Dhwaja Stambha (flagpole)**, is a popular feature, seen both in North as well as South Indian temples, is located in front of the main sanctum, adding to the grandeur.

Shri Rangnathji temple stands out because it is the only Vishnu temple in Vrindavan. South Indian influence can be seen in its architectural features like the concentric planning, tall gopurams, dhwaja stambha, etc which adds uniqueness to the temple structure. These features are not seen in any other temple on Vrindavan. The temple has some North Indian influence like the mandapa, Garbhagriha and shikara. It also has Rajputana style entrance gateways on the east and west side.

4.4 Landscape Features:

Pushkarni Kund:

The **Pushkarni Kund** within the Sri Rangji Temple complex holds immense spiritual and functional significance. This sacred water reservoir is used exclusively for preparing offerings to the deity, symbolizing purity and devotion.

Architecturally, it is integrated into the temple's concentric planning, enhancing its spiritual ambience. The kund not only serves as a ritualistic focal point but also complements the temple's ecological balance by sustaining its surrounding flora.



Figure 35. *Pushkarni Kund*



Figure 36. *Pushkarni Kund at night*

Chota Bagicha and Bada Bagicha:



Figure 37. *Bada Bagicha*



Figure 38. *Chota Bagicha*

Sri Rangji Temple features beautifully maintained **bagichas** (gardens) that enhance its spiritual ambience and architectural charm. These gardens play a vital role in temple rituals, as flowers for deity offerings are sourced directly from them.

One notable garden, located near the eastern gopuram, hosts Andal's weekly processions on Fridays, creating a serene and devotional atmosphere. Adorned with

stone fountains that operate during special occasions, these gardens symbolize nature's harmony with divinity and provide a tranquil space for pilgrims.

The temple's notable features include the five concentric rectangular enclosures, intricately carved stone gates, seven-storeyed gopurams, a 50-foot-high gold-plated Dhwaja Stambha, and the Pushkarni (sacred pond). Its precincts house various smaller shrines, a Yagyashala, and the Vahan Ghar, showcasing the richness of temple rituals and festivals like Brahmotsav and Vaikunth Ekadashi.

It is to be noted that over a period of time there has been changes, the prominent entry which was once from parikrama path side, has now become the back entry or the secondary entry, the prominent entry is now one which is flanked by Lion gates.

The temple complex demonstrates axial planning with a compact enclosure made of tall mighty walls.

4.5 Festivals

Brahmotsavam

The grandest festival of the temple, Brahmotsavam, spans over ten days during the Hindu month of Chaitra (March-April). The celebrations include elaborate processions of the deity on different vahanas (divine mounts) like Garuda, Hanuman, and the temple's iconic 50-foot- high wooden chariot. The procession is accompanied by music, dance, and devotional chanting. The Brahmotsava festival is the most important festival of Vrindavan and is enjoyed by the local people and the pilgrims alike. The deity is ceremonially paraded each day from the temple to a pavilion in a nearby garden, covering a distance of 690 yards.

Latthe Ka Mela

Held during the Brahmotsavam, this festival is similar to the Dahi Handi celebrations. Participants climb a tall, oil-coated wooden pillar (Lattha) to reach a handi suspended at the top. This event symbolizes devotion and the playful lilas of Lord Krishna, bringing joy and vibrancy to the temple grounds.

Jhoola Utsav

Celebrated during the monsoon months, this festival involves placing the utsav murtis (processional deities) on beautifully decorated swings in the Sheesh Mahal. It is a serene and visually captivating event where the divine couple is gently swung amidst devotional singing.

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Vaikuntha Ekadashi:

Observed with great reverence, the temple opens its Vaikuntha Dwar/ door or gate, symbolizing the gateway to heaven. Devotees pass through this sacred gate, seeking spiritual elevation and blessings.

Makar Sankranti

The celestial union of Sri Goda-Rangamannar is celebrated at the Baradwari. The festival involves offerings, cultural performances with a focus on renewal.

Gajendra Moksha Enactment:

Rituals around the **Kund (water tank)** celebrate Lord Vishnu's rescue of Gajendra, highlighting the importance of water features in the temple's design.

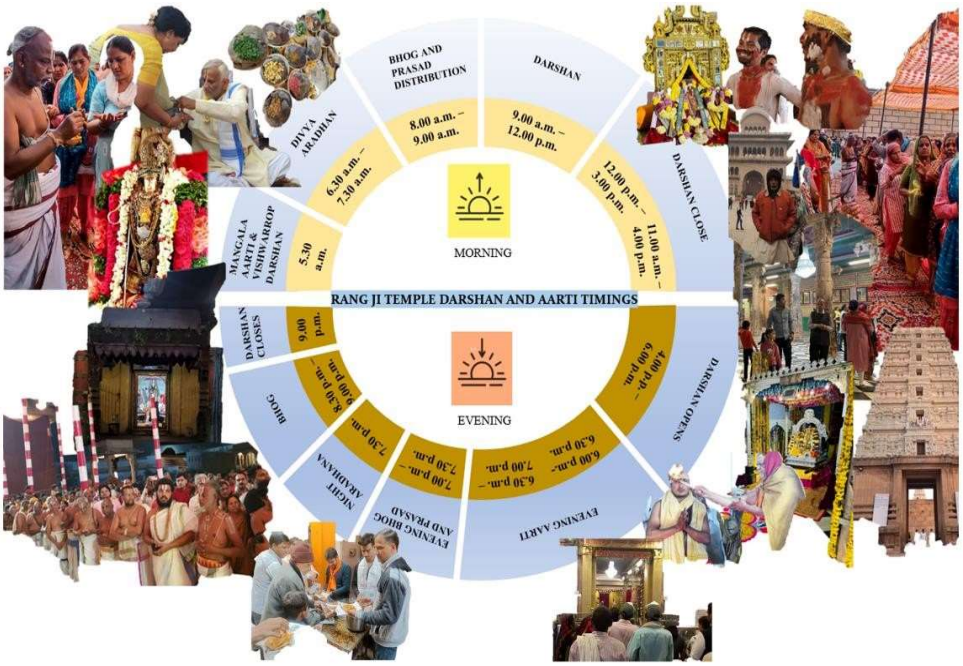


Figure 39. *Rangji temple Rituals schedule*

It can be concluded that the festivals of both North India as well as South India are celebrated in context of Rangji temple. Different parts of the temples are involved during different festivals. Some celebrations are specific to life and legends of Lord Krishna, reinforcing his presence and attachment enlivening the place.

5. Discussion and Conclusion

Comparative Analysis of prominent Temples of Vrindavan

Feature	Madan Mohan Temple	Radha Raman Temple	Govind Dev ji Temple	Sri Rangnathji Temple
Introduction	It one of the oldest temples of Vrindavan with 50ft tall shikhara	It is one of the oldest Haveli temples of Vrindavan which enshrine deity manifest from black stone	The temple is built in sandstone to intricate carvings	It is one the largest temples of Vrindavan dedicated to lord Vishnu and Lakshmi
Location	Located on small hill in Vrindavan , offering scenic view of Yamuna river	Near Keshi Ghat in Vrindavan	Located in Raman reiti , Vridavan	Near Nidhivan and Vishram Ghat,Vrindavan
Deity	Madan Mohan (Lord Krishna)	Radha Raman (Lord Krishna) Self-manifested (Swayambhu) Shaligram form of Krishna	Govind Dev ji (Lord Krishna)	Lord Vishnu and Lakshmi
Built By and period	Kapur Ram das in 16th Century	Gopal Bhatt Goswami in 16th Century	Raja Man Singh in 1590	Seth Govind Dasji in 1851
Material	Red sandstone sourced from Rajasthan	Red sandstone, bricks and lime mortar	Red sandstone sourced from Rajasthan	Sandstone and white marble sourced from Rajasthan, Granite, Bricks and lime plaster
Structure and Planning	50ft tall shikhara, Axial planning	Haveli style planning with courtyards and flat roof	Axial planning with imposing sandstone structure	Concentric planning, tall walls and gopurams
Architectural Style	Nagara style	North Indian style with Rajasthani influence	Blend of Rajput and Mughal architectural styles	Blend of Dravidian and Rajputana style of architecture
Unique Features	Tallest shikhara, temple located near Yamuna River	Haveli style architecture with central courtyard	Grand structure in sandstone	Only Vishnu temple of Vrindavan, Amalgamation of North Indian and South Indian Influence

Each of these Hindu temples reflect distinctive architectural sytels and historical influences.

Each temple embodies a distinct spiritual and architectural legacy showcasing the diverse ways in which hindu temple architecture evolved across different regions.

Unlike the typical planning of towns in South India where temple is central in position, in case of Vrindavan, the Rangji temple stands at the edge of the settlement, but bounded by the Parikrama route.

The temple occupies like South Indian temple a huge piece of land. Rangji has concentric pattern, with layers of enclosure reminiscent of south Indian style. Instead of 4 gopurams and 4 entrances, there are 2 gopurams and 2 entrances. The gopurams are the tallest feature of the temple complex. There is presence of Kund, typical of South Indian temples, which is used for ritualistic purposes. Distinctly, there is also a Chota Bagicha which is a North Indian influence, where gardens are present in geometrical pattern within the enclosure.

Temple displays strong axial planning, with predominant one axis only. There is Dwaja stambha and Nritya Mandapa which is also a typical South Indian temple feature.

The entrance gates on Eastern and Western sides typical shows Rajasthani influence with predominant roof profile – the Chatri at the top and centre of the gate. The arches are typically north Indian in style.

The festivals are both borrowed from North as well as South India. Typical Rath Yatra where the God sits in the chariot an Circumambulates the temple is typical of South Indian temple tradition, However the God is also taken to Bada Bagicha on the 10^{th} day seems to be a diversion from the tradition.

The garden is based on Charbagh garden planning to some extent, it houses flowering trees and fruit orchard, the flowers are offered to the deity daily.

In conclusion, Vrindavan is one of the most popular temple towns of India attracting a large number of tourists and pilgrims every year. Vrindavan's architectural landscape display varying traditional Indian styles in temples. The Rangji temple in a very interesting way, demonstrates a rich and rare blend of temple styles – predominantly **Dravidian (South Indian)** with North Indian and **Rajasthani features in its architecture, landscape and festival celebrations. It demonstrates a confluence of architectural traditions and is therefore a unique example of design hybridity** in its architecture, landscape and festival celebrations.

Place experience involves ritual enactments involving the visual and the haptic senses (Sinha, 2014), hence all elements involved in creating the place experience, building place identities are central to development. It is important in conservation and development to protect the distinctive features of both the styles of architecture as according to Kamalapurkar (2018), the tangible and intangible values of architecture and landscape are significant to all – the Pilgrims, Tourists and Locals alike.

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Cultural landscape, Art forms, and their relevance to a Sustainable economy: A focus on Karuppur Kalamkari painting

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Abstract: *Cultural landscapes encompass not only the physical spaces we inhabit but also the heritage, traditions, and art forms that shape our identity and way of life. Exploring the relationship between cultural landscapes and art forms reveals that these traditions are central to cultural identity and play a key role in building a sustainable economy. Nurtured traditional art forms contribute to economic sustainability in several ways: (a) providing employment for artisans, (b) promoting local tourism, (c) preserving traditional craftsmanship, and (d) empowering communities. These contributions generate long-term economic and social benefits, supporting environmentally responsible and culturally mindful development. Protecting traditional art forms is not just about preserving the past but creating pathways for a sustainable, culturally rich future. This paper explores how cultural landscapes and art forms contribute to a sustainable economy, focusing on Karuppur Kalamkari painting as a case study. Known for its intricate designs and use of natural dyes, this art form reflects the cultural landscape of Tamil Nadu's Cauvery Delta Region. It embodies values, stories, and skills passed down through generations, closely tied to the region's religious and cultural life. The decline of this art form signifies not only a loss of aesthetic beauty but also a disruption of vital connections to the region's heritage. This research will provide actionable insights for stakeholders—artisans, policymakers, and business leaders—to sustain Karuppur Kalamkari as both cultural heritage and an economically viable art form through mapping and documentation. The findings will help develop strategies to preserve other important art forms in the region for the future.*

Keywords: Cultural landscapes, art forms, sustainable economy, cultural identity, heritage



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1.Introduction:

நீர்விரியும் காவிரியால் பயிர்வளரும்

பயிர் செழிப்பு காரணமாய் பசி அழியும்

பசி ஒழிந்த பின்னாலே மனம் விரியும்

விரிந்த மனக் கற்பனையால் கலை செழிக்கும்[1]

கவிஞர் நந்தலாலா

The **Cauvery Delta region of Tamilnadu** is one of India's most culturally and historically rich landscapes**.** This fertile land, referred to as the **Marutham**[2] **landscape** in Sangam literature**,** represents a **continuing cultural landscape,** reflecting centuries of harmonious interaction between human societies and their environment. Known as the "Granary of South India," the delta is celebrated not only for its agricultural prosperity but also as a cradle of Tamil cultural, artistic, and religious traditions.

Thanjavur, the adorned capital of the Cholas, stands as one of the most historically significant cities in Tamil Nadu, located within this **region.** The Cholas, who ruled from the 9th to 13th centuries CE, transformed Thanjavur into a flourishing center of political, cultural, and artistic renaissance. Their patronage fostered the development of monumental temple architecture, classical dance, music, and timeless art forms such as Karuppur Kalamkari, a traditional textile art central to the region's artistic heritage.

The Marutham landscape illustrates the interconnectedness of agriculture, religion, and trade, which shaped the region's economic and culture. This interaction has sustained artisanal practices like Kalamkari, blending tradition with modern needs to create a sustainable economy. Karuppur Kalamkari, known for its natural dyes and hand-painting techniques, showcases eco-conscious art rooted in ecological harmony.

By focusing on the Karuppur Kalamkari painting, we explore the broader theme of cultural landscapes and their relevance to a sustainable economy. This study emphasizes how traditional art forms, grounded in local ecosystems and cultural contexts, can promote sustainable development while preserving regional identity and heritage.

[1] Cauvery flows, Crops flourish; Thriving crops vanishes hunger; Mind Broadens, Art Flourishes. -Poet Nandalala

[2] Tamil Sangam literature mentions five distinct geographical landscapes: Neithal, Kurinji, Marutham, Mullai, and Paalai. Each represents the relationship between the environment and the lives of the people. Marutham is classified as the riverine ecozone.

2. The Varied Art Forms of the Region:

"Craft has always been a basic activity in human society; in fact, it is considered more cohesive and permeating in human relationships than even language, for it can penetrate the normal barriers to communication. Particularly has this been true of the older societies such as those in Asia, South and Central America, Africa where certain aspects of the ancient handed down cultures still continue to produce powerful impressions that are almost ageless." (Chattopadhyay, 1980)



Figure 1. *Map depicting the distribution of art forms across the Thanjavur Region*

(Source: Author)

This Cauvery delta region is a repository of both tangible and intangible cultural heritage. Its rich history and deep-rooted artistic traditions have given rise to a variety of art forms and crafts, each with distinct characteristics.

Its tangible art forms include the iconic **Thanjavur Painting,** which emerged in the 16th century and is celebrated for its intricate designs, vibrant colors, and surface richness. The **Thanjavur Dancing Dolls** (Thalayatti Bommai) are designed to sway their heads rhythmically, mimicking the graceful movements of dancers. The **Natchiyarkoil Lamps**, crafted in brass or copper, are intricately linked to temple traditions, while **Swamimalai Bronze Sculptures** exemplify ancient bronze-casting techniques through their detailed depictions of deities and idols. Similarly, the Thanjavur **Veenai**[3]**,** a revered South Indian string instrument, reflects the region's expertise in both acoustics and artistic design.

Complementing these tangible forms are the region's intangible heritage, including **Bharatanatyam,** one of the oldest classical dance forms; **Carnatic Music,** with its complex melodies and legacy of renowned musicians and composers; and temple rituals, where music, dance, and spirituality converge. Together, these art forms preserve and celebrate the region's vibrant cultural identity, connecting its rich past to the present.

3. Art as an economic catalyst

The Delta region's combination of occupational diversification and cultural richness fosters a dynamic local economy. Diversified job opportunities not only strengthen economic stability but also nurture creativity. Traditional art forms like Thanjavur plates and bronze sculptures transcend their cultural roots to become globally valued commodities, boosting exports and driving economic growth.

This blend of culture and economy forms a unique synergy, where the artistic heritage of the region not only serves as a cultural asset but also as a catalyst for economic vitality. Expanding local markets to global audiences through e-commerce is crucial for broadening the reach of these traditional crafts. Training in digital marketing, online sales, and logistics will empower artisans to connect with global buyers effectively.

Cultural tourism further accelerates economic growth by attracting scholars, artists, and visitors. This influx fosters cultural exchange and creates secondary employment opportunities. It benefits local businesses, service providers, and the hospitality sector, generating a ripple effect across the economy.

The convergence of culture, commerce, and tourism forms a thriving ecosystem where each element enhances the other. Promoting local arts on digital platforms and

[3] Veenai – South Indian string instrument

investing in skill-building initiatives will ensure sustainable economic growth while preserving the region's rich cultural heritage for future generations.

4. Karupur Kalamkari: Cultural and Economic significance

Karuppur Kalamkari, originating from Karuppur village in Tanjore, which lies on the bank of River Kollidam a tributary of River Cauvery, is a unique art form deeply connected to the region's temples, culture, heritage, and textile crafts. This artform Known for intricate designs and natural dyes, reflects rich tradition of this region.

4.1. Temple and Royal Heritage

4.1.1. Religious Significance

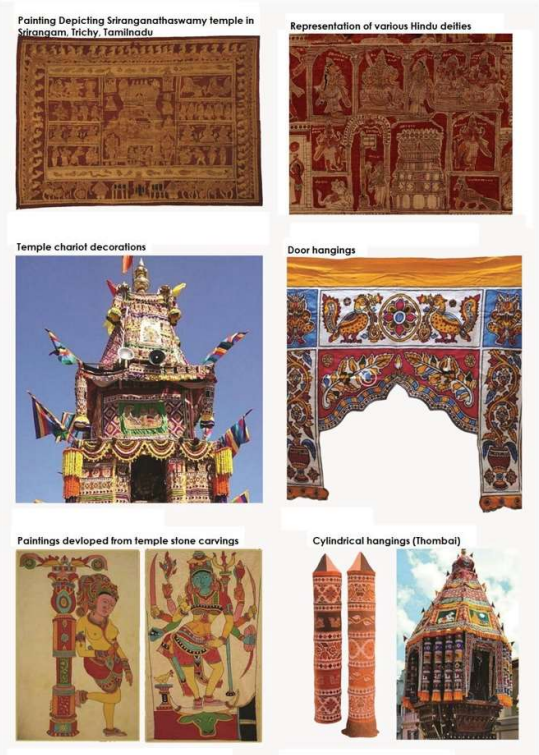


Figure 2. *Karuppur Kalamkari paintigs used in religious rituals and festivals*

Source: (yatri, 2019), (Varadarajan, 1982), (Dallapiccola, 2015), (E, 2016)

As per *Geographical Indications Journal* No. 131, Karuppur Kalamkari art uses traditional hand-painted techniques using natural dyes. These patterned cloths, depicting scenes from from Hindu epics like the Ramayana and Mahabharata,were used in temple rituals - ceiling cloths, umbrella covers, cylindrical hangings (thombai), and chariot covers.. Surrounded by temples and Mutts, Sickalnayakkanpet used these paintings in rituals and festivals, making them integral to Tamil temple culture.

4.1.2. Royal Patronage

Kalamkari designs evolved under the patronage of Nayak Period which ruled over the region during l6th - l7th Century. The wall hangings of the Nayak period depict processions and religious themes with highly stylized figures. They were in great demand during early 17th century (G. O. I, 2020). The noble class used these painted fabrics as garments such as sarees and dhotis, and their production was encouraged within the palace and temple complexes.

4.2. Artistic and Aesthetic value

4.2.1. Complex Craftsmanship

As artist Lakshmi Narayanan mentioned, the art involves a 23-step complex process to produce a finished product. The steps include the preparation of brushes, paints, and fabric, as well as dyeing, starching, washing, and drying. He further added, as noted by Sethi and Han (2022), that completing a single artwork takes approximately 45 days and requires skilled artisans with deep knowledge of traditional techniques. The detailed documentation of the process is illustrated in the following figure.

4.2.2. Distinct style

Karuppur Kalamkari painting is unique for its techniques, which resemble Tamil Nadu's stone and wood carvings. It exclusively uses hand painting to create intricate motifs and is deeply influenced by regional traditions, with designs resembling those found in Kumbakonam applique. This art form highlights the rich cultural heritage of the region, as noted in *GI Journal* No. 131.

4.3. Cultural Identity and Preservation

4.3.1. Link to Tamil tradition

Tamil Nadu temples are central to cultural and religious life, hosting numerous festivals like Panguni Uthiram[4] that require decorative fabrics and paintings. Karuppur Kalamkari, depicting deities and mythological stories, is valued for decorating ceremonial spaces and chariots. As Gite (2023) notes, this sacred art reflects local customs and aligns with Tamil Nadu's storytelling tradition, visually narrating epics like the Ramayana, Mahabharata, and local legends.

[4] In Tamil Nadu, Panguni Uthiram is celebrated as a Hindu festival during the full moon in the Tamil month of Panguni, which falls between mid-March and mid-April. On this auspicious day, many divine marriages are commemorated, including those of Parvati and Shiva, Murugan (Karthikeya) and Deivanai, Andal and Rangamannar, and Sita and Rama. It is a ten-day festival in most temples, with the divine marriage taking place on the final day.

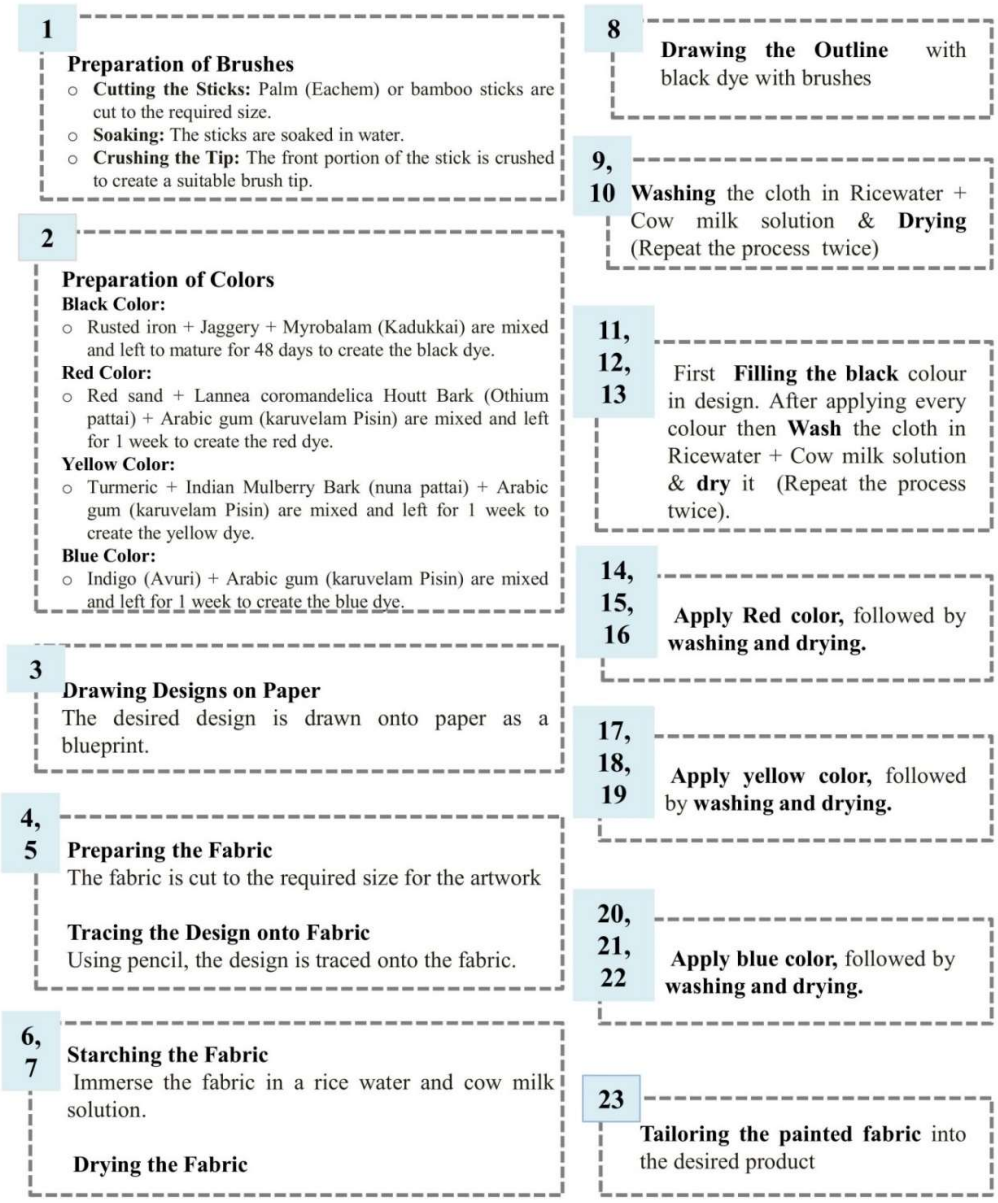


Figure 3. *23 Steps in the making of Karuppur Kalamkari as practiced today mentioned by artist Lakshmi Narayanan* (Source: Author)

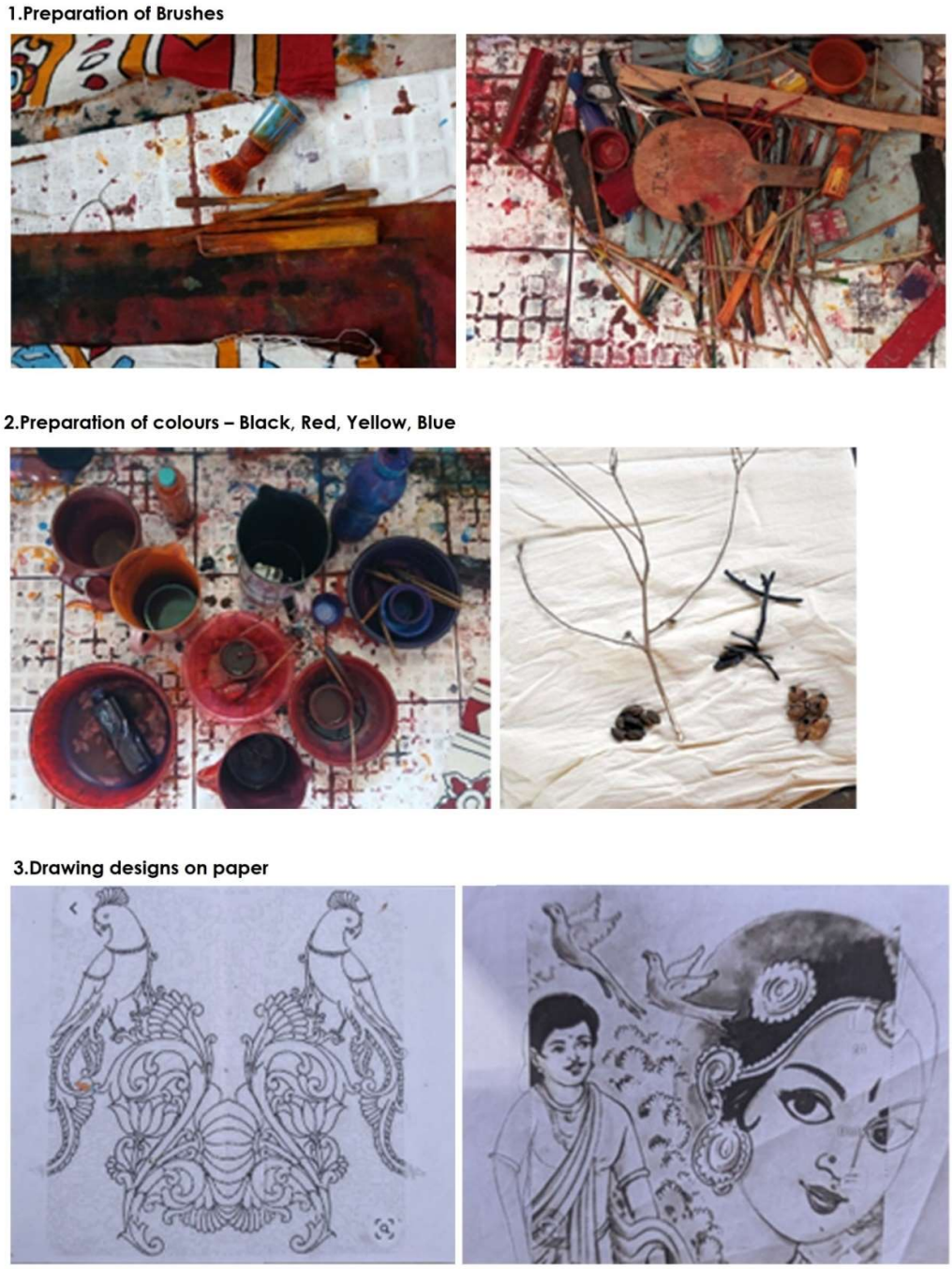


Figure 4. *Karuppur Kalamkari making process: steps 1-3*

(Source: Author)



Figure 5. *Karuppur Kalamkari making process: steps 4-7*

(Source: Author)

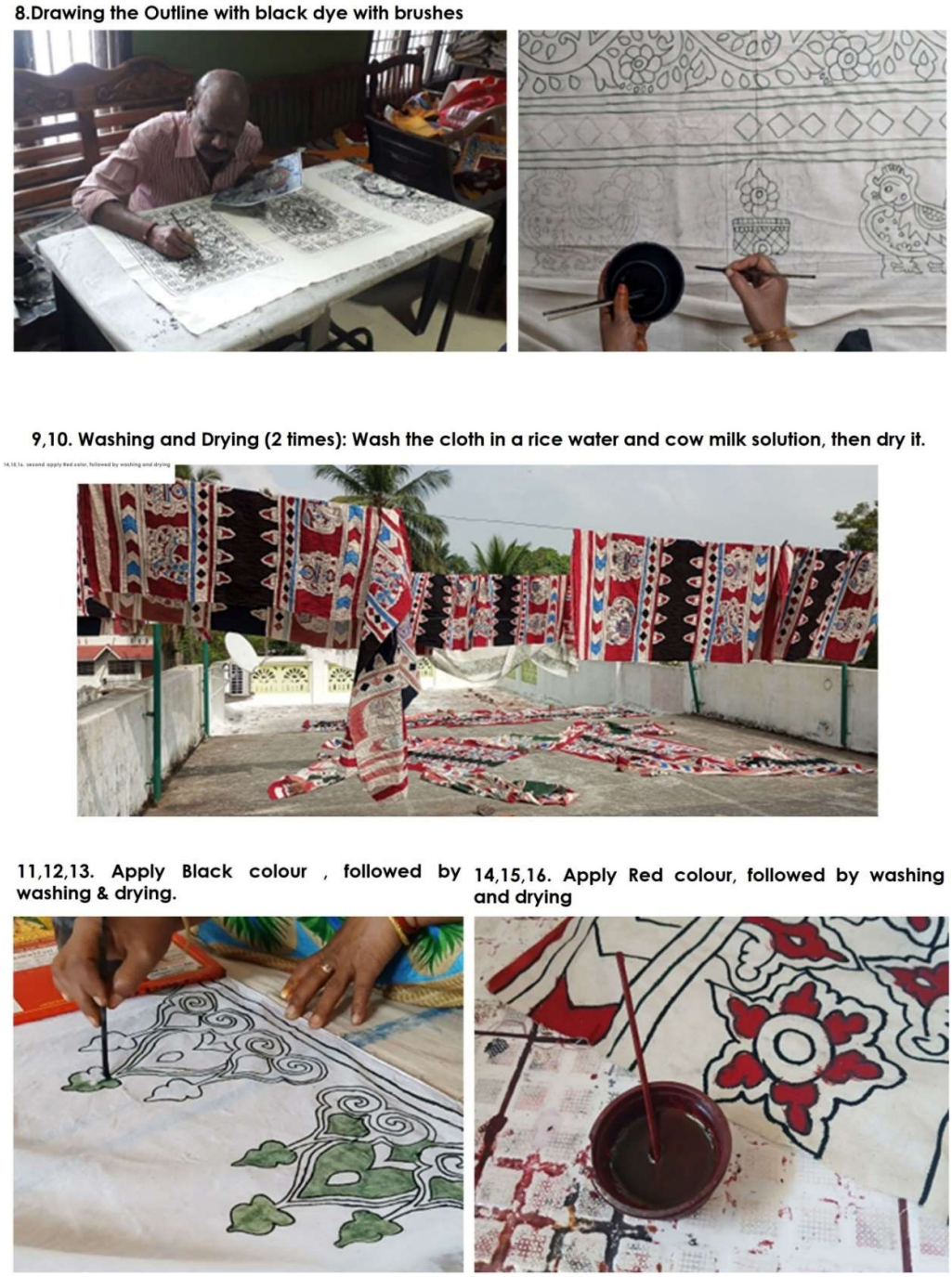


Figure 6. *Karuppur Kalamkari making process: steps 8-16*

(Source: Author)

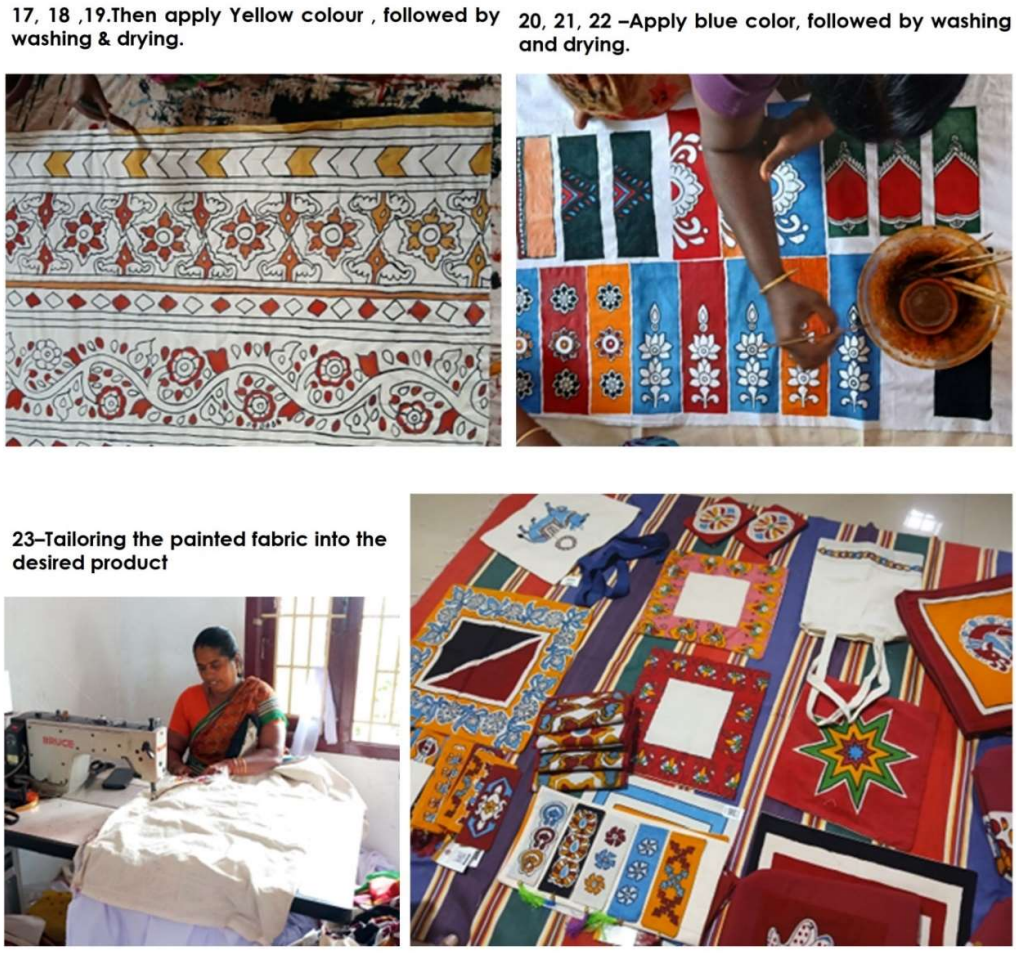


Figure 7. *Karuppur Kalamkari making process: steps 17-23*

(Source: Author)

4.3.2. Cultural Revival and GI tag

Recognizing the cultural and historical significance of Karuppur Kalamkari, the Tamil Nadu Handicrafts Development Corporation (Poompuhar) applied for and secured a Geographical Indication (GI) tag for the art form in October 2021. This recognition not only protects the art's cultural identity but also prevents imitation; ensuring artisans receive due credit and fair compensation for their work. The GI status has elevated Karuppur Kalamkari on national and international platforms, attracting the attention of craft enthusiasts and preserving its legacy. It also strengthens the local economy by empowering artisans, promoting sustainable practices, and preserving the art's deep connection to the region's heritage.

4.4. Environmental sustainability: Use of Natural Resources

Karuppur Kalamkari uses natural materials like palm, tamarind, or bamboo brushes and dyes from jaggery, myrobalam (kadukkai), Lannea coromandelica bark (othium pattai), Arabic gum (karuvelam pisin), red sand, turmeric, Indian mulberry bark (nuna pattai), and indigo (avuri). Starching is done with cow's milk and rice water. While traditional gada cloth is replaced by Mangalagiri cotton, tussar silk, and pure cotton, washing in running water- in nearby river, Lower anaicut (Anaikarai) or motorpumps- is key to reventing colour spread, as noted by artist Lakshmi Narayanan. This art preserves Tamil Nadu's heritage and ecological legacy through traditional methods.

4.5. Cultural and Economic Impact

Traditional crafts like Karuppur kalamkari sustain local economies, especially in rural areas where provide livelihoods. Its decline leads to the loss of income for artisans and disrupts the local economy, affecting production, sales, and tourism linked to these crafts. The loss of Karuppur kalamkari is more than a visual tradition. It reflects a disconnection from the region's cultural, economic, and ecological heritage. Preserving this art form is crucial for maintaining a connection to a way of life that has shaped the community for centuries.

5. Present Scenario of Karuppur Kalamkari Artists: Insights from Semi-Structured Interviews

5.1. Overview

Semi-structured interviews were conducted in person with all the mentioned artists, except E. Rajmohan, who was interviewed by phone. These interviews explored insights from prominent Karuppur Kalamkari artists about challenges, efforts, and opportunities to preserve this traditional art form.

I had the privilege of interviewing Lakshmi Narayanan, a 46-year-old artist with 35 years of experience, who represents a family with a 400-year legacy in Karuppur Kalamkari. His lineage includes award-winning artisans such as his grandfather, Radhakrishnan Naidu (National Award, 1975), his father, R. Krishnamoorthy (State Award, Living Craft Treasure Award), and his uncle, R. Emberumal (National Award, 2002 & Shilpaguru, 2005). Lakshmi Narayanan, alongside E. Rajamohan and Prabhakaran, leads the last family actively practicing this craft in Sickalnayakkanpet, supported by 15–30 artisans.

5.2. Key Insights from the Interviews

5.2.1. Challenges Faced by Senior Artists

1. **K. Lakshmi Narayanan (46 years):**

Strictly follows traditional techniques using natural dyes but faces declining demand due to cheaper imitations and limited financial returns.

Market Challenges: Many temples and institutions prefer machine-made products, undermining the cultural significance of handmade Kalamkari.

Preservation Issues: Historic designs, some 300–800 years old, lack proper documentation and restoration.

Recognition Gap: Despite the 2021 GI tag, the craft is overshadowed by unrelated forms like Thanjavur paintings.

2. E. Rajamohan (48 years)

Concerned about the younger generation's reluctance to invest 2–4 years to learn the craft.

Produces smaller works (20 feet vs. his grandfather's 80 feet) due to reduced demand and lack of financial support.

3. Prabhakaran (60 years):

Highlighted the climate challenges, noting that natural dye production is only viable from February to July.

4. R. Krishnamoorthy (75 years):

Retired due to health issues but continues to guide and share expertise.

5.2. 2.Training and Skill Development

Lakshmi Narayanan conducts **Comprehensive Skill Upgradation Programs**, sponsored by the Ministry of Textiles and the Tamil Nadu Handicrafts Development Corporation, training 30 individuals annually for 2 to 5 months.

Notable Trainees:

- **Akila (38 years):** Transitioned from a 15-day workshop participant to a skilled artisan, earning ₹300/day.
- **Varsha (24 years):** Progressed from a trainee to a full-time employee, contributing to ongoing orders year-round.
- **Kamatchi (36 years):** Now a regular employee specializing as a tailor and painter.
- **Meeradevi (36 years):** Converts chief artist designs into fabric-ready patterns

5.2.3. Documentation and Preservation Efforts

Rajamohan's family has lost over 1,000 historic designs due to poor preservation.

The absence of formal training centers and residential facilities is a major barrier to attracting and retaining new learners.

5.2.4. Modernization and Adaptation

Artists are blending traditional techniques with modern utility products like sarees, dupattas, bags, bookmarks, and placemats to appeal to contemporary tastes.

5.2.5. Challenges in Recognition and Financial Support

Vaishali (Communication Engineer): Documenting Lakshmi Narayanan's work for the All-India Artisans and Craftworkers Welfare Association (AIACA), Vaishali highlighted the logistical challenges faced by researchers and artisans, suggesting the establishment of a dedicated training center with residential facilities to sustain the craft.



Figure 8. *Women undergoing training in a comprehensive skill development program at the artist's residence* (Source: Author)

6. Case Studies:

Before developing recommendations based on the interview insights, literature case studies from various parts of India were conducted. This analysis explored how different institutions and organizations operate and the measures they have implemented to revive traditional art forms, foster regional economies, and safeguard cultural heritage.

TABLE 1. *A COMPARATIVE ANALYSIS OF FOCUS AND OPERATIONALIZATION*

CASE STUDIES	**LLDC CRAFT MUSEUM (**The Living and Learning Design Centre), **AJRAKHPUR, KUTCH, GUJARAT**	**RAGHURAJPUR VILLAGE, PURI, ODISHA**	**KHAMIR CRAFT RESOURCE CENTRE, BHUJ, GUJARAT**	**KOCHI-MUZIRIS BIENNALE, KOCHI, KERALA**	**GANGA MAKI DESIGN STUDIO, BHOGPUR, UTTARAKHAND**
PRIMARY FOCUS	Aims to preserve Kutch's craft heritage and ensure sustainable livelihoods for artisans.	Raghurajpur, known as the "Heritage Crafts Village," revives Odisha's traditional arts like Pattachitra and Gotipua dance.	Focuses on revitalizing Kutch's crafts, promoting sustainability, and empowering artisans.	The Biennale, primarily contemporary, also integrates traditional crafts and folk art.	Combines traditional weaving with modern design to create sustainable textiles.
OPERATIONALIZATION	**Skill Development:** Conducts training and workshops to enhance artisans' skills and introduce contemporary techniques. **Exhibitions and Documentation**: Hosts exhibitions showcasing traditional crafts like Ajrakh, Bandhani, and Rogan art.	**Village as a Craft Hub:** Every household participates in crafting, making the village a living museum. **Training and Apprenticeship:** Elder artisans informally train younger generations	**Craft Resource Hub:** Provides artisans with tools, resources, and materials. **Sustainable Practices:** Promotes eco-friendly practices like natural dyeing and local resources.	**Global Platform:** Showcases crafts alongside contemporary art for global exposure. **Artisan-Artist Collaboration**: Fosters collaboration between local artisans and global artists.	**Artisan Employment:** Provides artisans with steady employment and a dignified livelihood. **Skill Enhancement:** Trains weavers in new techniques while preserving traditions.

OPERATIONALIZATION	**Knowledge Sharing:** Provides a platform for knowledge exchange between artisans, designers, and researchers. **Museum and Archive:** Maintains an archive documenting craft history & technique	**Cultural Tourism:** Attracts tourists and art enthusiasts, providing artisans with direct market access . **Recognition and Support:** Supported by government initiatives and NGOs to promote local crafts.	**Market Linkages:** Helps artisans reach broader markets through exhibitions and online platforms. **Education and Awareness:** Conducts workshops and public programs on crafts	**Workshops and Seminars:** Organizes programs on crafts' relevance to contemporary art. **Cultural Revitalization**: Revives dying crafts through installations and performances.	**Sustainability:** Focuses on natural fibers and dyes for environmentally friendly production. **Design Innovation:** Combines traditional weaving with modern design for wider market appeal
INFERENCES	**Preservation and Revival**: All centers prioritize preserving traditional knowledge and techniques. **Training and Skill Development**: They train artisans to refine skills and adapt to modern markets. **Market Access**: Facilitate direct or digital market connections for artisans **Sustainability**: Many focus on using eco-friendly methods and promoting sustainable livelihoods. **Community Empowerment**: Strengthen artisans' roles as self-reliant contributors to cultural heritage. . These centers show how craft heritage can be preserved, adapted, and support artisan communities.				

7. Strategies and Proposals to preserve the art Form:

- Based on interviews and case studies, the following strategies aim to safeguard Karuppur Kalamkari, preserve its cultural value, and ensure a sustainable livelihood for artisans:

Preserving Heritage and Historical Works

- Establish a dedicated archive similar to LLDC, to document Kalamkari paintings, techniques & History.
- Create a museum for historic artworks, ensuring preservation and accessibility
- Implement initiatives for restoring and conserving existing works.

Improving Marketing and Awareness

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- Organize global art platforms, similar to the Kochi Biennale, to promote Kalamkari.
- Train artisans in branding, patenting, and marketing to protect intellectual property.
- Utilize social media, storytelling, and collaborations to boost visibility.
- Facilitate partnerships between artisans and buyers for large-scale orders.

Integrating Contemporary Design

- Blend traditional techniques with modern designs to appeal to diverse preferences like Ganga Maki studio.
- Promote collaborations between local artisans and global designers.
- Balance modern innovations with authentic production methods.

Policy Advocacy and Government Support

- Educate artisans on existing government schemes and benefits.
- Advocate for tailored policies focusing on financial aid and market access.
- Ensure government initiatives prioritize the craft's sustainability

Access to Resources and Digital Platforms

- Establish resource hubs like Khamir Craft Resource Center to provide tools, materials, and workspaces.
- Train artisans to effectively use e-commerce platforms and digital tools to expand their customer base.
- Create an online marketplace to reduce reliance on middlemen.

Enhancing Sales and Distribution

- Facilitate direct access to online sales platforms for broader reach.
- Empower artisans with digital marketing skills.

Knowledge Sharing and Training

- Establish residential training centers to encourage nationwide participation and ensure the continuity of the craft.
- Develop programs to pass traditional knowledge to younger generations.

Fostering Collaboration

- Build partnerships among artisans, NGOs, craft cooperatives, designers, cultural tourists, curators, and collectors.
- Promote cooperative initiatives to ensure fair practices and mutual benefits.

Promoting Cultural Tourism

- Transform Sickalnayakkanpet into a heritage craft village, inspired by Raghurajpur.
- Develop infrastructure to attract cultural tourists.
- Provide trainees with financial support and training programs for independence.

Ensuring Environmental Sustainability

- Highlight eco-friendly practices like natural dyes and hand-painting.
- Promote sustainable production methods to appeal to conscious consumers.

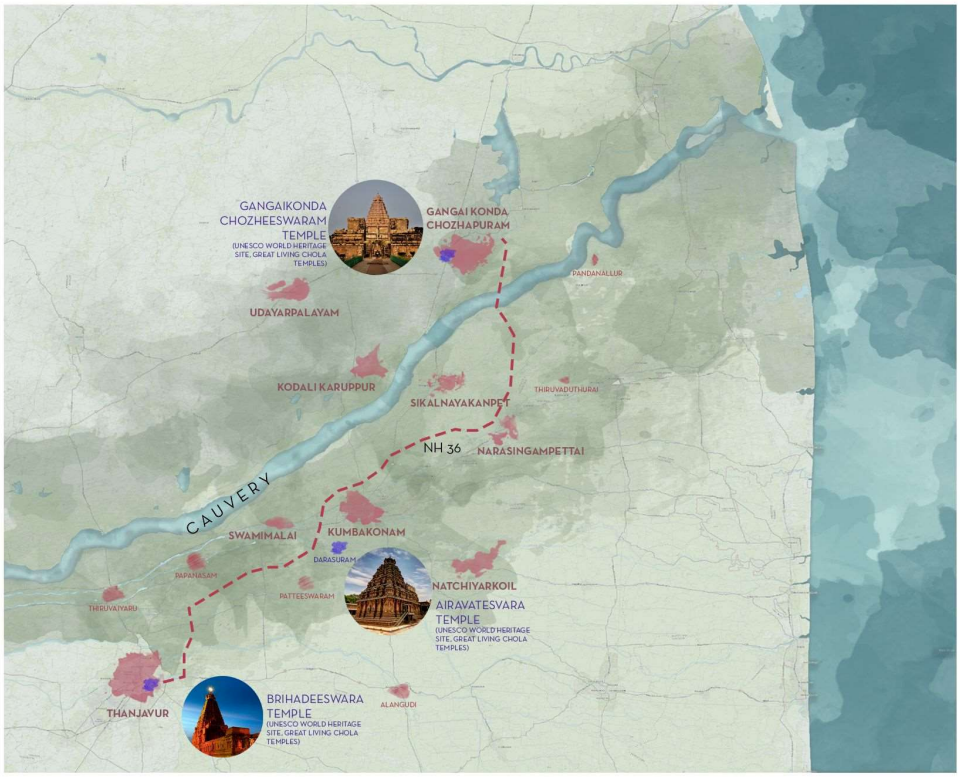


Figure 9. *Map highlighting. Recognition strategic location near*

UNESCO's "Great Living Chola Temples

(Source: Author)

8.Conclusion:

The revival of Karuppur Kalamkari art has a scope to blend tradition and innovation, with the potential to thrive in the modern world. This art form can continue to inspire and connect diverse audiences, contributing to India's cultural heritage while appealing to the global artistic community. A strategic approach integrating cultural preservation, economic empowerment, community engagement, and innovation is essential for the craft's flourishing.

This study highlights Karuppur Kalamkari's rich history, religious significance, and evolving role in contemporary culture. Despite challenges like economic sustainability, market competition, and changing cultural practices, growing interest in revitalizing the craft holds promise. Collaborative efforts involving artisans, NGOs, cultural institutions, and government agencies are vital to ensuring its sustainability.

Effective marketing strategies and financial support empower artisans, creating secure livelihoods. Additionally, digital archiving and promotion enhance global accessibility, preserving these traditions for future generations. By adopting a comprehensive approach, Karuppur Kalamkari can achieve sustained growth while preserving its heritage and cultural essence.

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Kalinjar Fort—A Multilayered Architectural and Cultural Legacy

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Abstract: *This research paper will be focusing on the structure inside the Kalinjar Fort in Bundelkhand region which belong to different time period and was built under different dynasties. Located in the Vindhya Range, this fort was located atop a solitary flat-topped hill. The fort at Kalinjar is a powerful defensive structure that combines the characteristics of a Giri durga (hill fort) and a Vana durga (jungle fort). The fort has multiple historic layers from Neolithic time cave paintings to Bundela Empire's Palaces. 'Spanning over centuries, this fortress was ruled by several political powers such as the Guptas, the Gurjara-Pratiharas, the Chedis, the Chandelas, the Solankis, the Mughals, the Marathas, and the British, and served as a key bastion for each one of them. The fort rose to prominence during the reign of the Chandelas who ruled the region from the 9th to 13th century CE. Kalinjar was the first capital of Chandelas and later they shifted their capital to Khajuraho and built the Great Khajuraho temples which are of greater significance and are in World Heritage Sites. There are various structures inside the Fort, but with time they have lost their identity and forgotten. The research paper will focus on the significance of these structures and the need of conservation and preservation of these structures. Beyond its architectural heritage, Kalinjar holds cultural value. The Neelkanth Temple within its walls resonates with spiritual significance and the mentions in Vedic Literature about the various water bodies present inside the fortification. Kalinjar exemplifies the fusion of architectural prowess with cultural context. It stands as a living testament to the interplay between human creativity and divine reverence. The methodology followed in writing this research paper will include the exploration and documentation the architectural and cultural significance of the structures within Kalinjar Fort, spanning various historical periods and dynasties. Focus on the fort's historical layers, architectural styles, and the need for conservation and preservation. Summarizing the key findings of the research and provide recommendations for future research and conservation efforts.*

Keywords: Culture; Heritage; Defence structure; Historical Layers; Culture and belief

1. Introduction-

Forts constitute some of the most ancient historical structures apart from places of worship. The forts of India have stood witness to significant political events of the country. Forts are hundred and thousand year's old structures which tell the history and stories of their pride and strength, built for protection, power and settlement. We can learn a lot about the architecture and culture from the forts and teach them to the future generation. Understanding the significance of the forts leads us to some unique construction techniques, cultural activities, planning strategies, etc.

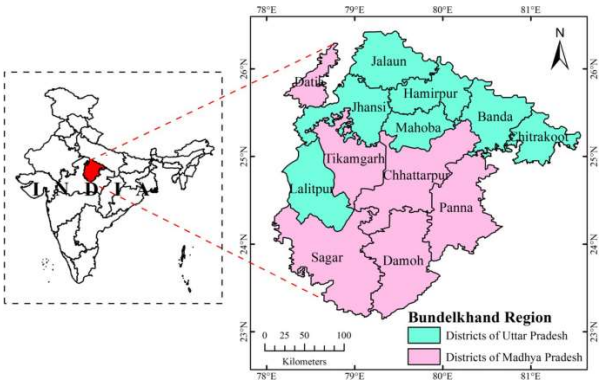


Figure 1- *Map showing Bundelkhand Region*

The Bundelkhand region's Kalinjar Fort, which is located in the Tarahati village, is a significant historical landmark. Located in the Vindhya Range, this fort was located atop a solitary flat-topped hill. The fort at Kalinjar is a powerful defensive structure that combines the characteristics of a giri durga (hill fort) and a vana durga (jungle fort). Etymologically, Kalinjar is a combination of the Sanskrit words "Kaal", meaning time, and "jar", meaning destruction, translating to destroyer of time.

The aim of the research is to highlight the multiple layers of the Kalinjar Fort from different time period and state its significance in recent times.

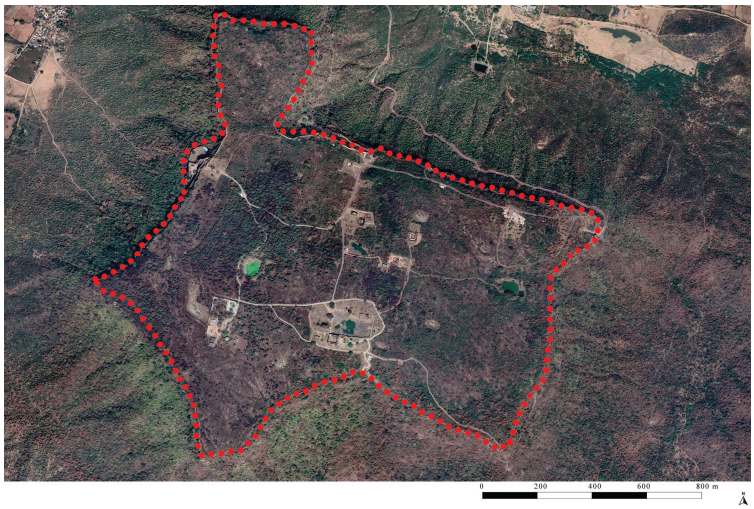


Figure 2 *Map showing fortification of the fort (Source: Google Earth)*

2. Methodology-

The methodology for research involves two main stages: Primary and Secondary Data Collection. Primary data is gathered through site studies, which include surveys, interviews, and oral histories, mapping and documenting features, and developing detailed inventories supported by measured drawings and photos. Secondary data collection encompasses a literature study on forts' history, strategies, and architecture, research on Kalinjar Fort and similar structures, and an analysis of socio-economic impacts and conservation theories. The analysis phase identifies issues, assesses conditions, and evaluates the fort's significance. Lastly, recommendations are formulated based on comprehensive data analysis, offering conservation strategies and sustainable development plans.

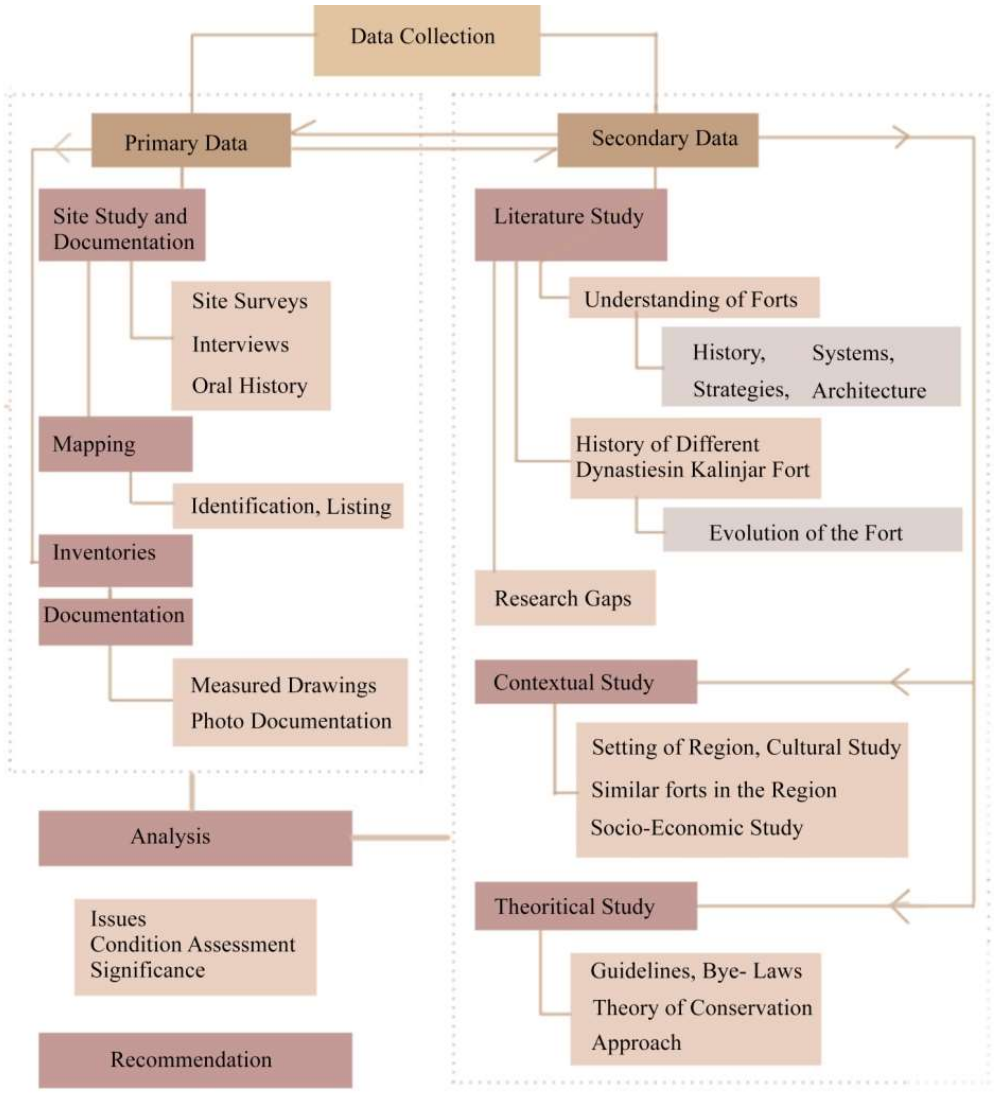


Figure 3 *Flow chart for Methodology*

3. Literature Review

A History of Boondelas (1828) by W.R. Pogson "The book is about the stupendous forts of Kalinjar and Ujee Gurli, the antiquities they contain, and the vestiges of former ages, apparent throughout Boondelkhund(Bundelkhand is refer as Boondelkhund in the book), first prompted enquiry into the history of that province. Detailed history about the Bundelkhand region, about the kings, palaces and forts built by the different rulers, it also mentions the antiquities which were later found at the different places of Bundelkhand. This book also contains some orders by the then Governor General of British council."

–Tour in Bundelkhand and Rewa in 1883-84, Cunningham's Report (Vol. XXI) "This book is a collection of Cunningham's report on his tour in Bundelkhand and Rewa in 1883-84. It covers description of Kalinjar fort, its history focusing on the attacks it

faced. The report also covers the detail of the Inscription that was present in the fort in 1883."

–*Medieval Fort of Kalinjar and its History (2002) by Syed Ali Nadeem Razavi* "This document is about the medieval structures inside the fortification, about the description of the water bodies that were initially there inside the fort and graveyards and mosques which were built during the rule of Islam shah. The document also has description on Neelkanth temple in the fort, in terms of the structure and inscriptions which were found near the temple."

–*Kālañjar: An Important Gupta Art Centre of Bundelkhand (2011) by Dr. Rajendra Verma* "This report is about the Significance of Kalinjar during the Gupta period and finding in the fort during the ASI excavations which belongs to the Gupta period are also mentioned in the report."

–*Religious spots within forts and fort sites: a study in cultural history of Bundelkhand region in India (2015) by Dr. Purushottam Singh* "The document is about the Brief history of Bundelkhand region in terms of it geography and topography in ancient times. There was no fort without religious spots. The religious spots in the forts of Bundelkhand were the center of belief not only for royal families but also become the center of faith and reverence of general people. Therefore these sites have gained unique and peerless fame. The religious sites within the forts played an important role in preserving and recharging the cultural heritage up to the centuries in Bundelkhand. These became the cause of cultural and religious harmony between the royal families and general people."

–*The Nature of Fortifications: Their Conception, Construction and Sustenance (2015) by Nupur Prothi Khanna* "This paper explores the classification of one theme, namely landscapes associated with our military or defense past. These are landscapes represented by defense structures such as 'fortifications (including fortified towns), works of military engineering, and naval battlefields, barracks, military bases, testing fields, and other enclaves and constructions built or used for military and defensive purposes; Landscapes, including battlefields, territorial or coastal defense installations and earth works, ancient or recent' Their intangible associations of victory/defeat, valor and folklore also represent the diversity of nature and culture of India's rich geographical palette and political history. This paper addresses how fortification nominations for World Heritage can incorporate the landscape element and in relevant cases be perceived, projected and protected as Cultural Landscapes."

–*Characteristics of Gajā ntak Shiva and Bhairavi at Kā linjer fort: A study of tantric tradition of Central India (2019) by Dr. Purushottam Singh* "This report is about the significance of the Sculpture of kalbharav in the Neelkanth temple complex. Kalinjar is one of the strongholds controlled by Chandela rulers. Kalinjar has several antiquities with incarnation of Bhairava and Bhairavi on its eastern portion. Bhairava and Bhairavi

incarnation is apex of Chandela art including whole Chandela art of Khajuraho , Mahoba and Kalinjar."

– *Research Paper on Neelkanth Temple at Kāliñjara (2019) by Vijay Kumar* "This report is about the brief description of the fort, Neelkanth temple and its significance in ancient and recent times."

–*Fort Heritage (2021) by Devyani Kumvati* "This is a thesis on fort heritage which covers the history of forts, its significance in terms of architecture, history, construction. Description of 'Hill forts of Rajasthan' and case studies related are documented." This thesis helped in understanding the hill forts and conservation of hill forts.

–*An Enigmatic Figure from K¯ala˜njara by Hans Bakker* "This paper is about the carved into the rocks an image of a figure carrying two buckets on a yoke (vihamgika or `bangy'), but none of whose iconographic details are exactly the same. Two of these images are connected with an inscription, chisseled into the rock, reading: samadhigata-pancamahasabdasamanta-sri-vasantah, `The illustrious Minister Vasanta, who has obtained the five great titles.' It is not clear who this minister Vasanta is and what his connection is with the carrier or with Kalanjara. It may be questioned whether this Vasanta is a historical person."

–*Significance of Kalanjara Fort in The History of Chandellas by Dr. S. K. Sullerey* "This report is about how the whole history of Chandellas has centered round the historic fort of Kalanjara and to a lesser degree, the fort of Ajaigarh. Time and again fortune of the dynasty depended upon the possession of Kalanjara fort. Extraordinary significance of forts in the kingdom of the Chandellas was due to geographical factors of the country which determined the methods of war that were followed in that period.

As per the literature available on the fort, we can state the significance of the structure. The fort's strategic location has made it a significant barrier for invaders aiming towards the south. Kalinjar Fort has also been the subject of archaeological analysis, particularly focusing on its construction over different time period under different dynasties and its role in regional history. Not just the structures built inside the fortification wall play a crucial role in stating its cultural and architectural significance but also the presence of many water bodies, stone carved religious sculptures and pre historic cave paintings. This shows multiple cultural, architectural and archeological layers of the fort.

4. History of Kalinjar Fort

4. 1 Etymology

Kalinjar is a combination of the Sanskrit words "*Kaal*", meaning time, and *"jar*", meaning destruction, translating to destroyer of time

4. 2 Mythology

Kalinjar has its mention in texts from the Puranic period, according to "Padma puran" when Lord Shiva consumed poison during the time of "*Samundra mantha*" he visited this place and defeated time that is how the name Kalinjar came and the temple is known as Neelkanth temple. Later Kalinjar is mentioned in "*Mahabhart*" also as a place of Gods.

'Spanning over centuries, this fortress was ruled by several political powers such as the Guptas, the Gurjara-Pratiharas, the Chedis, the Chandelas, the Solankis, the Mughals, the Marathas, and the British, and served as a key bastion for each one of them. The fort rose to prominence during the reign of the Chandelas who ruled the region from the 9th to 13th century CE. Their kingdom was also called Jejakabhukti.'

4.3 Prehistoric

Archaeological evidence suggests that the area of Kalinjar has been inhabited since prehistoric times. The Palaeolithic and Upper Paleolithic stone tools obtained from the banks of the Bachini river flowing near the fort confirm this fact. Mesolithic period stone tools found from Kalinjar hill are proof of the presence of contemporary humans in this area.



Figure 4 *Cave Paintings present in Kalinjar (Source: JSTOR)*

4.4 Vedic Period

First of all, the mention of Kalinjar comes in the Vedic literature. Probably Kalinjar would have been under the Chedis during the Vedic period. In a donation eulogy of the Rigveda, there is a mention of Chedya' Vasu giving a donation to a sage.5 It appears that the region of Kalinjar was ruled by the Yadavas in Puranic times. By defeating the Chedis, Vasu (the fifth or eighth descendant of King Kuru of (Hasitanapura) annexed

[5] Rigveda, 8.5,39

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the Chedi country to his kingdom for some time and hence came to be known as 'Chethoparichye' (conqueror of the Chedis).

4th century BC In the current Banda district and the Kalinjar area, it must have been controlled from Ujjain, where Ashoka himself was the governor before becoming the king.

In 2nd century BC most part of North India, came under the Shunga dynasty. The regions of Bundelkhand and Malwa, which included the region of Kalinjar, were under the Shungas. After the Shungas, this area remained under the control of Kanva and Mitra rulers. The Mitra rulers were ruling from Kaushambi, under whom the Bundelkhand region also came.6

4. 5 Gupta period

It is known from the inscriptions obtained from Kalinjar fort and the ruins of Gupta period temples and the seal containing the inscription 'Kalanjar Bhattaraksya' obtained from Bhita excavation, that many temples were built here in the Gupta period.7





Figure 5 *Cave and rock carved sculptures belong to Gupta period (Source: Author)*

Figure 6 *Mrigdhara- inscription from Gupta period can be seen on the walls on this structure*

(Source: Author)

4.6 Kalachuris

In about the seventh century, the Kalchuri kings of Tripuri, Vamraj and Lakshmanraj, took over Kalinjar. According to historian Mirashi, the time of Vamraj must have been between 675 ADS to 700 AD.

4.7 Gurjara Pratiharas

It is known from the Varaha inscription of Bhoj I in 636 AD that he had donated in Kalinjar Mandal. The Gurjara Pratihara ruler Nagabhatta-II sat on the throne of

[6] Rajendra Yadav- Kalinjar- Pg. 8
[7] Rajendra Yadav, Kalinjar A Gupta Art Center of Bundelkhand, Pragdhara, Issue 20. Pg. 65-78.

Kannauj in about 800 AD, during whose reign the boundaries of the Pratihara kingdom extended up to Kalinjar.8

4.8 Chandelas

From the earliest times, the traditional legends about the origin of the Chandelas establish their relation with Kalinjar. 'Pratiharas' vassals in the areas around Mahoba, the early Chandela ruler. It is known from traditions and epigraphic evidence that in the first half of 825 AD, a king named Nannuk had laid the foundation of the Chandela dynasty. Chandela power started flourishing as soon as Harsha (905-925 AD) became the king. He strengthened his position by establishing matrimonial relations with many contemporary dynasties such as the Chahamanas of Shakambhari and the Kalachuris of Central India. Harsha's son Yashovarman (925-950 AD) started expanding the boundaries of his kingdom as soon as he sat on the throne. Yashovarman playfully won Kalinjar Giri. In an inscription of V. Samvat 1055 (998 AD), Dhanga (950-1102 AD) is called "Kalanjaradhipati". It is clear from this that Kalinjar had become the main center of strategic importance during the time of Dhanga.

The successor Vidyadhar (AD 1017-1029) killed the pratihara ruler. The major events of his rule are the two invasions of Mahmud Ghazni, its first attack happened in 1019 AD. Mahmud's second attack happened in 1022 AD, it can be said that Mahmud failed to penetrate the Chandela power. After Vidyadhar Kalinjar was under Chandelas for a long time, Paramardidev (1165-1202 AD) one of the successor of Chandelas the most important event of his reign was the invasion of Kalinjar by Prithviraj III (1178-1192 AD), the Chahamana ruler of Delhi.

After that Muhammad Ghori attacked Kalinjar in 1202 AD under the leadership of Qutubuddin. At this time Kalinjar was under the authority of Paramardidev (1165-1202 AD). Although Muslims continued to attack the Chandela areas, but the authority of the Chandelas remained on Kalinjar.

4.9 Afgans

In 1545 AD, Sher Shah Suri attacked Kalinjar. At this time, Kalinjar was under the authority of Chandela ruler Kirat Singh, who faced the Afghans strongly and Sher Shah Suri died in this battle. After the death of Sher Shah, his son Islam Shah (1545-1554 AD) ascended the throne. As soon as he sat on the throne, he ordered Kirat Singh to be killed. Kirat Singh was badly defeated in this war and with this defeat, Kalinjar went out of the hands of the Chandelas forever.

4.10 Mughals

After the Afghans, Kalinjar was under the rule of Baghel Raja Ramchandra for a short time in 1569 AD. At the same time, Akbar sent a huge Mughal army under the leadership of Majnukhan Kaksal to conquer Kalinjar. After one day's siege, in 1569 AD,

[8] Rajendra Yadav- Kalinjar-Pg. 11

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the Baghel king surrendered and Akbar appointed Majnukhan Kaksal as the fort of Kalinjar. Later, Akbar handed over Kalinjar as a jagir to one of his Navratnas, Raja Birbal. Sayyid Ahmed was the governor of Kalinjar during the time of Shahjahan. After this, Aurangzeb had authority over Kalinjar for some time. The Persian inscription of 1673 AD above the Alam Darwaza, the first entrance of Kalinjar, shows that Muhammad Murad got this door constructed during Aurangzeb's time.

In 1688-89 AD, the Bundelas under the leadership of Chhatrasal attacked Kalinjar fort and besieged it, which lasted for 18 days. In the end, the Bundelas emerged victorious after a fierce battle. Aurangzeb finally made a treaty with him and appointed him a "mansabdar"9 of 4000 in 1705 AD. After Aurangzeb, his son Bahadur Shah (1707-1712 AD) sat on the throne.

4.11 Bundelas

In the early phase of the fourteenth century, a regional power emerged in central India. It is known from the inscription in Sanskrit language of Pratap Rudradeva from Patthar Mahal Mosque, Kalinjar that it was ruled by Pratap Rudradeva, who got a Vishnu temple built in the fort. Historians are of the opinion that Maharaja Chhatrasal was the first Bundel ruler to conquer Kalinjar fort, but Pratap Rudradev's Kalinjar Prashasti shows that many centuries before Maharaja Chhatrasal, Bundel King Dronpal (1251-1259 AD) and Pratap Rudradev (1456 -1531 AD) ruled the area near Kalinjar fort and also built some structures in the nearby areas.

After Chhatrasal became the mansabdar in 1705 he appointed Mandhata Chaubey as the Governor of Kalinjar and also Aman Singh was the minister of Chhatrasal. Chhatrasal had divided his empire into three parts before his death. With this division, Kalinjar became a part of Panna state. Mandhata Chaubey was the governor of Kalinjar during the reign of Hriday Shah, the ruler of Panna (1732-1739 AD). After Hriday Shah, Sabha Singh (1739-1752 AD) and Aman Singh (1752-1757 AD) became the kings. Aman Singh's Dewan Hindupat (1757-1776 AD) captured Kalinjar by killing him on the banks of a pond in Chitrakoot. After Hindupat his son ruled the fort for 8 years and the Chaubey family continued as the governor and treasurer of the fort.

4.12 British

In 1798 Ali Bahadur attacked Kalinjar but Ramkishan made all the efforts of the Nawab unsuccessful. After the death of Nawab Ali Bahadur, its commander Himmat Bahadur Gosai, seeing the critical situation, made a treaty of Bassein with the British in 1802 AD. On January 18, 1812, the British surrounded Kalinjar with a huge army under the leadership of Colonel Martindale. At this time Kalinjar was under the control of Dariav Singh, the grandson of Ramkishan Choubey. Realizing the situation, Dariyav Singh accepted the offer of surrender.

[9] Mansabdar-Military generals, of thea military unit within the administrative system of the Mughal Empire introduced by Akbar

According to the terms of the treaty, the Chaubey family received a jagir with an annual revenue of Rs 75,000. After this, Kalinjar district became a part of Banda and the British made it their military cantonment. In 1835 AD, the British formed the North Western Region, in which the district Banda and the unconquered fort of Kalinjar were included. After that Kalinjar remained under the authority of the British till independence.

Therefore, in short, it can be said that Kalinjar was a region under the Chedi kingdom in the Vedic period, which became famous as Jejakbhukti in the early medieval period and as Bundelkhand in the medieval period. Presently Kalinjar is famous as the invincible fort of Bundelkhand region. In view of its historical importance, the Archaeological Survey of India declared it a Centrally Protected Monument in the year 1920 and is continuously striving for its conservation and preservation.10



Figure 7 *Evolution of Fort under Gupta and Chandela dynasties (Source: Author)*

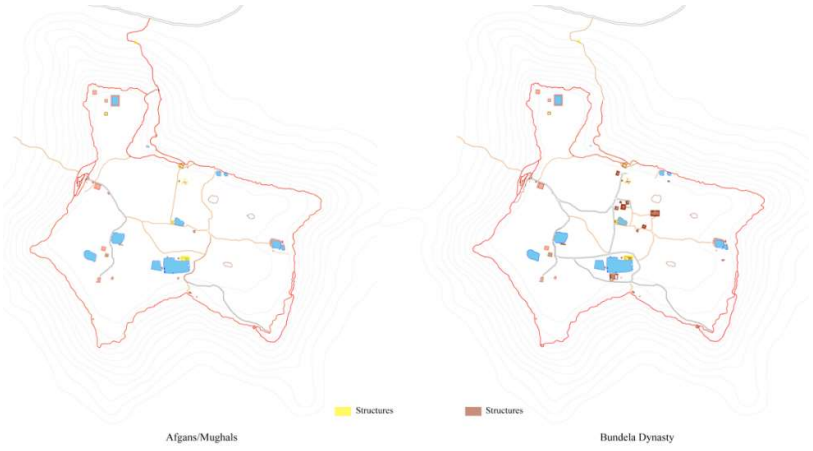


Figure 8 *Evolution of Fort under Afgan and Bundela Dynasties (Source: Author)*

[10] Rajendra Yadav- Kalinjar 2016 Pg. 19

The architectural features of the fort structures reveal various characteristics of Gupta, Chandela, Bundela and Mughal architecture present in the structure. The fort complex includes several temples, mosques, gateways, palaces, water tanks, and tombs.

Archeological Remains

Remains of any plinth or stones places in certain pattern are considered as archeological remains and potential areas for the future excavation. There are various remains of plinths which can be seen in the fort at different spaces. This gave us the evidences of presence of more structures in the fort. The canon mounds can be seen on the northern side of the fort which shows that northern side was the prominent location which was used for attacks.



Figure 9 *L-R Round mounds used to place canons- Near Paramala gate, Stones are places in rectangular form, -near paramal gate (Possibly plinth of a temple), Plinth remains near Amaan Singh Palace (Source: Author)*



Figure10 *L-R In Moti Mahal Complex, Near Medieval Tombs, Near Bada Darwaza inside the fort (Source: Author)*

Water Bodies

There is various water bodies present in Kalinjar fort in various areas inside and outside the fortification wall and these water bodies are believed to be sacred with mentions in Purans and Vedic Literatures. One of the most sacred water bodies is Kothi Tirth, which is also one of the largest water bodies of the fort. It gets the water only from the rain water and which doesn't get dried till the next monsoons. Most of the water bodies present in the fort also get there water from the rain water other than Patal Ganga which probably gets its water from the ground. Buddha Buddhi Talao- according to the legends the water in this pond is medicinal. At present the area in not accessible because of Vegetation growth. Sanichari talao- according to legends taking dip in the pond on Saturday will wash away the sins.



Figure 11 *L-R Kothi Tirth during Monsoons (Source: Kalinjar Kila) -situated on the northern side of Amaan Singh Palace, Kothi Tirth in November (Source: Author)*

There is a continuous water flow in the structure which came from the Kothi Tirth which is situated on the higher level. There is a mythological connection of mrigdhara with a saint.



Figure 12 *L-R Cave 4 Neelkanth Complex, such sculptures related to Lord Shiva are carved on the hill when we come from Paramala gate to Neelkanth temple, Sculpture of Kaal situated South to the Neelkanth Cave on a lower level. (Source: Author)*

There are 7 caves in total in the Neelkanth complex, where cave 1 on the highest level and cave on the lowest. These caves were built by Guptas and some are natural Caves and they added rock carved sculptures. Kaal Bhairav is the largest sculptures which can be seen in the fort, its height is around 7.5m. There is no direct evidence of succession of Guptas over Kalinjar, but it can be consider that Kalinjar was under control of Guptas on the basis of architectural findings from the fort.

5. Conservation theory

Conservation theory deals with the value-based approach for the conservation, maintenance, reuse of heritage without harming its authenticity and integrity. In the value-based approach, the inclusion of material values (tangible) and significant values (intangible) in processes of conservation and heritage is combined with the material scientific requirements of conservation of materials and techniques. A value-based approach to preserving and presenting heritage, focusing on the views and values of the local community and an inclusive approach to the process. As the fort is protected by ASI at present therefore the approach and conservation will be mainly based on the National conservation Policy.

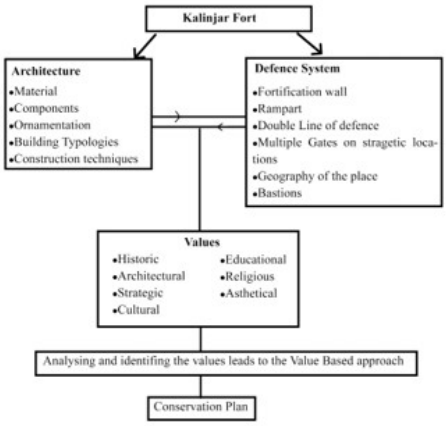


Figure 13 *Flow Chart for Approach*

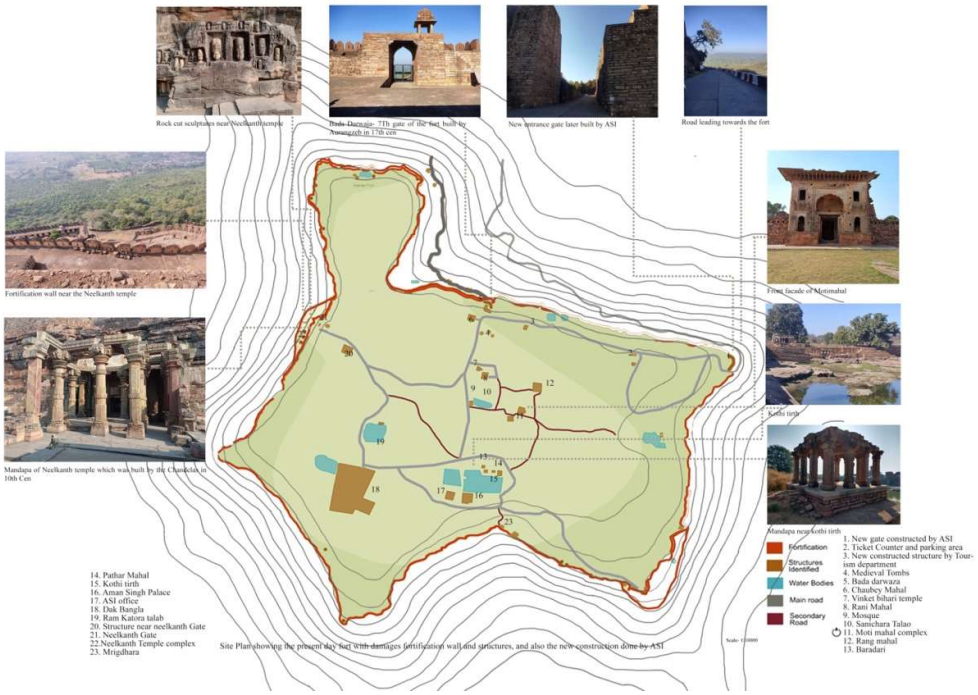


Figure 14 *Site plan showing all the structures inside the fortification*

6. Observations

The fortification wall, though partially damaged in certain areas, remains largely intact. Significant repairs were undertaken by the Archaeological Survey of India (ASI) in 2017, with continuous maintenance efforts for Kothi Tirth. However, rampant vegetation poses a major threat to both the structures and the fort walls. Additionally, vandalism has compromised the integrity of several structures. Despite the rich historical significance of the fort, most tourists primarily visit the Neelkanth temple,

largely due to a lack of awareness about the fort and its diverse structures. The original entrance has been sealed by the ASI, and several gates are now in ruins. Due to negligence and unchecked vegetation growth, many structures and ruins remain inaccessible. The construction of new structures by the Tourism Department lacks harmony with the fort's historical aesthetics. Moreover, the absence of visitor amenities within the fort further diminishes its appeal and accessibility.

6.1 Issues

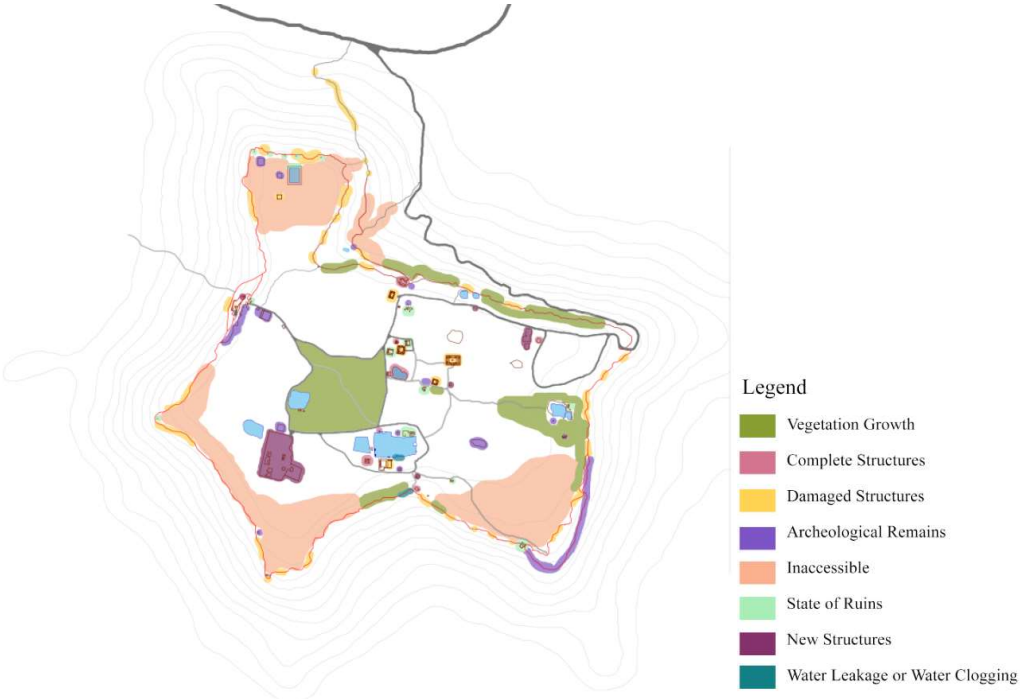


Figure 15 *Site plan showing the issues*

On site level the issues are majorly are because of its geographical location and land type. Connectivity to the fort is a significant issue, as although it is accessible by road from nearby cities, there are no facilities provided for those without personal vehicles, making it challenging to reach the site. Excessive vegetation growth obstructs access to many areas, and the steep terrain near the fortification wall further complicates reaching it. The scattered arrangement of structures across the site, coupled with the absence of a movement plan, results in visitors struggling to locate and view all the structures. Site management is inadequate, with only a few prominent structures receiving proper care. Antiquities are dispersed throughout the site and neglected, which can impact their preservation. Moreover, some structures remain inaccessible due to the lack of proper pathways. During festivals and fairs, crowd management becomes a major issue due to the significant increase in footfall.

7. Conclusions and Way Forward

A fort plays a crucial role in the existence of the empire. Forts are essential for the defense of a region or territory. The Kalinjar fort was constructed for the purpose of defense and safety. The fort was there from Guptas' period but the fortification wall and other defense systems were constructed by Chandelas in 10th century and later other structures were added by different dynasties. The fort was constructed on the flat land available on the hill of 800m from sea level. This heritage fort has vast significance in the Indian history and well known for the attack of Mahmud of Ghazni but he failed to capture the fort and Sher Shah Suri died here in the war. For many years, this fort served as the defense capital of the Chandelas. The fort has greater religious significance because of the presence of Neelkanth Temple and sacred ponds such as Kothi tirth, Sita kund, Patal Ganga because of their mentions in Purans and Mahabharata. The fort has its own ecosystem i.e. presence of water, forest, structures which make it more significant.

Kalinjar Fort's cultural impacts are multifaceted and deeply rooted in Indian history and heritage.

Religious Significance: The fort houses the Neelkanth Temple and sacred water bodies like Kothi Tirth, Sita Kund, and Patal Ganga, which are mentioned in ancient texts such as the Purans and Mahabharata. These religious sites attract pilgrims and contribute to the fort's spiritual importance.

Historical Legacy: The fort has witnessed significant historical events, including the attack by Mahmud of Ghazni and the death of Sher Shah Suri. These events have cemented its place in the annals of Indian history, influencing regional folklore and cultural narratives.

Architectural Heritage: The construction of the fort, with its sophisticated defense mechanisms and strategic location, showcases the architectural ingenuity of ancient Indian builders. The fort's structures provide valuable insights into medieval engineering and design, influencing the study of Indian architecture.

Cultural Identity: Kalinjar Fort is a symbol of regional pride and cultural identity for the local communities. It represents the resilience and strength of the people who defended it and contributed to its upkeep over centuries.

Tourism and Education: As a heritage site, the fort attracts tourists, scholars, and history enthusiasts, promoting cultural tourism and educational opportunities. This influx of visitors helps in preserving the cultural heritage and fostering a deeper understanding of India's rich historical legacy.

Ecological Balance: The fort's unique ecosystem, with its water sources and forests, plays a role in maintaining the ecological balance of the region. This aspect highlights the interconnection between cultural heritage and environmental sustainability.

Overall, Kalinjar Fort stands as a cultural landmark that continues to inspire and educate, reflecting the diverse and rich tapestry of India's historical and cultural heritage.

Acknowledgments: We extend our sincere thanks to everyone who made this paper possible. This would not have been possible without my close association with many people. I take this opportunity to extend my sincere gratitude and appreciation to all those who made research possible. First and foremost, I would like to extend my sincere gratitude to my guide **Prof. Ajay Khare** for his dedicated help, advice, inspiration, encouragement, and continuous support. My special words of thanks also **Dr. Vishakha Kawathekar** and **Ar. Apoorva Pillay,** their continuous support, guidance, cooperation, encouragement, and for facilitating all the requirements.

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TRACK
02



ENVIRONMENT AND LANDSCAPE

Hydromentality of the region of chennai, india: social-ecological insights from an citizens' perspective

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Abstract: *Accessibility to water to all, particularly in dense urban situations is of concern in many countries the world over. Recent literature specifies 'hydropsychological' and 'hydrosocial' dimensions of water related aspects of human living. In this paper, we have approached the 'hydromentality' (which pertains to the water-related administration) of the city of Chennai, India and the implications of this term over a broad spatial and temporal span. This becomes significant in our pursuit of sutainability in terms of urban lifestyles and water consumption. While urban water supply determines indicators of community well-being, the well-being of the ecosystem is an offshoot of several other factors. These include land and water management and inter-disciplinary approaches to real-world situations like climate change effects, water pollution, loss of biodiversity, lack of adequate housing resulting in the urban poor occupying land associated with water bodies. This paper examines the situation in hand, in Chennai, India and offers suggestions and solutions drawing parallels from other cases, based on experience of humanities/ engineering and social sciences experts' literature.*

Keywords: Hydromentality, hydrosocial, hydropsychology, Chennai, Urban water supply, Water resource management.

1. Introduction:

Water is the 'elixir of life', quoting the famous Indian scientist, Sir C.V.Raman Water has nurtured civilizations the world over and sparked off controversies and wars over the years. The Sustainable Development Goals, of the United Nations insist on guaranteeing the right to 'clean water and sanitation' (Paranage & Yang, 2020). Nevertheless, shortage of water is a threatening issue in many countries, as are the issues of commons and uncommoning of land. Later in this article, we will explore the difference in approach of land planners and water managers. Water management is a complex exercise, which explores supply and demand, upstream and downstream conditions, top-down and bottom up (grassroots level) approaches (Linton & Budds, 2014). Water distribution, particularly urban water supply is a no mean engineering feat, and today, experts recommend an integrated approach with respect to water management, one which incorporates sustainability and inter-disciplinarity. The Integrated Water Resource Management (IWRM) approach takes into account, society, economy and environment, as in the pillars of sustainability.

More significant literature on water management typically focused on finding the most effective technical solutions required to distribute the highest quantities of water among populations. This has triggered a number of approaches: the colonial "water infrastructural mindset" that promotes engineering structures which are state-sponsored, for water management (canals, dams, etc.), the "neo-liberal hydro-

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mentality" that first brought private-sector funding to the arena of water management (which is debatable in Indian conditions). Further, concept of integrated water resource management (IWRM) seeks to harmonize water management techniques with broader principles of sustainable development.

While the development of the key concepts and techniques mentioned above has majorly contributed a variety of useful tools to the water manager's arsenal, one can alternatively argue that addressing the best ways of managing water often fails to take into account potentially different philosophies of water management held by different social, geographic and cultural groups (Paranage & Yang, 2020).

In this context, recent and path-breaking literature on water management relates to the 'hydrosocial cycle' by Linton and Budds (Linton & Budds, 2014). To differentiate between the hydrological cycle and the hydrosocial cycle, one must envisage the hydrological cycle as physical and elemental, with water evaporating into clouds and precipitating and percolating, while the hydrosocial cycle comes with a man-made intervention component, wherein, water reaches urban areas by means of pipes, gets released as grey water and goes through recycling processes. Water supply by means of desalination is another demonstration of such a hydrosocial cycle.

The hydrosocial cycle emphasises both the material and sociocultural relations to water and can be used to decipher the different human communities' relationships with water. Linton & Budds present this definition: "Whereas H_2O circulates through the hydrological cycle, water as a resource flow through the hydrosocial cycle, a complex network of pipes, water law, meters, quality standards, garden hoses, consumers, leaking taps as well as rainfall, evaporation and run-off". Thus, the hydrosocial cycle configures water as the product of H_2O and the social circumstances in which it becomes constituted (Goldman & Narayan, 2019; Linton & Budds, 2014).

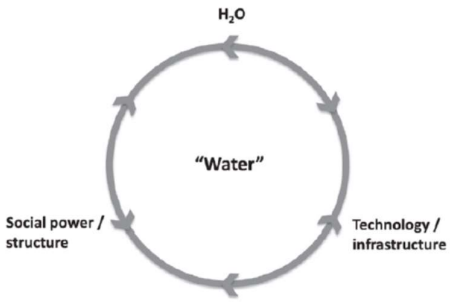


Figure 1: *The hydrosocial cycle*

For instance, the power relations behind dams that store water and generate electricity vary vastly from the worldview of indigenous groups that have entirely different socio-natural relations with water. Also, the politics behind desalinated water which involves seawater, technology, energy and economics is altogether different.

The hydromentality of the region of Chennai is shaped by its relationship with water. Chennai happens to be one of the acutely water-starved cities(Janakarajan, 2013, 2015; Sethuram, 2014b), and its citizens have been subject to droughts in the distant and recent past. As described by Hellberg (Paranage & Yang, 2020), according to the framework of critical geography, scarcity is not a natural or neutral phenomenon, but rather socially constructed within the present social and economic order. However, as it is being 'constructed', water accessibility, or the lack of it, is also inherently 'material'; the availability, distribution and use of water from the crux of the Organisation of the economy, to survival, health and possible lifestyles, and to the processes of the functioning of ecosystems (or not).

Planning and management of shared waters ("shared waters" or "shared basins" refers to both international and intra-national shared basins), and water in general, involves consideration of many different aspects and associated challenges, which are interconnected in complex ways. These include scientific, political, economic, environmental, social, cultural, racial, religious, linguistic and other aspects. The difficulties involved in the planning and management of the Mekong River basin can be attributed to the differences in culture among the countries sharing the basin (China, Myanmar, Thailand, Laos, Cambodia and Vietnam). Religion plays an important role in sharing the Jordan River among Israel, Jordan, Lebanon and Syria. The nature of the Cauvery water dispute in south India and the challenges in dealing with it include a strong linguistic component.

This new and growing research agenda goes to explain how water shapes our social worlds through multiple material engagements and assemblages and highlights how water and water-related infrastructure is often a space that is contested, with different assemblages of actors, discourses and interests seeking to establish particular forms of infrastructure to control water flows in certain ways to achieve predetermined ends.

This discussion serves as a demonstration of the social and socio-cultural associations with water. A study of water landscapes or water-based communities would be incomplete without due acknowledgement of these epistemological theories and ensuing concepts.

2. Study area:

Chennai is the fourth largest metropolitan city in India and the capital of Tamilnadu. The current area of CMA is 5904 sqkm, extending towards the intended 8848 sqkm. The area indicated in Fig. 4a as core city area extended to 176 sq.km as of 2008 and the corporation boundary was increased to 426 sq.km in 2011. The population of Chennai is 10.4 million. The climate of Chennai is tropical and humid, with a heavy downpour in the North-east monsoon in november. The annual precipitation is 128cm / yr. the Chennai basin, as shown in the figure comprises eight river basins and numerous natural and manmade water bodies. The water supply for the metropolitan area of Chennai is

taken care of mainly by five reservoirs, namely, the Poondi, Chembarambakkam, Cholavaram, Red Hills and recently, the fifth, Thervoy Kandigai. According to Naga Kumar, the sources of water for Chennai city include

Table 1: *Water sources of Chennai*

Source	Quantity in MLD
Poondi, Cholavaram, Red Hills Lake System	200
Ground water from Northern Well Fields	100
Southern Coastal Aquifer	5
Krishna Water I Stage	400
Krishna Water II Stage	530
New Veeranam (CWSAP-I)	180
CWSAP-ii (Proposed)	20
Sea Water Desalination	200
Total	1635

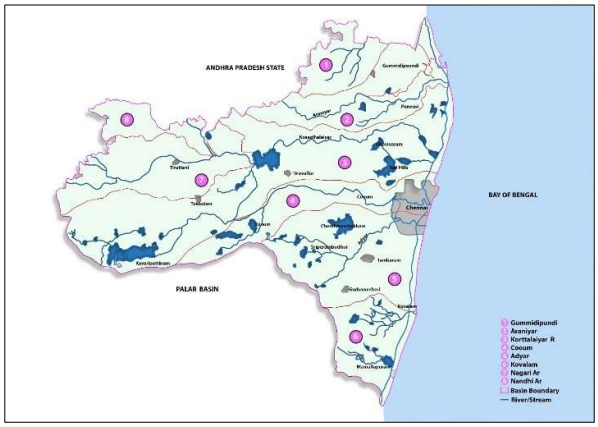


Figure 2: *Sub-basins of Chennai* (Image redrawn by author)

The grey polygon along the coast, in this figure, indicates the erstwhile corporation boundary and many regions were added to the city limits since the 2008 master plan. Hence, the original city of Chennai is located within the Cooum sub-basin in the north and the Adyar sub-basin in the south. The Adyar sub-basin is the drainage basin of the river Adyar which is a major flood moderator of the city. The estuary of the river was known for its sand bars and its endemic vegetation. Other landscapes which are part of this sub-basin include the Chembarambakkam tank, which is one of the reservoirs of the city and its annex, the Porur lake. Other than this, the Pallikaranai wetland which has found its way into the Ramsar list is significant. These regions spurred additional social ecological changes, trends which have impacted the larger landscape and interact with one another in a multi-scalar fashion, both in spatial and temporal scales. The multiscalar interactions have been highlighted in the social ecological approach, a principle advocated by Elinor Ostrom (Nagendra & Ostrom, 2014)

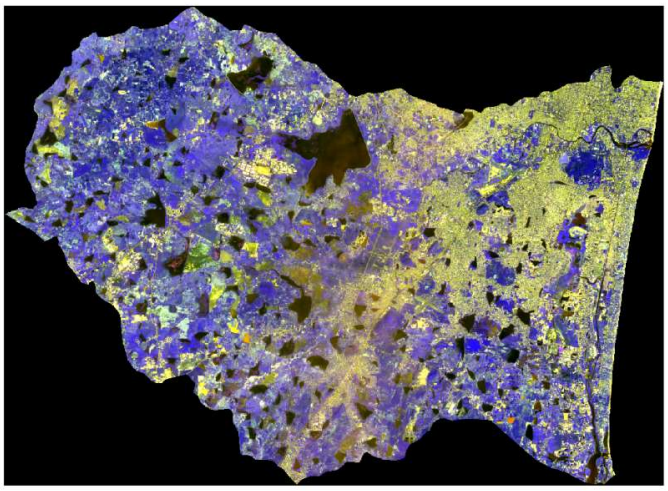


Figure 3 *Landsat 8 Image of Adyar sub-basin, South Chennai Area, January- 2018*
Image Source: USGS Earth Explorer. Processed by Author



Figure 4a: *Chennai city and its suburbs* **4b:** *Relational location of Pallikaranai wetland* **4c:** *Relational location of Porur lake, airport & Chembarambakkam lake.* Source: Author

The satellite image of Adyar sub-basin includes the following three water bodies and associated regions: 1. at the source of the Adyar river, namely Chembarambakkam & Porur lakes 2. Pallikaranai wetland, included in the Pallikaranai drainage basin, which is a southern, coastal landscape and 3. Erstwhile corporation of Chennai, where the erstwhile tanks are converted into settlements. The objective of this work is to examine the hydromentalities associated with each of these geographically distinct areas in order to infer how diverse the individual geographies are an how they interact systemically. This is discussed within the framework of "hydrosocial paradigms", the acting parameters and "control elements" of management of the water body-city nexus.

3. Hydrosocial paradigms characterizing Chennai

The importance of water, as a public good, or as a material contested over, features greatly in sociological studies (Janakarajan, n.d.; Sethuram, 2014). In fact, the social-ecological approach and the modern science of Urban Ecology take root in this body of literature and its demonstrations. In the case of Chennai, various parameters act in the daily activity of water consumption and urban living. Keeping in mind the epistemological theory of hydrosocial relations, we go on to differentiate various

paradigms or worldviews with respect to Chennai's water story. They cover various aspects such as history, climate change, ecology, politics and administration, water policies and management and protection of water as a resource.

3.1. *Historical paradigm*

Examining the history of Chennai, we are able to trace periods of "blight" corresponding to the planned development. In the late 70s and 80s, various housing schemes were under implementation, though coupled with lack of amenities, while droughts prevailed. Water tankers have been supplying water to the city of Chennai since the mentioned period, and lack of precipitation in summers, due to Tamilnadu being on the leeward side during the south west monsoons, is a contributing factor to the 'blight' described above. Lack of water made Chennai a very unpopular city to live in, coupled with the hot and humid weather, and in the late 1990s, and early 2000, the then chief minister is even said to have considered evacuating the city, a capital city to manage the then drought situation. This information was obtained in a talk at a conference which included stakeholders, experts from the academic community, the industry and the government. A particular model of hand-pump, the Mark II, quenched the city's thirst and few planners / engineers began to explore the concept of allowing water to infiltrate into the ground, since Chennai received copious rains from the north-east monsoon (Thomas, n.d.). Thereby, the mandatory rain-water harvesting (RWH) drive was initiated. It was implemented in various parts of the city and its suburbs, including the within erstwhile corporation boundary and suburbs such as Porur, additionally, all over Tamilnadu, and the results were initially found to be satisfactory, with improved groundwater levels. Various NGOs are today exploring the idea of storing water from terraces or in underground sumps, or infiltration wells, and harnessing road-driveway water also in a similar manner.

In this context, we need to examine water bodies, the erstwhile sources of water, mainly for irrigation. Before urbanization took over Chennai, many areas surrounding the city were of agricultural land use and the public harnessed the water for various purposes. The lands occupied by water were termed 'commons' as they did not belong to anyone. This was followed by a practice of encroaching upon the 'commons' also known as 'poramboke', which included the watershed of major and minor 'tanks', and inlet and outlet canals(Maringanti, 2011; Rukkumany & Vedamuthu, 2017). Instances of encroaching on canals, thus choking and depleting the water from its sources were practices of urban development.

The relationship between the previously discussed suburbs or peri-urban areas to the core city region is thus. Due to availability of water in the Chembarambakkam Porur belt, there was population influx into these regions from the 1970-80s onwards. Porur lake also supplies a major portion of the city, namely regions like KK Nagar. As for Pallikaranai, this was a region rich in groundwater and was happened upon after the government policy to promote light industrial activity and encourage the establishment

of multinational companies here. Two events ensued. Population multiplied, a water market took its origins and drinking water plied from these regions in tankers all over the city. Due to extensive urban development these regions also are a witness to inundation, which is discussed in the following section.

3.2. Climate change and climatic events paradigm

Climate change may be a recent concern at this massive scale, but Chennai being a coastal, peninsular city, concerns of seawater rise, cyclones and damage due to disastrous events, urban heat island (UHI) effect are featuring among the threats to the city and its people.

The drought that characterized the city of Chennai has been described. On the other hand, floods in the particular years of the North-east monsoons, have also rocked Chennai. Particularly in 2015, which has been cited by many as a manmade disaster, many low-lying parts of the urban area and susceptible regions, exposed to the water body edges have suffered due to inundation.

This is a concern because, drainage becomes key and loss of life and property are also damaging. The economic loss due to the 2015 flood has been cited as over Rs.15,000 crores impacting 10-15% of the country's production, which was suffered by the industry lobby.

3.3. Demographics and land use paradigm

The population of Chennai has grown from $32.85 \times 10^{5\ pax}$ in 1981 to 10.4×10^{6} pax. The area of the Chennai metropolitan area is projected as 8848 sqkm and the urban area is still growing to this extent. While the urban area engulfs the surrounding rural and urban territory, we need to examine the water basins. The Chennai basin consisting of eight river basins, is shown in the figure. The city of Chennai is primarily in the Cooum and Adyar sub-basins and the presence of these basins forms hydrological territories. In the urban basins, we witness what may be termed as the presence of hydrosocial territories. The rivers flow into the Bay of Bengal, and as a planning unit, the river basins act as hydrological boundaries, irrespective of administrative or other boundaries.

In this context, changing land use due to urban growth and development often puts pressure on natural resources, particularly water bodies. A study by Mathan and Krishnaveni shows that in the Chennai Metropolitan area, the changes in land use are as follows: during the period of February 1988 to February 2017, the agriculture/fallow land, barren/semi-barren, vegetation, and water bodies/wetlands have decreased by 53.62%, 1.45%, 58.99%, and 30.59%, respectively. This decrease has contributed to an increase of 173.83% in built-up area (M & M, 2019).

This phenomenal increase in built-up area has given rise to "new communities". On the one hand, due to affordability of land as a result of government policies, there is a section of society which includes people who acquire dwellings in water-rich regions. On the other hand, due to eviction of settlements from one water body to another (from the core city regions, due to construction of an MRTS, due to the tsunami, because of which communities had to be evacuated) (Report of the Comptroller and Auditor General of India on Performance Audit of Flood Management and Response in Chennai and Its Suburban Areas, n.d.), newer colonies have sprouted rising to new communities adjacent to the water bodies we have referred to. The impact of government policies encouraging industrial land use vis a vis residential land use is also of concern, as the ecological footprints of either vary drastically. The relationship between the previously discussed suburbs or peri-urban areas to the core city region is thus. Due to availability of water in the Chembarambakkam Porur belt, there was population influx into these regions from the 1970-80s onwards. Porur lake also supplies a major portion of the city, namely regions like KK Nagar (Madhusudhan & Ambujam, n.d.). As for Pallikaranai, this was a region rich in groundwater and was happened upon after the government policy to promote light industrial activity and encourage the establishment of multinational companies here. Two events ensued. Population multiplied, a water market took its origins and drinking water plied from these regions in tankers all over the city. Due to extensive urban development these regions also are a witness to inundation, which is discussed in the following section.

3.4. Ecology paradigm

A study by Vencatesan, discusses that the original landscape of the Chennai region was somewhat arid and Chennai did not boast of a tropical evergreen vegetation but rather of a dry forest, with palms and other arid region species. They go on to say that with the enthusiasm to 'green', one should not fall into the trap of afforestation, when the true nature of the land did not encourage such species.

On the other hand, there are forests within the city, including a national park, like the snake park and the institutional zone adjacent to it. The coastal landscape is also of significance, as we have to address the growth of transit corridors along the east coast known as "East coast road' and "IT expressway" parallel to it.

The ecology of Porur was such that vegetation and fauna were once abundant. Presently, threats due to water contamination and dumping of wastes is rampant. Pallikaranai is even more interesting, being a Ramsar site (Vencatesan et al., 2014), with an abundance of wetland flora and fauna, having found its way into the Ramsar list in April 2022. Currently the number of Ramsar sites in Tamilnadu is 20 and in India is 75.

3.5. Administrative policies and governmental action paradigm

As we have described before, there are five major reservoirs supplying water to the city of Chennai. Smaller tanks like the Porur lake, which is the receiving point for water supply from the Veeranam lake, as per the scheme, have also contributed. In this context, the prime body for water supply and sanitation services, has the onus responsibility of supplying and managing the urban water. The various schemes under the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), include piped water supply all over Chennai, underground sewerage system projects, sewage treatment plants in growing urban areas, and other means to augment water supply for the city, such as desalination, which includes three functioning desalination plants. Desalination is an expensive option, but the practice is in place, and in many areas, in proximity to desalination plants, the water supply is available to the various communities, rich and poor. What is of concern is that in most states in India, as in other developing countries, water connection cannot be obtained at the initial stages of settlement growth. This leads to alternative practices like exploiting local sources of water. In Chennai, as discussed b (Packialakshmi et al., 2010) there is indiscriminate pumping of water by open wells and bore wells. The restriction is that it should be in land owned by the individual and not in public property, as per permission by the CMWSSB. In recent literature and media, certain NGOs recommend for apartments and gated communities, the use of open wells 30-40 feet deep as against borewells 300feet deep.

3.6. Hydromentalities of the specific regions from the study area

	Core city area	**Chembarambakkam /Porur**	**Pallikaranai wetland**
Administrative	Chennai corporation	Erstwhile town panchayat. Porur became part of corporation in 2011.	Erstwhile town panchayat. Became part of corporation after 2011.
Features of the underlying hydromentatlity	Completely urban. Water sourced from far away	Primarily peri-urban. Act as sources of water	Per-urban. Source of groundwater and ecological hotspot.
	Erstwhile wetlands lost in history to reclamation. Currently being inundated.	Threats to water body due to transit corridors	Threats due to economic development
	Water viewed purely as a resource. Functional and needed.	Water for recreation.	Water and biodiversity for recreation.
	Greater density of population. Hence need to decongest in order to access water bodies.	Increasing density of population. Migration. Residential and transit.	Increasing density of population. Migration. Greater threats from industries.
Interaction with surroundings	Urban sprawl leads to pockets of infill and outliers	Population growth along transit corridors.	Encroachment along water bodies. Transit corridor's role to decongest.

		Encroachment along water bodies.	
	Drilling of borewells and reaching hard strata	Water table higher. Use of open wells	Water table higher. Use of open wells
	Rainwater harvesting of individual sites as well as common areas such as driveways recommended.	Recommended to reduce paved areas. Need for sustainable urban drainage system.	Recommended to reduce paved areas. Need for sustainable urban drainage system, as against engineering solutions for inundation.
	Local water bodies/ canals/ water and sewer lines susceptible to contamination	Recent addition of sewer connections and water lines. Need for appropriate green solutions.	Recent addition of sewer connections and water lines. Need for appropriate green solutions.

4. Present and future policy directions

In a country like India, the water use policy has drawn attention but the policies are weakened due to low positive response. The society's response for a policy decision towards a goal, is crucial for it to achieve success. Hence, social acceptance, awareness and education are elements that are the crux of the community response. For example, in California when there is drought, watering lawns is prohibited except unless they use sprinkler systems, and the timings for use are also mandated, there are fines levied on policy violations. The "polluter pays" policy enables an effective reinforcement, and may be necessary for India also. Not everyone adopted the policy instantly but it is re-enforcing many times with fines, so that most communities comply and have sprinkler systems installed in California. Hence, re-enforcement of policy achieves policy success. Every policy change effects positive changes within the community and the environment depending on how well it is accepted and re-enforced by the administrative bodies. Water bodies in Chennai, namely rivers, canals and tanks and wetlands, are subject to various natural and anthropogenic impacts such as loss of biodiversity, pollution from harmful substances, extraction of ground water, loss of natural edge quality due to encroachments, according to Devaki Panini (Panini, 1998), the earliest efforts to address the need for a National Wetland Policy had not been taken by the Government but by concerned individuals working on various aspects of wetlands and non-governmental organisations.

Loss of biodiversity in urban wetlands and processes which lead to encroachment of the commons in various metro cities of India are cases which demonstrate the damage wrought upon the citizens. Since we are in dire need of inter-disciplinary solutions which will achieve the compromise between human aspirations and growth coupled with physical and external phenomena and the processes, institutions will take into

account technical and advanced knowledge and effective management solutions for the same. Which is why, we are building eco-cities, at least, in policy and many stewards of water bodies and the environment have found a voice among the public.

5. Gaps in implementation

Difference in approach between land planners and water managers

IWRM perspective:

The concept of Integrated Water Resource Management (IWRM) assumes a holistic perspective for coordination of institutions, bring about stakeholder involvement, integrate all scales and disciplines to develop a sustainable management framework, and development of water resources. As we have discussed before land planners and water managers approach their job independently.

The spatial turn in water management as demonstrated in many real-world problems, (Scholten et al., 2020) has its repercussions in the common management of land and water. Land use has had impacts on water, but also water governance has influenced land use. In most countries, spatial planning and water management are divided institutionally and thus relatively independent actors. The traditional strategy to manage land and water under different governance regimes no longer works with the changing environmental constraints and social arrangement of the two key regimes in urban development. For instance, coastal regions and delta areas like Chennai, Tamilnadu, are often intensively used areas. Climate change will lead to sea-level rise, which calls for adaptive and resilient spatial planning and water management solutions. Cities along rivers prepare for higher and more frequent floods due to climate change, on the one hand, and growing vulnerabilities because of intensified land use, on the other.

Other relationships and community engagement

Groundwater resources are modified by land use, and vice versa. As the use of land and water becomes more pressured, interrelations increase. For example, freshwater and sewage management need to respond to demographic changes such as shrinkage and urbanization. Thus, successful water management correlates with the success or failure of spatial development policies. Scholte et.al., (Scholte et al., 2016)have researched on the perception of water by means of responses to ecosystem services concepts in Persina nature park, Bulgaria. Community perceptions play a major role in protection or stewardship of water bodies. In Chennai, an NGO, Arappor Iyakkam, has been playing a major role in monitoring of water bodies, and promoting activists to participate in administrative activities. Their documentation of urban lakes and up-to-date monitoring may be supporting individual and institutional research and knowledge creation. Perry & Gillespie have discussed through semi-structured interviews, in Cambodia, the gender-bias which governs female participation in public occupations and their

dependence on men. This is an aspect which is often discussed in socio-cultural studies related to water. A field survey undertaken in Kovalam, Chennai, India, pointed to the fact that the public were traumatized by the bias on their young women, who were actively occupied outdoors, given their cultural values and changing societal beliefs in urban coastal Chennai.

Tudor et al., have studied a sample population from various parts of Chennai and concluded that the public, in terms of their attitude, awareness and willingness to act, may be classified into five categories. Chiefly among these is a voluntary group of environmental activists. As mentioned before, committed individuals are called upon in every situation, whether it involves monitoring of water resources, or questioning the government, or supporting disaster management activities. NGOs and experts and activists have time and again enabled for the public, movements to protect their natural resources. The reason it is always a reaction of a learned minority, questioning the government, has been attributed to the development-hungry populace supporting economic growth over environmental awareness and protection.

As with the nature-environment divide, which is prevalent in many parts of the world, not just India, one needs to rethink our outmoded education which places nature on one end of the spectrum as against economics and urbanity.

6.Conclusion -

One needs to establish and reiterate the essentiality of preserving natural resources especially as they form an essential unit of spatial planning, particularly in the context of gargantuan scales of development as we are currently witnessing in Chennai. The masterplanning for Chennai needs to be a hydrologically conscious one with hydrosocial cognizance as well, for achieving sustainable development and eco-conscious living. Bottom-up methods of management and planning, coupled with a participatory approach by the government will go a long way in ensuring that the SDGs are met with in our context as well as the rest of the developing world.

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Green spaces in transition: decadal analysis of park design and microclimates in pune.

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Abstract: *Rapid urbanization will see two-thirds of the world's population in cities by 2025, leading to urban heat islands and climate change. Localized microclimate management in smaller urban areas is vital to combat this global issue.*

This study examines how neighborhoods open spaces in Pune, influenced by their landscape design, impact sociocultural characteristics and microclimates. Six parks, two from each decade between 1990 and 2020, were analyzed to understand the evolution of design parameters and their influence on park microclimates. This research aims to offer insights into urban green space design, contributing to more effective climate change mitigation at the city level.

Microclimate variables such as temperature, wind speed, wind direction, relative humidity, and radiant energy were systematically measured using a 5-in-1 environmental meter. Site visit to parks were conducted at different times of the day, allowing for a comprehensive examination of the design factors and their impact on the neighborhood's microclimate.

The analysis encompassed an assessment of the microclimate, design parameters, and the overall comfort of the park atmosphere. The findings revealed that design considerations and elements such as the material palette, plant selection, and visual aesthetics play a pivotal role in shaping and sustaining the microclimate within the neighborhood, as well as defining the park's purpose.

This research can offer urban designers and city planners' valuable guidance in optimizing microclimates and developing design guidelines that promote more sustainable, inclusive, and climate-resilient urban parks, ultimately improving the quality of life for city residents while contributing to broader environmental goals.

Keywords: Climate Change; Microclimate; Neighborhood; Urban parks; material palette; visual aesthetics; plant palette.

1. Introduction -

The urban population in India at the beginning of 20th century was only 25.85 million constituting 10.84 per cent of India's population in 1901, and is, expected to hit figure of 550 million or 42% of the total population by 2030. With growing urban sprawl in Pune, the demand for basic resources of human needs has also increased. As there is increase in the urban sprawl humans need to be close to nature is explored through the urban public green spaces.

The green spaces in an urban context can be defined as "Green space literally covers all public and private open space in urban area, mostly covered by plants (naturally or artificially) including trees, shrubs, and grasses (Fam et al., 2008) which are directly or

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indirectly available for use (Mensah, 2014) and mainly found in semi-natural areas (Chi Yung Jim & Chen, 2003)"

It basically explains that the Green Space is any publically accessible area within any open space having green or vegetation elements. Such green spaces can also be public parks, children's play areas, hilltop parks which provide utility to residents provides habitat for some flora fauna and fulfill natural services. All in all, it is a piece of land, water and geographical features which have been naturally or artificially colonized by vegetation and accessible to a large number of residents (Nicole & Blake, 2000). Having such a green space in any open space with Urban Setting will be termed as urban green open space in this research paper. Urban green space is an integral part of city providing with many intangible and tangible benefits to residents of city. In Pune city such urban green open spaces have come into existence since 1800 when various neighborhoods came into picture and one common green space accessible by residents was designed. Since then, there has been change in the designing trend of urban green open spaces. Over time, neighborhood open spaces have undergone significant design transformations, often influenced by prevailing trends in urban green space planning. These design shifts, encompassing changes in visual character, material palettes, and plant selections, directly impact the microclimate of the adjacent residential zones. However, the influence of these evolving design trends on microclimatic conditions and user comfort in the surrounding areas needs to be analysed.

Background, Need and Significance

Over time, landscape design trends have evolved significantly, influenced by changing aesthetic preferences, functional requirements, and urban development pressures. However, the impact of these ^changes on microclimate management and user comfort remains underexplored. While visual, aesthetic, and functional qualities are often prioritized, it is equally critical to assess how design attributes influence environmental parameters such as temperature, wind patterns, and thermal comfort.

Drawing insights from past and present landscape design practices can help create a more cohesive approach to microclimate management. By identifying key design attributes that effectively balance aesthetics, functionality, and environmental performance, we can develop strategies that benefit the end-user while addressing broader climatic challenges.

In Pune, where neighborhood planning dominates urban development, studying open spaces within these neighborhoods provides a unique opportunity to understand their role in mitigating climate change. Many of these neighborhoods, over 30 years old, are undergoing redevelopment. This transitional phase presents a crucial opportunity to introduce guidelines for urban green spaces that prioritize microclimate management and user comfort. Such guidelines can help minimize the environmental impact of redevelopment while enhancing the livability of these spaces.

This study is particularly significant in today's context as it offers valuable insights for guiding new landscape designers. By integrating principles of microclimate management into contemporary design practices, this research can contribute to creating sustainable and climate-resilient urban environments.

Aim and Objectives

The aim of this paper is to analyse the changing design trend of urban green space and its effect on microclimate parameters. The objectives are 1. To define what is a designed urban green space and how these spaces have change in the past 50 years. 2. To understand parameters that constitutes microclimate. 3. To analyse how change in the design of urban green space affects microclimate of neighboring residential areas. This study is carried out to prove that microclimate and landscape design of urban green open spaces are interrelated.

Scope and Limitations

Scope of this study is the urban green spaces that are built in Pune in 1980's, 2000's and 2020's. The urban green spaces should be surrounded by residential buildings. The parameters that show maximum effect on microclimate will be studied. Those parameters are- temperature, wind speed and relative humidity.

Limitation for our study was time period which allows to measure microclimate only in winter season. Also, all these parks have specific timings and hence temperatures will be taken on different days but possibly at same time of the day.

2.Literature Review

1. Importance of Urban Green Spaces in City Structure

Harasimowicz, A. (2018): Urban green spaces are essential for maintaining a "healthy" urban structure, catering to physical and psychological well-being while meeting a wide range of demands from city residents. These spaces, composed of natural or artificial vegetation, play a pivotal role in improving the quality of urban life and should be designed considering the city's population, environmental circumstances, climate, and cultural practices.

2. Cooling Effects and Mitigation of Urban Heat Islands (UHI)

Aram, F., García, E.H., Solgi, E., & Mansournia, S. (2019): Urban green spaces significantly mitigate the UHI effect, lower temperatures, and improve thermal comfort. These spaces provide cooling effects beyond their immediate boundaries, creating a comfortable environment for nearby residents.

Dimoudi, A., Kantzioura, A., et al. (2011): Green spaces regulate urban microclimates by providing shade and promoting evapotranspiration, which reduces surface and ambient temperatures. This makes them vital for urban sustainability and mitigating climate change.

3. Definitions and Functions of Urban Green Spaces

Rakhshandehroo, M., Johari, M.Y.M., & Afshin, S.: Green spaces are vegetated areas that can be public or private, and they play a critical role in the urban ecosystem. These spaces, often referred to as semi-natural environments, integrate networks of natural and artificial ecological systems, enhancing urban amenities and landscapes.

Padigala, B. (2018): Rapid urbanization in Indian cities like Pune has led to the conversion of green spaces into grey areas. Despite awareness of their benefits, urban vegetation is being degraded, emphasizing the need for sustainable green space management to combat GHG emissions and climate vulnerability.

4. Carbon Sequestration and Climate Benefits

Shinde, V.R., & Mahajan, D.M. (Year): Urban parks and green areas in Pune serve as the "lungs" of the city, reducing atmospheric CO2 through vegetation. Pune's tropical climate, with its distinct seasons, highlights the importance of maintaining green spaces to sustain the city's moderate and pleasant environment.

5. Role of Microclimate in Urban Design

Graham, J., Berardi, U., Turnbull, G., & McKaye, R.: Microclimate analysis should be a key driver in urban design, influencing material selection, building heights, and surface coverage ratios to enhance urban comfort.

Dimoudi, A., et al. (2011): Factors such as urban density, material choices, and lack of green spaces influence microclimates. Fixed and mobile monitoring methods, as well as remote sensing, are essential for assessing urban microclimate parameters.

6. Vegetation and Human Thermal Comfort

Wei, Y., Lin, Y., & Li, C.: In tropical urban environments, vegetation significantly enhances thermal comfort by reducing heat stress. Trees are more effective than grasslands in lowering surface and air temperatures due to their canopy and evapotranspiration effects.

Hai Yun, Wang X., Hao P., Dong L.: Microclimate parameters like wind speed, relative humidity, temperature, and radiant energy impact human comfort. Planting strategies that address these variables can enhance comfort in urban parks, especially during summer.

7. Urban Microclimate and Sustainability

Gaitania, N., Spanoua, A., et al. (2011): Urban energy and microclimate issues are integral to sustainability. Green spaces reduce UHI impacts, improve air quality, and enhance city livability through shading, evapotranspiration, and reduced heat radiation from surfaces.

3. Methods and Methodology:

For primary data collection six sites built in different years were selected. Microclimate was measured from all these sites and relationship between design attributes and microclimate was analysed. Through this study we can derive various design and material or plant selection criteria which help in maintaining microclimate. Urban spaces designed by landscape architects in any era, utilizing appropriate materials and plant palettes, consistently contribute to maintaining cooler and more comfortable microclimates for users throughout the year.

Selection criteria of urban green open spaces

1.Six different open spaces were selected which belong to different years of establishment to know the changing design trend in designing of these open spaces and its relation to microclimate.

2.The selected spaces were surrounded and used by residential areas only.

3.They had access road from at least two sides.

4.All selected open spaces were rectangular in shape and similar in size.

5.They should have different visual design, material pallet and plant pallet to judge the effect of these elements on microclimate as these parameters change as per design trends.

Data Collection and Analysis:

Sites selected and microclimate readings taken

Sites selected are major parks of Pune situated in the old neighbourhoods of Pune. These parks are under Pune Municipal Corporation and have fixed activities like jogging; kids play area, Open Gym area and other social activities. Microclimate is measured during morning 8 am, afternoon 1 pm and evening 8 pm to understand how these temperatures change throughout the day.

Every park has 5 study points outside the garden.

1980	2000	2020
Lokmanya nagar park Area- 8000 sq.mt.	Shyam Prasad Mukherjee udyan (2006) Area – 11757 sq.mt.	Matoshree Ramabai ambedkar udyan (2012) Area- 12000 sq.mt.
Ideal colony Area- 10300 sq.mt.	Tathawade Udyan (2002) Area- 11128 sq.mt.	Nanded city lalit garden (2015) Area – 10000 sq.mt.

Lokmanya Nagar- Joggers Park:

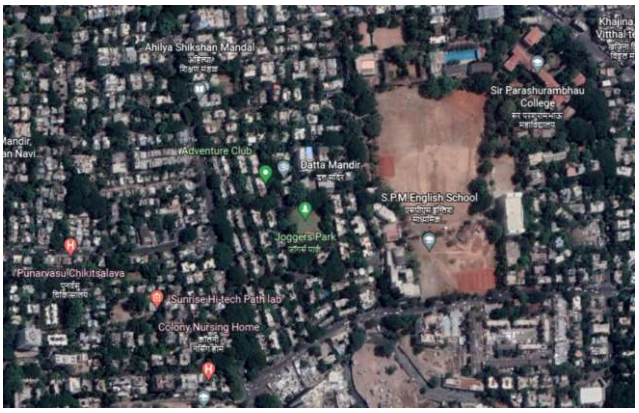


Figure 1- *Location of Lokmanya park*



Figure 2- *Photos showing interior and exterior of park*

Activities- Joggers Park, Kids play area

Landscape Elements of park:

Landscape elements of Park	
Tall canopy tress – old trees like peepal, banyan, Mango, Tamarind surrounding the park	Visual connectivity by using grill for compound walls Surrounded by narrow roads on all 4 sides Buildings surrounding park have an average height of 15 m or less.
Shrubs along lawn area and space dividers	Organic mud and brick curb stones used
Lawn in the central area	Curved Pathway with non-permeable concrete pavers

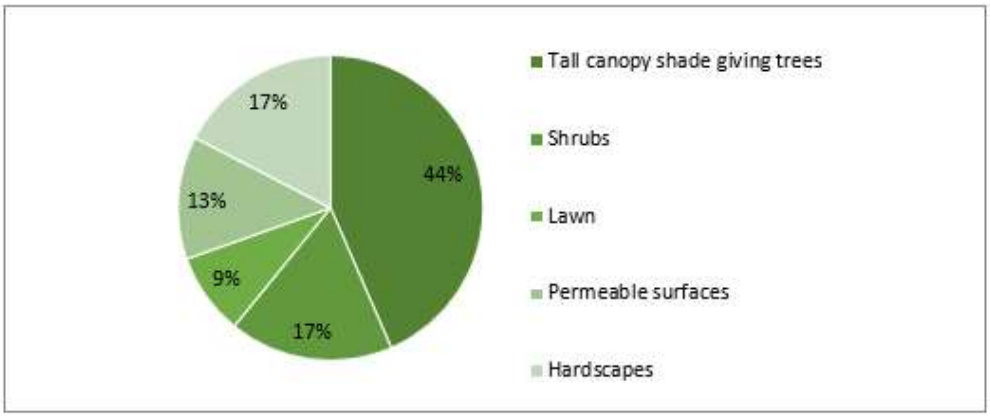


Figure 3- *Landscape elements of design*

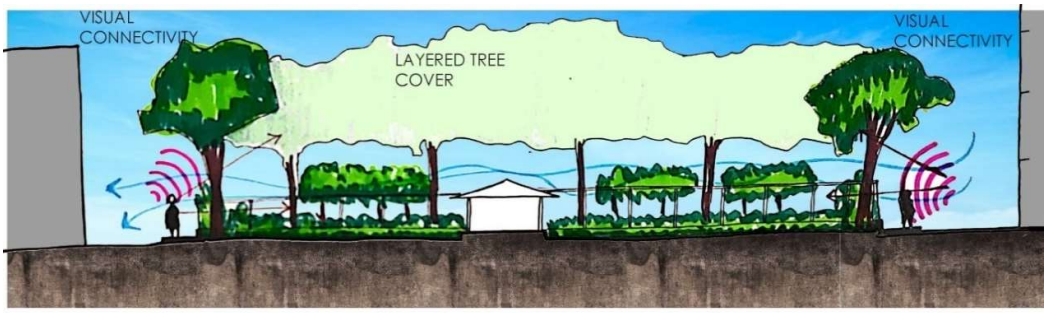


Figure 4- *Section*

Ideal Colony, Kothrud:

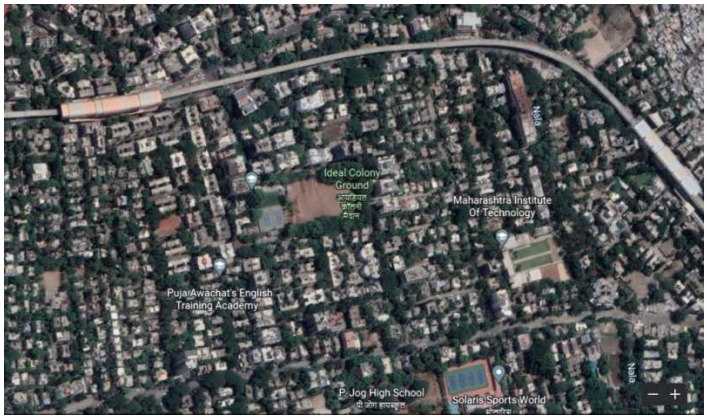


Figure 5- *Location of Ideal colony ground*



Figure 6- *Photo of Ideal colony ground*

Activities- Joggers Park, Kids play area, cricket or football ground.

Landscape Elements of Park

Landscape elements of Park	
Tall canopy tress	Visual connectivity by using chain link for compound walls
Minimal Shrubs	Surrounded by narrow roads on all 4 sides
Lawn in the central area-playground	Buildings surrounding park have an average height of 30 m or more
Organic mud and stone curbs	
Straight pathway with non-permeable concrete pavers	

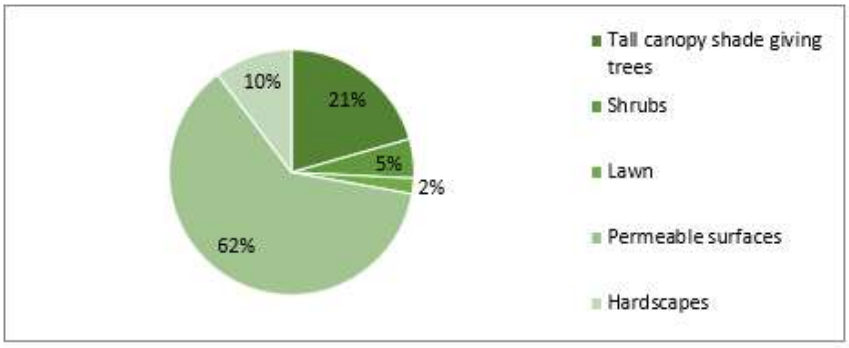
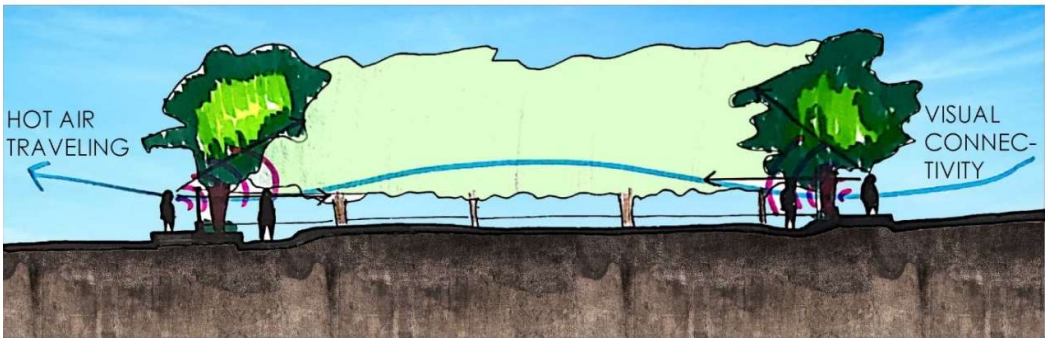


Figure 7 - *Landscape Elements of design pie chart*



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Figure 8 - *Section*

Shyam Prasad Mukherjee, Kothrud.

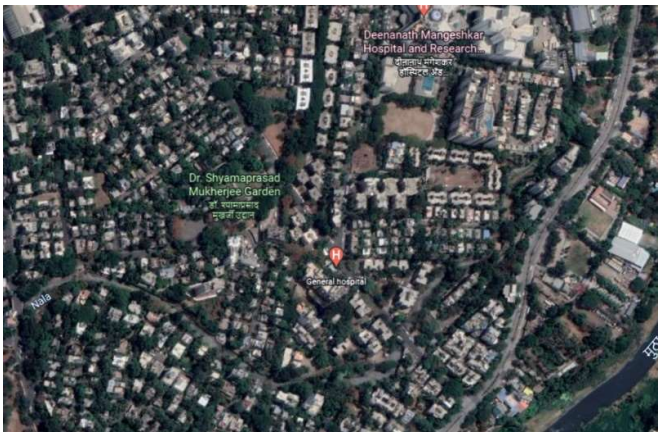


Figure 9- *Location of Shyam prasad mukharjee udyan*



Figure 10 - *Photos of Shyam Prasad mukherjee udyan*

Activities- Joggers Park, Kids play area, open gym.

Landscape Elements of Park

Landscape elements of Park	
Tall canopy tress surrounding park covering 40 percent of its area	Partial Visual connectivity by using chain link for compound walls
Shrubs all around the park used as dividers	Surrounded by main roads on 1 sides and tall buildings from other 2 sides with playground in front of it.
Lawn in the central area with rolling landscapes creating interest in kids for playing	Buildings surrounding park have an average height of 15 m.
Organic mud and brick curb stones used	
Curved pathways with non-permeable concrete pavers	

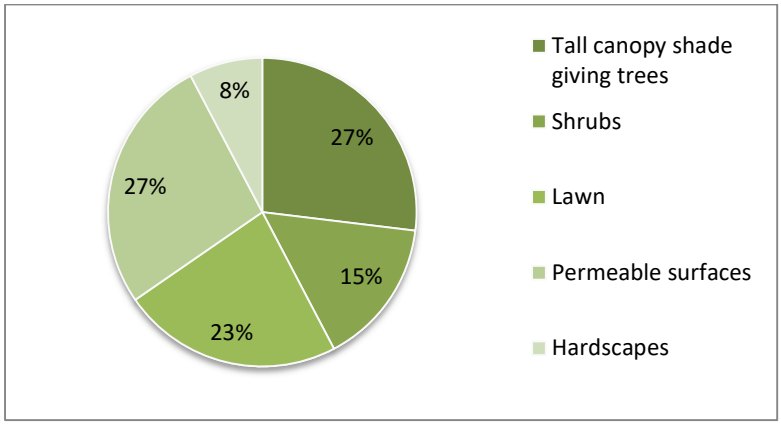


Figure 11- *Landscape Elements of design pie chart*

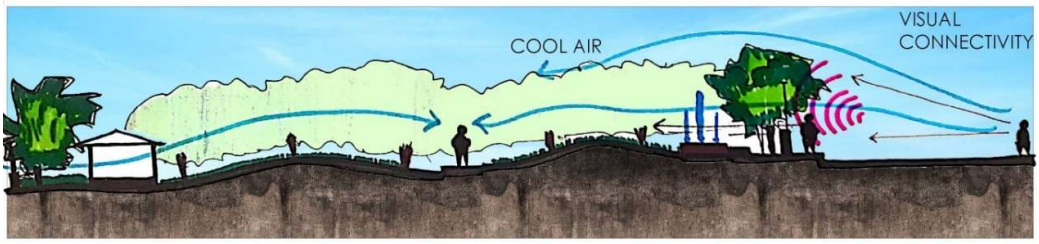


Figure 12- *Section*

Tathawade Udyan, Karve Nagar:



Figure 13- *Location of Tathawade Udyan*



Figure 14 –*Photo of Tathawade udyan*

Activities- Joggers Park, Kids play area, Open gym

Landscape Elements of Park

Landscape elements of Park	
Tall canopy tress surrounding park mostly have palm trees and shade giving trees	Partial Visual connectivity by using chain link for compound walls
Shrubs all around the park used as dividers	Surrounded by main roads on 2 sides and buildings from other 2 sides.
Lawn in the central area with rolling landscapes creating interest in kids for playing	Buildings surrounding one side of park have an average height of 30 m.
Organic mud and brick curb stones used	
Curved pathways with non-permeable concrete pavers	

Figure 15- Landscape *Elements of design pie chart*

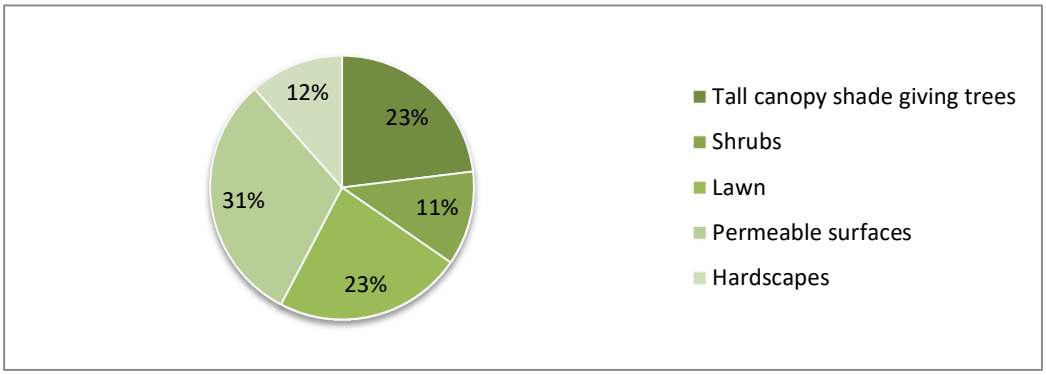




Figure 16 - *Section*

Matoshree Ramabai Ambedkar udyan:



Figure 17- *Location of Matoshree ramabai ambedkar udyan*



Figure 18- *Photo of Matoshree Ramabai Ambedkar udyan*

Activities- Joggers Park, Kids play area.

Landscape Elements of Park

Landscape elements of Park	
Tall trees mostly palms and other exotic species	Partial Visual connectivity by using chain link for compound walls
Shrubs all around the park used as dividers	Surrounded by main roads on 2 sides and tall buildings from other 2 sides.
Lawn in the central area with hardscapes like gazebos is present.	Buildings surrounding park have an average height of 15 m.
Mud pots with hardscapes are seen in park	
Curved pathways with non-permeable concrete pavers	

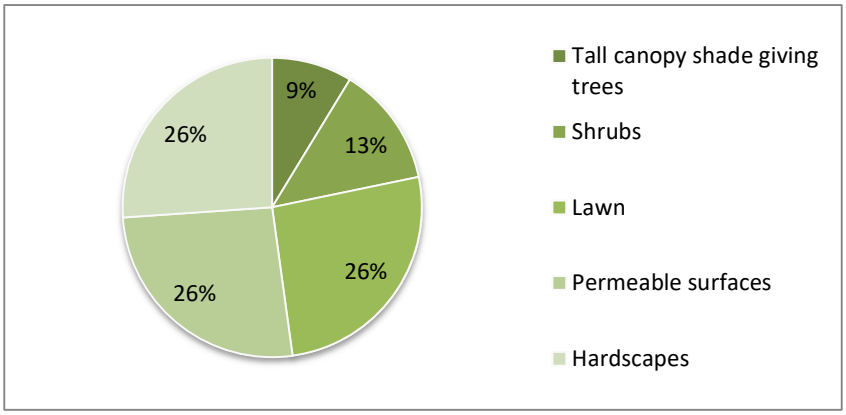


Figure 19 - Landscape *Elements of design pie chart*

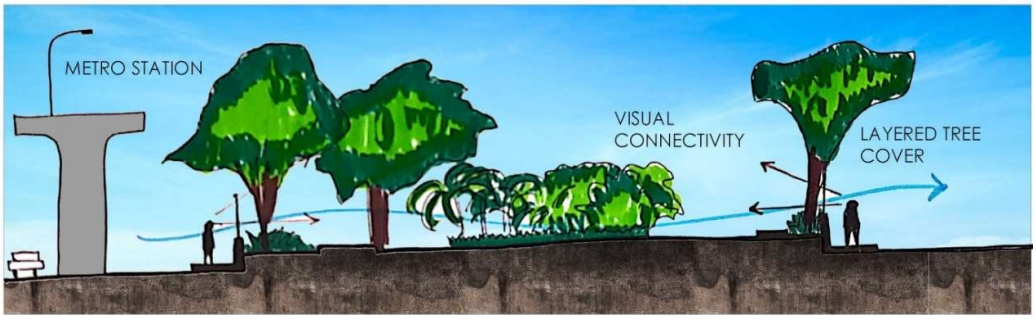


Figure 20 - *Section of Matoshree Ramabai Ambedkar Udyan*

Lalit Garden-Nanded City:

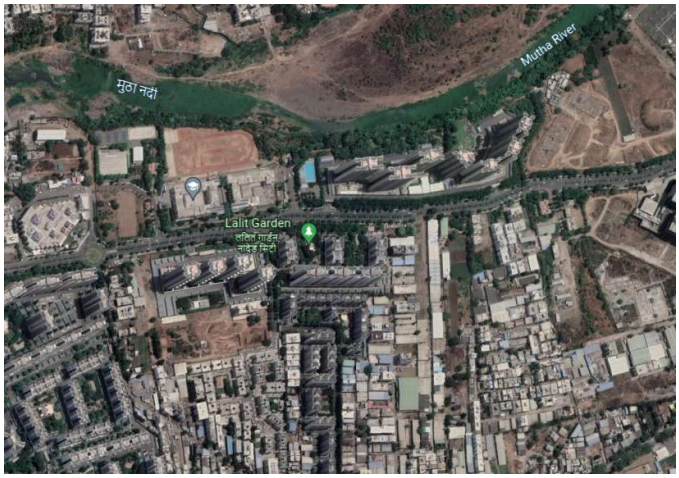


Figure 21- *Lalit Garden, Nanded city*



Figure 22- *Photo of Lalit Garden.*

Activities- Joggers Park, Kids play area

Landscape Elements of Park

Landscape elements of Park	
Tall trees for screening and cooling air are used. Strategic plantation	Full visual connectivity for society members but screening from road.
Shrubs all around the park used as dividers	Surrounded by main roads on 1 sides and tall buildings from other 3 sides.
Minimal Lawn area used as the place has water issues.	Buildings surrounding park have an average height of 60 m.
Mud playgrounds for children along with pits for trees.	Buffer zones between roads and park.
Straight pathways and buffer zones are used	Setback spaces between building and park allows air to flow freely.

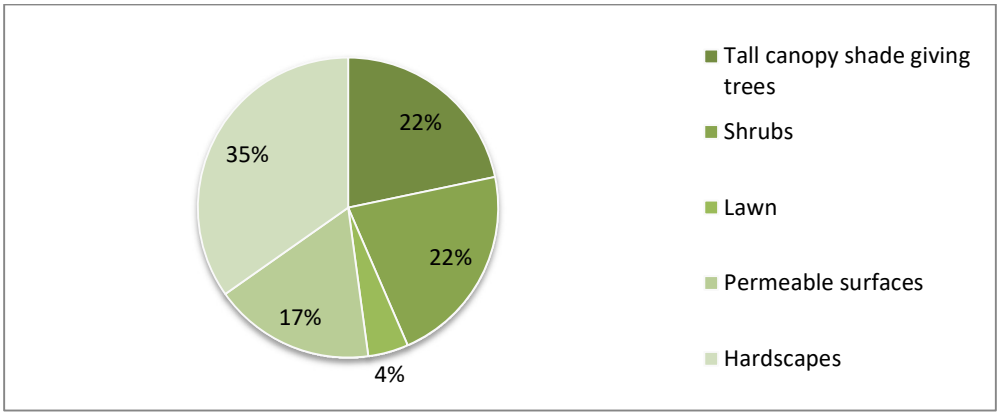


Figure 23 - *Landscape Elements of design pie chart*

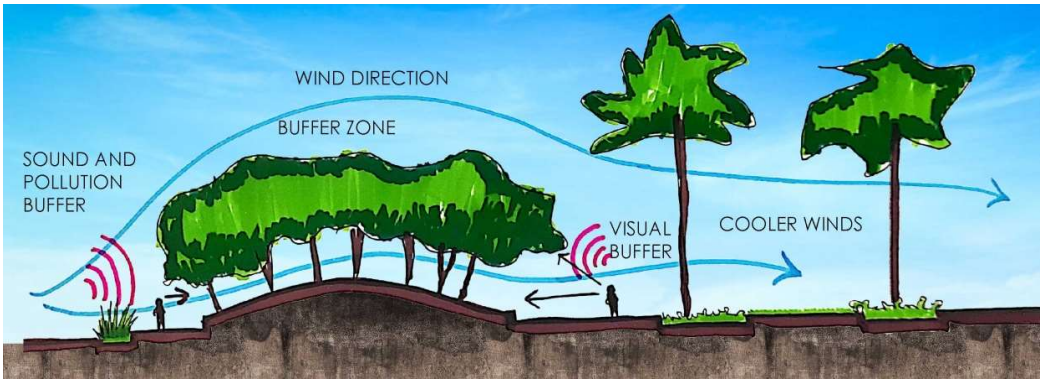


Figure 24- *Section through Lalit Garden*

Key Findings-

After observing the design considerations for each park microclimate measurements were taken at 5 points to understand how microclimate of each park is different. Following are readings taken on site.

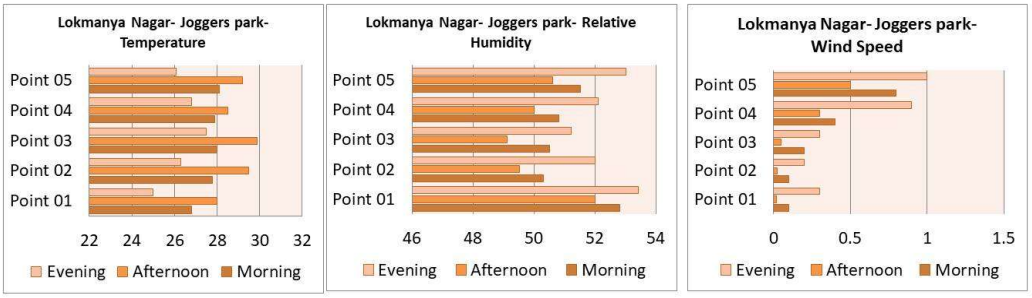


Figure 25- *Lokmanya Nagar joggers park- Microclimate readings*

Afternoon sun is not harsh and cool breeze through the high canopies cool down when they reach ground areas.

As we go closer to garden areas climate becomes cooler than compared to other areas.

Elements such as canopied trees and heavy vegetation help in cooling the surrounding area of this park which can be observed in above charts. Although at all points the maximum temperature observed is 30 degrees combined with high wind speed and relative humidity this neighbourhood feels very cool.

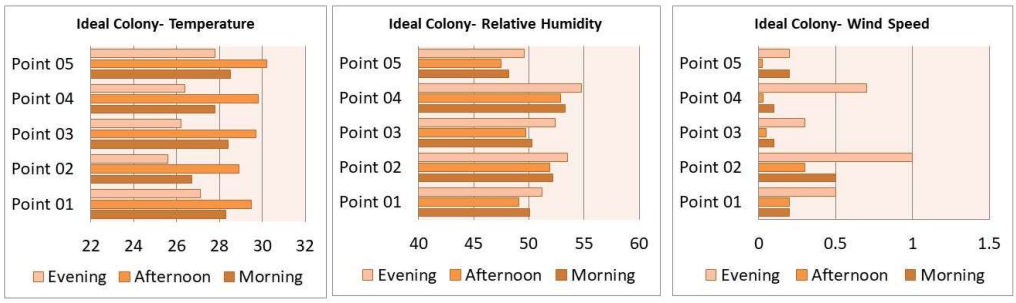


Figure 26- *Ideal Colony- Microclimate readings*

Ideal colony ground has less vegetation and more of play area which has mud. Muds heat up quickly and create a heat island effect causing a warmer micro climate surrounding this park. The trees present have scanty canopy proving negligible shade and chain link fence permits the dust, noise and heat from concrete roads to enter into park. All these elements help create a heat island instead of cooling the climate.

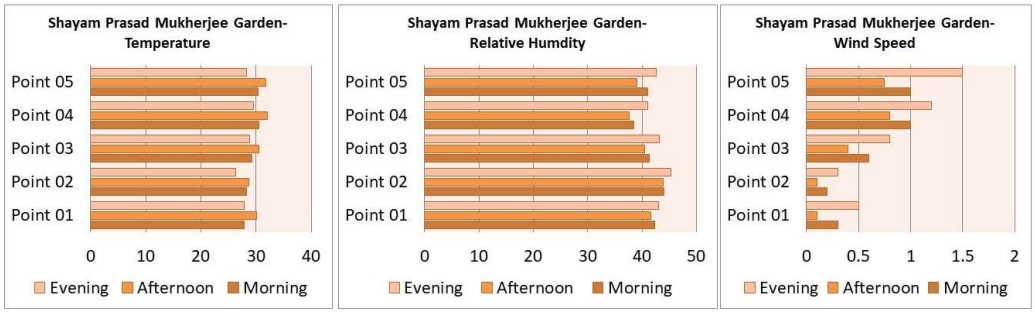


Figure 27- *Shayam Prasad Mukherjee Garden- Microclimate Readings*

Shayam Prasad Mukherjee Garden has strong winds during the day and night. These cause the humidity from lawn area and fountain area to mix in atmosphere. Increase in humidity causes the air become heavy and have hotter humid air during the day. Less trees cause lesser shading areas whereas shrubs and lawns increase humid air. Hence event though this park is greener than others the overall effect is much like a heat island.

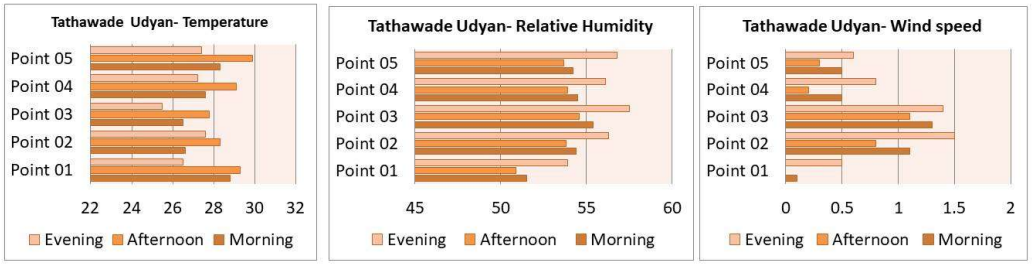


Figure 28- *Tathawade Udyan Garden- Microclimate*

Readings Tathawade udyan is also similar to Shayam Prasad Mukherjee Garden and hence people experience harsh sun during afternoon and cool winds during night times. There are small trees and big lawn areas but no high shady trees. Visual connectivity is present. Strong winds are experienced but they are hot during day and cold at night as wind doesn't filter through trees to cool down.

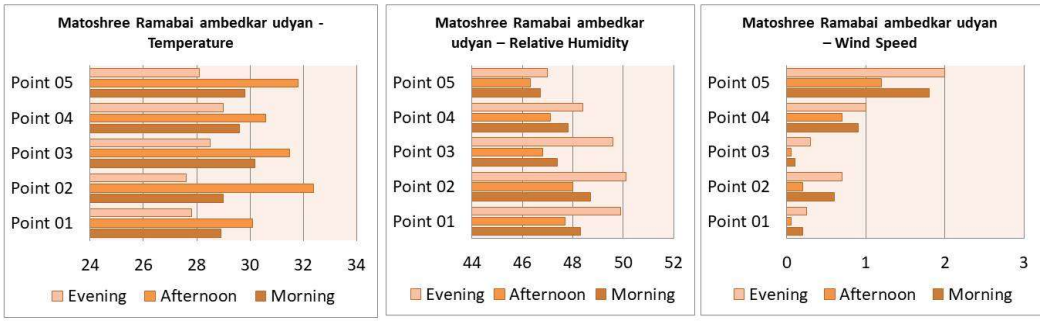


Figure 29 - *Matoshree Ramabai Ambedkar Udyan- Microclimate readings*

This park is a perfect example of urban parks with its detached connectivity and no relevance to its neighbourhood. The park has exotic trees and shrubs which do not help in the climate cooling or mitigation. The main road connectivity adds to its heat and surrounding areas also exhibit lower number of trees thus increasing in the heating effect.

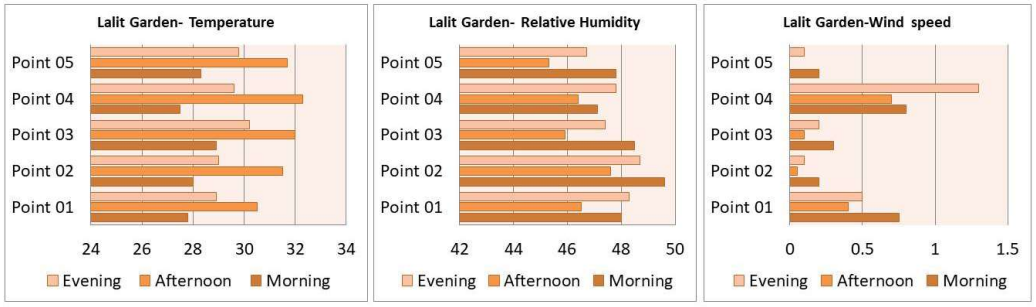


Figure 30- *Lalit Garden- Microclimate Readings*

The buffer zone and overall plantation of this park makes it 2-degree cooler than surrounding area although paving material is used on all sided still it gives cool feeling to users. Wind speed is observed at only certain spots due to high rise buildings but the wind is cool during afternoons also. The buffer zone between park and road not only acts as barrier for children protection but also helps in cooling winds and regulating the temperature. Strategic plantation and native species promote cooling effects of park and its surrounding area.

Conclusion and Recommendations-

In conclusion, we can say that, microclimate and landscape design strategies of urban green open space are interrelated. As the park have evolved, we see a change in the planting palate and material palate of parks. Where initially natural stone and bricks and organic mud was used, now we use cement block non permeable flooring materials like EPDM etc. This change with reduced focus on plantation of native trees has caused the parks to add on the urban heating islands phenomenon.

Landscape design strategies play an important role in managing the microclimate of neighbourhoods is portrayed by nanded city parks which use buffer zones, tall tree canopies, tree screening, and plantation in wind direction for the cool air.

The ratio of softscape with hardscape also plays a role in managing microclimate as excessive lawns may cause humidity to rise thus trapping hot air whereas no lawn space will create harsher effect on climate.

This decadal change in design can be observed all though pune city and along with design change we see urbanized parks which harm the neighbourhoods rather that provide relief from its microclimate. Thus, adopting older design strategies and having native trees with shrub beds and lawns for parks will definitely help in managing microclimate for Pune’s neighbourhoods.

Recommendations-

Compound wall can be chain linked fence for visual connectivity. This way the urban green space can attract more public.

There should be buffer zone between park and road specially if there is a main road adjacent to it.

Use of shady native trees to be used in this buffer zone so that wind flowing through park and in neighbourhood are cooler even in afternoon times.

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Acknowledgement –

I am grateful to Dr. Bhanuben Nanavati College of Architecture, Pune for giving me the opportunity of conducting and presenting this research. I am thankful to Dr. Bhanuben Nanavati College of Architecture for women for providing me with the needful instrument to measure microclimate. I am also grateful to my guide Ar. Mukta Gokhale for their constant and valuable guidance. I would like to thank my family and all my classmates who helped me in my research.

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Optimizing Watershed Management approaches for Dhalai district, Tripura

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Abstract: *Tripura is a state, where a number of villages and hamlets are inhabited by 'adivasis' or tribals. Several districts in Tripura face the perennial problem of water shortage despite of getting heavy rains during the monsoons. Lack of water is an acute problem during the months after the monsoon season. The majorly affected areas in the state are situated in Dhalai district and North Tripura. The paper takes up Dhalai district as the study area as it is the most affected one.*

Shortage of water in the dry season leads to many health and socio-economic problems. Lack of knowledge at village level also causes the water scarcity. In the light of current context watershed management will play a vital role in water conservation of the region and also reduce water scarcity of the district. This study aims to cater the water scarcity by implementing watershed management practices.

Keywords: Dhalai district; Watershed; Review; analyse; Strengthen.

1. Introduction:

Tripura is a part of Himalayan Ecosystem. Climate change impact on this fragile ecosystem has its fallout in Tripura as well. The climate change resulted in various issues like a) Decrease in total annual rainfall, b) Change in rainfall pattern, c) sudden bursts of rain over a small period of time causing floods. The above-mentioned points have resulted either to scarcity of water or causing severe flood.

The topography of Dhalai district is characterized by mostly rugged terrain with some undulating surface. About 75 percent of the district geographical areas are under hilly terrain covered with dense forests and 25 percent are under plains. Three hills range i.e. Atharamura, Longtarai and Sakhan ranges run almost parallel to one another in a north-south direction and the valleys are present in between the hills.

The elevation of these hill ranges is higher in the south and decrease towards the north; however, the height of these ranges rises as one move from west to the east direction (Saigal, 1978). These hill ranges are characterized with narrow ridges, knife edged and steep slopes.

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The prominent hill ranges, isolated hillocks, undulation etc., in the district give rise to higher runoff, rather than natural recharge. And that's the reason many interior tribal localities in Dhalai are facing acute drinking water crisis mainly caused during the dry spell.

Urgent action is required to be taken on watershed management which involves (i) proper monitoring of rainfall, (ii) river conservation (iii) restoration of water bodies (iv) strengthening of ground water recharge techniques and (v) improvement of drainage systems to eradicate floods. The challenge of watershed management needs to be addressed at a broader level ie. from source to end. The institutional arrangements of judicious governance should be in place at the level of settlement, watershed, aquifers and river basin.

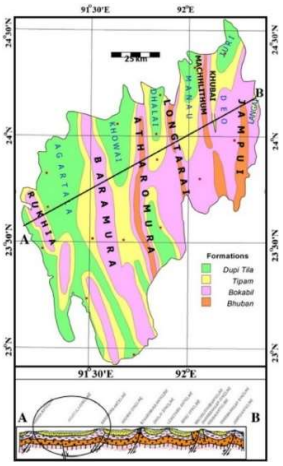


Figure 1: *Geological formation map of tripura* [1]

2. Methodology

The following methodology is adopted for the research paper:

Literature review is done to understand watershed management in detail and the steps involved in it. The climate, geographical conditions, physiography is studied to identify water and soil (conservation) related Problems in the district. The watershed management initiatives taken by the state government (present condition) in Dhalai district are reviewed and analysed whether the initiatives taken caters/meets the water demand required in the district. Strategies are suggested to strengthen the watershed management in Dhalai District as recommendations.

3. Literature Review

3.1. Watershed management [2]

3.1.1. Understanding of Watershed management

The word 'Watershed' was coined in the early 20th century and was used to signify 'water parting boundaries. It is defined as that area of land which passes on or drains runoff through a single outlet into a larger water body like river or lake.

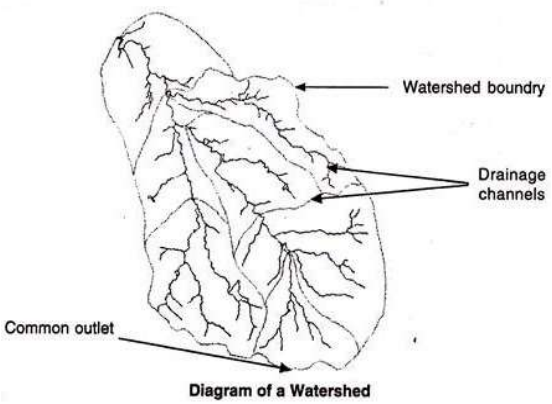


Figure 2: *Diagram of watershed* [2]

It includes land surface and vegetation management strategies for the conservation of soil and water for timely, speedy and long lasting, prolonged benefits.

The entire community or farmers can get benefitted as a result of a quality watershed management.

3.1.2. Types of watershed management

Depending upon the size, shape or land use pattern, Watershed can be classified under following:

- Macro watershed for area coverage of 1000 -10,000 ha
- Micro watershed for area coverage of 100 -1000 ha
- Mini watershed for area coverage of 10 -100 ha
- Mille watershed for area coverage of 1 -10 ha

3.1.3. Objectives of watershed management

There is a lot to gain as a result of systematic watershed management. Few of the important objectives can be discussed which could play a very important role in the lifecycle. Production of food, fodder, fuel can get better over the period of time. Environmentally also there are few benefits of the process including pollution control, flood control, sedimentation check, soil erosion reduction, preservation of soil, stoppage of degradation, ground water recharge and so on. Wild life also gets long term benefits with the strategic implementation. Over and above daily life style improves with generation of employment amongst the locals. All these objectives of watershed management have potential to improve not only living standards but environmental balance also.

3.1.4. Main components

Main components of watershed management can be on following fronts:

Soil and water conservation,

Water harvesting and water management,

Alternate land use system.

3.1.5. Steps involved

A systematic sequence or a stepwise progress is crucial in order to get the desired results. It involves certain phase-wise planning to assure the efforts in the right direction. The steps come in the following order:

Recognition phase- This primarily focuses on the problem identification area. Root cause of the problem detection is a key to have right solution. All possible solutions that are relevant could be brainstormed.

Restoration phase- In this phase best possible solution is selected which needs to be tested from the implementation point of view. Application of solution takes place in this phase.

Protection phase- The land under consideration needs to be protected from dysfunction or any other obstacle which prevents its natural course. Normal functioning needs to be monitored in this phase.

Improvement phase- Overall progress enhancement or upgradation of the entire land comes under this phase. Objectives of watershed management are monitored and allied socio-economic impact is observed. Farms, meadows, forests or community living can be targeted as various objectives of this process.

3.1.6. Watershed Management Approaches

3.1.6.1 Integrated Approach

This approach advocates for the integration of technologies within the natural confines of a drainage area to promote the sustainable development of land, water, and plant resources, addressing the essential needs of both people and animals. Its goal is to enhance the living standards of local communities by boosting their earning potential through the provision of necessary resources for optimal production. To achieve this, integrated watershed management recommends adopting practices like land and water conservation, water harvesting in ponds, and groundwater recharge to enhance water resource availability. It also emphasizes crop diversification, the use of improved seed varieties, integrated nutrient management, and integrated pest management, among other strategies.

3.1.6.2 Consortium Approach

The consortium approach focuses on collective action and community involvement, engaging primary stakeholders, government and non-government organizations, and other institutions. Effective watershed management demands a broad range of multidisciplinary skills and expertise. Easy access to timely advice for farmers is a key factor in the positive outcomes observed in watershed projects. This access increases farmers' awareness and enhances their ability to seek the right support when challenges arise. Achieving this requires proficiency in areas such as engineering, agronomy, forestry, horticulture, animal husbandry, entomology, social sciences, economics, and marketing. Since it’s often challenging to find all the necessary skills within a single organization, the consortium approach brings together expertise from various fields, amplifying the effectiveness of watershed initiatives and interventions.

3.1.6. National level relevant Programmes

- **National Watershed Development Programme for Rain fed Agriculture (NWDPRA):**

Year of start: 1986-87

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Objectives: To conserve and utilize rain water from both arable and non-arable lands on watershed basis. To increase the productivity of crops and to increase the fuel, fodder and fruit resources through appropriate alternate land use system.

- **Control of Shifting Cultivation:**

Year of start: 1986-87

Objectives: Restoring ecological balance in hilly areas and improving socio-economic conditions.

3.2. Study the geographical and climatic conditions [3]

Covering around 2312.29 square kilometer area the district of Dhalai is located in the North-eastern part of Tripura. "Atharamura range" & "Sakhan Range" are the main two hills which surround the district. Having mostly undulating and hilly terrain the district also has small water streams (chheras), rivers and fertile valleys. The district headquarter Ambassa is located about 85 km from state capital Agartala and connected through a national highway (NH44).

District of Dhalai comes under Tropical monsoon climate. Monsoon winds enter Tripura by the mid of May and continue till September. Pre-monsoon thunder shower and storms are common. Average annual rainfall is high (around 2150mm) out of which 70% occurs during monsoon till the month of September. Average annual temperature reaches to 35℃ while minimum drops to 10.50℃. July and August are the hottest months of the year, whereas November to January is the winter period.

4. Problem Identification & Review of The Initiatives Taken by The State Government.

4.1. Problems existing in the district

Due to hilly terrain and steep slope, water retention capacity is very low. Due to which there is lack of water supplies in summer season. 579 habitations have partial coverage of drinking water supply. Many villages need drinking water supplied by tanker in the dry season and 59 such distressed pockets have been identified.

Very low irrigation. Except for the areas near streams and rivers, most of the agriculture is rain-fed.

Dhalai district has high incidence of open defecation, especially in the interior hilly and forest areas. Many tribal inhabitations use water from open streams and ponds for

drinking, cooking, washing utensils and clothes, and bathing. Water-borne disease diarrhea is common due to mixing of human excreta into drinking water source in many villages. Open defecation also leads to vulnerability to malaria.

Few of the tribal hamlets situated on the up hills are not connected to the urbanized areas. The tankers deployed by the water works department (PWD) cannot reach the remote areas due to lack of accessibility or transportation facilities to the interior parts.

High rainfall above 2220 mm season causes severe soil erosion and landslides. During the monsoon season due to heavy downpours the soil found in the hills become moistened triggering landslides. The rainwater drains the humus and nutrient contents of the soil causing the soil significantly infertile.

The hill soils are less fertile in comparison to the valley soil and it is here that the small communities practice shifting cultivation which had initially emerged as a response to the prevailing geo-environmental and cultural factors but at present needs to be checked due to environmental problems, also the growth of population, and modern lifestyle etc., is leading to smaller jhum cycles resulting to increasing deforestation and associated problems.

High illiteracy level in the district causing lack of awareness. The lack of awareness leads to many health and socio-economic problems. Very low-income levels hence low living standard also.

4.2. Initiatives taken by the state government influencing watershed management

Besides the normal afforestation activities, roadside and river bank plantations are also taken up regularly every year under state government initiative.

- Tripura Japan International Cooperation Agency (JICA phase I & II) Project

The activities in the project included promotion of bamboo plantation, agroforestry-based livelihood, eco-tourism development, development of value addition for bamboo and other Non-Timber Forest Product (NTFP) in order to create alternative livelihood opportunities for local communities. As bamboo is one of the key resources in the district, strong emphasis is laid on enhancing the production base and value addition of bamboo production. From Dhalai district only Gomati Wildlife Sanctuary is included in the project.

- Indo-German Development Corporation (IGDC) Project

Under Indo-German Development Corporation (IGDC) Project, which started in the year 2009-10 with a budget outlay of Rs.87.20 crore, a total of 9198 ha of new plantations has been created and besides other significant interventions in the livelihood sector, restocking of 1411 ha plantations has been carried out in the project. The project is implemented through Village Development Planning and Implementation Committees of Village Councils in 70 tribal villages.

Inference: Both JICA and IGDC Projects are more of plantation projects contributing to afforestation, soil conservation & significant interventions in the livelihood sector in Dhalai district. As such no water conservation schemes are implemented in the district.

Watershed management projects involve combination of vegetative measures and engineering measures. It is clearly evident that though lot of initiatives are in place of the plantation part but less initiative for the engineering measures is taken in the district.

5. Review of present situation of watershed management in Dhalai district



Figure 3: *Shifting cultivation practiced in dhalai district, Tripura.* [8]

After having meeting with different stake holders of the Gram Panchayat we came to know that there is severe water scarcity problem faced in the district in the dry seasons. The major problems are faced by the tribal hamlets which are situated in the remote areas, on the up hills of Atharamura, Longtarai and Sakhan ranges. During the dry spell water tankers are deployed to various water scarce pockets but the major constrain with the remote tribal hamlet is the lack of accessibility or transportation facilities to the interior areas.

There are some measures taken at the local level as far as watershed management is concerned like contour bunding, bench terracing, micro-catchment, Check dams, Percolation ponds, stone barriers etc. However, the outcome of the watershed management efforts is not sufficient enough to serve the purpose.

5.1 Identification of the issues

Enlisted below are some of the issues related to watershed management in the region:

Challenging geographical / topographical conditions: Steep slopes and undulating land profile

Open defecation

Disconnected settlements

Disconnected settlements

Heavy rainfall and topographical conditions

Shifting cultivation

High illiteracy level

6. Analysis of regional practices and potential implementation

6.1. Practices in watershed management:

Enlisted below are some of the practices which have the the potential to tackle the water shed management issues.

Table 1: *Vegetative measures of watershed management*

Vegetative measures	(a)	Strip cropping	Alternate strips of crops in the same field
	(b)	Pasture cropping	providing the animals with forage grasses and legumes and keeping the soil healthy
	(c)	Grass land farming	Using grass as primary crop
	(d)	Woodlands	can help with soil erosion, biodiversity, and carbon sequestration

Table 2: *Engineering measures of watershed management*

Engineering measures	(a)	Contour bunding	using bunds to control soil erosion and for water percolation.
	(b)	Terracing	creating flat, stepped areas on hillsides or mountainsides to make the land suitable for farming
	(c)	Construction of earthen embankment	to retain water on the hilly slopes
	(d)	Construction of check dams	retention of water to percolate naturally
	(e)	Construction of farm ponds	They are constructed across gullies to reduce the gradient and stabilize the soil
	(f)	Construction of diversion	to direct the water flow
	(g)	Gully controlling structure	they are constructed across gullies to reduce the gradient and stabilize the soil
	(h)	Rock dam	embankment constructed across a drainage way to create a temporary basin for collecting sediment
	(i)	Establishment of permanent grass and vegetation	growing indigenous plants and grass in the region for soil conservation
	(j)	Providing vegetative and stone barriers	water retention techniques
	(k)	Water harvesting techniques	roof top rain water harvesting, percolation pits, recharge pits

Table 3: *Awareness and skill development measures of watershed management*

Awareness and skill development measures	(a)	Focused group discussions (FGD)
	(b)	Training and skill development programs
	(c)	Community participation

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6.2 Recommendation of possible solution through identified practices

As per the review of present situation of watershed management and problem identification thereafter, the recommended possible solutions are discussed in the table below. The possible solutions are recommended according to the analysis done in alignment with the current regional practices.

Table 4: *Present issues and solutions of watershed management in Dhalai district*

Sr. No	Existing Issues	Negative Effects	Solution	Watershed management practices applicable	Current status	Expected Outcome
1	Challenging geographical / topographical conditions: Steep slopes and undulating land profile	Drinking Water scarcity	Water harvesting techniques (roof top rain water harvesting, percolation pits, recharge pits)	Engineering measures: (h)	Not in practice	Sufficient water storage during dry season
2		Low irrigation	Water retention ponds and tanks, check dams in water catchment areas	Engineering measures: (a), (b), (c), (d), (e), (f), (g)	Partially in practice (few of the areas)	Perennial cultivation could be achieved
3	Open defecation	Health issues like Diarrhoea, Malaria etc.	Awareness campaigns	Awareness and skill development measures: (a), (b)	Trial Initiatives taken by government bodies	Improved health conditions
4	Disconnected settlements	Water scarcity	Self-sustainable nodes through water harvesting techniques	Engineering measures: (h)	Not in practice	Dependency on external resources can be minimized. Improved living conditions.
		Health issues	Awareness campaigns	Awareness and skill development measures: (a), (b)	Partially in practice (few of the areas)	
5	Heavy rainfall and topographical conditions	Soil erosion and landslides	Plantation	Vegetative measures: (a), (b), (c), (d)	In practice	Soil erosion control

6	Shifting cultivation	Soil erosion, soil degradation, air pollution, social instability	Limited exploitation, Strengthening communities with an alternate livelihood opportunities	Awareness and skill development measures: (a), (b)	Trial Initiatives taken by government bodies	Improved living conditions, pollution control
7	High illiteracy level	Lack of awareness	Conducting FGDs and community participation in various training programs	Awareness and skill development measures: (a), (b)	Trial Initiatives taken by government bodies	Skill upliftment

7. Inferences

Sustainable growth and development are not possible without appropriate water resource management. Most of the issues are interlinked and complex in nature, thereby need to be addressed in an integrated manner so that sustainability of this precious wealth is maintained from generation to generation.

The water scarcity problem is more in the remote tribal areas situated on the Atharamura, Longtarai and Sakhan hills, than the semi urban areas situated on the plains. Rural dwellers continue to suffer greatly as a result of non-accessibility to good quality drinking water. They are the people who still use contaminated water from the streams to run daily household duties, resulting in more health issues and sanitation problems. It is evident that due to lack of accessibility to the remote areas water related problems and water-borne diseases are major issues faced in the areas in the dry spell.

With construction of dams still a pipeline process/project and available infrastructures not in place, watershed management has the capacity to provide the district with solution to clean water access especially to rural dwellers.

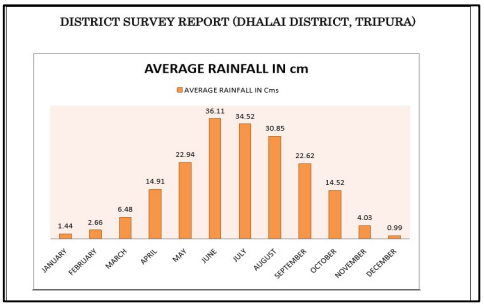


Figure 4: *Average rainfall* [3]

8. Proposals / Recommendations

Sustainable development of watershed is a very important factor. This can be achieved with various awareness programs, water harvesting techniques like roof top rain water harvesting technology, construction and recharging of different natural water storage tanks etc. Contour bunding, contour barriers (vegetative and stone), contour trenches, contour stone walls are some of the ways to prevent soil erosion. At the same time obstructed water increases soil moisture and recharges the ground water.

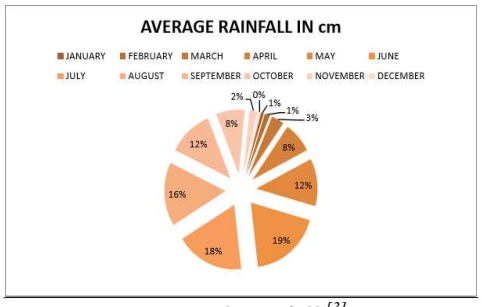


Figure 5: *Annual rainfall* [3]

The rainfall pattern in the hilly area is high (15-year annual average rainfall is 1800- 2150 mm) and erratic. This area is one of the high rainfall areas of Tripura. The months from December to March are dry with 2 to 3 % rainfall. The time between April and May is transitional period between dry and wet season with irregular rainfall of 8 - 12 %. The rainfall data shows that the duration between May and October is rainy season with 90 % annual rainfall (Fig. 4 and 5). The rainfall data shows that the rainwater can potentially be harvested in these hilly areas during the period from May to October (Fig. 4 and 5), which can be used during the dry period spanning from December to April. [3]

There can be two types of water harvesting proposals for Dhalai district. One is water conservation for irrigation and the other is water conservation for drinking purpose. For irrigation purpose water can be stored from the surface runoff (overland flow) directly without any treatment because the runoff water quality shall well suit for irrigation. The micro level initiatives could include roof top rain water harvesting where the water stored is of good quality and suits the portable standards.

River Dhalai and Manu River are the main water courses of the district which serve as the source of the drinking water for the valleys. As the district is characterised with landforms like structural hills, denudation hill, inter-hill valley, there are many big and small rivulets or 'charras' (streams) in the district like Jarulchhara, Kanchanchhara etc. During the rainy season these 'charras' (streams) serve as the major sources of drinking water for the areas on hill top and hill slops.

8.1. Proposals for storage of irrigation water & Household Work (washing & cleaning etc) water:

8.1.1. Kuhl technique:



Figure 6: *Kuhl technique* [4]

This is a technique used by the farmers for building canals aligned with contours from hill streams or springs known as kuhls. They divert water from natural flowing streams and run at a higher elevation than the

stream to irrigate more upstream lands. The length of the Kuhls varies from 1 to 15 kms. They convey a discharge of around 15 to 100 liters per second. Many kuhls collect rainwater and snow melt running of the slopes from up streams. It has a cross-section of 0.1 to 0.2 square meters. This type of traditional irrigation is in practice in the lower belts of Himachal Pradesh like Kangra, Mandi, Hamirpur. A typical community kuhl services 6 to 30 farmers, irrigating an area of about 20 ha. The kuhls are generally constructed and maintained by the village community.

8.1.2. Naula technique:

Naula is a surface-water harvesting technique in which small wells or ponds are created to collect water. Water is collected by making a stone wall across a stream.



Figure 7: *Naula technique* [5]

They are primarily used for drinking purpose. Big shady trees should be planted surrounding Naula to reduce water evaporation. This is a traditional method used in hilly areas of Uttaranchal. This type of techniques can be strengthened with the help of artificial tanks where the water can be purified and stored for the dry season.

8.1.3. Khatri techniques:

This technique involves hand-hewn caves carved out in the hard rock mountain. Specially trained skilled stonemasons are required to construct them. The size of such storage tanks is around 10X12 feet and 6 feet deep. Cost of constructing storage tanks is around Rs 10,000-20,000 each. This traditional technique is in practiced in few of the districts of Himachal Pradesh. Basically, the water is not harvested from the surface run off but the rainwater that flows through the rocks of hilly regions. In rainy season, water drops down continuously from the roof of the khatri which amounts to approximately 40-50 buckets per day. Usually, the capacity of a khatri varies between 30,000 to 50,000 liters. Different khatris can be dug on a particular hill but at the same level. Training to the tribal people can be given through various skill development programs to construct such storage tanks in their areas.

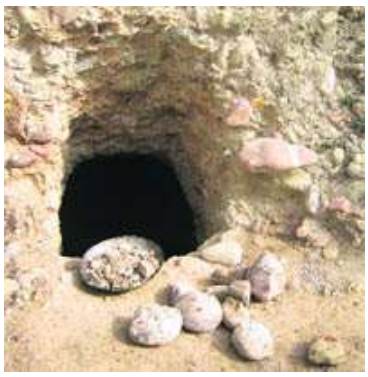


Figure 8: *Naula technique* [6]

All the above-mentioned techniques are low-cost techniques and can be developed by community participation. Participation here does not simply mean being involved in the construction of facilities, it means contributing ideas, making decisions and taking responsibility. Community participation shall motivate the villagers to work together and feel a sense of ownership of the project. They shall feel proud of the benefit of their involvement.

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8.2. Proposals for Drinking water:

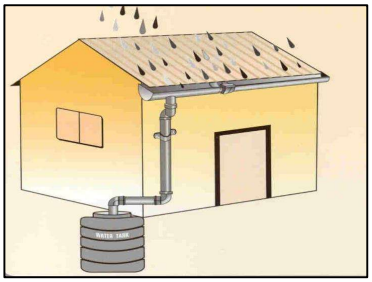


Figure 9: *Roof top rain water harvesting*

Roof top rain water harvesting is one of the less expensive and very effective methods of storing high-quality water that is soft and low in minerals. Rainwater harvesting can prove to be economically viable for rural areas as well as dispersed population in hilly areas. In hilly region like Dhalai which receive a high rainfall, the Government investment for community supply schemes could be replaced by subsidies for installation of rainwater harvesting system.

Following considerations play an important role in the process

a. Requisites for roof top water harvesting: Every year several houses are constructed under Pradhan Mantri Awaas Yojana where the walls are made of bricks and the roof is made out of corrugated sheets. The corrugated sloping roof offers a ready-made solution as the roof catchment of the rain water harvesting system. The existing houses in the hilly area are also low cost houses having sloping roof which will actually help in installation of rain water harvesting system. The size of the houses under Pradhan Mantri Awaas Yojana is 25 sq.mts each.

b.Role of Government: The Government shall provide incentives to the individual users to adopt rainwater harvesting by providing technical and financial guidance along with tax benefits or subsidies. It shall facilitate provision of infrastructure including labour, construction materials, etc.

c.Procedure of Implementation: It is a simple technique of harvesting rain that falls on the rooftop. The amount of water available through this technique is directly proportional to the total quantum of rainfall, run- off coefficient of the roof and the roof area. The requirements for the rooftop rainwater harvesting are stated below:

• Roof catchment

• Gutters

• Down-take pipe and first flush pipe

• Filter unit

• Storage tank

Generally, 6 to 8 households are clustered together in a particular area. So, cluster or community level common drinking tanks can be proposed for these hilly areas as an option. however, we can also propose an individual drinking tank collaborating with Pradhan Mantri Awaas Yojana. Discussed below are both the options along with calculations.

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8.2.1. Option 1: Collective tank system

Projected roof area for 25 sqm house, (Pradhan Mantri Awaas Yojana) with a sloping roof, comes to 31 sqm.

Estimation of water availability from Roof area of 248 sq. m (31sq.m X 8 household) and water harvesting potential:

Table 5: *Calculation of requirements*

Sr.No.	Details of rooftop water harvesting	Value
1	Average rainfall per year	2,150 mm
2.	Average rainfall per day (monsoon months)	12 mm
3.	Average Drinking water consumption per household	40 lit / day
4.	Considering 6 people per household for 8 houses, drinking water required per month	9,600 lit
5.	Drinking water requirement for 4 months (Considering 4 dry months December, January, February, march)	38,400 lit.
6.	Size of the tank considering water level of 2 mts.	4X5X2.3 m
Water harvesting potential (Q) = C (runoff coefficient) x I (intensity of rainfall in mm) x A (area of catchment in sqm). = 0.9 X 12mm X 248 sqm = 2678.4 lit (collection of rain per day) So, **a tank of 38,400 lit will be filled in 15 to 16 days** (considering 12 mm rainfall per day).		

8.2.2. Option 2: Individual tank system

Projected roof area for 25 sqm house, (Pradhan Mantri Awaas Yojana) with a sloping roof, comes to 31 days (of water availability from Roof area of 31 sq. m and water harvesting potential:

Table 6: *Calculation of requirements*

Sr.No.	Details of rooftop water harvesting	Value
1	Average rainfall per year	2,150 mm
2.	Average rainfall per day (monsoon months)	12 mm
3.	Average Drinking water consumption per household	40 lit / day
4.	Drinking water requirement per month per household	1200 lit
5.	Drinking water requirement for 4 months (Considering 4 dry months December, January, February, march)	4,800 lit.
6.	Size of the tank considering water level of 1.5 mts.	2X1.6X1.8 m

Water harvesting potential (Q) = C (runoff coefficient) x I (intensity of rainfall in mm) x A (area of catchment in sqm).
= 0.9 X 12mm X 31 sqm = 334.8 lit (collection of rain per day)

So, **a tank of 4,800 lit will be filled in 15 to 16 days** (considering 12 mm rainfall per day).

Dependency on water harvesting by this procedure is quite high due to sufficient amount of rainfall spread over a longer duration of time. The maintenance is also very low as cleaning and change of filter medium only is required.

Runoff coefficients for various catchment surfaces

Type of Catchment	Coefficients
Roof Catchments	
- Tiles	0.8- 0.9
- Corrugated metal sheets	0.7- 0.9
Ground surface coverings	
- Concrete	0.6- 0.8
- Brick pavement	0.5- 0.6
Untreated ground catchments	
- Soil on slopes less than 10 per cent	0.0 - 0.3
- Rocky natural catchments	0.2 - 0.5
Untreated ground catchments	
- Soil on slopes less than 10 per cent	1.0 - 0.3
- Rocky natural catchments	0.2 - 0.5

Figure 10: *Runoff coefficients for various catchment surfaces* [7]

8.3. Methods that can be adopted to augment/protect the existing sources of water:

Deepening of the present reservoirs by removal of silt and sediments (Dumbo or lake): Over a period of years such type of reservoirs gets filled with mud, silt and plant materials, which either comes as runoff from the catchment area or are deposited due to wind and other factors, make the water body revert to marshland reducing the storage capacity of the reservoir. In the absence of any soil conservation structures in the catchments, the erosion from such catchments gets deposited as silt in the lakes. The process of annual de-silting needs to be undertaken and removal of silt accumulated over the years should be done.

9. Conclusions

The study shows that there is a high potential for rainwater harvesting during rainy season and subsequent use of harvested water in the dry seasons. The findings of the study can be useful for supplying water for:

1.Drinking purpose

2.Agriculture

3.Household Work (washing & cleaning etc).

The improved water supply system can facilitate triple cropping system for valley land and permanent horticultural intervention at hilltop and hillslope. The perennial vegetation in hilltop and hillslope would also act as a soil and water conservation practice. Perennial vegetation is considered as a best management practice to reduce sediment and nutrient loss from hillslope farming. Up scaling of the practices can bring the vast hilly region under sustaining cultivation, which will improve livelihood of the

local farmers. The watershed management will reduce on the overall cost of supplying water to the water scarce areas and in return will help to improve the health and living conditions of the tribal people. The study can provide recommendation for appropriate policy guidelines for future development of hill farming in similar regions to maintain healthy environment and ecological balance.

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Pedagogical Approaches to Ecology in the Anthropocene: Nurturing Nature-centered Learning

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Abstract: *Landscape architecture, architecture and visual art are all primarily mediations between nature and culture. This paper introduces the methodologies, theoretical tools and frameworks adopted at IESCOA Mumbai, for the landscape architecture introductory elective for masters and undergraduate students of architecture.*

The course acts as an introduction to the theories that are central to landscape architecture and explores modes of critical thinking about designed landscapes, in order to strengthen critical practices and stimulate interest in deeper inquiry into the potentials of landscape. It aims to expose students of landscape to wider and more imaginative understanding, appreciation and critique; to expand the range and canon of projects, movements, methods, and modes of practice that we draw on to structure our own design practices; and to build a community of discourse to carry forward through our academic and professional careers.

The collaborative nature of the course encourages co-creation of knowledge and conversation throughout the semester. The politics of a project and the way it engages the layered cultural landscape of a site are always of interest to critical thinkers; but perhaps more so now than in the recent past, as landscape designers and allies seek to process social movements, current events, and challenges to our field together. The course culminates in a catalogue of memos and writings that will help distill larger concepts in the field. Fostering ecological kinship in the way we teach starts with breaking the hierarchy between teachers and students and engaging with students to create a community that shares passions and creates a symbiotic environment.is document as a template for writing paper.

Keywords: Landscape Urbanism; Sensitizing architecture students; Reading

1.Introduction:

Landscape architects and educators over the years have collectively strived to redefine the urban environment and the understanding of the profession beyond mere aesthetics. Society still holds certain expectations for landscapes, viewing them primarily as gardens, parks, plazas, countryside, or wilderness, along with the emerging concept of green infrastructure and sustainability. These spaces are often perceived as beautiful, traditional, and ecological, but rarely as critical. As Richard Weller succinctly puts it, "*Unlike literature, film, theater, art, and architecture, as an expressive medium, landscape is relatively mute. And when it does speak, it tends to do so in the dulcet tones of paradise and arcadia. In that these eclogues are all fundamentally opposed to the venal nature of the city, they can be considered 'critical' artistic tropes, but painted into the background they become little more than escape acts and end up serving the object of their original critique*." (Weller, 2018, pg. 1)

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However, considering we are at the dawn of the Anthropocene and that in 2024 we are inching closer towards a 1.5* C (2.7*F) global warming scenario having crossed 6 out of 9 planetary boundaries, it seems that the time for a more critical approach to landscape design may have come. The challenge for all who wish to engage critically with the subject lies not just in what to express, but in finding effective ways to communicate these ideas through a medium that may seem limited. This is where in addition to innovative designers, the role of design critics becomes paramount.

To bridge the gap between critical theory and practical applications, the course titled "Nature and Culture" was devised for the Masters of Landscape Architecture department as an elective and was also open to students in their final year of undergraduate architecture studies. It was built to eke out space in the curriculum to act as a platform where the art of criticism can be learned and applied. Building on the experience of being a teaching assistant for Jamie Foster and James Billingsley's theory and criticism in landscape architecture course at the University of Pennsylvania the elective explores the various dichotomies and binaries that exist between Nature and Culture.

The aim of the course was to act as an introduction to theory and critical thinking acting as a primer for students who come from varying design backgrounds and introduce them to critical thinking through narrative writing, image making and the spoken word. The paper will cover the methods used to develop the course which include a careful selection of readings and case studies that are spread across various themes that are both global and local which are central to large theoretical concepts that are essential to gain a holistic understanding of the field. It will also talk about building student participation through varying formats that range from reading responses, mediated discussion sessions, reflective graphic making and formal paper submission. It will further outline the observations made during teaching the course and various discussions and feedback received from students which lead to co-creation of the syllabus. The major takeaways will elaborate on the challenges of teaching theory and making it relevant to a generation of students that have easy access to technology and AI and have a very different approach towards design thinking.

2.Framing the Course

Designing a critical thinking course requires blending structured learning with creative exploration. Design theory can often be intimidating as it is a complex concoction of abstract philosophies and theories with practical applications. The dense use of academic language can make reading these theories overly intellectual and inaccessible to student

who are new to the subject and may have varied reading levels. Additionally, it requires students to step out of their comfort zones to reflect on their world-views, question their belief systems and deep dive into frameworks that may seem intangible and

disconnected from direct world applications. The challenge then becomes to as we globally awake to the impact of the commodification of the architectural practice and the built environment on the urban fabric, landscape has a new found relevance, offering a multivalent and manifold medium of making the urban form especially when it comes to dealing with complex natural environments, post industrial sites and the public realm. In his introduction to the Landscape Urbanism reader, Charles Waldheim states that across a range of disciplines landscape has become a lens through which the contemporary city is represented and a medium through which it is constructed. These sentiments are evident in the emergent notion of landscape urbanism. (Waldheim, C, 2006). The course centers around this notion and pulls from existing bodies of knowledge digging deep into the various dichotomies and binaries that confront Nature and Culture.

Spread over 12 weeks the course was constructed to make theoretical frameworks more approachable by dividing the lesson plan into small modules spread over 10 weeks each addressing a broader theme within critical theory, with the first week being reserved for a formal introduction to critical thinking and the last week structured to act as an open forum for students to share their work and exchange vital takeaways.

2.1Building Discourse

Through the course the challenge was to address and engage with readings and precedents for insights into our contemporary conditions and the invocation of the cultural image that nature has been prescribed with. This is central to the idea that Nature and Culture that are often seen in silos are highly intertwined with each other and are in continuous flux thus leading to co-creation of each other and interdependent evolution through time. Each week students were prescribed with two readings and introduced to two project precedents relevant to the weekly theme. These precedents explored the potential of landscape urbanism as an ideology and its ability to shift scales, locate urban fabrics in their regional and natural contexts and to design the various synergies that exist between dynamic processes in the environment and the built urban form. (Corner, J, 2016)

2.2Thematic Literature

The 10 big themes that the course looked at were in the order of Orienting, Seeing, Poetics, Binaries, Ecology, Informality, Water Literacy, Environmentalism and Sustainability. The readings for each week were specifically chosen to highlight key themes and interrogated through the lens of Nature and Culture, the overarching theme that connected all the weeks and became the basis of class discussions and assignments. Special emphasis was placed on not only what the readings would be centered around but also on who was writing them. As designers it is essential to understand the subject through the lens of thinkers from both, within the field and allied to the field. To ground the course in the context the readings and precedents chosen were balanced between scholarship from the Indian Subcontinent and writings by thought leaders around the

world. This exposed students to various ways of seeing and helped them explore themes that could be tangibly applied to their projects.

frame the course as a set of tools that can be used to approach design from the first week, Orienting, looked at readings from a landscape historian, John Stilgoe and a cultural geographer, John Wylie. Their readings act as a primer and introduction to approach the land from and define the various tensions that exist when addressing landscapes, all the time referencing painters like Paul Cézanne and drawing from the etymological origins of the word. Landscape is tension. Tensions that exist between proximity and distance, observation and inhabitation, eye and land and culture and nature.

Seeing, looked at some of the seminal readings from art history and is thematically tied to John Berger's seminal book titled, Ways of seeing, a great introduction to critical thinking and seeing. This was also supplemented by "A View from a window", an article written by Mohammed Shaheer for the LA Journal of Landscape Architecture, India. The aim of the week's readings was to expand the way in which students approached theory and nudge them to let go of their preconceived notions and look beyond the obvious.

Landscape is poetic in nature. As the students expand the way they see Poetics, it helps widen their way of seeing and connects them with the evocative side of the profession. Readings were pulled from poets like Kalidasa and The Kuruntogai, a collection of 401 short poems written in the Sangam period. Five Landscapes: The Tinai of the Kuruntogai delves into the imagery associated with different landscapes and how that portrays distinct moods and experiences.

Binaries pulled from writings by James Corner from The Landscape Urbanism reader and Shaheer and Dua's Landscape and Landscape Culture. The week explores the dualities that exist in theoretical and visual frameworks. "*The practice of landscape design does not have the autonomy of art, but it can certainly question, as art did at the beginning of the last century, the whole premise of its "being" in this new and interconnected world. For art it was the historic 'movement of cubism' in John Berger's memorable phrase, the move from representation - of the object or the scene - to the exploration of the surface and materials of the medium itself. For landscape urbanism the answer to the question what the next step will be is also a subject of theory*." (Shaheer, M, 2016, pg-53)

Chris Reed and Marie Lister's readings inform the Ecology week, drawing from the various genealogies in landscape design, while Travis Beck talks about principles of ecological design and introduces the concept of patch, matrix and corridor dynamics in ecological design.

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The Informality week speaks to the various ways ecology plays out in the global south. David Gouverneur's informal armatures approach looks at ecological corridors and provides tangible examples in applying the patch, matrix and corridor approach to the regional and city level scales of ecological planning, while Alpa Nawre's readings explore designing with nature at the rural scale.

Water Literacy draws from readings by Anuradha Mathur and Dilip Da Cunha and brings the context back to Mumbai and cities around the world where living with rising water levels and extreme storm surge events is slowly becoming the new reality. Learning to design with water and not villainize its existence or treat it merely as an aesthetic element is essential to safeguard our collective climate futures.

Environmentalism looked at readings from Anne Whiston Spirn and her understanding of Ian McHarg's seminal book Design with Nature and introduced students to the layer cake method of understanding the various palimpsests that exist in the landscape.

The Environmentalism week was followed with readings that looked at Sustainability and the readings focused on the fact that landscapes and nature is forced to perform various functions and is objectified to be used as a tool to enhance human life rather than becoming integral and foundational to its very being.

The final week connectivity thus explores the trope by calling back the awareness to the fact that we are not apart from nature but an integral part of it as blood kin and incarnate members and ends with readings from The Song of Trees by David George Haskell.

Table 1. Literature referenced over the ten thematic weeks

Week Theme	Project 1	Project 2
Orienting	What is Landscape? Introduction John Stilgoe	Introduction Of Landscape John Wylie
Seeing	Ways of Seeing John Berger	View From a Window Mohammad Shaheer, Notes
Poetics	About Kalidasa, the world garden and gardens in the world Mohammad Shaheer, Notes	Five Landscapes: The Tinai of the Kuruntogai Mohammad Shaheer, Notes

Binaries	Terra Fluxus The Landscape Urbanism Reader	Landscape and Landscape Culture Mohammad Shaheer, Notes
Ecology	Ecology and Design: Parallel genealogies Projective Ecologies	An Ever-Shifting Mosaic: Landscape Ecology Principles of Ecological Landscape Design
Informality	The Informal Armature Approach Responsive Urbanism	Between community and culture: The criticality of landscape infrastructure reuse in India Journal of Landscape Architecture
Water Literacy	the Sea and Monsoon Within: A Mumbai Manifesto Ecological Urbanism	Introduction: River Literacy of Rivers: Alexander's Eye and Ganga's Descent
Environmentalism	Ian McHarg. Environmentalism and Landscape Architecture Environmentalism in Landscape Architecture	Constructing Nature Anne Whiston Sprin
Sustainability	Slow Landscape: A New Erotics of Sustainability Harvard Design Magazine, vol 31	Sustaining Beauty Journal of Landscape architecture
Connectivity	Preface and Ceibo The songs of trees: Stories from Nature's connectors	

Design in its real sense has been abandoned as a teaching responsibility. Ideas of abstraction, of poetics, of the philosophical import of landscape design and how this can be translated into design is something that systematically has been consigned to the margins. The reasons are again not too difficult to fathom. It is easier to talk about large environmental concerns since it appeals to the heart, but also has no real manner in which its testing or articulation can be really commented upon sharply by the tutor. At the very best the teacher can try and comment on the depth and systemic manner in which the student gathers data and makes connections - but beyond that there is really no possibility of being empirically precise about the critique.

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Data is spotty, the context is usually far removed from general understanding and highly specific to the geography it sits in. The tutor has almost never grappled with similar contexts in real life, nor seen the meanings of the strategies set in place over a period of a few decades. This could be remedied somewhat by serious case referencing - but is almost never done. So, the teaching becomes a collective dance of lament - but rarely sharp sets of actions whose import can be assessed and commented on. (Bhagwat,2019) As Aniket Bhagwat puts it there needs to be a sense of rigor required when it comes to referencing not only projects but also literature that aids in the unraveling of design thinking. A careful curated selection of reading material can help act as a launchpad for students and provide a good theoretical foundation. Designing courses that leave enough space and flexibility for co-creation of knowledge ensures students walk away confident about the subject matter and build long term skills that can aid them in their design careers.

3.Collaborative Learning and Teaching

To foster collaborative learning the class format was designed to enable students to develop their own methodology of critique and reflect on their learning. This was done in 5 ways.

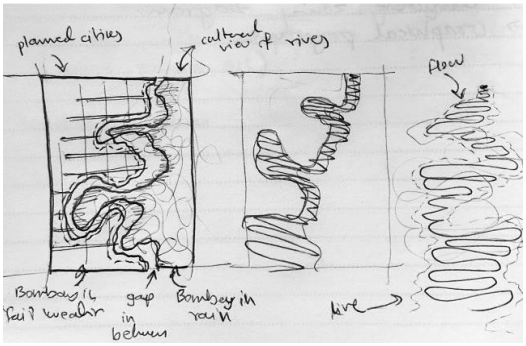
- Weekly reading responses: Every week the students were asked to submit a reading response that was limited to 300 words where they were asked to summarize the readings by highlighting important takeaways and offer their understanding of the literature prescribed.

Reflective writing is essential to summarize big ideas. A smaller word count often reduces the pressure on students who are new to critical thinking and writing thus giving them the space they need to process big ideas and create small memos to capture and store their thoughts.

Reading Roles: Instead of using the whole class time to run a lecture the students were asked to lead the discussion circle for the week that they resonated the most with or were interested to explore more deeply. This led to students taking up initiative and deep diving into themes that interested them and forced them to play a more active role in the class. The discussion leader was asked to read through all the reading responses submitted a night prior to class to help guide the discussion. They were also asked to set up a presentation with parts of the readings that interested them and use it as a tool to walk the rest of the class through the discussion. This method of co-learning became an essential tool and provided the students with the opportunity to gain subject expertise in a specific category, develop their own process and pedagogical approach to both learning and teaching and lead to rich conversations where everyone got a chance to voice their opinions on the readings and generate critical discourse on big theories central to landscape urbanism. Creating a safe environment to share ideas is essential for students to feel comfortable to think out aloud and helps develop a sense of camaraderie.

Postcards: Everyone has a different learning style. Some students find it easier to jot down their thoughts via words while others prefer discussing their ideas. However, since ours is a more visual profession, students were asked to submit two graphics each week. The medium they chose was up to them but the brief was to draw visual parallels between the thematic readings and the critical discourse surrounding them. This turned out to be a highly successful method welcomed by students which led to a creation of memos that helped them make tangible theories that are often abstract and highly intellectualized.

The images below are excerpts from student work.



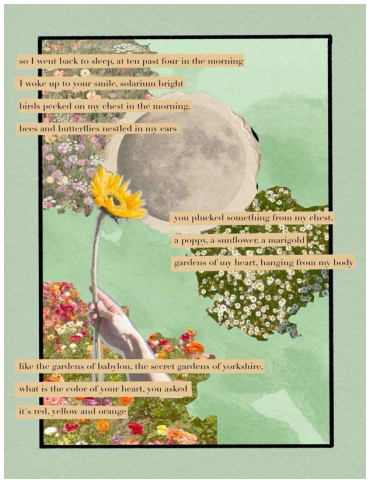


Figure 1. *Student Postcards: Water Literacy Nimish Sawant,2024. (above)*

Figure 2. *Student Postcards: Poetics Prathamesh Patil 2024. (right)*

Case Study referencing: Each week after the student run session of the day 2 seminal case studies were introduced to the students. These case studies covered a range of projects and design proposals from both India and around the world that helped frame the theme of the week. As this session took place right after the student run session the discussions had a certain depth and richness to it that built upon ideas discussed in the previous session. Thus, the student session fed into the teaching session and vice-versa ensuring that the class was on the same page and aligned with each other.

Table 2. Case Studies referenced over the ten thematic weeks.

Week Theme	Project 1	Project 2
Orienting	Fresh Kills Lifescape Field Operations	Timba Basalt Quarry Restoration Prabhakar.B.Bhagwat Associates
Seeing	Vietnam Veterans Memorial Maya Lin	Parc de la Villette Bernard Tschumi Architects
Poetics	Art Biotop Water Garden Junya Ishigami+Associates	Rock Garden Chandigarh Nek Chand Saini
Binaries	LA River Project U.S Army Corps and Engineers	Wadi Hanifah Reserve Moriyama Teshima Planners and Buro Happold
Ecology	Maharashtra Nature Park MMRDA, WWF, India,	Mindscape Garden
Informality	Urban Transformation of Medellín Sergio Fajardo's Vision	
Water Literacy	Chulalongkorn University Centenary Park Landprocess	Red Ribbon Park Turenscape
Environmentalism	Central Park New York Olmsted and Vaux	Potamic River Basin Study Ian McHarg
Sustainability	Allegheny River Park Michael Van Valkenburgh	Nick's Head Station Nelson Byrd Woltz
Connectivity	TIEEDI Forest Garden Utsav Pradhan	

Final Paper: At the end of the semester the students were asked to turn in a 1000-word paper asking them to critically analyze and project of their choice using the various tools, theories and themes introduced to them throughout the semester. Having learnt how to critique projects and write critically the students were enabled to develop their own methodology of dissecting a project and analyzing it to draw conclusions that would help confirm their world view on the subject and draw tangible learnings that could be directly translated into their designs.

3. Conclusion:

Central to the idea of nature centered learning and creating an ecologically sound pedagogy requires a great deal of cross disciplinary interactions and an intersectional understanding of theoretical frameworks spanning across art history, social studies, planning theory, design studies, political ecologies, and natural processes. The course, though young, has been run two times since its inception with each iteration adding to the cannon of projects and readings. Nature and Culture are always synchronous and play hand in hand with each other. Traditional urbanism separates nature and culture, viewing nature as the backdrop to human activity rather than an integrated system. The course challenges this separation by promoting an intertwined approach where ecological systems are embedded into urban planning and design, blurring the line between the natural and public realm. The key to running an elective that hopes to delve into this dichotomy is to cultivate a highly safe, active, participatory and collaborative class environment that engages with students and different levels giving them the space they need to reflect on pressing themes in the Anthropocene and a platform to voice their opinions as equals giving them the confidence the confidence that is required for a good discourse.

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Designing Meditative Spaces: The Role of Environmental and Landscape Elements in Enhancing Spiritual and Emotional Experiences

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Abstract: *A meditative space is a calming and tranquil area that encourages Individual reflection. This research explores the role of architecture and landscape in creating environments that foster meditation, community living and spiritual growth by studying the relationships between the open and the built environment, Landscape Design and the human perception within the Meditative Spaces through an in-depth analysis of two prominent case studies: Triveni Ashram, Pune and Vipasanna Kendra, Igatpuri.*

Using a mixed-method approach, the study integrates both qualitative and quantitative elements. While quantitative analysis includes measurements of physical dimensions, lighting levels, and acoustic conditions, qualitative methods include site observations, architect interviews, and spatial mapping.

By Analyzing parameters like Spatial Layout, Open Built Proportions, Volume and scale, Lighting Design, Acoustic Environment, integration of Landscape features, and Natural Surroundings the research examines how these elements contribute in creating tranquil environments that support both individual as well as community and creates a sense of association to the space. By examining the connection between the quality of spaces and the experience they evoke, the research seeks to understand how architecture can significantly contribute to mental and physical well-being and build a sense of community. The results show how well-considered architectural and Landscape Design along with natural environment deeply rooted in cultural and contextual sensitivity influences healing practices and the meditative experience. It discusses design approaches for spiritual and wellness centers that prioritize general health and foster harmonious cohabitation between people and their surroundings. It focuses on the significance of spatial layout, lighting, acoustics, and nature integration in developing peaceful spaces. Cultural and contextual sensitivity is further emphasized, demonstrating that local traditions and spiritual needs must shape design to enhance the meditative experience. The study suggests that holistic health is related to well-balanced designs fostering both individual reflection and communal activity, with sustainability and integration of natural elements emphasized. The research, in this regard, highlights the role of cultural appropriateness in shaping spaces that support both personal well-being and community connection and offers important lessons for the design of future spiritual and wellness centers.

Keywords: Natural Environment; Landscape Design; Built and Open Environment; Meditation; Sensory Experience.

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1. Introduction:

It is more important than ever to create conditions that promote calm and well-being in the fast-paced, anxiety-prone world of today. Finding balance and tranquilly becomes more challenging as a result of people's disconnection from their inner selves due to the demands of modern life. The creation of contemplative spaces—sanctuaries where people can escape the chaos of everyday life, re-establish a connection with oneself, and attain mental clarity—has consequently attracted increasing attention. This study emphasizes how important design is in creating these kinds of places, turning them from simple physical shelters into settings that promote mental, physical, and spiritual health. This study examines how architecture contributes to the creation of these areas, highlighting how it might enhance emotional stability, mental health, and general quality of life.

Meditative areas serve as havens of peace where the users' well-being is intricately linked to the architectural architecture. Through careful consideration of factors like lighting, materials, natural features, spatial organisation, and aesthetics, architects can design spaces that offer more than just a physical haven. These areas provide significant chances for reflection, rest, and recovery. This study looks at how these architectural elements, when skillfully combined, improve the use of contemplative areas while encouraging emotional equilibrium and mental clarity.

Two noteworthy case studies—Vipassana Kendra and Triveni Ashram—are the subject of the study. These locations were chosen because they creatively combine contemporary architectural ideas with customary religious rituals, illustrating the various ways that design may encourage both solitary contemplation and group engagement. Every website provides insightful information about how to create environments that meet the various needs of those looking for solace and spiritual development.

By fusing traditional Indian architectural features with modern design ideas, Triveni Ashram creates a peaceful setting that encourages social interaction as well as reflection. On the other hand, Vipassana Kendra is a prime example of a minimalist strategy that emphasises quiet areas for in-depth meditation. This research attempts to guide future architectural solutions for meditation spaces by examining these opposing approaches, which not only promote spiritual practices but also contribute to the growing focus on mental health and environmental sustainability.

The primary research questions guiding this study are as follows:

How can the design of built environments be optimized to enhance both psychological and physiological well-being?

In what ways can open environments and open space programs be leveraged to create environments that foster relaxation and promote healing?

How do natural elements like water features, greenery, and natural light, alongside man-made architectural elements, impact the effectiveness of meditative spaces, and howcan these elements be thoughtfully integrated into architectural designs?

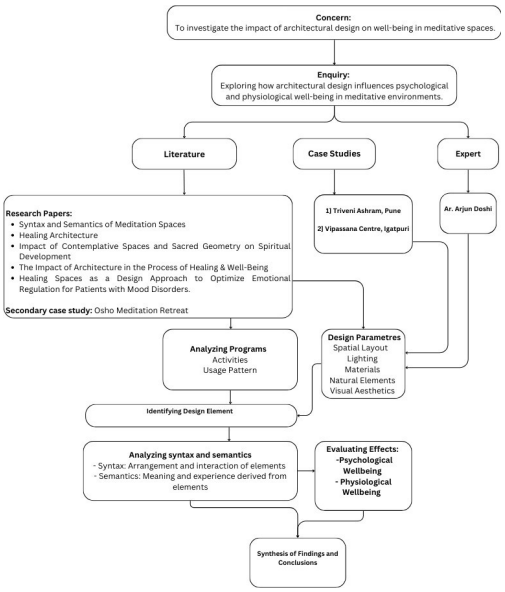


Figure 1: *Methodology Chart*

By means of these enquiries the research paper aims to develop a set of architectural principles that can be utilized in the design and creation of such meditative environments enhancing the wellbeing of individuals in a stressful and hectic modern world. The study examines how architecture and the human experience interact in these sanctuaries, the study seeks to offer valuable insights for architects, designers, and who want to create spaces that foster emotional and spiritual development in addition to physical comfort. The results of this study will provide a roadmap for future advancements in the field of architectural design for well-being and add to the continuing conversation about the significance of creating environments that promote inner peace and harmony.

Literature Review:

Healing architecture is a growing field that explores how the built environment can enhance mental, physical, and emotional well-being. This research focuses on how architectural and landscape elements contribute to meditative spaces, emphasizing their impact on relaxation, spiritual growth, and self-reflection.

Healing architecture integrates natural and artificial elements to create spaces that promote peace and mindfulness. Scholars like Ghazali et al. (2021) and Younis (2020) emphasize that features such as natural light, water, and vegetation are essential in fostering calm and tranquility. Their studies highlight how being surrounded by nature positively influences emotional and psychological well-being, making meditative spaces more effective in reducing stress. Beyond natural elements, architectural features also play a crucial role. Sternberg et al. (2019) and Singh et al. (2018) focus on how materials, spatial arrangements, and sacred geometry contribute to environments that support meditation and spiritual contemplation. Thoughtfully designed spaces can influence emotions, promoting relaxation and deep focus.

The way a space is designed has a significant effect on the people within it. Lee (2017) and Boschi & Pagliughi (2022) furthered research by studying the layout of architectural design to how that might evoke either feelings of serenity or tension. For instance, meditative spaces, by means of circular seating, soft lighting, and enclosed spaces, help facilitate more introspection

and relaxation. The following study draws upon these thoughts and analyzes which particular design features in real life meditative experiences influence such practices.

As more and more texts are written regarding healing architecture, most studies target hospitals, houses, or open spaces rather than meditation centers. Singh et al. (2018) and Sternberg et al. (2019) discuss general principles but do not explore how that applies specifically in meditation spaces. This study attempts to fill in the gap, investigating how architecture can create the spaces that support users seeking spiritual and mental renewal. There is scant evidence, especially in the empirical sense, of how, for example, particular architectural details, such as sacred geometry or watery features, can impact one's emotional well-being in meditation spaces. Younis, 2020, and Ghazali et al., 2021 offer theoretical frameworks but have no cases in real-life experience. This research fills in the gap by using site observations and user wellbeing.

Cultural and spiritual values must be considered when designing meditative spaces. While universal healing architecture principles exist, they need to be adapted to local traditions and user needs. Boschi & Pagliughi (2022) highlight the importance of context, and this research applies those insights to case studies that reflect different wellbeing.

To create truly effective meditative spaces, both natural and built environments must work together. This study aims to provide practical insights into how architectural design can enhance mental and spiritual well-being. By combining theoretical frameworks with real-world case studies, it contributes to the growing field of healing architecture and its application in meditation spaces.

Research Methods:

In order to thoroughly investigate the layout and effects of meditative spaces on promoting peace and wellbeing, this study used a mixed method approach. While quantitative methods were used to study the use of specific heights and volumes, the spatial layout, and lighting to create a meditative setting, qualitative methods were chosen because of the need to explore the complex relationships between architectural elements and their effects on user experience, which are frequently very subjective and personal. In order to collect information that shed light on the spatial, sensory, and emotional aspects of meditation settings, the study used case studies, in-person observations, and interviews.

Criteria for Selecting the Context of Research (Site/Case)

The selection of the two Case studies- Triveni Ashram and Vipassana Kendra was based on several criteria:

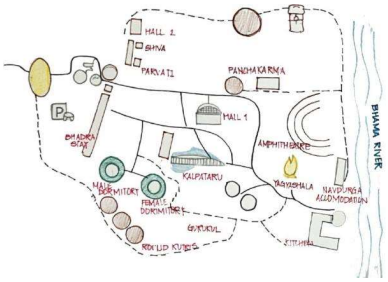


Figure 2: *Triveni Ashram Site plan*



Figure 3: *Vipassana Kendra Site plan*

Relevance to the Research Focus: Both the case studies serve as an example for the use of architecture to create meditative spaces that address present- time issues of stress and mental well-being.

Diversity in Architectural Approach: Both the case studies represent different architectural philosophies and approaches that integrate modern design with spiritual practices, offering a comprehensive perspective on the subject.

These criteria ensured that the chosen case studies offered a basis for investigating the research questions and fulfilling the study's objectives.

Type of Interviews

In order to get the insights into the design intentions and decision-making processes, the research employed a semi-structured interviews with the Architects and Designers who were engaged in the design and planning of the meditative spaces.

Plan for Conducting the Data Collection

The data collection was conducted over a year which included Drawings, Interviews, and relevant research papers, with site visits to two case studies:

Triveni Ashram: These standards made sure that the selected case studies provided a foundation for examining the research issues and achieving the goals of the study.

b) Interview Types
In order to get insight into the design intents and decision-making processes of the architects and designers involved in the planning and design of the meditative spaces, the research employed semi-structured interviews with them.

b) Make a plan for gathering the data.
Drawings, interviews, pertinent research articles, and site visits to two case studies were all part of the data collection, which lasted more than a year:

Triveni Ashram: Two site visits were made, with an emphasis on various aspects of the ashram's design, common areas, and private areas for introspection.

Vipassana Kendra: Two visits to Vipassana Kendra were conducted, with a focus on examining the meditation halls, individual cells, and the overall acoustic environment

Method Employed for Gathering Data to Answer Research Questions To answer the research questions, the following methods were employed:

Site Observations: During the site visits detailed observations were made with an emphasis on the spatial layout, use of materials, lighting, acoustic environment, and natural elements. Both the tangible and intangible elements were captured through sketches, photographs, and notes.

Document Analysis: Existing architectural plans and sections, and relevant literature werereviewed to contextualize the findings from site visits and interviews.

These methods were chosen to provide a miscellaneous understanding of how architectural design influences the experience of meditative spaces, aligning with the research questions.

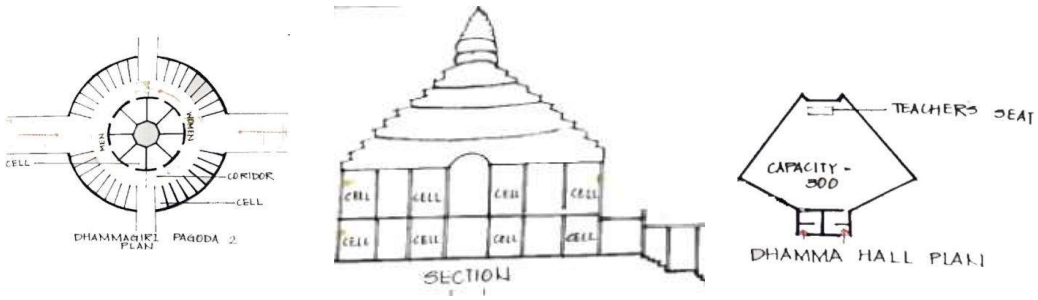


Figure 4: *Plan and Section of Meditation Hall, Vipasanna Kenda, Igatpuri*

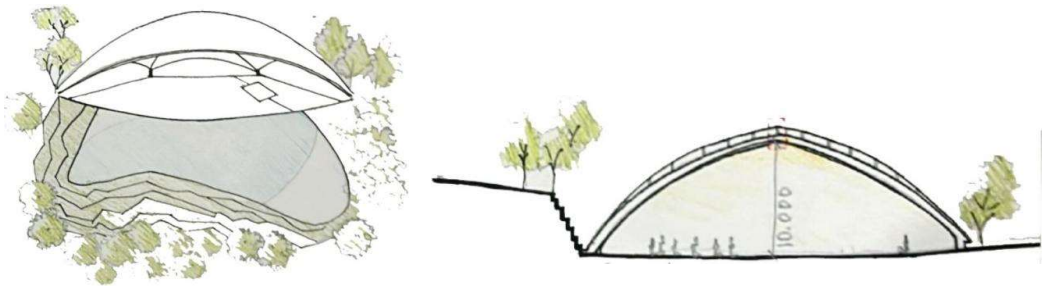


Figure 5: *Elevation and Section of Meditation Hall, Triveni Ashram, Markal, Pune*

To determine how well architectural design can create places for meditation and spirituality, a thorough study of Triveni Ashram and Vipassana Kendra was carried out. In order to visually depict the spatial arrangements and context, site sections for both locations were created for this study. Meditation, social meetings, and therapeutic practices were highlighted as important programs that occur in these places.

The precise design components that support these activities were identified for each program, including the volume of structures for best results, the placement of water features strategically, and the usage of materials.

light and ventilation. Additionally, the impact of these design elements on the user experience and overall functionality of the spaces was assessed. This approach allowed for a comprehensive understanding of how design choices influence the effectiveness of the programs and contribute to the meditative spaces and spiritual quality.

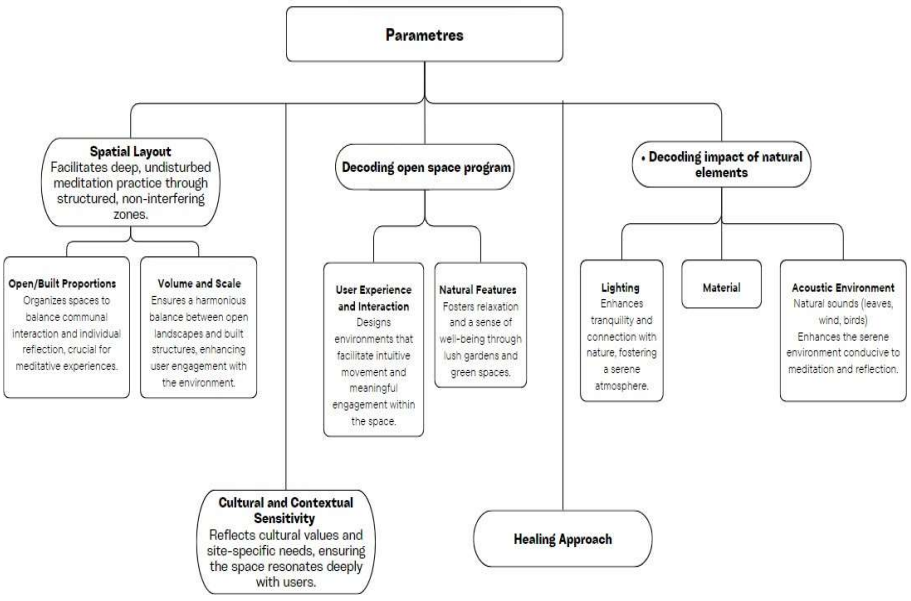


Figure 6: *Design Parameters taken into consideration*

Analysis, Results & discussions -

The research focuses on two significant meditative spaces: Triveni Ashram in Pune and Vipassana Kendra in Igatpuri.

Triveni Ashram is a holistic spiritual center that integrates traditional Indian spiritual practiceswith contemporary architectural elements. The ashram emphasizes community living, personalreflection, and a balanced environment that nurtures both individual and group activities. Its design incorporates natural elements, shared courtyards, and quiet zones, creating harmony.



Figure 7: *Triveni Ashram*



Figure 8: *Vipasanna Kendra*

Vipassana Kendra, Igatpuri, is one of the most renowned meditation centers dedicated to the practice of Vipassana meditation. The center's architecture is minimalistic, with a strong focus onfunctionality and simplicity. It features distinct zones for various activities, including individual meditation cells, large halls, and open gardens, all designed to support deep, uninterrupted meditation. The site's architecture reflects the

core principles of Vipassana, emphasizing silence, introspection, and a direct connection with nature.

Through these case studies, this research critically examines how architectural elements shape theexperience of meditative spaces. The study explores the influence of spatial layout, lighting, materials, natural elements, and acoustics on creating environments conducive to meditation and spiritual growth. The analysis presented here correlates directly with the Program of Spaces, Syntax, and Semantics, providing detailed insights and authenticating the findings.

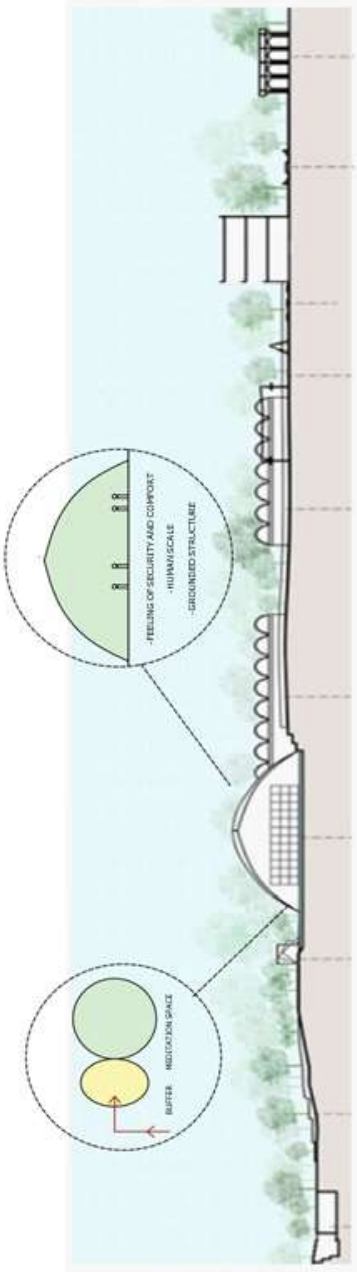


Figure 9: Site section of Triveni Ashram

Program	Elements	Meaning
Program: Welcoming and impressive entry point.	Element: Aesthetically designed entryway	Meaning: The entrance creates a sense of invitation and openness, setting a welcoming and tranquil tone as visitors enter the ashram, symbolizing the transition from the external world to a spiritual sanctuary.
Program: Relaxation and meditation area for individuals and small groups.	Design Elements: Circular seating arrangement, central water pond, surrounding greenery, soft lighting.	Meaning: Community gathering, fostering a sense of unity, and connection with nature.
Program: Outdoor central gathering space.	Element: Central Courtyard	Meaning: Promoting social interaction and community activities. This space also includes a kids' play area, fostering a family-friendly environment that encourages relaxation and connection.
Program: Outdoor Activity Area	Element: Planned open space	Meaning: Provides a space for children to engage in physical activities. This area allows children to connect with nature and participate in the meditative program in an age-appropriate manner.
Program: Living accommodations for Male meditators.	Element: Simple dormitory-style rooms, often with shared bathrooms	Meaning: Provides basic, comfortable accommodations that encourage simplicity
Program: Living accommodations for female meditators	Element: Simple dormitory-style rooms, often with shared bathrooms	Meaning: Provides basic, comfortable accommodations that encourage simplicity.
Program: Meditation	Element: High ceiling and large openings	Meaning: The high ceiling creates an open and airy environment, which enhances the feeling of spaciousness and tranquility. This design supports deep meditation by providing a serene space with a direct visual connect to the nature
Program: Leisurely walks	Element: Meandering Pathways Surrounded by Greenery	Meaning: Encourages leisurely walks and contemplation, promoting relaxation and a connection to nature. The greenery provides a calming and restorative environment.
Program: Open Area for Public Gathering	Element: Amphitheatre	Meaning: Creates a focal point for community gatherings and spiritual programs, promoting collective experiences and a sense of unity. The view of the river adds a serene backdrop, enhancing the spiritual ambiance.
Program: Private, quiet residential spacesDesign	Elements: Subterranean rooms, minimalistic interiors.	Meaning: The below-ground accommodation offers a secluded and quiet environment.

Table 1: Program and use of Architecture element analysis at Triveni Ashram.

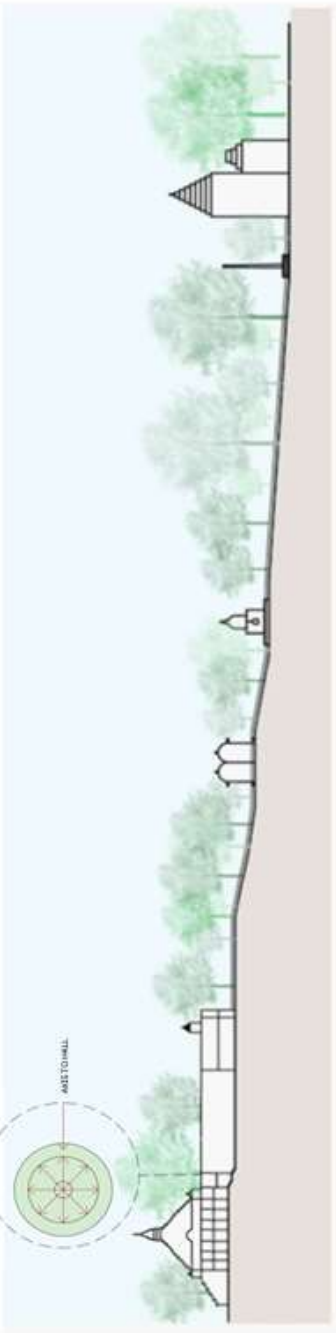


Figure 10: Site section of Vipassana Kendra .

Program	Element	Meaning
Program: Welcoming and impressive entry point	Element: Large, aesthetically designed entryway	Meaning: Creates a sense of importance
Program: Symbolic monument design	Element: Tall, monumental column, Ashoka pillar-inspired design, central placement at the entrance.	Meaning: The grand entrance with standing monument embodies the principles of mindfulness, reverence and strength
Program: Leisurely walks	Element: Meandering pathways surrounded by greenery	Meaning: Encourages leisurely walks and contemplation, promoting relaxation and a connection to nature
Program: Bell tower and sound fore marking meditation sessions	Element: Elevated bell tower, centrally located, resonant bell tones	Meaning: Ritualistic signalling of meditation periods, creating a rhythmic and calming effect
Program: Living accommodations for meditators	Element: Simple dormitory style rooms, often with shared bathrooms	Meaning: Provides basic, comfortable accommodations that encourage simplicity
Program: Group meditation sessions	Element: Large, open halls with high ceilings	Meaning: provides a communal space for collective meditation, fostering a sense of unity and shared purpose
Program: Personal meditation practice	Element: Small, isolated rooms with minimal and subdued lighting	Meaning: Facilitates deep, undisturbed meditation

Table 2: Program and use of Architecture element analysis at Vipassana Kendra.

DECODING BUILT ENVIRONMENT

Spatial Layout

The spatial layout of meditative spaces plays a crucial role in facilitating both individual and communal activities. Triveni Ashram, with its central courtyards and open areas, encourages community engagement while also providing secluded zones for personal reflection. Vipassana Kendra's layout, on the other hand, includes isolated cells and meditation halls designed to minimize distractions and support deep, undisturbed meditation.



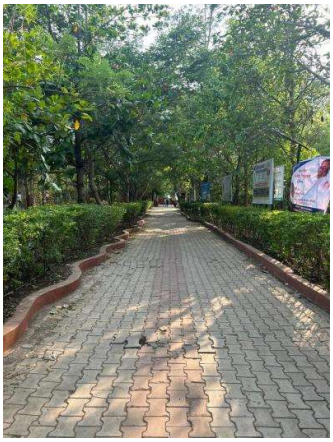


Figure 11: *Spatial Layout – Triveni Ashram and Vipassana Kendra*

Triveni Ashram: The open areas in Triveni Ashram foster community gatherings, promoting unity among users, while more secluded zones provide space for individual meditation practices.

Movement patterns within the ashram are characterized by a natural flow between communalspaces, such as courtyards and amphitheaters, where higher concentrations of people come together for group activities.

Vipassana Kendra: The spatial organization of Vipassana Kendra emphasizes isolation and quietness, catering to individuals seeking deep meditation experiences. Movement patterns lead directly to private meditation cells and halls. This results in lower density in communal areas andhigher concentrations of people within the isolated meditation space.

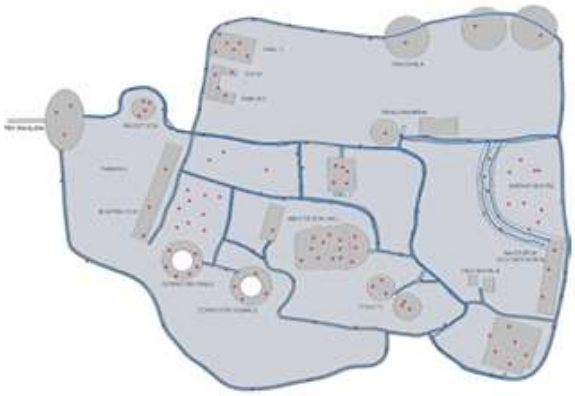


Figure 12: Movement Lines and Concentration Points in Triveni Ashram

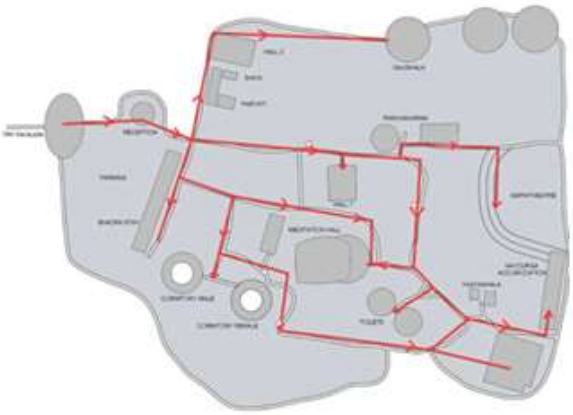


Figure 13: Spatial Configurationin of Triveni Ashram

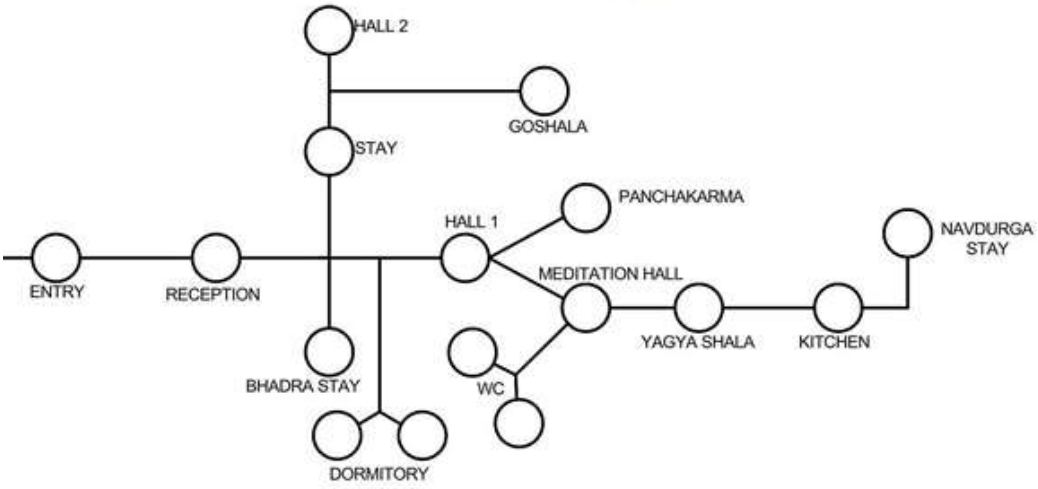


Figure 14: Space Syntax Diagram of Triveni Ashram



Figure 15: Movement Lines and Concentration Points in Vipassana Kendra



Figure 16: Spatial Configuration in Vipassana Kendra

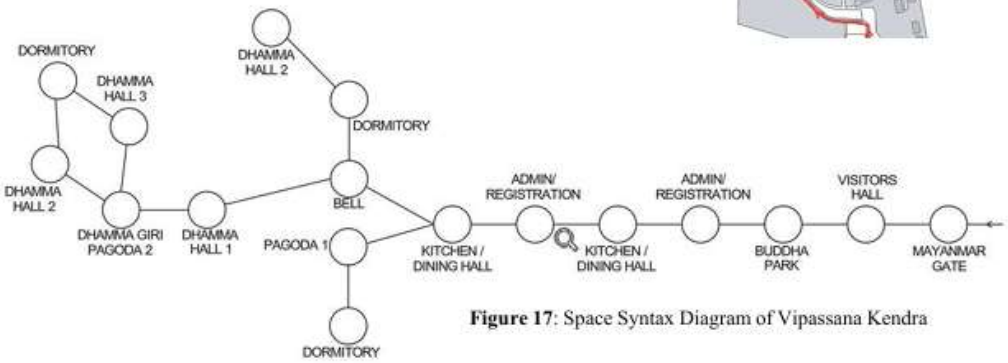


Figure 17: Space Syntax Diagram of Vipassana Kendra

DECODING OPEN SPACE PROGRAM- Landscape Design

User Experience and Interaction

User experience is a central consideration in the design of meditative spaces. Both Triveni Ashram and Vipassana Kendra prioritize ease of navigation, comfort, and meaningfulengagement, which are essential for effective meditation and healing.

Triveni Ashram: The design encourages communal and individual practices, providing spaces that cater to different needs and preferences.

Vipassana Kendra: The emphasis on simplicity and minimalism in design supports focused and uninterrupted meditation.

The analysis of Triveni Ashram and Vipassana Kendra underscores the importance of architectural design in creating effective meditative spaces. By considering factors such as spatiallayout, lighting, materials, natural elements, and acoustics, architects can design environments that not only facilitate meditation and reflection but also promote overall well-being. The findings highlight how architectural syntax (design elements) and semantics (meaning and experience) contribute to the creation of peaceful and harmonious spaces that support spiritual growth and personal transformation.

Integration of Natural Elements

Natural elements such as greenery and water features are essential components of meditative spaces. These elements not only enhance the aesthetic value but also contribute to the therapeutic environment that supports meditation and relaxation.



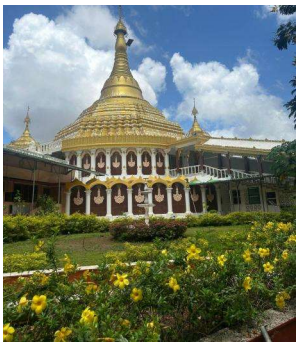


Figure 18: *Natural Elements in Triveni Ashram and Vipasanna Kendra*

Triveni Ashram: The integration of gardens and water bodies enhances the sense of tranquilityand promotes a deeper connection with nature.

Vipassana Kendra: The minimal use of natural elements is strategically designed to avoiddistractions while still providing a calming influence.

3. Topography

Topography adds diversity to meditative environments, influencing spatial organization and user experience.

Triveni Ashram:

Natural land forms come alive as stepped meditation areas for private, differentiated experiences. Elevated grounds and curvaceous walkways take the user to shaded gardens and water elements that promote exploration and human nature interaction.

Vipassana Kendra:

Ground rises gradually from the entrance up to the Dhamma Hall, concretely demonstrative of spiritual growth. Walkways were designed with slope gradient in mind; principal interior spaces are located on higher levels to eliminate distractions and retain privacy.

4. Water Features

Water features enhance tranquillity, fostering a serene sensory experience and connection with nature.

Triveni Ashram:
Reflecting pools and cascading water elements promote calmness, cool the microclimate, and provide soothing sounds. Symbolizing purity and continuity, these features align with the ashram's spiritual philosophy.

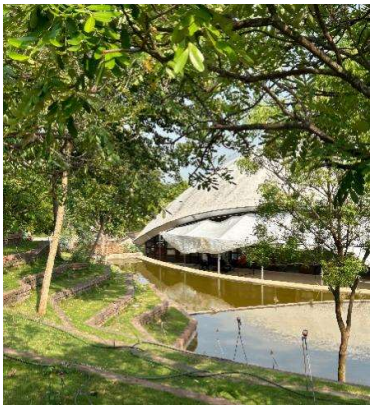


Figure 19: Water Feature in Triveni Ashram

Vipassana Kendra: Unlike Triveni Ashram, Vipassana Kendra does not feature evident water elements in its design. This aligns with the center's philosophy of minimalism and focus, ensuring that meditation practitioners experience an undistracted environment.

5.Seating Areas

Seating areas are optimized for comfort as well as to suit individual and group needs.

Triveni Ashram:

Ferrocement seating is neutral in tone and positioned among trees, water bodies, and pathways, evoking serenity. Circular benches promote group interaction yet sit well with the ambiance.



Figure 20: *Seating Area in Triveni Ashram*

Vipassana Kendra:

Muted wood or stone seating is put forth in inconspicuous places to encourage silence and introspection. The minimal scope of communal seating aligns with the ideals of having the student focus on meditation.

DECODING IMPACT OF NATURAL ELEMENTS

Lighting and Its Psychological Impact

Lighting is integral to establishing a serene and contemplative atmosphere in meditative spaces. Triveni Ashram utilizes natural lighting to create a calming ambiance, while Vipassana Kendra employs subtle artificial lighting to maintain focus and reduce distractions during meditation session.



Figure 21: Lighting Schemes in Triveni Ashram and Vipasanna Kendra

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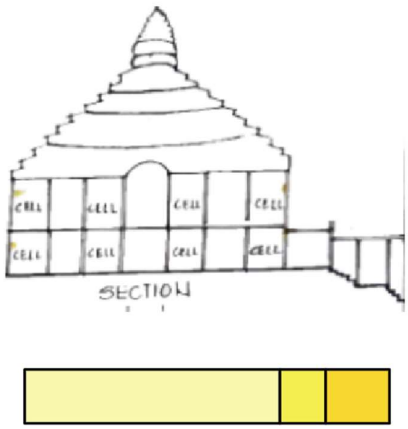


Figure 22: Hierarchy of Quality of Light

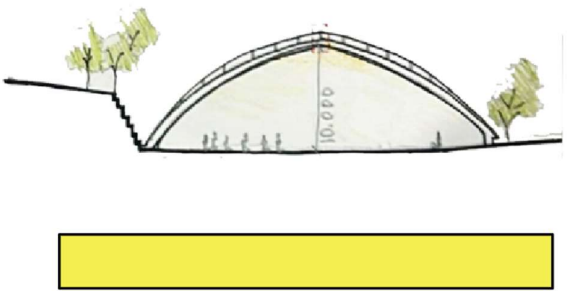


Figure 23: Quality of Light in Triveni Ashram

Triveni Ashram: The natural light enhances the spiritual ambiance, connecting users with the external environment and supporting peaceful meditation.

Vipassana Kendra: Controlled lighting techniques ensure that the environment remainsconducive to meditation, with minimal visual interruptions.

Materials and Their Influence on Atmosphere

Materials play a vital role in shaping the atmosphere of meditative spaces. Triveni Ashram's use of Ferrocement allowed for the creation of innovative and structurally sound spaces that seamlessly integrated with the ashram's natural surroundings. Vipassana Kendra, with its focus on

simplicity, employs locally sourced materials that emphasize sustainability and support the meditative practice.

Triveni Ashram: The choice of materials contributes to a visually and spiritually enriching environment, fostering a deep connection with the space.

Vipassana Kendra: The minimalist approach to material selection aligns with the center's philosophy of simplicity and mindfulness.

Acoustic Environment and Sensory Experience

The whole experience in meditation areas is greatly influenced by the soundscape. While Vipassana Kendra uses controlled acoustics to keep meditation participants focused, Triveni Ashram uses the natural noises of the surroundings to create a tranquil mood.

Triveni Ashram: The tranquil surroundings are enhanced by natural sounds like chirping and leaf rustling, which contribute to the contemplative experience.

Vipassana Kendra: Deep meditation is supported by a controlled acoustic environment that minimises aural distractions.



Figure 24: Bell used at Vipasanna Kendra to mark The beginning and end of meditation sessions.



Figure 25: Isolated cells with a controlled Acoustic environment for deep meditation environment.

CULTURAL AND CONTEXTUAL SENSITIVITY

The design of both Triveni Ashram and Vipassana Kendra reflects a deep sensitivity to cultural and contextual factors, ensuring that the spaces resonate with their intended users.

Triveni Ashram: The architecture embodies traditional Indian spiritual values, making itrelevant and meaningful to its users.

Vipassana Kendra: The minimalist design aligns with the philosophy of Vipasanna, providing a space that supports the meditative practice.

Conclusion:

Optimizing Built Environments for Well-Being: Through careful consideration of spatial arrangement, materials, and sensory factors, the research explores how architectural design, particularly in meditative places, promotes well-being. The design of Triveni Ashram promotes psychological comfort and mental health by establishing settings that strike a balance between privacy and social connection, as shown in the quiet areas and central courtyards. As demonstrated in Vipassana Kendra, natural materials, simple designs, and thoughtful lighting all help to lower anxiety and create a calm environment that is ideal for meditation and rest.

Leveraging Open Environments for Relaxation: Triveni Ashram's gardens and common areas are examples of open spaces that are purposefully planned to promote social interaction and introspection. Direct access to nature is offered by these areas, which is known to reduce

stress levels and promote healing. The incorporation of open landscapes promotes outdoor activities and supports physical movement and mental relaxation, aligning with research that highlights the benefits of nature in enhancing well-being.

Impact of Natural and Man-Made Elements in Meditative Spaces: The effectiveness of a meditative space crucially depends on the integration of natural elements like water features, greenery, and natural light, alongside man-made elements such as architectural layouts. For example, in Vipassana Kendra's cells enhance the serene ambiance. These elements are thoughtfully integrated to create a harmonious environment that nurtures introspection, spirituality, and relaxation, demonstrating how natural and architectural features can work together to enhance the meditative experience.

Future Exploration: By investigating how these design concepts be applied to other cultural contexts or by examining how emerging technologies affect the development of meditative spaces, future research could build on these findings. Furthermore, additional research might examine how these areas affect users' mental and physical health over the long run, offering quantitative evidence to back up the study's qualitative findings. Lastly, architects and designers should explore how meditative design principles can be implemented on different scales. At the site level, larger green spaces and water bodies can create expansive, restorative environments, while at the building level, smaller meditative nooks, private gardens, or soundproofed chambers can provide intimate spaces for individual reflection. Balancing the open-built ratio with a sensitivity to local environmental conditions is key to creating spaces that encourage both communal and solitary experiences. Architects should consider the integration of natural elements such as trees, water, and light while ensuring the structures are responsive to climate, user needs, and the surrounding landscape.

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Viewing Architecture through the Landscape Lens

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Abstract: *How does one 'think' Architecture? If we popularly establish that it is the 'act of building', then it is critical to question what and why are we building and most importantly how and how much are we building. Architecture as a field has immense possibilities to proliferate into multiple*

capacities and thence adopt varied, diverse approaches to perform the said 'act of building'. One such approach is that of Landscape Architecture Theory and Research. The landscape lens can be an effective tool to design built environments and more often provides an all-encompassing framework to not just build but also assess and analyse the construct of the built environment.

If we interpret 'Design' as a form of research, then the design studio may be considered as the setting for research. In that case, the studio becomes a generator of theoretical insights and propositions and the studies conducted, offer a comprehensive base-work to enable oneself to design sensitively and contextually.

The paper attempts to discuss the landscape architecture pedagogical framework – a lens that can integrate with architectural thinking and the design studio to create built environments that effectively address issues of climate change, ecological sensitivity and loss of cultural identity. The paper shall look into various theories, techniques and models in the domain of Landscape Architecture that can possibly set up the base for designing built environments. The paper shall also present some of the academic works that perhaps become a sample to investigate the appropriateness & application of the said framework.

Keywords: Landscape Architecture Theory, Landscape Research and Models, Architectural Thinking, Design Studio Approaches

1.Introduction:

The research paper presents three modules which are basically exercises conducted in Landscape Design Studio for Semester 5 & 6 in the under-graduate architecture degree program (B.Arch.). Each module is explained through four sections; the Premise- which gives a brief introduction to the title of the module, Theoretical Framework – the models and theories based upon which the exercise is designed, Studio Exercise – details of the exercise conducted in the aforesaid design studio & Application Possibilities. The theoretical framework is adopted from the book Landscape Architecture Research: Inquiry, Strategy, Design by M. Elen Deming & Simon Swaffield and mentions references from the same.

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The modules can perhaps become components of the landscape architecture pedagogical framework – a lens that can integrate with architectural thinking and the design studio to create built environments that effectively address issues of climate change, ecological sensitivity and loss of cultural identity. These tools can not only be an effective tool to design built environments but also provide an all- encompassing framework to build and also assess and analyse the construct of the built environment.

Module 1: Associations in Landscapes Premise

The understanding of this module itself begins with the understanding and interpretation of the two terms in its title – 'associations' & 'landscapes'. The word association here means connections or relationships that one can have with and within landscapes. And the interpretation of the term 'landscape' changes across scales. For example, one can connect with the idea of landscape through a *tulsi vrindavan* in their garden, while one connects with landscape through their experience of an adventure trek and its journey. Perhaps then, we could identify and define the nature and type of these associations in landscapes depending on the narrative linked with them. Imagine a group of children, climbing and playing around a mango tree grove; their association with landscape is that of play and probably nostalgia as they grow. For a farmer whose livelihood depends on the rice field that he works in day and night, landscape is a resource. And whether the *Tulsi Vrindavan* or the River Ganga, both revered by people in India, association with landscape is that of faith, belief & prayer, perhaps, at two different scales.

Theoretical Framework

Interpretive research strategies start from the recognition that the meanings of objects, events, words, actions, and images are not always plain and obvious, and they require the investigator to actively engage in "making sense" of the phenomena they encounter. The consequence of becoming actively engaged in interpreting meaning is that conclusions can never be totally independent of the investigator. In effect, the investigator becomes a social actor within the research, and understanding is actively constructed through mediation between researcher and the data. The interpretive strategy, therefore, sits between the objective and subjectivist positions. Interpretive strategies are also characterized by a second type of mediation, as the researcher moves reflexively between the observed data and the theoretical concepts that are brought to the investigation and used to make sense of what is found.

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The situations in which interpretive research strategies can be helpful vary widely, as do the research designs and detailed methods that can be used. However, interpretive strategies are most typically used when people and their social relationships are a significant or primary focus of investigation. In landscape architecture this can range from situations where information about a landscape research question comes from working with people in a particular landscape, to situations where understanding and insight is sought through analysis and interpretation of text, signs, or images that people--both past and present-have created about landscape. What is common across this range of interpretive strategies is the need for some measure of empathy with those involved, and an ability and willingness to reflect critically and actively upon the role of the researcher and the wider research community in constructing understanding.

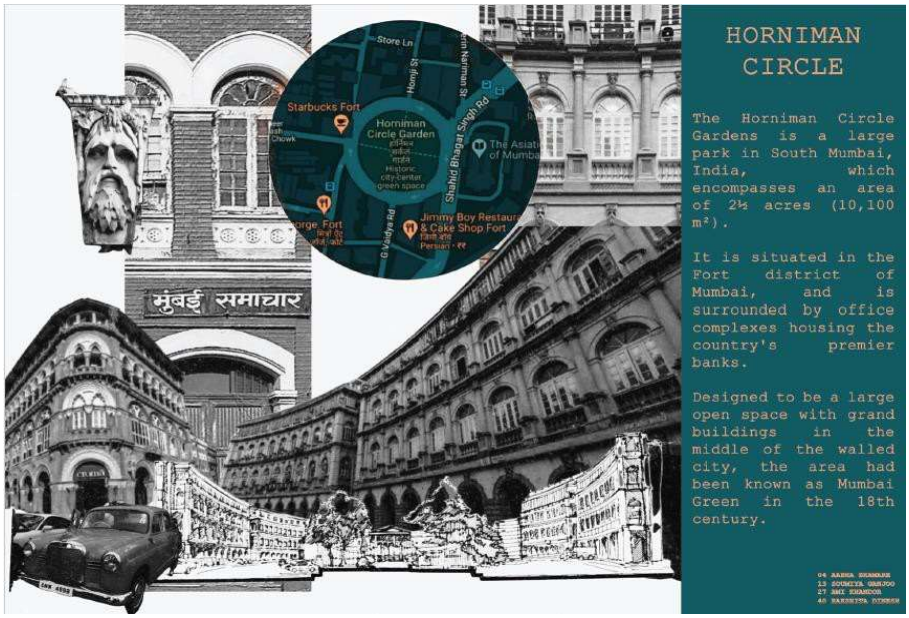
Studio Exercise

Type of Exercise: Group, On-field & Studio Work

Students are given public spaces in the city as sample spaces to study. They are to conduct on-field observations, surveys, interviews for the given sites. Thereafter, a detailed understanding of the sample space with respect to history, demographics, present scenarios etc is to be looked at. After gathering on- field data and information from research carried out, the students are to present their understanding about 'Associations in the Landscape' (ie in the sample space) under the following titles; *personal* – looking at expressing individual associations of people with the place, *collective* – decoding shared experiences and narratives of the people about the place & *city* – identifying values and functions of the place at the urban scale. The three titles categorically attempt to interpret socio-cultural relationships within the setting at three distinct scales. The setting for each sample space could vary from natural to man-made to man modified.

The objective of the exercise is to view a place, a site through a socio-cultural layer. The three titles do present an overlap where the individual is a part of a collective and the collective in turn is eventually a part of the city. However, separating them into different layers simply offers a nuanced perspective of the place ranging from findings that could be experiential and hence personal to endemic and pertaining to a large group or a bigger entity.

Following are two sample spaces presented. Sample Space 1: Horniman Circle, Fort, Mumbai & Sample Space 2: Banganga, Walkeshwar, Mumbai.



Graphic illustrating the 'Image of the Place: Horniman Circle'

Source: Students' Work. Graphic generated by Aabha Bhamare, Soumiya Ganjoo, Ami Khandro, Rakshita Dinesh



Graphic illustrating Individual Associations with the sample space (Horniman Circle)

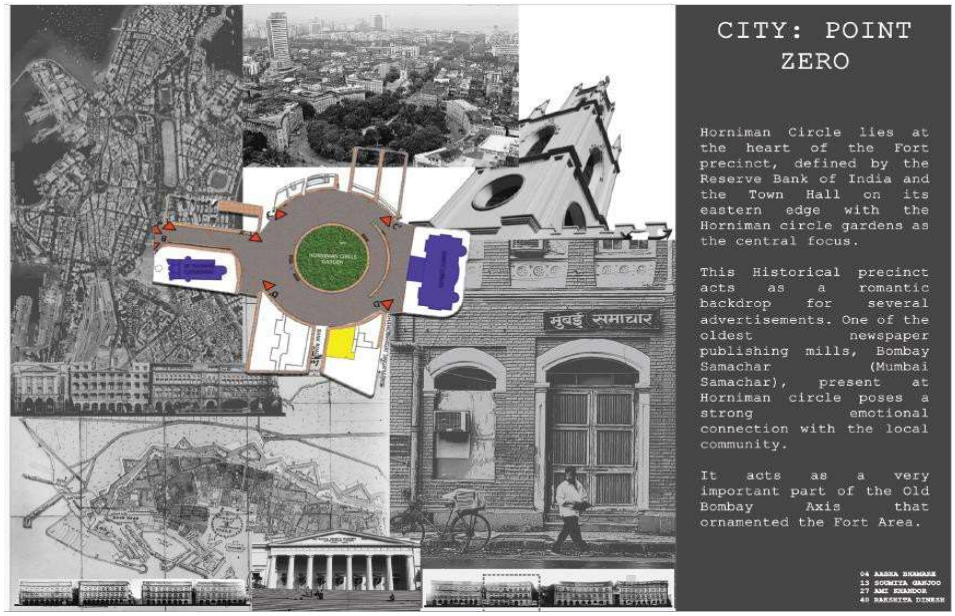
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Graphic illustrating Collective Associations with the sample space (Horniman Circle)

Source: Students' Work. Graphic generated by Aabha Bhamare, Soumiya Ganjoo, Ami Khandor, Rakshita Dinesh



Graphic illustrating Associations of the sample space (Horniman Circle) with the city

Source: Students' Work. Graphic generated by Aabha Bhamare, Soumiya Ganjoo, Ami Khandor, Rakshita Dinesh

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Graphic illustrating the 'Image of the Place: Banganga'

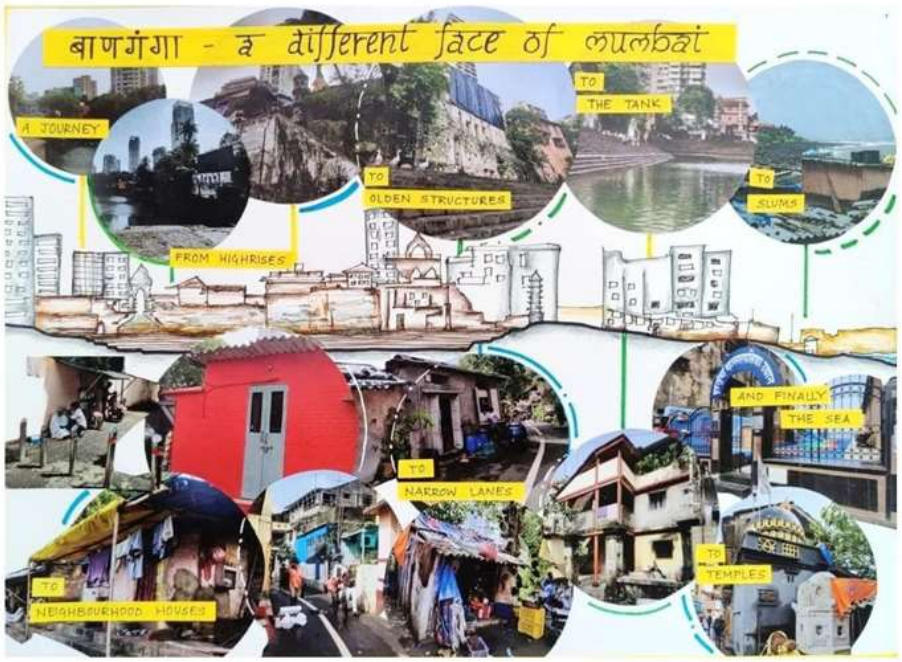
Source: Students' Work. Graphic generated by Srishti Dusane, Sakshi Kanchan, Shatakshi Sawant, Anushka Sutare



Graphic illustrating Individual Associations with the sample space (Banganga)

Source: Students' Work. Graphic generated by Srishti Dusane, Sakshi Kanchan, Shatakshi Sawant, Anushka Sutare

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Graphic illustrating Collective Associations with the sample space (Banganga)

Source: Students' Work. Graphic generated by Srishti Dusane, Sakshi Kanchan, Shatakshi Sawant, Anushka Sutare



Graphic illustrating Collective Associations with the sample space (Banganga)

Source: Students' Work. Graphic generated by Srishti Dusane, Sakshi Kanchan, Shatakshi Sawant, Anushka Sutare

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Application Potential

Architectural Typology: Public Spaces, Urban Inserts

The module offers a framework that helps analyze the socio-cultural references in the given setting. It may also prompt the relationships the place may have had in history. The findings, especially in the third title – 'association at city level' could present larger scale physical connects and narratives in the landscape setting. All of this, perhaps, can become a part of the research for design while dealing with projects falling under Public Space Design & Urban Inserts typology.

Module 2: Landscape as Setting for Architecture Premise

It is imperative that we view Architecture or any built form in conjunction with its surroundings or the larger landscape context. The context may hide or complement the built form; it may overpower or simply enhance the composition of the built form. It may add to the quality of the architectural experience making it more dramatic or it may simply be of an aesthetic appeal to the user. If the Landscape context is analyzed and reviewed appropriately, then it can offer itself as a setting or a canvas for the architecture that is to be proposed in it.

The aim of this module is to analyze an architectural intervention with respect to its setting within a Landscape. It also attempts to understand the experiential quality of the landscape, independently and in conjunction with architecture.

Theoretical Framework

Many research strategies used in the natural sciences and the naturalistic social sciences achieve explanatory value by narrowing the focus of investigation. For example, experimental strategies adopt designs that aim to isolate key factors that can be controlled and their relationships manipulated, in order to derive formal measures that can be analyzed using statistical methods. These, in turn, can be used to test formal models and theories. However, landscape is a complex phenomenon that is very hard to break up into pieces in order to investigate using experimental techniques- particularly as it involves people and social relationships as well as biophysical relationships. In situations where the subject of research is complex and involves the interaction of both human and biophysical relationships, many applied disciplines adopt a case-study strategy (Yin 2005, Gerring 2007)

Case studies are complex multifaceted investigations into a particular place, project, organization, or landscape. Yin (2005) defines them as "empirical" inquiries into "contemporary phenomena within a real-life context" and notes that they are particularly useful when there are no clear boundaries between the focus of research and the context. He identifies three types of case study descriptive studies, exploratory studies, and explanatory studies. According to Yin, the key factors in selecting a case-study strategy are the type of question, the degree of control over the situation, and the type of phenomenon, particularly over time It is important to note that case studies can also be

used in a strategy to explore new topics, and there are many examples where a number of comparative case studies are used to build a typology or working classification of situations that can generate further, more precise research questions. It is also possible to use a case-study approach to test alternative explanations, either by selecting several case studies that provide contrasting situations, or by using a single complex case study as the basis for several contrasting modes of analysis or alternative theoretical explanations.

Studio Exercise

Type of Exercise:

Group, On-field & Studio Work

Students conduct analysis of various case studies which are architectural projects. The lens used here is that of landscape architecture and the projects are reviewed from certain points of analysis or questions categorized as follows:

Framework 1

Design Philosophy

1. What are the dominating site forces that shape the Architecture?
2. What is the central idea in the design that responds to those site forces?

Site Planning

1. How is the layout and arrangement of spaces & its response to the setting?
2. What relation does the orientation of the built form have with the setting?
3. How is the nature & choreography of approach to the built structure?
4. How does the Architecture engage with the ground?

Form & Materiality

1. How does the building form respond to the setting?
2. How is the built material palette in conjunction with the landscape color palette?

Spatial Experience

1. How does the transition between built & unbuilt take place?
2. How do the architectural spaces frame or bring in the surrounding views for the user?
3. What is the relation or dialogue between the vegetation character and building?

Framework 2

Idea

1. Connection of central idea in the design with the landscape setting
2. Site forces that shape the architecture Function
3. Layouts and arrangements in response to the landscape setting
4. Designed landscape spaces in conjunction to the built form & existing setting
5. Material palette
6. Architectural program and it connect with landscape spaces
7. Transition between built and un built

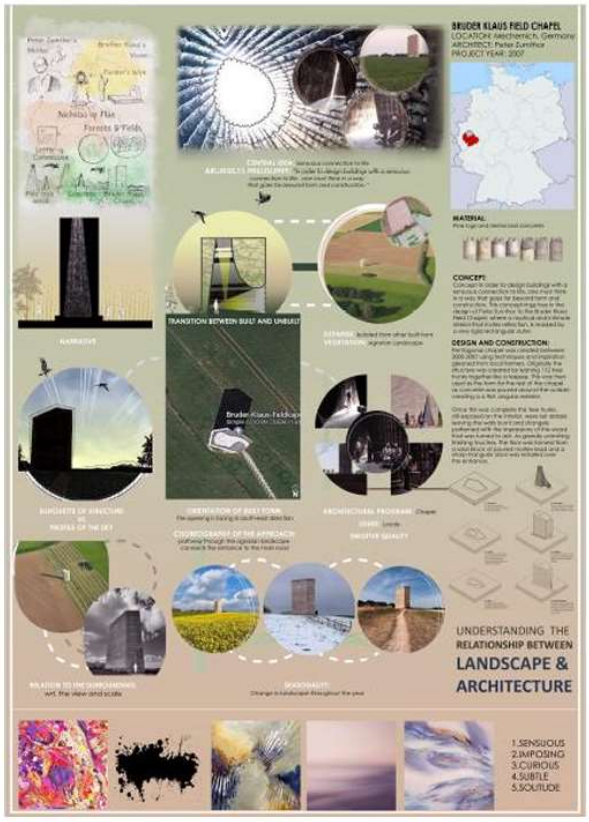
Aesthetics

1. Orientation of built form
2. Nature and Choreography of Approach
3. Sight lines and their impact on the experience of Architecture
4. Expanses & Distances
5. Silhouette of the built form against the sky
6. Notion & experience of the ground (outdoor-indoor)
7. Vegetation character
8. Emotive quality



Graphic analyzing Lunuganga, Sri Lanka
Source : Students' Work. Graphic generated by Isha Kambli, Janhavi Rane, Vrushali Shah, Gauri Sharma

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Graphic analyzing Bruder Klaus, Germany
Source : Students' Work. Graphic generated by Isha Kambli, Janhavi Rane, Vrushali Shah, Gauri Sharma

The study looks at architectural examples that

1. establish a connect with a Natural Feature in the setting
2. Respond through a Form to the Setting
3. Reflect the Architect's Philosophy while presenting themselves in a dramatic setting
4. Respond to a larger landscape context in an indirect way while they have their own narrative within the Site Layout
5. Respond to a larger landscape context in a direct way while the form reflects abstraction and symbolism.

Application Potential

Architectural Typology: Private Residential, Institutional

The key factor in this module is the framework defined for the case studies. This framework views the object (the architecture) from a different lens, which is not architectural! The findings to the questions or the parameters often initiate though-provoking conversations and perhaps, set a base for design which then deals with the site more sensitively. While the case study examples become a part of the design studio process, the resolution of the proposed architecture too can be done by probing the same

set of questions to the conceptual design or by testing the same through the parameters prescribed for conducting the study.

Module 3: Overlay Mapping Technique Premise

The overlay mapping techniques is a method of design proposed by Ian McHarg, that he calls “ecological regionalization,” which involves mapping the natural features of a region and using that information to guide the design process. He advocates for a holistic approach to design that considers not only the immediate needs of a project, but also its long-term impact on the environment and the surrounding ecosystem. Known as ‘landscape suitability analysis’, the idea of “overlay,” involves layering different maps to create a comprehensive picture of a region’s natural features. By overlaying maps of topography, geology, hydrology, vegetation, and other factors, designers can gain a more nuanced understanding of the natural environment and use that knowledge to inform their designs.

Source : blog.iaac.net/design-with-nature-Ian-McHarg/ Team member(s): Julia Aurora Guzmán Modified by Julia Aurora Guzmán on April 1, 2023

Theoretical Framework

Diagnostic studies are a useful form of evaluation frequently utilized by landscape architects. They include feasibility studies (evaluating the carrying capacity of a site for a certain program), suitability studies (evaluating the optimization of a site for a particular program), environmental impact analysis (evaluating the environmental trade-offs between specific interventions or even different levels of development), and cost-benefit analyses (financial trade-offs of different programs or designs). Can such diagnostics be engaged as a form of research? It depends. If a diagnostic study develops new procedures and understandings that extend the systematic knowledge of the discipline, then it may well constitute research. In Design with Nature (1969), McHarg explained that suitability analysis begins with an understanding of embodied landscape values: "These can be ranked the most valuable land and the least, the most valuable water resources and the least, the most and least productive agricultural land, the richest wildlife habitats and those of no value, the areas of great or little scenic beauty historic buildings and their absence and so on" (1969, 34). Overlay analysis is a graphic technique for discerning and assigning the scale of values, as well as the evaluation of spatial correlation and conflict among these values. However, by linking suitability analysis with a theory of value, McHarg's approach results in the development of a kind of environmental rubric that could respond to different programs or values, or dialectical trade-offs between development and conservation, or agriculture and urbanization.

Studio Exercise

Type of Exercise: Individual, Studio Work

The exercise comprises of the following stages:

Site Analysis

1. Elevation Mapping (plan & sections)
2. Slope Analysis (plan)
3. Hydrology Pattern (plan)
4. Vegetation Typology (plan, sections & sketches/photos)
5. Aspect (plan)
6. Views & Vistas (plan & sketches)
7. Immediate Context
8. Site Sections
9. Physical 3D Model

Establishing Criteria & Preferences

Based on points analysed in #1 Site Analysis and individual design inclinations,

1. Sketches explaining ideas with respect to Site Occupancy –where on site are the given functions (built & unbuilt) suitable and why as per the designer.

Building Orientation & Site Zoning

1. Site Plan & Sections (Site & Detailed scale) explaining orientation of the built blocks
2. Shadow Analysis (Site Plan showing shadow patterns and overlaps depending on the way the buildings are oriented)
3. Site Zoning Plan (shall include building footprints, pathways & landscaped areas)

Assigning of Levels

1.Site Plan denoting assigned levels for building plinths, pathways and landscaped areas. Overall levels will be reviewed for the design as a Master Plan

Contour Modification

1. Modified Contour Plan & Sections (Site & Detailed scale) showing existing & modified contours –modifications done based on levels assigned for building plinths, pathways & landscaped areas.

Final Model

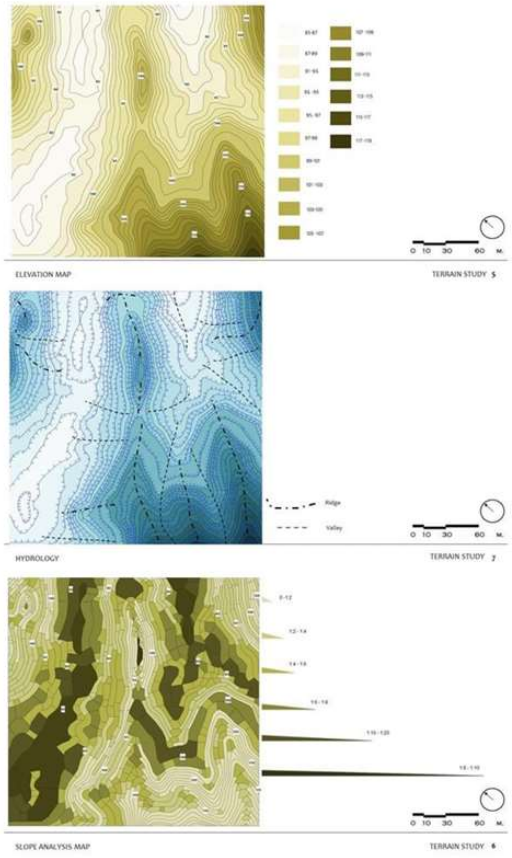
1. Site Model with new modified contours as base, building blocks & pathways – Individual Design Model

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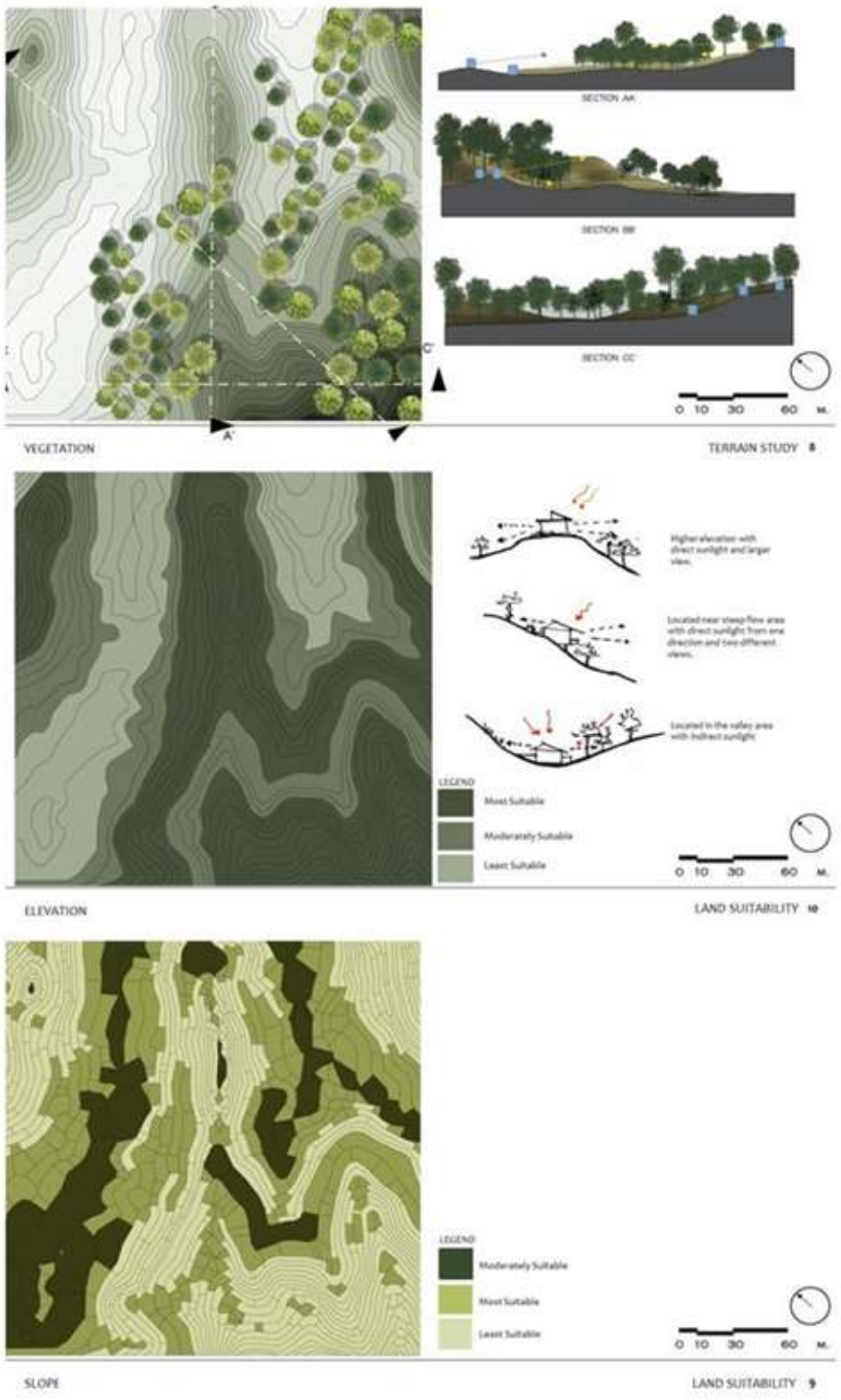
The Intangibles

1. Graphics explaining ideas for
2. Color Platte for the Design
3. Textures in the Design
4. User Experience in the Design
5. Approach Choreography in the Design (min 2 pathways/approaches)
6. Foreground –Background

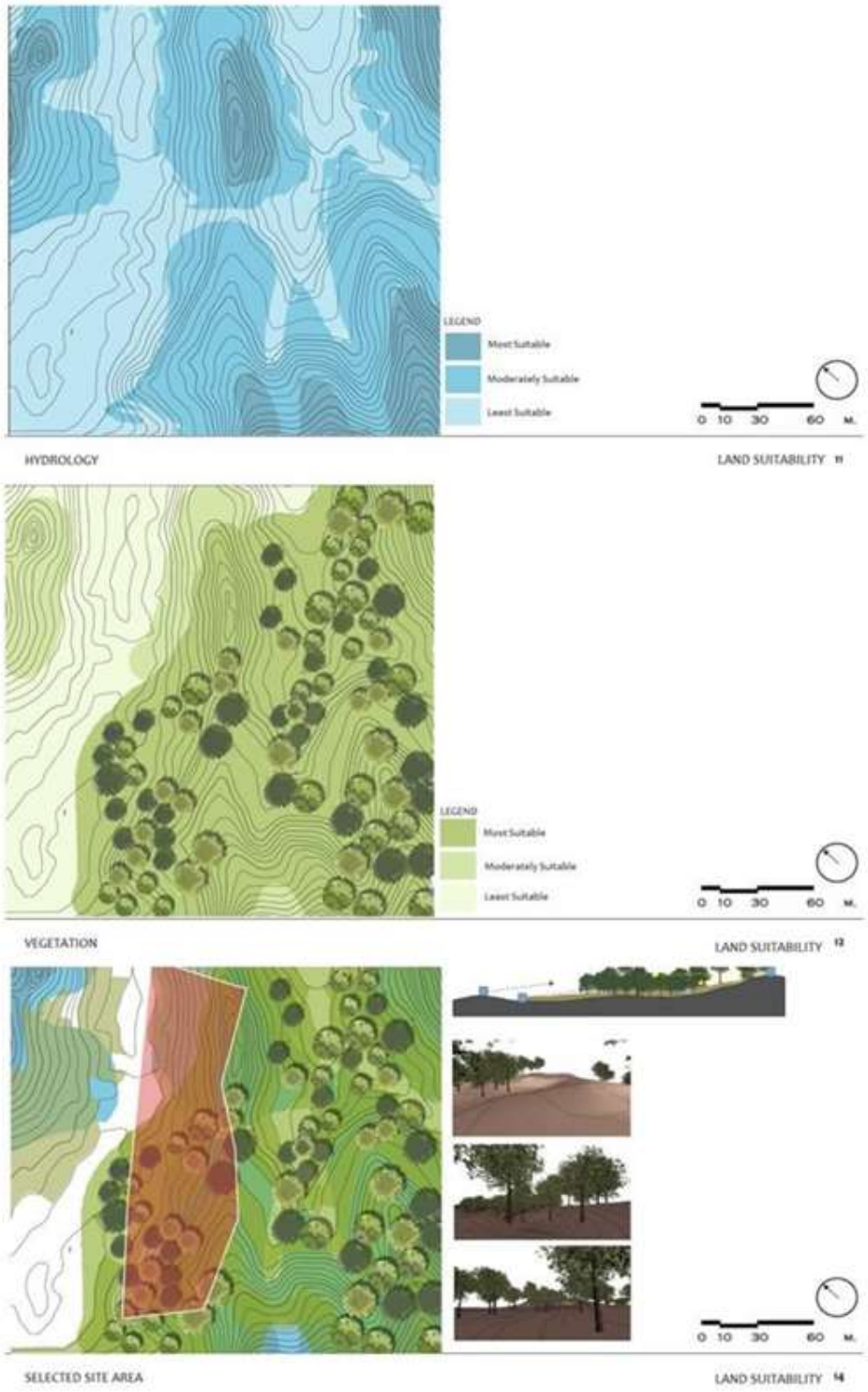
The proposed overlay technique is a part of stage 1 – Site Analysis.



Source : Students' Work. Maps generated by Anchal Singh

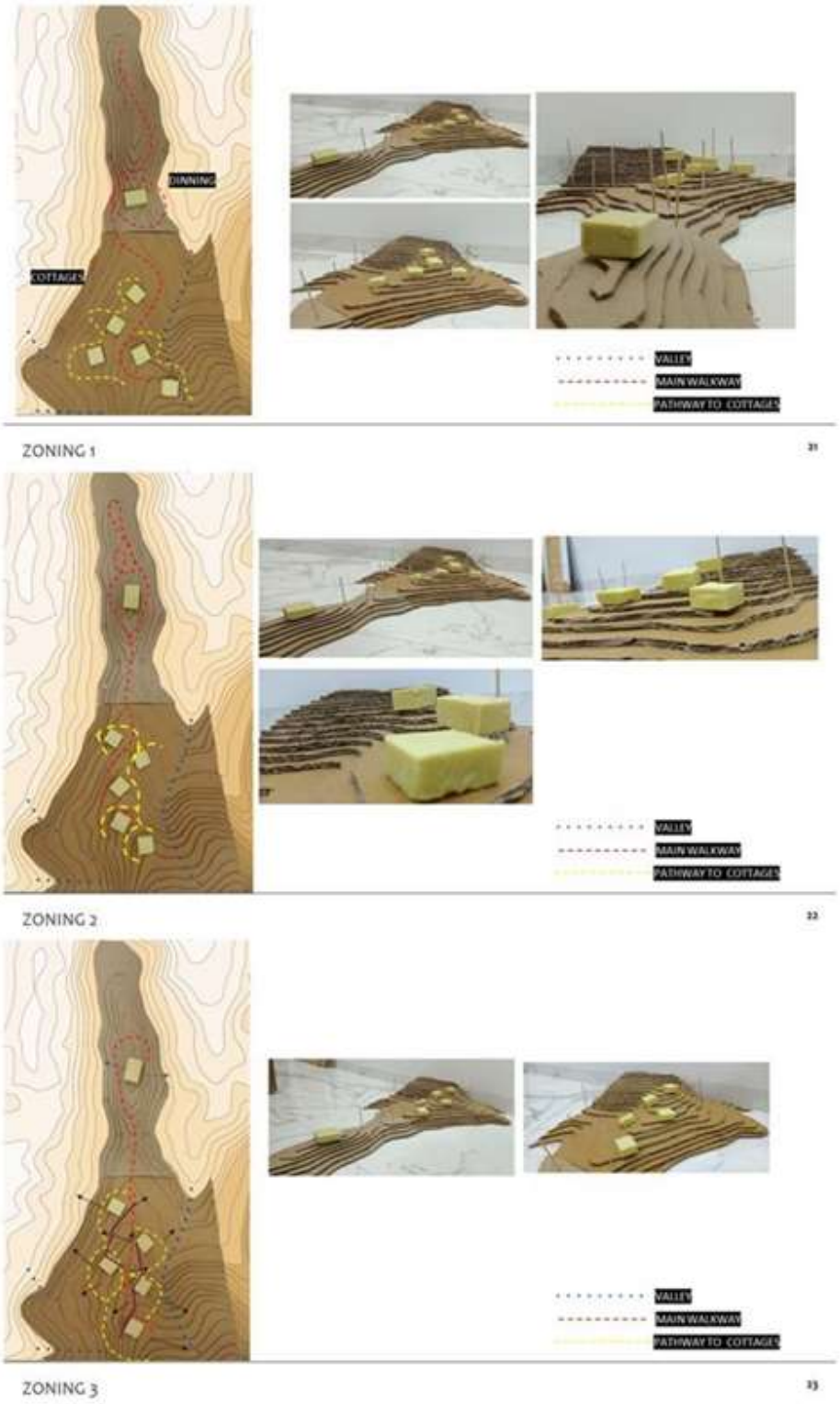


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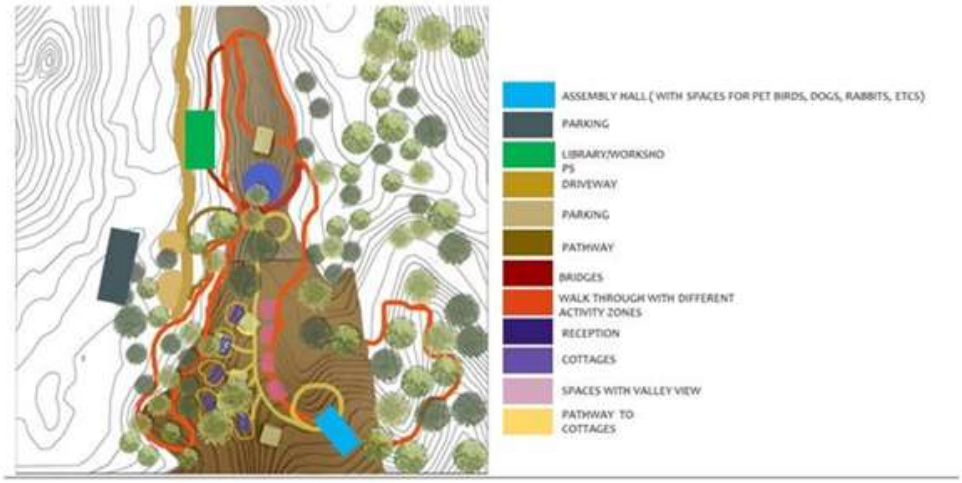


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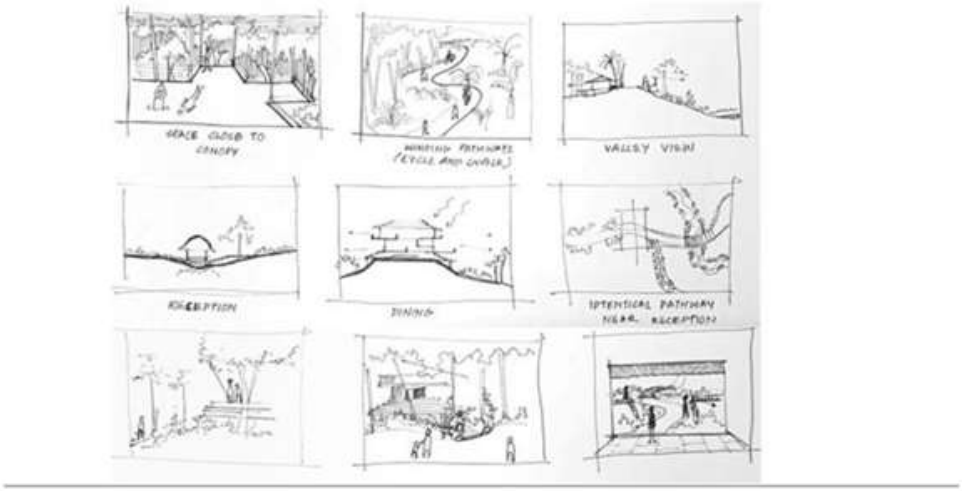
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Source : Students' Work. Model Photographs by Anchal Singh



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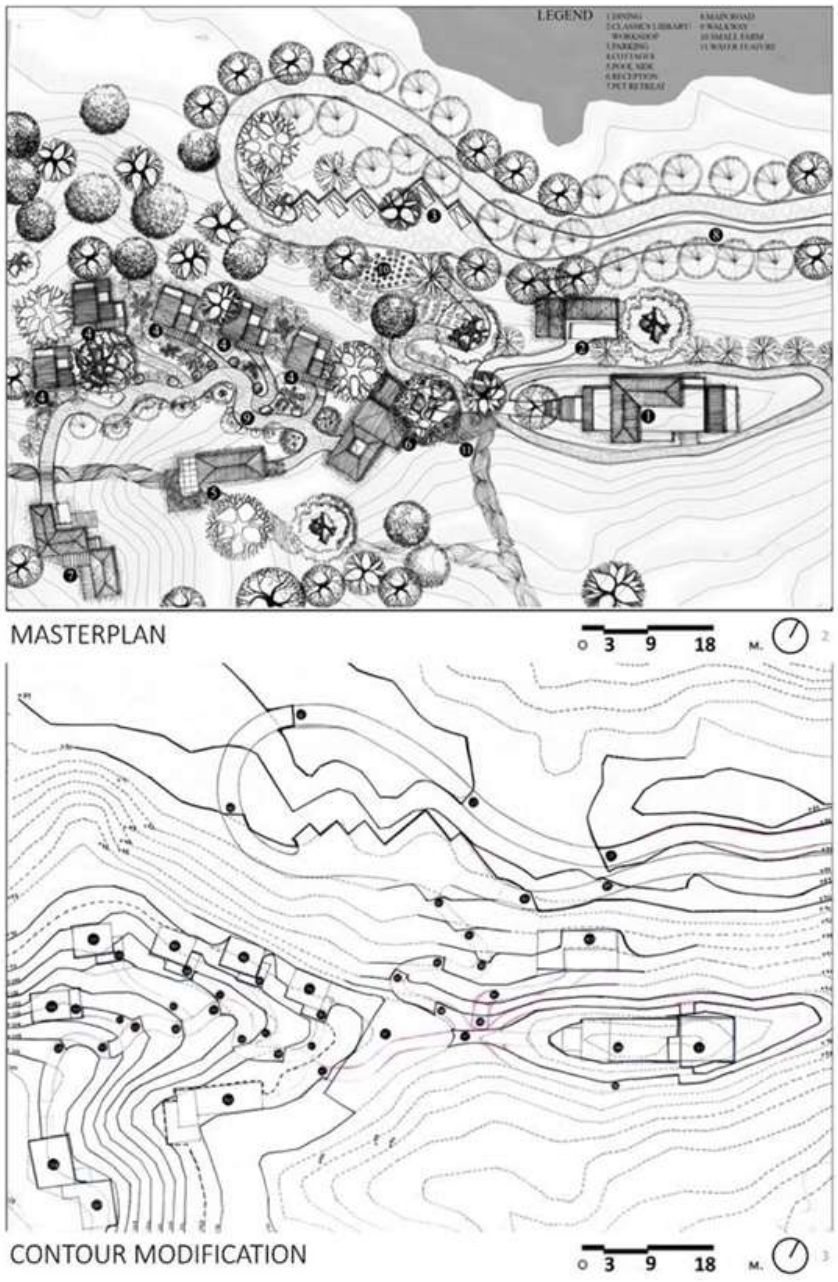


SPACES

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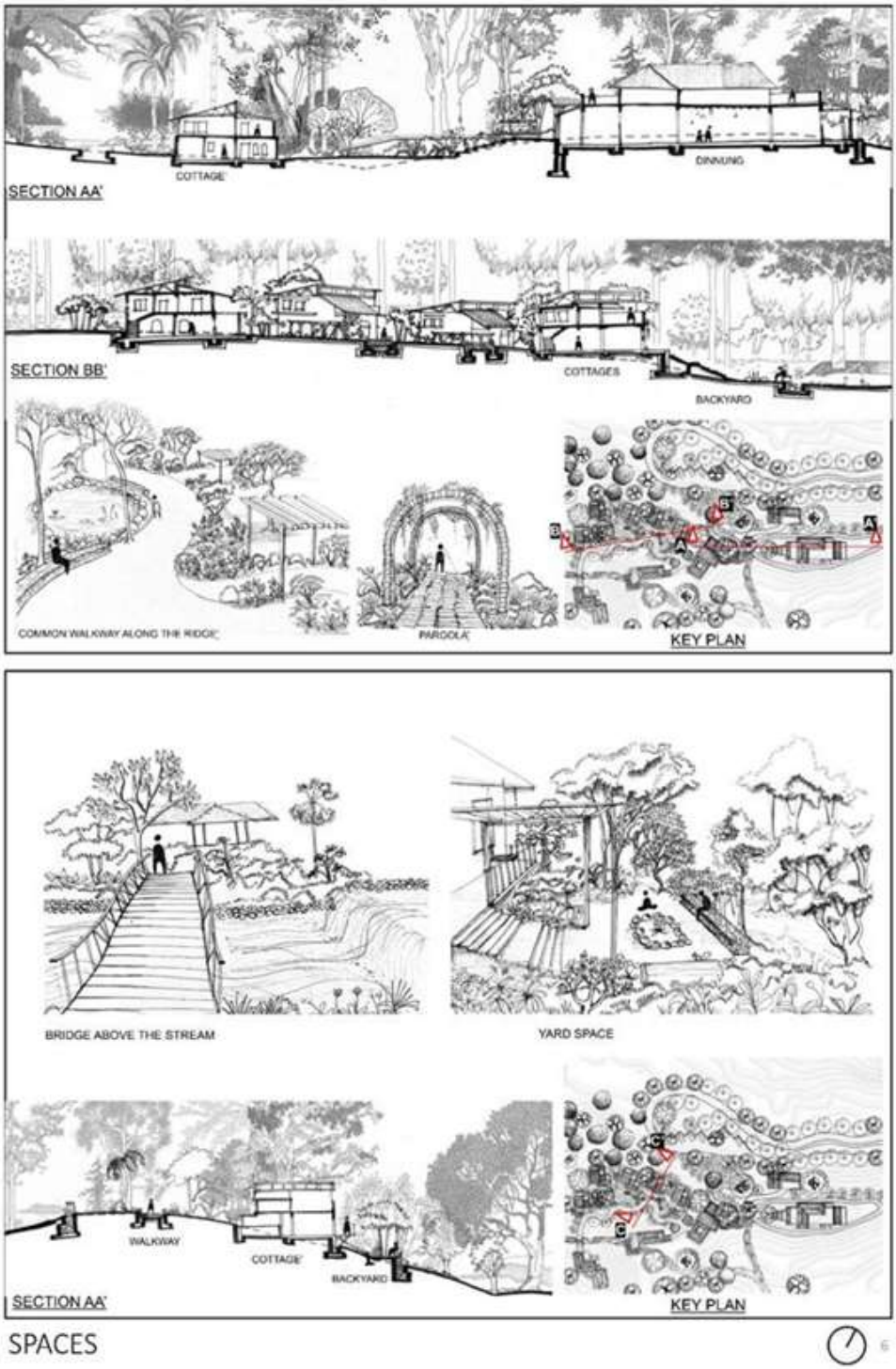
Source : Students' Work. Sketches generated by Anchal Singh

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Source : Students' Work. Drawings by Anchal Singh

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Application Potential

Architectural Typology: Institutional, Plotting

The overlay technique perhaps becomes a very strong base for design. It presents scenarios which need to critical thinking and decision- making if one intends to approach the act of building sensitively. Large scale projects often need a Master Planning approach which provide a vision for the project. They mapping technique proposed in this module indeed applies well at this scale.

Conclusion:

If we interpret 'Design' as a form of research, then the design studio may be considered as the setting for research. In that case, the studio becomes a generator of theoretical insights and propositions and the studies conducted, offer a comprehensive base-work to enable oneself to design sensitively and contextually.

The modules presented in this research paper are tools that can be remodeled to create sensitive built environments. There could also be more such designed to suit the need of the project and ones that touch upon other aspects in Landscape Architecture.

Enhancing Daylighting and Energy Efficiency through Advanced Glazing Materials: Availability, Applicability, and Challenges.

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Abstract: *Daylighting refers to the strategic use of natural light to illuminate indoor spaces, reducing the need for artificial lighting and creating healthier, more pleasant environments. Energy efficiency, on the other hand, involves reducing the amount of energy required to perform a given function, such as heating, cooling, and lighting. Integrating Daylighting Systems appropriately into building windows can contribute to energy efficiency.*

This paper aims to analyse various types of glazing materials to enhance daylight and energy efficiency and its applicability in buildings. Increasing the glazing area is the simplest way to maximize daylight. But glazing allows daylight as well as heat inside the building. So, properties of glazing like U-value, shading coefficient, visible transmittance play major role for increasing the thermal and optical performance of glazing and it is simple and cost effective. Numerous colours, metallic and low-emissivity coatings, and fritting are offered by glazing producers. Glass with many panes that enhance U-values can also be easily found, filled with inert gases like argon or krypton. In most climates, glass with a moderate-to-low shading coefficient and relatively high visual transmittance should be considered for daylighting large structures.

Objective of the research is to study various types of glazing available in market. Another objective is accessing the application of advanced glazing materials in buildings and challenges for using these materials. Literature review narrates various types of daylight and energy efficient advanced glazing materials while market survey demonstrates advanced glazing materials available in market. The research will help in selecting the advanced glazing materials based on properties of glazing materials. The paper also explores the application of advanced glazing materials for daylight and energy efficiency in buildings through case studies reveal how use of such type of glazing material will help to enhance daylight and energy efficiency.

Keywords: Daylighting, Energy Efficiency, Glazing, Windows.

1.Introduction:

Indeed, the burning of fossil fuel to produce energy has been highly contributing to climate effects change. As a step considered to control such consumption of fossil fuel, designers increasingly want to decrease the energy consumption of the product throughout the life cycle. (Yingying Seow a, A 'Design for Energy Minimization' approach to reduce energy consumption during the manufacturing phase) Here, the energy shall be reduced to large extent; the energy consideration must be incorporated into the product design stage, at which most of a product's environmental impact is decided. Meanwhile, at present, the fast-changing climate is also taking extreme inverse

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action. This work introduces a new 'Design for Energy Minimization' approach, not designed to provide increased transparency with respect to energy consumed during manufacture but to help guide design decisions (Yingying Seow a, A ‘Design for Energy Minimization’ approach to reduce energy consumption during the manufacturing phase). It goes without saying that materials play the most important role in the energy efficiency of any building. Critically evaluating this day, it is important to determine how materials affecting daylighting contribute to the quantity as well as quality of daylight that enters the building, and how such materials assist in reducing consumption ("Khaled Alhagla). Here is a structured introduction to the review. Properly designed daylighting and optimal energy performance stand out as significant concerns in making buildings more sustainable and energy efficient. Daylighting involves smartly using natural light in a building to illuminate the occupied spaces. This reduces the need for artificial lighting, while indoors stays a healthier and pleasanter place ("Khaled Alhagla). Energy efficiency is the reduction of energy required for a function in the same frame. For example, it would involve heating, cooling, and even lighting. In daylighting as well as energy efficiency, the main medium involved is the material. The right materials thus play a big role in the performance of the buildings: maximize gains from natural light while minimizing any gains or losses in heat and, therefore reduce energy consumption (W.J. Hee a). Combustion of fossil fuel for energy generation has been a significant source of the climate change effect. To counter this practice, designers have become increasingly inclined to reduce the consumption of their products through the life cycle. If energy-related considerations are integrated into the design stage of a product, then it is easy to achieve a large reduction in energy consumption. That's because most of a product's environmental impact occurs during this stage (Fei Yu a b, A state-of-art review on concepts, criteria, methods and factors for reaching ‘thermal-daylighting balance’). Additionally, in the present scenario, the climatic change is forcing extreme but inverse actions also in a rapid changeover. This work is going to offer a new 'Design for Energy Minimization' approach, targeted at offering more transparency of the energy use in manufacture toward guiding design decisions.

2.Literature review:

Integration of natural lighting and energy-efficient design in buildings will propel the quest for sustainable architecture. The lighting design and window glazing, innovative materials used for enhancing energy performance in buildings, will be studied as part of the literature review.

The growing requirements for energy consumption worldwide and the factors driving CO_2 emissions have made the need most vital at present, in particular energy saving-the biggest consumer of energy building and huge food providers. Since windows are highly prone to heat gain and loss, they are the critical component in the energy performance of buildings. This leads to increased demands on HVAC systems, with immense electrical energy consumption. Passive, active, and smart windows belong to

an important solution class amidst evolving glazing technologies, to be capable of making valuable contribution to lower energy consumption while at the same time improving the indoor environmental quality. (Avnesh Kumari a b 1)

2.1 Daylighting and Thermal Balance

Yu et al. (2020) makes a very thorough review of the concept of "thermal-daylighting balance," thus giving attention to architectural design with both thermal comfort and daylighting. Methods for attaining the balance were categorized into five approaches: separate investigations, overall comparisons, multi-objective optimization, and others. Important recommendations on window-to-wall ratios together with suitable shading methods had also evolved, subject to local influences. The review outlines the complexities in balancing thermal comfort with natural light with a suggestion for further research to be carried out by future studies into the several challenges in this area. (Fei Yu a b, A state-of-art review on concepts, criteria, methods and factors for reaching 'thermal-daylighting balance', 2020)

Window Glazing Technologies

Hee et al. presented a crucial discussion on the effect window glazing has on both energy efficiency and daylighting performance in buildings. The authors pointed out that determining the types of glazing that balance the gain in energy savings against visual comfort is complex. The review concerns several optimization techniques and emerging technologies regarding glazing, so it further stresses the view that window design is at the heart of achieving energy-efficient buildings. The paper strongly emphasizes contextual-specific glazing solutions in lines of variation that are not isolated to climate but also take account of occupant needs. (Rawan AlQudah)

A strategy that involves the integration of Transparent Insulation Materials within a double-glazing unit offers the potential to deliver combined improvements in thermal, solar and daylight performance. (Yanyi Sun)

As relatively few studies exist that seek to effectively and accurately characterised window systems with integrated TIMs and explore their impact on building performance prediction, this review also summarized the experimental and numerical studies for characterizing other complex glazing systems with interstitial structures, which share many of the characteristics of TIMs. Their bodies of research provide potential methods for tackling similar questions posed in relation to the performance of window systems with TIMs. Among the research that has taken place into windows with interstitial structures, many studies have been conducted using Computational Fluid Dynamics modelling to evaluate the possibility of reducing free convection and long-wave radiation exchange between the two glazing panes. (Yanyi Sun)

(Soroosh Daqiqeh Rezaeia, 2017)covers the basic definitions and ideal window followed by discussing more conventional glazing optical properties.

Some of these glazing systems feature complex structures, which present challenges when integrating them into existing building simulation software to assess their impact on building performance (Wu, 2022)

When the low visible glazing is used, the amount of visible light entering the space reduces. Since the daylight is blocked, the luminance level may be insufficient and the need of using artificial lighting may arise. On the other hand, when the high visible transmittance glazing is used, glare can happen due to extensive daylight. It is important to design appropriate glazing components to have optimum daylight (Gundogdu and Cilasun Kunduraci (2019). (Wu, 2022)

To overcome these issues existing into the traditional window systems, innovated glazing technologies have been widely developed (Akram et al., 2021)

They all noted the growing popularity of vacuum glazing and aerogel solutions, which offer competitive U-values. Rezaei et al. (2017) also reviewed various types of glass coatings and glazing systems, including conventional, advanced and smart and analysed their applications in hot, cool and temperate climates. (Wu, 2022)

Despite the variety of classification methods, only a few studies have classified different advanced glazing technologies based on their functionalities or working principles, such as U-value, Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT), as illustrated in (Ghosh and Norton, 2018). (Wu, 2022)

A product of suspended coating glazing possesses the lowest U-value of 0.28W/m2K in the central-glazing region. The suspended coating glazing includes ‘Suspended Coated Films (SCF)’ or only ‘suspended films’ in between the exterior and interior glass panes, which acts as a third or fourth ‘glass pane’ (Wu, 2022)

Window glazing Technology in Complex Structures

A wide range of glazing technologies has emerged, aiming to enhance their thermal, optical and electrical properties. A glazing system with good thermal insulation properties, such as a low U-value, can minimise heat loss through windows, thus contributing to maintaining warmth within the room to the greatest extent possible (Li et al., 2023). Higher SHGCvalues lead to increased cooling load, whereas low SHGC values contribute to greater heating load (Ghosh et al., 2024). In addition to thermal considerations, VT emerges as a significant parameter distinct from SHGC. VT describes how effective the window is in admitting visible light, thereby influencing the illumina tion of interior spaces (Morrey and Ghosh, 2024). Consequently, these properties of the window-glazing system ultimately impact the overall energy and daylight performance of the building to which they are applied. (Wu, 2022)

Glazing systems with complex configurations are often characterised using pre-computed Solar Heat Gain Coefficients (SHGCs) and Visible Transmittances (VTs). (Wu, 2022)

Impact of Glazing on Energy Use and Comfort

Johnson et al. (1984) simulated energy performance of office buildings in different climates by using the DOE-2.1B energy simulation program, simulating the effect of glazing systems on the energy use of the building. They estimated the sensitivity of total energy consumption to window area, glazing properties including U-value and shading coefficient, and lighting control strategies. Findings indicated that building optimization strategies for glazing can result in reduced or increased annual energy intake on account of building design and location. Thus, climate-specific glazing strategies are to be emphasized for thermal comfort and energy savings. (R. Johnson)Ste. gousagia et al (2007) makes similar analyses on energy consumption and comfort conditions in Greece, focusing upon how glazing choices influence building energy behaviour. Using simulation-based analysis, they pinpointed the window as a cornerstone weakness for both offices and residential buildings. Their conclusions highlighted early design interventions and especially those related to glazing to ward off energy loss, augment comfort, and ensure all-year-round energy efficiency. (A. Stegou-Sagia)

Design Strategies for Energy Consumption Reduction

Seow et al. (2016) have developed a Design for Energy Minimization (DfEM) methodology to mitigate energy use in product manufacturing. Although this research is centered around product life cycles, principles in it are much closer to building energy optimization, which focuses on early-stage design decisions to minimize the harm created toward environmental elements. The DfEM methodology delineates how centralized and distributed approaches to design systematically reduce the energy usage in manufacturing; this research effort can be used as a practical illustration in the context of sustainable building materials and construction processes. (Yingying Seow a, A ‘Design for Energy Minimization’ approach to reduce energy consumption during the manufacturing phase)

Some reviewed studies highlight the incorporation of window design, glazing technologies, and simulation tools into the early stages of architectural decisions to maximize energy efficiency and visual comfort. With multi-objective frameworks, designers can possibly optimize a balance between thermal comfort, daylighting, and aesthetic considerations. Suitable WWR, optimal utilization of shading devices, and optimized glazing materials for the site-specific strategy are vital in each climate to minimize HVAC loads and consumption. Implications from these papers suggest interdisciplinary collaboration between architects, engineers, and energy analysts in achieving performance within sustainable building. (Peiman Pilechiha1)

Future work could include integrated next-generation materials nano-coatings or smart glazing that can optimize building energy use, or further refinement of existing strategies using data-driven design tools developed around real-time weather and occupant behaviour.

Literature review highlights use of following Enhancing Daylighting and Energy Efficiency through Advanced Glazing Materials**:**

- A strategy that involves the integration of Transparent Insulation Materials within a double-glazing unit offers the potential to deliver combined improvements in thermal, solar and daylight performance. (Yanyi Sun).
- A product of suspended coating glazing possesses the lowest U-value of 0.28W/m2K in the central-glazing region.
- A glazing system with good thermal insulation properties, such as a low U-value, can minimize heat loss through windows, thus contributing to maintaining warmth within the room to the greatest extent possible (Li et al., 2023).
- Among these glazing technologies, the vacuum glazing-based technologies, such as triple vacuum glazing (Manz et al., 2006) and vacuum glazing with low-e coating (Fang et al., 2007) tend to possess the best thermal insulation property (lowest U-value, e.g. less than 1W/m2K).
- Glazing systems with complex configurations are often characterized using pre-computed Solar Heat Gain Coefficients (SHGCs) and Visible Transmittances (VTs). (Wu, 2022).

3.Methodology:

When studying the materials that enhance daylighting and energy efficiency, three parameters were studied. Different advanced technologies were and different brands available in the market, which provide varied glass types were listed. A market survey was conducted to identify commonly used materials through purposive sampling. This involved market visits to observe material usage and analyzing highly rated brands. Selected brands were then studied for their product ranges, comparing technical factors like reflectance %, transmittance %, SC values, and U-values. The selection and application of various glazing materials in various types of buildings and climates were discussed. Which was also supported with doing case studies of buildings using glazing technologies.

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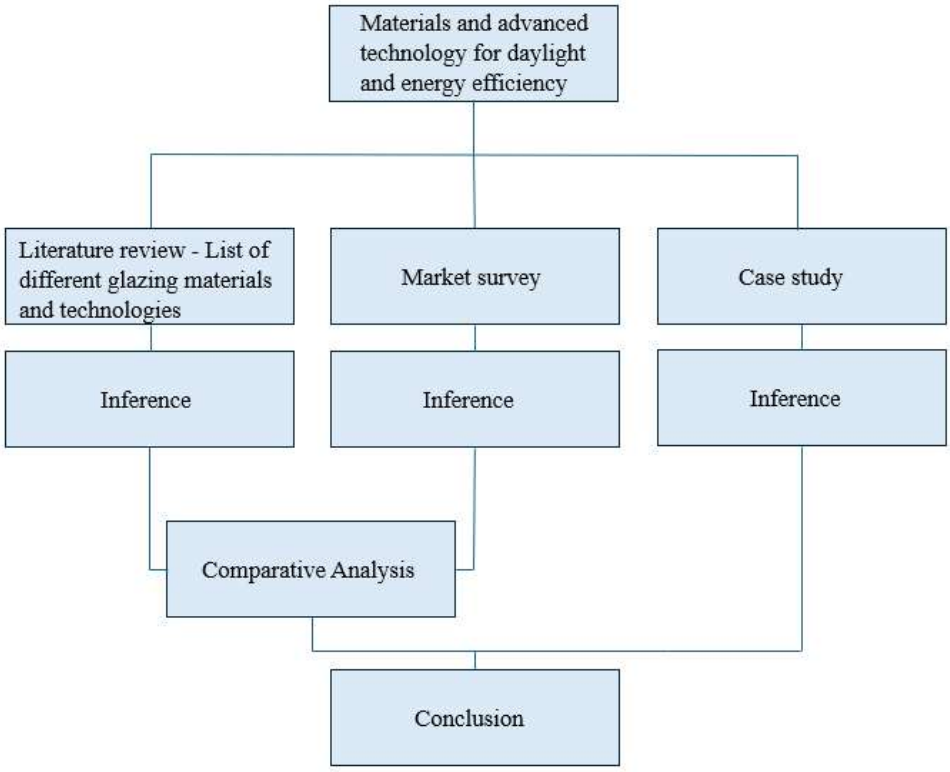


Figure 1: *Methodology for the research.*

3.1 Market survey method:

- Noting recurring brands in market and evaluating its different typologies and understanding its varied use in building. Brands such as Saint Gobain, AGC Inc, AIS, etc were noted out of which AIS glass study is conducted

Table 7 *Type of glazing and relative thickness, transmittance value, U value and Solar heat gain coefficient (SHGC) and use.*

No	Glass	Thickness	Transmittance %	U – Value	Shading Co - Efficient	Use
1	AIS Ecosense Enhance	6 mm (Solar Control Glass)	67	5.6	0.78	Float glass gives the glass product uniform thickness and a very flat surface. Float glass is the primary glass product on which all other value-additions are done to enable glass to do more.
2	AIS Ecosence Essense-	(6 mm (Low-E Glass) – 12 mm (Air	71	1.8	0.61	A modern, low-e glass product that can only be used in an IGU*, AIS

		Gap) – 6 mm (Clear Glass))				Ecosense Essence helps with the insulation of the building helping achieve energy efficiency.
3	AIS Ecosence Enhance	6 mm (Solar Control Glass) - 12 mm (Air Gap) - 6 mm (Clear Glass)	60	2.8	0.68	A solar-control glazing solution that lets you stay close to nature, AIS Ecosense Enhance is ideal for tropical nations like India where cooling needs.
4	AIS Ecosence Edge	6 mm (Solar Control & Thermal Insulation Glass) – 12 mm (Air Gap) – 6 mm (Clear Glass)	40	2.4	0.38	Developed for use in single-glazing applications, AIS Ecosense Edge is a solar control glass product that provides excellent thermal insulation.
5	AIS Ecosence Spectra	6 mm (Solar Control Glass) - 12 mm (Air Gap) - 6 mm (Clear Glass)	40	1.5	0.28	It can be a natural choice for eco-friendly architecture. The AIS Ecosense Spectra is a product that provides the perfect balance between the outdoors and indoors, aesthetics, economics, function, and finesse.

Source: AIS ecosense brochure

Transmittance measures the amount of light able to pass through a material without the material reflecting or absorbing it. Therefore, transparent glass will transmit 100% of light, translucent material only allows some light to come through, and opaque glass will achieve close to 0% transmittance. (Reynolds, 2019)

The U-value of a window is a measurement of the rate of heat loss indicating how well your windows are keeping valuable heat in. It is expressed as Watts per square metre Kelvin W/m2 K. The lower the U-value the better the thermal performance of the glass. So called 'Low-emissivity' or 'Low E' glass offers improved thermal insulation denoted by very low U-values. (Gobain, 2025)

Solar Heat Gain Coefficient (SHGC)

SHGC indicates how much of the sun's energy striking the window is transmitted through the window as heat. As the SHGC increases, the solar gain potential through a given window increase.

The SHGC is a ratio between 0 and 1. SHGC = 0 means none of the incident solar gain is transmitted through the window as heat and SHGC = 1 means all of the incident solar energy is transmitted through the window as heat.
AIS ecosense essense has highest visual light transmittance allowing more daylight even as compared with float glass. AIS ecosense spectra has lowest U value and solar hear gain coefficient allowing less heat and thus becomes more energy efficient.

3.2 Case study method:
Case studies highlight the applicability of advanced glazing technology in buildings Buildings with use of energy efficient glass are studied.

1.Project: Motilal Oswal Headquarter Building
Location: Mumbai
Client: Motilal Oswal Financial Services
Architects: Niteen Parulekar Architects
Project area: 3,00,000 sq-ft
Interiors area: 1,50,000 sq-ft
Motilal Oswal, Mumbai: Sited in the heart of Mumbai's commercial belt with a footprint of over 3,00,000 sq-ft, the Motilal Oswal Headquarter building. The particular material deployed for the skin is a special solar-control glass termed as KT 440 – Nano Green glass by Saint Gobain. It is a high-performance glass with a very low solar factor, and high thermal insulation; this immensely helped maintaining the energy efficiency of the building. The headquarter addresses the commitment for creating energy efficient and comfortable indoor environment for its employees, derived from a well-established foundation of program-driven design. Building has a glass-dominated façade with an eclectic mix of various configurations in green hues.

2. Project: ICED, Rajasthan
The International Centre for Environment Audit and Sustainable Development (iCED) has the unique distinction of being the country's first ever GRIHA (Green Rating for Integrated Habitat Assessment) five-star rated green building. Developed on the GRIHA principles, glass for UPVC windows has played an important role in creating the project on the concept of sustainable design. Located at Jaipur, the institute has been commissioned by the Comptroller and Auditor General (CAG) of India, after India was chosen as the centre for imparting environmental and sustainable development audit by the International Organization of Supreme Audit Institutions (INTOSAI).



3.3 Challenges in applicability of Advanced green building glazing technologies.

A balanced view of energy-efficient glass, discussing both the pros and cons of it. It focuses on the fact that this material supports daylighting, energy efficiency, and sustainable buildings, while noting barriers such as cost, low awareness, and skillful workforce.

- Environmental Responsibility: The text puts energy-efficient glass at par with modern green building practices by focusing on its sustainable aspects.
- Economic and Practical Drawbacks: The drawbacks of high cost and inaccessibility is on the forefront over merits provided as critical shortcomings.
- Technological Attractiveness vs. Adoption Issues: The technology stands out for better adoption prospects with big commercial projects, but small projects and residential sectors are kept at bay by cost factors and lack of knowledge.

Focus on Green Building Practices:
It links energy-saving glazing glass with environmental benefits, taking them in before being part of sustainable architecture. It's very clear about energy efficient glass as a precious innovation for the environmentally conscious design, but it is still showing some valid reasons why not to use it - high cost, manufacturing restrictions, and labour inputs. Technical details concerning market insights, examples, and convincing arguments could strengthen this argument. While expensive in the short term, the long-term benefits such as energy efficiency and durability make this technology promising for wider use, especially with increased awareness and capacity.

4.Discussion and future development

Various glazing technologies have developed to reduce the U-value, regulate the SHGC and VT, as well as producing additional power for building windows. Among these glazing technologies, the vacuum glazing-based technologies, such as triple vacuum glazing (Manz et al., 2006) and vacuum glazing with low-e coating (Fang et al., 2007) tend to possess the best thermal insulation property (lowest U-value, e.g. less than 1W/m2K). Glazing systems with complex configurations are often characterised using pre-computed Solar Heat Gain Coefficients (SHGCs) and Visible Transmittances (VTs). (Wu, 2022) It is evident that advanced window-glazing technologies represent a significant advancement in energy efficiency and sustainability within the building sector, offering benefits such as enhanced thermal performance and improved occupant comfort. Nevertheless, there is a notable absence of comprehensive studies focusing on the accurate integration of these advanced glazing systems into existing building simulation software for performance assessment. The complexity of some of these technologies introduces challenges in characterizing their thermal, optical and electrical properties, as well as in their accurate integration into building simulations. (Wu, 2022) Thus, simpler and more efficient methods are required to accurately integrate complex window systems into building simulations and validate their performance. These efforts will enhance the estimation of the impact of various complex window systems on building energy consumption and daylight performance. (Wu, 2022)

5.Conclusion:

Material selection would indeed play a prominent role in building design, but daylighting plays a much more important role. Using fewer windows contributes to the lower energy use, but it somehow affects the natural light that will be needed for the better comfort of the occupants. Glass then presents a solution through enhancing daylighting but brings some other complications with it: heat gain. Other parameters include the overall heat transfer coefficient (U-value), solar heat gain coefficient (SHGC), and visible transmittance (VT), which are essential for determining the performance level of the window glazing used in building. The paper considered an explicit analysis of some window-glazing options, focusing on VT, SHGC, and U-value. With U-values less than 1W/m2K, vacuum and aerogel glazing-based systems among these technologies have high qualities of thermal insulations, suitable for heat-heavy concentration climates. Though they have lower SHGC (0.17–0.30) and VT (23%–50%), suspended films remarkably have the lowest U-value at 0.28W/m2K; it may imply cooling-dominated climates if VT can be improved. Due to their low SHGC and VT, smart window systems such as electrochromic windows are also suitable for Li and Wu 35 climates, which are usually dominated by cooling. Semi-Transparent Solar Panels. Fortunately, several energy-efficient glazing technologies are now available in the market, mostly used in commercial projects due to their cost and complexity. Glazing devices play an essential role in improving energy efficiency and sustainability in building design. They enhance natural lighting while improving thermal performance, leading to energy-cost savings, reduced environmental impacts, and greater comfort for the occupants. With availability of different glazing types and technology in market, its applicability is becoming more challenging in building sector.

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From Indigenous Heritage to Queer Landscapes Documenting and analyzing ponds of Limbu Community in Darjeeling, India

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Abstract: *Amidst inevitable developmental changes and the primacy of land as a resource, Indigenous ways of life are encroached upon by settler colonialism, state authority, and cultural manipulation. These forces are reinscribed by dominant heritage frameworks that prioritize monumental aesthetics and treat landscapes as static entities.*

Within the Indigenous knowledge system of the Limbu or Kirat Yakthung community of the Eastern Himalayas, ponds are mentioned as significant cultural heritage sites, embodying ancestral stories and collective memory. Whereas, in the Limbu minority regions of Darjeeling, India, the absence of ponds, and their "Hinduization" by translating culture through rampant temple building, inform how non-Indigenous practices manipulate spatiotemporality of landscapes, everyday activities, and the performativity of cultural memory.

However, the community as a minority in Darjeeling evolved their association through producing written accounts, exercising living memory as a form of resistance through the reconstruction of narratives, therefore reproducing heritage and identity.

In order to examine this gradual transformation, the project works collaboratively with the Limbu community to analyze pond landscapes by documenting narratives, ethnographic observations, and intersectionality of everyday interactions. The research thus explores how the community experiences, reclaims, and reinterprets its heritage, countering the dominant frameworks of heritage analysis that fix space within existing social complexities, therefore queering them through reconsideration of landscapes as non-stationary.

As a result, this study primarily builds on spatial ethnographies, artifactual and archival research through phenomenology, and intersectionality in expanding the potential to subvert colonial power dynamics and reconsider spatial narratives. By foregrounding the challenges of representing Indigenous landscapes in socio-political and cultural contexts, the project poses critical questions about the meanings and articulations of cultural heritage, providing opportunities for expanding the context-based Indigenous heritage discourse.

Keywords; Indigenous heritage, intersectionality, queer landscapes, phenomenology

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1. Introduction:

Why does understanding indigenous landscapes matter?

In the shifting terrain of Darjeeling's urban and rural ecologies, Indigenous heritage is increasingly confronted by the dual forces of development and erasure. These forces are reinscribed by dominant heritage frameworks that prioritize monumental aesthetics and treat landscapes as static entities. In contrast to official heritage discourses that prioritize monumental architecture, this research argues for a phenomenological and decolonial approach that sees landscapes as taskscapes. Drawing from Ingold's (1993) notion of taskscapes, this research reframes the landscape not as a static site but as a web of interwoven activities, memories, and bodily gestures. These affective interactive spaces are shaped by bodily movement, ritual, gendered labor, and memory.

So, the answer is we can never sufficiently justify the need to decolonize the atmosphere of Indigenous landscapes unless we queer our (academic and activist) understanding of landscapes, therefore, of Indigenous[11]. It focuses on a repository of sites that explore the complexities of addressing alternative frameworks of documentation, based on the concept from 'Uses of Heritage', where Laura Jane Smith argues that heritage studies favor "monumentality and grand scale, innate artifact/ site significance tied to time depth, scientific/ aesthetic expert judgment, social consensus and nation building" (2006, p.11). This favor for grandeur aesthetic and narrative, thus contributes to the systematic erasure of everyday events and narratives of change from histories of landscapes, simultaneously allowing the marginalization of people, culture and practices dependent on it.

Similarly, the apparent voids in the landscape, like the missing ponds, abandoned ritual sites are not neutral gaps. Rather, they are active sites of meaning and absence, constituting what I refer to as a symbolic void. The term is used to describe the epistemological rupture that occurs when expected cultural forms such as sacred ponds are neither remembered nor mourned, yet still shape the researcher's gaze and desire.

To address this, the paper adopts a queer and decolonial orientation toward Indigenous landscapes. Following Ahmed (2006), queerness here signals not identity but disorientation: the will to notice what doesn't align, to dwell in misdirection. Likewise, Halberstam's (2011) call to embrace "the queer art of failure" allowed me to treat the collapse of my original research question not as a loss, but as a productive methodological turn. The paper is organized in three movements. First, it situates the cultural landscape of Darjeeling within its colonial and postcolonial histories, examining how regimes of mapping, settlement, and conservation have reordered space. Second, it draws on ethnographic encounters with the Limbu community, especially women and ritual leaders, who navigate land, memory, and mobility in ways

[11] "Such groups have been sidelined in most countries and turned into subalterns, as in India." (Das, 2015, p. 11)

that exceed state legibility. Third, it reflects on the phenomenon of non-memory, the absence of ponds not as a deficiency, but as an invitation to rethink how space is remembered, inhabited, and refused.

Ultimately, this study argues that to understand Indigenous landscapes is to let go of architectural mastery—to let go of the need to find, document, and define. It requires learning to read what isn't there, to honor the symbolic void, and to recognize that the sacred may no longer reside in stone or sediment, but in ritual breath, running water, and everyday gestures of care.

1.1. Plurality of narratives (interwoven in everyday life and practices of communities that are potentially under cultural threat)

Recently, Architectural Historian Dr. Gauri Bharat jokingly claimed at a talk over her book, 'Indigenous Architecture in India,' "We are Indians and so Indigenous[12]. Who is indigenous?- the question is suspended into a character. The International Indigenous day observed on 9th August asserted the term 'Indigenous' that impacted across scales of locations mapped across space and time. However, the repurposing of the loosely used word 'Indigenous people' is always evolving from Indigenous [13] to indigeneity.

Politically and Categorically, all the natives also known as Vernacular, Adivasi, indigenous are fit to exist into the ST caste category. While the critique of the terms 'indigenous' or 'adivasi' within the resistance movement has perceived as synonymous of marginalized representations tagged with hollow impact echos in terms of symbolic utility, these arguments, however, trace a legacy of non-indigenous articulations within constructs of academia. The very contemporary example the 'Save Mukkumlung; say no to cable car' movement started with the identification of indigenous reinforced by the rights to preserve the indigenous signifcant landscapes. What started as an cultural identity has now shaped into a strong movement of political resistance against the developmental logic in Nepal.

1.1.1 Indigenous in the Indian context

An introduction to Limbu as one of the significant groups among Kirant people, an indigenous ethnic community in India is necessary. The Limbu Kirantis, are traditionally known as wanderers and hunters, hill and mountain dwellers, indigenous knowledge holders, users of medicinal herbs and spices, physicians and architects; they are also known as nature worshipers and animists, and indigenous land owners; they have a very strong attachment to native agro-pastoral tradition. The Limbus designate

[12] CEPT Library Book Talk with Dr. Gauri Bharat on 22/11/24 attended through Instagram live of CEPT Library

[13] …if aboriginality is the 'quality of being aboriginal', then indigeneity can be defined as 'the quality of being indigenous', which itself describes he quality of being born or produced naturally in a land or region (Das, 2015, p.14)

themselves as Lungbongba Khambongbasa, meaning 'the lineage which emerged from the rock and the soil' (Limbu, 2003).

The Limbus historically inhabited the hills situated at the intersection of Nepal, India, and Tibet, an area that remains geographically significant today. Their territory once spanned across these regions, but the establishment of the three states—Hindu-majority Nepal, British India, and the Kingdom of Sikkim, fragmented their homeland, dividing the Limbu population into three distinct nations (Chemjong, 2017). The work studies the case of Darjeeling in West-Bengal to further explore the notions of indigenous and indigeneity and their role in shaping the minority cultural heritage.

1.1.2 Themes of Inquiry

In minority regions like Darjeeling to document the Indigenous landscapes through the IK system, Mundhum references Ponds as cultural landscapes. Ponds [barak] carry histories and mythologies that provide philosophy and wisdom about indigenous self-hood, particularly as it relates to the modes of self-management and governing. Contained in such histories and mythologies are also ways of 'knowing' and 'being', particularly in conjunction with one's communal coexistence with nature.

These histories and mythologies that touch on ponds as meeting points and are associated with purity, love and emotion as a ritualized practice of story-telling. However, to examine ponds, the landscape itself was observed to be changing along with the ideas associated with it. In his book, Ponds Are Still Relevant, Anupam Mishra talks about the birth of ponds as man-made landscapes, and the knowledge systems and language that expressed the phenomena shaped by the ecological conditions. A similar undertone corresponds with Mundhum's archetypal references to water with the creation of the incarnated deities (Tumbahang, 2013, p. 348). While the unconscious is intricately connected with the life cycle, waterscapes like rivers suggest the flow of time. These archetypal symbols remind of Sagent's ethnographic journals that host a photo of the commons' market along the river, possibly remembering the landscapes of separation traced by ancestors (Krauskopff, 2021). Echoing through these ethnographic insights of landscapes, once sites of separation, memory, and cultural negotiation reveal the complex interplay of time, history, and identity that can be better understood through documenting oral histories and lierature from the community as decolonial framework juxtaposed with obervations and analysis as an intersectional approach. This approach allows us to reframe landscapes like ponds, not merely as static objects but as living, relational sites that reflect the dynamism of Indigenous knowledge systems.

2.Darjeeling, dialectic, social mobility

Darjeeling's complex historical and material landscape is shaped by colonial legacies, social mobility, and the intersection of diverse cultural practices. Historically, as a colonial hill station, Darjeeling became a site of British imperial interests, facilitating both cultural exchange and exploitation of land, labor and resources. This external imposition reconfigured the region's social and spatial dynamics, severing Indigenous

ties to their ancestral lands. The material transformation of the landscape through the establishment of tea gardens, infrastructural developments, and land reforms has continued to impact the Limbu community's relationship to their environment. This section examines how these historical and material shifts in Darjeeling reflect broader socio-political forces that have reshaped Indigenous cultural practices and spatial understandings.

2.1 Darjeeling, Limbu, and a colonial past

Within the discourse put forth by Indigenous Limbu scholars from Nepal, central to the pursuit of decolonization, Marohang Limbu (2017) describes the Limbu past through violence of colonial systems (and institutions) and academic marginalization. He highlights their historical genealogy, noting that The Limbus ruled over parts of Nepal for centuries before the Lichchhavi invasion from ancient northern India. Following this invasion, the Kirat-Yakthung migrated to the eastern part of Kathmandu, which is referred to as "Kirat Pradesh" (Kirat region), an area that has been historically significant for the Kirat-Yakthung and is considered their ancestral homeland. Following, the "Nun-Paani Sandhi" or Salt-Water Treaty in 1774, the great annex of Pruthvi Narayan Shah, the Khas-Aryans strategically partitioned Kirat-Pradesh into three zones, namely "Wallo Kirat," "Majh Kirat," and "Pallo Kirat," benefitting their colonial objectives of imposing norms, resulted in the suppression of Limbu traditions, marginalizing the Limbu culture, viewing it as ‘uncivilized. The Khas-Aryan government ideologically and politically banned the Limbu people from teaching their language, writing, and Mundhum rhetorics. This institutionalized oppression erased Limbu's cultural identity by promoting Khas-Hindu ideologies.

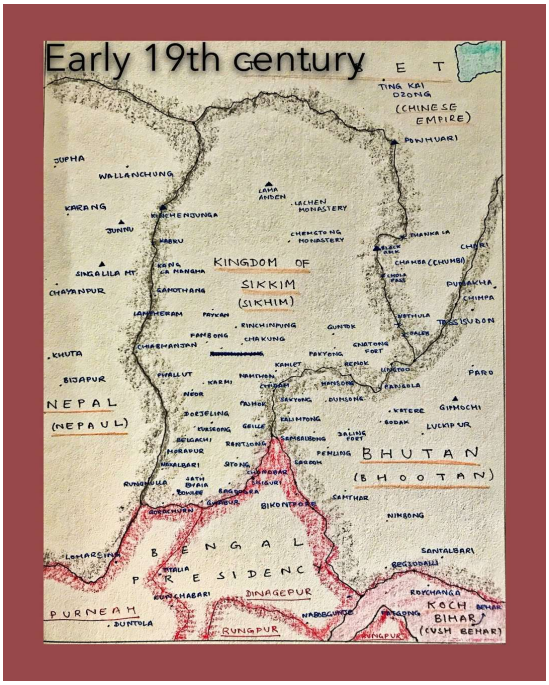


Fig. 1 *Map of 19th CE Sikkim Kingdom, maps by sagar. blogspot*

The idea of borders, however, has been a contested territory, and so has been the land affecting the lives and livelihood of those settled. Adjacent to the Nepal border, Darjeeling was once part of the Nepal and later Sikkim Kingdom, ruled by the Bhutanese kings before it was annexed by the EIC under the Bengal Presidency. Historically as a part of Sikkim, it was annexed by Nepal in 1780 during its territorial expansion from Sirmur (Himachal Pradesh) to Sikkim. Following the Anglo-Nepalese War (1814-16), Nepal ceded territories, including Darjeeling and Sikkim, to the East India Company. The British restored Darjeeling to Sikkim, ensuring its sovereignty and positioning it as a buffer state between Nepal, Bhutan, and Tibet.

This marked the beginning of British influence in the region, shaping its political and cultural landscape while ending Nepal's dominance over the area. The conflict and subsequent treaties redefined territorial boundaries, embedding Darjeeling into colonial history. In India, today, the Limbus are a majority in Sikkim, relatively dense in Kalimpong and Darjeeling.

During the later and early half of the nineteenth and twentieth centuries respectively, with the setting up of tea estates and bazaars in Darjeeling, it became a booming market under the colonial regimes. With the introduction of taxation, changes in land use, and capitalizing on the resources for tea estates, the fabric consequently witnessed migration in the form of labor, and leasing land to the laborers within the tea estates. These families settled around the slopes and even today exercise their culture around the forest landscapes near the plantations. Although very little written or documented information is available wrt pre-colonial Indigenous landscapes.

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2.2 Material shifts

Throughout the historical context of the Limbu community across the eastern Himalayas, the spatiality of landscapes, and the social and political processes are rooted in material culture. Felix Padel (2014) highlights the critical role of material culture in understanding landscapes, emphasizing how displacement disrupts the social fabric of tribal communities. Traditionally, handmade items and skilled techniques tied to cultivation and forest use are replaced by mass-produced goods and a shift to unskilled wage labor, eroding self-sufficiency and cultural identity. Control over local environments, including water management, is lost, reducing these communities to marginalized positions in polluted surroundings. Furthermore, displacement fractures communities, creating divisions over development projects and undermining traditional value systems tied to the sacred natural environment. This underscores material culture's centrality in preserving the relationships between communities and their landscapes.

For example, The Kipat system was a sophisticated communal land tenure and resource management system practiced by the Limbu Indigenous community before the imposition of colonial and state-controlled land policies. This system was integral to the Limbu people's socio-political and ecological governance, wherein land, forests, rivers, and streams were held collectively, and access was regulated through customary norms. Unlike feudal land tenure systems, the Kipat system was not established by royal decree but rather was rooted in ethnic identity and communal ownership (Regmi, 1976). The Limbu Jimmawal, or village chief, oversaw tax collection and resource allocation, reinforcing a decentralized governance structure that resisted state control (Limbu, 2011).

As the British colonial administration expanded into India and the surrounding Himalayan regions, policies were enacted to centralize resource management and dismantle indigenous governance structures. The colonial forestry policies severely undermined traditional land tenure systems like Kipat by nationalizing forests and curtailing indigenous subsistence practices. The prohibition of shifting cultivation (jhuming) and the imposition of licensing for forest product collection disrupted the economic and cultural sustainability of Indigenous communities, particularly the Lepcha and Limbu. These policies led to displacement and the erosion of communal resource management, replacing it with bureaucratic oversight that disregarded indigenous ecological knowledge (Sarkar, 2014).

Post-colonial India continued many of these restrictive policies but allowed limited, regulated access to forest resources. Indigenous communities adapted by integrating traditional agroforestry practices within the state-controlled system, such as cultivating cardamom in forest understories, selectively harvesting trees, and maintaining ceremonial uses of forest products. Until the enactment of stringent wildlife conservation laws in 1972, Indigenous peoples could still hunt and forage in their ancestral forests. Despite the loss of formal recognition of the Kipat system, customary

norms continue to influence communal stewardship of sacred sites, water sources, and fragile ecological zones.

While the shift from self-governance under the Kipat system to state-administered resource management reflected a spatial rupture of livelihood practices transforming Limbu people's relationship with land, it arguably reflects a temporal adaptation, negotiating with the imposed legal frameworks. This transformation not only altered their economic subsistence patterns but also reshaped their identity and perception of land as both a material and spiritual entity. This disruption within material culture comes from the shift in access to forest landscapes of the Limbu community through change in management of resources.

This is well illustrated in an oral history with Divakar Subba (President) and C.K. Subba (Vice President) of the All-India Limbu Association, highlighting the changed dynamics of Limbu cultural identity in response to urban contexts. They both elaborated on the growing disconnect between urban Limbu populations, their language, and traditional practices, unlike the *basti and* the 'semi-rural' town population. However, despite this disconnect between language and script, cultural resilience maintained through the celebration of festivals in public grounds and town squares, with required permissions from the Gorkhaland Territorial Administration (GTA) remains evident. Not only this, but he mentions the river Chota Rangeet where they perform post-death rituals, an hour's drive from Darjeeling with a relative Limbu majority, Bijanbari. He adds we'll find 'solid limbu' with proper settlement there.

These urban and rural cultural performances illustrate the community's ability to express identity despite changing environments. The shift from traditional spaces to urban public grounds shows how cultural practices adapt to modern settings, negotiating both spatial limitations and administrative requirements. This spatial adaptability across the temporal dimension underscores how Limbu heritage is sustained by reinterpreting traditions within contemporary urban-social frameworks. The adaptation of heritage and performance (Limbu, 2013) reveals how indigenous identity is continuously constructed and redefined, rooted in cultural heritage yet responsive to the socio-political and spatial realities of urban life. In doing so, the means of adapting to the *bazaar* life has given rise to a 'sense of loss' of spoken and written Limbu language. The sense of loss however is not only limited to the nuanced 'intangible' characteristics of culture but also plays out on a spatial front.

Another evident example of the material shift is the lack of ponds in the region. The spatiality of the Bazar area of Darjeeling reveals critical insights into the Limbu community's relationship with its cultural landscapes amidst urban transformation. The absence of pond landscapes, historically significant in Indigenous heritage, highlights a 'void' within the spatial memory of Limbu. Instead, the community's cultural markers, such as establishing the religion of *Yumanism* and the construction of *Manghim* temples, serve as fixed locations of non-indigenous representations of their otherwise animate and dynamic cultural traditions. This shift illustrates how animate Indigenous practices

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have been translated into inanimate forms, reflecting a broader transformation of meaning and translation into the dominant template for claiming Indigenous cultural heritage. With the concept of Manghim, the Limbu temple suggests the spatial compensation of cultural construction within the dense urban context as a means of claiming spatial access set within non-indigenous undertones. The dominance of markets food tourists and bazaars of colonial memory have thus reshaped the landscape as well as socio-economic conditions in Darjeeling.



Fig. 2 *Board reading 'site for Yuma Manghim' at Bijanbari, by author, Feb 2024*

Such material shifts have traced a long trajectory of social and structural migration. Historically, Darjeeling's colonial identity as a tea estate and hill station displaced Indigenous Limbu populations from Nepal and Sikkim, forcing them into labor roles. Over time, the migration of the Limbu community from ancestral lands to urban bazaars reveals a colonial-, institutional violence between not only the land and community but also their knowledge systems of survival within social structure and negotiation for upward social and economic mobility across varying degrees of indigeneity. These changes are further complicated by the lack of protected Indigenous landscapes, leaving cultural heritage vulnerable to both state-led developmental projects and non-indigenous dominant cultural templates. This process reflects not only a structural shift but also a phenomenological shift in meaning-making, where the relationship between the Limbu and their landscape is reconstituted to align with evolving cultural and spatial contexts.

Phenomenological readings of landscape, such as those by Edward Casey and Tim Ingold, illuminate the impact of temporal transformations on the lived experience of space. Casey's notion of *place as an event* hints that the bazaars, rather than acting merely as economic spaces, become loci of cultural negotiation and identity construction. Similarly, Ingold's concept of *taskscape* highlights how Indigenous

practices adapt within new environments, revealing the interdependence between socio-economic systems and cultural heritage (Gruppuso, 2020).

These characteristics suggest the two-fold deepening tension between maintaining and practicing Indigenous identity as much as documenting and representing its physical absence in non-indigenous materiality giving way to a rethink of the plurality of exclusionary practices over Indigenous lands. This results in the prioritization of economic utility over cultural preservation while erasing the spatial memory of the Limbu community. Institutions driven by state-led mechanisms often ignore or undervalue dynamic landscapes like these, focusing instead on static heritage such as temples (Manghim). The landscapes inhabited by the Limbu people are not just geographical territories but also cultural localities that hold their historical narratives, traditions, and practices, true for not only spatial but also in temporal dimensions. In this manner, the colonial and post-colonial forces (Treudeu, p. 1,2) impacted these landscapes which are vital for the revitalization of their language, culture, and knowledge systems. The connection to these landscapes is integral to their identity, as they embody the cultural and spiritual heritage of the Kirat-Yakthung people.

In the minority Limbu settlement of India, the process began with a daunting experience of navigating sites due to the lack of 'ponds or any other 'natural' landscape heritage. This approach towards ponds was a symbolic reminder of colonial pedagogy as the absence of this cultural waterscape drew attention to the practice of rituals along the existing waterscape of river Chota Rangeet, an hour away from the main market of Darjeeling. To illustrate the cultural interactions along the waterbody, we walked along the river tracing existing narratives/ ethnic signatures of Limbu locals as an important insight into the understanding of landscape, the dynamic articulations of landscape shaping the performance of culture. In Darjeeling, as a minority, the community may have turned to written records such as producing written accounts of rituals, performances, and agents as a tool of preservation and resistance of their culture through translation into Yumanism as Limbu religion.



Fig. 3 *Digging hills for road construction in Nepal, by author, March 2024*

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While working with the Indigenous scholars and activists in India and Nepal, the rampant developmental changes like the roads we used to travel (or were getting constructed) emerged as the need to document the gradual erasure of Indigenous landscapes that we occupy on an everyday basis. Throughout the process-oriented approach, as a student of architectural history, our favorite hobbies include sketching, mapping, and tracing material histories of the built form. While the same spirit of this professional hat felt daunting during community engagement, narratives often supported or set a background for the tangible findings but never took center stage. Walking with the locals helped us situate the narratives in a space, the very act of walking overlapped the interconnected atmospheres. However, landscapes are central to humans, occur in all human activities, and can be often read as disguised in people's stories in India. As Manprasad Subba says," occupants are occupying the land," while we walk back from Manidhara, discussing the common land and conflicts surrounding it or Jasmant Subba expressing his desire to move to the Bazaar to escape the laborious life of tea gardens. The context of these perceptual nuances leads to the common denominator, if landscapes are always dynamic, in what ways does materiality alter the cultural landscapes?

3.Chota Rangeet, cultural performativity and symbolic void

Bijanbari features several riverside picnic spots and is home to the naturally occurring water source near the Mani Dhara Mandir (Temple), a site of significant local importance due to its alleged mythical origin. Bijanbari, in India, is a small town within the Darjeeling district. Known for its relatively moderate climate, Bijanbari experiences neither extreme heat nor severe cold. The town is situated in a valley at an elevation of approximately 760 meters above sea level, with the Little Rangeet River (Chota Rangeet) flowing nearby. The river meanders through a bed of rocks and boulders, serving as a geographical border for the surrounding hills and past territories of Sikkim and British-ruled India.

The political history of Chota Rangeet is illustrated by Manprasad Subba, the local Limbu poet in his early 70s. Bijanbari has been his home for all his life and has led his creative journey having won multiple awards for his contextual flair. When talking with Manprasad Subba, he adds, "I remember swimming in his river, it used to flow way below than it does now…we don't have ponds here in Darjeeling or Kalimpong, we only have mountain rivers and rivulets." The absence of ponds through Limbu narratives becomes a symbolic void. As Zizek puts across, it adds surplus meaning by posing questions of interactions and association around the existing landscapes and waterscapes like the river Chota Rangeet itself.

Cultural performativity, as explored by Ramesh Limbu (2010), extends beyond traditional theater, encompassing a wide range of human activities, including rituals, rituals, and everyday social practices. Performance involves enacting or bringing something into effect, such as an identity, a story, or a cultural practice. In the Limbu context, performance is deeply embedded in the religious and ritual narratives of

Mundhum, where mythical stories and the genesis of the universe are communicated through oral poetic language during rituals. These performances are not only about enacting stories but also creating a world where memory, identity, and meaning are continuously constructed. The landscapes of ritual sites, like rivers and sacred spaces, become performative acts, creating meaning and cultural identity through their use, reinforcing the dynamic interaction between memory, place, and performance in shaping the Limbu worldview.

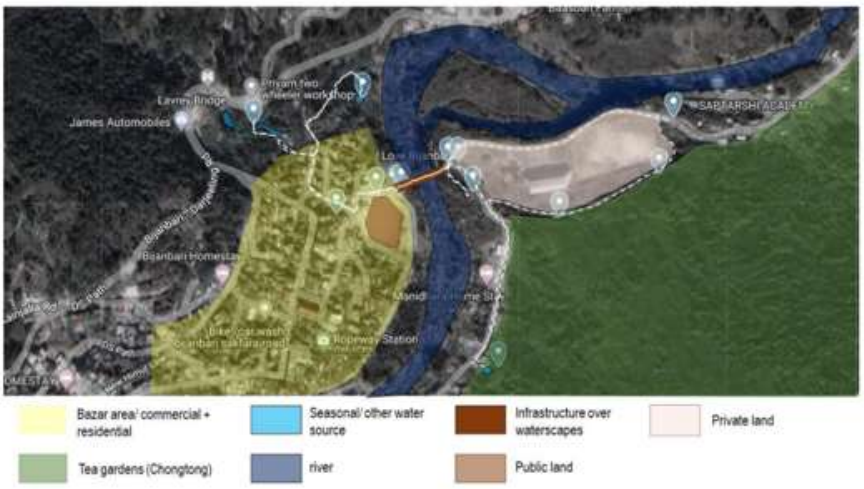


Fig. 4 *Map illustrating places walked and experienced (Chota Rangeet river, Manidham, Stream-graveyard) in Bijanbari*

2.2 Reclaiming (gendered) visibility

Similar to the narratives by Manprasad Subba, his sister-in-law, Mrs. Padma Subba, who serves as the head of Bijanbari Gram Panchayat block, reflects on her youthful days when she moved from a nearby *basti* to Bijanbari post marriage. She would sit by the river along the Tea Gardens with her friends, as they swam in the river— shaped by leisure and spatial accessibility. However, this memory of the river starkly contrasts with her later experiences as spatial mobility became tied to the event of marriage, chores and familial responsibilities, such as filling water from Manidham, a nearby perennial freshwater stream or not crossing the river post demise of family members. Her accounts reveal how movement patterns are deeply influenced by traditionally practiced gender roles, shifting from personal agency in youth to duty-bound movements later in life.

Similarly, Yamini/Yeba, a female shaman highlights her ritualistic movement tied to post-death ceremonies along the river, further emphasizing how women's mobility is bound and laden with cultural significance, embodied practices, and spatial memory. The ritual starts at midnight after the last rites, from home along the banks of the river. Chota Rangeet holds utmost importance, having sacrficed chicken or fish, only accepted till the water turns red of blood. Throughout the episode, her body becomes a container of the dead soul, communicating, demanding physical and psychological

capacity, sometimes sexual too. Yamini/Yeba's ritualistic movement along the Chota Rangeet river during post-death ceremonies demonstrates the gendered embodiment of sacred spaces.

During the fieldwork, what started as a 'quest for ponds as cultural landscapes' moved into a contested territory of documented simulteneity of the river through oral histories and observations. The simultaneity lay not only for the spatiality of place but also temporality of place as event. A frozen frame of frequent passersby trail across the river overlaps with the heaps of cement bags in the river bed after the ritualistic ceremony of yamini the previous night. The co-existence of these bodies within the river landscape is an indicator of the socio-economic exchanges that adds to the cultural multiplicity of the river landscapes.



Fig. 5 *A woman labor, a kid and bags of cement, by author, February 2024*

These documented narratives are however not grand in gesture as much normative to the lives of the community. Stories of everyday practices bring visibility to women's interactions with landscapes, contrasting their perceived invisibility around Indigenous women's narratives and positionality in shaping and preserving cultural practices otherwise curtailed in grand construction of heritage. For example, Padma Subba recalls her youthful days spent along the river with friends, engaging in recreational activities. However, marriage restructured her mobility, binding her to responsibilities such as fetching water from Manidham and adhering to ritualistic prohibitions. yamini's role in death rituals and Mrs. Subba's emphasis on preserving the Limbu script foreground women's active participation in maintaining and constructing heritage as language as much as shaping the meaning-making process of the landcape at an everyday scale. These narratives foreground the agency of gendered association of culture within landscape for livihood and leisure. Such practices rooted in their everyday livelihood along with rising concerns also inform the extent of perceiving their positionality within the politics of social relations. Women's experiences in Bijanbari's landscapes highlight the fluidity of agency and restriction. Their mobility shifts from leisure to duty, shaped

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by patriarchal, economic, and ritualistic structures. Despite constraints, women actively contribute to cultural heritage through labor, language, and ritual.

The embodied memories experienced by gendered bodies of swimming, picnics, and ritualistic practices emphasize how women become vessels of spatial temporality often with discontinued materialities manipulated by institutional logic of marriage, domestic labor, and perceived social construct, intertwining their personal histories with that of the culture around the landscape. Such memories reflect not only nostalgia but also the loss of accessibility and cultural spaces, as the river transforms into a site of restricted mobility due to social (and developmental) changes. Reclaiming their visibility challenges dominant narratives, advocating for inclusivity in landscape studies.

In his paper, Politics of Belonging in the Construction of Landscapes: place-making, boundary-drawing and Exclusion," Daniel Treaudeu discusses the visibility of cultural heritage in the context of landscape construction and the politics of belonging. Trudeau highlights how landscapes serve as visual articulations of orthodoxy, reflecting dominant cultural practices while often excluding the 'other' cultural practices. This exclusion can render certain cultural heritages invisible or marginalized within the landscape, as the dominant group's norms and values are prioritized in the construction of space. The paper suggests that the clear exclusion of different cultural practices is treated as an incidental cost of maintaining the perceived proper order of things, thereby undermining the visibility and recognition of diverse cultural heritages (p. 19, 17). To address this exclusionary phenomenon, Kimberlé Crenshaw's (1989) intersectionality theory highlights how overlapping identities—such as gender, ethnicity, caste, and class—compound systemic inequalities. Intersectionality allows us to see how power and privilege operate differently across social contexts. In Bijanbari, women like Padma Subba and others' relationships to sites like *Manidham* are tied to domestic labor (fetching water), cultural rituals, and mobility. These spaces act as both sites of agency and as constraints under patriarchal norms. Padma Subba's family history of migration from Nepal to Darjeeling, coupled with changes in land use (e.g., privatization under the Land Reform Act of 1975), further shapes how Limbus negotiates identity, mobility, and belonging within a colonial and capitalist framework.

3.Shifting Culture and Moving Landscapes/

The intersection of land, culture, and colonial history is evident in the transformation of Indigenous landscapes through imposed frameworks of governance and material conservation. The Land Reform Act of 1975, as noted by Padma Subba, facilitated external access to indigenous territories, but earlier colonial interventions had already disrupted indigenous land tenure systems. British colonial policies transformed landscapes into economic assets, as seen in the imposition of tea plantations over indigenous spatial practices. This imposition not only altered material culture but also marginalized intangible cultural expressions, challenging Indigenous claims to land and identity.

The dominance of tangible heritage frameworks has led to the erasure of oral traditions and performative cultural practices, reinforcing colonial ideologies of ownership and documentation. The recognition of cultural landscapes such as the Chota Rangeet River, central to Limbu rituals, illustrates the necessity of decolonizing heritage frameworks. This entails acknowledging Indigenous relational landscapes beyond Eurocentric static categorizations and embracing non-material heritage as a legitimate claim to identity and belonging.

Queering landscapes further challenges rigid binaries of heritage representation by recognizing landscapes as fluid, relational, and socially constructed. This perspective resists colonial frameworks of conservation that prioritize monumentality over lived experience. By reclaiming indigenous knowledge systems and everyday interactions with the land, decolonial and queer methodologies offer alternative ways to assert heritage, ensuring Indigenous communities maintain agency over their cultural landscapes despite ongoing socio-political transformations.

Is it the Land Reform Act of 1975 that opened doors for the outsiders as Padma Subba mentions, or, historically, is it the topography of the terrain that allowed the British to strategically impose tea plantations as tangible frameworks over intangible assets? The question remains what is the material culture that informs material residue? To put simply, how do materials intersect and alter the context they exist? Is the dialectic inseparable from these processes of marginalization and should it be looked at as not static, but as an agency?

3.1 Culture and Heritage Frameworks

In India, the conservation of Indigenous, and Adivasi cultural heritage is supported by various constitutional provisions, policies, and institutional frameworks. These aim to protect the rights, culture, and heritage of Indigenous communities (referred to as Scheduled Tribes or Adivasis). However, the implementation of these frameworks often faces challenges due to systemic gaps within socio-political complexities. Religious diversity and the protection of minority traditions are mandated within the Indian Constitution (Part III, Article 26), but this does not necessarily play out in the recognition and preservation of minority heritage sites.

On authenticity: Because we know the only template to claim something hinges on the material authenticity of the evidence, to say that, to claim land rights, or land- a limited resource for establishing identity, culture has to be performed through physical material manifestation. It raises questions of what exists as measurable and qualitative enough to be claimed. To counter the homogenized and mass-perpetuated capital-driven ideology, unsettling the fragile ecosystems that are habitats for human and non-human species, it becomes necessary to identify the systems that allow and enable this negotiation.

The challenges in existing frameworks lie in the overemphasis on tangible heritage (monuments, artifacts) while neglecting intangible aspects like oral traditions, rituals, and spatial practices. Other large-scale development projects (dams, mining) often override the cultural and ecological concerns of Indigenous communities, eroding their heritage. Heritage conservation efforts often exclude community participation, leading to projects that are disconnected from Indigenous priorities and contexts. With the constant flux of developmental schemes towering over the common's land, the temporality of complex approval processes and insufficient coordination among institutions hinder conservation efforts and initiatives.

As much as the movement of landscapes is true for the temporal dimension, it is true for the spatial dimension as well. For example, geological transitions such as the stream along which the Limbu graveyard stretches changed its course post the landslides in the early 2000s to the other side of the graveyard. Even changes in land use/ privatization change the physicality of the landscape, altering its spatiality too.

Landscape and Heritage Frameworks

The river Chota Rangeet acts as not only a physical marker of political territories ad a resource for the people, it is also a cultural 'place' for the Limbu community from regions around to perform rituals and practice cultural heritage. The landscape, however, refrains itself from the euro-centric notion of fixed relationship and witnesses a rather relative temporality. In doing so, the approach not only deviates from the dominant understanding of landscape but also demands decolonizing methodologies for a nuanced take on indigenous cultural heritage.

Decolonization of Landscapes

Decolonization involves dismantling colonial power structures and epistemologies, as outlined by Linda Tuhiwai Smith in *Decolonizing Methodologies* (1999). For the Limbu, this means reclaiming Indigenous practices, language, and relationships with landscapes. Sacred geographies: Sites like *Manidham* (a place for water collection and community interaction) and ancestral land used for cultural rituals represent more than utility; they are imbued with the memory of ancestral knowledge and cultural performativity. However, colonial land reforms and modern pressures commodify these spaces, disrupting their relational meanings and articulations. Practices like *dhan naach* or worship of the Yuma goddess (without idol worship) resist dominant Western frameworks of religion and heritage. These traditions emphasize non-material connections to the land, challenging colonial and capitalist paradigms of resource extraction and commodification.

Existing methods of documenting and claiming heritage

The Indian judiciary has played a critical role in safeguarding marginalized communities' rights, as seen in landmark rulings like the 1997 Samata Judgment, which upheld the Forest Protection Act and tribal self-governance under PESA. However, the

Forest Rights Act (FRA) of 2006 suffers from poor implementation, reflecting an ongoing reliance on colonial frameworks. Despite its intention to empower Gram Sabhas and recognize customary rights, systemic issues persist. Claims remain unprocessed, official forests are notified without proper settlement of tribal rights, and outdated state laws, like in Tripura, disregard communal land ownership, leading to significant land loss. These gaps undermine tribal autonomy, perpetuate dispossession, and prioritize state-driven, top-down approaches over genuine community empowerment and self-governance (Das, 2015). The discussion points to the dominance of colonial frameworks in heritage narratives. For instance, the absence of community ponds as commons' cultural markers results in altering the narrative of 'Indigenous heritage' in colonial systems of documentation, which prioritize 'monumental' heritage over everyday relationships with lived landscapes. While the colonial articulations of heritage pose a serious structural threat to most of the indigenous communities in India stemming from 'conservation guidlines' and

Decolonizing heritage practices would mean approaching indigeneity- in all forms of relating to native habitus, emphasizing oral histories, embodied practices, and relational landscapes, as seen in the Chota Rangeet river narratives. By documenting Indigenous methods of ritual, memory, and daily interaction, such an approach could foster a rights-based framework that values lived heritage over imposed templates. This would not only reclaim visibility for Indigenous communities like the Limbu but also offer sustainable ways to navigate identity and belonging in the face of socio-political and economic changes.

Queer(ing) Indigenous landscapes

As the larger looming narratives around the erasure of indigeneity through landscapes highlight the 'development-led displacement, as it reinforces the rigid categorization of space (sacred/profane, Indigenous/non-Indigenous) and obscures the depth of invisibilization of what overturns the visible imprints. An urgent need to decolonize these understandings is not sufficient and therefore, queering landscapes become necessary as they embody fluid identities shaped by political structures and institutional logic, and resist within frameworks of dominant heritage representation.

The perspective on landscapes presented in the paper, therefore, necessitates queer methods of analysis not only because it challenges normative, binary understandings of landscapes as static, fixed entities but also destabilizes their understanding as external to human agency and experience. By proposing that landscapes are agencies that can "migrate" and are relational (in this paper) to humans and human activity —shaped through interaction with people, objects, and ideas like the use of a football ground in Bijanbari for *Udhavali* rituals twice a year—it destabilizes dominant frameworks that situate, view and dictate landscapes through colonial lens of resistance and claim-making.

Queering landscapes involves rejecting the essentialist notion of landscapes as solely physical or "immovable" and instead embracing their temporal, spatial, psychological, and non-linear qualities. This perspective aligns with queer theory's broader critique of binary thinking (e.g., monumental/ mundane, nature/culture, fixed/moving, subject/object) and its emphasis on relationality, multiplicity, and disruption of norms. The cultural significance of the river, thus becomes productive when understood within the larger historical social and phenomenological orientation. Landscapes, like queered identities, resist being confined to a single, static definition. They exist in flux, constantly renegotiated through memory, practice, and power.

In this framework, queering landscapes also allow for the inclusion of historically and socially marginalized perspectives and practices (that may otherwise seem mundane), such as women's perception and negotiation with the changing Indigenous ways of knowing and living, provides tools for examining the dominant colonial or capitalist ideologies that move across scales of categorization. Recognizing landscapes as relational queering transforms them into sites of possibility, resistance, and reimagination—spaces where the fixed meanings imposed by dominant powers can be resisted and rewritten. This queerness lies in landscapes' refusal to conform to normative frameworks, making them active agents in socio-political and cultural negotiations.

Towards a (more than) human heritage;

This research began with a critical inquiry into the documentation of ponds as cultural landscapes of the Limbu minority in Darjeeling, WB, India. The research involved ethnographic and phenomenological processes that highlight the lack of ponds and therefore the structural and epistemological gaps in existing frameworks that engage with Indigenous cultural landscapes, particularly focusing on the Limbu sites in Darjeeling. The structural problem—the systemic marginalization of Indigenous cultural landscapes within colonial and post-colonial heritage frameworks—reveals how institutionalized practices in architecture, heritage conservation, and urban planning have rendered the Limbu's dynamic relationship with their landscape's invisible. This marginalization is not a passive erasure but an active construction that positions these spaces as inert and devoid of meaning, thus denying the vibrancy of Indigenous knowledge systems that are spatially and experientially embodied. By focusing on water sources like the Chota Rangeet River, the research challenges the dominant assumption that heritage is bound by fixed, monumental landmarks. This speaks to the larger question of how global development and capitalist exploitation reshape local cultural identities and erase relational landscapes that have sustained communities for centuries.

The epistemological problem further deepens this critique by addressing the philosophical disconnect between Western conceptualizations of landscapes and Indigenous worldviews. While Western frameworks view landscapes as material and static, Indigenous cultures, as exemplified by the Limbu community, perceive

landscapes as *movable* and *non-stationary*, embedded in social, ecological, and spiritual processes. The epistemological gap between these worldviews is not just an intellectual difference; it is a structural issue that influences policy, heritage conservation practices, and the legal recognition of Indigenous cultural spaces. The relegation of oral histories and performative rituals like the *Mundhum* to secondary status is a direct manifestation of this epistemic violence, wherein Indigenous knowledge is treated as peripheral to "official" heritage narratives.

Queering the relationship with landscapes becomes a necessary framework to address these challenges. This perspective subverts fixed binaries by allowing for a more fluid, non-hierarchical understanding of space. It questions the assumptions of colonial constructs that landscapes are immutable, 'beautiful', and sublime objects of desire by proposing that landscapes are ever-changing and shaped by the constant physical and intellectual human and non-human agency. This view aligns with contemporary decolonial thought, which seeks to rupture the linear and Eurocentric narratives of history, heritage, and spatial belonging. In doing so, the research advocates for the need to incorporate Indigenous epistemologies into heritage conservation policies that must recognize landscapes as living, relational spaces, continuously shaped by cultural practices, oral traditions, and community interactions.

The larger implication of this study lies in its challenge to both academic and policy frameworks that continue to perpetuate colonial structures of knowledge and land ownership. By acknowledging the landscapes as non-stationary, and mutable, and highlighting their critical role in identity formation, this research calls for a fundamental shift in how cultural landscapes are understood and protected outside the framework of 'monumentality' and 'divine sites of beauty'. Decolonizing these frameworks will not only expand the articulation of cultural landscapes but also protect, validate, and amplify the dense, diverse forms in which Indigenous communities, like the Limbu, have historically interacted with, understood, resisted, and lived through their environments. Recognizing these shifting, fluid landscapes as heritage sites will allow for reimagining conservation practices that are inclusive, equitable, and truly reflective of the cultural complexity and resilience of Indigenous communities. The study does not claim authenticity on scientific basis but as a curious and critical inquiry into the ideological and material world through dialectic engagement. The work thus invites academicians, artists, anthropologists, activists, legal consultants, historians and researchers to take forward what they find useful and deepen the understanding of Indigenous Cultural Landscapes.

In conclusion, the study underscores the urgency of decolonizing landscape theory and heritage practices to foster a more inclusive and ecologically integrated approach to cultural preservation. It offers a critique of current methods while proposing a more nuanced, relational understanding of landscapes that respects Indigenous sovereignty, knowledge, their fundamental rights, and access to landscapes and the environment. It does so by investigating the cultural landscapes as environments and practices not fixed

in space but rather complex and hinged in time, space, and psyche at the intersections of gender and social institutions like inter-caste marriages, geological processes, resource mobilization and restrictions in access, the articulation of land use of market-Tea Estate- basti through transport routes, privatization of land, daily practices and garbage disposal. By embracing this approach, we move towards a world that acknowledges the fluid, interconnected nature of space and culture, where Indigenous communities are not passive recipients of external frameworks but active agents in shaping their cultural landscapes.

Acknowledgments: This is to acknowledge the ancestors in cognizance of their lived landscapes, the memories of culture carried with the people, remembering the struggles and hope of the indigenous. This archive works with and from the land of Mundhum stories, the Limbu or the Lilim Yakthung of the Eastern Himalayas, the Yakthung Laje Limbuwan or Kirat Pradesh1 from the hills. This attempt to apologize and undo my unconscious biased gaze; is an attempt of my informed attempt disguised from its colonized effort. These words that I type as I bite my teeth are for othering myself from a language that is devoid of indigenous cultural practices. In no form do I intend to disrespect the 'home' where I situate the work physically, politically, emotionally, and intellectually in the legacy of what you preserved, and what's yet to come. I apologize for the need I desire to apologize for it would never occur in an alternate reality that is now the hope for the indigenous future.

Conflicts of Interest: The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interests that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results must be declared in this section. If there is no role, please state "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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TRACK 03

EDUCATION , ETHICS & RESEARCH

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From Mapping to Thematic Enquiries: Through decoding aspects of urbanising peripheries of Pune

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Abstract: *Throughout history, maps have fundamentally represented a space on 2-dimensional surfaces, but the mapping process goes further by capturing integral layers of the living environments. Mapping is an experiential and experimental process that creates visual expressions of a physical environment with layers of natural settings, socio-cultural constructs, economic cycles, and morphology. This broadens the role of mapping as a thinking tool in urbanism.*

In understanding the phenomenon of urbanising peripheries of Pune - Hinjewadi, Kharadi, Bhugaon, Dehu, Chikhali, and Narhe, cognitive mapping becomes instrumental for identifying the tangible and intangible aspects of the study area like - culture and identity, environment and ecology, livelihood and economy, built and open environment, social amenities, mobility and infrastructure, safety and security. Decoding these aspects through various exploratory mapping methods brings out the critical observations of these study areas, understanding their response to the forces of development helps associate values and identify generic and specific concerns. Based on these ideas, a thematic enquiry is generated to address the holistic development of these peripheral areas of the city.

This research discusses the journey from mapping as a tool to capture the nuances and character of the place, to identifying the emerging concerns, to developing thematic enquiries as a pedagogy for informed decision-making in the context of the urbanising peripheries of Pune.

Keywords: Urbanizing Peripheries; Studio Pedagogy; Mapping methods; Aspects; emerging Concerns; Thematic Enquiries

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1. Introduction -

"The image of the city is a combination of physical reality and mental organisation."

(Lynch, 1960)

Cities and their peripheries are multilayered models of growth and development. There is a continuous challenge to study its physical reality, social constructs and economic cycles. Can the experiential and experimental process of mapping become a tool for critical design thinking? With this pedagogical enquiry, this paper aims to establish the correlation between mapping aspects and formulating thematic enquiries.

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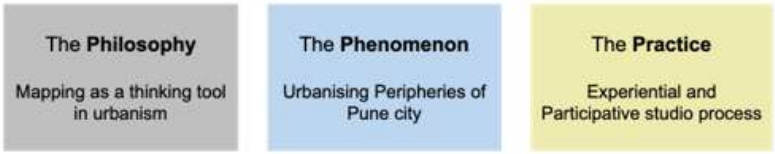


Figure 1: *Diagram representing the 3 major areas of thought.*
Source: Author

The **philosophy**: Mapping as a thinking tool

As stated by Senel, mapping may provide us with more than an analytical and visualisation tool that produces representations of a linked and dynamic world. Mapping suggests a performance of a place that is more than merely a representation of it (Senel, 2014, p. 91). Mapping emphasises and illustrates the notable dynamics of spatial knowledge and are active agents for design thinking.

The **phenomenon**: Urbanizing Peripheries

"The Phenomena of Suburbs is almost as old as cities. Where there is tight circumscription, there will be spill" (Kostof, 1992). Cities are difficult to contain (Author, 2020, p. 2693). Pune city is largely radial, with development occurring in the outskirts. These peripheral areas that are getting urbanised and are in the process of getting absorbed into Pune city are in a constant struggle to maintain a balance between their own identity, culture, landscape, and the new forces of development and migration. Thus, the aspect-based method of understanding these areas became a critical approach in studio pedagogy.

The **practice**: Experiential and Participative studio process

For decoding the phenomenon of urbanising peripheries, mapping aspects - like culture and identity, environment and ecology, livelihood and economy, built and open environment, social amenities, mobility and infrastructure, safety and security becomes the crucial framework. According to Shannon, the maps attempt to understand the shifting relationships (smooth and conflictual) between landscape, infrastructure, and urbanisation (Shannon, 2009, p. 27). In the chapter of Shifting Ecologies, the authors argue that as the city's economic decisions seem to be ever stronger and more powerful, decision-makers appear to fail to understand the negative impacts of unsustainable development and are quick to forget that 'natural' disasters are to a large extent provoked by a 'form follows profit' mentality. The city's urban environment has been shaped by economic purposes, more than by social or environmental concerns, generating unsustainable pressure on ecosystems (Da Costa, Favaro, & Campos, 2009, p. 68)

In this scenario of continuous urbanisation, a strong pedagogical framework needs to be established through socio-spatial research addressing the multidisciplinary nature of cities. Realisation of critical concerns, formulating thematic enquiries, and carving out need-based interventions can lead to a more responsive form of development.

2. Research Enquiry and Method

The central theme of this research revolved around mapping practices as a pedagogical approach in studio processes. The main Enquiry dealt with the role of Mapping as a thinking tool in decoding the phenomenon of urbanising peripheries of Pune - Hinjewadi, Kharadi, Bhugaon, Dehu, Chikhali, and Narhe through identified aspects like culture and identity, environment and ecology, livelihood, and economy, built and open environment, social amenities, mobility and infrastructure, safety and security to develop holistic strategies and thematic enquiries for the study areas.

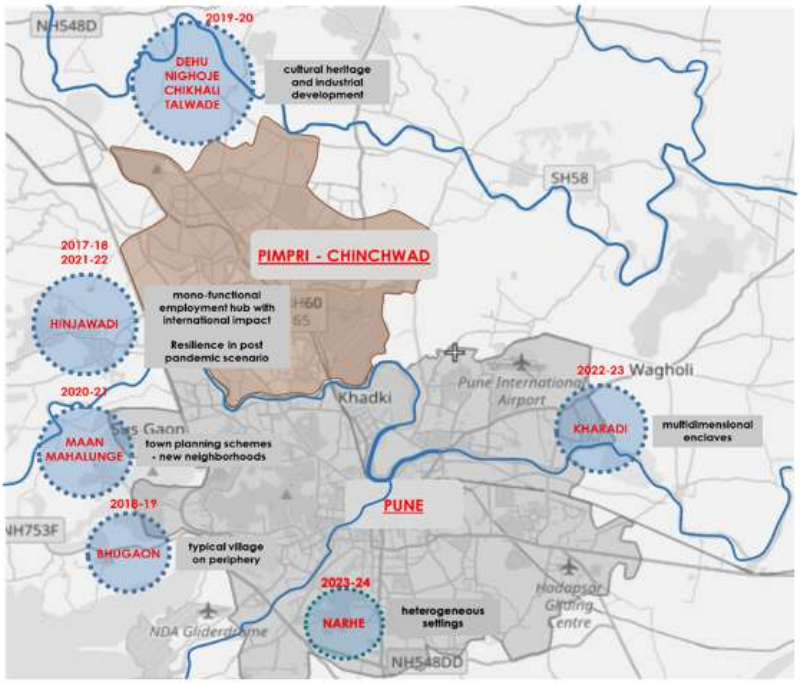


Figure 2: *The six identified urbanising peripheries as study areas in the context of Pune city. Source: Author*

Each of these urbanising peripheries though showing similar characteristics of gradual land conversion, growth, and many patterns of development where market-driven residential development overlaps existing villages and their culture that become similar traits. But there also are certain unique phenomena of each area that give impetus to the new development (Author, 2020, p. 2696). These peripheral areas of Pune city are facing issues of - loss of cultural identities & local economies, lifestyle change and its impact on social structure, the non-responsive built environment and character, and assimilation of local and migrant cultures.

An interpretative mixed-methods approach of both Quantitative and Qualitative methods has been adopted for this socio-spatial research. The representation of data is majorly visual and supported by textual narratives. The measurable or quantitative paradigm of this research is the territorial representation of actual spatial reality and deals with the tangible aspects of natural settings, built-form and morphology, availability of amenities and utilities, mobility and infrastructure whereas the experiential or qualitative paradigm deals with intangible aspects like culture, identity and social constructs, livelihood and economy, sense of safety and security of the study area.

A stratified random sampling survey has been conducted amongst the students to comprehend the outcome of this pedagogical approach of employing mapping methods to study aspects of an area in carving out the thematic enquiries for the studio.

The role of Mapping as a tool has been assessed through the following skillsets -

1. **Documenting the Area** – recording the observations related to existing situations.
2. **Tapping the Experiential Layer** – drawing meaning from the experiences.
3. **Representing the Aspects** – synthesis of different types of data such as base plans, diagrams, photographs, and perceptual data through spatialization and overlay.
4. **Communicating the Observations** – Visual and verbal communication of the aspects studied.
5. **Analysing the Situations & Identifying the Gaps** – examining the existing conditions and determining the need for interventions.
6. **Interacting with the Stakeholders** – conducting workshops for participative learning and generating feedback.

3. Analysis and Discussions

3.1 Understanding the relevance of Aspects for the study area

Multiple forces shape cities at a macro and micro level. In the context of Pune, the major driving forces of development can be classified as - IT and Service sectors, Industrial sectors, Institutional sectors, and some large-scale cultural magnets. As stated earlier, the development pattern of the selected study areas for this research is the outcome of these major forces.

Instead of grossly bracketing this growth in peripheries as ‘Urban Sprawl’, can this growth in the peripheries be understood and analysed in detail (Author, 2020, p. 2695)? Mapping of various Aspects becomes the major framework for a detailed understanding

of these areas. The identification of Aspects of the Study area is done in a participative manner through the following steps -

- Understanding of forces of development acting on the study area
- Primary site visits to the study areas.
- First impressions of the area through cognitive maps and Photo-stories.

3.2 Mapping of aspects to capture nuances of the study area

A participative approach is adopted for generating the critical pointers to be studied under each of the aspects through a discussion between the faculty and students. As this research has both tangible and intangible aspects, the challenge lies in the actual integration of observational data into spatial representation more so because mapping is not a linear process rather it is a continuous collating of data collected and data analysis. This is especially important for mapping as a visual method because the map is an object that is produced continuously. The collection of data goes hand in hand with its continuous interpretation (Baxter, et al., 2021, p. 15) . The representation of each of these aspects in the form of maps demonstrates the role of mapping as a thinking tool in urbanism.

3.2.1 Mapping Image, Identity and Culture

Understanding Image, Identity and Culture of the study area starts with the learnings from the first impression exercise which brings out the initial nuances of the aspect and these perceptions get further strengthened through detailed observations and interaction with the local population. This helps in tapping the micro and macro identities of the study areas and its cultural heritage. Furthermore, the local narratives and oral histories of the study areas have strong bearings on the understanding of Image identity and culture. Mapping of important Socio-Cultural Activities, festivals and processional routes in the area and physical elements like local landmarks, important nodes and cultural activity generators contribute in understanding the spatial scale of the cultural aspect.

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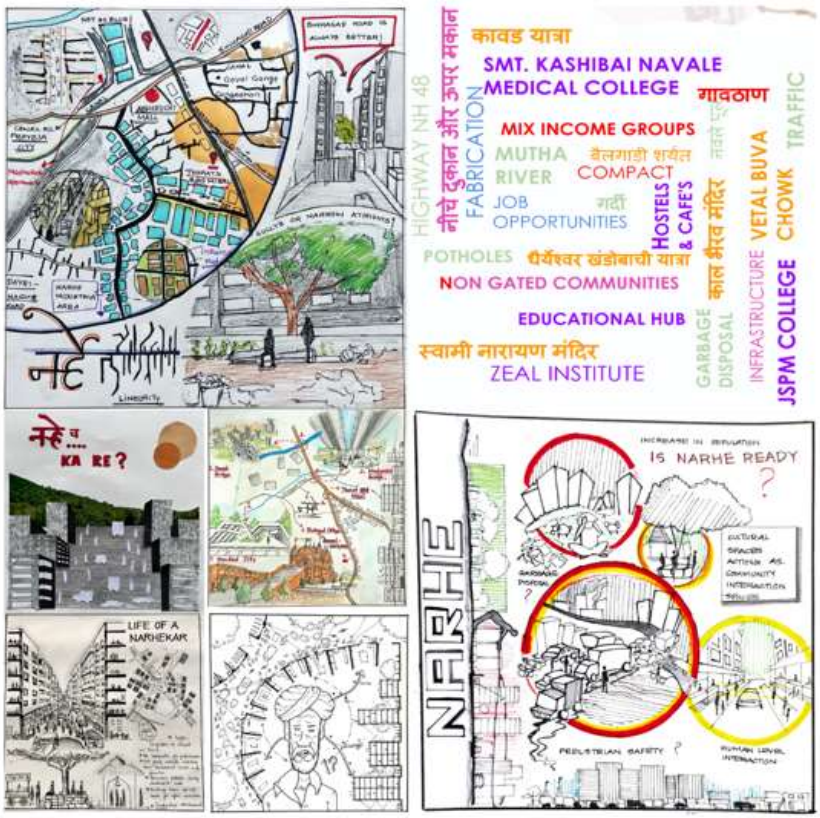


Figure 3: *Representative Image of First Impression of the study area of Narhe in south-west periphery of Pune city.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

The main intention of this exercise done by individual students is to capture the cultural essence of the study area of Narhe. It sheds light on the inherent character of the area, highlighting its strengths and concerns.

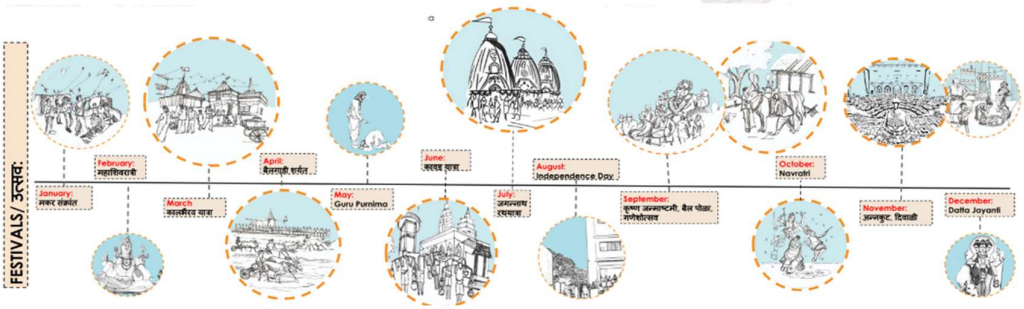


Figure 4: *Festival mapping and cultural calendar*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)



Figure 5: *Representative Mapping of Image Identity and Culture of Narhe*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

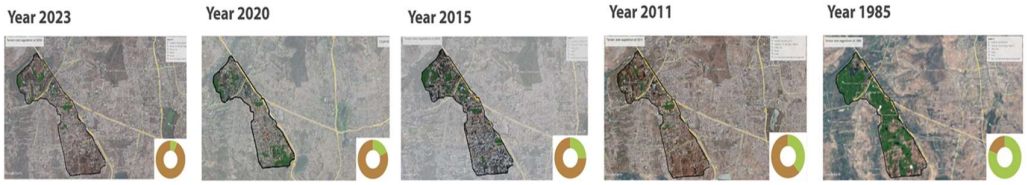
This cognitive map of the study area of Narhe on the south-western periphery of Pune city is a spatial representation of local landmarks, important nodes, and Socio-Cultural Activities, festivals, and processional routes in the area.

Indicators for Strong-Sense of Image Identity and Culture

1. Coexistence of different communities
2. Existence of cultural assimilation
3. Higher level of participation in cultural events
4. Maintaining a unique identity through well-maintained heritage

3.2.2 Mapping Landform, Ecology and Environment

Mapping Landform, Ecology, and Environment deals with the ecological and environmental layer of the study area, through documentation of the terrain and topography, vegetation cover and biodiversity, hydrology lines, and riparian zones. Chronological maps extracted from the satellite image give the idea about change in green cover and invasion of built environment and physical infrastructure. These interventions in natural settings lead to the fragmentation of natural landscapes. The identification of various pollution sources of different environments (like, land, water, air, visual, and sound) plays an important role in developing a deeper understanding of the challenges faced by the study area.



(a) **(b)** **(c)** **(d)** **(e)**

Figure 6: (a), (b), (c), (d), (e) *Mapping the chronological growth of Narhe through Google-Earth satellite imagery. The chronological study of Google-Earth images of Narhe indicates the reduction in green cover with the increase in built infrastructure.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

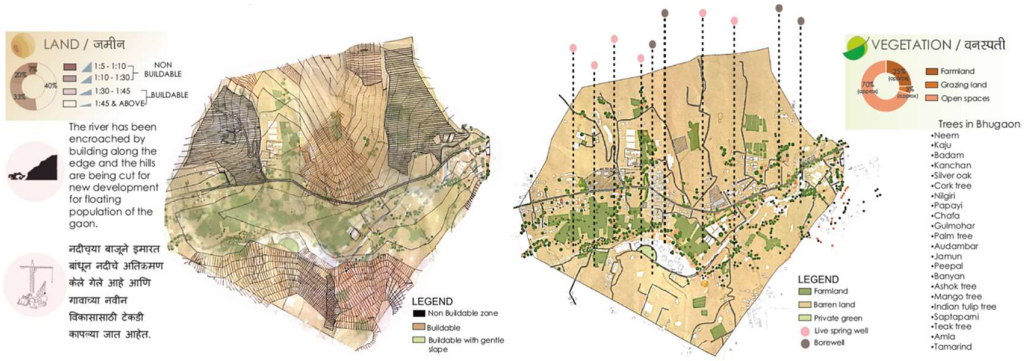


Figure 7: *Bhugaon area map indicates the slope analysis and vegetation analysis for identification of ecologically sensitive land parcels.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

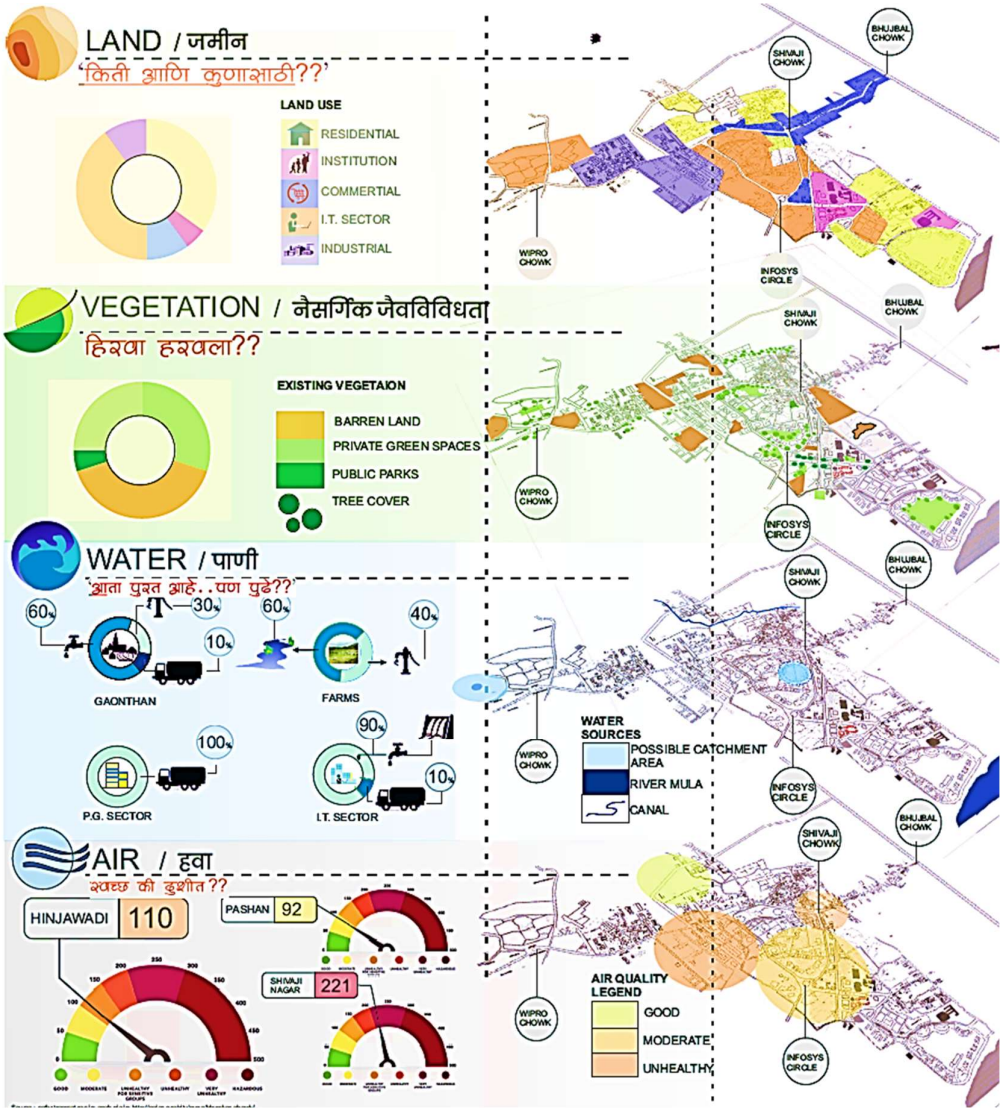


Figure 8: *Mapping vegetation, tree cover, water consumption, and level of air pollution in Hinjewadi, on the northwestern periphery of Pune*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

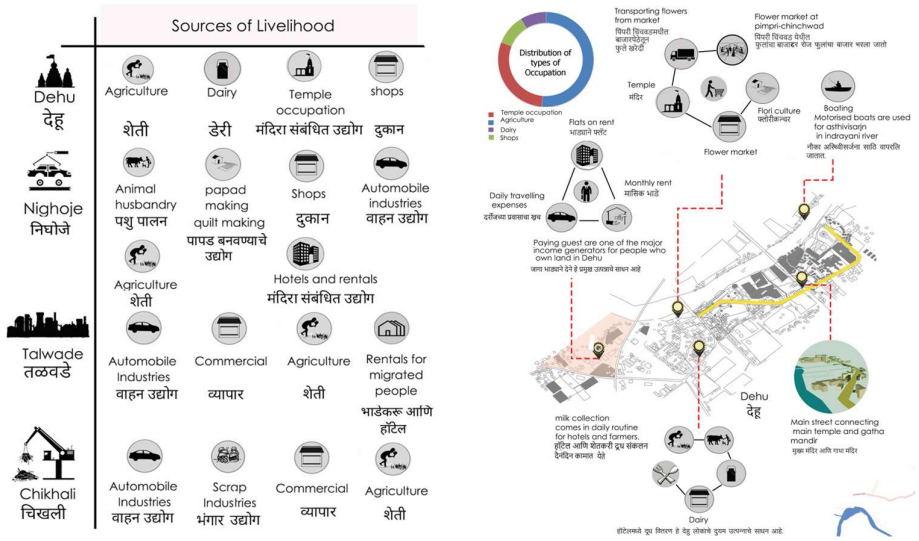
Indicators for healthier Landform, Ecology and Environment

1. Cognisance of ecological features in and around the study area
2. Sensitive response to Land profiles
3. Preservation of ecologically sensitive zones
4. Reduced sources of environmental pollution.

3.2.3 Mapping Livelihood, Economy & Lifestyle

The interdependency of various inherent economic cycles of the study area are studied in this aspect. Through mapping major economic generators and economic spines, local production chains, skill sets, occupations and income groups, it gives an understanding

about the formal and informal economic activities of the area. It has been observed that some study areas have stronger local economies whereas in others, a hybrid economy which is a mix of traditional market economy and planned economy is more visible. Another important facet of this study is the mapping of live-work environments. Sources of livelihood, proximity of living and working areas, mixed-use typology, help in decoding the live-work culture of the area. Caricatures used as a medium to express 'a day in a resident's life' captures the nuances of inter-connected lifestyles and livelihoods.



(a) **(b)**

Figure 9: ***(a)*** *Listing sources of livelihood.* ***(b)*** *Mapping occupations and interdependencies.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

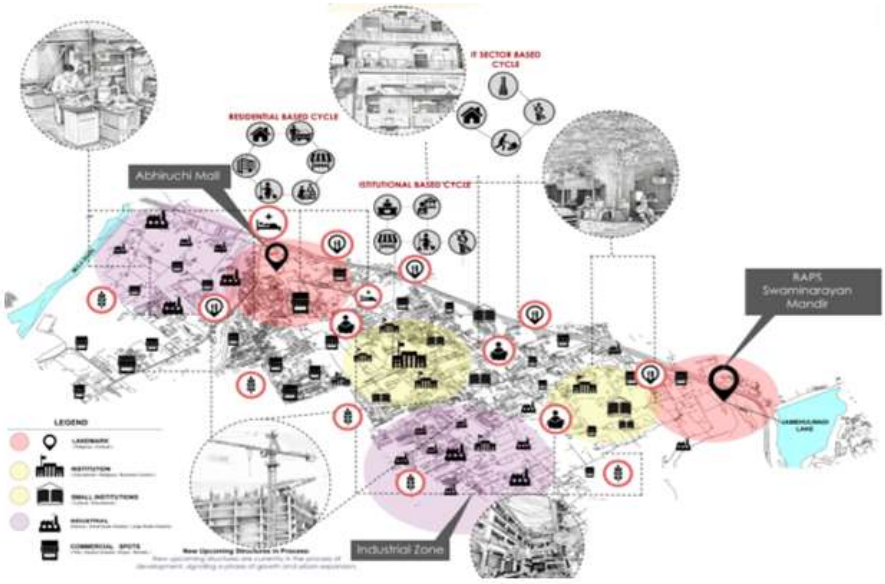


Figure 10: *Mapping live-work environments and sources of livelihood in Narhe.*
Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

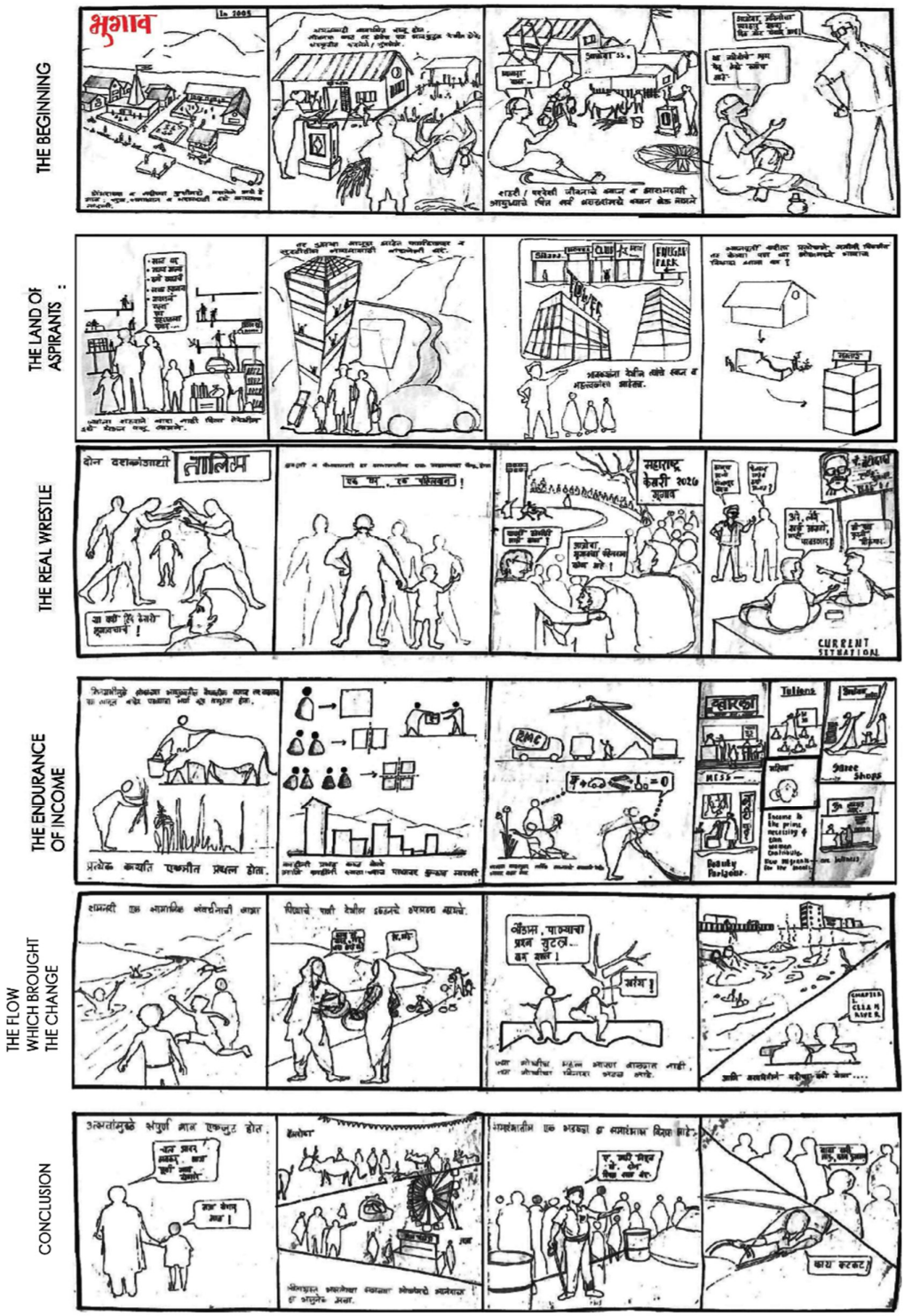


Figure 11: *Caricatures used as a medium to express* ***'a day in a resident's life'*** *of Bhugaon.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

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Indicators for Dynamic Economic Cycles and Livelihood

1. Diverse livelihood options in the study area
2. Interdependence of economic cycles
3. Strong local economic cycles
4. Lifestyles responding to micro and macro-economic cycles of the study area

3.2.4 Mapping Built & Open Environment

Understanding the quality of built and open environment of the study area plays a major role in making an informed decision about the thematic enquiry for the studio. Chronological maps extracted from the satellite image give an idea about the growth of the study area as well as transitions in administrative boundaries. Morphology, land use patterns and functional interdependence are spatially drawn and correlated through detailed documentation processes. On the basis of morphological character and configuration of built and open spaces different clusters of development are identified - ranging from traditional Gaothan to the newer neighbourhoods for further decoding the building typologies and built character. Activity mapping becomes a critical tool for understanding the concentration of activities and user engagement in important nodes.

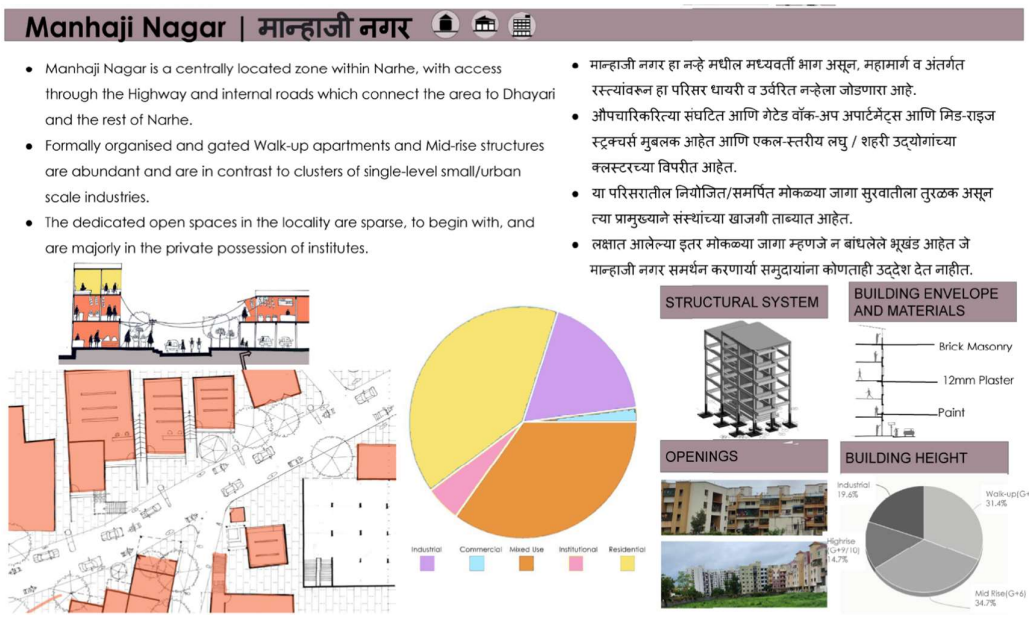


Figure 12: *Mapping clusters of development through activity mapping, edge section, building systems and building materials.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

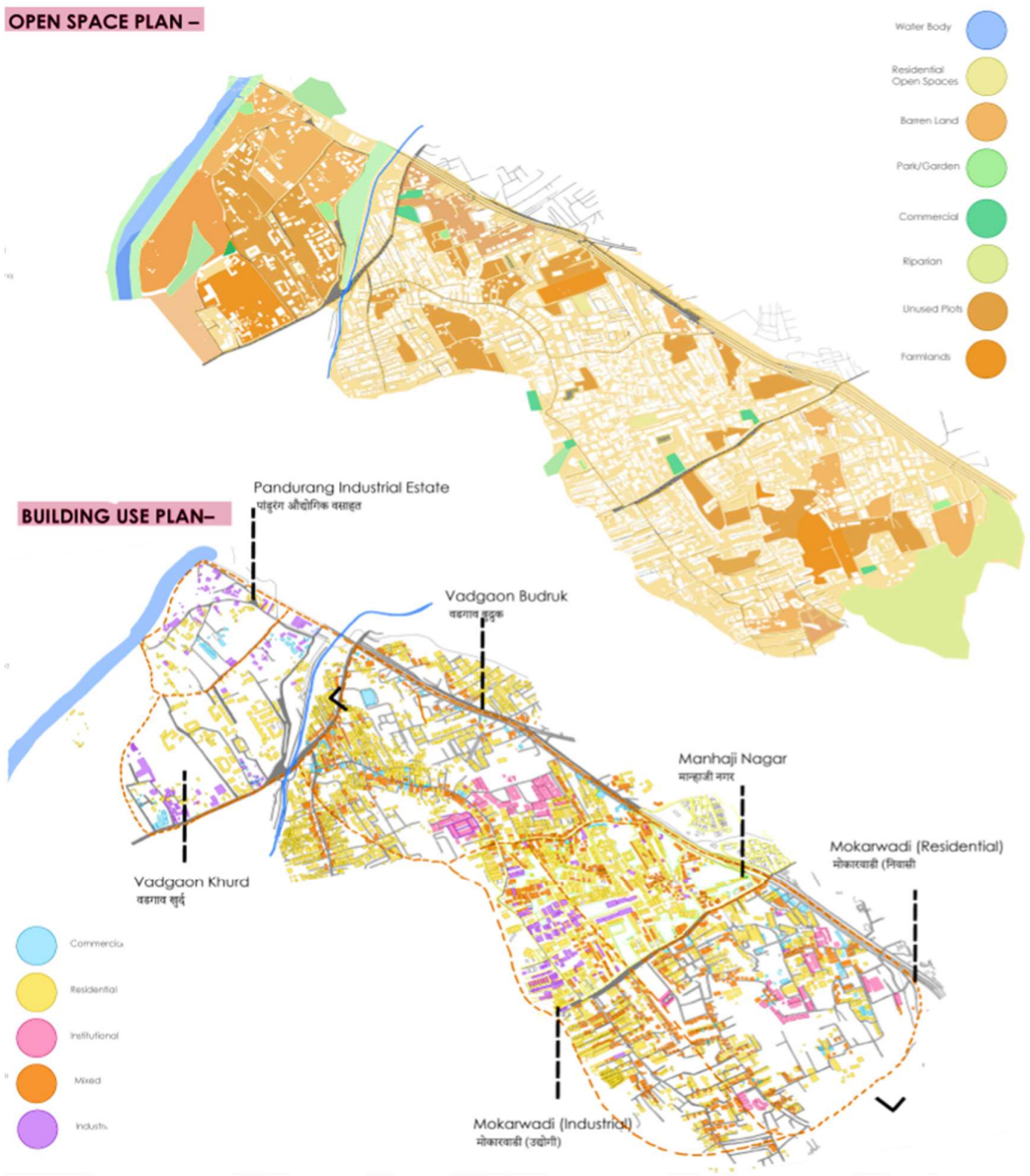


Figure 13: *Mapping built and open environments of Narhe through open space and building use plans.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)



Figure 14: *Character sections of Narhe indicating its built-form disposition.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

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Indicators for strong Built and Open space character

1. Cohesive built character between the old gaothans and the new upcoming neighbourhoods
2. Strong morphological character
3. Well defined and active transition spaces
4. Accessibility to public open spaces.
5. Compatible land uses

3.2.5 Mapping Amenities & Facilities

The liveability of the study area is evaluated through the mapping of the existing diverse categories and hierarchies of amenities in - Health, Cultural, Educational, Recreational, Commercial, Religious, and Civic facilities, and cognitively assessing the three attributes of Quality of built environment, Quantity and Accessibility of these amenities. Appropriate colour-coding and layered icons are used to represent the amenities and facilities along with the walking radius. Furthermore, understanding the functional typology of the neighbourhood and analysing the gaps in amenities is represented by the preparation of the bar graphs and interdependency diagrams for the existing amenities in the area.

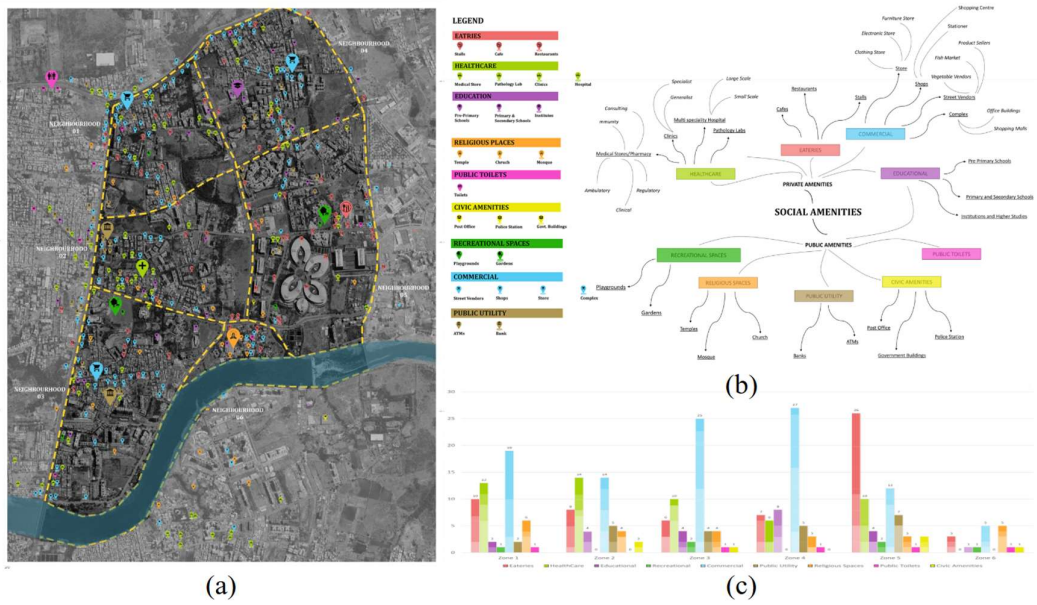


Figure 15: *(a) Mapping of Amenities and Public Facilities in Kharadi. (b) Hierarchy in existing amenities. (c) Quantification of amenities in various neighbourhoods.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

Indicators of social infrastructure for liveable neighbourhoods

1. Presence of diverse amenities - Health, Cultural, Educational, Recreational, Commercial, Religious, Civic facilities
2. Hierarchies in existing amenities and facilities
3. Density of amenities and facilities as per neighbourhood requirements
4. Accessibility and walkability to essential amenities

3.2.6 Mapping Movement, Mobility & Infrastructure

Under this aspect, an elementary observation of the traffic and parking condition of the study area during peak and non-peak hours is presented to understand the mode and transportation, like 'Private, Para-Transits, Public Transport', and 'Mechanized, Non-mechanized, Pedestrian' and the points of congestion. The hierarchical network of roads, important nodes, and traffic generators are mapped for analysing the level of accessibility from and within the area, pedestrian safety, and last-mile connectivity. Furthermore, networks and built environments for basic urban services (water supply, drainage, waste management) are mapped for assessment of the accessibility and efficiency for infrastructure.

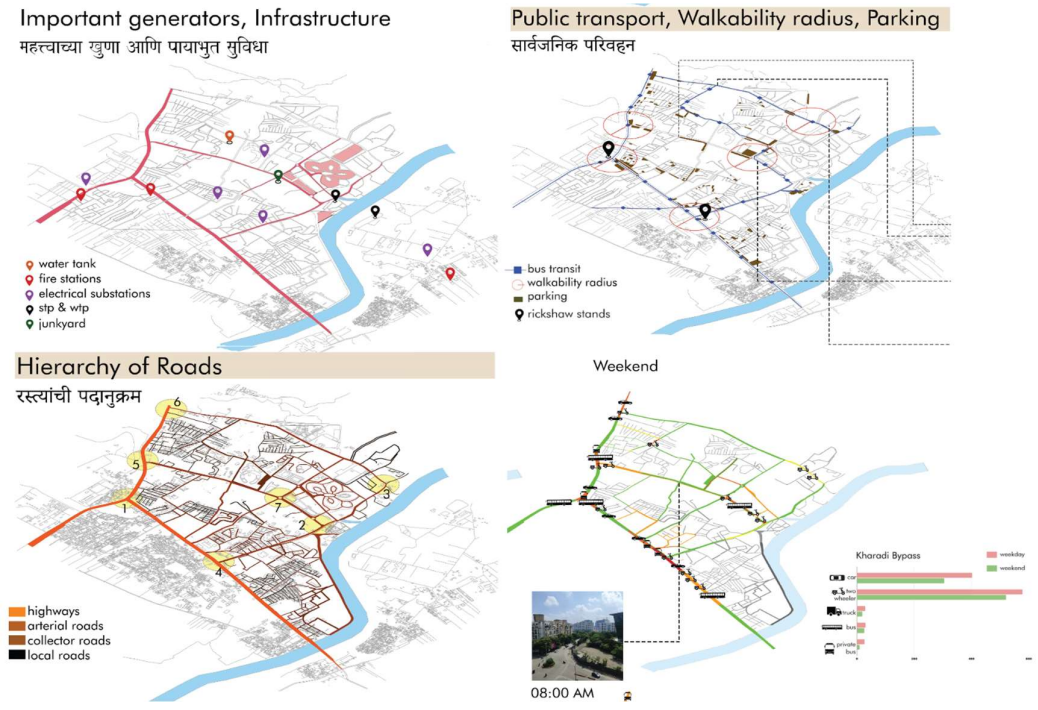


Figure 16: *Mapping aspect of movement and mobility of Kharadi by locating generators of traffic, public transportation facilities, walkability radius, and hierarchy of roads.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

Indicators for efficient movement systems and infrastructure

1. Hierarchical and well-connected movement networks.
2. Efficient Public transport systems
3. Last mile connectivity and presence of paratransit systems
4. Universally accessible and safe pedestrian network and
5. Level of services in urban physical infrastructure

3.2.7 Mapping Social Behaviour, Sense of Safety & Security

The perception of safety, security, and well-transitioned boundaries of the study area are represented on the physical map through interaction with local stakeholders, identification of the mono-functional/multifunctional areas, demarcation of gated/non-gated communities, assessing the porosity, publicness, and activities promoting 'eyes on the street'. This aspect also focuses on the identification of distinct communities and interfaces between the communities in the form of social behaviour.

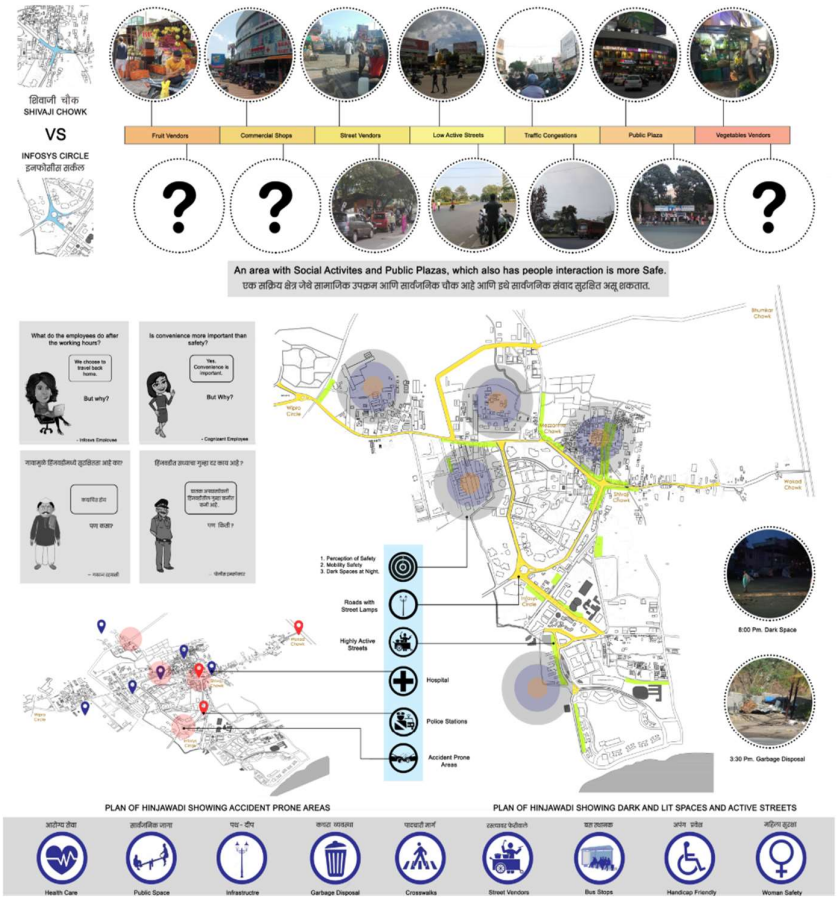


Figure 17: *Understanding sense of safety and security through stakeholder interaction.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

Indicators for strong-sense of safety and security

1. Presence of mixed-use areas instead of mono-functional areas
2. Well-distributed density of people and activities leading to 'eyes on street'
3. Well-transitioned notional boundaries
4. Increased porosity and publicness

3.3 Mapping Interactions in Public Domain: A Stakeholder's perspective

"First life, then spaces, then buildings - the other way around never works."

(Gehl, Cities for People, 2010)

Mapping interaction with the local stakeholders through various interactive methods becomes a key approach for participative decision-making. Through these interactions specific local issues, challenges & concerns get highlighted and emerging concerns get validated. The entire data is represented on the study area map indicating localization of the issues and missing activities and amenities.

3.3.1 Workshop with local schools



(a) **(b)**

Figure 18: (a), (b) *Workshops conducted with local schools in different study areas to capture children's perspectives on their unique identities and needs.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

3.3.2 Exhibition in the public domain



1. **(b)** **(c)**

Figure 19: (a), (b), (c) *Exhibitions in the public-domain throughout the years.*

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)



(a) (b) (c)

Figure 20: (a), (b), (c) Initiatives for sensitisation of issues in the study area.

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

Another crucial role of these experimental processes is creating awareness regarding the prevalent issues in these areas. Making movies and screening them, performing street-plays, and conducting tactical urbanism exercises prove to be important tools in this process.

3.3.4 Board Games & Stakeholder Participation for generating feedbacks



(a) (b) (c)

Figure 21: *(a) Board games (b) Stakeholder engagement for generating feedback*

(c) Interactive panel

Source: Author (Generated as a part of Studio Process, 4th yr B.Arch.)

Board games and stakeholder engagement are amongst the other exploratory mediums for generating feedback for the localization of issues in the spatial context. People's participation ensures a more inclusive and collaborative model for development by making them a part of the decision-making process.

4. Findings:

The findings of this research can be assimilated in 2 dimensions. Firstly, evaluating the learnings in linking pedagogy to practice from a student's perspective. This advocates the applicability of Mapping as a critical tool in the thinking process. Secondly, identification of critical concerns from decoding aspects of the study area for formulating thematic enquiries. This explains the direct relationship between aspects and enquiries for making guidelines for developing areas.

4.1 Students feedback of Mapping as a thinking tool in studio process

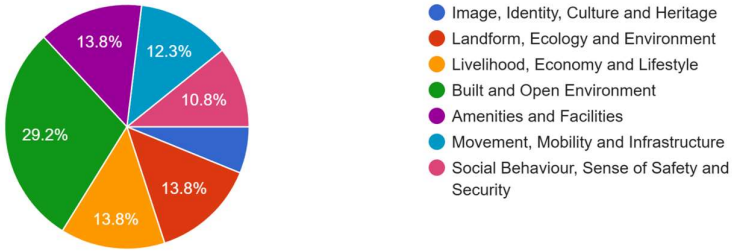


Figure 22: *Pie-diagram showing student distribution*

Source: Author (generated from questionnaire survey)

The pie chart indicates the distribution of student respondents across the aspects to understand the study area. Certain aspects like built and open environment required a greater number of participants to map all the components of the aspect.

4.1.1 Involvement of students in the studio process

The mapping process starts from the identification of aspects to be studied, which are carved-out from the first impressions. In continuation, the method of study of this aspect is successful because of students' involvement. The survey shows that around 90% of the student respondents have good involvement in the process of identification of the aspect studies for the study area. Which is the crucial part for the studio process of linking aspect study with thematic enquiry.

(scale - 1 - least involvement, 5 - maximum involvement)

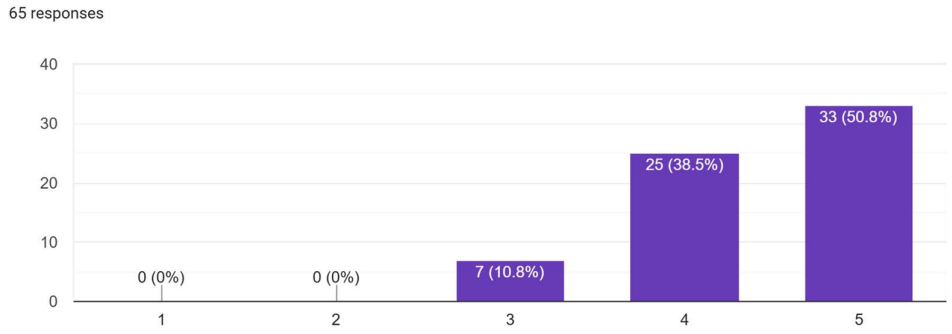


Figure 23: *Bar graph showing student involvement in studio process*

Source: Author (generated from questionnaire survey)

4.1.2 Mapping as a tool for developing Skill-sets and Thematic Enquiry

The mapping process is not a mere spatial representation of the existing condition of the study area. The process of mapping involves observations, ground truthing, experiencing, and correlating the findings to identify the challenges in the area. The representation of the maps plays an important role in communication.

The survey indicates that the mapping process helped student respondents build the following skillsets-

a. **Documenting the Area -** through site visits and observations
b. **Tapping the Experiential Layer** - through experiencing the ambiance
c. **Representing Aspects -** though an indication of the data on map
d. **Communicating the Observations** - through narration, graphics, diagrams, sketches, caricature, word cloud, maps
e. **Analysing the Situations and Identifying the Gaps** - through SWOT analysis
f. **Interacting with Stakeholders** - through interviews, surveys, workshops, exhibition

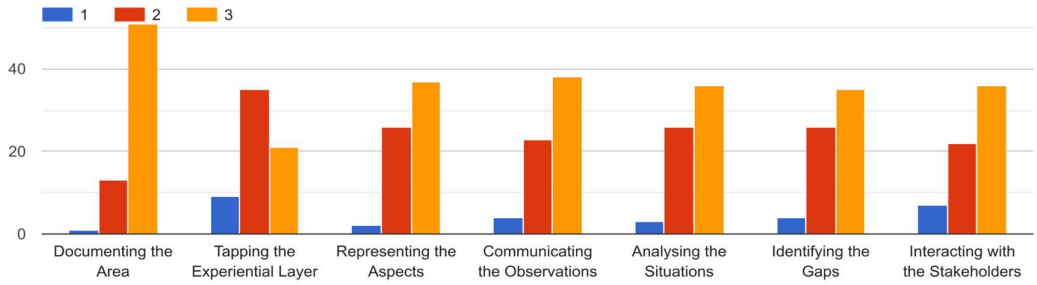


Figure 24: *Bar graph showing the effectiveness of mapping tool in building skillset.*

Source: Author (generated from questionnaire survey)

The thematic approaches for study areas are developed through detailed understanding of the aspects from the above-mentioned process. The survey indicates that around 84% student respondents found the mapping process of aspects helped structure the Thematic Enquiry for the study area.

(scale - 1 - least helpful, 5 - most helpful)

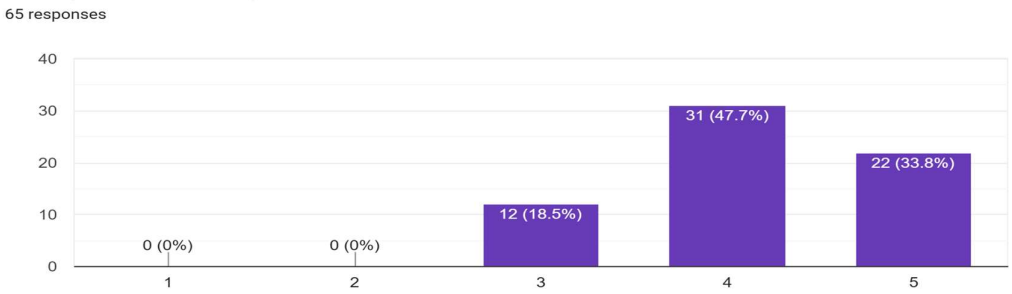


Figure 25: *Bar graph showing the effectiveness of the studio process in structuring enquiry.*

Source: Author (generated from questionnaire survey)

The survey also indicates that around 80% of student respondents agree that mapping of aspects have a direct relation to developing thematic enquiries.

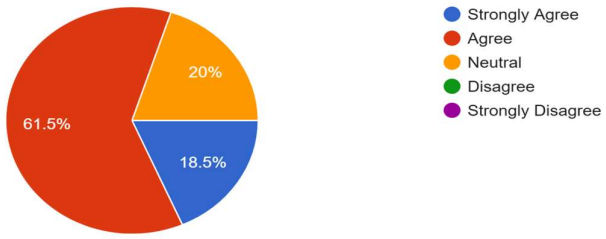


Figure 26: *Pie-diagram showing the percentage of students agreeing to the direct relationship between aspects and enquiry.*

Source: Author (generated from questionnaire survey)

This logical process of the studio helps in the demonstration of need-based typologies of projects as a derivative of the thematic approach. The survey indicates that around 72% of student respondents recommends this process

(scale 1 - not recommended, 5 - highly recommended)

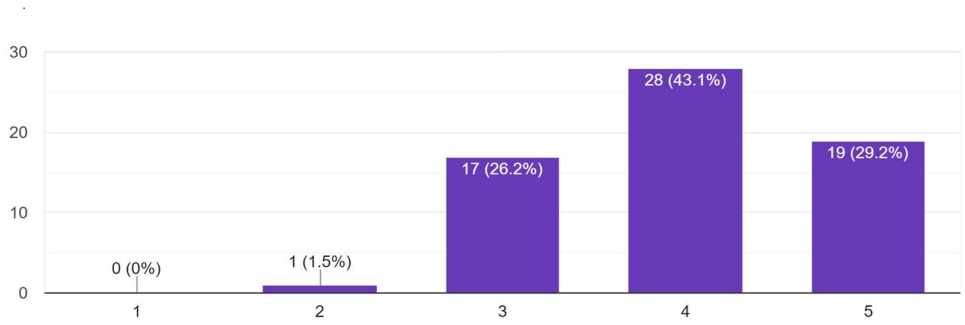


Figure 27: *Bar graph showing the recommendation of students in favour of the studio process.*

Source: Author (generated from questionnaire survey)

4.2 Critical concerns from Mapping aspects as the founding principle for thematic enquiries.

Through mapping various aspects of the study areas, critical concerns emerged which became the seminal idea for generating the thematic enquiries for the study area. Specific understanding of indicators within every aspect acted as major determinants for developing these enquiries.

The table of Indicators (Table 1) and mapping their levels (Figure 28) in all six study areas reflect the understanding of the situation of various Aspects in response to the major forces acting on them like - IT and Service industries, cultural, industrial and institutional footprints, unplanned growth due to other surrounding magnets. These forces tend to shape the urban peripheries. The sporadic urban development that takes place in the ever-growing city peripheries has always followed patterns that respond to the needs of the parent city, usually taking place on cheaply available lands loosely connected along existing transport corridors. These developments often overlap on existing landscape of rural settlements, their unique culture, traditions, and connections with ecology and environment. (Author 2020). As a reaction to these insensitive patterns of development, thematic enquiries have been carved out in the studio process based on the understanding of Aspects to increase the livability of the study areas.

Table 1: *Appraisal of the study areas based on the indicators from the aspect studies*

No.	Indicators of Aspect Studies	Hinjewadi	Kharadi	Chikhali	Narhe	Bhugaon	Dehu
1. Indicators for strong sense of Image Identity and Culture							
1.1	Coexistence of different communities						
1.2	Existence of cultural assimilation						
1.3	Higher level of participation in cultural events						
1.4	Maintaining unique identity through well maintained heritage						
2. Indicators for healthier Landform, Ecology and Environment							
2.1	Cognisance of ecological features in and around the study area						
2.2	Sensitive response to Land profiles						
2.3	Preservation of ecologically sensitive zones						
2.4	Reduced sources of environmental pollution.						
3. Indicators for dynamic economic cycles and Livelihood							
3.1	Diverse livelihood options in the study area						
3.2	Interdependence of economic cycles						
3.3	Strong local economic cycles						
3.4	Lifestyles responding to Micro and Macro economic cycles						
4. Indicators for strong Built and Open space character							
4.1	Cohesive built character between old and new neighbourhoods						
4.2	Strong morphological character						
4.3	Well defined and active transition spaces						
4.4	Accessibility to public open spaces.						
4.5	Compatible land uses						
5. Indicators of social infrastructure for liveable neighbourhoods							
5.1	Presence of diverse amenities						
5.2	Hierarchies in existing amenities and facilities						
5.3	Density of amenities and facilities as per neighbourhood						
5.4	Accessibility and walkability to essential amenities						
6. Indicators for efficient movement systems and infrastructure							
6.1	Hierarchical and well connected movement networks.						
6.2	Efficient Public transport systems						
6.3	Last mile connectivity and presence of paratransit systems						
6.4	Universal accessibility and safe pedestrian network						
6.5	Level of services in urban physical infrastructure						
7. Indicators for strong sense of safety and security							
7.1	Presence of mixed-use areas instead of mono-functional areas						
7.2	Well distributed human activities leading to 'eyes on street'						
7.3	Well transitioned notional boundaries						
7.4	Increased porosity and publicness						

LEGEND		High		Medium		Low

Source: Author

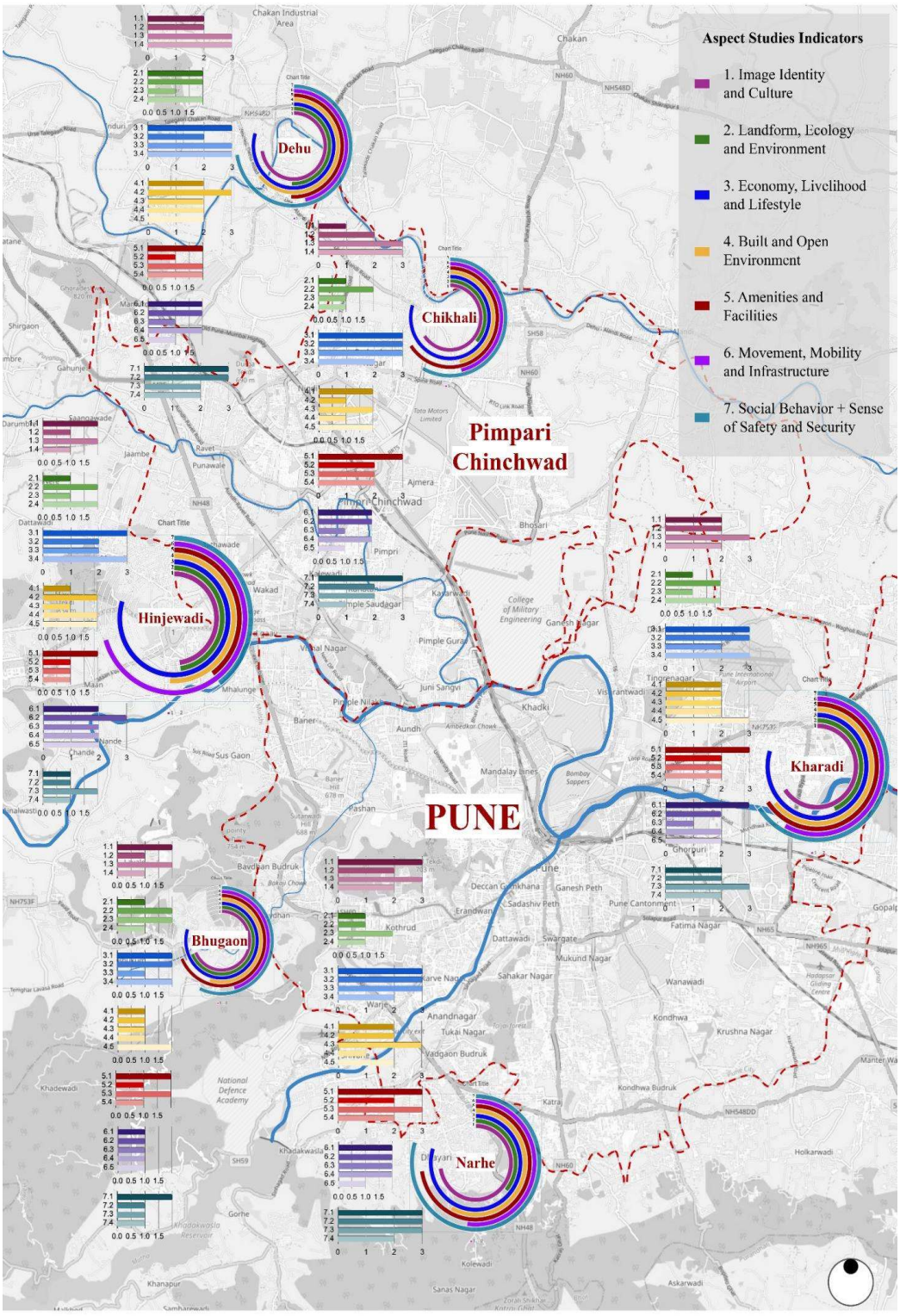


Figure 28: *Mapping level of indicators for various Aspects of all the six study areas*

(Refer Table no. 1 for list of indicators of aspects)

Source: Author

Table 2: *Critical concerns from various Aspects and the corresponding thematic enquiries.*

Source: Author

Identified Forces	Critical Concerns emerging from Aspects	Developing Thematic Enquiry for studio
IT & Service industries	Monofunctional development of work areas, floating job population, lack of human scale and neighbourhood activities.	'**Humanising HINJAWADI'** to demonstrate a response to the scenario of mono-functionality, in form of multifunctional mixed-use liveable neighbourhood with appropriate functions and human scale
	Distinct socio-cultural and economic territories and missing transitions, existing inter-dependencies but lack of collectiveness	**'Addressing multidimensional enclaves of KHARADI'** to generate appropriate interfaces between the distinct socio-cultural, economic territories and promote inclusivity.
Unplanned growth due to surrounding magnets	Loss of unique identity & local economy, rapid change in land-use pattern, limited access to infrastructure	**'Recontextualising BHUGAON'** to counteract the phenomenon of urbanising villages getting engulfed by the parent city and address the non-responsive form of development.
Cultural core, Industrial forces	Strong identities and micro forces (Cultural, industrial, military), large floating cultural footprint during Wari, need for temporal infrastructure	**'Addressing centres on urban peripheries: DEHU, CHIKHALI'** to appreciate and reinforce the existing unique identity of the area as centres of culture and industries.
Industrial & Institutional forces	Multi-layered and heavily densified urban situations, coexistence of diversified and variegated user groups and functions	**'Exploring opportunities in heterogeneous settings of NARHE'** to define the approaches for bridging functions and user groups by creating various platforms promoting multifaceted transactions and interactions.

5. Conclusion

5.1 Strong correlation between the production of spatial knowledge and thematization in urbanism.

"Mapping is, in and of itself, a design action, as it often establishes the terrain for discussion and frames it in specific (and always value-laden) ways"

(Paez, Valtchanova, Larroya, & Perelló, 2024, p. 172)

Mapping is the production of spatial knowledge with an overlay of experiential knowledge. If one focuses on the facilitating nature of maps, one can contribute to design thinking and theorizing, thus becoming a critical tool in urbanism. If innovative mapping techniques are adopted in design studios not only for documentation but as a more comprehensive tool, it can enable students to think laterally. Through this kind of pedagogical approach, students get an opportunity to explore the invisible and

intangible aspects of urban space. Decoding the study areas through mapping various aspects bring out the critical concerns, based on which a thematic enquiry can be developed for holistic growth and appropriate interventions in the peripheral areas of Pune city.

5.2 Hybridization in mapping methodologies

Urban peripheries are ever-expanding multi-dimensional areas. To understand these areas socio-spatial research becomes necessary. New methodologies combining visual, spatial and sociological tools, allow diverse perspectives into data collection, analysis, and synthesis of the design process. New skills in the representation of urban space are required to produce mapping relatable to the city and its dwellers and ensure public participation.

As stated by Hutzell, successful mappings are those that are creative, and aesthetically pleasing and portray not only socio-cultural competency but also unseen or hidden patterns, connections, or comparisons (Hutzell, 2012, p. 324).

Conflicts of Interest: The authors have no conflict of interest to declare.

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Collaborative Pedagogy for Technology Studio: Addressing urban infrastructure challenges with contextualized interventions

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Abstract: *This paper discusses the effectiveness of adopted methodologies and resulting processes employed in the technology studio of 'Advanced Building Construction and Services' (ABCS), along with learnings from other subjects to demonstrate practical solutions for Pune's urban infrastructure, which is under tremendous pressure due to rapid urbanisation. The research argues that this collaborative studio pedagogy engages students effectively to take cognizance of the real-world challenges of urban infrastructure issues. Through this studio process context-sensitive, situation-specific, and need-based infrastructural interventions, responding to socio-cultural, environmental, and technological challenges are demonstrated. This process is Organised into primarily four stages along with inputs from other subjects, and is different from conventional technology studio conduct. The stages followed in the studio are, 'Theoretical and Project Introduction', 'Literature and Precedent Studies', 'Context-Study and Analysis + Program Formulation and Ideation', and 'Technical Resolution and Demonstration'. Studio stakeholders, viz., faculty members, students, field experts and resource persons collaborate to enhance the learning experience through interpretation of the urban infrastructural challenges from study area as ABCS topics like, 'Multi-level Basement', 'Industrial Structure', 'High-rise Structure', 'Auditorium', and 'Architectural Details' through active, passive and experiential learning processes.*

Keywords: Studio Pedagogy; Curriculum Interpretation; Studio Integration; Urban Infrastructure; Contextualized Interventions

1. Introduction:

'Architectural Education' should play a critical role in equipping future professionals to respond to the complex challenges brought by urbanisation. This paper discusses the methodologies and processes adopted in the technology studio of 'Advanced Building Construction and Services' (ABCS) subject. The studio serves as a unique pedagogical model in 'Curriculum Transaction' for tackling challenges that must be addressed through urban infrastructure in Pune's rapidly urbanising peripheries. Rapid growth of urban peripheries often outpaces urban infrastructure development, creating gaps in addressing sociocultural, environmental, and technological needs with context-sensitive, situation-specific, and need-based interventions.

"Incorporating active learning methodologies, design thinking, and problem-based learning requires a shift in pedagogical practices and faculty development. Embracing these new approaches ensures that students are prepared for the evolving demands of the profession." (India Today, 2023) . Similarly, "collaboration is a pivotal skill in architectural practice, particularly in the 21st century where the complexity of building projects necessitates effective teamwork across interdisciplinary groups" (Karimi & Farivarsadri, 2024). The studio model aligns with this perspective, emphasising experiential, structured and collaborative learning to prepare students for real-world challenges.

The primary aim of this paper is to evaluate the effectiveness of the ABCS studio process in enhancing student learning outcomes and preparing them to address urban infrastructure challenges. To achieve this, the study employs a mixed-method approach that incorporates surveys and reflective discussions evaluating the collaborative, experiential, and active learning methodologies employed in the ABCS studio.

Research Question:

1. How do **collaborative learning-outcomes** from other subjects' shape curriculum-transactions for ABCS Topics?
2. How does the **ABCS Studio process** contribute to **understanding** of urban infrastructural needs?
3. What **role** do the **studio stages** play in demonstrating context-sensitive urban infrastructural interventions?

How does this **pedagogical approach equip students** to tackle real-world urban infrastructural challenges?

2. Review of Literature

A strong theoretical foundation is crucial in shaping effective pedagogical models in architectural education. This section reviews literature on collaborative, experiential, and context-sensitive learning in the ABCS studio.

2.1 Collaborative Learning in Architectural Education

Collaboration is an essential component of architectural education, particularly in addressing complex, real-world challenges. The paper draws upon key literature on collaborative learning in architectural education including the following works:

2.1.1 (Nicol & Pilling, 2005)

This paper emphasized that design studios are critical spaces for fostering creativity, innovation, and critical thinking. Group projects encourage peer learning and diverse perspectives, skills that are vital in professional practice.

2.1.2 (Salama, 2010)

This paper advocated for the integration of inquiry-based and active learning methods, which empower students to become active participants in their education rather than passive recipients of information.

2.1.3 (Karimi & Farivarsadri, 2024)

This paper highlighted the importance of interdisciplinary teamwork, noting that collaborative skills are critical for navigating the complexities of modern architectural projects.

The studio process applies these principles through structured horizontal and vertical group formations to encourage collaborations.

2.2 Addressing Urban Infrastructure Challenges in Architectural Education

Rapid urbanization, particularly in peri-urban areas, has resulted in gaps in infrastructure development that fail to address socio-cultural, environmental, and technological needs. This section reviews key studies that emphasise the importance of context-sensitive approaches in architectural education

2.2.1 (Salama, 1995)

This paper stresses the importance of context-sensitive and need-based interventions in urban infrastructure design, highlighting the role of architects as problem-solvers addressing complex socio-environmental issues.

2.2.2 (Khan & Khan, 2019)

This paper identifies the necessity of engaging with local stakeholders and communities to ensure that infrastructure projects meet user needs while fostering inclusivity and sustainability.

2.2.3 (Author, Urbanising Peripheries: An aspect based study of urban fringes in the region around Pune city to understand its character and pattern of development, 2020)

This paper highlights infrastructure gaps in Pune's peripheries and emphasizes context-sensitive, field-based learning in architectural education through public participation and stakeholder engagement.

By integrating experts, resource persons, and local communities at key stages, the ABCS studio strengthens project relevance and bridges the gap between academia and practice.

2.3 Pedagogical Theories

The learning outcomes are interpreted through the lens of two established pedagogical theories: 'Dale's Cone of Experience' and 'Kolb's Experiential Learning Cycle'.

2.3.1 Dale's Cone of Experience

Drawing inspiration from active learning principles adapted from Dale's Cone of Experience (Figure 1), the studio incorporates direct and participatory methods enhancing learning outcomes (Dale, 1969). This paper evaluates effectiveness of studio processes for collaborative, experiential, and active-passive learning methods for addressing urban infrastructural challenges.

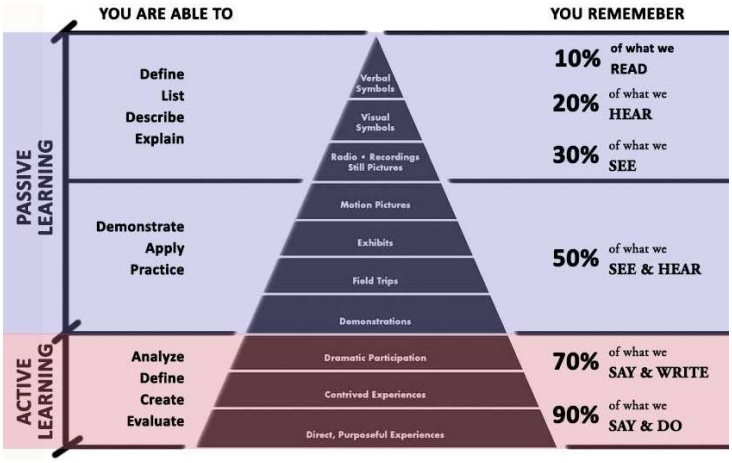


Figure 1. *The Learning Pyramid*

(Generated by the Author, adapted from Dale's Cone of Experience, 1969)

2.3.2 Kolb's Experiential Learning Cycle

"Experiential learning transforms concrete experiences into knowledge, emphasizing active participation and reflection in the learning process" (Kolb, 2015). Through a structured studio, students develop a holistic understanding of urban infrastructure, aligning with Kolb's 'Experiential Learning Theory' (Figure 2) that emphasizes active learning.

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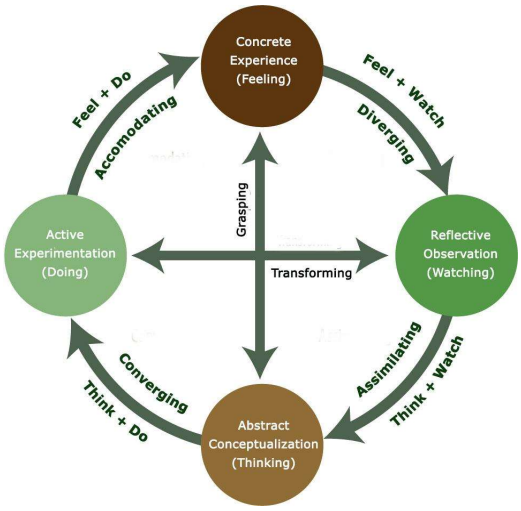


Figure 2. *Experiential Learning cycle*

(Generated by the Author, adapted from David Kolb's Experiential Learning Cycle, 1984)

3. Methodology

"I hear and I forget. I see and I remember. I do and I understand." (Confucius)

This paper elaborates on both the qualitative and quantitative aspects of the unique methods employed for curriculum-transaction in the ABCS studio, which focused on need-based urban infrastructural interventions in the context of the rapidly urbanising peri-urban areas of Pune. The studio implemented active-learning methodologies, engaging students in collaborative activities beyond lectures and readings. These included identifying issues, conducting literature and reference studies, analyzing the context, and proposing situation-specific urban infrastructural interventions based on learning outcomes and primary observations.

The paper evaluates the effectiveness of the ABCS studio process, within the research framework, using a 'mixed-method approach' that combines qualitative and quantitative tools.

A. Key Aspects of Evaluation:
   a. Engagement: Student participation in collaborative sessions.
   b. Learning Outcomes: Ability to analyze and address urban challenges.
   c. Design Quality: Practicality and innovation in proposals.
   d. Preparedness: Readiness for addressing real-world challenges.

B. Tools and Techniques:
   a. Focus Groups: engaging discussions with students, faculty, and experts to extract qualitative insights.
   b. Expert Feedback: Experts provided technical insights, bridging academia and industry practices.

c. Surveys: using ‘Stratified Random Sampling’ with ‘Likert-scale’ to assess effectiveness of studio stages.

C. Pedagogical Theories for Analysis: The paper applies Dale’s Cone of Experience (1969) and Kolb’s Experiential Learning Cycle (2015) to ABCS studio process.

D. These qualitative and quantitative analysis examined how the pedagogical approach influenced:

a. The use of collaborative learning outcomes from other subjects
b. The effectiveness of collaborative studio processes
c. The development of appropriate urban infrastructural interventions
d. The preparedness of students in addressing real-world challenges.

This structured methodology ensures a comprehensive evaluation of the ABCS studio’s collaborative pedagogy.

4. Studio-Process and Role of Stakeholder in Curriculum Transaction: the collaborative pedagogy

This section details the collaborative studio process, enhancing stakeholder engagement, teamwork, and technical and conceptual knowledge. "What students learn is greatly influenced by how they learn, and many students learn best through active, collaborative, small-group work inside and outside the classroom" (Springer, Stanne, & Donovan, 1999)

4.1 Collaborative Pedagogy: Studio-Process and Curriculum Interpretation

"The design studio is the most important part of architectural education. It is here that students work together on projects and learn how to be creative, innovative, and critical thinkers” (Nicol & Pilling, 2005). The below-mentioned four stages of ABCS Studio showcase a comprehensive approach to experiential learning in architectural education.

4.1.1 Theoretical and Project Introduction

The first stage introduces ABCS topics and urban interventions through lectures, discussions, and interdisciplinary inputs, building a strong theoretical foundation for real-world applications.

4.1.1.1 Topic Introduction

Lectures introduce foundational theories, technical knowledge, and urban challenges, equipping students to analyze and design practical urban infrastructural interventions.

4.1.1.2 Concerns and Introduction to Project

"There is an intimate and necessary relation between the process of actual experience and education" (Dewey, 1938). Experiential learning from 4th-year subjects (AD VI, VII, and US I, II) identifies urban infrastructural concerns. Studio deliberations analyze these within ABCS topics, applying advanced knowledge to develop real-world urban interventions.

4.1.1.3 Involvement of the expert in the field

Practising experts provide real-world insights, guide documentation, and offer technical knowledge. Their input significantly enhances the learning experience and bridges the gap between theoretical concepts and practical application. (Figure 3)



(**a**) (**b**)

Figure 3. *Expert sessions: (a) Online talk on site documentation and parking policy; (b) Guest lecture. (Source - Author)*

4.1.2 Literature and Precedent Studies

The second stage reviews and analyses literature, case studies, and site-visits to explore best practices, challenges, and global trends in urban infrastructure, establishing strong contextual precedence and reference.

4.1.2.1 Literature Material and Reference Project

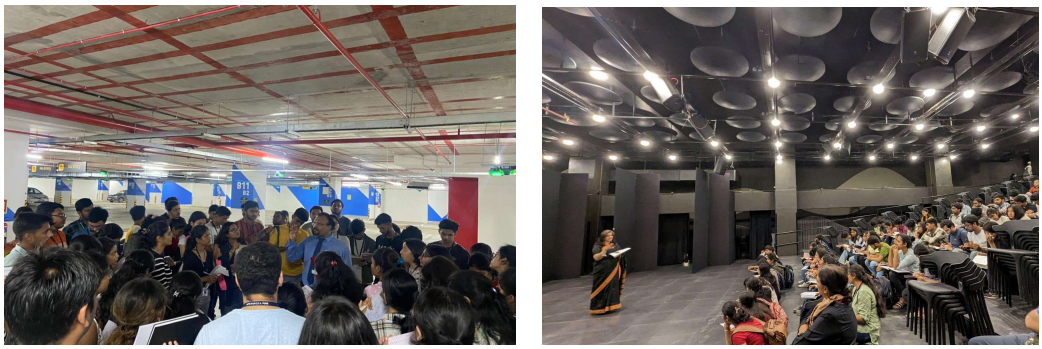
Relevant literature (systems, norms, standards and guidelines) and reference projects (Figure 4) are analysed to understand the systems, execution methods, impacts, and appropriateness of urban infrastructural interventions, drawing insights from both historical and contemporary reference studies.

No	Auditorium	Students	Reference Link
1	**Casa da Musica** Porto, Portugal Ar. Rem Koolhaas	Atleast one student from each group- A, B, C, D, E, F, G	https://www.archdaily.com/619294/casa-da-musica-oma https://www.re-thinkingthefuture.com/case-studies/a3154-casa-da-musica-porto-by-rem-koolhaas-the-asymmetrical-polyhedron/ https://architypereview.com/project/casa-da-musica/?issue_id=613
2	**Parco Della Musica** Rome, Italy Ar. Renzo Piano	Atleast one student from each group- A, B, C, D, E, F, G	https://arquitecturaviva.com/works/auditorio-parco-della-musica-2 https://www.re-thinkingthefuture.com/case-studies/a3924-parco-della-musica-by-renzo-piano-60-year-old-dream/
3	**Poly Grand Theater** Shanghai, China Ar. Tadao Ando	Atleast one student from each group- A, B, C, D, E, F, G	https://www.architecturalrecord.com/articles/7368-poly-grand-theater https://www.dezeen.com/2017/01/13/poly-grand-theatre-tadao-ando-shanghai-china-yueqi-li-photography/ https://www.designboom.com/architecture/tadao-ando-shanghai-poly-theater/
4	**Kauffman Center for the Performing Arts** Kansas City, USA Ar. Moshe Safdie	Atleast one student from each group- A, B, C, D, E, F, G	https://www.archdaily.com/151008/kauffman-center-for-the-performing-arts-moshe-safdie?ad_source=search&ad_medium=projects_tab https://www.safdiearchitects.com/media/video-kauffman-center-for-the-performing-arts-kansas-city
5	**Auditorio De Tenerife** Santa Cruz De Tenerife, Canary Islands, Spain Ar. Santiago Calatrava	Atleast one student from each group- A, B, C, D, E, F, G	https://arquitecturaviva.com/works/auditorio-de-tenerife-9 https://www.re-thinkingthefuture.com/case-studies/a4653-auditorio-de-tenerife-adan-martin-by-santiago-calatrava-the-great-arc/
6	**Grand National Theater of China** Beijing, China Ar. Paul Andreu	Atleast one student from each group- A, B, C, D, E, F, G	https://en.wikiarquitectura.com/building/grand-national-theater-of-china/ https://www.archdaily.com/1218/national-grand-theater-of-china-paul-andreu
7	**Finlandia Hall** Helsinki, Finland Ar. Alvar Aalto	Atleast one student from each group- A, B, C, D, E, F, G	https://www.re-thinkingthefuture.com/case-studies/a2912-finlandia-hall-by-alvar-aalto-celebrating-light-and-ature/#19fe59ee4d768c53100386c290177a42b27b1a58#195264 https://www.architecturaldigest.com/story/alvar-aalto-finlandia-hall https://www.alvaraalto.fi/en/architecture/finlandia-hall/
8	**National Kaohsiung Center for the Arts** Kaohsiung, Taiwan Mecanoo	Atleast one student from each group- A, B, C, D, E, F, G	https://www.archdaily.com/904019/national-kaohsiung-center-for-the-arts-mecanoo https://www.world-architects.com/en/mecanoo-delft/project/national-kaohsiung-center-for-the-arts
9	**Tianjin Juilliard School** Tianjin, China Diller Scofidio + Renfro	Atleast one student from each group- A, B, C, D, E, F, G	https://www.archdaily.com/960166/tianjin-juilliard-school-diller-scofidio-plus-renfro https://dsrny.com/project/tianjin-juilliard https://www.architecturalrecord.com/articles/15072-tianjin-juilliard-by-diller-scofidio-renfro
10	**The Sage Gateshead Music Centre** Gateshead, UK Ar. Norman Foster	Atleast one student from each group- A, B, C, D, E, F, G	https://arquitecturaviva.com/works/centro-de-musica-sage-gateshead-3 https://archello.com/project/the-sage-gateshead https://www.re-thinkingthefuture.com/case-studies/a6553-sage-gateshead-by-foster-and-partners-concert-venue-in-gateshead/ https://www.fosterandpartners.com/projects/sage-gateshead/

Figure 4. *Representative Reference list for auditorium topic (Source - Author)*

4.1.2.2 Site Visits

Assorted site-visits (Figure 5) are carefully chosen and curated to focus on functioning Urban Infrastructural Interventions. This plays a crucial role in developing an experiential understanding of the spatial and systemic requirements of the urban infrastructure. These visits offer firsthand observations of challenges faced and solutions implemented by professionals, with the involvement of stakeholders who explain the functionality of the interventions. They offer valuable insights into functioning systems, construction techniques, material application, building services and the relationship between the built environment and its urban context.



(a) (b)

Figure 5. *Site visit photographs: (a) Senior property manager of Pay and Park facility explaining type of parking, services and other technicalities involved in basement; (b) Architect explaining the challenges and solutions taken for design of the Experimental theatre, focusing on acoustics*

(Source- Author)

4.1.2.3 Learnings from Literature and Precedent Studies

Analyzing literature and precedent studies helps identify intervention needs and promotes critical thinking, linking urban infrastructure with practical knowledge and innovative technologies. Learnings are categorized into two areas:

A. Architectural Expression -

Explores how materials, size, proportion, structural systems, building services, and design elements shape the aesthetics and functionality of urban infrastructure, reflecting cultural, social, and environmental values. (Figure 6 & 7)

B. Processes and Systems -

Focuses on technical aspects like process flows, stakeholder movements, system integration, logistics, and resource management for sustainable, context-appropriate design solutions. (Figure 6 & 7)

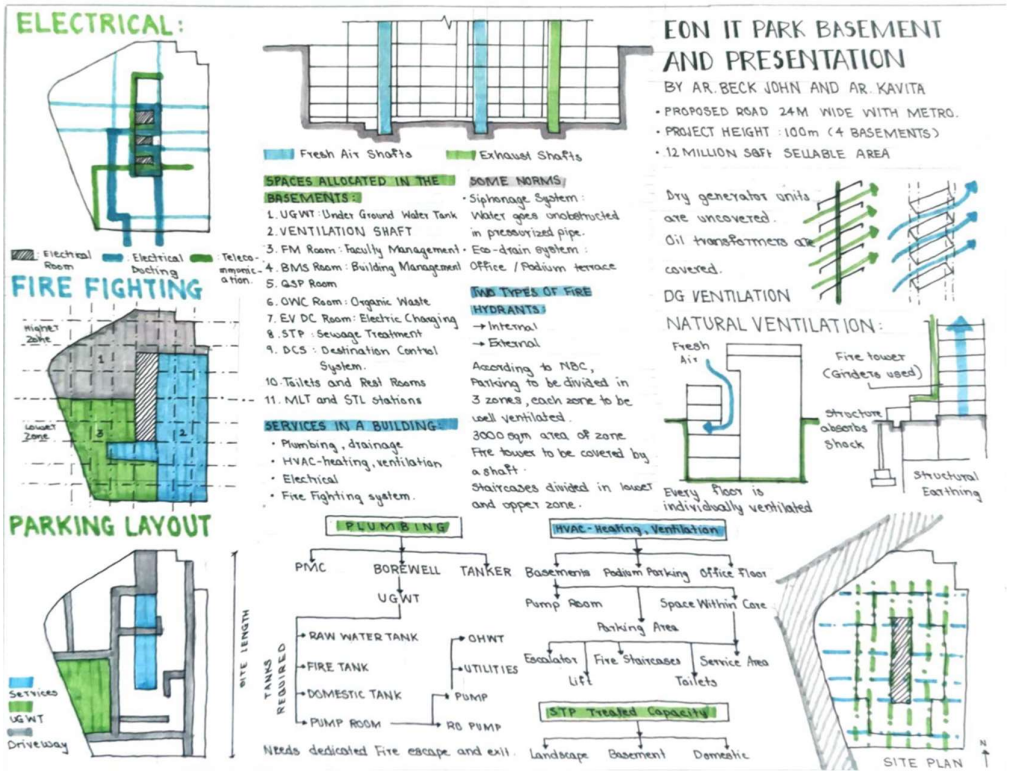


Figure 6. *Representative Site visit Report (Source- Author)*

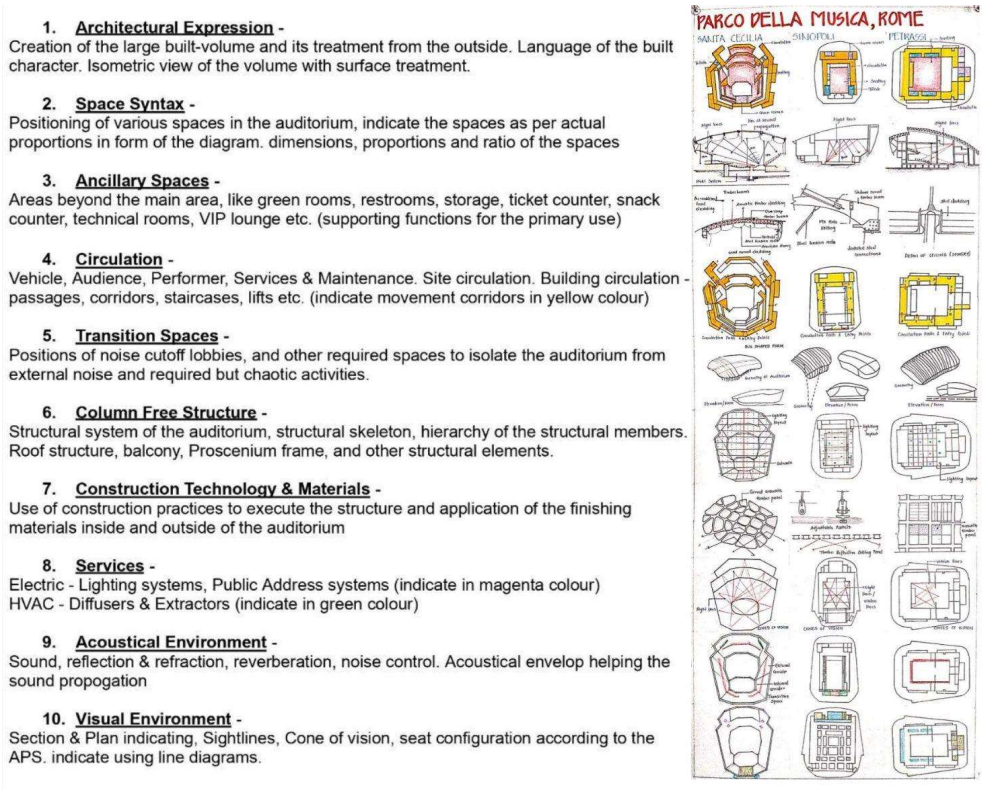


Figure 7. *Points of Analysis of reference study and Sample Output (Source- Author)*

4.1.3 Context-Study and Analysis + Program Formulation and Ideation

The third stage analyses the study area and context, developing ideas and programs based on prior insights, forming the foundation for design and technical resolution. “Educators tend to offer students hypothetical experiments in the form of hypothetical design projects where many contextual variables are neglected. In this respect, learning from the actual environment should be introduced. Real-life experiences can provide students with opportunities to understand the practical realities and different variables that affect real-life situations” (Salama, 2010).

4.1.3.1 Context-Study and Analysis

“While user behaviour and its influence on design are acknowledged in architectural education, these critical aspects are rarely incorporated into design studios. As a result, the societal role of architects is often oversimplified, with architects being perceived as creators of aesthetically pleasing spaces, catering primarily to those who can afford their services” (Khan & Khan, 2019). This stage analyses socio-cultural, environmental, and socio-economic factors through site visits and stakeholder interactions, identifying constraints and opportunities to guide interventions that promote community engagement and preservation (Author, Urbanising Peripheries: An aspect based study of urban fringes in the region around Pune city to understand its character and pattern of development, 2020).

4.1.3.2 Program Formulation and Ideation

The program formulation integrates inputs from previous stages, including infrastructure requirements, systems from literature and precedents, and context-based analysis. Program formulation has 2 subsets

A. Qualitative Program - idea of the intervention and approach to design starts materializing from this subset, eventually culminating into the Ideation process
B. Quantitative Program - tabulation of the data in the form of spatial, services, structural and special requirements is done in this subset.

The ideation stage develops the intervention idea, focusing on systems, structure, services, and architectural expression, ensuring practical, context-sensitive, and need-based urban infrastructure solutions.

4.1.4 Technical Resolution and Demonstration

In the final stage, ideas and programs are translated into detailed technical drawings through various design and technical resolution stages, bridging the gap between theoretical concepts and real-world applications.

4.1.4.1 Design and Technical Resolution

"Discussion in class is one of the most common strategies promoting active learning- with good reason" (Bonwell & Eison, 1991). The transition from ideation to design development marks a shift from abstract concepts to concrete, structured solutions, where ideas are refined into tangible drawings. This phase involves a series of discussions to clarify concepts and ensure the feasibility of the design.

4.1.4.2 Expert Review

The design proposals are presented to a panel of faculty and experts for review and critique (Figure 8). These presentations include technical drawings, 3d visualisation. The feedback process allows for refinement and optimization based on expert suggestions. This interaction not only highlights the strengths and weaknesses of the proposal but also encourages critical thinking, adaptability and problem-solving skills.



Figure 8. *Review and interaction with Expert (Source- Author)*

4.1.4.3 Preparation of Technical Drawings

This stage involves generating comprehensive construction drawings, technical details and specifications, with appropriate building services. (Figure 9) The iterative improvements made based on expert feedback helps refine the design, ensuring it is both innovative and practical for real-world application. This approach deepens the understanding of how infrastructure and services are connected to overall building functionality.

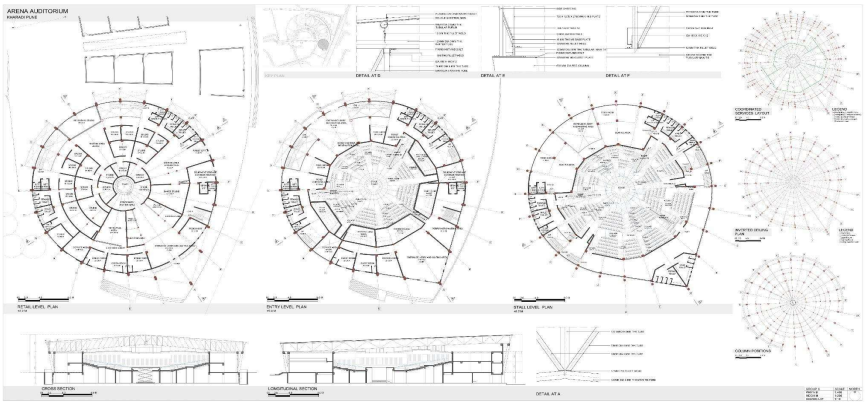


Figure 9. *Representative Student work of Technical Drawing of Auditorium*

(Source- Author, Generated as a part of ABCS Studio Process, 4th Year B.Arch.)

The studio process, guided by faculty and involving experts at key stages, fosters collaboration among faculty, students, and stakeholders. This approach connects theory to real-world challenges, enhancing learning through practical application and feedback.

4.2.1 Role of the Faculty Team in Guiding Collaborative Learning

Faculty members introduce the topic and project, prepare stage-wise assignments, and conduct iterative discussions. They provide references, organize site visits, and involve field experts, while overseeing student groups as they decode references and develop interventions.

4.2.2 Role of students in Collaborative Studio Projects

Students are organized into horizontal and vertical groups to promote collaborative learning. Horizontal groups decode literature and references, while vertical groups combine members from different horizontals, bringing diverse perspectives for context-sensitive, need-based interventions. Sharing experiences with peers fosters a collaborative learning environment. Discussions spark new perspectives, encourage analysis from different angles, and solidify learning through explanation and debate (Outlife, n.d.). This approach enhances the depth of understanding and encourages critical thinking, which is essential for addressing the complexities of urban infrastructure challenges.

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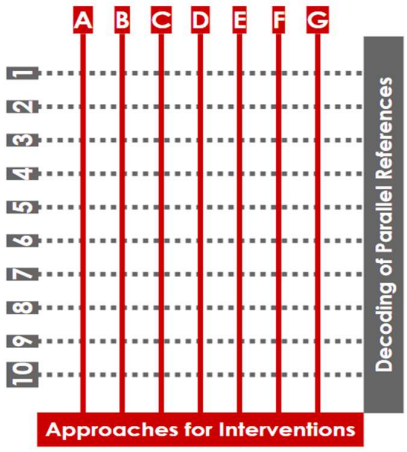


Figure 10. *Horizontal vertical grouping (Source- Author)*

4.2.3 Role of Experts

Experts enhance the studio process by delivering lectures, providing feedback on design proposals, and guiding project formulation with their industry experience. Their insights help students understand current trends, standards, and real-world challenges, ensuring designs meet practical expectations and aligning the curriculum with industry practices.

4.2.4 Role of Resource persons

Resource persons, such as individuals coordinating site-visits and local community members, provide students with firsthand insights through site visits. These interactions help students understand site conditions, stakeholder perspectives, and socio-cultural, environmental, and economic factors, bridging classroom learning with real-world applications and ensuring practical, context-sensitive designs.

5. Findings and Analysis Evaluating Studio Approaches for Curriculum-Transaction

5.1 Collaborative ABCS Studio Approach: Effectiveness and Key Findings

"Studies reveal that developing systematic approaches to teaching teamwork significantly enhances collaboration competencies in architectural education" (Karimi & Farivarsadri, 2024). An online survey using stratified random sampling evaluated the effectiveness of the collaborative ABCS studio process in enhancing students' understanding and skills.

5.1.1 Use of collaborative learning outcomes from the other subjects

The study area documentation done under 4th-year subjects (AD and US) led to the identification of urban infrastructural challenges, interpreted as need-based interventions for ABCS topics.

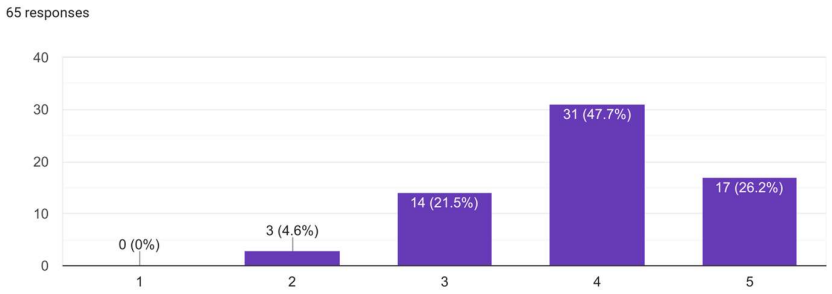


Figure 11. *Contribution of other Subjects (Source- Author)*

Around 74% of students feels that collaborative studio process was impactful in shaping proposed interventions.

(scale "1- not impactful" to "5- highly impactful.") (Figure 11)

5.1.2 Effectiveness of collaborative studio processes

"Collaborative learning enhances critical thinking by engaging students in discussions, clarifying their ideas, and evaluating others' ideas" (Gokhale, 1995). The ABCS studio curriculum progresses in 4 states with collaborative methods and stakeholder involvement.

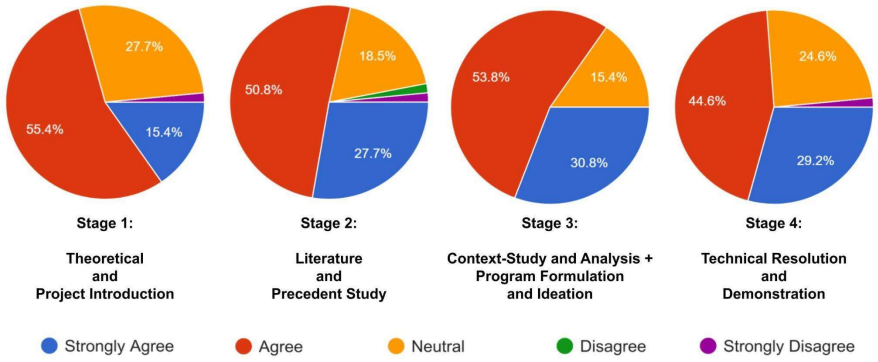


Figure 12. *Effectiveness of four Studio stages in addressing Urban infrastructure challenges*

(Source- Author)

The survey results highlight the impact of the 4 stages of ABCS Studio curriculum, addressing urban infrastructural challenges: (Figure 12)

(i) Theoretical and Project Introduction: 71% of students found this stage important for understanding issues and challenges.

(ii) Literature and Precedent Study: 79% agreed it was helpful for formulating ideas for interventions.

(iii) Context-Study and Analysis + Program Formulation and Ideation: 85% felt this stage effectively contributed to formulating interventions.

(iv) Technical Resolution and Demonstration: 74% appreciated the discussions, debates, and deliberations for producing technically accurate drawings.

5.1.3 Development of the appropriate urban infrastructural interventions

Under the structured studio framework, students identified challenges in urban infrastructure and demonstrated interventions that were context-sensitive, situation-specific, and need-based. (Author, Urbanising Peripheries: An aspect based study of urban fringes in the region around Pune city to understand its character and pattern of development, 2020)

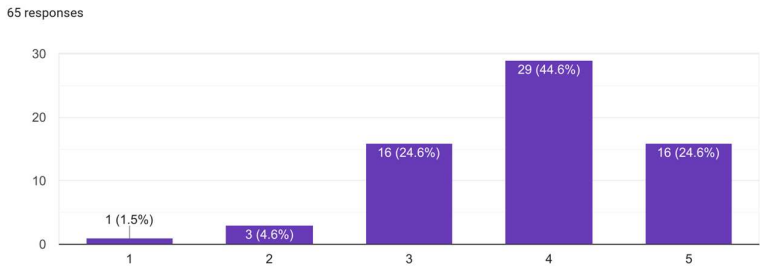


Figure 13. *Effectiveness of Subject Integration (Source- Author)*

Around 74% of students found the process enriched their understanding of urban infrastructure.

(scale from "1- not effective" to "5- highly effective.") (Figure 13)

5.1.4 Preparedness of students in addressing the real - world challenges

The studio process incorporated diverse learning activities, including data collection, interaction with professionals, and stakeholder engagement. This approach prepared students to understand and respond to real-world issues effectively.

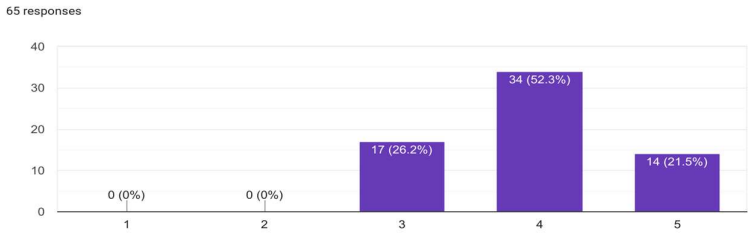


Figure 14. *Effectiveness of Studio Structure (Source- Author)*

70% of students reported that the studio process equipped them to address real-world challenges. (scale from "1- not effective" to "5- highly effective.") (Figure 14)

5.2 Active and passive learnings and stakeholders' involvement

"Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work" (Freeman, et al., 2014). ABCS studio process is mapped against the involvement of different stakeholders, with green indicating active involvement, orange for moderate involvement, and yellow for minimal or no involvement. Table 1 also identifies whether the learning for each process is passive (students mainly receive information) or active (students engage in hands-on, participatory activities).

Table 1. *Mapping of Stakeholder involvement and Learning Types across Studio Process*

Studio-Processes	Studio Stakeholders Involvement				Learning Type	
	Faculty Team	Students	Experts	Resource Person	Passive	Active
Theoretical and Project Introduction						
Topic Introduction						
Concerns and Project Introduction						
Literature and Precedent Studies						
Literature and Reference Study						
Site Visits						
Context-Study and Analysis + Program Formulation and Ideation						
Context-Study and Analysis						
Program Formulation and Ideation						
Technical Resolution and Demonstration						
Design and Technical Resolution						
Expert Review						
Preparation of Technical Drawings						
YES	IF REQUIRED			NO		

The ABCS studio employs comprehensive methods for active and passive learning, incorporating student-centered, hands-on learning and cognitive activities. These methods enable students to develop critical thinking skills, identify appropriate references, understand the application of technology, and retain knowledge. This multi-dimensional process provides the platform to analyse concerns, context, references in order to develop the idea about interventions to demonstrate and evaluate the intervention. (Figure 15).

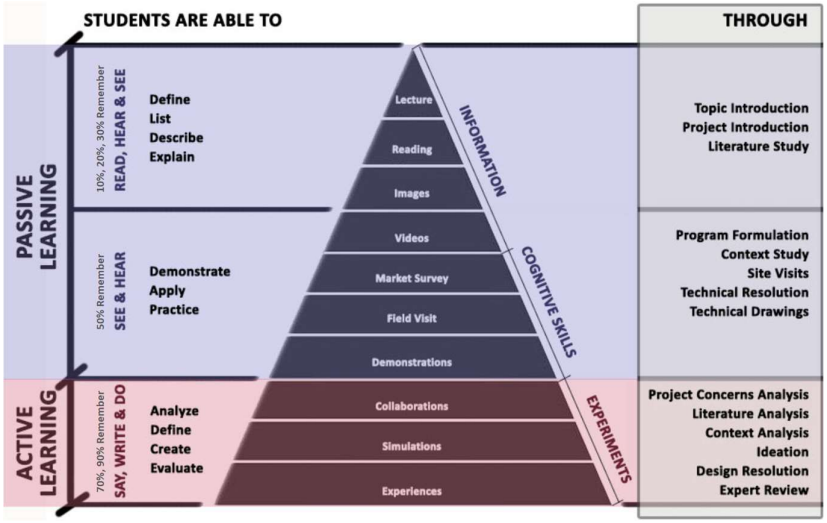


Figure 15. *Interpretation of the Edgar Dale's Cone of Experience for curriculum transaction in ABCS studio (Source- Author)*

5.3 *Curriculum-Transaction as a continuous learning process*

The studio process implemented for addressing issues through interpreting urban infrastructure challenges as ABCS topics is a continuous learning process for the faculty members and students. The four stages of the studio align closely with Kolb's Experiential Learning Cycles and can be interpreted as follows (also represented in Figure 16):

- 'Concrete Experience' corresponds to 'Theoretical and Project Introduction'
- 'Reflective Observations' align with 'Literature and Precedents Study'
- 'Abstract Conceptualization' is reflected in 'Context Study and Analysis + Program Formulation and Ideation'
- 'Active Experimentation' relates to 'Technical Resolution and Demonstration'

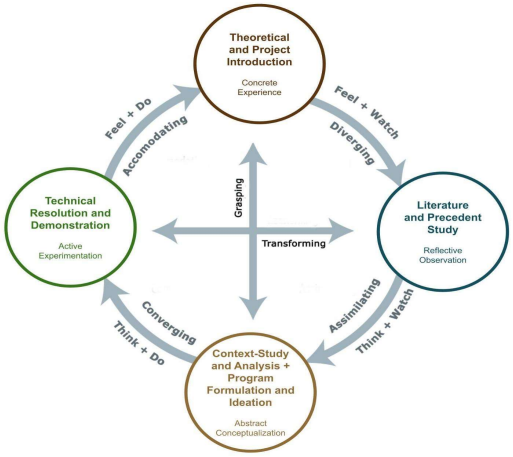


Figure 16. *Alignment of the ABCS Studio Stages with Kolb's Experiential Learning cycle for continuous learning (Source- Author)*

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5.4 Interpretation of Contextualized Urban Interventions

"Design education in architecture, like other types of education, conveys, conserves and transmits the values of the profession and society at large. Since architecture is created in a field of tension between reason, emotion, and intuition, design education in architecture is the manifestation of the ability to conceptualize, coordinate and execute the idea of building rooted in the tradition of humanism" (Salama, 1995). This underscores the foundational role of the studio in harmonizing technical knowledge with broader societal and humanistic values.

Table 2 presents a range of urban infrastructural interventions, each carefully selected to address the specific needs and challenges of the study area. These interventions are organized under relevant ABCS topics, offering a structured framework for effective urban infrastructure solutions.

Multi-level Basement	Identification of type of parking facilities required through analysis of movement and mobility and parking surveys for proposing the 'Pay and Park facility', in the study area, addressing issues like on road parking, pedestrian movement, traffic congestions. Emphasising necessary structural and service requirements for functioning of the basement.
Industrial Structures	Identification of the issues of waste management through analysis of physical infrastructure of the study area as well as through interaction with SWaCH, Pune and proposing appropriate 'Waste Handling Units'. Emphasising efficient workflow, human-machine interface, structural and envelope systems, and service requirements for functioning of the industry
High-Rise Structures	Identification of functional gaps and lacunae in urban infrastructure of study area taking clues from its image, identity and culture, to propose high rise infrastructures like, Elevated Service Reservoir, and Energy Tower. Addressing urban issues of space scarcity, preparedness of future expansion, eye-sore and secluded infrastructural interventions leading to issues of notion of safety and security in the area. Emphasising advancement in the technology of the relevant infrastructure, structural system under dynamic loading conditions and service requirements for functioning of the highrise building.
Auditorium	Identification of requirements for cultural infrastructure, congregation and cultural space in the study area from study of aspects like, 'amenities and facilities' and 'built and open environments' to propose 'Performing Arts Centre' as a group of auditoriums (proscenium, thrust, arena and experimental theatres), through decoding of parallel references. Emphasising on technical aspects like visual environment, acoustical envelope, seating configuration, structural systems and service requirements for functioning of the auditoriums.
Architectural Detail	Identification of the system requirement for functionality of built environment for proposed urban insert project from architectural design studio as a derivative of the thematic enquiry and design guidelines proposed under the subject. The intervention of the system proposes appropriate 'Architectural Details, required as its components, which gives required character, language and expression the the urban insert. Emphasising on technical correctness, appropriate material and process specifications.

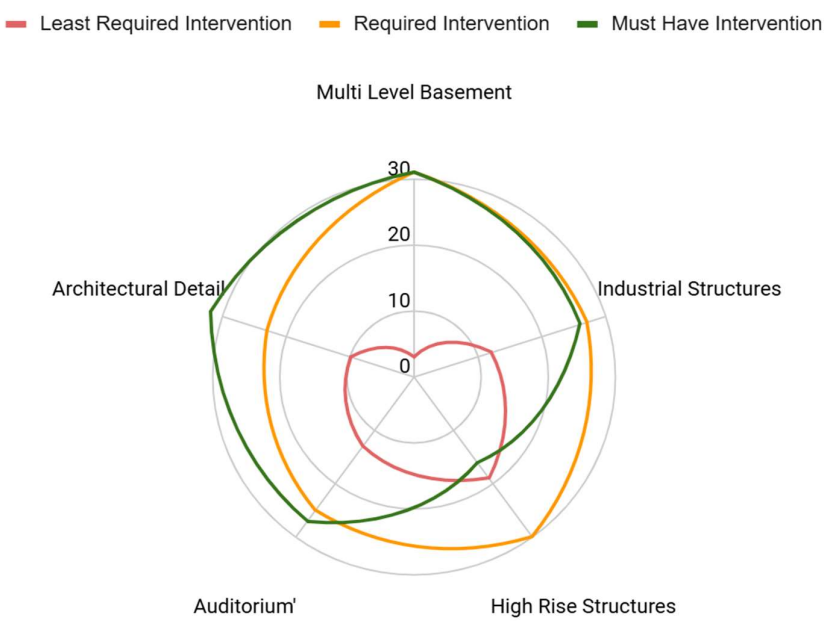


Figure 17. *Feedback indicating necessity of urban infrastructural interventions interpreted as ABCS topics (Source- Author)*

This graph indicates the most relevant urban infrastructural interventions for the study area by categorizing different types of interventions based on their perceived necessity. (Figure 17) The graph presents data across five types of interventions: Multi-level Basement, Industrial Structures, High Rise Structures, Auditorium, and Architectural Detail. From the graph, we can observe the following:

- Multi-level Basement and Industrial Structures are primarily seen as requiring Must Have Interventions, with high values in the orange category.
- Architectural Detail is also largely considered a Must Have Intervention, indicating a strong need for focus in this area.
- High Rise Structures and Auditorium show more balanced consideration across the categories, but they still have significant values in the Required and Must Have intervention areas.

6. Conclusion

"Experiential learning 'helps students apply academic knowledge in real-world contexts,' bridging the gap between theoretical learning and professional practice"

(Northeastern CATLR, n.d.)

Interpreting urban infrastructural challenges as ABCS topics reflects an experiential, experimental and continuous learning process involving the identification of concerns, contextual analysis, learnings from parallel references and creatively

addressing the challenge. This process bridges the gap between theoretical learning and professional practice.

The key findings show that the ABCS studio process helped students develop important skills for addressing urban infrastructure challenges by proposing context-specific interventions. Involving experts and the community made the projects more practical and contextually grounded. Group work encouraged peer-learning and teamwork. The study highlights how using real-world, need-based teaching methods helps students develop creative solutions and be ready for real-life challenges.

The four studio stages of the studio curriculum integrate collaborative, active, and experiential learning methods. These methods emphasize understanding the socio-cultural and environmental contexts of interventions, engaging with stakeholders, and acquiring advanced technical knowledge. This multidimensional framework underscores the need to address urban infrastructural challenges through multiple lenses, facilitating comprehensive and innovative interventions.

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TRACK 04



URBANISM , PLANNING & MANAGEMENT

Integrating Urbanism, Planning, and Management: Enhancing Interdisciplinary Collaboration for Resilient and Equitable Environments

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Abstract: *This study explores the interdisciplinary essence of urbanism, planning, and management in augmenting the built environment. The study, based on a systematic review of theoretical and practical evidence, emphasizes the role of cooperation among these disciplines to meet modern urban challenges. The article stresses the importance of sustainability, climate resilience, and social equity, recommending the unification of urban planning with environmental science, sociology, and engineering. By establishing areas of gap in existing theoretical frameworks and practical methods, this research advocates for an integrated urban development model that encourages innovation and flexibility in responding to social needs. This work adds to the literature on interdisciplinary approaches towards realizing a more sustainable and equitable urban future.*

Keywords Urbanism; Planning; Sustainable Development; Climate Resilience; Social Equity; Interdisciplinary Collaboration

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1. Introduction:

The world is experiencing an unprecedented trend in global growth of the urban population. Already approximately more than 55% of the worlds are living in cities and such a trend is expected to continue by concentrating people, resources, and activities into cities (United Nations, 2018). Such rapid urbanization poses considerable stress on the infrastructure regarding housing, transportation, and other vital services within the urban envelope, thereby challenging the very "fabric" of urban life. As cities grow, sustainability becomes a need that will call for methods that are not only resilient to environmental changes but also fair to all citizens.

Traditionally, it has been urbanism, planning, and management that have made up the core disciplines looking to these complex challenges. However, their effort tends to materialize as little pieces of fragmented and isolated accomplishment that don't consider any networked connections of urban systems (Healey, January 2007). That contributes to inefficiencies, increased inequalities, and environmental destruction. Not a clue for seeking sustainable liveable urban environments.

Modern cities are complex, and what is needed is integrated sight embracing sustainability, climate resilience, and social justice. The challenges that such complexity brings about demand an answer that goes beyond the boundaries of discipline. Is it, therefore possible that interdisciplinary collaboration can strengthen the strategies for urban development to achieve holistic solutions?

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In this direction, interdisciplinary approaches in urbanism, planning, and management are major opportunities to close the gaps that exist between existing lacunas within today's theoretical and practical frameworks. In this way, cities can cooperate more effectively with various disciplines, such as environmental science, sociology, economics, and public policy, in order to better meet some kind of complex, often competing demands of an urban population.

There is a dire need for such a framework that can accommodate these complexities of modern urban space within this context. By reading these time-honored models of developments through an interdisciplinary approach, innovation solutions for sustainable climate-resilient and social equity can be developed. This would lead the conclusion in providing strategic recommendations about the implementation process with such a framework and would bring out the call for cooperative engagement with the stakeholders toward having a more integrated and responsive method to resolving the issues in the urban arenas.

1.1 Aim & Objective -

The purpose of this research is to examine and enhance interdisciplinary collaboration in urbanism, planning, and management towards developing resilient, sustainable, and equitable cities. Through combining the knowledge from environmental science, sociology, and engineering, the study intends to provide a comprehensive framework that boosts interdisciplinary collaboration towards efficient urban development. To do this, the research will analyze how urbanism, planning, and management interact in determining built environments, recognizing where gaps exist in prevailing models of urban development that interfere with interdisciplinary collaboration. It will also determine the worth of interdisciplinary methods in confronting sustainability, climate resilience, and social equity in cities. By examining the case studies and best practices effectively integrating various disciplines, the research will provide perspectives on effective strategies for urban development. Lastly, it will advance a strategic framework for interdisciplinary engagement to enable collaboration across disciplines and recommend policy measures and management practice that foster inclusive, sustainable, and resilient city planning and city governance. By adopting this method, the research guarantees an organized but inclusive examination of interdisciplinary solutions for urban development.

2. Literature Review-

2.1. Urbanism, Planning, and Management -

Urbanism refers to the creation of urban spaces in accordance with various needs of the citizens. It also considers an understanding of social, cultural, and environmental conditions that reflect urban life. Urbanism is relevant not only aesthetically but also speaks to functionality in creating accessible community engagement that connects in building an excellent quality of life in an urban area (Gehl, 2010).

Planning, on the other hand, is a spatial organization tool and at the same time a regulatory framework guiding in the growth and development of urban spaces concerning land usage. It literally tells where to put which housing, what commercial space, how many parks, and where the infrastructure should go. Urban planning that ensures demographics and environmental sustainability can practically be lacking in some of these balancing considerations, as its core is actually the thinking process.

Management refers to the processes and practices applied to execute the urban plans effectively and efficiently. It makes cities work for them in an optimized way by understanding current societal requirements and then adjusting appropriately (Hall, 2014). In reality, though, urban management operates in silos because, generally, there are limited communications among the disciplines involved in urbanism and planning. This leads to broken development processes since each component of the various elements of urban life, such as transport, housing, and public services, does not run in harmony with others, hence leading to inefficient and incoherent urban development which also explains at boarder level in **Fig.1.**

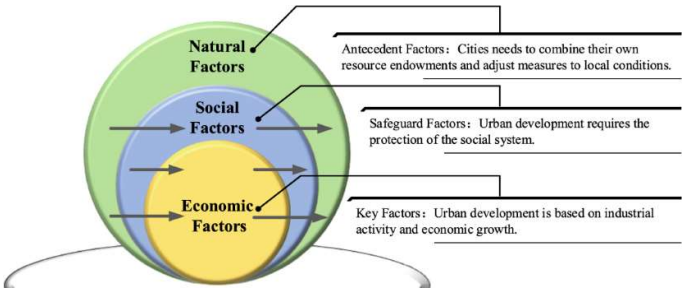


Figure 1. *Factors affecting the development*
Source: *https://link.springer.com/article/10.1007/s10668-022-02151-7*

Although, obviously, historical models, such as Howard's Garden City and Le Corbusier's Radiant City, have given a lot of theoretical ground for today's urban development, these usually separate the idealism of interdisciplinary insights generated by modern urban challenges from practical managerial practice. Visionary in themselves, they do not hold up against the current issues that plague cities, such as climate change, social inequities, and sustainable growth (Fishman, 1982). In this regard, modern urban development is bound to assume the dimensions of multilateral approaches in integrating all features of urbanism, planning, and management.

2.2. Interdisciplinary Collaboration in Improving Urban Development

Interdisciplinary cooperation integrates the influence of a group of professionals with diverse skills to develop approaches more susceptible to and integral solutions for urban issues. Combining the study of the city through urbanism, planning, and management with disciplines like environmental science, sociology, and engineering builds the city more richly to handle multiple challenges, such as resource management, social inclusion, and climate resilience (Newman & Jennings, 2008).

Environmental science provides crucial information with regards to the administration of sustainable sources of resources and ecological effects arising from urbanization. It informs on decisions made in planning centered around environmental protection and resource preservation. From sociology, one gains an understanding into social equity, community dynamics as well as a need for including all in urban spaces. Understanding how people are held together in cities empowers planners as well as managers with this information to craft interventions for different needs of different people so that people belong and there is cohesion within communities.

Engineering provides the technical knowledge and, more particularly civil and environmental engineering-how to build resilient infrastructure, how to be efficient with it, and how to make urban development functional and sustainable in climate risks and population growth (Beatley, 2011). When all of these disciplines work together, the consequence is a more holistic approach to city development-the new craft of balancing physical and social systems to make cities more livable for example mentioned in

fig 2.



Figure *2.* *Vadodara Smart city Smart Cities Mission Sustainable City*
Source:(https://images.app.goo.gl/QNjVpoN7i7mTuEHfA)

3. Gaps in Current Models:

In current urban development models, gaps persist that hinder the establishment of holistic and adaptive solutions. Many urban planning frameworks fail to fully integrate interdisciplinary collaboration, resulting in fragmented approaches to sustainability, climate resilience, and social equity. Although cities worldwide recognize the need for sustainability, equity, and resilience, they often address these objectives independently, rather than as interconnected facets of urban life. This separation leads to plans for climate resilience, for example, that do not consider socio-economic vulnerabilities within communities, leaving marginalized groups disproportionately exposed to climate risks and lacking the resources needed to cope.

A significant consequence of this disjointed approach is the production of piecemeal solutions. Such solutions may address individual problems but fail to respond to the underlying complexities of urban challenges, which are typically multifaceted and require cohesive strategies. Without an integrated framework, cities can end up with isolated initiatives—such as green infrastructure projects that target climate resilience but are located in wealthier neighborhoods, thereby reinforcing existing inequalities.

Similarly, programs focused on social equity might overlook environmental considerations, resulting in communities that are socioeconomically supported but remain vulnerable to environmental threats like pollution or flooding. This segmentation between objectives underscores the need for models that bridge the various facets of urban development.

Current frameworks in urbanism, planning, and management often operate in silos, which prevents effective collaboration between disciplines like environmental science, social policy, and engineering. Without coordination, these disciplines struggle to address the complex, interconnected challenges facing urban areas. For example, a project aimed at developing affordable housing may not involve environmental experts who could provide insights into sustainable building materials, or social experts who understand community needs. In the absence of a cohesive approach, the development may lead to unintended consequences, such as poor environmental sustainability or a lack of long-term resilience.

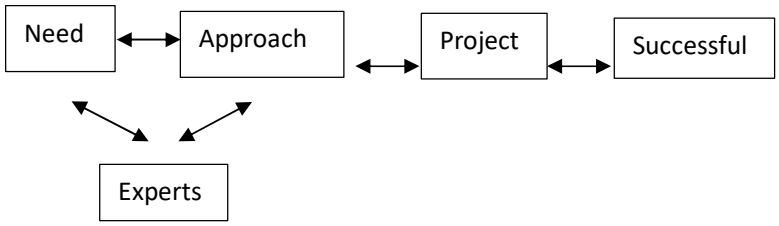


Figure 3. *The importance of Strategic Dependencies in Building Long-Term Resilience.*

(Source: Author)

To move beyond these limitations, there is a need to critically reevaluate existing models and introduce frameworks that prioritize interdisciplinary collaboration and inclusivity. A redefined approach would not only unite various experts in the planning stages but would also involve community members, particularly from marginalized groups, to ensure that their needs and perspectives inform the planning process. This inclusive, interdisciplinary collaboration is essential for creating adaptive, resilient, and equitable urban spaces that respond dynamically to environmental, social, and infrastructural challenges.

An integrated model of urban development would establish common goals across disciplines and facilitate shared data and resources to foster real-time collaboration. This model would support cities in meeting the evolving needs of their populations by addressing challenges at their roots, rather than treating symptoms in isolation. By creating a flexible, adaptive, and responsive planning framework, cities can overcome the fragmentation present in current models and better equip themselves to promote sustainable growth, social equity, and climate resilience as shown in **Fig. 4.**

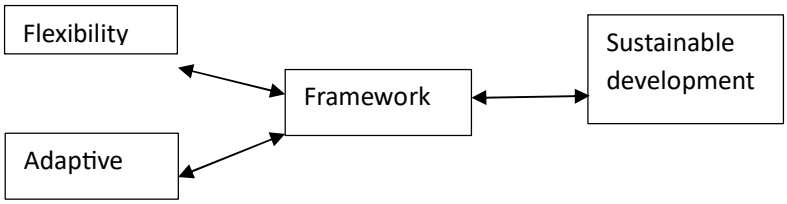


Figure 4. Planning for Sustainable Growth and Resilience. ***(Source: Author)***

4. Discussion on

4.1.1. Interdisciplinary Cooperation for Resilience

The results of this research bring the point of basic importance out about interdisciplinary cooperation for resilience in urban environments. Such infrastructure that could be developed by cities to be resilient to the increased risks brought along by climate change will be possible through integrating expertise from other diversely encompassed fields such as environmental science and engineering. For example, urban areas are very vulnerable to flooding, extreme heat, and rising sea levels risks (Bulkeley & Betsill, 2013). Through collaborations with environmental experts, novel material usage and innovative construction techniques will be integrated to mitigate this risk. Engineering designs may thus be selected to promote strength and elasticity, so that infrastructural systems in cities are both strong yet also fluid, so that they can respond to changes in environmental conditions.

Social experts play a fundamental role during the planning stage, since it is here that their contribution will go to making strategies that would pay most attention to the most vulnerable population. This means there is a need to cushion the impacts of climate change on such populations in such a way as not to disadvantage them. By focusing on social equity, this may help the resilience initiatives unlock cohesion among the community members, therefore leaving a door open for the general citizenry to co-exist amicably as they attain an equal situation in the urban space where every individual can pursue their dreams. This is because the advantages of resilient infrastructure are equitably proportioned by such an approach. Therefore, the predisposition towards social justice ends up reinforcing the identified gaps in sustainability and social justice.

4.1.2. Anchoring the gap: sustainability and social justice

One of the archaic gaps portrayed by modern models of urbanism relates to the misfit between the initiatives of sustainability and social justice. Many cities have established any number of green programs - from green building codes and renewable energy initiatives to urban greening projects - beneficial but often isolated from broader social equity goals (Angotti, 2013). Indeed, green projects are commonly found in well-to-do districts, while marginal communities are overlooked for access to these valuable resources and benefits. Separate from that, this segregation not only perpetuates the existing inequalities but also weakens sustainability efforts.

These are recommended to be dealt with by interdisciplinary collaboration among the planner, sociologist, and environmental scientist. This can ensure that sustainability initiatives are always focused on inclusivity and be able to take environmental benefits "back home" for all of the city's residents. The transition to inclusive growth promotes the equitable sharing of resources and opportunities to achieve a more just urban landscape.

4.1.3. Opportunities for Improved Management Practices

Interdisciplinary collaboration can revolutionize and advance modern urban management practices within an urban setting. Using this, a group of management professionals, architects, engineers, and social experts can work together for the purpose of making the space more functional, sustainable, and equitable. Through interdisciplinary cooperation, cities will be better placed to articulate comprehensive strategies for meeting the complex yet multidimensional needs of modern urban populations.

Effective management frameworks, in actuality designed to incorporate interdisciplinary insight, will enable urban managers to deliver the true needs of their communities. That means full utilization of resources, maintenance of infrastructure, and carrying out fluid infrastructure in relation to the dynamic social and environmental landscape (Batty, 2013). Integration of diverse talent in the management process can help cities increase responsiveness to changing demand. This enhances the resilience of an urban environment.

5. Policy Recommendations

Cities should adopt an interdisciplinary planning framework when implementing resilient, sustainable, and equitable urban spaces. This shall be achieved through the engagement of urban planners, architects, engineers, environmental experts, sociologists, and many other professionals through the comprehensive framework of problem-solving the modern urban environment experiences. At the very start, planning activities encompass more holistic and adequately skilled functions in meeting environmental, social, and infrastructural issues by taking on board diverse perspectives and skill-sets. Characteristics of collaborative frameworks shape holistic solutions whereby there is apt balance between physical and social systems whereby urban areas can cope with the demands placed on them both now and later.

Cross-Disciplinary Training constitutes an imperative within educational programs to successfully engage in collaborative urban planning. A view of professionals, like urbanism, architectural, and environmental management, does not afford them the necessary integrated view that requires this kind of joint planning for a city. Interdisciplinary training allows experts to gain an understanding of other disciplines that they can subsequently incorporate. This gives them a shared language and a sense of teamwork. Thus, there is structure and environmental considerations through urban design, while architects become more attuned to social dynamics and goals towards sustainability. Such educational programs lead to producing professionals who could be effectively working in interdisciplinary teams, and this would have a good effect on the outcome of urban development projects.

Common Data and Technological Innovation further adds to the empowerment of interdisciplinary collaboration because it creates accessible shared platforms for data exchange among departments. Many of the city's challenges are interconnected, and when fragmented data management is at play, it limits our ability to understand and address that complexity. Interdepartmental data platforms enhance ready access to infrastructural, demographic, environmental impact-related, and all other data; it thus helps in deciding across discipline bounds. Technological innovation allows professionals to use methodologies for analyzing urban trends by utilizing big data analytics along with modeling software and geographic information systems, making precise predictions of impending challenges with preemptive solutions designed at that moment. These technologies improve not only inter-personal collaboration, but also precision and efficiency in the results, which leads to improved outcomes in urban management and planning.

Inclusive Urban Policy would have to be able to ensure that all sectors in the community benefit from city growth; this policy particularly highlights especially marginalized sectors usually excluded from having access to resources and services offered within the city. Policymakers also have an important role in making development more inclusive, from planning to action, including communities in every stage of implementation. This participatory approach will allow the local governments to address the specific needs and concerns of marginalized communities while directing development policies to be a source of equitable resource distribution, affordable housing, and access to quality public infrastructure. Inclusive policies within an urban setting not only mitigate the social inequalities present but also enhance the sense of ownership among the citizens, thereby strengthening community resilience and cohesiveness.

These four pillars—interdisciplinary planning frameworks, cross-disciplinary training, common data sharing, and inclusive policies—are foundational in the conceptualization of adaptive, equitable, and sustainable urban spaces. In total, these set up a good foundation for resilient environments that keep on responding to the problems besetting modern cities and really provide for a future in which every citizen has an equal chance of flourishing.

6. Conclusion

This research finds great importance in building resilient, sustainable, and equitable urban environments through interdisciplinary collaboration. This emphasis demands substantive interdisciplinary, bringing together the disciplines of urbanism, planning, and management with environmental science, sociology, and engineering. Such an integrated approach is considered essential for dealing with the complex challenges posed by the built environment of modern cities.

Interdisciplinary collaboration enhances holistic and effective solutions, moving toward sustainability, climate resilience, and social justice. The book outlines what is lacking in existing models of urban development and formulates a structure for interdisciplinary collaboration that can fill the identified gap. Urban professionals must march into the future with full understanding of interdisciplinary collaboration as a mainstream practice needed for developing adaptable, inclusive, and sustainable cities to face the challenges of the future.

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Formulating a Scheme to Promote Self-Redevelopment of Housing Societies in Mumbai.

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Abstract: *Land is scarce in Mumbai, making redevelopment important for upgrading old buildings. The Maharashtra State Housing Policy, 2006, introduced housing redevelopment schemes that speed up the process of rebuilding older structures. These projects often happen because of maintenance problems, safety concerns or the need for more space and modern amenities. However, the redevelopment process faces many challenges.*

One emerging trend is self-redevelopment, where property owners manage their own building renovations without hiring a developer. They can earn money by selling new apartments added during the renovation, with help from Self Redevelopment Management consultants. However, this process is complex and time-consuming. Without proper planning, it can fail. It's important to understand the risks and difficulties of self-redevelopment, especially during the pre-construction phase, which includes selecting developers and getting building permits.

*This research aims to find a "**One-Stop Solution**" for societies to make the process faster, easier and more efficient. It will focus on improving the existing pre-construction system used by redevelopment project consultants in the Mumbai Metropolitan Area. The methodology is to understand delays in pre-construction stage case studies of projects which are on-going & projects which have completed the pre-construction stage of redevelopment to be studied along with semi-structured interviews with experts in the field of cooperative housing society & redevelopment schemes. The research paper deals with analyzing government policies/manuals and identifying loopholes to give suggestions and recommendations based on a quantitative data.*

The research will identify problems in the current system and suggest ways to reduce delays and effort in pre-construction. Additionally, a proposed scheme for providing funds to stalled self-redevelopment projects could solve the issue of financial shortages during the early stages of redevelopment.

Keywords: Self redevelopment, Pre construction stage, Scheme and framework for funding

1. Introduction-

In Mumbai many housing societies that are 30 to 40 years old currently require major structural repairs. However, they struggle to secure necessary funding and undergo redevelopment for a variety of reasons, including security, parking, contemporary amenities, and additional space.

Also, many factors/questions arise during the ongoing process of redevelopment and they are to be taken care of diligently while opting for redevelopment. The redevelopment process can be long & tedious & most of the time taken is during the pre-construction process of selection of developers & building permits from authorities.

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With 90% of the proposals in Mumbai's Building Proposal Department for residential redevelopment & along with the framework of 79(A) of MCSA in place as guidelines for the redevelopment of housing societies, such projects get delayed especially at the pre-construction stage itself & yet there is no adequate research neither on the topic of the redevelopment of housing societies nor on the delay in pre-construction process of the redevelopment process.

On the other hand, self-redevelopment is the process of demolish and rebuild an old society building. A constructor is hired to construct and hand over new apartments to society members at no cost, with added perks. Profit is made by balancing plot potential and building extra apartments and shops with clearance from the local municipal corporation.

Aim and Objectives:

1.1.1. Aim:

Aim of the research paper is to develop a comprehensive scheme that facilitates the self-redevelopment of housing societies in Mumbai by addressing regulatory, financial and technical challenges, thereby empowering residents to undertake sustainable and efficient redevelopment projects independently.

1.1.2. Objectives:

To examine & identify flaws or drawbacks in the existing redevelopment system.

To identify methods to revive existing systems/ models of redevelopment.

To educate the society members during the pre-construction stage.

To facilitate the availability of required documents/information at a single window.

Though this study has a wide range of scope as most of the buildings are planning to go for redevelopment in Mumbai, the study will include redevelopment process of a cooperative housing society (residential, only private plot owners / societies) & selection of developers for redeveloping the society building with plot areas up to 4,000 Sq.m, up to the pre-construction process only.

2. Literature Review

2.1 Risks and challenges for the redevelopment of buildings in Mumbai

The process of building redevelopment is inherently complex and becomes even more challenging in the case of housing societies. This complexity arises due to the involvement of multiple stakeholders, each with varying levels of knowledge, expertise, wisdom, and socio-economic status. Redevelopment projects face significant risks, including the dilapidated condition of buildings, frequently changing development control regulations imposed by authorities, and volatile market conditions. Additionally, several challenges such as the physical state of the plot, achieving coherence among tenants, arranging for alternate accommodations during

construction and mobilizing financial resources add to the intricacy of these projects. However, conducting a detailed feasibility study at the initial stage can help foresee potential risks and challenges. When paired with transparent communication, proper discussions and a collaborative approach during the initiation phase, these issues can be effectively addressed, paving the way for smoother project execution. (Vinod Vanvari, 2018)

2.2. Risks and Challenges in Self-Redevelopment Projects

The concept of self-redevelopment is relatively new and underutilized due to ignorance, lack of knowledge, risk aversion and concerns about project completion. This complex process involves risks at various stages, such as planning, finance and construction, which require early evaluation. Awarding projects to experienced contractors skilled in risk management can mitigate these issues. Key challenges stem from poor cooperation, communication, and commitment among stakeholders. Effective planning and scheduling, considering environmental factors, are essential. Regular reviews by consultants, timely progress payments, and minimizing order changes are critical to avoiding delays, cost overruns and ensuring successful project completion. (Prachi Aiyer, 2023)

2.3 Redevelopment project management

Dilip Shah, explained the need of redevelopment projects and described about categories of redevelopment projects which includes normal redevelopment and self-redevelopment.

The author has explained the process of self-redevelopment, guidelines to be followed by society members and stakeholders. The list of documents needed from the society members are given. The author has concluded that there is a need of proper management for self-redevelopment projects in India and the project manager plays important role in this. (Shah D.)

According to Adv. Shreeprasad, “Redevelopment through the Developer is the common option chosen by the Housing Societies nowadays. In the process of Redevelopment majority of the benefits are shared by the developer and the society members due to ignorance of law, ego issues, lack of expertise etc. fall trap of unconscionable bargain and in major cases one sided development agreement. Thousands of Redevelopment Projects are now in litigation in the Court of Law due to the lack of involvement of the Society Members in the Redevelopment Process. (Parab)

In the article Nisha has talked about funds hurdle for society eying self-redevelopment across Maharashtra. The state had in September 2019 announced the self-redevelopment scheme for the registered co-operative housing societies with an aim at empowering the residents to take control of the redevelopment process - right from commissioning a suitable architectural or contracting firm and managing construction

to selling the additional real estate constructed and sharing the final profits. "Many societies are willing to go ahead with the scheme. But the lack of clarity on funding has forced many of these societies to postpone their plans," a member in the federation said." Lead district manager, Pune, Shrikant Karegaonkar, told Times of India that "If a society wants to take loans for redevelopment, then the repayment aspect will be a driving factor on the loan proposals an if it is fulfilled, there should not be any issue for sanctioning the loan." (Nambiar)

The author has studied the concept of self-redevelopment and the reasons why it is not used by the society which are lack of information and unawareness, fear of not completing the project, risk taking ability, dealing with "n" number of agencies and government authorities. The author has done comparison of normal redevelopment and self-development projects from which he has observed that self-redevelopment has positive results. Self-Redevelopment gets project finance at lesser rate which is saving of 5% interest per year & almost 200% of more valuation of the property. ((2022) I.-J.)

Adv. Stuti said self-redevelopment offers benefits such as society has complete charge in the process, they get extra benefits compared to builder led projects but they should understand all the nuances they might face. They should ensure that the project completes on time with unnecessary costs. People who take initiative in self-redevelopment should have enough time and competence. This is because the managing committee will be required to engage in extensive coordination with various experts who need to be appointed for the purpose of completing the project. They will need to ensure that all the requisite permissions/approvals are in place, documentation is clear and not onerous for the society members and regularly monitor the project from time to time. ((2022) S. S.)

On January 29, 2024, the Indian Institute of Architects - Mumbai Centre submitted a formal letter to the Chief Minister of Maharashtra, addressing the pressing challenges faced by developers under Scheme 33(7) B of the DCPR 2034. The key issues highlighted in the letter include: (Indian Institute of Architects, 2024)

Widespread Challenges despite High Adoption:
The letter underscores the struggles faced by redevelopment projects under Scheme 33(7) B, despite its significant prevalence in Mumbai. Approximately 35% of housing societies in the city fall under this scheme.

Financial non-feasibility due to heavy premiums:
The imposition of steep premiums has rendered projects non-viable, especially in areas where the sale rate is below ₹25,000 per square foot, leading to stagnation in redevelopment activities.

Insufficient incentives:
The scheme offers minimal incentives, making it one of the least viable redevelopment frameworks in the Mumbai region. This discourages developers and delays much-needed urban rejuvenation.

3. Methodology

The study involved identifying stakeholders in the pre-construction phase of redevelopment through interviews with society members and industry experts. Semi-structured interviews with professionals in cooperative housing and provided insights into government policies, loopholes and the distinctions between normal and self-redevelopment. Case studies of ongoing and completed projects were analyzed to understand the process, benefits and risks of self-redevelopment. A flowchart is developed to illustrate the pre-construction phase in the redevelopment lifecycle identifying common issues and possible improvements and recommending technological solutions like digital portals.

4. Data Collection

4.1 Case studies (Primary data collection)

4.1.1. Trilochan Cooperative housing society, GTB Nagar, Sion, Plot Area: 4000sq.mt,

Developer: Shikara Constructions Pvt. Ltd, no of tenants: 112

Time Consumed in Pre-Construction Stage: 10 Years after development agreement

Points to Study: After DA in 2012, litigations started as a group of 8 members approached Court in opposition with the builder. Norms of MHADA changed in 2016, caused relaxation in premiums.

As per DCPR 2034, FSI Increased. CTS number of the Society was wrong in the records. It took 9 months to correct the records.

4.1.2. Society: Khambhat Chawl, Mulund (w), Plot Area: 1860 Sq.mt

Developer: Tendering Stage, no of tenants: 68

Time Consumed in Pre-Construction Stage: 7 Years & counting after passing resolution for redevelopment.

Points to Study:

Location is prime, but this is a cessed property. Land Owner wants to have maximum benefits.

Few Tenants do not have Tax Certificate.

Land Owner's PR Card shows Previous Land owner's name.

PR Card shows that the owner had taken a loan of 35,000 in 1982. According to owner he has repaid the loan, but it is not reflected in the documents, Hence, there is no Bank NOC for Redevelopment.

4.2 Secondary data collection

Secondary data was collected from society members through questionnaires, meetings, interviews, and discussions. A sample of 30 society members was interviewed to gather diverse perspectives and insights related to the redevelopment process.

Out of the 30 members interviewed, most expressed negative sentiments about the questionnaire, reflecting their limited understanding of the redevelopment process. While the members showed willingness to pursue redevelopment, they were largely unaware of the procedures and their responsibilities in self-redevelopment. This highlights a significant gap in general knowledge about initiating and managing redevelopment projects within their society.

5. Data analysis and findings

Factors	**Trilochan Society** (10-Year Delay)	**Khimjibhai Chawl** (7+ Years & Ongoing)
Legal Issues	Court case from 2012	No court case, but landowner disputes
Regulatory Changes	MHADA premium relaxation (2016), FSI increase (DCPR 2034)	Not a significant factor
Ownership/Title Issues	Incorrect CTS number (9-month correction)	PR Card reflects old owner & outstanding loan
Tenant Documentation	No major issues	Some tenants lack tax certificates
Developer Appointment	Developer finalized (Shikara Constructions)	Still in tendering stage

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Financial Issues	Adjustments due to policy changes	Loan repayment dispute, bank NOC missing

Table 1. *Comparative analysis of case studies and issues in the redevelopment process*

(Source: Author)

Both cases highlight how **legal, financial, and regulatory factors contribute to delays in pre-construction stages** making redevelopment in Mumbai a highly complex process. It also involves multiple stakeholders with diverse knowledge, experience and socioeconomic backgrounds. Key challenges include the physical state of the plot, tenant coordination, alternate accommodations and fundraising, while risks stem from deteriorating buildings, evolving regulatory norms and market fluctuations. Conducting a detailed feasibility study early on helps anticipate issues, while open dialogue and transparency during the initial phase can mitigate conflicts in these inherently unpredictable projects.

6. Feasibilty of projects

Working for Computing Feasibility of a hypothetical society under scheme 33(7) B, with redevelopment and self-redevelopment schemes and comparing them to understand benefits for the society.

Location and Area:

- **Diamond Garden, Chembur**: A well-developed area with a mix of residential and commercial spaces, ensuring good connectivity and demand.
- **Plot Area**: 1000 sq.m. (Approximately 10,764 sqft.), classified under residential zoning.

Members and Configuration:

- Total Members: **20 families**.
- Each family is assumed to occupy a reasonable space allocation (e.g., 2BHK or 3BHK units of 70-120 sq.m.) in the redevelopment or new scheme.

Access and Infrastructure:

- Road Width: **9 meters** (as per municipal norms, this affects the permissible FSI and building height).
- Surrounding Amenities: Likely to include schools, markets, hospitals, and recreational areas, enhancing livability and rates of the property.

Redevelopment of housing society by builder			
No	**Particulars**	**DCR 2034**	
A	**NET PLOT AREA CALCULATIONS**	**SM**	**SFT**
1	**Area of Plot of Society as per PR Card**	**1000.00**	**10764.00**
2	Deductions [5 % Amenity]	0.00	0.00
3	**Net Plot Area [A1-A2]**	**1000.00**	**10764.00**
4	Existing Carpet Area as per Survey.	**929.02**	**10000.00**
5	Existing Built-up Area @ 20% increment over Carpet Area [A4 X 1.20]	1114.83	12000.00
6	Existing BUA less balconies [A5 X 100/110]	1013.48	10909.09
7	FSI Consumed	1.01	
8	15% TDR Free of Premium on existing BUA as per DCPR 2034	167.22	
9	10 SM Free TDR per member	200.00	
10	Amenity - Two times TDR	0.00	0.00
11	Ready reckoner rate: Land	117230.00	10890.93
12	Ready reckoner rate: Residential built-up area	110980.00	10310.29
B	**FSI CALCULATIONS**		**SFT**
1	As per FSI 1	1000.00	10764.00
2	Additional 0.50 FSI Available by paying premium to MCGM	500.00	5382.00
3	TDR 0.50 available on plot	500.00	5382.00
4	Additional FSI if any	200.00	2152.80
5	FSI Credit of Road Handover	0.00	0.00
6	Development Potential as per FSI	2200.00	23680.80
7	35% residential fungible FSI available on existing BUA of Society without paying premium	354.72	3818.18
8	Balance Residential fungible area with Premium	415.28	4470.10
9	Total Development Potential of Site [B6+7+8]	2970.00	31969.08
10	Total Carpet area potential at 12% reduction for Walls	2651.79	28543.82

C	COMPUTATION OF PROJECT COST		CRS
1a	Construction Cost @ Rs 2700/- per Sqft of Built-up Area X 1.30 for Staircase + Lifts + Passages + Infrastructure Development + 18% GST	**132409535.54**	13.24
1b	Stilt + Podium Parking Cars (5 lacs per car) (281 cars)	140500000.00	14.05
2	**MCGM Statutory Payments**		
a	Statutory Development Charges	4689200.00	0.47
b	Liaoning Costs B9 X Rs.300 per sqft	9590724.00	0.96
3	**MCGM Premiums**		
a	Additional 0.50 Premium FSI @50% of LAND RR Rate	5445.47	2.93
b	Slum TDR @20% of permissible TDR @65% of Land RR Rate	7079.11	0.76
c	Open TDR [@80% of permissible TDR - A8] @40% of Land RR Rate	4356.37	1.88
d	Premium for 35% fungible FSI @50% OF Land RR Rate	5445.47	2.43
e	Staircase + Lifts premium @ 25% of RR Rate	1617303.51	0.16
f	Open Space Deficiencies [Planning Based Approx]		4.00
g	Land Under Construction [LUC] Tax		0.50
4	**Consultants Fees @ 5% of Construction Cost**	6620476.78	0.66
			14.75
5	**Post Tender Expenses**		
a	Hardship and Inconvenience allowance @ Rs 500 per Sqft of existing Carpet Area [A4 X 500]	5000000.00	0.50
b	Rent Allowance to existing members on existing Carpet area at Rs.50 per Sft average for 30 months	15000000.00	1.50
c	Brokerage [1 Months' Rent]	500000.00	0.05
d	Transport Allowance to and for at Rs.20000/member	3400000.00	0.34
e	Society Additional Area Registration Costs @11% on Residential RR Rate [6% Stamp Duty + 5% GST]	17744151.04	1.77
f	GST on Existing Area	12500000.00	1.25
			5.41

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6	**Operations**		
a	Administrative Costs @2% of Construction Costs	Admin	0.26
b	Marketing and Sales Cost @ 2 % of Sales Valuations + 18% GST	Marketing	1.29
c	Contingency on RS 140 CRS @2%	Contingencies	2.80
d	Development Agreement	DA	8.00
i	Interest on Investment on 40 CRS @16% per annum for 2 years	Interest	12.80
			25.16
6	**TOTAL PROJECT COST**	**CRS**	**45.33**
D	**INCREMENTAL CARPET AREA FOR MEMBERS + SALE CARPET AREA**		**SFT**
1	Total residential carpet area of existing residential tenements [As provided by Society]	SFT	10000.00
2	Additional Carpet Area to Members @35%	SFT	3500.00
3	Balance Residential Carpet Area for Sale [B10-D1-D2]]	SFT	15043.82
4	RERA Residential Carpet Area for Sale [D3 X 1.04]	SFT	15645.57
E	**SALES VALUATION**		
1	100% Sales Volume @ Rs 35000 per sqft of RERA Carpet Area	35000.00	54.76
3	Floor Rise + Amenities + Miscellaneous @ 1000 per Sqft of RERA Carpet Area	1000.00	1.56
4	Total Podium Cost Recovery of no. Car Parks @ Rs. 8 Lakhs	30.00	2.40
5	**Total Sales [E1+2+3+4]**	**CRS**	**58.72**
6	**Profits [E5 - C6]**	**CRS**	**13.40**
7	**Profit %**	**%**	**29.56%**

Table 2. *Profit calculation of project with redevelopment by builder (Source: Author)*

Redevelopment of housing society by self-redevelopment			
No	**Particulars**	**DCR 2034**	
A	**NET PLOT AREA CALCULATIONS**	**SM**	**SFT**
1	Area of Plot of Society as per PR Card	1000.00	10764.00
2	Deductions [5 % Amenity]	0.00	0.00
3	**Net Plot Area [A1-A2]**	**1000.00**	**10764.00**
4	Existing Carpet Area as per Survey.	929.02	10000.00
5	Existing Built-up Area @ 20% increment over Carpet Area [A4 X 1.20]	1114.83	12000.00
6	Existing BUA less balconies [A5 X 100/110]	1013.48	10909.09
7	FSI Consumed	1.01	
8	15% TDR Free of Premium on existing BUA as per DCPR 2034	167.22	
9	10 SM Free TDR per member	200.00	
10	Amenity - Two times TDR	0.00	0.00
11	Ready reckoner rate: Land	117230.00	10890.93
12	Ready reckoner rate: Residential built-up area	110980.00	10310.29
B	**FSI CALCULATIONS**		**SFT**
1	As per FSI 1	1000.00	10764.00
2	Additional 0.50 FSI Available by paying premium to MCGM	500.00	5382.00
3	TDR 0.50 available on plot	500.00	5382.00
4	Additional FSI if any	200.00	2152.80
5	0.5 Additional FSI for Self-Redevelopment 0.5	500.00	5382.00
6	Development Potential as per FSI	2700.00	29062.80
7	35% residential fungible FSI available on existing BUA of Society without paying premium	354.72	3818.18
8	Balance Residential fungible area with Premium	590.28	6353.80
9	Total Development Potential of Site [B6+7+8]	3645.00	39234.78
10	**Total Carpet area potential at 12% reduction for Walls**	**3254.46**	**35031.05**
C	**COMPUTATION OF PROJECT COST**		**CRS**

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1a	Construction Cost @ Rs 2800/- per Sqft of Built-up Area X 1.30 for Staircase + Lifts + Passages + Infrastructure Development + 18% GST	16852122 7.06	16.85
1b	Stilt + Podium Parking Cars (5 lacs per car) (50 cars)	25000000. 00	2.50
2	**MCGM Statutory Payments**		
a	Statutory Development Charges	4689200.0 0	0.47
b	Liasoning Costs B9 X Rs.300 per sqft	11770434. 00	1.18
3	**MCGM Premiums**		
a	Additional 0.50 Premium FSI @50% of LAND RR Rate	5445.47	2.93
b	SLUM TDR @20% of permissible TDR @65% of LAND RR Rate	7079.11	0.76
c	OPEN TDR [@80% of permissible TDR - A8] @40% of LAND RR Rate	4356.37	1.88
d	Premium for 35% fungible FSI @50% OF LAND RR Rate	5445.47	3.46
e	Staircase + Lifts premium @ 25% of RR Rate	1984872.4 9	0.20
f	Open Space Deficiencies [Planning Based Approx]		5.00
g	Land Under Construction [LUC] Tax		0.50
4	**Consultants Fees @ 6% of Construction Cost**	10111273. 62	1.01
			17.38
5	**Post Tender Expenses**		
a	Hardship and Inconvenience allowance @ Rs 500 per Sqft of existing Carpet Area [A4 X 500]	5000000.0 0	**0.50**
b	Rent Allowance to existing members on existing Carpet area at Rs.50 per Sft average for 30 months	15000000. 00	1.50
c	Brokerage [1 Months' Rent]	500000.00	0.05
d	Transport Allowance to and for at Rs.20000/member	400000.00	0.04
e	Society Additional Area Registration Costs @11% on Residential RR Rate [6% Stamp Duty + 5% GST]	25395825. 68	2.54
f	GST on Existing Area	12500000. 00	1.25
			5.88

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6	**Operations**		
a	Administrative Costs @2% of Construction Costs	Admin	0.34
b	Marketing and Sales Cost @ 3 % of Sales Valuations + 18% GST	Marketing	2.77
c	Contingency on RS 150 CRS @2%	Contingencies	3.00
d	Miscellaneous charges		5.00
i	Development Agreement	DA	10.00
j	Interest on Investment on 45 CRS @16% per annum for 2 years	Interest	14.40
			35.51
6	**TOTAL PROJECT COST**	**CRS**	**50.08**
D	**INCREMENTAL CARPET AREA FOR MEMBERS + SALE CARPET AREA**		**SFT**
1	Total residential carpet area of existing residential tenements [As provided by Society]	SFT	10000.00
2	**Additional Carpet Area to Members @35%**	SFT	**3500.00**
3	**Balance Residential Carpet Area for Sale [B10-D1-D2]]**	**SFT**	**21531.05**
4	**RERA Residential Carpet Area for Sale [D3 X 1.04]**	**SFT**	**22392.30**
E	**SALES VALUATION**		
1	100% Sales Volume @ Rs 35000 per sqft of RERA Carpet Area	35000.00	78.37
3	Floor Rise + Amenities + Miscellaneous @ 1000 per Sft of RERA Carpet Area	1000.00	2.24
4	Total Podium Cost Recovery of no. Car Parks @ Rs. 8 Lakhs	30.00	2.40
5	**Total Sales [E1+2+3+4]**	**CRS**	**83.01**
6	**Profits [E5 - C6]**	**CRS**	**32.93**
7	**Profit %**	**%**	**65.75%**

Table 3. *Profit calculation of project with redevelopment as self-redevelopment*

(Source: Author)

Sr.No	Particulars	Builder	Self-Development
1	Area of Plot	1000	1000
2	Max FSI Permissible	2	2.5
3	35% Fungible	0.35	0.35
4	Total FSI Permissible Carpet Area	31,969 sq.ft	39,234.78 sq.ft
5	Total Premiums to MCGM	15.09 CR	15.83
6	Total Project Cost	45.33 CR	50.08 CR
7	Returns	58.72 CR	83.01 CR
8	**Profit Percentage**	**29.54%**	**65.75%**

Table 4. *Cost comparative summary by two construction schemes (Source: Author)*

Comparison of the normal redevelopment against self-redevelopment clearly suggests that, **Higher FSI & Area Utilization**: Self-development allows for greater area construction.

Higher Costs but Higher Returns: While self-development incurs higher expenses, the financial gains far outweigh the costs.

Profitability & Financial Control: The self-development model ensures higher profit margins and greater control over project execution.

Challenges of Self-Development: While financially beneficial, self-redevelopment requires efficient management, financing and execution, which may be challenging for some societies.

Thus, if a housing society has the financial capacity and managerial expertise, self-development is the preferable option due to its significantly higher profitability and control over the project.

7. Conclusions and recommendations-

7.1 Software application:

An Application (App) is proposed to facilitate the information of procedures and can guide a person/society member throughout the entire redevelopment procedure step by step.

The Input and Output Data will be as shown:

INPUT INFORMATION

1. CTS No. of the Society

OUTPUT INFORMATION

1. Maximum Available FSI under different schemes.
2. Requirement of Different NOCs.
3. Reservations on the Plot.
4. Maximum Height Available.
5. Stepwise Procedure for the Redevelopment.
6. Current Documents with BMC of the Plot.
7. Any Liabilities of Society towards BMC.
8. Info about Architects nearby for Feasibility Report for a detailed one.

Basic Feasibility report.

And so on...

7.2 Formulation of builder / developer financing scheme:

A Builder can provide the finance for the self-redevelopment projects.

This finance can be capped to a max of 25 % of the Project cost/ Construction cost of the project.

In return the builder gets additional transfer of development rights (TDR) worth the invested amount, which can be used in Re-development project of Scheme 33(7) B within same ward or adjacent ward.

At the same time, the society gets the required finance and can proceed with self-redevelopment and avail all the benefits of self-redevelopment.

Whereas, the developer can use the TDR in his personal projects in the city.

Benefits of the scheme:

This scheme addresses key challenges and provides significant benefits to stakeholders in the construction and redevelopment sector through the following measures:

Addressing Pre-Construction Financial Challenges:
The scheme enables funding for stalled self-redevelopment projects facing financial constraints, thereby resolving their pre-construction finance issues and ensuring project continuity.

- **Enhancing Feasibility Under DCPR 2034 (33(7)B:**
  By rejuvenating the existing 33(7)B scheme, the provision of an additional TDR of 0.25 enhances project feasibility, encouraging more redevelopment initiatives under the Development Control and Promotion Regulations (DCPR) 2034.
- **Enabling Cross-Project Benefits:**
  Developers can leverage this scheme to generate extra FSI, which can be utilized for other projects that are not feasible under the 33(7) B framework, thereby promoting a balanced and sustainable approach to project planning.

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Investigating Social Risk Factors for Metro Project: Case of Pune

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Abstract: *Pune Metro is a rapid transit system designed to improve urban mobility in Pune, India. Construction began in 2016, and the project aims to connect key areas of the city to reduce traffic congestion and pollution. The metro network consists of multiple lines, with elevated and underground sections. The study in this research paper analyzes the social risk factors associated with the Pune Metro Project, focusing on the effects of metro usage and the inconvenience experienced by commuters during construction. The research investigates the model shift to metro transportation, assessing how well the proposed routes and schedules align with the needs of local residents. Through Questionnaire survey, the study observed shows crowd levels during peak hours, revealing significant congestion and dissatisfaction among users. Additionally, the analysis highlights the traffic jams caused by ongoing construction, which exacerbate travel difficulties for residents reliant on alternative modes of transport. Findings suggest that while the metro promises to alleviate urban traffic issues, the current planning and design processes does not adequately address commuter needs, leading to increased inconvenience. The study emphasizes the importance of developing a more user-friendly metro system that incorporates feedback from the community. From findings and analysis, the conclusion could be made to improve the construction process, such as implementing better traffic management strategies and enhancing communication between project authorities and residents. By prioritizing the needs of commuters and mitigating social risks, the Pune Metro Project can achieve its goals of sustainability and accessibility, ultimately developing a more effective public transportation system that benefits all citizens.*

Keywords: Pune Metro Project; metro usage; commuter; model shift; social risk

1.Introduction-

Infrastructural projects result in economic development of a country. There are different types of infrastructure projects like dams, bridges, tunnels, roads, airports and metro rail projects being one of them. These projects have direct interface with human being, thus making it more socially sensitive yet these projects are also important for efficient running a city. Each infrastructure project has many Risks associated with it. Metro rail project involves many stakeholders due to which the risk management becomes more complex and needs to be addressed. For an effective / good performing infrastructural project, identification of the risk and its mitigation is crucial right from planning to implementation of project.

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Following factors affect for any Infrastructural Project:

- Fail: because of any human / technical errors
- Use of infrastructure: meaning the project is completed but not used much by public itself
- Successful: win – win situation to both

Metro Rail Projects in India

There are fifteen Indian cities that have an active metro rail service and an operational metro map. The cities included in metro route map of India are Kolkata, Delhi, Chennai, Bengaluru, Hyderabad, Ahmedabad, Jaipur, Gurugram, Mumbai, Noida, Kochi, Lucknow, Nagpur, Kanpur, and **Pune**

(Indian Metro Rail Networks: History, Indian Cities Metro List, 2024).



Figure 1. *Indian Metro Rail Projects*

[source – https://www.mapsofindia.com/maps/metro-maps.html]

Figure 1. represents the Indian Metro Rail projects; in this the cities marked in green highlights city with operational metro network. The cities marked in red show that the cities are under construction for metro network, and the cities marked in blue indicate that the metro network is in the planning stage.

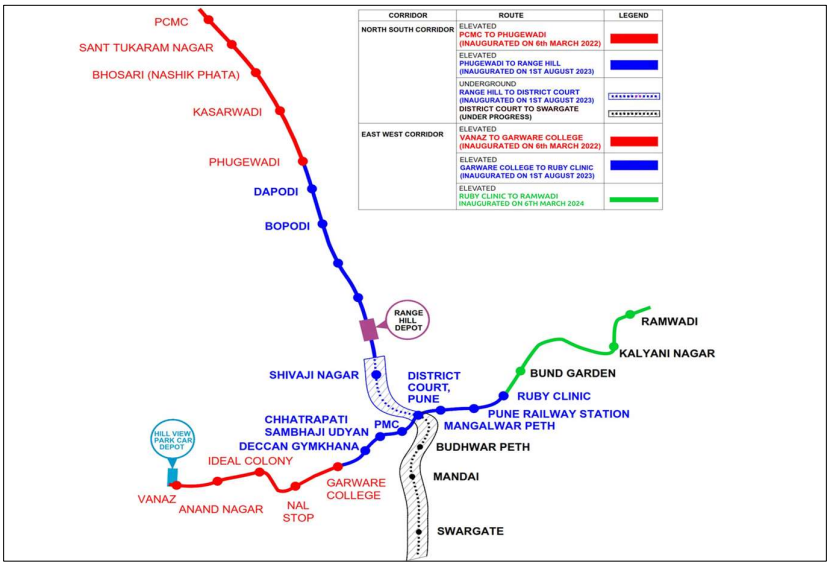


Figure 2. *Map of Metro Corridors of Pune.*

[Source: Pune Metro Rail's website https://metrorailnews.in/pune-metro-sets-june-deadline-for-civil-court-swargate-metro-services/]

The complete metro system of Pune is divided into 2 corridor system North-South corridor and East-West corridor. The lines indicated in blue, red and green are the elevated metro system whereas the line indicated in dotted from Shivajinagar – Swargate is the underground metro system. [refer fig 2].

Current operative routes of Pune metro are from PCMC-Swargate and Vanaz-Ramwadi.

The Pune Metro project is a rapid transit system currently under development in Pune, Maharashtra, aiming to reduce the city's severe traffic congestion and provide a sustainable mode of urban transportation. Although infrastructure projects of this nature have numerous benefits, they can also bring about complex social challenges, particularly in densely populated areas. Environmental effects, public opposition, livelihood loss, and displacement are examples of social risks that can cause project delays, increase expenses, and harm local community's perceptions.

The purpose of the paper is to analyse these social risk factors in relation to the Pune Metro project. The study focusses at the model shift to metro transportation and assesses how well the recommended routes and schedules meet community needs. The results of this study, which analyses crowd levels during peak hours using a questionnaire survey, indicate significant congestion and user dissatisfaction.

The research additionally highlights how traffic delays caused by ongoing construction make it harder for commuters who rely on alternative modes of transit for travelling around. The study highlights how important it is to design a more user-friendly metro system that considers community input. Improved traffic management strategies are needed. Putting commuter needs first and lowering societal risks will help the Pune Metro Project achieve its sustainability and accessibility goals. This will ultimately result in a more efficient public transport system that benefits every citizen.

2.Literature Review:

Urban metro projects are often seen as crucial solutions for reducing traffic congestion, pollution, and travel times in rapidly growing cities. However, they frequently face significant social risks that can delay implementation, increase costs, and generate negative public sentiment. Displacement of communities, disruption of local businesses, effects on the environment, and public opposition are social risk concerns in metro projects. The main social risk factors in metro projects are highlighted in this study of the research, with an emphasis on how they affect metro projects in places like Pune. These variables include displacement, environmental concerns, perceptions from the public, and social equity.

Urban infrastructure projects can pose threats to the **cultural identity** of neighbourhoods. **Chen and Lin**, 2017 state that “a community's identity is usually focused on its cultural landmarks, and when these are disturbed, opposing reaction could occur." The noise, vibration, and dust produced by construction activities lower the standard of living for communities. **Sahoo (2018)** highlights that "because of the **dust and noise pollution**, people who live close to construction sites often complain of respiratory problems." **Infrastructure growth** may result in less green space and deforestation, both of which have adverse impacts on the environment. In the case of the Mumbai Metro, for instance, the proposal to cut down trees in Aarey Forest led to massive protests. **Iyer and Sharma (2019)** observe that "**deforestation** is a major societal risk in metro projects because of the increased public awareness of environmental preservation”. Studies indicate that a **lack of public engagement** leads to distrust and offense. **Taylor and Jones (2021)** state that "participation of the community in decision-making increases public trust and decreases opposition”. They cite the Bangalore Metro as an example, where proactive public engagement minimized social resistance. News sources and social media may increase perception of the public disapproval for infrastructure projects. **Sinha (2018)** notes that "**project schedules** have been impacted by the quick mobilization against perceived societal risks brought up by social media's viral nature". **Singh and Patel (2017)** states that **affordable and inclusive transportation** is essential for low-income communities that rely on public transit. Also, the reason that "metro projects should prioritize affordability to ensure they benefit all social classes". **Mishra and Kulkarni (2020)** states that **marginalised communities** often feel overlooked in the planning and advantages of metro projects in Pune and other cities of similar types.

Also, it is observed that "transport infrastructure projects need to address the needs of marginalized groups to avoid reinforcing social inequalities".

Urban metro projects are crucial for reducing traffic congestion, pollution, and travel times in growing cities. However, they often face social risks such as displacement of communities, disruption to local businesses, environmental impacts and public opposition. Cultural landmarks, dust, noise, and vibration pollution can cause respiratory issues and environmental concerns. Public engagement can lead to distrust and offense, while social media and news outlets can increase public sentiment and opposition. Affordable and inclusive transportation is essential for low-income communities, and transit infrastructure projects should prioritize affordability to benefit all social classes. In cities like Pune, marginalized communities often feel neglected in planning and benefits, and transport infrastructure projects need to address their needs in order to prevent socioeconomic inequality from getting worse.

3.Methodology:

A comprehensive literature review of urban infrastructure projects and metro projects helped in identifying the social risks involved in metro projects. Questionnaire survey form was prepared to address the social risk for Pune metro, this form was reviewed from experts and further distributed the survey at metro stations, online platforms, public areas near metro services. Sample considered was metro users and non-metro users and stratified sampling method was adopted. This survey was conducted during peak hours at stations to ensure diverse responses.

The second method adopted is social media elicitation to set the dynamic and real-time data regarding social issues; where newspaper, clip, radio and TV channel reports were studied.

4.Analysis and discussion-

Responses received from the questionnaire survey were analysed and discussed to understand social risk perception and experiences regarding social risks.

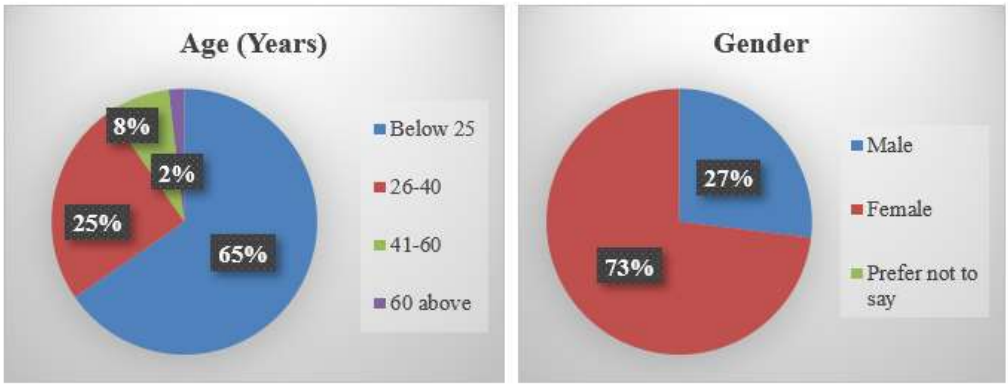


Figure 3. *Age and Gender*

Demographic data collected during metro survey serves various purposes and plays an important role in planning, and evaluating metro projects. This data ensures the metro system is efficient, equitable, and meets the unique requirements of the community it

serves. It is observed that more than **65% age** group is below 25 which means that the crowed which approaches the metro are mostly of student age group. Also, about **73% female** prefer the metro use. [refer Figure 3]

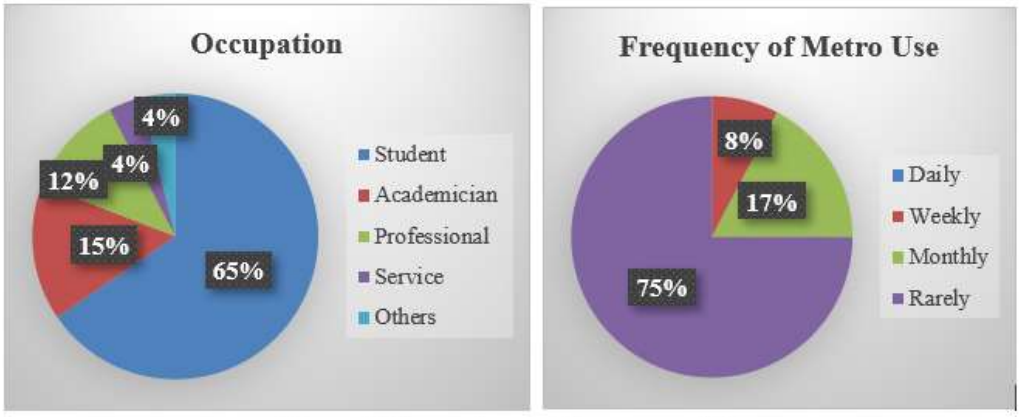


Figure 4. *Occupation and Frequency of Metro use*

The **occupation data and frequency of metro use** data in a metro survey helps to understand the commuting patterns, preferences, and needs of different groups of metro users. About 65% of crowed are the commuters from students, 15% academician, 12% professional and remaining service and others. It is observed that about 75% of commuters rarely use metro this means that there is not much use of metro done by public, recently it is seen that people are now approaching more use of metro to avoid traffic and convenient mode for transport. [refer Figure 4]

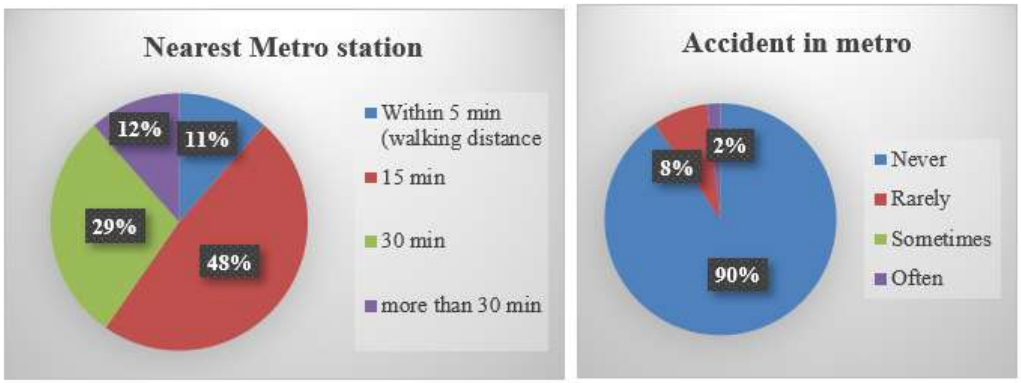


Figure 5. *Nearest Metro station and Accident in metro*

The above figure represents the **nearest metro station** from the locality of all social communities, it is observed that 48% of commuters have metro station more than 15 minutes from their locality, 29% commuters are having metro station about 30 minutes and 12 % commuters show that the metro station is more than 30 minutes; thus, people use other mode of transport (like car / bike /	From the **accident** witnessed or experienced in the metro station by all social communities, it is observed that more than 90% public have not witnessed any accident incident in Pune metro. [refer Figure 5]

rickshaw / bus / bicycle) to reach the metro station. [refer Figure 5]	



Figure 6. *Accessibility and safety in metro*

From the **accessibility** rate of metro station for individual and all disable people, it is observed that more than 65% crowd say that the services like elevators, escalators and ramps are properly provided with taking into consideration of universal design. [refer Figure 6]	From the **safety** factor for all social communities, it is observed that more than 50 % crowd say that the metro travelling is safer and more reliable. [refer Figure 6]

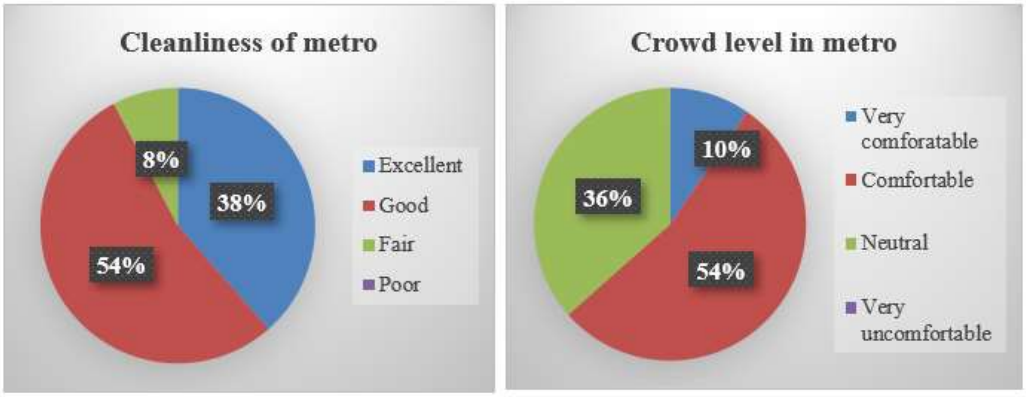


Figure 7. *Cleanliness and crowd level in metro*

The **cleanliness** factor of metro station shows a very good response from the commuters (38% and 54%), it is observed that the metro stations are clean and maintained properly with good hygiene. [refer 7]	It is observed that about 54% public feel the crowd is comfortable during the peak hours whereas 36% public feel the **crowd level** at metro stations are neutral during peak hours depending upon the locality/area of the metro station situated. [refer Figure 7]

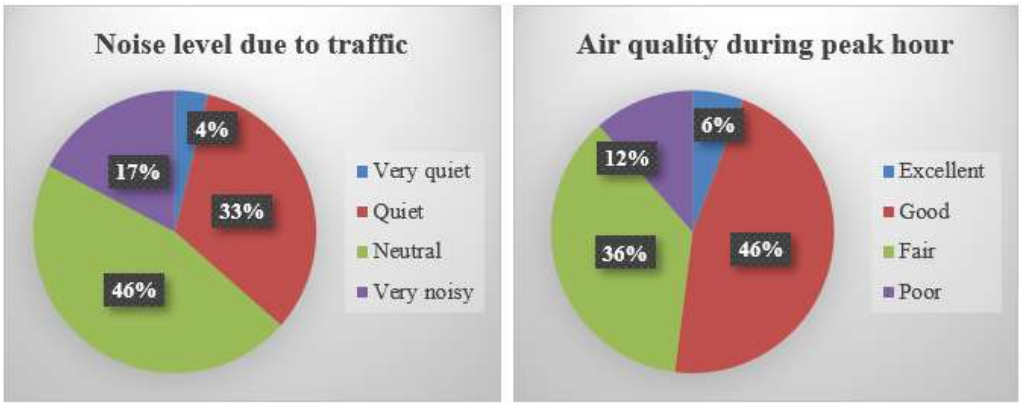


Figure 8. *Noise level due to traffic and Air quality during peak hour in metro*

It is observed a mixed response from the social communities depending upon the metro locality. These noise levels vary during the peak hours (day, evening and night). The crowd of about 46% feel neutral whereas 33% feel quiet of the **noise level** caused due to traffic jams near metro stations. [refer Figure 8]	Air quality data was collected to assess the **environmental impact** of the metro system on its passengers and surrounding community. It is observed a mixed response where 46% and 36% people feel good / fair air quality whereas 12% people say the air quality is poor during the peak hours depending upon the metro locality. [refer Figure 8]

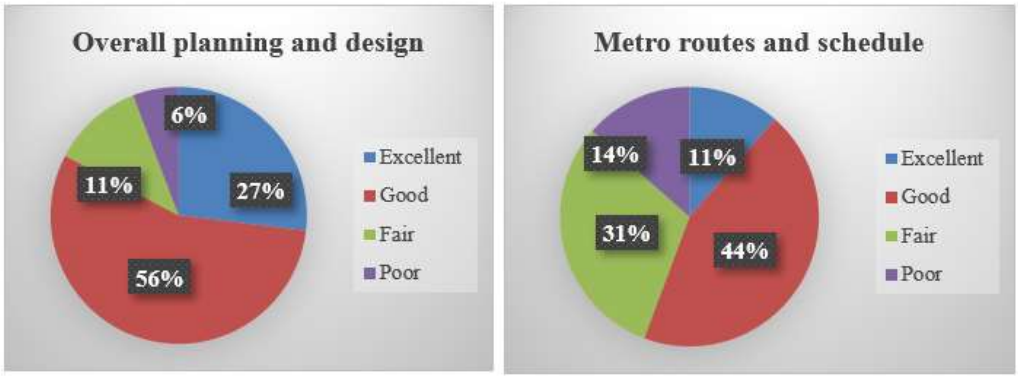


Figure 9. *Overall planning & design and Metro routes and schedule*

From the **overall planning and design** of metro system, it is observed that 56%-27% people say that the planning of metro system is well designed by taking into consideration all age and criteria users. [refer Figure 9]	From **metro routes and schedule** convenience, it is observed that 44%-31% people say that the timings of metro schedules are convenient but 14% people suggest more routes towards other cities to be extended so that more users will be able to approach this metro system. [refer Figure 9]



Figure 10. *Hygiene standards and inconvenience due to metro construction*

Through the **hygiene standards** in metro station, it is observed that 62% people say that the sanitation facilities along with trash bins are provided and maintained properly to ensure good public health. [refer Figure 10]	From the **inconvenience caused due to metro construction**, it is observed that 33% people face inconvenience due to ongoing construction system which is leading to more traffic jam, noise and air pollution also it is indirectly affecting public health. About 27%-15% people gave neutral/rare response depending upon the locality of the metro situated. [refer Figure 10]

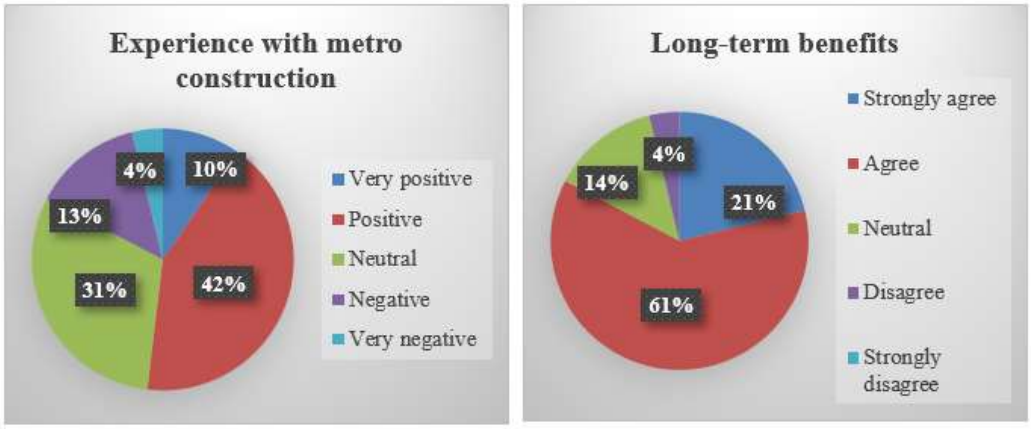


Figure 11. *Experience with metro construction and long-term benefits*

Through **overall experience** of users and social communities with metro construction, it is observed that 42% people feel positive about the metro experience. Since the metro construction is new a new phenomenon in Pune city; time will require to all social community to switch to the new mode of transportation. [refer Figure 11]	From **long-term benefits** of metro construction, it is observed that 61% people feel that this metro construction will benefit long-term to social communities since all inter-cities are now being connected through single route line. [refer Figure 11]





Image 1. Traffic Congestion. source: TNN / Updated: 8 Feb2023, 06:06 IS (TOI, 2023)	Image 2. Social issues at Yerrwada station, Pune. source – Author
The newspaper cuttings of **traffic congestion** show that due to on-going metro construction public face a lot of traffic congestions. The routes become more narrow causing problem for all the light motor vehicle and heavy loaded vehicles to move. [refer Image 1]	The above image shows the **social issues at Yerrwada metro station**, it is observed that the rainwater-drainage system is inappropriate which is causing problem to local people. [refer Image 2]





Image 3. Traffic congestion source Hindustan Times, Pune Jul 26, 2017 03:04 PM IST (Deshpande, 2017)	Image 4. Traffic congestion - university road Pune (Service, 2024)
The newspaper cuttings of **traffic congestion** metro station show that traffic police caught several commuters breaking rules by riding on the wrong side of the road thus, increasing traffic jam near Kharalwadi area.	The newspaper cuttings of **traffic congestion** metro station show that the traffic at university road has got worsen day-by-day due to on-going metro construction and road-diversions.

Through above analysis it is observed that social risk is a major factor for metro, issues like traffic congestion, air and noise pollution, inconvenience caused due to construction are mostly experienced, more of metro routes and schedules to other cities to be provided so that more cities will be connected.

It will take time for all the social group to shift to the new form of transportation because the metro construction is a recent development in Pune.

7. Conclusion and Recommendation

The Pune Metro project underscores the importance of addressing social risk factors in urban infrastructure development. By actively managing social risks—such as displacement, environmental impact, and community perception—the project can improve its acceptance and mitigate delays. Implementing the above recommendations can help to mitigate social risks associated with the Pune Metro project, enhance public support, and ensure a smoother transition to a sustainable urban transportation system. A focus on community engagement, equitable practices, and efficient traffic management will play a pivotal role in the project's long-term success.

Comprehensive Resettlement Plans can develop fair and transparent resettlement policies that include compensation for land, property, and livelihoods. Eco-Friendly Construction practices to adopt techniques so as to reduce noise, dust, and emissions during construction. Use barriers to minimize the spread of dust in residential areas. Design metro fare policies that cater to all income groups, ensuring accessibility for low-income individuals. Introduce concessions for students, senior citizens, and economically weaker sections.

Implement well-planned road diversions with clear signage and real-time updates to minimize traffic disruptions during construction. Arrange staffs to manage peak-hour traffic at critical junctions and ensure smooth vehicular movement around construction sites. Plan additional routes in high-demand areas, including suburban zones and underserved neighbourhoods, to increase metro accessibility and reduce dependency on private vehicles. Prioritize metro extensions to connect industrial areas, IT hubs, educational institutions, and other economic centres to enhance regional mobility.

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Suggesting guidelines and policy framework to upgrade living conditions of construction site workers in under-construction Residential buildings across Mumbai.

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Abstract: *It has been observed that workers' onsite accommodation is given a secondary concern while construction is underway, especially in metropolitan cities like Mumbai. The quality of this accommodation is mediocre due to a number of factors including limited site area, insufficient financial apportionments, and lack of importance placed on the workforce. This carries a negative impact on their physical and mental health, thereby bringing down productivity.*

Site workers' accommodations have rarely been thought of in a sensible manner as practically they do not yield any direct economic returns. It is a widely accepted fact that manpower planning is equally important, akin to equipment and finance planning. If the physical, emotional, and psychological wellbeing of workers is assured, it will certainly improve their efficiency. Thus, it is imperative to integrate labor facility management with the construction process.

The research aims to explore methods for the upgradation of living conditions of construction workers on sites in Mumbai, with respect to the provision of basic amenities, building materials and techniques used for constructing them, and social inclusion. It attempts to study available authority guidelines and their implementation. Both qualitative and quantitative research methodologies are used for analyzing existing conditions, studying norms, and identifying best practices in and outside the country including community-led development through case studies, suggesting remedial actions, and defining future trajectories. Research concludes with recommendations and suggestive measures to upgrade living conditions of site workers to improve the productivity.

Keywords: Transit accommodation; Construction workers; Site facility management and Upgradation; Social inclusion; Community-led development.

1.Introduction

Transit accommodation has its roots in India from early 1900s when British government-initiated construction of labor colonies for accommodating labors engaged in various civil works. Reports reflect the dismal living conditions in these colonies right from the beginning. The situation did not improve even in the post-independence era. It was only in 1990s that a need was felt to address this issue and subsequently some norms were floated towards improving living conditions of the construction site workers (Portable, 2023).As a result of these efforts, *Building and other construction workers* (BOCW) Act came into existence.

Construction sector contributes a significant share to the nation's economy and is consistently experiencing a rapid growth. Owing to ample availability of local as well as migrant workers, there is never a shortage of construction workers on site, especially in metropolitan cities like Mumbai. In order to regulate and organize the construction activities, a site facility management team is usually constituted. It is responsible for

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providing temporary facilities which support construction activities, including provision of transit accommodation for workers.

The developers are generally unwilling to invest much in these transit facilities as they do not directly yield any returns, due to which the workers basic needs are often neglected. Predominantly rooms made from corrugated metal sheets are provided, without any windows, resulting in discomfort due to inadequate natural light and ventilation. The sanitation & hygiene is found to be of a poor quality, as a result of which the workers suffer from serious health issues. They thus face a hard time struggling with the substandard quality of temporary facilities provided on site which have a negative impact on their overall productivity as well as it often results in erroneous output.

Rationale of the Study

In addition to planning of manpower required on site, planning of their work environments is equally important as these facilities are crucial for the physical and mental wellbeing of the workers. The provision of transit accommodation requires low investments in proportion to the overall project cost and also in terms of the intangible benefits derived. Hence it is essential to properly plan these areas so that workers can perform their tasks efficiently.

The research focuses on examining the amenities provided to construction workers on site. Central government had issued guidelines for provision of welfare measures and site facilities for the workers in the form of BOCW act (Code, 2023),which gave state governments the freedom to implement it with necessary changes as per their discretion. The basic needs were overlooked in the process of modification (Ministry of Labour, The Building and other Construction Workers‘ (Regulation of Employment and Conditions of Service) Act, 1996 , 2023).Moreover, the government has now amalgamated all labor laws into four codes, which are completely bereft of the any specific guidelines towards these provisions.

The objective of the research is to study the existing scenario in provision of transit accommodation for Construction workers on sites in Mumbai as a part of Site Facility Management by mapping the current practices, to study and list down the mandatory provisions under relevant acts and identify the grey areas, giving suggestive measures for improvement wherever required. It also targets to explore Best Practices towards the provision of worker accommodations on site in other Indian states and across the world, in terms of key features like, welfare measures for children’s education, Regulatory laws towards effective implementation of welfare facilities and utilization of cost-efficient Building materials. As per BMC records in April 2023, there were around 11,125 active construction sites in Mumbai Metropolitan Region (Baliga, 2023).

Improvement in transit accommodation for construction workers living at the worksite is possible only when both private and public entities undertaking construction projects, change their current approach, owing to state regulations or their own initiatives. The

work environment at site should be designed considering the aspect of social sustainability and aim at providing decent working conditions to the workers that will ultimately improve their productivity.

1.2 Materials and Methods

Quantitative and Qualitative research methodology has been adopted.

1.2.1 Qualitative data collection is done through online and book case studies.

Both central and state government Acts pertaining to the construction workers were studied along with the provisions in them for transit accommodations on site & the subsequent amendments made. The guidelines provided by International Labor Organization for workers accommodation were also explored. In order to understand best practices in prevailing codes across the globe, Temporary construction site workers' amenities and accommodation - Code of practice, Malaysia was studied.

Three online case studies were identified and documented for specific exemplary features a) Improving quality of life of construction workers through Sustainable practices- transit homes by Eco tech at Haldwani Uttarakhand, b) Safer and more dignifying work conditions with the use of low embodied energy building materials- Construction Workers Housing at Bhopal. c) Creating social impact through inherent strategies for the upliftment of children residing on construction sites through education – CWH Colony at Changodar, Ahmedabad (Gujarat). Findings from the Literature review and primary data were analyzed in observations that helped in formulating recommendations.

1.2.2 Quantitative data collection is done through Primary survey.

Two case studies were undertaken at construction sites in Mumbai suburb, to comprehend the existing scenario towards provision of workers accommodation. A structured survey was conducted through questionnaire and interviewing construction workers, contractors and developers.

2 Literature Review:

2.1 Transit accommodation for Construction Workers at site: Regulatory Framework

As discussed earlier, in order to standardize and regularize the living and working conditions of site workers, the BOCW norms came into picture in 1996. The literature review discusses the implementation of the act and subsequent amendments made in the act.

2.1.1 Building & Other Construction Workers (BOCW) norms by central government:

Labor laws pertaining to Health, Safety and Welfare measures at construction sites are: The Building and Other Construction Workers (Regulation of Employment and Condition of Services) Act, 1996, Central Rules 1998 and State rules, Building & Other Construction Workers' Welfare Cess Act. These acts are applicable to establishments employing 10 or more workers. Sections 32 to 37 of BOCW Act lay down the provisions of accommodation for workers with separate cooking area, canteen where up to 250 workers are working and provision of a creche for children up to age 06 years wherever 50 or more female workers are employed. Under the BOCW cess Act, 1 to 2 per cent of the total cost of every construction project worth over Rs 10 lakh, must be submitted to the Labor Department as 'welfare cess' meant to be utilized for various schemes meant for labor welfare.

2.1.2 Building & Other Construction Workers (BOCW) norms by state government:

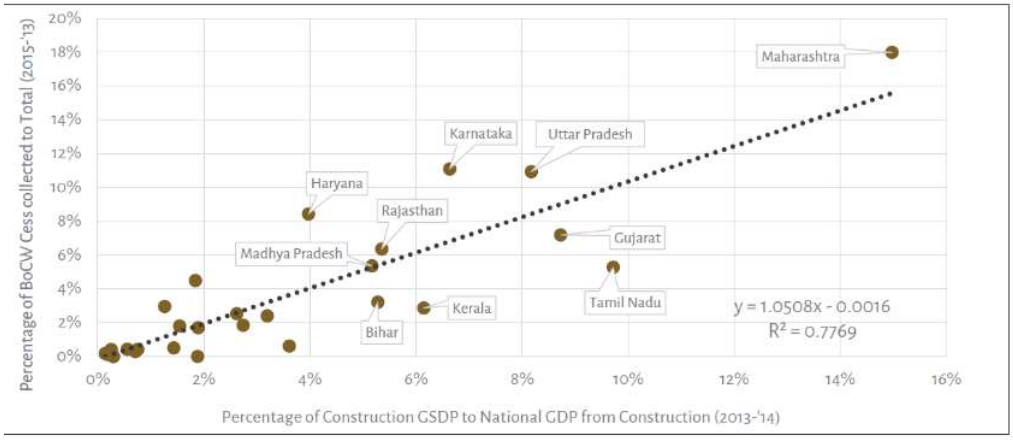


Figure 1- *Relation between Construction GSDP & Cess Collection.*

(Source:https://www.researchgate.net/publication/337150887_Evaluating_the_welfare_framework_for_building_and_other_construction_workers_in_india/link/5dc7acad299bf1a47b2764a0/download)

Enactment of Acts at State level and modifications: Under the Section 40 and 62 of the BOCW Act, the State governments were given the freedom to make changes in this act before implementing it at state level. The provision of accommodation for the construction workers was eliminated in BOCW Act of Maharashtra. The lower limit for collection of cess was modified to construction projects worth 5 lacs. The state collected 14% of nationwide cess and spent 4% (Shamindra Nath Roy, 2017).

Only 6 % of labourers had been enrolled to avail benefits of the welfare schemes.

2.1.3 Status of enforcement of Acts and Intervention of Supreme Court:

Parliamentary standing committee formed in 2012 found out several gaps in implementation of the existing Acts. In 2018 Supreme Court issued direction to the

ministry of labor and employment for effective implementation of the BOCW Act and Cess Act and further instructed them to frame one composite Model Scheme for benefit of construction workers in consultation with all stakeholders including NGOs who are working at the grassroot level with the construction workers (Administrator, 2018).

2.1.4. Amalgamation of Labor Laws and their impact on existing provisions:

In 2019, the Central Government came up with the proposal of consolidating the various labor laws into four codes: the Industrial Relations Code 2020, the Code on Wages 2019, the Code on Social Security 2020 and the Occupational Safety, Health and Working Conditions Code 2020 (Bill on Occupational Safety, Health and Working Conditions, 2020; PRS. , 2020) . Subsequently Building and Other Constructions Workers' Welfare Cess Rules, 1998 was merged into the social security code and The Building and Other Construction Workers (Regulation of Employment and Condition of Services) Rules, 1998 into Occupational Safety, Health and Working Conditions Code 2020, that are still in the incipient stage of implementation and formulation respectively, at the state level. Some of the major changes with respect to the BOCW workers are framing of skill development & awareness schemes and provision of bathing spaces, canteens, transit accommodation or hostel facility, creche etc. to the beneficiaries as may be prescribed by the Central Government. It also gives a uniform threshold for these provisions to be available at all establishments.

2.2 Recommendations of temporary housing for workers as per International Labor Organization:

The ILO recommends that the housing provided to workers should follow certain specifications ensuring a decent living environment (Accommodation, 2009).It also specifies standards based on the number of occupants, sanitation facilities, health and safety measures and frequent inspections to monitor them. It also suggests consulting the future occupants on their needs and aspirations, while designing these facilities.

2.3 Best Practices Attributes of Transit Accommodation model in other countries:

MS 2593:2015(Malaysia)- Temporary construction site workers' amenities and accommodation Code of practice - It was devised with the objective of specifying the minimum requirements and spatial standards for construction workers accommodation and amenities on site ensuring their welfare, safety, security and health. It classifies construction works into several categories and mentions the types of facilities to be provided, along with guidelines for their management and maintenance. It also gives specifications for various amenities and mandates that the sleeping area or resting area shall not be less than 3 sq.m. per worker, giving other spatial standards as well. Temporary construction site workers' amenities management team must be formed that will provide written management plan and policies as well ensure their implementation. Community relations management plan can be given to measure community impact assessment. It suggests that the code of conduct related to these amenities be a part of the construction contract documents. A safety committee shall be established where

amenities have been provided for 40 or more workers. The employer needs to set up the consultation and grievance mechanisms

(Yaman Siti Khalijah, 2020).

2.4 *Initiatives for Construction Workers Housing in other Indian States -online case study:*

Three online case studies were identified as best practices in terms of key features of sustainability & community pockets, building materials and other welfare measures respectively.

2.4.1 Case study 1:

Upgrading quality of life and facilitating sense of community spirit through provision of communal spaces and sustainable practices: Proposed Construction Workers Housing at Haldwani (Uttarakhand)- Team Echo developed a Model fabricated using modules that can be conveniently stored, transported, assembled, maintained and dismantled on site. (Solar Decathlon, 2023)

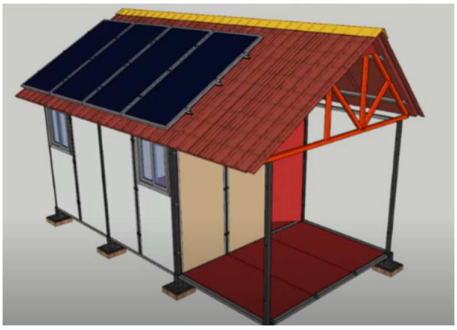




Figure 2 & 3 (Below): *Proposed CWH at Haldwani, Uttarakhand*

(Source: https://www.youtube.com/watch?v=fWndbE_ONTU)

Project site -200 Bedded Hospital at Haldwani (Uttarakhand)

CWH for 72 workers is proposed on a site of 70 m x 30 m.

Safety, Comfort, Convenience, Maintenance and Affordability were the key concerns. Orientation of these units is considered with respect to sun path for optimal thermal performance. Ample daylight will help in saving energy. Community pockets have been carved out to promote social cohesiveness and sharing of resources. Verandah has been provided outside the units that doubles up as an interactive space. There is also a provision of creche for early childhood learning and medical facility on site.

Parabolic solar cookers will serve as shared cooking resources in open kitchen to promote energy efficient cooking and to instill the sense of community living and togetherness amongst the workers. Mobile toilets with bio digestors are proposed for

minimum residue production. Portable STP has been provided. ETP treats grey water which is used for gardening. A module is dedicated to services including water pump, electrical panels, batteries, surveillance monitors and an executive room. For maintenance, the units are priced at an affordable price of INR 60/- per construction worker per day.

2.4.2 Case study 2-

Enriching the quality of life and reducing carbon footprint by using efficient materials and construction techniques: Proposed Construction Workers Housing, Bhopal by Econique. Residential units provided are of two types: For single and family. (Decathlon, 2023)





Figure 4 & 5: *Proposed CWH at Bhopal by Econique*

(Source: https://www.youtube.com/watch?v=BQ22AYZSAyQ)

Material Palette: Rockwool, Bamboo mat corrugated sheets, Bamboo, Low emittance glass fiber Gypsum panel. Fiber cement board.

The housing units comprise of thermally insulated wall panels, and eco-coolers. At the community level, there is a provision of biogas systems, urine diversion dry toilets, and root zone treatment plants. It has been designed considering energy performance, water performance, and low embodied carbon emissions. Key features include affordability, ease of installation, low transportation cost and recyclable.

2.4.3 Case study 3-

Creating social impact by catering to children's education Construction workers housing colony, Nebula Infraspace's Aavaas, Changodar -Ahmedabad. Workers living in labor colony-400-500; Land was provided by developer on project site. Construction cost of labor colony – 70 lacs. The developer engaged a CSR consultancy firm. (Desai, 2020)

It provides subsidiary social infrastructure, including low priced shops, healthcare facilities and education. A multi grade multi learning technique adopted for inclusive & age-appropriate learning. Children were divided into 3 age groups: up to 3 years, 3-5 years, and bridge class was conducted for children of 5-15 years.

2.4.4 Building Materials and Indoor Environment Quality-



Evaluating indoor environmental quality of onsite construction workers housing in Pune, India through performance-based simulation- A previous research undertaken examines the indoor environmental quality of onsite housing for construction workers by analyzing it in terms of building materials, and comfort level. Simulation studies were conducted to analyze the annual performance.

(Sayali Andhare, 2015)

Figure 6: *Teaching & learning in crèche (Source: https://indiahousingreport.in/resources/resource-reports/living-at-worksites-policy-and-governance-for-migrant-worker-housing-in-ahmedabads-construction-sector/)*

2.5 collection of primary data

2.5.1 Live case study

In order to understand the nature of amenities provided for construction workers on site, two case studies were conducted, at under construction sites in Mumbai sub urb. The findings were analyzed to understand the nature of amenities provided to the construction workers on site. To maintain confidentiality, the project particulars have not been included.

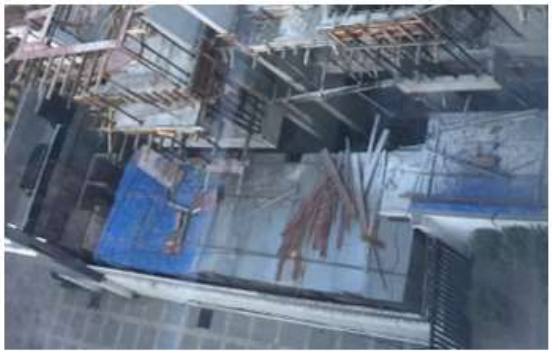




Figure 7 & 8: *View of Construction workers housing at Site 1 and Site 2*

(Source: Authors)

2.5.2 The contents are summarized in the table below-

S. No.	Primary Data Analysis		
	Description	***Case Study 1***	***Case Study 2***
1.	Site Facilities for Workers		
	No. of Rooms	3	14
	No. of occupants per room	4	4-6
	Room Size	8'x10'	8'x10' and 12'x15'
	i.Material Specifications a. Walls and Roof b.Flooring	Corrugated Metal Sheets PCC	Corrugated metal sheet partitions created at the 2nd level podium to serve as rooms. RCC Slab
	ii.Ventilation	Only door opening	Open from one side with just a parapet wall.
	iii.Toilets	2 WC's using PVC Sheets	Mobile toilet facility.
	iv.Bath Area	1 No. constructed using corrugated sheets	6 No. using constructed using corrugated sheets.
	v.Provision of Family accommodation	None	None
	vi.Kitchen area	None	None
	vii.Site Office	Modular system using PVC Sheets	Modular system using PVC Sheets
	viii.Medical Facility	Checkup conducted once a week	Checkup conducted twice a month.
	ix.Other facilities	Water, Electricity, Insurance	Water, Electricity, Insurance
	x.Welfare facilities- creche, education etc.	None	None
2.	Responsibility of providing Site facilities	Contractor (as per contract agreement)	Developer
3.	Maintenance of Site facilities	1 supervisor per 50 workers	1 supervisor per 50 workers
4.	Collection of Cess fund	Yes	Yes
5.	Collaboration with NGO	None	None
6.	Random Inspection by BMC officials	Yes	Yes
7.	Provision of amenities on site affects the performance	Yes	Yes

Table 1: *Analysis of Primary data through live case studies (Source: Authors)*

3. Results and Discussion

3.1 Critical analysis of the various acts, reforms and the inherent risks:

The BOCW Act Central Rules lay down provision for workers temporary accommodation etc. but do not give any specific norms for the same. In the BOCW Act of Maharashtra the guidelines have been modified eliminating the provision for transit accommodations for workers. If we examine the BOCW Acts of other states, such as Gujarat, we find that it is mandatory to provide free accommodation to workers on or near the site with separate cooking area, facilities for bathing, washing and toilets. This caters at least to their necessities. As per available information, Maharashtra did not establish welfare board until 2015. In its absence, the cess collected could not be disbursed and utilized for any welfare measures. Data shows that there is still a huge segment of labor force that have not registered under the BOCW Welfare Board, due to lack of awareness or motivation. A network of migration resource centers run by NGO's is actively involved in linking migrants with government schemes in Ghaziabad, mediating with the local labor department to resolve any blocks related to registration (Reddy, 2016).This practice proved quite beneficial in achieving higher rates of registration and increased awareness about the various welfare schemes.

Multiple labor laws have distinct compliance requirements for the employing establishments leading to utter chaos. The amalgamation of these laws into four codes seems quite beneficial in resolving this issue, but there are several concerns that still need to be addressed (Covernote-Overview of Labour Reforms, 2020).Under the Code on Occupational Safety, Health and Working Conditions, safety committees are to be constituted in establishments employing more than 250 workers. This excludes almost 90% of units from the purview of such committees. Additionally, the term "building and other construction work" is defined in the Code in a manner that excludes construction of residential works below fifty lakh rupees, which can have serious repercussions on the entitlement to registration (Ministry of Labour, The Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 , 1996).The BOCW Act mandated the provision of free temporary accommodation, drinking water and toilets to workers. The Codes modify these legal rights to facilities that the central government may prescribe. Hence, workers have no rights to these facilities if not prescribed. It even disallows surprise inspections by labor inspector, thus compromising heavily with the safety of workers.

3.2 Learning from provisions under ILO and MS 2593:2015(Malaysia)-

The Malaysian code has many similarities with the recommendations made by ILO and thus can be emulated. Further the construction works can be categorized based on scale, giving norms, space standards and specifications for all the amenities, listing the safety management plan, defining guidelines for the maintenance and upkeep of these facilities and grievance redressal system. Provision of these facilities under the contract document is yet another good practice that can be adopted. (Yaman Siti Khalijah, 2020)

3.3 Learning from best practices (Online case studies):

These helped identify the best practices towards enriching the quality of temporary accommodation on site, thereby improving their overall productivity, use of low-cost modules that can be easily transported, quickly assembled and disassembled. Building Orientation can help maximize daylight and facilitate natural ventilation. The provision of community spaces can enable mutual interactions to instill a sense of belongingness. To achieve sustainability by reduced water consumption, achieve energy efficiency by using building materials with low embodied energy, smokeless fuel. Effluent Treatment Plant can be given and Rain water harvesting incorporated. Minimize disturbance to flora and fauna on site and there should be negligible residue leftover on project site after dismantling of the units. Provision of creche that can double up as a learning area in collaboration with relevant NGO's and concept of bridge classes for children in the age group of 6-15. Providing healthcare center and routine health checkup could be beneficial.

3.4 Improving Indoor Environment Quality:

The main findings of the previous research undertaken were that a modular prefabricated system created using wall panels made of paper honeycomb sandwiched between powder coated G.I. sheets with additional aluminum bubble wrap insulation for the roof can provide indoor environmental comfort (Sayali Andhare, 2015).This system is affordable and scalable for the temporary housing category. Another research study found out that modular designs may not be universally suitable as the social settings could be different. It is important to understand their indigenous practices rather than imposing any customized prototype.

3.5 Case Study Observations:

As around 40 workers are employed on 1st construction site at any given time, the BOCW Act should be applicable. The interview helped us understand that the number of accommodation units provided are very less and of a smaller size with no provision for family accommodation. The enormous heat gain inside the corrugated sheet structures, creates a lot of thermal discomfort and may lead to frequent illness. (Brickell, 2023) It was found that the corrugated sheets are usually reused on different construction sites for a period of around 5-6 years and then sold as scrap.

At least 300 workers are employed on the 2nd construction site at any given time. If we analyze the provision of accommodation, it is again of an inferior quality. They have been simply accommodated in the under-construction structure, which is very threatening due to the ongoing construction activities and with no safety measures. The number of units provided are very less and of a smaller size just created using sheets. As it is fully open from the sides, the problem of heat gain inside remains much the same and also offers it no privacy. The drainage system has not been properly designed and it generates foul smell at times due to water logging. There is no provision of any kind of recreational or community space. What kind of accommodation do they look

forward to and with whom would they prefer to share with? They prefer sharing it with their relatives and friends from their village. Survey from an earlier study revealed that migration for construction sector comprises of an ecosystem highly dependent on family members as the projects of a reasonable scale last for around 3-5 years. There is no provision of family accommodation. The project will be going on for at least three years, thus these provisions would have been desirable as mentioned by a few workers during the interview.

Thus, we can conclude that the room sizes and numbers were inadequate, no family accommodation or welfare measures were provided and there were no safety measures in place. In case of both the projects, no NGOs were involved. Many NGOs are playing an active role in running creche, providing education to the children of BOCW workers on site, providing meals at very subsidized rates and the possibility of collaboration should have been worked out in improving the living conditions. The questionnaire also helped decipher that if suitable amenities are provided on site, it helps to control absenteeism from work and ultimately benefit project's schedule.

4. Challenges/Limitations of the Study

Limited data availability on existing practices due to reluctance of the site supervisors.

2. Different regulations and enforcement mechanisms across states may pose challenges in drawing generalized conclusions.

3.Gaining access to active construction sites for data collection was constrained due to safety concerns and averseness from construction companies.

4.Construction projects are dynamic, and site conditions can change rapidly. This may impact the consistency and applicability of the findings.

5. Recommendations

The analysis of secondary data reveals that though BOCW Act has listed down provision for workers accommodation but there are no specific guidelines, and furthermore the amendments at state level have overlooked these provisions. The amalgamation of different laws into the new code has not improved this facet. The cess fund collected has not been efficiently utilized. The best practices identified have certain salient features in terms of construction technique, choice of materials, welfare measures in collaboration with CSR initiatives etc. that can serve as an ideal module for implementation.

The findings from primary data helped identify a few grey areas that need immediate attention. The number of accommodation units provided are insufficient, with rare or no provision of family accommodation. Additionally, it has been observed that there is an absence of welfare facilities and partnership with any NGO, that can be significantly tapped to improve the overall living conditions. Some large construction companies are

taking such initiatives to raise the living standards, but it is on a limited scale and a large segment of workers is still neglected.

5.1 Keeping provisions under BOCW Act intact and improving workers Registration:

Provision of welfare amenities, social security and decent working environments should be seen as rights of the construction workers and should be applicable to all establishments regardless of the number of workers engaged on site. For ensuring this, the provisions under BOCW Act for temporary accommodation of workers and other amenities (As given in Chapter VI-Section 32 to 37) should not be diluted in any code at centre as well as state level. As observed from the registration drive in Ghaziabad (Shamindra Nath Roy, 2017),a network of Construction workers resource centres (CWRCs) should be created in each ward to help the workers in registrations, secure work. They can be run by civil society organizations mediating with the local labor department to resolve any issues. Awareness camps should be organized periodically to create awareness among the workers regarding their rights, welfare schemes; and enrol them for registration.

5.2 Efficient utilization of Cess Funds:

The focus must be on utilizing the cess fund collected till date, through strategic planning. In the Development Plan, land should be allocated for construction worker colonies adjacent to the future development zones and corridors. The collected cess fund could then be utilized in developing these colonies, which can be further rented to the developers.

We need to assess the possibility of linkage between obtaining required building approvals from MCGM, the Labor department & RERA and the provision of transit accommodation. The Commencement certificate should not be issued prior to checking of the provisions made for the various amenities. i) The provision of amenities and code of conduct should be a part of the construction contract documents. Cess fund should be directly utilized on site, rather than depositing it with a particular welfare board. The compliance towards this effect can be ensured by the CWRC at the ward level. The site supervisor appointed should submit a monthly report to them who should be further given a free hand in analyzing these reports and checking the ground reality. These reports can then be submitted to the welfare boards. ii) Temporary construction site workers Welfare management team needs to be formed and provide written management plan and policies, lay down the Standard Operating Procedure of the management and suggest tentative schedule of inspections as per project's schedule. iii) Workers should have easy access to medical facilities and medical staff. A safety committee shall be established. A specific fire safety plan must be prepared and submitted. All these provisions will be checked by the building sanction committee in collaboration with an assigned NGO(Ward-wise). If all these provisions are in place. then only Commencement Certificate will be issued.

Consultation and grievance mechanisms: Workers will be made aware of these facilities. The employer needs to set up the consultation and grievance mechanisms. The workers may lodge any grievances about their accommodation.

5.3 Improving worker housing:

Basic guidelines specifying minimum quality of dwelling area, sanitation, safety for onsite accommodation and material palette:

i. G+2 framed structures can be constructed using either RCC or steel sections. Orientation of these units should be considered with respect to cardinal directions for optimum thermal performance. We need to customize the building materials as per the climatic conditions. G+3 structures can be created, in case of limited site area, with a wide staircase and corridor. Thus, going vertical may help overcome the area limitations.

ii. The unit size and the number of toilets and bathing facilities, kitchen etc. should be as per Annex C (Clause 14) Special Requirements for Low Income Housing in Urban Areas, given in National Building Code,2016.

iii. There is a strong necessity of incorporating community spaces within the unit designs to create a sense of security and symbiotic relationship that might also help to curb the practice of randomly abandoning the work. If possible, a courtyard or a corridor, similar to the traditional chawl system, can be created to provide this interactive space. To support the families in a holistic manner, provision of creche and learning model similar to one at Aavaas Changodar, Ahmedabad can be adopted with bridge leaning classes for varying age groups. The children can be secured transferrable admission in the nearby government schools with the help of NGOs.

iv. While constructing the accommodation units the focus should be on adopting the principles of circular economy. A supply chain of transit facilities can be created which is entrusted with the task of developing environmentally sustainable products. Encourage transforming non-recyclable waste into sheets that can be used as building materials (e.g. Ricron panels). Other materials that can be used are:

Walls- Pre cast concrete blocks, PVC Sheets, Paper honeycomb sandwiched between powder coated G.I. sheets, Low emittance glass fiber Gypsum panel. Fiber cement board.

Roofs - Bamboo mat corrugated sheets, PVC or Polycarbonate sheets, solar panels above;

5.4 Provision under Corporate Social Responsibility:

Manpower planning is a crucial aspect as workers are the backbone of the construction industry. The firms under CSR umbrella should be directed to utilize a part of its fund towards providing the accommodation and welfare facilities on site as a pre requisite.

This practice should be monitored and rewarded in some kind, to inspire other firms to play their part.

6. Conclusion

Since workers are the backbone of construction industry, manpower planning thus becomes crucial. Onsite accommodation may foster a sense of community amongst workers, thereby promoting a collaborative work environment. Investing in proper planning for workers' accommodation has long-term benefits for the construction industry, contributing to its sustainability. The efficient utilization of human resources can significantly impact productivity and overall project success. Thus, it is important to safeguard their rights to decent accommodation and improvise the existing conditions that can help achieve social sustainability in long run.

Policy framework needs to be strong enough to make sure that the basic needs are appropriately taken care of. Under current scenario, state governments have the right to modify the policy guidelines outlined by the central government. This helps in molding and formulating the regulations in the most desirable way. However, the flexibility given to the state government needs to be monitored by the central government so that larger interests are safeguarded and the purpose for which the policy was framed is fulfilled.

Improvement in the working conditions of the site labors can positively impact the quality and speed of the construction. Both these parameters are directly associated with cost and time and they need to be closely monitored to prevent overruns. Therefore, a wise step in the correct direction can prove advantageous for the field of construction. Few more opportunities open up during the process of quality improvement of worker accommodation. Environment conscious planning, solid waste management, capacity building, sustainable habitat could be some of the parallel achievements integrated in the plan of action. Adopting a holistic approach can certainly change the course of construction industry in future.

Conflicts of Interest: "The authors declare no conflict of interest."

"The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results".

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Assessment Of Universal Design in Multi-Speciality Hospital Buildings of Pune.

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Abstract: *The United Nations defines accessibility as ensuring "equal access for everyone," encompassing not only the physical infrastructure but also the delivery of services. Universal design emphasizes creating environments that are intuitive and accessible to all patients, including those with mobility, sensory, or cognitive impairments. This approach enhances patient's autonomy by removing barriers to access, fostering independence, and ensuring that hospitals are equipped to meet the diverse needs of their users. Multi-Speciality hospitals are crucial in delivering health-care services, making it essential for them to adopt universal design principles that cater to Persons with Disabilities (PwDs). By establishing accessible environments, these hospitals can guarantee that PwDs have equal access to treatment and care, ultimately enhancing their health outcomes and overall quality of life.*

The research aims to assess the current status of the two multi-Speciality hospitals in Pune regarding compliance with accessibility standards for a barrier-free physical environment, equal opportunities and appropriate information features for persons with disabilities as per the Harmonized Guidelines and Standards for Universal Accessibility 2021. Qualitative assessment is done through questionnaire survey of stakeholders like doctors, patients, support staff, nurses and ward boys of the hospital for universal accessibility with total sample of 40 respondents. For purpose of this research accessibility status is considered only on the ground floors of these hospitals, specifically areas like the entrance, emergency ward, OPD, and circulation spaces.

The research revealed that even though the awareness of the standards was high among the hospitals, yet there is still a scope for improvement considering the design parameters stated in the guidelines and its implementation. Hospitals need to upgrade to create an accessible and barrier-free environment for persons with disabilities as per the Harmonized Guidelines and Standards for Universal Accessibility 2021.

Keywords: Universal Design; Multispecialty Hospitals; Harmonized Guidelines and Standards for Universal Accessibility 2021; persons with disabilities; Hospital design; Universal accessibility.

1.Introduction-

The United Nations defines accessibility as "giving equal access to everyone," which includes access to all possible infrastructure as well as all services. Infrastructure includes ramps, handrails etc. Services include to provide accessible formats like braille, audio or sign language interpretation (1.) (Singh,2022). Apart from this availability of services, access to necessary information, accessible communication, awareness of PwDs special needs, and the ability to meet those needs is equally important.

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Services include Accessible health-care encompasses not just the constructed infrastructure, but also the availability of services, access to necessary information, accessible communication, awareness of PwDs special needs, and the ability to meet those needs.

When evaluating universal design in multi-Speciality hospital buildings, accessibility is essential. Hospitals must go beyond incorporating physical elements like ramps and elevators, taking into account how health-care services are provided to PwDs. This includes using assistive technologies, clear signage, and communication systems that accommodate a variety of disabilities which are the services (Moonis Mirza, 2023). Universal design aims to ensure that all individuals, regardless of their ability, have equal access to health-care, enabling full participation in the health-care system.

The goal of universal design is to create spaces that are easy to use and accessible for all patients, including those who have cognitive, sensory, or mobility disabilities (Dr. Ketna Mehta,2012). By eliminating obstacles to access, encouraging self-reliance, and making sure hospitals are prepared to handle the various demands of their patients, this strategy improves patient autonomy (Agrawal,2014). We can identify places where accessibility is deficient and endeavor to make healthcare facilities more inclusive for people with disabilities by evaluating multispecialty hospitals using the universal design lens.

A. Increasing Population of Persons with Disabilities

According to recent census data, the number of persons with disabilities (PwDs) increased significantly, from 21.9 million in 2001 to 26.8 million in 2011. (Singh,2022). This pattern emphasizes how urgently comprehensive accessibility policies are needed in a number of industries, including health-care. In addition to a higher prevalence of chronic non-communicable diseases, research has highlighted the major obstacles PwDs experience in obtaining health-care and employment possibilities.

Even though PwDs make up a small portion of the population overall, their needs and rights must be given priority when evaluating universal design in multispecialty hospital facilities (Singh,2022). They should not be considered 'things' of charity, but rather 'subjects' entitled to equitable and accessible health-care.

As the population of PwDs grows, health-care facilities need to adapt to meet the various needs of this population. Buildings must be physically accessible, a variety of services must be offered, appropriate technology must be integrated, and supportive surroundings that promote self-reliance and social interaction must be created.

In order to provide health-care services, multispecialty hospitals must embrace universal design principles that accommodate people with disabilities (2.) (Sharma).

These hospitals can ensure that PwDs have equal access to care and treatment by creating accessible environments, which will ultimately improve their general quality of life and health outcomes. Thus, the need for inclusive design in healthcare facilities grows more pressing as the number of people with disabilities rises, highlighting the significance of ongoing research and activism in this area.

Challenges in Accessible Healthcare

Accessing health-care services in India presents a number of challenges for those with impairments (Gaurav). It has been noted that individuals with impairments do not have the same access to health-care services as their peers without disabilities (Emil Erdtman). Equal chances and independent life in an inclusive society depend on universal access and a barrier-free environment. However, even though accessibility is required by law in many nations, limitations on the movement of those with disabilities, including those who use wheelchairs, in public buildings continue to exist globally (Emil Erdtman).

Purpose of the Study

India's public guidelines on the subject are called Harmonized Guidelines and Standards for Universal Accessibility 2021 (Ar. Vikram Singh,2023). These guidelines replace the previous Harmonized Guidelines 2016 and address raising awareness among various stakeholders about the planning, design, and implementation of universal accessibility in the built environment. Using these principles, this study aims to assess the universal accessible features of two multispecialty hospitals in Pune with regard to universal design for individuals with disabilities (Gaurav). The objective of this study is to evaluate the Harmonized 2021 guidelines using a structured methodology, followed by an in-depth analysis and subsequent research proposals aimed at improvement.

2.Literature Review

What is the point of Universal Design?

Universal Design aims to create environments that are naturally accessible to individuals of all abilities, reducing the need for later changes. Ronald L. Mace established the notion, which emphasises inclusivity by ensuring that products, services, and environments are accessible to everyone, regardless of age, handicap, or special requirements (Emil Erdtman). With growing global awareness of disabled people's rights and an ageing population, UD has emerged as a vital strategy to equitable and sustainable development (Emil Erdtman).

Why use Universal Design in Hospitals?

By incorporating UD principles, hospitals can remove obstacles to vital medical services, promoting equity and dignity in health-care through accessibility.

Accessible entryways, ramps, tactile guidance systems, clear visual and auditory signs, simple circulation and universally designed furniture all contribute to increased usability for everyone (Ar. Vikram Singh,2023). These aspects not only improve the patient experience, but they also help to increase operational efficiency by allowing for smooth navigation and minimising carer workload for especially abled population 2021 (Ar. Vikram Singh,2023).

Acts of Universal Accessibility in India

India has implemented numerous legislative and policy initiatives to enhance universal accessibility:

Persons with Disabilities Act of 1995: This law recognized the importance of accessibility but provided insufficient enforcement tools. (Equal Opportunities, Protection of Rights, and Full Participation)

Rights of Persons with Disabilities Act of 2016 (RPwD Act): A groundbreaking law requiring accessibility in public and private infrastructure, with rigorous deadlines and penalties.

Accessible India Campaign (Sugamya Bharat Abhiyan) in 2015: This effort aims to make urban and rural infrastructure broadly accessible. These frameworks demonstrate India's commitment to inclusivity by complying with international norms such as the UN Convention on the Rights of Persons with Disabilities.

2021 Harmonized Guidelines and Standards for Universal Accessibility: Comprehensive design guidelines for a range of constructed environments, including healthcare facilities, are provided under the Harmonized Guidelines and Standards for Universal Accessibility in India (2021).

In order to determine whether multispecialty hospitals in Pune comply with the Harmonized Guidelines and Standards for Universal Accessibility 2021, the study looks into Multi Speciality hospitals in the city. It focuses on assessing how well the hospitals adhere to accessibility guidelines and the built environment, as well as the availability of suitable technology and services that guarantee equal chances in accordance with the Guidelines.

Need For Study

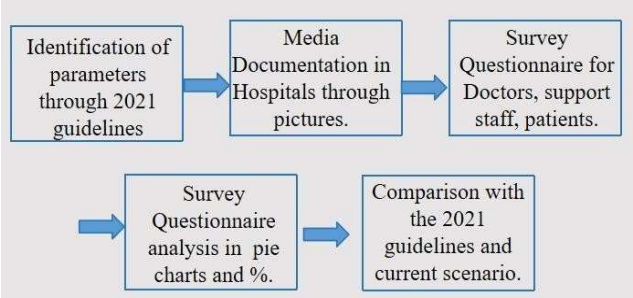
People with severe disabilities have poor access to healthcare due to a variety of factors, including cost, transportation, unfavorable attitudes, lengthy waiting lists, and physical barriers, as seen by the diverse healthcare systems found throughout the world (RAJESHWARAN THAIGESAN, 2023). People with disabilities access to hospitals is often overlooked and taken for granted in many nations. Everyone has the right to unhindered access to all government agencies, private hospitals, and other medical facilities (Jonathan White).

Methodology

The main research instrument utilized in the study to gather information on the characteristics needed for the evaluation of the hospital buildings in Pune was the Harmonized Guidelines and Standards for Universal Accessibility 2021. Two well-known multispecialty hospitals in Pune, Deenanath Mangeshkar Hospital in Erandwane and Sahyadri Hospital in Deccan Gymkhana, were evaluated, with special attention on the ground floor areas.

Analysis focused only on the ground floors of these hospitals, specifically analyzing areas like the entrance, emergency ward, OPD, and circulation spaces. Study was in a comparative format and Qualitative approach through case study. The data collection method went through Visual documentation through pictures of key areas such as ramps, waiting areas, signages, etc explaining design of both the Hospitals. A survey was conducted for specific target respondents (doctors, patients, and support staff) in form of multiple choice and open-ended questions. During survey, the confidentiality and anonymity of the participants was ensured especially since the study involved doctors, patients, and support staff.

This questionnaire justified the total sampling size of 40 respondents from both the Hospitals and the result was presented in graphical format through statistical report like pie charts and percentages. The survey performed a comparative analysis between the two hospitals to identify common patterns and gaps in universal design features. These findings were also compared with the 2021 guidelines to highlight areas for improvement. This comparison between the Guidelines and the current status of the Hospitals in relation with the Universal design was done in form of a checklist



Research methodology adopted for study

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3.Discussion

The above methodology was adopted to assess the Hospital design and survey questionnaire to understand the current scenario through user perspective. The data received from the Harmonized Guidelines and Standards for Universal Accessibility 2021 has been compiled and presented in a table format.

2021 GUIDELINES PARAMETERS
1. Entrance and Exit:
Ramp with 1:12 gradient, non-slip surface, handrails.
Entrance door width: minimum 900 mm.
Automatic or easy-to-open doors.
2. Signage and Wayfinding:
Braille and raised letter signage.
Tactile maps at key locations.
3. Circulation Spaces:
Corridor width: minimum 1800 mm.
Clear, unobstructed pathways.
4. Emergency Exits and Fire Safety:
Accessible emergency exits with visual and tactile signs.
Accessible evacuation plans.
2021 GUIDELINES PARAMETERS
5.Tactile and Non-Slip Flooring:
Tactile paving for navigation.
Non-slip flooring, especially in entrances and toilets.
6.Seating and Waiting Areas:
Accessible seating for wheelchair users and people with mobility aids.

Requirements to be followed in the Hospital buildings according to the Guidelines:

Health-care systems must offer a smooth experience to everyone by utilizing suitable elements in a patient-friendly setting that is universally accessible.

Using globally accessible characteristics such as pictograms and icons, multilingual features in contrasting colour schemes, and braille, an accessible wayfinding signage system would effectively incorporate the clear zoning of different health-care facilities. Hospital emergency doors must be easily distinguished, and other entries must also be easily recognized by entry signage, pictograms, etc.

Preferably step free entrance is recommended from the drop off or entry porch of hospitals to their internal spaces to ensure accessible movement of stretchers, wheelchairs and persons using other assistive devices for movement.

Mobility and circulation routes to various health care functions like Registration counters, OPD's, Diagnostics, etc. shall be planned in a way to optimize movement for all. Vertical circulation shall be taken care through well designed accessible ramps, lifts and staircases.

Media Documentation on site:

Media documentation during the site visit was done in the form of pictures on the basis of the Standards for Universal Accessibility 2021. This media documentation showed the current scenario of the Hospitals as per the design parameters. Compilation of the pictures on the site has been done.



Easy to open wide doors in Deenanath.



Ramps with no slip textured tiles and metal hand rail in both the Hospitals.





Waiting area with no specific space for U.A.



Waiting area with no specific seating space for U.A and congested lobbies.





Accessible emergency evacuation plans and visual signages in Sahyadri Hospital.



Visual signage and separate drop off for people with special needs in Deenanath.

Overall Analysis:

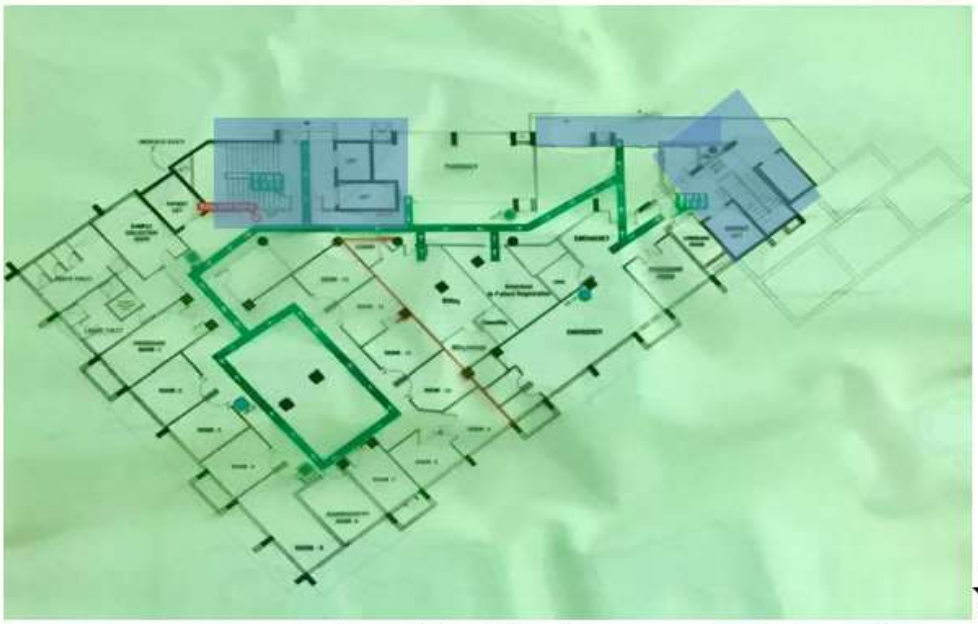
Although the majority of the primary requirements were satisfied for both the hospitals, the review found that there is still much space for improvement in areas like tactile signage (services as per UN), waiting rooms designed for people with special needs, and corridor width to facilitate circulation. Despite the fact that most users gave good feedback through survey questionnaire, highlighting the usefulness of many current features, the evaluation pointed out important areas where accessibility should be enhanced in the ground floor.

For instance, the lack of tactile signage makes it difficult for those with visual impairments to move around the hospital on their own, which is a major obstacle to their independence. In order to make people with special needs feel comfortable and supported as they wait for services, waiting places should also be made more inclusive through special area designed.

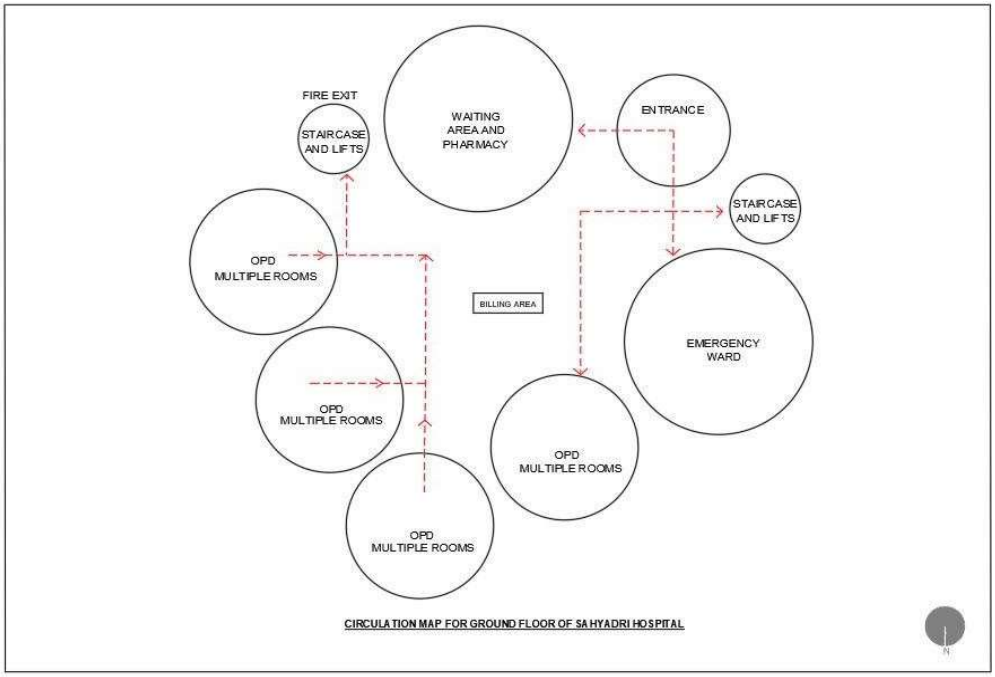
Improving corridor widths is also essential for promoting easier mobility as the area is crowded, especially for people who need mobility aids. As demonstrated by media documentation through pictures reports, it is crucial to concentrate on improving these components in spite of the positive comments in order to ensure equitable chances and assistance for people with disabilities in the health-care setting.

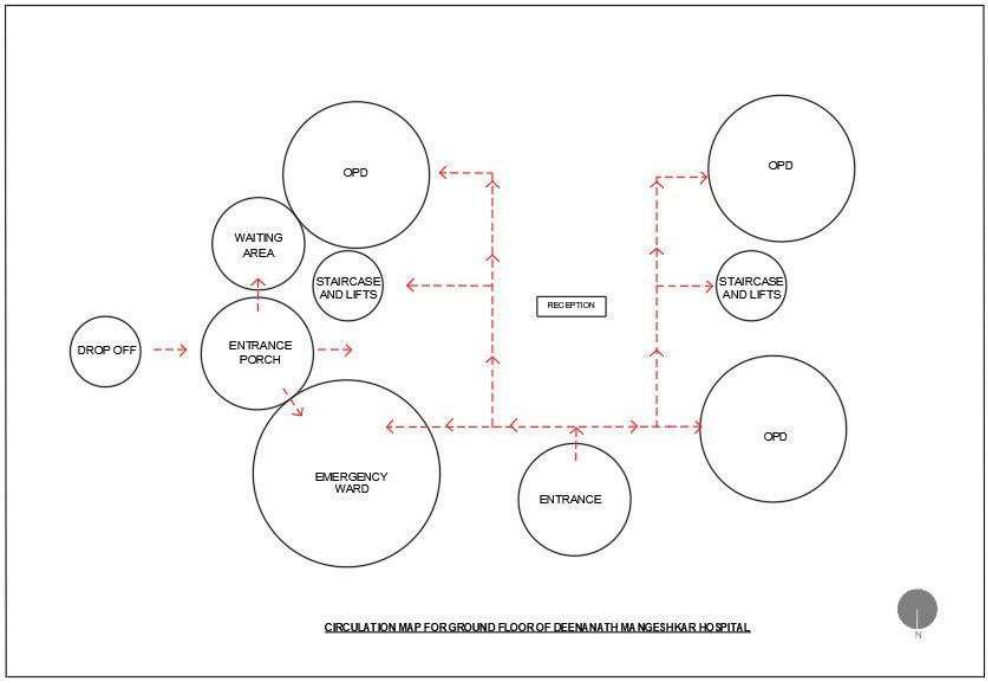


Plan of Deenanath Mangeshkar Hospital Ramps and Staircases



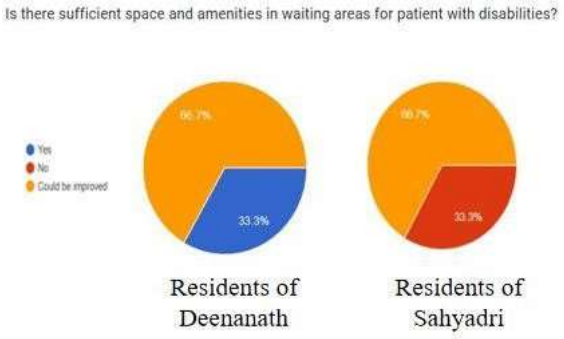
Plan of Sahyadri Hospital. Ramps and Staircases

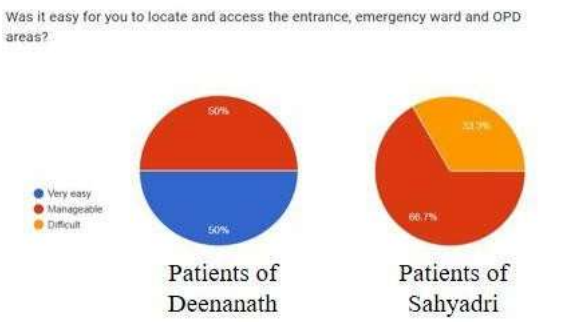

FIRE EXIT
STAIRCASE AND LIFTS
WAITING AREA AND PHARMACY
ENTRANCE
STAIRCASE AND LIFTS
OPD MULTIPLE ROOMS
BILLING AREA
EMERGENCY WARD
OPD MULTIPLE ROOMS
OPD MULTIPLE ROOMS
OPD MULTIPLE ROOMS
CIRCULATION MAP FOR GROUND FLOOR OF SAHYADRI HOSPITAL

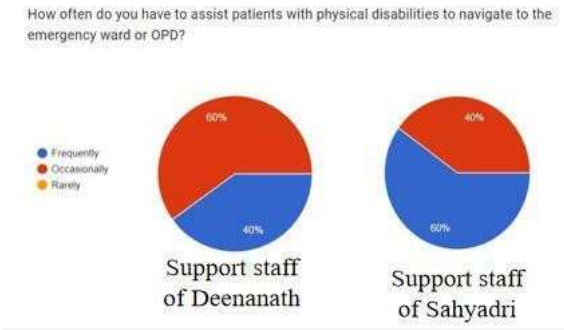

OPD
OPD
WAITING AREA
STAIRCASE AND LIFTS
STAIRCASE AND LIFTS
RECEPTION
DROP OFF
ENTRANCE PORCH
OPD
EMERGENCY WARD
ENTRANCE
CIRCULATION MAP FOR GROUND FLOOR OF DEENANATH MANGESHKAR HOSPITAL

Survey Questionnaire:

From the survey conducted, it was followed that along with the disabled patients, the supporting staff still faces a lot of difficulties inspite of fairly good Hospital design in terms of Universal accessibility for cleaning and patient circulation purposes. Few of the key insights from the survey have been compiled in form of pie charts that show major problems through user perspective in the Hospital.







According to the questionnaire, patients and support workers face major obstacles even though the hospital's design is generally effective in terms of universal accessibility listed from the standards of 2021. The design may not adequately meet the practical needs of people who maintain the facility, as seen by the supporting staff's complaints about having trouble moving about the area for cleaning and patient circulation.

The survey's key findings indicated some of areas that needed improvement. Many staff members voiced feedback with Sahyadri Hospital's wide walkways, which can get crowded during peak hours and make it difficult to move around effectively. Furthermore, Deenanath Hospital's storage facilities and necessary equipment placement were often considered insufficient, which resulted in staff workload increases and service delivery delays.

This feedback underscores the need for a more thoughtful approach to hospital design, one that prioritizes not only patient accessibility but also the operational efficiency of supporting staff. By addressing these issues, hospitals can enhance overall functionality and provide a better experience for Doctors, patients and staff alike.

2021 GUIDELINES PARAMETERS	DEENANATH HOSPITAL	SAHYADRI HOSPITAL
1. Entrance and Exit:		
Ramp with 1:12 gradient, non-slip surface, handrails.	Y	Y
Entrance door width: minimum 900 mm.	Y	Y
Automatic or easy-to-open doors.	Easy to open doors	Automatic Doors
2. Signage and Wayfinding:		
Braille and raised letter signage.	N	N
Tactile maps at key locations.	Y	Y
3. Circulation Spaces:		
Corridor width: minimum 1800 mm.	Y	Y
Clear, unobstructed pathways.	Y	Congestion in pathways seen
4. Emergency Exits and Fire Safety:		
Accessible emergency exits with visual and tactile signs.	Visual signage þ	Visual signage þ
Accessible evacuation plans.	Y	Y

2021 GUIDELINES PARAMETERS	DEENANATH	SAHYADRI
5.Tactile and Non-Slip Flooring:		
Tactile paving for navigation.	Y	Y
Non-slip flooring, especially in entrances and toilets.	Y	Y
6.Seating and Waiting Areas:		
Accessible seating for wheelchair users and people with mobility aids.	N	N
7.Communication Systems:		
Public announcements with visual aids (LED screens).	Y	N

Compared to the Guidelines, there was still a lack of implementation in upgrading buildings and infrastructure to be compliant with accessible building standards, despite the fact that most hospitals acknowledged knowing about the Harmonized Guidelines and Standards for Universal Accessibility 2021.Even if the evaluation of the ground floor is the sole basis for this study, many problems may still go unresolved on the upper floors.

The user experience recorded through the survey questionnaire also gives away the glimpse of how there is a room for improvement in these Multi-Speciality Hospital Buildings. Improving accessibility in multi-Speciality hospitals will increase the access of persons with disabilities and decrease issues regarding universal accessibility (RAJESHWARAN THAIGESAN, 2023). This study aims to provide a base for future research on accessibility for persons with disabilities in Hospitals buildings on the basis of the Harmonized Guidelines and Standards for Universal Accessibility 2021 and the United Nation's standard for equal access through infrastructure and services.

Conclusion-

Finding Hospital's accessibility requirements in relation to the Harmonized Guidelines and requirements for Universal Accessibility 2021 was the main goal of the investigation. The survey found that although hospitals were well aware of the requirements, there was still opportunity for improvement. The Harmonized Guidelines and Standards for Universal Accessibility 2021 were known to the majority of hospitals, according to the survey.

The studies highlighted that even though the awareness is high, there is a lack of implementation within the hospitals, which ultimately hinders persons with disabilities. To provide equitable opportunities and independent life in an inclusive society, universal access and a barrier-free environment are crucial. The need for a universally accessible, barrier-free environment for people with disabilities must be continually brought to the attention s in order to provide them with equal opportunities, increase their access to resources, and enable them to become contributing members of society.

A change in the mindset is necessary to ensure that policymakers approach building designs not accessible to a few but as an empowerment for all. Furthermore, to extend this research one can focus on the upper floors of the hospitals to know the current scenario better. This study majorly focused on the infrastructural developments and some of the services mentioned in the United Nations's parameters for accessibility. More focus can be put upon the services stated for similar study as a way forward to this research.

Conflicts of Interest: I declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

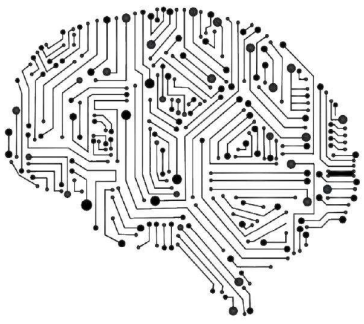
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TRACK 05



TECHNOLOGY & INNOVATION

Experimental Investigation of a Sawdust Concrete for its Compressive Strength

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Abstract: *Sawdust is a sustainable material that is biodegradable, compostable, and recyclable. It is easily available in the woodworking market since it is a by-product. Although burnt, it releases a large amount of carbon dioxide and pollutes the environment. The components in sawdust, like lignin and fatty acids, protect trees from predators while they are still alive and can impact cement's setting and hydration, hence pre-treatment was done, as setting time may increase. The main objective of this research was to reuse the sawdust to make lightweight concrete blocks and test its compressive strength. Sawdust reduces weight and offers heat and sound insulation. This is done by partial replacement of sand in the mixture of 1:3:6 where three parts of fine aggregate (sand) were divided further into two parts of sand and one part treated sawdust. This decreased the weight of the sawdust concrete block to that of a normal concrete block. The blocks of size 150 x 150 x 150 mm were prepared, and were tested for its compressive strength. The findings reveal that introduction of pre-treated saw duct into concrete blocks lead to light weight concrete blocks with a compressive strength of 8.90 N/mm2 at 7 days, which cannot be used for structural purpose in its current proportion. Thus, a saw dust concrete blocks can be considered as a sustainable solution for up-cycling the saw dust and reducing the demand for sand for manufacturing the concrete block.*

Keywords: Saw dust concrete, Compressive strength, Pre-treated saw dust.

1.Introduction:

Concrete is used extensively in construction in all building typologies. Many alternatives have been used and found to overcome the disadvantages of concrete. One such alternative is to add treated sawdust to the mixture of concrete. Utilization of such waste items in the construction works will be a viable solution not only to the pollution issues but also to the problem of the excessive cost of construction items which are being faced by many growing countries. Sawdust, being a by-product of woodworking, is produced in large quantities across the globe. Sawdust in its raw form contains cellulose, acids, soluble sugar, lignin, oils, and other organic materials which affect the properties of concrete, hence there is a need to treat it. Hence treated sawdust will be used in the mixture as it has good bonding properties with the concrete. Pre-treatment also reduced the water–cement ratio to achieve the same workability as the sawdust concrete with untreated sawdust. The setting time of sawdust concrete made with untreated sawdust was more than the setting time of sawdust concrete made with treated sawdust. Pre-treatment of sawdust also helps sawdust concrete to achieve greater strength (Deokar, 2020). Several studies have been conducted on the recycling of waste products into construction supplies in order to protect the environment. Utilizing these waste materials in construction projects will be a practical way to address pollution problems as well as other problems that construction projects face a significant issue

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that many people are experiencing is the high cost of construction materials (Mangi 2019). Researchers from other fields have also made attempts to study and determine the cost of each component to determine the total building cost by identifying materials that are considered local.

2.Literature Review:

In many developing and developed countries, the timber industry produces a significant quantity of sawdust as a by-product of timber processing. Although a limited quantity of it is used as fuel in some countries, most of the sawdust generated is wasted. With the limited availability of dumping sites and landfills, sawdust disposal has become a serious problem facing the timber industry. Past studies have shown that sawdust being a lightweight material, can be used as aggregate in concrete mixes to produce lightweight concrete. As early as in 1940, an investigation on the properties of sawdust concrete was reported (Baver 1940). The physical and mechanical properties of sawdust concrete are not only depended on the amount of sawdust used but also on the chemical and physical characteristics of the sawdust. Due to the high-water absorption characteristics of the Proceedings of the Construction Tec sawdust, the sawdust concrete showed poor mechanical properties when used in significant quantities (Paramasivam et. al. 1978). The compressive strength of sawdust concrete decreases with an increase in the volume of sawdust in the mix proportions (Mageswari 2009). Pre-treated sawdust concrete has more compressive strength than untreated sawdust concrete for the same sawdust ratio, especially for high sawdust ratios. The improvement in compressive strength is larger for coated sawdust concrete (contains sawdust treated with hydrated lime and waterproofing materials) than uncoated sawdust concrete (contains sawdust treated with just hydrated lime/ferrous sulphate). This can be explained by the reduced water/cement ratio required for coated sawdust mixes than the untreated sawdust or uncoated sawdust to acquire the same workability or slump. The decrease in compressive strength with increasing sawdust ratio is much more for untreated sawdust, which means that larger pretreated sawdust content can be used to attain the same compressive strength of untreated sawdust concrete. Therefore, lighter sawdust concrete can be produced with the same strength (Saeed 2013).

According to some theories, mixing sawdust with cement and gravel could replicate the artificial wood fiber bond observed in trees. Since trees exhibit great strength International Journal of Advanced Science and Technology and feats that manmade concrete structures cannot do without steel reinforcements, wood fiber bonding that could be more flexible and intricate in its own way might be adapted by most concrete structures allowing them to be shaped in more complicated forms. Additionally, suppose each sawdust particle absorbed enough water during hydration. In that case, presumptions suggest that they could assist the hydration process, especially in the centre of concrete that is impossible to cure with water, obviating the need for curing because cement particles are harvesting water deposited in sawdust particles (Saeed 2013). Low sawdust ratios may increase the flexural strength of concrete due to the "fiber action" of sawdust. However, for higher sawdust ratios, flexural strength is

reduced due to higher water/cement ratio and higher voids content (Mageswari 2009) (Saeed 2013). Phase one of pre-treatment of sawdust also improved flexural strength remarkably due to the better bond between pre-treated sawdust and cement paste. Washing toxic extractives from sawdust particles that reside in the setting and hardening of surrounding cement paste increases the bond between pre-treated sawdust and cement paste. Due to the suppression of any remaining extractives that may have been present on the surface of the sawdust, phase two of the pre-treatments significantly strengthened the flexural strength and binding between the sawdust and cement paste (Deokar, 2020). The four concrete groups have about similar properties in regard with thermal conductivity, because the effect of reducing water absorption capacity of pretreated sawdust with water proofing materials is compensated by the reduced mixing water (w/c) for such concrete. Coated sawdust concrete has about 40% less water absorption than uncoated sawdust concrete. However, coated sawdust concrete is expected to perform better in humid conditions due to the reduced water absorption capacity of such concrete (Saeed 2013). The water absorption of sawdust concrete was found to increase with the increasing amount of sawdust in the mix. This is obvious, because sawdust is relatively porous than the aggregates like sand, stone etc. used in normal concrete mixes (Mageswari 2009). By nature, sawdust particles are porous and absorb most of the water leaving insufficient water for the setting of cement. Since sawdust absorbs most of the water from the concrete mixture, it delays setting time, affects the hydration of cement and thus, reduces the strength of the sawdust concrete (Saeed 2013; Awal 2016). On the contrary, it is also presumed that if sawdust particles take up enough water during hydration, they could aid the hydration process particularly in the inner parts of concrete which is not possible to cure with water. As a result, since cement particles are collecting the water deposited in sawdust particles, curing is no longer necessary. (Kumar 2014; Ganiron Jr., 2014)

3.Methodology:

In this test, first, the moulds for the concrete block were made using discarded wood pieces from the wood lab. Next, concrete slumps with the same percentage of sawdust were made of size 150 mm x 150mm x 150mm and then cured for 7 days. A mixture of 1:2:4 was used and sand was partially replaced by sawdust by weight. First phase treatment was done to the sawdust i.e washing it with water and then drying it. Sawdust was added to the mixture without phase two treatment and the blocks obtained from this after 24 hours did not set, the mixture in the mould was damp and smelly. This proved that phase 2 treatment was necessary i.e adding of Calcium Hydroxide, 15% to 20% of the volume to that of cement. The blocks obtained after 24 hours were solid and intact after which it was submerged in water for 7 days for the curing process.

The concrete needs to be self-cured to reduce the water evaporation from concrete and hence increase the water retention capacity of the concrete compared to conventional concrete, efficient curing improves the strength and durability of concrete. After seven days blocs were tested for compressive strength. Although exact weights were taken, 10% to 20% more cement was required to bind the sawdust.



Figure 1: Discarded wood in the trash, Figure: Making the moulds for sawdust concrete mix, Figure 3: Phase 1 treatment of sawdust.



Figure 4: 20mm aggregates 4kgs, Figure 5: 1kg treated sawdust, Figure 6 : 1kg Cement



Figure 7: sawdust concrete mixture, Figure 8, 9- Mixture without calcium hydroxide mixture, after 24hrs.





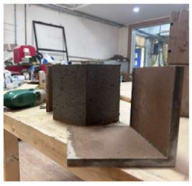


Figure 10: Remade Concrete moulds with Calcium hydroxide, Figure 11: Moulds after 24hrs, Figure 12: Opened blocks from moulds



Figure 13: Blocks of sawdust concrete.

Result and Discussion:

The process and the results show us that phase 1 treated sawdust does not let the mixture to set in 24hrs leaving it moist and damp. The sawdust concrete block takes about 2 days to set and the bonding with cement is extremely poor due to excessive water absorption of sawdust leaving the cement no water for hydration. This leaves the block to disintegrate while taking it out of the mould (Figure 8,9). Hence, we treat the sawdust with calcium hydroxide which helps the block to set in 24 hrs. This justifies the need for a waterproofing agent which was told by Deodar. The compressive strength was 8.90 N/mm2 at 7 days, slightly less than a normal concrete block of M15. Sawdust concrete with a cement ratio of 1:1 comes under the category of lightweight concrete which has a high density close to a normal concrete block. This cannot be used for structural purpose in its current proportion. The density could be around 1876 kg/m3 (Awal, 2017). The weight of the sawdust concrete block is less than that of a normal concrete block.





Figure 14 :Testing of the block, Figure 15: Compressive Test result.

Conclusion:

Before being used in sawdust concrete, sawdust must be pre-treated. There should be two stages to it. Better bonding between the components of sawdust concrete is achieved through the pre-treatment of sawdust. It keeps sawdust from taking up water and allows the cement to have enough water for hydration and setting.

Pre-treatment decreased the cement-to-water ratio to achieve the same workability as that of normal concrete. Sawdust is abundant in the wood industry and hence instead of throwing it away in dumping grounds, making it use in a way that it benefits the construction industry by reducing the overall cost of the structure and is environmentally sustainable. Additionally, since the sawdust blocks have less weight, they can be used for temporary lightweight structures.

Further Research scope:

Further research can be done on the Thermal conductivity of sawdust concrete as internal as well as external building material.

Innovative Steel Installations: A Study of Creative and Technical Aspects in a Student Design Competition

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Abstract: *Among the many purposes of architectural installations are the demonstration of design concepts, raising social awareness, and imparting identity to space. In line with these objectives, a leading steel manufacturer from Maharashtra, launched a competition inviting students from engineering and architecture colleges across the state to design and construct an installation using their recycled steel products. This paper examines the creative and technical dimensions of the prize-winning architectural installation from the competition.*

The study delves into the process of selection of design concepts, the proportioning, material handling, and the technical challenges faced by participants in working with recycled steel. The collaborative efforts of the students in overcoming these challenges—such as shaping and joining steel components to solve practical design problems, are discussed. The cost of Installation is worked out and is compared to the three other entries that reached the final round. The paper also proposes ideas to improvise the existing installation for an interactive user experience.

Keywords: steel; material properties; hands-on learning; competitions.

1. Introduction-

Architectural installations are pivotal in shaping spatial experiences, providing platforms for artistic expression, and addressing critical social and environmental issues. These structures often serve as mediums to demonstrate innovative design concepts, foster community engagement, and imbue spaces with distinctive identities. In this context, competitions centre around installations offers a unique opportunity for aspiring designers to explore creative and technical challenges while engaging with contemporary material practices.

A leading steel manufacturer based in Jalna, Maharashtra, renowned for its high-quality structural steel products, organizes the **Kreate Competition** annually to engage engineering and architecture students across the state. This initiative highlights the creative potential of recycled steel while promoting environmentally conscious practices in design and construction. By providing a platform for students to explore steel's versatility through hands-on experience, the organizers not only showcase the material's aesthetic and structural possibilities but also reinforces its role in sustainable development.

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The competition serves as part of the company's corporate social responsibility (CSR) efforts, enhancing its brand visibility and strengthening ties with the next generation of professionals in the construction industry.

By inviting engineering and architecture students from across the state to design installations using recycled steel products, the competition not only highlighted sustainable practices but also fostered interdisciplinary collaboration. This paper focuses on the prize-winning architectural installation from the event, analysing its conceptual development, material handling, and execution.

The study explores the participants' journey in designing with recycled steel, navigating challenges such as proportioning, shaping, and joining steel components while addressing practical design constraints. It evaluates the cost-effectiveness of the installation compared to other finalists and proposes enhancements. Through this examination, the paper sheds light on the intersection of sustainability, creativity, and technical expertise in architectural installations.

2. Literature Review -

Architectural installations play an important role in blending art, technology and functionality. It acts as a medium to bring to life various envisioned concepts. Installations leave a lasting impact on its viewers making it an innovative way to spread awareness to the public. Public art unites people. It encourages them to pause and reflect. Installation design is integral to the practices of an increasing number of architects. Like competition design, it presents an opportunity to explore ideas that can later be incorporated into the built work (Bonnemaison & Eisenbach, 2009).

The competition that requires the participants not only to design but also to build an installation, demands technical knowledge of material properties and material handling. “In our culture, technical subjects have always been the stepchild of architectural education and have been largely neglected. The formal, spatial and theoretical aspects of design have dominated design education so far while the neglect of the technical component has slowly boiled up a crisis in architectural education.” (Peters, T. F. 1986). Technical subjects are often taught non visually, in a classroom without any practical applications. The complexity of materials makes it difficult to be fully understood by the student through classroom learning only.

The present study aims at analysing the prize-winning installation’s concept, technical execution, and material application. The objective is achieved through discussing and documenting the design concept, innovative application of material properties, quantity of material used, challenges faced while creating installation and the ideas to overcome the same.

3. Methodology

The objective of the Kreate Competition was to design and construct an architectural installation to showcase United Nation's Sustainable Development Goals (UNSDGs), using recycled steel products supplied by the organizers.

Focus Areas and Evaluation Criteria was to encourage innovative design concepts that leverage the unique properties of steel, practical and efficient use of recycled steel in the construction process and address real-world challenges like material handling, cost optimization, and execution feasibility. The eligibility criteria of the competition were all students from engineering and architecture backgrounds across Maharashtra.

The Process included following rounds.

Round 1: Online Design Submission

A] Abstract Submission (max 500 words) of design proposals. It should include an introduction, Objectives, Innovative Aspects, Potential Impact, Design (drawings, sketch, image), Steel Properties, SDG Integration, Expected Outcomes, and Conclusion.

B] Video submission which should include key features and innovations, Design Process and Methodology, Expected Impact and Benefits, Engaging Story or Philosophy.

Round 2: Technical Submission Round

A] A bill of quantities (BoQ) is required to make the model.

B] Video submission: structure, focusing on its steel-based design, highlight how you've utilized TMT bars for bendability, twist ability, weldability, and machinability to enhance the design. Explain your strategy for load distribution to optimize construction, minimizing steel use while maintaining structural integrity.

Finale Round:

A] Physical Model Preparation: Create a physical model, structure, or sculpture using TMT Bars based on your submitted design. Model Size Dimensions were given as: Maximum 3 ft (width) by 3 ft (length) by 3 ft (height).

B] Poster Preparation: Finalists are required to prepare a poster summarizing their project for display during the exhibition.

Participants had to use a combination of materials with a minimum of 80% Thermo-Mechanically Treated (TMT) bars, steel (any size). 20% from any other material of their choice. TMT rebars and binding wires were provided by the organizers.

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3.1 Initial Design concept for 1st round submission:

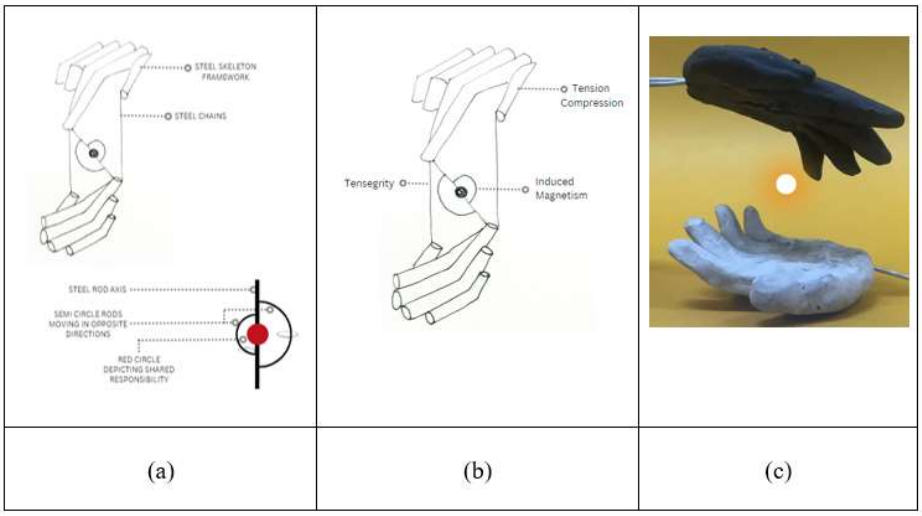


Figure 1. *Initial design concepts (a) Basic concept (b) Incorporation of steel properties (c) Clay model for the video.*

The design theme was to showcase the UNSDGs, for which we chose gender equality, being in an all-women college, we tried showcasing it through our model. The idea of the model is rooted in Yin and Yang, the concept of Yin and Yang from Chinese philosophy can serve as a powerful metaphor for gender equality. Yin and Yang represent opposing but complementary forces that exist in all aspects of life and nature, creating balance and harmony. Neither force is superior to the other; instead, they are interdependent, working together to form a unified whole. Applying this concept to gender equality allows for a deeper understanding of the natural balance between masculine (Yang) and feminine (Yin) energies, emphasizing the necessity of both in achieving a harmonious society. Figure 1 shows the conceptual design where the circles represent shared responsibilities of Yin and Yang, which rotate, with the help of magnetism, to depict the same. We have also kept in mind the 12th SDG, which is responsible consumption, by producing minimal waste, which was possible with the pre-planning of the desired outcome, something that the organizers resonate with.

3.2 Technical Details and BOQ for 2nd round submission:

Table 1 shows the Bill of Quantity (BOQ) for the model for obtaining quantity from the organizers. The steel quantity in kg is calculated in addition to the original BOQ.

Figure 2 and 3 shows the poster of the installation sent for submission at the competition.

Figure 3 shows the technical details of the installation. The sculpture installation, inspired by SDG 5: Gender Equality, reflects the ethos of the women's college, empowerment, resilience, and progress. Through interactive elements, it aims to spark dialogue, inspire action, and reinforce the message that empowering women is the key to a just and sustainable future. Steel with its the strength and versatility reflects the virtue of empowered women.



Figure 2. *The poster representing the process and technical details of installation*



(a) (b)

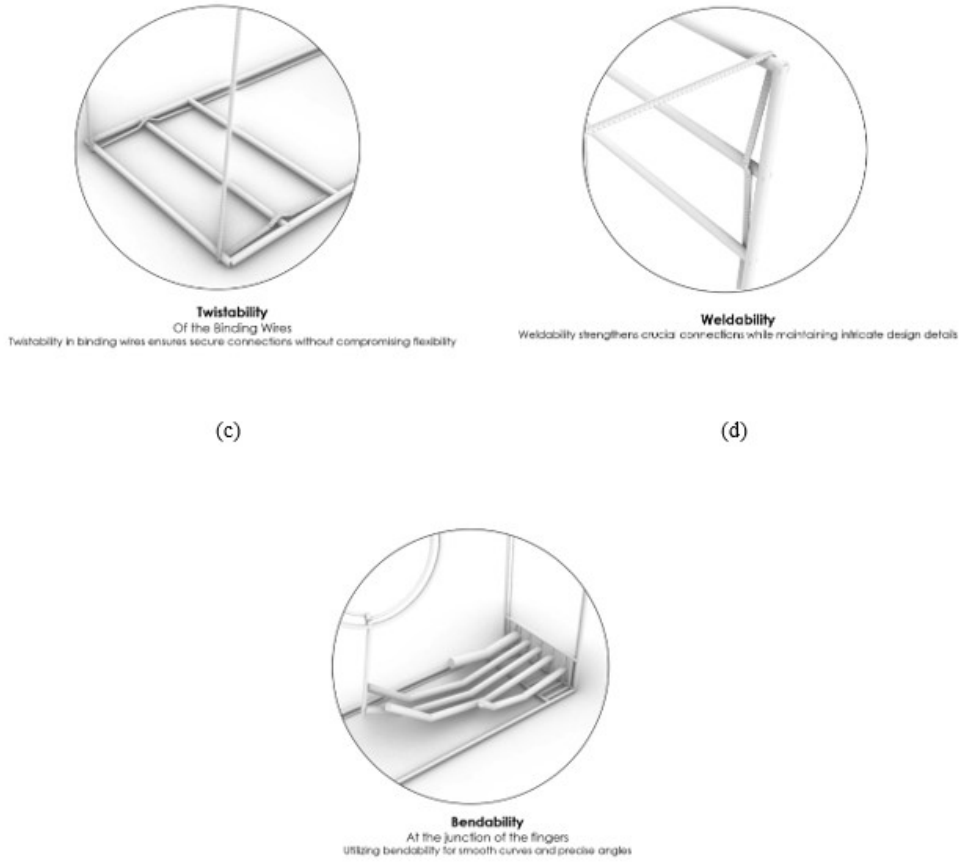


Figure 3 *Technical details of 3D model (a) Tensegrity (b) Magnetism (c) Twistability (d) Bendability (e) Weldability*

The properties of steel that have been incorporated in the installation are bendability, weldability, machinability, twistability, magnetism and tensegrity. This unique sleek and lightweight model contradicts the notion that steel structures are bulky. There is also zero wastage. If you leave out the magnets, this model is completely made of steel TMT bars because steel itself is a statement. This design also has a delicate balance of compression and tension. The frame acts as the primary support of the model, where the 8mm steel members are in compression.

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The rods are welded at the ends. The two hands and fingers (which are also welded at the joints) are cantilevered from the frame and are subjected to tensile bending stresses which are taken care of well by 16 and 25mm TMT bars. Here, larger bars have been welded to smaller bars. The central circle representing yin and yang, male and female elements, is held in position not by compression but by tension Thus, tensegrity. For efficient display of tension, a twisted cable is created from 2mm binding wires.

Which also exhibits machineability property of steel property of steel property of steel. Semi - circles in the center are held together by magnetism which is a unique property to steel. It also makes the rods dynamic in nature. They also exhibit bendability of steel. The overall theme and sculpture start with gender equality but extends to humans and nature to go hand in hand with sustainability because their existence is intertwined together.

3.3 Final Round Submission

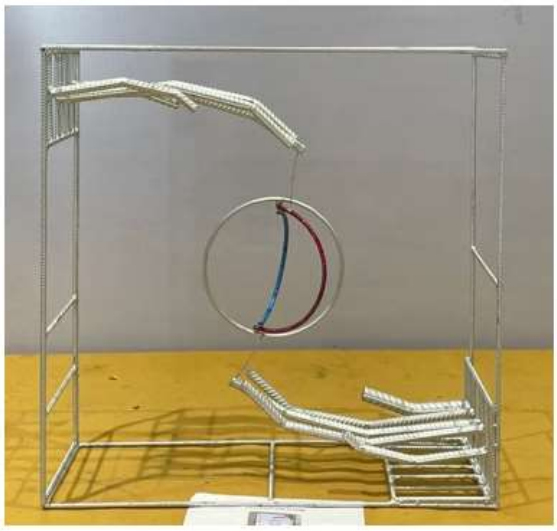


Figure 4. *Photograph of actual installation made by authors*

Figure 4 *shows the actual installation created by the authors for the competition.*

4. Results and Discussion

Table 1. Team authors (winners)- Bill of Quantities

Sr.no	Material	Specifications	Length	Quantity(no.)	Weight(kg)
1	TOR Bars	8mm	770mm	4	1.216
2	TOR Bars	8mm	260mm	12	1.232
3	TOR Bars	8mm	2800mm	1	1.106
4	TOR Bars	16mm	500mm	2	1.580
5	TOR Bars	16mm	460mm	4	2.906
6	TOR Bars	16mm	270mm	2	0.853
7	TOR Bars	25mm	270mm	2	2.082

	Steel		3000mm	12	0.888
8	Binding wires	2mm			
9	TOR Bars	8mm	200mm	2	0.158
10	TOR Bars	8mm	1600mm	1	0.632
11	TOR Bars	8mm	1450mm	1	0.573
12	TOR Bars	8mm	1320mm	1	0.521
13	Magnet			10	
				TOTAL WEIGHT(KG)	**13.747**

Table 2. Runner-up Team A- Bill of Quantities

Sr.no	Material	Specifications	Length	Quantity(no.)	Weight(kg)
1	TMT Steel	8mm	1m, 1.2m	4, 2	2.525
2	TMT Steel	10mm	1m, 1.2m	4, 2	3.946
3	TMT Steel	12mm	1m, 0.5m	4, 4	5.327
4	TMT Steel	16mm	1.7m	4	10.732
5	TMT Steel	20mm	1.5m	4	14.796
	Steel			1.5kg, 1kg	1.5
6	Binding wires	2mm, 2.5mm			
7	Wooden support	10mm		0.5kg	
8	Paper	A4 size		200g	
				TOTAL WEIGHT(KG)	**38.826**

Table 3. Runner-up Team B- Bill of Quantities

Sr.no	Material	Specifications	Length	Quantity(no.)	Weight(kg)
1	TMT Steel	40mm	1m	1	9.864
2	TMT Steel	20mm	3m	1	7.398
3	TMT Steel	32mm	0.5m	1	3.156
4	TMT Steel	8mm	2m	21	16.572
	Steel			1kg	1
5	Binding wires	2mm			
				TOTAL WEIGHT(KG)	**37.99**

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Figure 5. *Photograph of actual installation made by Team A*



Figure 6. *Photograph of actual installation made by Team B*

Table 1, 2 and 3 indicate the bill of quantities (BOQ) for three different teams while **figure 4, 5 and 6** show the final installation by the teams who participated and won the final round in first, second and third positions. Each BOQ outlines the materials, their specifications, lengths, and quantities.

Comparative Analysis of the steel quantity is as follows.

Weight of Steel:

Team author: Steel used includes TMT bars (8mm to 20mm) of various lengths. Additionally, 2.5 kg of binding wire.

Team A: Primarily TOR Bars ranging from 8mm to 25mm with specific lengths and counts. Binding wire is also mentioned but without weight detail.

Team B: Uses TMT bars from 8mm to 40mm. The quantity is detailed, but specific weights need to be calculated from the lengths and diameters.

Length of Steel:

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Team author: The lengths are primarily 1m and 1.2m, with a few longer bars (1.7m for 16mm steel and 1.5m for 20mm steel).

Team A: Contains numerous shorter pieces, such as 770mm, 260mm, and 500mm, contributing to a dense design. Some bars reach up to 2800mm.

Team B: Includes 3m and 2m pieces, alongside shorter lengths.

Cost: Larger diameters and longer pieces (e.g., 40mm, 3m bars in Team 3) indicate higher costs. The actual Cost is unknown since the organizers provided all of the material.

Design Implications:

Team author**:** Simpler geometry with uniform lengths suggests a focus on modularity and assembly ease.

Team A: The diverse sizes and lengths imply a detailed and intricate sculpture design.

Team B: Utilizes fewer but larger elements.

The challenge faced in implementation of design was that initially, the plan was to support the entire structure using tensegrity principles. However, during fabrication, it was discovered that the hand's weight was too heavy for the binding wire to sustain. As a result, an additional frame had to be constructed to support the hand. Despite this adjustment, the central support remained successfully held through tensegrity, which functioned effectively.

Additionally, the team envisioned the rings rotating independently through magnetic forces. However, the rings did not rotate as anticipated. Instead, they showcased the magnetic properties of steel by securing the rings in place using magnetism.

While many participants emphasized the aesthetics and visual appeal of their sculptures, the team prioritized functionality. Their design was deeply rooted in a strong concept and seamlessly translated into a form that upheld and reflected that idea. They achieved a zero-waste approach, ensuring sustainability throughout the process. Additionally, they effectively leveraged the diverse properties of steel, including tensegrity, magnetism, compression, tension, bendability, and weldability, to create an innovative and structurally sound design.

The juror panel consisted of practicing structural engineers and architects with vast experience in the field.

5. Conclusion

The platform provided an opportunity to showcase the team's design and talent while aligning with the Sustainable Development Goals for a more sustainable future. It also offered a chance to visit the organizer's factory, enriching their understanding of steel production. Furthermore, the experience deepened their knowledge of steel as a material and its applications in building structures.

The winning team built a model weighing 13.747kg, runners up team A built their model weighing 38.826kg and the runner up team B built their model weighing 37.99kg. The winning team's model used 64.6% less material than the runner up team A and 63.8% less material than the runners up team B.

It would be suggested to use lighter steel bars, such as light-gauge steel, combined with stronger and more tensile ropes or wires to better support the weight in a tensegrity structure. Additionally, incorporating electricity could enable the self-sufficient rotation of the rings through magnetism, bringing the initial concept to life.

Following are the learnings from the process of participating in the competition.

- Gained practical insights into steel as a material, including leveraging its properties effectively.
- Improved understanding of the fabrication process and optimized material usage. Enhanced teamwork and time management skills.
- Learned resilience in adapting to challenges, turning setbacks into opportunities for creativity.
- Developed organizational abilities such as coordinating with fabricators and sourcing materials efficiently.

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TRACK 06



ALLIED

Health benefits of urban parks, for physical, emotional, and mental well-being: a case of pune

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Abstract: *Urban parks are one of the most important aspects of public open spaces and green areas used by people in cities. In the current context of rapid urban development and related issues, the importance of urban parks in improving public health has been widely discussed. They are usually located near the center of a city or town. They usually provide rest, relaxation, entertainment, education, exercise, inspiration, or entertainment to tourists or neighbors. Furthermore, they are often called urban parks, city parks, public parks, or botanical gardens. Urban parks help purify the air and produce vital oxygen. Urban parks provide health, social, and cultural opportunities for the people. John Muir, also known as "Father of the National Parks", a Scottish-born American, once said, "Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul." The following research understands and highlights the health benefits of urban park visitors. This research focuses on the mental, physical, and emotional benefits experienced by the visitors of urban parks in Pune City. A survey was conducted by circulating Google forms among the residents of Pune, who visit various parks within the city. The results documented the visitors' experience and response to the conditions of the parks, which were then subsequently examined. A key observation was noted that the individuals visit parks primarily for mental health benefits instead of physical health benefits. The study also explores the social impact and highlights the importance of urban parks in promoting social interaction and strengthening community connections among city dwellers. Therefore, it is important to create close-knit urban communities, thereby contributing to urban life's overall fabric.*

Keywords: Green space; urban parks; emotional well-being; nature and mental health; physical health; Pune city parks

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1. Introduction:

Urban parks are essential elements of urban life, offering significant benefits for city residents' physical, mental, and emotional well-being. As urbanization continues to increase, these green spaces provide much-needed relief from the challenges of overcrowding, pollution, and social isolation. Historically, parks have been part of urban environments, evolving to meet the changing needs of society. Today, they not only offer recreational spaces but also promote health and social interaction, fostering community connections.

Parks have been part of the urban landscape since at least ancient times. Gardens in ancient Mesopotamia and city parks in the United States, like those located in Brooklyn or Los Angeles, are among the first forms of parks known to humans. By the mid-twentieth century, public parks arose in direct reaction to the challenges cities were facing with over-crowdedness, environmental obscuration from pollution, and

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insufficient green areas. One of the optimistic defenders Heath wrote about was Frederick Olmsted, an early American landscape architect, who favored urban parks. The designs include his companion costs for Manhattan's Central Park and other public parks developed with Calvert Venaux throughout the 1920s and were believed to be a revolution in the evolution of public parks. (Reference from Agi Architects).

While extensive research has established the benefits of urban parks globally, limited studies focus specifically on Pune's urban parks, their accessibility, and their impact on diverse population groups.

This study seeks to bridge this research gap by exploring the unique role of Pune's urban parks in shaping visitor experiences. Unlike previous research, which broadly examines urban greenery and mental health, this study **analyzes visitor motivations, patterns of usage, and park-specific challenges** through a structured survey. It aims to determine how factors such as **location, maintenance quality, and demographic variations** influence the well-being benefits derived from these parks. Additionally, the study delves into **barriers to park accessibility and the potential for urban parks to enhance social equity**, offering new insights for urban planners and policymakers.

By focusing on Pune—a rapidly expanding metropolitan city facing urban congestion and environmental concerns—this research highlights how urban parks contribute to sustainable urban living. The findings will provide **data-driven recommendations** for optimizing park design, ensuring accessibility, and enhancing their role as holistic wellness spaces for city dwellers. This study adds to the growing discourse on urban parks by offering **locally relevant, evidence-based insights** that can inform future urban planning strategies.

2. Significance:

There are many ways that the significance and benefits of urban parks can be derived from life today:

2.1. Public health: Urban parks could also be extremely beneficial in maintaining and improving the physical as well as mental health of people dwelling in urban places. Numerous studies (eg: "A nearby urban park is associated with the same mental health benefits as decreasing local unemployment rates by 2 percentage points, suggesting at least the potential of environmental interventions to improve mental health. The number of visits and physical activity minutes are significantly related to distance." (reference from NIH)); have demonstrated that regular use of these green areas lowers stress, worry, and melancholy while also increasing physical activity and lowering the risk of chronic illness.

2.2. Environmental Perspective and community well-being: Studies of the health benefits of gardens also give insights into how human behavior interacts with the environment. Through studies on how the presence of green spaces influences cognition, mood, and behavior, researchers can provide urban planners and politicians

with critical information in designing and affecting the sustainability of cities for everyone in the community. Equitable research of urban parks can also result in equity when it comes to the distributive policies management on the allocation of parks; this will reduce health imbalance between economic classes.

3. Literature review:

Urban parks play a crucial role in improving and enriching public health and the overall well-being of humans. Many developing studies of research have highlighted the many benefits that urban parks offer. Urban parks promote physical activity; people can walk, jog, and engage in other forms of physical activity when they have access to green spaces nearby. Psychological benefits of urban parks include a calming effect that can reduce stress along with improving mental health. Also, spending time in natural settings can help to reduce feelings of isolation and social loneliness. Green spaces provide opportunities for relaxation which can improve cognitive function. The following is a summary of the results from ten research papers on urban parks and their health benefits that were studied as a preview and analysis of existing knowledge on these Urban Park's benefits:

3.1. Reihaneh Sadat Hajmirsadeghi's 2012 paper on “The influence of urban parks on sustainable city via increase quality of life” states and highlights the importance of biologically diverse ecosystems in global environmental conservation efforts. Because they offer social as well as psychological advantages and environmental services, urban parks or green spaces are essential to the standard of living in any city. Research has indicated that being in a natural setting improves mental wellness and awareness. Nature also plays important societal responsibilities like fostering closer family bonds and offering secure play areas for kids. Activities in parks are performed by people in an urban park depending on their age groups and needs as individuals The overall experience is assumed to be significantly influenced by our emotional connection to nature. Urban parks impact cities through improved quality of health, emotional intelligence, and sustainable life.

3.2. In “Benefits of Urban Parks (A systematic review)” by Cecil C. Konijnendijk, Matilda Annerstedt, Anders Busse Nielsen, and Sreetheran Maruthaveeran published in 2013, it was also described that Parks contribute to stormwater management. The authors point out that urban parks enhance water infiltration rates compared to other urban land uses, thereby mitigating surface runoff and reducing the burden on urban drainage systems. Studies find that regular interaction with green spaces contribute to reduced stress levels, reduced obesity, reduced noise, and environmental cooling along with stormwater management. Urban parks contribute to social inclusion and cohesion by eliminating feelings like isolation. The respective paper was assessed, and it can be concluded that there is evidence for a range of benefits of urban parks, i.e. that we have sound scientific evidence that parks contribute to human and social well-being and also demonstrate the strategic integration

and maintenance of green spaces in urban planning to enhance both environmental quality and public health outcomes.

3.3. Urban parks and green spaces offer a varying range of advantages, such as ecosystem services directly or indirectly, and better recovery rates for patients in hospitals. Urban parks are vital for promoting biodiversity and can improve the physical, mental as well as emotional health of city dwellers. They also play a pivotal role in decreasing noise pollution and lowering the expenditure of energy When planning and designing urban parks, it is important to focus on their accessibility, obtainability, and appeal. The green spaces around a property directly affect the property value. Parks greatly help in reducing carbon emissions levels in metropolitan cities. Also, Urban Parks help in tourism in a city. The assessment of urban parks should incorporate the benchmark for both ecological and recreational advantages, as noted by Mohammad Mehdi Sadeghian and Zhirayr Vardanyan (issued in 2013) in their paper "The Benefits of Urban Parks, A Review of Urban Research."

3.4. In "Stories, shrines, and symbols: recognizing psycho-social-spiritual benefits of urban parks and natural areas" a research paper by Erika S. Svendsen, Lindsay K. Campbell1, and Heather L. McMillen published in 2016, explores the psycho-social-spiritual benefits of urban park and green spaces in New York City. The study is conducted, and data is collected from interviews, field observations, and photo documentation in 40 different NYC parks expanding to 11,200 acres. The findings show that engagement with parks significantly affects psycho-social-spiritual well-being across geographic, sociocultural, and religious. It was also found that the perspective of urban parks and their utilization vary from densely urbanized areas to rural outskirts of the city. Urban parks support well-being by providing spaces for relaxation, solitude, and personal refuge, as well as opportunities for social interaction and the cultivation of social ties.

3.5.A study by Kyushik Oh, and Seunghyun Jeong, available from 2007, the study uses GIS network analysis to assess the spatial distribution of urban parks and their serviceability in Seoul. It shows that although all urban parks in Seoul are large, the poor location of the parks makes them useless. The study shows urban parks network area analysis and identification using the buffering method. The service area and the land use were analyzed by the traditional "simple containment method". The study concluded distribution of parks in Seoul subdistricts determines the existence of regional inequality. Moreover, many insufficient areas in a park were also identified using spatial graphing and that can be eradicated/improved according to the local needs. In a word, identifying the land use distribution, neighborhood accessibility, and needs can help in improving the usability of urban parks.

3.6. The paper by Anastasia Kaushik on "Urban Form and Social Context: Cultural Differentiation in the Uses of Urban Parks" published in 2016, examines the importance of urban parks in densely populated urban areas, and their role in meeting the leisure, recreation, and social needs of urban residents. It displayed the history and development of public parks in the United States with four community parks in the city. The studies are presented, exploring similarities and differences in their use and understanding by different groups of users. This paper emphasizes the importance of highly user-centered park design and the specific cultural and social characteristics of different user groups. It concludes that in-order to be relevant and respond to cultural needs, it should be location and neighborhood context specific.

3.7. Another interesting research was conducted in 2017 by Somajita Paul and Harini Nagendra on "Factors Influencing Perceptions and Use of Urban Nature: Surveys of Park Visitors in Delhi" which talks about the significance of urban green spaces, especially parks, for residents and tourist in Delhi, India. Research indicates that local city dwellers as well as tourists value parks for their environmental, health, and psychological benefits. However, visitors are often not aware of the diversity of life, with many failing to notice the different trees and animals in the park. Most visitors live within 0.5 km of the parks however, some travel 10 km or more to visit the large and well-known parks, Small local parks nearby are noteworthy when: well-maintained, and accessible to the public in crowded cities. It highlights the importance of gardens and suggests that the results found in the research are crucial information that can contribute to better planning, designing, and creating urban green spaces.

3.8. The research document "Characteristics of Urban Parks Associated with Park Use and Physical Activity" studied by Gavin R. McCormack, Melanie Rock, Ann M. Toohey, and Danica Hignell in 2010 looks at the relationship between parks and physical activity in cities based on individual or focus group interviews or situ observations. It looks at things like safety, design, amenities, upkeep, and proximity. It highlights those perceptions of security—shaped by lighting, park visibility, and law enforcement presence—affect how comfortable individuals feel using these spaces, particularly at night. Along with that, it reviews how the social environment affects park use, for example, if there are wrongdoers around the locality and if there are festivals. The paper gives us a better understanding of how people use parks and how they engage in physical activity using qualitative research methods for different parks. The research also finds that the presence of families, senior citizens, and recreational groups fosters a welcoming atmosphere, encouraging greater participation in physical activities. It concludes that the utilization of a park also depends on its maintenance, aesthetics, accessibility, facilities and features, and safety. The research also finds that the presence of families, senior citizens, and recreational groups fosters a welcoming atmosphere, encouraging greater participation in physical activities.

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3.9. The research paper by Hongqiang Chen "Research on the Application of Vertical Greening in Urban Park Design" published in 2021, looks at the potential of vertical greening in urban park design to introduce and integrate with traditional cultural elements thereby, making it a legacy of park design and culturally prominent and valuable. It suggests that the landscaping of parks should be a three-dimensional integration and harmony of mountains, rivers, and nature co-existing with humans. The study also emphasizes the role of **traditional cultural elements** in park design, advocating for a **three-dimensional landscape approach** that harmonizes mountains, rivers, and green spaces with urban structures. It suggests that blending **natural and artificial landscapes** can create **culturally significant spaces**, preserve local heritage while promote sustainability, for example, the landscape design of 'Dragon Playing in Water' and the greening design of Hanque Square. In conclusion, the paper asserts that **vertical greening has the potential to redefine urban parks** by making them more **environmentally sustainable, visually appealing, and culturally significant**. It highlights the need for **policy support, public awareness, and advancements in green infrastructure technology** to successfully implement vertical greening strategies in urban landscapes worldwide.

3.10. Research conducted by D. F. Shanahan, B. B. Lin, K. J. Gaston, R. Bush, R. A. Fuller in 2014 on "What is the role of trees and remnant vegetation in attracting people to urban parks?" examines if a greater level of biodiversity and ecology in a park attracts more visitors. The researchers found that although parks with more vegetation offered an enhanced experience of nature and potential well-being benefits, these parks were less popular among people living in an advanced socio-economic neighborhood but individuals who have passion and connectedness for nature tend to travel to parks with more plants. The study also found gender directly influenced the visits to parks with more vegetation, where **females are more likely to travel longer distances to visit parks with higher ecological value**. This may be linked to **perceived safety, personal interest in nature, or preference for quieter, less crowded green spaces**. However, the study concluded that the influence of tree population in parks is limited. In conclusion, the research underscores that while **biodiversity and vegetation enhance visitor experience and well-being, they are not the sole determinants of park popularity**. A balanced approach that integrates **natural elements with accessibility, safety, and engaging park features** is essential to encourage widespread public use of urban green spaces.

In **conclusion**, Urban parks play a significant role in **enhancing the quality of life** in cities by providing **environmental, psychological**, and **community benefits** along with enhanced **mental well-being, alleviating stress, encouraging social inclusion**, and sustaining biodiversity. Parks also contribute to environmental sustainability by stormwater management and reducing carbon emissions. Notable factors influencing park use include **accessibility, design, safety, and maintenance**. A park with an inconvenient location or poor maintenance fails to meet local needs thus, resulting in a low number of visitors and less utilization. Cultural and demographic distinctions

influence how parks are perceived and used by the people, reinforcing the need for **culturally sensitive and inclusive designs**. **Vertical greening and biodiversity integration** are emerging trends in park planning, offering both environmental and aesthetic value. However, challenges remain for **equitable accessibility and optimizing park usability** to its full potential, especially in densely populated areas of urban cities. Future research should focus on aligning park designs with community needs for positive impact.

4.Aim

This research examines the physical, emotional, and mental health benefits of urban parks in Pune, highlighting their role in well-being, social interaction, and stress reduction. It aims to provide insights for improving park accessibility, maintenance, and usability for city residents.

5.Objectives:

Examine the health benefits of urban parks in Pune, focusing on their impact on physical, mental, and emotional well-being.

Analyze visitor experiences and usage patterns to understand key factors influencing park visits, such as accessibility, maintenance, and amenities.

Evaluate the role of urban parks in fostering social interaction and strengthening community ties among city residents.

Identify challenges related to park accessibility, safety, and infrastructure to provide recommendations for improving urban green spaces.

6.Scope

This study examines the impact of urban parks in Pune on visitors' physical, mental, and emotional well-being, focusing on accessibility, usage patterns, and social interaction. It aims to assess how factors such as maintenance, infrastructure, and park design influence visitor engagement and community building. The research is limited to urban parks in Pune and is based on survey responses from adult residents. Findings from this study will provide insights for urban planners and policymakers to enhance the design, accessibility, and overall effectiveness of public green spaces in urban environments.

7.Limitation

By looking at Pune and its varied population, we can get a better understanding of the multi-faceted nature of this problem. Pune's socio-economic situation, cultural diversity, and diverse neighborhood dynamics have a significant impact on how people interact with public spaces. Due to the limited demographic scope of the research, which is 18 years above, overlooking the unique recreational habits and interests of other age groups like children, and adolescents who play an important role in the park's user dynamics.

The results may not reflect the wide range of perspectives across the nation and behaviors across the state's diverse communities. The complex relationship between the socioeconomic background of the users is unexplored, which may hide the differences in access, usage, and experiences across different social classes.

8.Identifying Biases

Potential biases in this study include:

***Selection Bias*:** The sample consists only of individuals who responded to the survey, which may not be representative of all park users in Pune.

***Self-Report Bias*:** Participants' responses might be influenced by personal perceptions rather than objective assessments.

***Demographic Bias*:** The study focuses only on adults (18+), excluding children, adolescents, and elderly individuals who might have different experiences.

***Geographic Bias*:** Only major parks in Pune were included, limiting generalizability to other urban contexts.

9.Bias Declaration

"This study acknowledges potential biases, including selection bias due to the voluntary nature of participation, self-report bias in responses, and demographic bias as only individuals aged 18+ were surveyed. These factors may influence the generalizability of findings, and future research with a larger and more diverse sample is recommended."

10.Questionnaire Design & Pilot Study

A pilot study was conducted to assess the feasibility and reliability of the research methodology before the full-scale study. The primary objective was to refine data collection tools, identify potential challenges, and ensure the validity of the proposed framework. The study's procedures, including data collection, analysis methods, and ethical considerations were studied before the survey was circulated.

The questionnaire was structured to collect demographic details, preferences, views, and experiences of Pune's urban park visitors. It covered aspects such as frequency of visits, duration, purpose, emotional and physical benefits, and urban park conditions.

The pilot study results provided critical insights, allowing necessary modifications to improve clarity, enhance participant engagement, and ensure methodological robustness. Key refinements included adjustments in questionnaire design, interview protocols, and data analysis techniques to align with the research objectives effectively. The findings confirmed the practicality of the study design, ensuring a smoother execution of the main research phase.

11.Methodology:

***Research Design*:** A quantitative research methodology is used to collect detailed information and findings.

***Population and Sampling and Park Selection*:** The target population consists of Pune residents aged 18 years and above. A random sampling method was employed to ensure representation across various age groups, income levels, and residential areas. The selection of parks for the survey was based on their popularity, infrastructure quality, accessibility, and geographic distribution across different localities in Pune, ensuring a diverse and comprehensive analysis.

***Survey form Development*:** A detailed questionnaire for the survey form was designed to collect relevant information from respondents. The survey form questionnaire was prepared using literature reviews and pre-requisite knowledge of the topic. The questionnaire was structured to collect preferences, views, and experiences relevant to the research topic.

***Passive Observation in Local Parks*:** Passive observation was conducted in small local parks across Pune to analyze visitor demographics, activity patterns, and park usage trends. Non-intrusive monitoring focused on the preferred activities (e.g., walking, exercising, socializing), and interaction with amenities. These qualitative insights complemented survey data, enhancing the study's understanding of user behavior and urban park functionality.

***Data Collection for the survey*:** The designed questionnaire was distributed to participants via Google Forms. Additionally, a review of existing knowledge on the topic was conducted to gain insights and understand the current awareness surrounding it.

***Data Analysis*:** Data coding was done through Excel and were used to analyze quantitative data, while qualitative data was used for thematic analysis to spot trends and issues.

***Ethical Considerations*:** Privacy and confidentiality of participants was respected. Before any data was collected, consent was obtained. All data was used only for research purposes.



12.Data analysis-

It was observed that a few people don't know the term urban parks but rather know them as parks or gardens. A total of 60 people participated in this survey, who were above the age of 18 mostly. In this survey, the major 5 parks of Pune were studied, which are popular and well-known among the city residents and tourists. The experiences and observations of the visitors of the parks were duly noted and studied for a thorough analysis of each question asked related to the research topic.

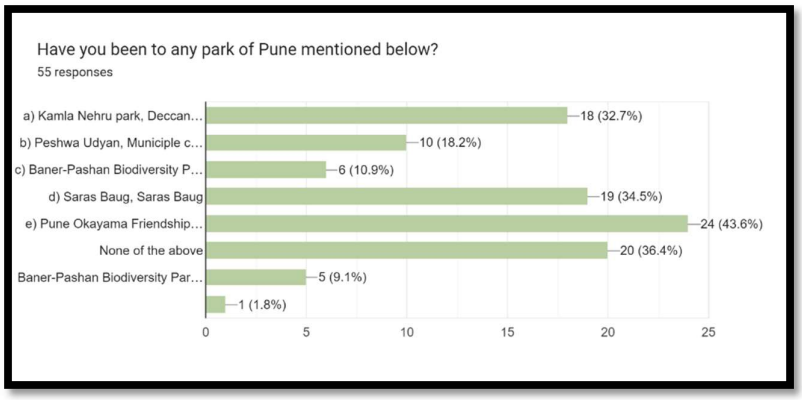


Figure 1. *Pune parks visited by respondents*

The data presented in **Figure 1**. indicates that all the parks listed in the survey have been visited by residents of Pune city, with varying levels of visitation. However, "Pune Okayama Friendship Park" located in Koregaon Park, Pune stands out with the highest number of visitors. This could be attributed to its strategic location which enhances its accessibility to most people. 24 people out of 60 people have visited the "Pune Okayama Friendship Park". In contrast, the "Baner-Pashan Biodiversity Park" seems to have the least number of visitors, 6 of 60 people. Several factors may explain this disparity, including the park's relative inaccessibility, the newer development of its surrounding area, or other socio-environmental factors that may influence visitation patterns. It is also possible that the park's location is comparatively in a less densely populated region, coupled with a lack of sufficient infrastructure or public awareness, which plays a role in limiting its appeal.

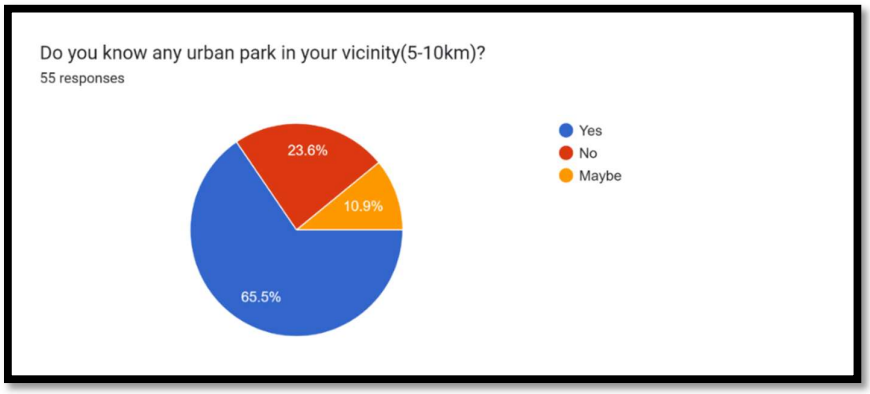


Figure 2. *This shows if the respondents have any parks near them which is accessible to them within 10 km*

Figure 2. illustrates that most people have access to urban parks as they are often located near the places where people reside. The availability of this green is crucial in promoting the health and well-being of local communities. Unfortunately, 23.6%, that is 14.16 of the total respondents, lack access to a park within 10 km of their residence. Regarding this issue, it is important to highlight, that government policies and

regulations often require a certain percentage of green space like open spaces, parks, and recreational areas in urban areas, typically around 10% - 15 % (referred from and guided by Master Plans of Municipalities and Urban Development Authorities, and MoHUA), to ensure that residents have access to natural environments that promote physical activity, relaxation, and other health benefits. In summary, the availability of urban parks has become increasingly important today, and cities around the world are making efforts to ensure that residents have access to green spaces that promote health, well-being, and a sustainable environment.

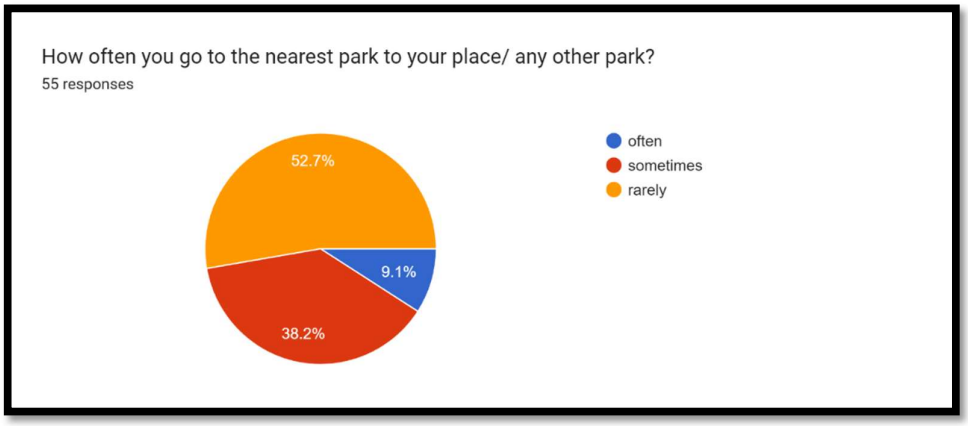


Figure 3. *Displays the frequency of visits of the respondents to their nearest park*

In Figure 3., 52.7%, that is 31.62 of the total participants acknowledged that they rarely visit parks, which highlights the difficulty for individuals to prioritize leisure activities like visiting parks. Despite being aware of the benefits that urban parks offer, such as providing a green and peaceful environment for relaxation, promoting physical activity, and improving mental well-being, many people still struggle to make regular park visits. This emphasizes the importance of finding a balance between work, personal commitments, and leisure activities. Incorporating Park visits into daily routines, even if it is just for a short period, can provide individuals with valuable moments of relaxation and rejuvenation. Visitations can be increased using strategies like well-thought-out locations of parks, organized fitness programs, walking and nature trails, cleanliness, light and security, cultural and community events and many more effective actions.



Figure 4. *Displays the number of days in a week the respondents visit their nearest park*

Based on the survey results displayed in Figure 4., it is evident that a majority of the participants visit parks either once a week or not at all. Specifically, 80% of the respondents indicated that they visit a park only 0-1 day. Additionally, it appears that none of the participants visited a park throughout the entire week. These findings suggest that there may be various reasons why people are not able to visit parks frequently. As mentioned earlier, busy schedules, time constraints, and a lack of time management skills could be factors contributing to the infrequent park visits. It is also worth considering other possible factors such as proximity to parks, personal preferences, or alternative options for outdoor activities that may affect the frequency of park visits. For individuals interested in visiting parks more often, it could be helpful to assess their schedules and try to allocate specific time slots for leisure activities like park visits. Additionally, exploring other nearby parks or considering different days of the week for visits could also be options to increase the frequency of park visits.

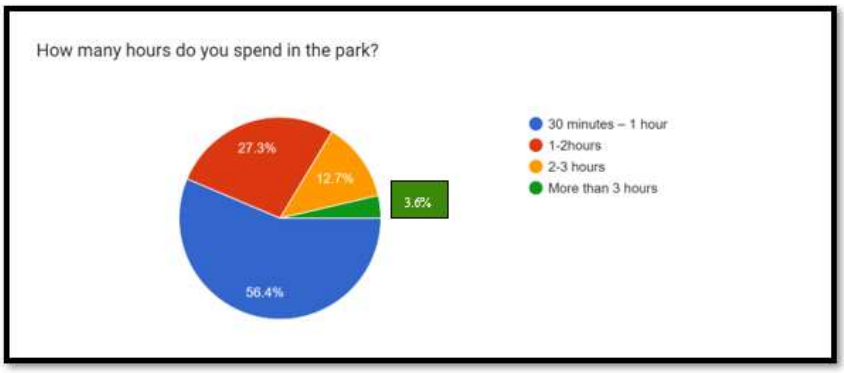


Figure 5. *shows the percentage of hours spent by the respondents in a park*

The information is presented in **Figure 5.** clearly shows that people spend relatively little to no time in parks on a daily basis. Many park visitors typically restrict their visitation time to a window of thirty minutes to two hours at most. The 0-minute to 2-hour timeframe has the maximum response for time spent in a park as one of the daily tasks. Notably, only a small proportion of respondents—merely 3.6%—report spending more than three hours in the park. This finding underscores that the majority of people's

daily routines are characterized by brief visits to parks, while a very small segment of the population engages in longer visits for leisure and relaxation. The data suggests that park visits are generally short and incidental, with only a few individuals dedicating extended periods to outdoor recreation.

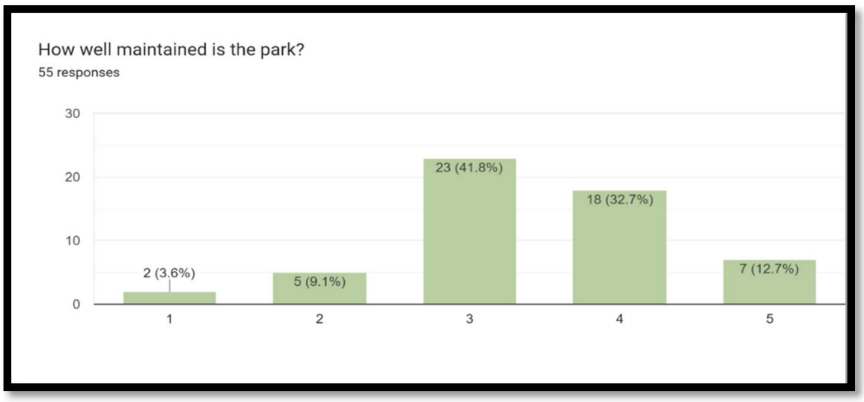


Figure 6. *Respondents rated the park's maintenance on a scale of 1-5 (1 is the lowest and 5 is the highest)*

Figure 6. presents the distribution of ratings given by respondents regarding the maintenance of parks in their vicinity, with the majority rating the condition as a 3 on a 5-point scale. This suggests that while the parks are not in poor condition, they are also not exceptionally well-maintained. Only 12.7% of respondents rated their parks as a 5, indicating that a small proportion of individuals perceive their local parks as being very well-maintained. Contrariwise, 3.6% of respondents rated their parks as poorly maintained, which, though a smaller percentage, represents a significant number of individuals, potentially limiting the appeal and accessibility of parks for many people.

The maintenance of urban parks is a crucial factor in encouraging regular use, as well-maintained green spaces are more inviting and can serve as important recreational and social hubs for communities. Poorly maintained parks, on the other hand, may demoralize potential visitors, leading to decreased public engagement and diminishing the overall quality of urban life. A properly maintained park is essential not only for aesthetic and functional purposes but also for promoting physical and mental well-being.

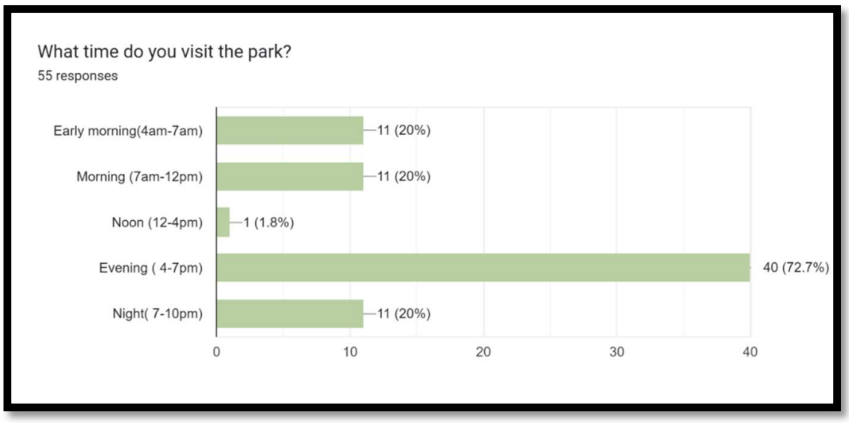


Figure 7. *displays the preferred time to visit parks by the respondents*

The evening hours, particularly between 4 and 7 pm, are the most popular time for participants to visit the park, with 72.7% of respondents indicating that they typically frequent parks during this period. This time frame is often characterized by a quiet yet lively atmosphere, as noticed by observation. Additionally, visits during the early morning (4-7 am), morning (7 am-12 pm), and night (7-10 pm) show relatively equal percentages, with around 20% of individuals choosing these times for their park visits. This pattern of visitation can likely be attributed to several factors, including the alignment of park visits with individuals' daily routines, favorable weather conditions, and a desire for a calm, less crowded environment.

Understanding these temporal preferences is vital for park management, as it can help optimize park operations and improve visitor experiences. By acknowledging the peak visitation times, parks can better allocate resources, such as staff and facilities, ensuring that visitors have a positive experience regardless of when they choose to visit. This approach not only enhances the efficiency of park maintenance but also fosters a more welcoming and enjoyable environment for all.

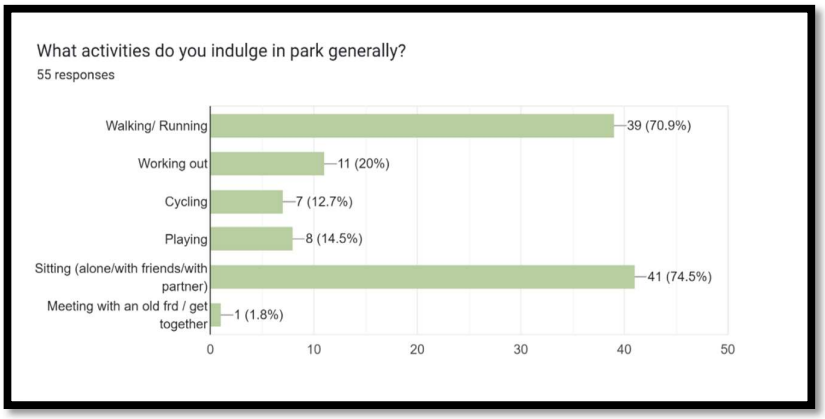


Figure 8. *The preferred activities respondents engage in during their visit to the parks*

Figure 8 highlights that a significant portion of participants, approximately 74.5%, who visit parks commonly enjoy sitting in the park either alone, with family, or with friends, primarily to unwind and relax. In addition to relaxation, many individuals use parks for more active pursuits, with 70.9% of respondents citing walking and running as primary activities. Furthermore, 20% of individuals visit parks specifically for workouts and other physical activities, indicating the park's role as a venue for maintaining physical health.

The diverse range of activities that people engage in at parks, each fulfilling distinct needs. Whether for mental relaxation, emotional well-being, or physical exercise, these activities contribute to the overall vitality of the park environment and also add to the dynamic atmosphere of the park.

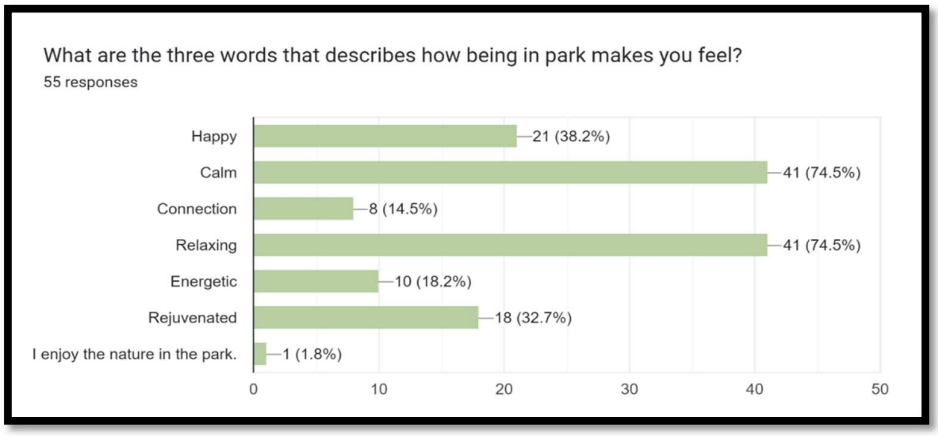


Figure 9. *The emotions that the respondents experience while in the park*

Parks serve as a sanctuary for millions, offering a peaceful escape from the demands of everyday life. According to Figure 9, the majority of park visitors (74.5%) report experiencing a profound sense of relaxation and calmness during their time in these natural spaces. The soothing atmosphere of the park appears to have a direct positive impact on visitors' mental well-being, with many individuals finding that simply being in nature helps to alleviate stress and improve their mood. Additionally, it is also revealed that many people feel a general sense of happiness during their park visits.

This analysis delves into how different activities and environmental factors within parks work synergistically to foster emotional well-being, by highlighting the complex relationship between nature and emotional health, in promoting a balanced and positive state of mind. The findings emphasize the critical role of parks as essential spaces for emotional rejuvenation in urban life.

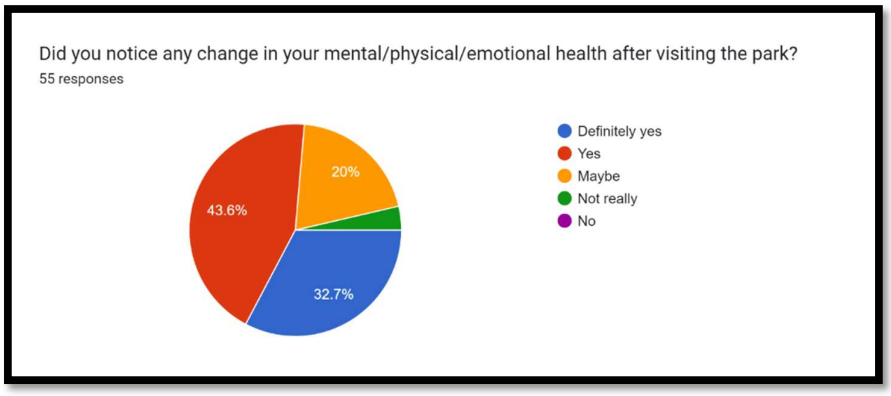


Figure 10. *The changes noticed in physical/mental/emotional health by the respondents*

According to the data displayed in Figure 10., around 43.6% of participants reported experiencing mental, emotional, or physical benefits following their visit. The park's lush greenery provided more than just a break from the demands of modern life; it became a refuge for quiet reflection and relaxation. Noticeably, none of the respondents experience absolutely "no" change after their visitation to parks.

This data highlights the vital importance of incorporating green spaces into urban settings, emphasizing the powerful role nature plays in enhancing psychological well-being. By offering a space for rejuvenation, parks help foster a sense of inner peace and balance, showing how essential these natural environments are to maintaining mental and emotional health in today's busy world.

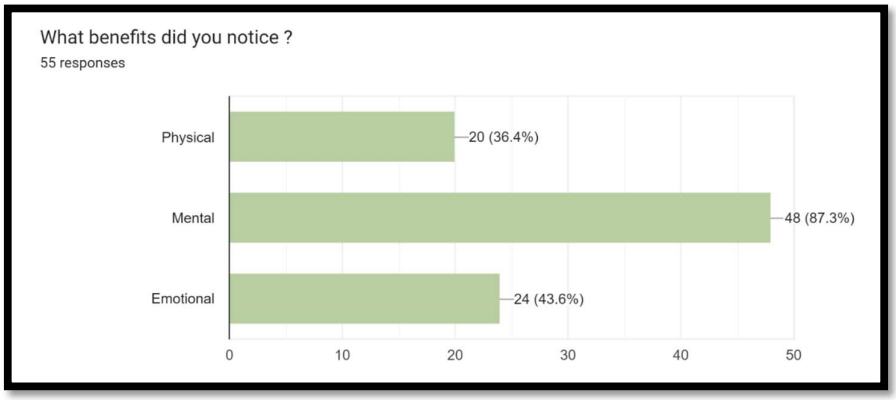


Figure 11. *The changes noticed in physical/mental/emotional health by the respondents*

As shown in Figure 11, a significant 87.3% of park visitors reported a noticeable improvement in their mental well-being after their visit. Additionally, 36.4% of respondents experienced physical benefits, while 43.6% reported emotional benefits. These findings underscore the multifaceted advantages of spending time in nature.

The natural elements of parks, including the lush greenery, the warmth of sunlight, and the fresh air, combine to create an environment that counteracts the negative effects of elevated cortisol levels—often associated with the stress of urban living. The calming

influence of nature triggers biochemical responses that reduce stress, enhance mood, and promote overall mental health. These statistics emphasize the critical role of urban parks in supporting not just physical health, but also emotional and psychological well-being.

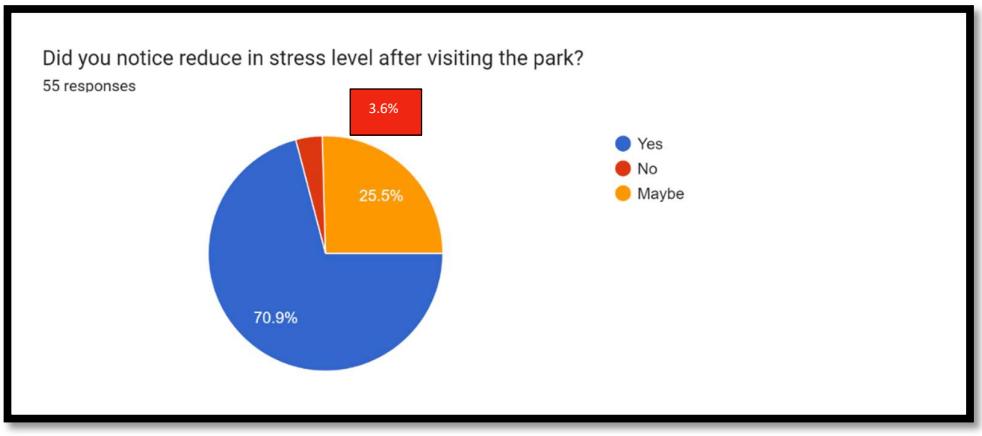


Figure 12. *The percentage of respondents who experienced a reduced stress level after visiting the park*

Figure 12 illustrates that a significant majority, comprising 70.9% of respondents, reported a notable reduction in stress levels after visiting a park. In contrast, 25.5% of participants were uncertain about whether parks contributed to stress relief, while 3.6% indicated that they did not experience any reduction in stress levels. The increase in serotonin levels during park visits plays a pivotal role in not only uplifting mood but also promoting a sense of contentment and overall well-being (stated in a study by "Integris Health"). Stepping away from the frenetic pace of urban life and immersing oneself in the peaceful ambiance of a park encourages a mental detoxification process. Such respite often leads to improved decision-making and a more optimistic outlook, fostering an environment conducive to cultivating a positive mindset and inner tranquility.

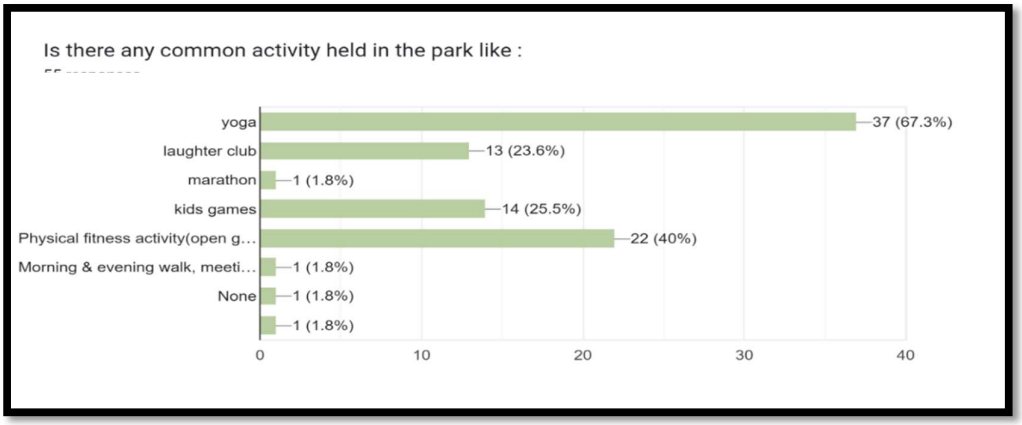


Figure 13. *shows the different activities conducted in parks near the vicinity of the respondents*

As parks verdant spaces pulsate with life, offering a spectrum of physical pursuits that invigorate both body and mind, Figure 13. shows the shades of communal activities flourish, encompassing an array of physical engagements. With its serene poses and mindful breathing, yoga attracts a notable 67.3% of the park's enthusiasts, fostering flexibility and inner calm. Laughter clubs, echoing with contagious mirth, drew in 23.6% of participants seeking the euphoria of shared laughter and uplifting fellowship. The open gym, a representation of accessible fitness, appeals to 40% of park-goers, offering an avenue for strengthening muscles and enhancing physical prowess under the open sky. As the respondents immerse themselves in these activities, a tangible sense of holistic well-being takes root, transcending the realm of individual fitness pursuits to nurture a profound feeling of communal belonging and social interconnectedness.

13.Discussion:

This study highlights the patterns of park visitation, visitor engagement in various activities, and the challenges faced by park-goers. The survey findings indicate that well-maintained parks with good infrastructure, accessibility, and diverse recreational facilities tend to attract a higher number of visitors. In contrast, parks with inadequate amenities, poor maintenance, and safety concerns witness lower engagement.

One of the key insights from the survey is the variety of activities that take place in parks. Visitors participate in activities such as walking, jogging, exercising, yoga, and social gatherings. The presence of well-maintained walking paths, seating areas, and green spaces encourages more engagement. However, challenges such as lack of proper lighting, inadequate security, and insufficient restroom facilities were frequently mentioned as deterrents to frequent visits. These challenges underline the need for better planning and maintenance to enhance visitor experience and park usability

13.1 *Park Selection & Sampling*

Parks were selected based on popularity, infrastructure, accessibility, and geographic distribution to ensure comprehensive analysis. Random sampling minimized bias and included diverse age groups, income levels, and residential areas, providing balanced insights.

13.2 *Why 18+ Adults Were Surveyed*

Adults (18+) were surveyed as they made independent decisions about park visits and offered perspectives on safety, accessibility, and usability. Their responses help assess park functionality and improvement needs.

13.3 *Implications for Accessibility & Maintenance*

Findings suggest the need for better infrastructure, improved safety, regular maintenance, and enhanced accessibility. Authorities can use these insights to upgrade facilities, install better security measures, and improve park connectivity, ensuring inclusive and well-utilized green spaces for the community.

The use of random sampling played a crucial role in minimizing bias and ensuring a diverse representation of visitors from different age groups, income levels, and residential areas. This approach allowed for a balanced dataset that reflects the experiences and perceptions of a broad population.

By addressing these factors, urban planners and local authorities can create more inclusive and engaging green spaces that cater to diverse demographics. Ultimately, well-maintained parks not only promote physical and mental well-being but also strengthen community engagement and environmental sustainability.

14.Conclusion:

The findings of this research underscore the pivotal role urban parks play in enhancing the quality of life for city residents. The data reveals both the strengths and challenges of urban **park utilization** in Pune. Notably, the **"Pune Okayama Friendship Park"** emerges as a standout, with the highest visitation rates, likely due to its **accessibility and central locatio**n.

The accessibility of parks within a 10-kilometer radius, as depicted in Figure 2, reflects an encouraging trend toward **inclusive urban planning**. However, some of the respondents who **lack access** to such spaces signify an area requiring immediate attention to align with **governmental urban development policies**. Furthermore, while parks are integral to **fostering mental, emotional, and physical well-being**, as evidenced by Figures 9 through 12, the **limited frequency and duration of park visits** (Figures 3 through 5) suggest significant barriers such as **time constraints, maintenance issues, and competing priorities**.

Interestingly, the analysis also reveals a spectrum of activities and emotional experiences within parks. From **passive relaxation and emotional rejuvenation** to active pursuits like yoga and workouts, urban parks cater to diverse needs, fostering both individual well-being and community cohesion. This dual role underscores their importance as not just physical spaces but as vital social and psychological ecosystems.

To maximize the potential of urban parks, concerted efforts must be directed toward **improving maintenance** (Figure 6), promoting awareness, and ensuring equitable access. Implementing creative strategies such as **community-driven events, enhanced security, and diversified activity** offerings could encourage higher visitation rates and prolonged engagement. Furthermore, leveraging insights into peak visitation times (Figure 7) can enable optimized park operations and resource allocation.

The study also suggests that there may be an association between urban parks and improved mental, physical, and emotional well-being of visitors. The findings suggest that parks play a crucial role in stress reduction, social interaction, and overall quality of life. While this study provides valuable insights into the impact of urban parks in Pune, future research with a broader and more diverse sample can further strengthen the understanding of correlations between park accessibility, frequency of use, and health benefits, contributing to more inclusive urban planning and well-being initiatives.

As seen from the responses and collaborating with literature, the primary finding of this research is that **mental and emotional well-being outweigh physical activity as the primary motivator for urban park visits in Pune**. While traditional studies emphasize parks as spaces for exercise, this study reveals that visitors **prioritize relaxation, stress relief, and social interaction** over structured physical activities. This insight challenges conventional urban park planning, suggesting a need for **more quiet zones, shaded seating areas, and mental wellness initiatives**. Additionally, **park accessibility, maintenance, and safety perceptions significantly impact visitation patterns**, underscoring the importance of **inclusive and well-maintained green spaces** in urban well-being.

A broader investigation that includes a more diverse demographic and a deeper exploration of how socio-cultural factors influence the use of public spaces would help develop urban planning strategies that better address the varied needs and preferences of the city's population.

Acknowledgments

I would like to express my sincere gratitude to my co-author, for their invaluable support, guidance, and collaboration throughout this research. I am grateful to all the respondents who took the time to participate in the survey, providing essential insights for this study. Lastly, I would like to extend my heartfelt appreciation to my family for their constant support, understanding, and encouragement during this journey.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Political Ideologies Shaping Architecture: A Case of India

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Abstract: *Architecture is intrinsically linked to political ideologies, shaping urban landscapes, public infrastructure, and construction policies. Government priorities, funding mechanisms, and urban planning frameworks are largely dictated by the ideological orientation of ruling parties. This study explores the relationship between political ideology and architectural development by analysing three Indian states—Kerala, West Bengal, and Gujarat—each representing distinct ideological spectrums: left-wing, centrist, and right-wing governance, respectively. By employing a comparative framework, this research examines how these political models influence architectural decisions, infrastructure investment, and construction typologies. The study draws on official government data, case studies, and policy documents to assess the correlation between governance and architectural trends. Findings indicate that political ideology significantly impacts the nature and scale of infrastructure projects. By identifying the impact of political ideology on architecture, this study contributes to a broader discourse on governance, spatial planning, and sustainable development, offering valuable recommendations for future research and practice. The findings underscore the need for inclusive urban policies that harmonize economic growth with social welfare.*

Keywords: Building typology, soft power, infrastructure, policies, socio-economics

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1. Introduction:

All architecture has a political dimension, in the sense that it expresses a set of values. The architectural object performs politically through the situations and activities it encourages and the ones it prohibits (Cutieru, 2020). Architecture serves as a reflection of societal values, influenced by governance models and ideological priorities. Political decisions directly shape urban landscapes through policy frameworks, budget allocations, and regulatory structures. This research explores how differing political ideologies—socialist, centrist, and right-wing capitalist—manifest in architectural and infrastructural development in India. It is important to distinguish the party's agenda and the views of the party by outsiders like journalists, researchers and other official bodies. The urban landscape of India, especially the scale and typologies of government-owned buildings, varies massively throughout the country.

By examining three states with distinct political backgrounds—Kerala (Left), West Bengal (Centre), and Gujarat (Right)—this study investigates how governance influences architectural typologies, urban planning, and public infrastructure investments. Understanding these patterns can offer valuable insights into future urban development trends and policy-making.

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2. Literature Review:

Political ideology is defined as a "set of beliefs about the proper order of society and how it can be achieved" (Erikson & Tedin, 2003). Soft power refers to the ability to influence public perception through intangible elements such as culture, philosophy, architecture, and diplomacy (Nye, 2004).

Historical studies have demonstrated the ideological impact on state-driven architecture, particularly during the Cold War, where socialist and capitalist nations followed distinct architectural strategies (Broadbent, 1980). Architect Ernst May's work in Frankfurt, guided by socialist principles, sought social reform through innovative housing projects, whereas Albert Speer's architectural designs under Nazi rule symbolized Hitler's nationalist vision of power and dominance (Lane, 1986). Similarly, the USSR's social housing projects, characterized by small kitchens and bathrooms, provided large-scale housing solutions, reflecting the government's focus on mass accommodation (Broadbent, 1980). These examples highlight how political regimes directly influence architectural priorities and urban development.

Architecture has also been used as a powerful tool for political messaging. In countries like the UK and the US, politicians leverage architecture to project authority and stability, often delivering speeches or hosting events in front of historically or culturally significant buildings. This strategic use of architectural settings strengthens political narratives and enhances public perception (Cairns, 2012). Thus, architecture extends beyond its functional purpose to serve as a medium for political identity and influence.

In the Indian context, significant shifts have been observed from socialist governance to neoliberal policies, particularly after the 1991 economic reforms. This transformation led to the privatization of urban development, altering land use patterns, population densities, and socio-economic structures, making Indian cities more aligned with global urbanization trends (Kavilkar & Deshmukh, 2017).

Political ideology shape's architectural identity through governance models, urban planning policies, and funding mechanisms. In India, post-1991 economic liberalization led to a shift from state-controlled socialist urban development to a market-driven landscape, blurring rural-urban boundaries (Kavilkar & Deshmukh, 2017). However, recent studies on regional governance and architectural development remain limited. This research fills that gap by analysing contemporary political influences on infrastructure across ideologically distinct Indian states.

3. Methodology

3.1. Content analysis of secondary data sources

This study adopts a comparative case study method, utilizing qualitative and quantitative data analysis. Three Indian states—Kerala, West Bengal, and Gujarat—are selected based on their distinct political ideologies and governance models. Data sources include:

- Official government reports and infrastructure statistics
- Political party manifestos and policy documents
- Peer-reviewed journal articles and news publications
- Case study analysis of prominent infrastructure projects

3.2. Case selection

Defining political ideologies in India and applying the left-to-right narrative to the Indian political landscape is difficult. These terms have been coined by the Western world and can never capture the nuances of Indian politics. However, using the available sources, three states have been chosen for ease of understanding, which have been largely associated with a certain political party or ideology for the past five years.

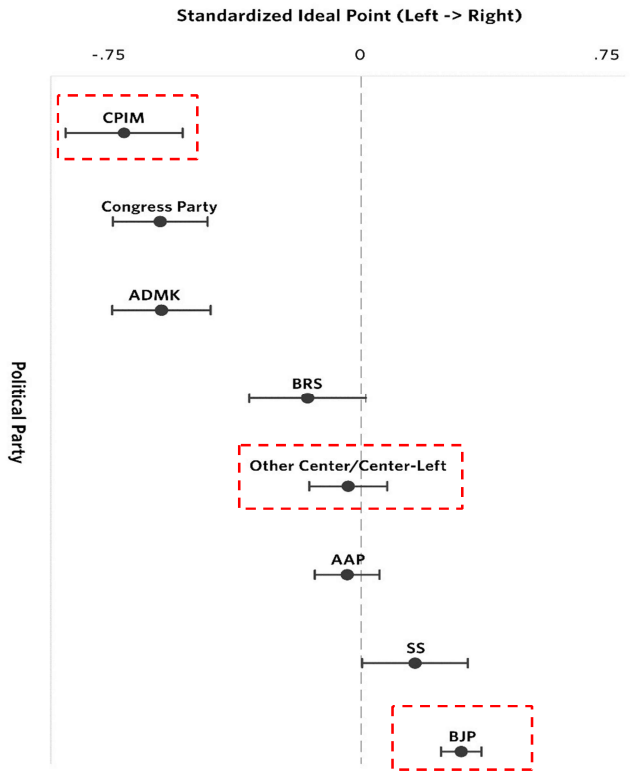


Figure 1. *Haas & Majumdar, 2023. Survey done for the article "How Ideology Shapes Indian Politics" for the Carnegie Endowment website. Authors' analyses based on an online survey panel, August-September 2022*[14]

[14] This figure displays average ideal point estimates, with 95% confidence intervals, by respondents stated partisan affiliations. It displays all parties for which there are a sufficient number of identifiers (at least N=80) in the sample, and it includes a residual "Other Centre/Centre Left" category for the remaining parties.

Using the above parameters, states of India having different ruling parties and on two ends of the political ideology spectrum have been taken, and a centre has been chosen as a control.

3.2.1 Left: Kerela (Communist Party of India (Marxist))

The Communist Party of India remains firmly wedded to the goal of a just socialist society in which equal opportunities for all and guarantee of democratic rights (Communist Party of India (Marxist), n.d.). CSIM's ideology is based on Communism, as defined by Karl Marx, and is centre around common ownership of the means of production, distribution, and exchange that allocates products to everyone in the society based on need (Chakrabarty, 2014) (Marx & Engles, 1910).

3.2.2 Centre: West Bengal (All India Trinamool Congress)

The aim of the Party is be to make all-round development of India in the political, economic, industrial, social, cultural, and agricultural sectors and to establish India as a global power keeping in view the multi-lingual, multi-faceted, multi-ethnic, rich culture and heritage of India (All India Trinamool Congress, 2024).

External sources describe the political ideology of AITC as:

Bengali nationalism (PTI, 2021)

Regionalism (Chirkkara, 2022)

Welfarism (Debnath & Chatterjee, 2021)

3.2.3 Right: Gujarat (Bharatiya Janata Party)

BJP is committed to using constitutional means to bring about socio-economic change in society and to its all-around development on the basis of Integral Humanism (Bharatiya Janata Party, 2024).

Based on external sources, BJP's ideology is broadly described as:

Indian Conservatism (Mazumdar, 2017)

Neoliberalism (Mazumdar, 2017)

Hindu nationalism (Berglund, 2004)

Right-wing populism (McDonnell & Carrera, 2018)

3.3. Comparison Parameters

The government data on the infrastructure development is taken from Indian Government websites, respective state government websites and/or other news outlets. The parameters that will be used are:

- volume of projects,
- percentage increase in number of projects,
- sector-wise distribution of projects,
- costs of projects,
- project promoters, and
- case study from each state of a project promoted by the state government that aligns with its political ideology

Thus, the independent variable is the Indian state, the dependent variable is the ideology of the ruling party of the state, and the unit of analysis is infrastructure development using the parameters mentioned above.

4. Findings

4.1. Infrastructure Development Trends

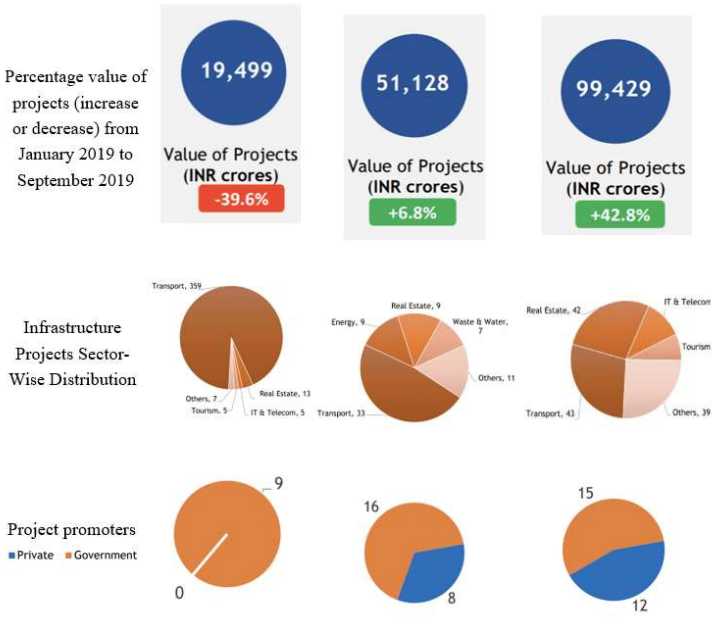
Table 1. State-wise volume of projects

Project parameter	Kerela (CPI(M))	West Bengal (AITC)	Gujarat (BJP)
Volume of projects	147	444	538
Total project costs (in crores)	58,714.13	181,869.06	350,357.70

Source: Infrastructure Projects – State-wise summary report - Public-private partnership in India database, Department of Economic Affairs, Ministry of Finance, Government of India (https://www.pppinindia.gov.in/state_wise_summary_report)

Table 2. Comparative data from the National Investment Promotion and Facilitation Agency

Comparative parameter	Kerela (CPI(M))	West Bengal (AITC)	Gujarat (BJP)



Source: Invest India Grid, All data as of Sep 30, 2019. Invest India, National Investment Promotion and Facilitation Agency. (https://indiainvestmentgrid.gov.in/states)

4.2. Case Study Analysis

Three case studies were selected from state government websites, public announcements and/or newspaper articles about the project. These projects also align with the state governments political ideology.

4.2.1. Case 1: Government Hospital, Paravoor, Kerela

Government Hospital in Paravoor was randomly chosen among a list of completed projects list that is available on Kerela government websites. These projects were of a similar scale, including Anganvadis (primary schools), small-scale biogas plants, local hospitals in remote areas, electrification projects, market yard development, drinking water and drainage infrastructure, etc.

Many government entities, such as the Kerala Infrastructure Investment Fund Board (KIFB), Kerela State Coastal Area Development Corporation Ltd. (KSCADC), and Kerala Industrial Infrastructure Development Corporation (KINFRA), are involved in the approval and completion of these projects. As all project promoters are Kerela government entities, project typologies include public and social welfare infrastructure.



Figure 2. *Government Hospital, Paravoor, Kerela (Source: Kerela State Coastal Area Development Corporation Website https://www.keralacoast.org/projects-details-completed.php?id=19)*

4.2.2. Case 2: Dhonodhanyo Auditorium, Kolkata, West Bengal

One of the more monumental projects in recent Kolkata history, The Dhonodhanyo Auditorium was chosen as a case study from a newspaper article of the inauguration.

Dhonodhanyo Auditorium is a multi-auditorium complex in Alipore, Kolkata, West Bengal, India. The auditorium was named "*Dhonodhanyo*" in honor of the renowned poet, playwright and lyricist Dwijendralal Ray. It embodies the cultural regionalist ideology present in West Bengal with its iconic conch shaped structure.

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Figure 3. *Dhonodhanyo Auditorium, Kolkata, West Bengal (Source: New Monument in Kolkata – Dhono Dhanyo Auditorium. Explore India Youtube channel. https://www.youtube.com/watch?v=XqhOsv2NYao)*

4.2.3. Case 3: NSE IFSC, GIFT City, Gujarat

One of the largest projects, Gujarat International Finance Tec-City, also called GIFT City, is a central business district under construction in the Gandhinagar district of Gujarat, India. The government of Gujarat promoted it as a greenfield project and made it India's first operational greenfield smart city and international financial services centre.

The NSE IFSC (National Stock Exchange International Financial Services Centre) International Financial Services Centre) in GIFT City, Gujarat, is a landmark initiative aimed at positioning India as a global financial hub.



Figure 4: *NSE IFSC, GIFT City, Gujarat (Source: Indian Express Gujarati https://gujarati.indianexpress.com/business/sgx-nifty-nse-ifsc-gift-nifty-stock-market/120523/)*

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5. Conclusion

5.1. Discussion

There is a strong correlation between the reigning political ideology of the ruling party of the state, its popularity within the country and the funding for infrastructure projects. The more popular the party and its ideology in the country, the greater number of development projects in the state. The image of the political party is also important, at inaugurations, for future elections as infrastructure development is one of the main sectors where public funding is utilized. The political ideology of the party affects the typologies of buildings and their architectural language.

	Left	Centre	Right
Ideology	Communist	Socialist, Regionalist	Capitalist, Nationalist
Number of projects	Fewer	More than left, less than right	More
Sector wise distribution	90% of projects are in the Transport sector	50% projects are in transport sector with the rest distributed between energy, real estate, waste management, etc.	25% each almost equally distributed between Transport and Real Estate. Transport and IT account for 20%
Infrastructure typologies	Transport, Public Welfare Projects (Institutional, buildings, Services)	Public welfare with monetary gain (Auditorium, Airports)	Industrial and commercial buildings (Office Buildings, Stadiums)
Case Study Takeaways	The project is an example of a state-driven welfare project, reflecting on the socialist model	The project Balances public utility with economic viability, a key aspect of regionalist politics	The project aligns with a pro-business stance, prioritizing economic liberalization, large-scale commercial development, and strategic investment opportunities.
Funding	Funded by state run initiatives that work under the state government	Funded directly by the state government with a few private investors	Funded via the PPP model (public-private partnerships)
Project Value	Social value	Socio-economic value	Economic value
Inferences	Priority given to social infrastructure, particularly in healthcare and public welfare, with substantial government funding ensuring accessibility to all citizens.	Centrist approach that balances cultural identity with infrastructural development.	Emphasis on financial growth, economic liberalization, and attracting foreign investment through large-scale commercial developments.

Thus, Kerala, governed by a left-wing ideology, prioritizes public welfare structures such as hospitals and transport networks. West Bengal, with a centrist approach, balances public and economic development projects, integrating regional cultural identity into its architectural landscape. Gujarat, under a right-wing neoliberal model, focuses on large-scale commercial and industrial infrastructure, emphasizing economic expansion and foreign investment.

5.2. Implications

This research aims to provide valuable insights into the relationship between political ideology and architectural development, offering implications for various stakeholders:

Urban Planners and Policymakers: Understanding how political governance shapes infrastructure priorities can help in formulating balanced urban policies that integrate economic development with social welfare.

Architects and Designers: By recognizing the influence of political ideologies, architects can adapt their designs to align with state priorities while ensuring functionality and inclusivity.

Government and Regulatory Bodies: The study highlights the need for governance models that promote equitable infrastructure distribution, ensuring that urban development benefits a broad spectrum of the population.

Investment and Real Estate Development: Private investors and real estate developers can leverage insights from political influences to anticipate future infrastructure trends and policy shifts that may impact commercial and residential projects.

Researchers: This paper lays the groundwork for further studies on how governance impacts urban form, providing a framework for analysing political-architectural relationships across different regions and governance models.

5.2. Further Scope of Research

Further research can delve into multiple aspects of the interplay between political ideology and architecture:

Comparative Global Analysis: Explore how political ideologies influence architecture in different democratic and authoritarian regimes worldwide, identifying patterns that align with governance styles.

Historical Transitions and Their Architectural Impact: Assess how political transitions, such as shifts from socialism to neoliberalism, impact urban planning and infrastructural investments over extended periods.

Sustainability and Political Priorities: Examine the relationship between political ideologies and sustainable architectural practices, focusing on green infrastructure policies, environmental conservation, and energy-efficient urban development.

Conflicts of interest: The author declares no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Analysing impact of architecture in films -A case of four Bollywood feature films.

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Abstract: *The most influential part of any film is its narrative, which develops the storyline, and to present this narrative architecture is seen to play a crucial role. The paper explores the profound impact Architecture has on shaping narratives in Bollywood films. By focusing on four films, Delhi 6, Piku, 2 States, and Paheli. The choice of the films is such that the urban/rural characteristics of varied regions of India are highlighted. The study examines how architecture serves as more than just a visual backdrop and becomes an active, dynamic force that influences and enhances the storyline. The details from macro to micro level, such as specific historic monuments, culture based built planning, thoughtfully designed landscapes, intricate ornamentation, and urban capes including meticulously crafted street views etc. work in harmony to create a rich social and cultural language. The method of Questionnaire survey analysis is implemented for collection of data which is further analyzed using categorical data analysis. These elements set the tone and atmosphere of scenes, enhancing the emotions and themes of the narrative. The idea is to identify the vital role played by architecture to bring in the sense of place, rootedness, and situatedness in films, beyond the immediate plot and performances. The research paper intends to find out how audiences connect to the diversified symbolic expression in the movies and find the aspects of architecture that are most influential in connecting with the film's narrative. It also tries to identify the role of architecture, more than framing the narrative to offering a window into local traditions and regional identities, while adding depth to the cinematic experience.*

Keywords: Architecture; Bollywood film; cultural identity; urban and rural landscapes.

1.Introduction

Films are popular worldwide, resonating with audiences of all ages and making a significant impact. (Rane, 2023) However, the way everyone interprets a film can vary greatly. Hindi films, commonly known as Bollywood and formerly referred to as Bombay cinema, is the film industry based in Mumbai, specializing in Hindi-language productions. The term "Bollywood" is a blend of "Bombay" and "Hollywood". (Masterclass, 2021) In India, Bollywood has thrived, with a rich history that spans 128 years. Over the years, Bollywood films have portrayed a wide range of settings, from cultural heritage sites and architectural landmarks to landscapes and intricate details like ornamentation. (Rane, 2023) This research paper explores how these cinematic backdrops contribute to the overall storytelling and aesthetic in the context of Indian cinema. The study focuses on four Bollywood films—*Delhi-6*, *Piku*, *2 States*, and *Paheli*—selected to represent different regions of India as depicted in the respective films. The research methodology includes surveys and a questionnaire-based analysis.

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The hypothesis of this research is that the architectural settings in films have a strong impact on audiences, serving as an integral element in creating a compelling and cohesive backdrop.

1.1Aim:

The aim of this research is to explore how Bollywood films use architecture as a narrative tool to reflect cultural heritage, influence storytelling, and shape audience perceptions, particularly in the context of films like Paheli, Delhi 6, Piku, and 2 States.

1.2 Objective:

To analyse how 4 Bollywood films like *Paheli (Film 1)*, *Delhi 6 (Film 2)*, *Piku (Film 3)*, and *2 States (Film 4)* use architectural settings to represent and preserve cultural heritage. (The films are considered such for ethical considerations.)

To examine the role of architecture in shaping narratives and character development in selected films.

To investigate how architectural elements in Bollywood films influence audience perceptions and engagement with cultural spaces.

Significance- Enrichment of viewers by experiencing the architectural settings. This promotes awareness for preservation of settings.

2.Literature review:

2.1Place:

Sense of place refers to people's personal perception and emotional connection to their surroundings. It encompasses both interpretive and emotional aspects of experiencing a place. This concept is a combination of psychological, interactive, and physical elements. The relationship between people and their environment is transactional: individuals either receive something from a place (positive or negative) or contribute to it in some way. The physical and social characteristics of a place together create an environment that influences this dynamic. (Mina Najafi, 2011)

2.2Staged authenticity:

Staged authenticity refers to the deliberate presentation of cultural or historical elements in a way that appears authentic but is curated or performed for an audience, typically tourists. This happens when destinations or heritage sites modify or reconstruct aspects of local culture to make them more accessible, appealing, or marketable. (Maccannell, 1973)

2.3 Situatedness and place:

In architecture, place refers to a specific, tangible location experienced through physical presence, emphasizing the direct, bodily engagement with space. It is singular, focused, and rooted in immediate perception. Situatedness, or situation, expands this concept by adding context, history, and the passage of time, making the place dynamic and subject to change. An historical monument is a place, but its role in commemorating events adds to the situation. Situations arise through events that occur within space and time, requiring interpretation and imagination to understand their full impact. Together, place and situation form a holistic understanding of spatial and cultural identity. (Casey, 2018)

2.4 Films and importance of background creation:

The production design, which incorporates elements such as setting, locations, props, and visual themes, enhances the film's believability and emotional impact. (DeGuzman, 2023) Quoting Guzman, “Great production design is more than just aesthetics. It serves as a storytelling tool.”

2.5. Cultural significance and influence:

The literature on Hindi cinema, especially Bollywood, underscores its role as a cultural bridge that connects domestic and international audiences to Indian heritage and values. This research emphasizes that Bollywood is more than just entertainment; it is a cultural prism reflecting societal norms, traditions, and historical values, engaging both the diaspora and foreign audiences. (Chaudhari, 2023)

Cultural theorists argue that Bollywood offers a visual and emotional reconnection for international viewers, particularly the diaspora, through its use of iconic architecture and traditional landscapes. The preservation of India's cultural and architectural history through cinema strengthens Bollywood’s global influence. Bollywood acts as a medium for cultural discourse, heritage preservation, and diplomacy, reinforcing Indian identity on the global stage and shaping how India is perceived both locally and internationally. This interplay between cinema and cultural identity positions Bollywood as a crucial force in promoting and safeguarding India's cultural traditions. (Chaudhari, 2023)

2.6. Reflection and influence of Indian films on heritage:

Indian culture has demonstrated resilience through historical shifts, social challenges, and external influences. Films often showcase how traditions and values remain deeply embedded in Indian society, even amidst change. By incorporating symbols like rituals, attire, festivals and architecture, cinema becomes a tool for preserving and celebrating cultural heritage. (Saxena, Preserving cultural heritage through hindi cinema- an exploration of narrative techniques , 2023)

2.7. The Role of Architecture in Bollywood Films:

The transition from ornamental, small-scale settings as merely surroundings to useful urban places that are now a part of film storylines itself is highlighted by emerging studies on contemporary Indian cinema. The architecture that has been produced is indicative of a changing culture in which narrative and space are connected in previously unimaginable ways. Modern Indian cinema is focusing on delivering realistic stories that capture a distinctively Mumbai urban sensibility, whereas traditional Bollywood concentrated on glitzy, escapist plots. The emergence of increasingly diverse themes and narratives, which were primarily encouraged by globalization, subtly sparked some of these shifts. (Radaei, 2014)

Bollywood films have long employed architectural elements as powerful visual tools to preserve and promote India's cultural heritage. Through the depiction of rural and urban landscapes, historical structures, and traditional homes, films serve as cultural artifacts that express different eras and contexts. Architecture in Bollywood not only acts as a backdrop but also embodies the essence of India's cultural and architectural diversity, portraying its evolution across time and space. (Saxena, Preserving cultural heritage through hindi cinema: an exploration of narrative techniques, 2023)

3.Methodology

Table: 1- Methodology

Aspect	Details
Research Approach	Qualitative
Dependent Variable	Opinions of participants
Independent Variable	Four selected Bollywood films (Film 1,2,3,4)
Case Study Approach	Selected four films to represent different regions of India, highlighting regional cultures and architectural styles
Sample Size	70 participants
Target Population	Millennials and Gen Z
Participant Background	35 from architectural backgrounds, 35 from non-architectural backgrounds
Data Collection Methods	Surveys, observations, and interviews
Survey Instrument	Questionnaire with Likert scale
Purpose of Sample Selection	To reflect the popularity of the films during their release periods and ensure diverse perspectives on architectural elements.
Analysis	Likert scale analysis, using sample frequency.

A. Questionnaire survey analysis:

Questionnaire-based analysis involves collecting data through structured questions to gather insights from respondents. It is a common tool in both qualitative and quantitative research to identify trends, opinions, and perceptions on specific topics (Comm, 2023) The questionnaire focuses on understanding how architecture and cultural settings influence the audience's experience of Bollywood films. The survey asks respondents to reflect on their attention to architectural elements in films, with specific references to Delhi 6, Piku, 2 States, and Paheli. Furthermore, it investigates what aspects viewers typically focus on when watching a movie and whether they consider heritage and architecture to be important components of film storytelling.

B. Categorical data analysis:

Categorical data analysis refers to the statistical methods used to analyze data that can be classified into distinct groups or categories rather than numerical values. (Watson, 2014) Consequently, this type of analysis is particularly useful in studies where data is sorted into qualitative groups, allowing researchers to identify patterns and relationships within categorical variables.

C. Likert Scale

In this paper, Likert scale has been employed. It is classified as ordinal data, as it measures attitudes or opinions across a series of ordered categories.

For example, a typical Likert scale might look like:

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

Future scope- Qualitative analysis type for greater findings.

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Researcher's inventory

Table 2: Comparative analysis of the four films (Observations)

Sr. no.	Film name	Context	Storyline	Architectural details
1.	Delhi 6	Delhi culture, exploring traditional and communal harmony.	Delhi-6 follows NRI Roshan as he visits Delhi with his ailing grandmother, discovering his roots, cultural contrasts, and the essence of unity amidst diversity.	Chandni chowk, lanes, market, cluster of houses connected through roofs, monuments like India, Rashtrapati bhavan, Raj path. Ornamentation of houses (arches, jaali walls, parapets, terrace)
2.	Piku	Kolkata, Bengali culture.	Piku follows an architect balancing life with her eccentric father, whose health obsession leads them on a road trip from Delhi to Kolkata, reconnecting with their roots amid the city's nostalgic charm.	Kolkata house, with a central courtyard, Shyaambaazar, Victoria Memorial, bustling streets of market, Hooghly bridge, Kolkata baaris (traditional houses). Kashi ghaats, Delhi house.
3.	2 States	2 varied cultures; Punjabi and Tamilian	A dramatic romance where Krish and Ananya navigate love and challenges between two diverse cultures.	Sloping roofs, houses with central courtyard, minimalist, simple and modest design of Ananya's house, Dravidian temples and market streets around it.
4.	Paheli	Rajasthani traditional culture	*Paheli* is a magical tale of love, choice, and identity, where a lonely bride in Rajasthan faces a dilemma when a ghost, disguised as her husband, stays with her.	Rajasthani haveli, baudi (stepwell), ornamentation of elements (jaalis, baywindows, murals, wall paintings), use of colours, interiors of haveli, and motifs.

Experts' observations:

DELHI 6: *Delhi 6* is a 2009 film by Rakeysh Omprakash Mehra, set in Old Delhi. It weaves a rich tapestry of cultural and social themes through the story of a young man's return to his ancestral home. The film explores traditions, communal harmony, and the vibrant essence of Delhi's streets. Notably, both real and constructed locations were used to capture the essence of Old Delhi. For instance, the bustling streets, vibrant culture, and traditional elements like kites and pigeons were filmed on location in actual Old Delhi. However, for the night scenes, a set replicating the streets of Delhi was constructed away from the city. This set, resembling the narrow alleys and atmosphere of Old Delhi, allowed for controlled filming conditions while still maintaining the film's authentic feel. Consequently, the combination of real locations and sets contributed to the immersive portrayal of Delhi, blending authenticity with practical filmmaking techniques. (Mehra, 2009)

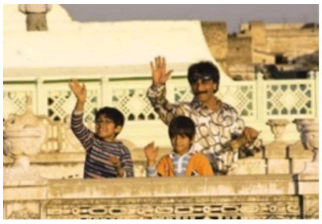




Fig 1 and 2: Terraces and roofs with jaali parapet (Ornamentation)

Fig 3: Jama Majid (Monumental architecture)





Fig 4: Chandni Chowk (Streetscape)

Fig 5: Houses connected through roofs (Urbanscapes)

Fig 6: India Gate (Monumental architecture)

(Mehra, 2009)

PIKU: In *Piku*, the city of Kolkata plays a crucial role in capturing the essence of the film. The old-world charm of the city comes alive through its narrow lanes, bustling with activity, and the aroma of food, which adds warmth to the atmosphere. Notably, iconic areas like Shyambazaar Chowk—a vibrant part of North Kolkata—are central to the narrative, especially in scenes where Amitabh Bachchan navigates through the chaotic streets. Despite shooting early at 5 AM, the roads remained crowded, making the experience challenging yet nostalgic for the crew. Director Shoojit Sircar, who grew up in these very lanes, had vivid memories of the place, which greatly influenced his decision to shoot there. Additionally, landmarks like the Victoria Memorial, the Hooghly Bridge, and traditional Kolkata baaris (houses) further emphasize the city's significance, blending a sense of nostalgia with the film's storyline. Ultimately, Kolkata's presence in *Piku* not only adds authenticity but also enriches the emotional landscape of the film. (Sircar, 2023)




Fig 7 and 8: Piku's house in Kolkata (Residential architecture interior and exterior)




Fig 9 and 10: Shyaambazaar (Streetscape)

(Sircar, 2015)

2 STATES: In *2 States*, the filmmakers effectively used architecture to visually represent the cultural contrasts between North and South India. Specifically, Director Abhishek Varman emphasized this divide by carefully selecting locations and designing sets that reflect the cultural ethos of each region. For instance, Ananya's Tamil Brahmin home in Chennai features traditional South Indian architecture—minimalist, functional, and modest. With its muted tones and open courtyards, this design symbolizes simplicity and discipline. In contrast, Krish's Punjabi household in Delhi is designed to be vibrant, modern, and ornate. This space showcases brighter colors and grand interiors, which are typical of Punjabi culture. Ultimately, this thoughtful use of architectural settings not only enhances the film's aesthetic appeal but also reinforces the cultural differences that form the heart of the story. (2 States - Behind the Scenes with Sunsilk, 2014)



Fig 11: Ananya's house interiors (South Indian architecture)





Fig 11 and 12: South Indian temple architecture

(Verman, 2014)

PAHELI*: Paheli*, starring Shah Rukh Khan and Rani Mukherjee, is a film based on a Rajasthani folktale, which further enhances its cultural depth. In this context, the video likely discusses the filmmaking process of *Paheli*, highlighting the use of Rajasthani motifs and the unique blend of traditional architecture and set design. Notably, the film is known for its vibrant portrayal of Rajasthan's culture, using elements like puppets, folklore, and language to infuse authenticity. While many scenes were shot on location, such as the "baudi" or stepwell, the team ultimately decided to create an indoor house set for flexibility. This approach ensured they could modify the set according to script demands. Although the outdoor heat presented challenges, it was embraced as part of the overall production experience. (Palekar, 2018)



Fig 13: Step well (Rajasthani Architecture)



Fig 14: Wall paintings and murals (Exterior)



Fig 14: Wall paintings and murals (Interior)

(Palekar, 2005)

4.Data findings and analysis:

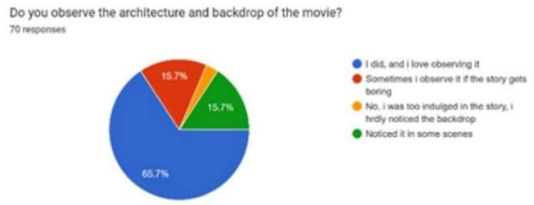


Fig 14: Graph 1

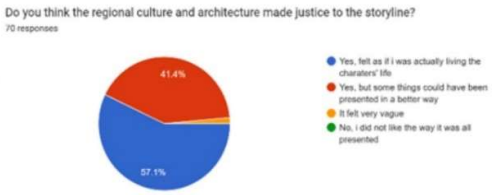


Fig 15: Graph 2

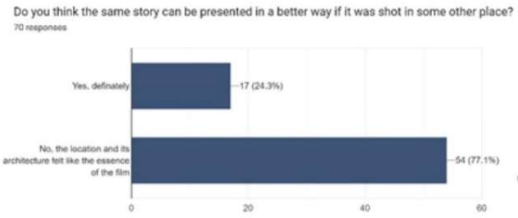


Fig 16: Graph 3

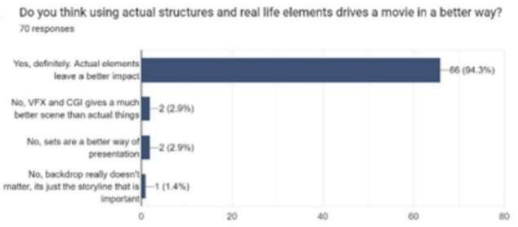


Fig 17: Graph 4

The data collected through the questionnaire provides valuable insights into how audiences perceive films beyond just the storyline and acting. To begin with, the study indicates that viewers greatly appreciate and pay attention to the film's backdrop, as shown in graph 1. This appreciation underscores the fact that the visual environment plays a significant role in enhancing the overall cinematic experience. Additionally, as graph 2 reveals, audiences recognize that heritage and culture are essential to conveying the narrative effectively. By incorporating cultural and historical elements into the setting, filmmakers can enrich the story and add depth to the film.

Moreover, another key insight from the study is that audiences generally prefer real locations and actual elements over sets or CGI/VFX, as depicted in graph 3. This preference arises from the belief that authentic settings allow for a deeper connection with the characters and storyline. In turn, real locations enhance believability and enable viewers to fully immerse themselves in the film's world.

Lastly, a significant 77% of respondents believe that the plot's setting enhances the film, as shown in graph 4. This finding emphasizes that for most viewers, the location is not simply a backdrop but feels central to the story itself. Ultimately, the choice of location shapes how the narrative resonates with audiences, influencing both its development and reception.

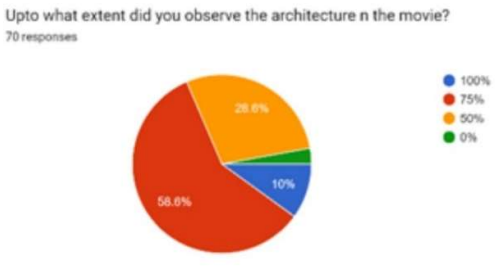


Fig 18: Graph 5

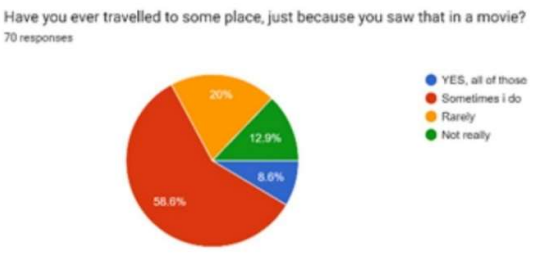


Fig 19: Graph 6

The study reveals that architecture serves as a crucial element in films, playing a pivotal role in supporting the storyline. Without its presence, effectively conveying the narrative would be challenging (graph. 5). While none of the respondents focus exclusively on architecture, they see it as a strong foundation that subtly influences their viewing experience. Further analysis shows how architecture penetrates the subconscious of viewers, shaping their perception of the film's setting. Additionally, the study uncovers that many people are inspired to visit the locations depicted in films, seeking to experience firsthand the atmosphere and feel that the movie conveys (graph. 6). This illustrates how films can drive tourism by highlighting visually appealing and culturally rich location.

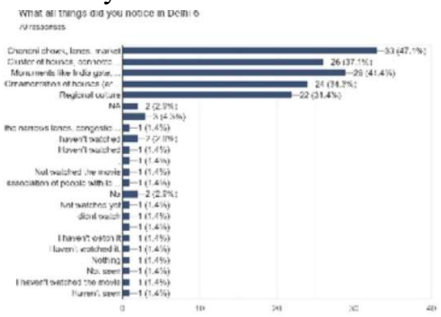


Fig 20: Graph 7

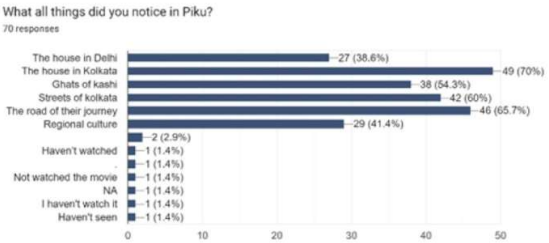


Fig 21: Graph 8

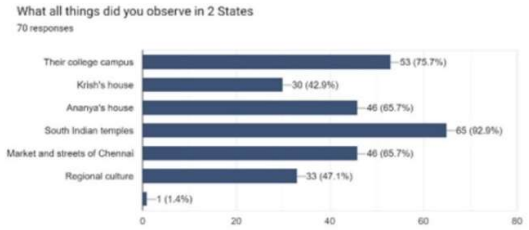


Fig 22: Graph 9

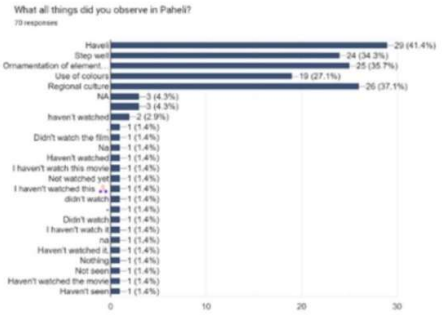


Fig 23 Graph 10

Graphs 7, 8, 9, and 10 further demonstrate that even though audiences may not consciously focus on the architecture or background, these elements still leave a lasting impact.

The choices made by viewers reflect their awareness of the detail's filmmakers emphasize to enhance the overall setting. This suggests that filmmakers deliberately craft these elements to enrich the narrative, knowing they will resonate with audiences on a subconscious level. The filmmaker's perspective acknowledges architecture as a vital tool in storytelling, supporting the film's themes and emotional depth.

In this analysis of the graphs for *Film 1,2,3,4*, we can see how integral architectural spaces and cultural surroundings are to the audience experience. *Fim 1* was characterized by the crowded streets, bazaars, and ancient temples typical of a Northern Indian city. *Film 2* took us around the house in Kolkata, along with the lesser-known ghats and streets, adding regional authenticity. For *Film 3*, South Indian temples stood

out, highlighting a significant cultural division in the story. Meanwhile, in *Film 4*, the focus was on the haveli and regional culture, with the lavish ornamentation enhancing the visual richness. Each film integrates architecture as a key storytelling element, helping build deeper cultural and emotional connections with audiences.



Fig 24: Graph 11

Audiences appreciate every aspect of a film, from its storyline to the immersive experience of culture, with the architectural backdrop playing a crucial role in enhancing the scenes. Altogether, these elements combine to create a movie that leaves a lasting impact.

6.Conclusion:

The study found that architectural characteristics in Bollywood films are essential to storytelling, influencing both the narrative and spectator perception. The analysis of Delhi-6, Piku, 2 States, and Paheli demonstrates that architecture enhances the atmosphere, interacts with characters, and develops emotional and thematic resonance. Audiences not only notice these aspects but also interpret them as cultural icons of India's different regional identities. Interviews with filmmakers and consumers reveal a distinct preference for actual architectural surroundings over contrived sets, which reinforces the narrative's realism. However, when certain scene requirements dictate it, filmmakers create authentic sets to maintain the film's visual integrity. Furthermore, the study discovered that Bollywood films frequently promote tourism, with viewers motivated to visit the sites where significant scenes were shot. This involvement helps viewers to connect more closely with the film by experiencing the characters' emotions and culture in real-world settings.

Using the Likert scale employed to measure responses, allows for a deeper understanding of how regional culture and architecture are portrayed in Bollywood films and are perceived by different generations. The audience perspective is studied here.

In cinema, a film's success is decided not just by its plot or performances, but also by how successfully it captures the audience's imagination through a variety of sensory and cognitive experiences. A well-crafted screenplay draws viewers in, but the cultural setting and architectural aspects enhance the visual and emotional appeal. Architecture frequently serves as more than just a backdrop; it can represent cultural heritage, create the tone, or even mirror a character's inner world. By consciously blending these

aspects, a film goes beyond simply entertainment and becomes a multi-layered, meaningful experience that connects with audiences on multiple levels. The fusion of all these aspects is what turns an ordinary film into something memorable.

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Psychological & demographic drivers of housing preferences

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Abstract: *Designing often prioritizes the client's perspective and requirements, reflecting the psychology of the intended users. Considering human psychology is crucial in housing design as it significantly impacts well-being. This study examines how demographic and psychological factors influence housing preferences, shaping comfort and satisfaction in residential spaces. Focusing on women in urban areas, it highlights how personal identity, cultural background, and environmental elements drive housing choices, emphasizing design's role in enhancing well-being. Using a questionnaire survey, the research identifies key environmental factors—natural light, air quality, and privacy—as essential for improving comfort and reducing stress in residential spaces. Cultural traditions also play a critical role, influencing housing layouts and residents' satisfaction with their living environments. The findings reveal that housing preferences are shaped by both physical design and psychological factors, such as personal identity and cultural values, which foster a sense of belonging and connection to one's home. These insights offer valuable guidance for urban planners, architects, and homeowners, encouraging the integration of psychological and cultural aspects into housing design. By addressing these elements, residential spaces can be transformed into environments that promote comfort, reduce stress, and enhance living experiences. This approach lays the groundwork for future housing development that prioritizes well-being, offering a holistic understanding of what makes a house a home.*

Keywords: Housing; Demographics; Comfort; Housing design; Architecture and Well-being; Design Strategy; Cultural Influence in Housing

1.Introduction:

In architecture and urban planning, the concepts of "house" and "home" are often used interchangeably, but they represent distinct aspects of human living environments. A **house** is the physical structure designed for habitation, including walls, floors, a roof, and various rooms and amenities. Houses come in various forms, such as single-family homes, apartments, and townhouses. From a technical and legal perspective, a house is defined as a property that can be owned, rented, or occupied, providing basic necessities such as shelter, a place to sleep, and protection from the elements. The term focuses on its architectural features, size, location, and functional attributes.

On the other hand, a **home** encompasses more than just the physical structure; it carries emotional, social, and psychological significance (Henny Coolen, 2012). It is where individuals or families feel a sense of belonging, comfort, and personal connection. A home represents a place of refuge and security, where people express their identities, create memories, and build relationships. Unlike a house, a home extends beyond physical boundaries, capturing the people, memories, and experiences

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associated with it. Thus, while a house offers the physical framework, it is the emotional attachments and personal experiences that transform it into a home. (SIXSMITH, 1986)

- **Psychological aspect:**

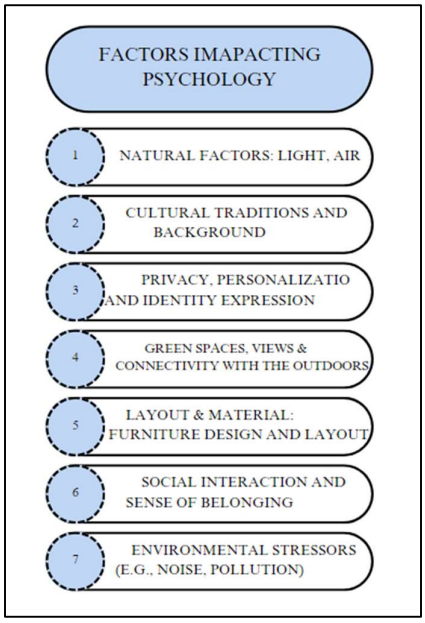
The psychological sense of attachment towards home is a complex and profound phenomenon that goes beyond the physical aspects of a place. It involves a deep emotional connection and a sense of rootedness that significantly influences our well-being and mental health. (GIULIANI, 2003)

Your home can also impact your mental health based on colors, natural light, and set-up. Appropriate light, furnishing textures and patterns, and room organization can help reduce signs of anxiety and depression. (Yangyang Wei, 2023)

The architectural aspect of psychology in designing considers how built environments influence human behavior, emotions, and well-being. Architects integrate psychological principles into their designs to create spaces that are functional, aesthetically pleasing, and supportive of occupants' needs. The architectural aspect of psychology in designing considers how built environments impact human behavior, emotions, and well-being. By integrating psychological principles into their designs, architects create spaces that are functional, aesthetically pleasing, and supportive of occupants' needs, enhancing their quality of life and overall experience.

- **Distinction between house and home**

The distinction between a house and a home highlights the balance between physical and emotional dimensions in living environments. A house serves as the foundation for shelter, while a home is shaped by personal experiences, rituals, and memories. Homes reflect the values, identities, and aspirations of individuals, becoming sanctuaries that offer stability and continuity. The transformation of a house into a home depends on personalization and meaningful interactions, emphasizing how relationships and activities within the space define its emotional value.



This evolution is dynamic; while the physical attributes of a house may remain constant, its perception as a home can shift over time as circumstances and relationships change.

This diagram highlights the main factors that influence psychological well-being in housing environments.

These factors collectively shape an individual's comfort, identity, and sense of belonging in their residential spaces.

This study aligns with psychological theories:

- Place Identity Theory (Twigger-Ross, 1996): Personalization of space enhances emotional attachment and well-being.
- Environmental Psychology (Gifford, 2002): Access to natural elements like light and air quality impacts mental health.
- Stress and Home Design (Guite, 2006): 73% of respondents stated that their home layout affects their stress levels.

Impact of environmental factors in housing

1. Colors: Color plays a crucial role in architectural spaces, influencing human emotions and behaviors. Studies show that different colors evoke various feelings; warm colors (like red, orange, and yellow) are associated with higher arousal emotions such as happiness, love, or anger, while cool colors (like green, blue, and purple) induce calmness and relaxation. The right choice of colors in residential spaces can enhance mood, attention, and performance. Warm colors tend to activate the nervous system, while cool colors have a calming effect, contributing to the overall well-being of residents. (KAKKAR, 2022)

2. Architectural Shapes: The shapes used in architecture significantly affect human psychology and behavior. Simple shapes like rectangles and squares offer a sense of security, while triangles symbolize stability. Circles convey unity, and complex shapes with sharp angles may trigger discomfort and anxiety. The neurological impact of shapes can affect mood and well-being, making it important for architects to choose designs that promote comfort and safety, ensuring the space supports residents' physical and psychological needs. (KAKKAR, 2022)

3. Green Spaces: Green spaces within residential areas are essential for improving well-being, but they are often overlooked in home designs. Exposure to greenery reduces stress, improves mood, and enhances mental health. For children, green spaces promote cognitive development, and for older adults, they improve health and life satisfaction. Green spaces also help filter pollutants, providing cleaner air and a tranquil environment conducive to relaxation and recovery. Incorporating green areas in residential design is crucial for enhancing occupants' quality of life across all age groups. (KAKKAR, 2022)

4. Air Quality: Indoor air quality directly affects human health and well-being. Factors like ventilation, humidity, and pollutants can impact indoor air quality, leading to respiratory issues, allergies, or even neurological disorders. Maintaining good air quality in homes is vital, as people spend most of their time indoors. Architects should prioritize ventilation and access to natural light, ensuring optimal air conditions for healthier and more comfortable living environments. (KAKKAR, 2022)

5. Flooring: The choice of flooring material has both physical and psychological impacts. Different materials, like hardwood, bamboo, vinyl, or carpet, offer various benefits and drawbacks. Carpeting provides warmth but can harbor allergens, while hardwood and bamboo are more durable and easier to maintain. Flooring influences comfort, health, and indoor environmental conditions. Selecting appropriate flooring can positively affect the mood, health, and behavior of residents, making it a critical aspect of home design. (KAKKAR, 2022)

6. Ceilings: Ceiling design impacts the atmosphere and functionality of a room. High ceilings are often preferred for their association with openness and freedom, promoting creativity and energy. Low ceilings, on the other hand, may create a feeling of restriction, potentially leading to negative mood effects. Different ceiling styles, like domed, dropped, or coffered designs, contribute to the aesthetic and psychological aspects of a space. The height and design of ceilings can thus influence the physical and mental comfort of occupants. (KAKKAR, 2022)

7. Furniture: Furniture choices in a home affect well-being, providing comfort, functionality, and aesthetic appeal. Furniture must be practical, durable, and aligned with the occupants' social, cultural, and emotional values. Curvilinear furniture shapes often create a positive impression, boosting morale, while inefficient or uncomfortable furniture can negatively impact mood and health. Well-designed furniture supports the physical, emotional, and social development of children and enhances the overall well-being of occupants. (KAKKAR, 2022)

The aim of incorporating psychological aspects into residential design is to create living environments that support and enhance occupants' mental well-being, satisfaction, and overall quality of life. To achieve this, several objectives are considered. Firstly, the transformation of a house into a home is emphasized, focusing on personalization and the creation of meaningful interactions within the space. Psychological comfort is also prioritized by ensuring that elements like privacy, natural light, and views are effectively integrated into the design. Furthermore, the design supports social interaction, fostering a sense of belonging and community among residents.

In addition, addressing environmental stressors is crucial to promoting physical health and well-being within the living environment (H.F. Guite, 2006). The design must also be inclusive, taking into account special needs and diverse populations to create spaces that are accessible and accommodating for all. Residential housing projects aim to align with these objectives, ensuring that they address housing needs while promoting well-being, supporting community development, and contributing to sustainable, inclusive urban environments. By integrating these factors, architects and designers can create living spaces that not only improve the quality of life for all occupants but also fulfil both their practical and emotional needs, resulting in environments that provide comfort, security, and a sense of belonging. (Qin, 2016)

Housing choices and residential satisfaction are deeply influenced by a combination of demographic, cultural, psychological, and environmental factors. Rapoport (1969) underscores the importance of demographic characteristics such as age, income, and family structure in shaping housing preferences, as different life stages demand varying spatial and functional needs. Integrating biophilic design principles, as suggested by (Kellert, 1993), highlights the role of natural elements like greenery, natural light, and ventilation in promoting mental and physical health by reducing stress and enhancing mood.

The spatial layout of a home also plays a critical role. (Altman, 1975)emphasizes that well-organized layouts that provide a balance between communal spaces and private areas foster social interaction while ensuring personal comfort. Cultural influences, explored by (Lawrence, 1987), add another layer of complexity, where traditions and practices influence the design, such as dedicated spaces for religious or communal activities. This highlights the necessity of designing culturally resonant homes.

Environmental psychology, as discussed by (Gifford, 2002), connects residential satisfaction with external factors like noise, air quality, and lighting. These environmental elements significantly impact mental health and well-being. Personalization, a critical psychological driver discussed by (Twigger-Ross, 1996), strengthens emotional attachment to homes and fosters comfort. Allowing for adaptable designs ensures that individuals can shape their living spaces according to their unique needs and identities.

1. Demographic Factors: Age, income, family structure, and life stage preferences.
2. Biophilic Design: Incorporation of natural elements to enhance well-being.
3. Layout and Privacy: Balance between communal and private spaces for comfort.
4. Cultural Traditions: Design elements that reflect cultural practices and values.
5. Environmental Factors: Noise, lighting, air quality, and their psychological impacts.
6. Personalization: Flexibility in design to allow individual expression and comfort.

Methodology:

Research design

Definition: research design is a framework for conducting a systematic investigation, including a set of strategies and methods used to collect and analyse data. It is the overall plan or strategy formulated to address a research problem and includes the theoretical framework and the methods of data collection and analysis.

Research design type used: descriptive research is a type of research that seeks to describe the characteristics of a population or phenomenon being studied. It is used to provide a detailed account of the population or phenomenon

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Type of data collection:

Primary data:

For primary data collection in descriptive research, several methods may be used, including surveys, interviews, focus groups, and observational methods.

The current study uses questionnaire as a tool for conducting online survey. A google form was designed for collecting responses from the respondents.

Secondary data:

Internal source: secondary data can be sourced extracted from internal sources such as past studies, reports, surveys, and databases within the organization.

External source: secondary data sources for descriptive research include industry reports and existing research studies from other organizations or institutions.

Sampling method:
Sample size:

A sample size of 90 participants was chosen for this study. This number was deemed appropriate as it allows for a sufficient representation of investor behaviours while remaining manageable in terms of data collection and analysis.

Rationale for sample size: The decision to use a sample size of 90 was influenced by the study's goals and available resources. Factors such as the population size, time constraints, budget limitations, and the desired level of accuracy were considered in determining the appropriate number of participants

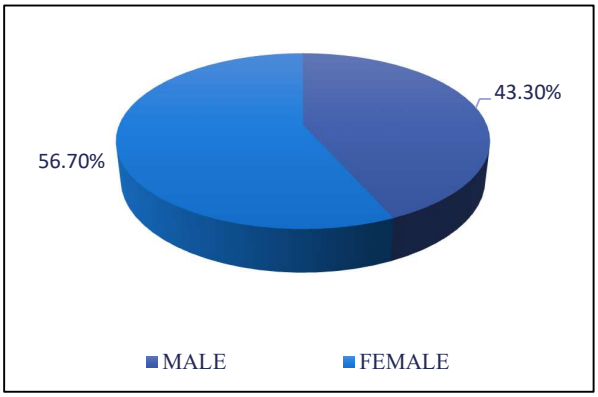
Purposive sampling was chosen to ensure the study captures insights from individuals most relevant to the research objectives. This method allows for targeted selection, focusing on women in urban areas who experience different housing environments. The sample size of 90 respondents was determined based on feasibility, diversity, and ensuring meaningful statistical analysis. Key considerations included:

- Ensuring a mix of self-owned and rental properties
- Capturing perspectives across varied age groups and housing typologies
- Maintaining a balance between urban, semi-urban, and rural settings
- This approach ensures robust insights into housing preferences and psychological well-being.

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Data analysis and Interpretation:

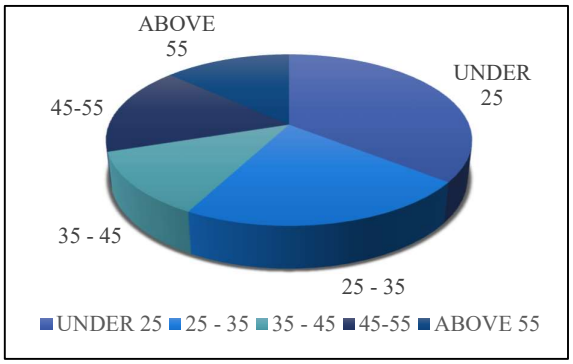
Gender:



Interpretation: The data indicates that the majority of respondents are male, accounting for 51 individuals, while female respondents make up 39. This suggests a gender distribution where males are slightly more represented than females in the survey. The almost balanced participation highlights a diverse perspective, allowing for a more comprehensive analysis of housing preferences and psychological impacts across different gender groups.

Particular	No. Of respondent
Male	51
Female	39

Age groups:



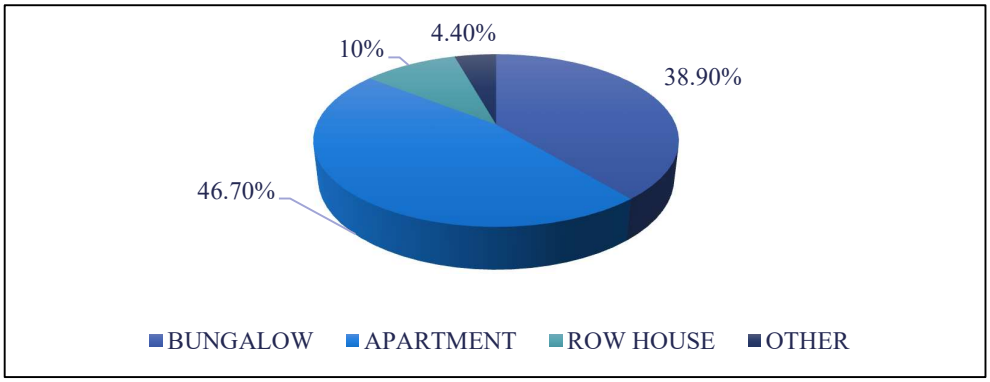
Interpretations: the age distribution of respondents shows a diverse range, with the majority (32) being below 25 years. The second largest group consists of those aged 25-35, with 20 respondents, followed by 15 respondents aged 45-55.

The 35-45 age group has 11 participants, while 12 respondents are above 55.

This variation provides insights into housing preferences across different life stages, Enabling a comprehensive understanding of how age influences comfort, well-being, and design preferences in residential spaces.

Age groups	No. Of respondent
Below 25	32
25-35	20
35-4	11
45-55	15
Above 55	12

Housing typology:

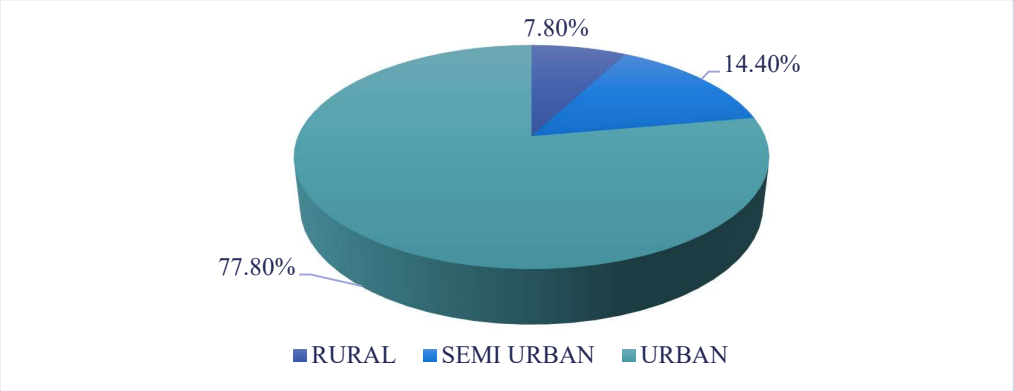


Housing typology	No. Of respondent	
Apartment	42	
Bungalow	35	
Row house	9	
Other	4	

Interpretation:

the housing typology data shows that the majority of respondents, 42 individuals (46.7%), live in apartments. Bungalows are the second most common, with 35 respondents (38.9%), followed by row houses, with 9 respondents (10%). The remaining 4 respondents (4.4%) fall into other housing categories. This distribution highlights that apartments and bungalows are the predominant housing types among the respondents, providing key insights into their living preferences and comfort levels.

Locality:

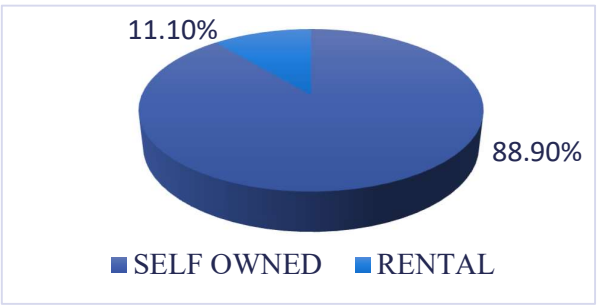


Residential location	No of respondents
Rural	7
Semi- urban	13
Urban	70

Interpretation:

the data on residential location reveals that the majority of respondents, 70 individuals (77.8%), reside in urban areas. Semi-urban areas account for 13 respondents (14.4%), while only 7 respondents (7.8%) live in rural locations. This distribution indicates that most of the survey participants are urban residents, providing a strong basis for understanding housing preferences and well-being in urban contexts, with some insights from semi-urban and rural environments.

House ownership:



Ownership	No. Of respondent
Self-owned	80
Rental	10

Interpretation:

the ownership data shows that a significant majority of respondents, 80 individuals (88.9%), live in self-owned properties, while only 10 respondents (11.1%) reside in rental accommodations. This indicates that most participants have a stable, long-term commitment to their homes, which may influence their preferences for personalized and well-designed living environments, compared to those in rental housing who may have more temporary or flexible arrangements.

Surrounding preferences:

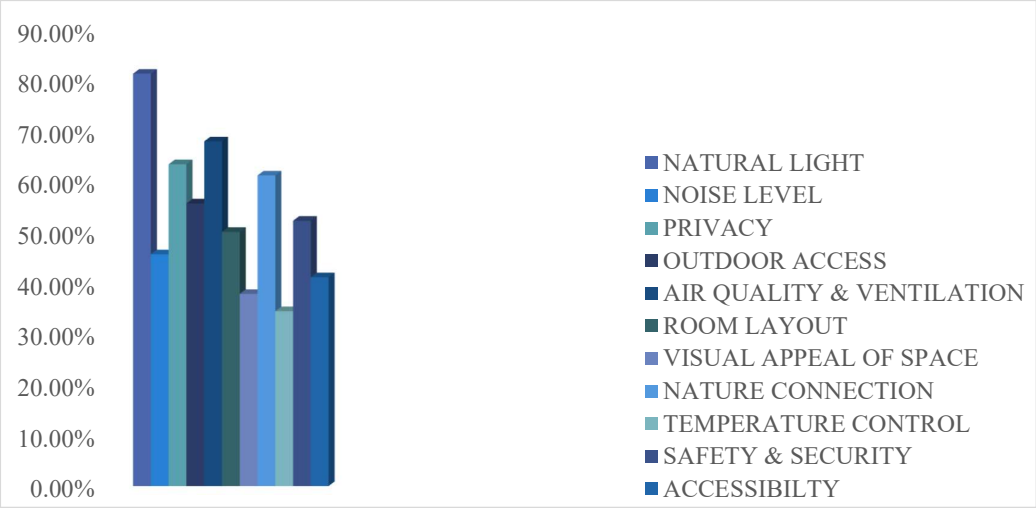


Surrounding of house	No. Of respondents
Scenic view	40
Locality	60
Being familiar with my immediate Surroundings	40
Meeting family, friends and Acquaintances	35
Having a good relationship with the neighbours	34

Interpretation:

the data on the surroundings of respondents' houses highlights multiple aspects that contribute to their sense of well-being and satisfaction. A significant number, 60 respondents (66.7%), prioritize the locality of their residence, indicating that access to essential amenities and services is crucial. Scenic views are also valued, with 40 respondents (44.4%) appreciating a visually pleasing environment. Familiarity with immediate surroundings is equally important, as 40 individuals (44.4%) find comfort in their neighborhood. Social connections matter as well, with 35 respondents (38.9%) valuing interactions with family, friends, and acquaintances, and 34 respondents (37.8%) emphasizing the importance of having a good relationship with neighbors. This variety of preferences suggests a balanced focus on aesthetics, accessibility, and social interaction in residential settings.

Psychological well-being and design:



Factors impacting	No. Of respondents
Natural light	73
Noise level	41
Privacy	57
Outdoor access	50
Ventilation	61
Room layout	45
Visual appeal of space	34
Nature connection	55
Temperature control	31
Safety & security	47
Accessibility	37

Interpretation:

the data on factors impacting housing preferences shows that natural light is the most influential factor, with 73 respondents (81.1%) considering it essential for their comfort and well-being. Ventilation follows closely, valued by 61 respondents (67.8%), highlighting the importance of air quality. Privacy is another significant concern, with 57 respondents (63.3%) emphasizing its importance. Outdoor access and a connection to nature are also prioritized, with 50 (55.6%) and 55 (61.1%) respondents, respectively. Noise level (41 respondents, 45.6%) and room layout (45 respondents, 50%) further impact comfort. Safety and security (47 respondents, 52.2%), accessibility (37 respondents, 41.1%), visual appeal (34 respondents, 37.8%), and temperature control (31 respondents, 34.4%) also play crucial roles, indicating that both environmental and aesthetic factors significantly influence housing satisfaction.

Comfort factors:

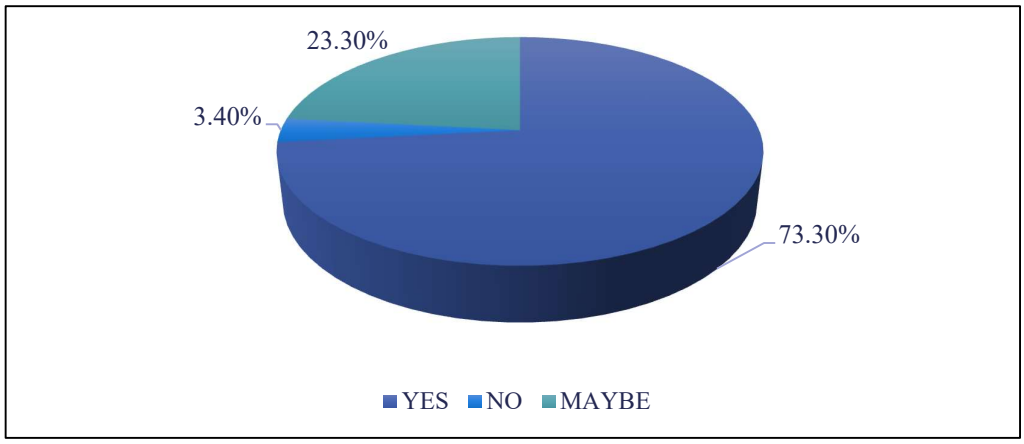


Comfort aspects	No. Of respondents
Spaciousness	56
Natural light	71
Colour scheme	44
Good surroundings	23
Comfortable furniture	34
Personalization of space	37
Access to outdoor spaces	35
Quite environment	46
Easy accessibility	1
People	1
Other	3

Interpretation:

the data on comfort aspects indicates that natural light is the most valued factor, with 71 respondents (78.9%) considering it essential for comfort. Spaciousness follows, valued by 56 respondents (62.2%), showing the importance of ample living space. A quiet environment is significant for 46 respondents (51.1%), while the color scheme influences comfort for 44 respondents (48.9%). Personalization of space (37 respondents, 41.1%) and comfortable furniture (34 respondents, 37.8%) are also important factors. Access to outdoor spaces is valued by 35 respondents (38.9%), while good surroundings matter to 23 respondents (25.6%). Less emphasized aspects include easy accessibility and people, with just 1 respondent each (1.1%), and other factors noted by 3 respondents (3.3%). This shows a focus on natural light, spaciousness, and personalization as key contributors to comfort.

Home layout and stress level:



House layout reduces stress level	No. Of respondents
Yes	66
No	3
Maybe	21

Interpretation:

the data regarding house layout and its influence on stress levels reveals a strong preference among respondents for layouts that promote well-being.

A significant majority, 66 individuals (73.3%), affirm that an effective house layout helps reduce stress, indicating a clear recognition of the importance of spatial arrangement in creating a calming atmosphere. Only 3 respondents (3.3%) believe that the layout does not impact their stress levels, while 21 respondents (23.3%) remain uncertain. This highlights the need for thoughtful design in residential spaces, as most respondents associate a well-considered layout with enhanced mental well-being and comfort in their living environments.

Living space comfort:



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Living space comfort	No of respondents
Lowest	6
Low	3
Moderate	12
High	31
Highest	38

Interpretation:

the data on living space comfort indicates a predominantly positive perception among respondents. A substantial majority, 38 individuals (42.2%), report experiencing the highest level of comfort in their living spaces. Additionally, 31 respondents (34.4%) rate their comfort as high, demonstrating a strong sense of satisfaction. Moderate comfort is noted by 12 respondents (13.3%), while only a small number report lower comfort levels, with 3 respondents (3.3%) rating it as low and 6 respondents (6.7%) indicating the lowest comfort level. This distribution highlights that most participants feel comfortable in their living environments, underscoring the effectiveness of their housing choices in promoting well-being.

Cultural influences on housing layouts:

the responses to the survey question on the influence of culture on housing layout reflect a strong consensus on its significance. A majority of participants affirmed that culture plays a crucial role in shaping housing designs, impacting aspects such as spatial organization, room usage, and communal areas. Many emphasized that cultural practices dictate preferences for privacy, communal spaces, and the layout of living areas, highlighting the importance of social interaction and family structures. Specific cultural elements, such as religious beliefs and traditions, were noted to influence design choices, including the inclusion of prayer spaces and the arrangement of rooms. Furthermore, several respondents mentioned that cultural considerations help create a sense of belonging and identity within the home. Overall, the data indicates that cultural values and practices profoundly influence how homes are designed and organized, ultimately affecting the occupants' well-being and comfort in their living environments.

Mental well-being & living environment:

the survey responses to the question regarding changes that could enhance mental well-being in living environments reveal several key themes. A significant number of participants emphasized the importance of natural light, ventilation, and green spaces, noting that these elements positively impact mood and reduce stress. The incorporation of biophilic design, such as indoor plants and natural elements, was frequently mentioned as a means to create a calming atmosphere. Additionally, decluttering and organization were highlighted as essential for reducing anxiety and promoting a peaceful environment. Many respondents expressed the need for personal space and privacy, which are crucial for relaxation and mindfulness. A well-organized and clean environment along with friendly neighbours also contribute significantly to mental well-being. Overall, these responses reflect a strong desire for a living space that fosters tranquillity, connection to nature, and a sense of community, all of which are vital for enhancing psychological health.

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Stress including features:

the responses to the question regarding stressors or discomfort in participants' living spaces reveal a range of concerns affecting their well-being. Noise pollution emerges as a prominent issue, with many respondents highlighting disturbances from traffic, neighbours, and communal living environments. Lack of natural light and ventilation were frequently mentioned as contributing factors to discomfort, impacting both mood and health. Additionally, respondents expressed frustrations related to clutter and disorganization, which contribute to feelings of chaos and stress. Privacy concerns were also significant, particularly in apartment living where visibility from outside can compromise personal space. Other notable stressors included poor storage solutions and inadequate living area size. These insights underscore the critical relationship between living environments and mental health, highlighting the need for thoughtful design that minimizes stressors and promotes comfort and well-being. Overall, the data suggests that enhancing these factors could significantly improve residents' quality of life.

Mood boosting features:

the responses to the question regarding specific features in homes that positively impact mood highlight the significant role of **natural light** and **connection to nature**. Many participants emphasized the importance of **large windows**, **balconies**, and **outdoor spaces**, which allow sunlight to flood in and provide scenic views. These elements contribute to a sense of calm, spaciousness, and well-being, fostering a positive atmosphere in the home. **indoor plants** and greenery surrounding the living space were frequently mentioned as crucial for enhancing air quality and promoting relaxation. Additionally, features like **good ventilation**, **soothing color schemes**, and **comfortable furniture layouts** were noted for their contributions to creating a pleasant living environment. Overall, the data reveals a clear preference for design elements that prioritize **light, nature, and openness**, illustrating how these factors are essential for emotional health and enhancing the quality of life within the home.

Conclusions and discussions:

In conclusion, the research highlights the significant influence of demographic and psychological factors on housing preferences and the resulting comfort and well-being in residential environments. The data collected from respondents reveal that aspects such as natural light, spaciousness, and access to outdoor spaces are pivotal in shaping their perceptions of comfort. The emphasis on natural elements and personal connections to space indicates a growing awareness of the psychological benefits derived from well-designed living environments.

moreover, the responses underscore the importance of cultural and social influences in determining housing layouts and design preferences. Different cultures exhibit varying needs, such as communal spaces for gatherings versus private areas for

relaxation. This cultural context not only shapes individual preferences but also enhances the overall sense of belonging and community.

designers can greatly benefit from these insights, as understanding the psychological drivers behind housing preferences can lead to more thoughtful and tailored designs. By focusing on elements that promote well-being—such as maximizing natural light, creating spacious layouts, and incorporating greenery—designers can develop residential spaces that resonate with the needs and desires of their clients. Furthermore, acknowledging factors that cause discomfort, such as noise pollution and lack of privacy, allows for proactive design solutions that mitigate these issues.

discussion points that emerge from this research include the necessity of integrating cultural sensitivities into design practices, the potential benefits of biophilic design in enhancing mental well-being, and the importance of creating flexible living spaces that accommodate various family dynamics and lifestyle choices. Additionally, the role of personal and communal spaces in fostering social interaction and privacy highlights the need for a balanced approach in housing design.

ultimately, the findings emphasize that effective residential design is not just about aesthetics but also about understanding the psychological and cultural nuances that influence how individuals experience their homes. By bridging the gap between design and psychology, architects and designers can create environments that truly enhance the quality of life for residents, ensuring that their homes are not only comfortable but also supportive of their mental and emotional well-being.

The study provides practical applications for different stakeholders:

Architects & Designers: Prioritize natural light, ventilation, and privacy in layouts. Urban Planners: Incorporate green spaces and scenic views into city planning.

Policy-makers & RERA Authorities: Develop policies that support psychological well-being in housing.

These findings emphasize that housing should be seen as an environment that nurture's identity, mental well-being, and cultural values.

To strengthen the analysis, statistical correlations were examined:

A significant correlation ($p < 0.05$) was found between housing type and scenic view preference, indicating bungalow owners prefer scenic views. Where apartment owner prefer privacy. Gender was positively correlated with privacy needs, showing women prioritize privacy more.

Younger respondents were more likely to rent, as indicated by chi-square tests. Comfort levels were positively correlated with natural light, reinforcing its role in well-being.

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Annexure

Demographic data collection

1. **Age group**

- Under 25
- 25 – 35
- 35- 45
- 45- 55
- Above 55

2. **Gender**

- Male
- Female
- Transgender
- Prefer not to say

3. **Housing typology**

- Bungalow
- Apartment
- Row house
- Other

4. **Residential location**

- Rural
- Semi urban
- Urban
- Ownership of the house
- Self-owned
- Rental

5. **Psychological data collection**

- What surrounding do you prefer while selecting a home?
- Scenic view
- Locality
- Being familiar with my immediate surroundings
- Meeting family, friends & acquaintances
- Having good relationship with neighbors

6. **How would you rate overall comfort of your current living space?**

- 1 (uncomfortable)
- 2
- 3
- 4
- 5 (very comfortable)

7. **Which of the following design aspects do you think have greatest impact on your psychological well-being?**

- Access to natural light
- Noise levels
- Privacy

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- Access to outdoor spaces (e.g. Balcony, garden)
- Air quality & ventilation
- Room layout & size
- Visual appeal of the space
- Connection with nature
- Temperature control
- Safety & security
- Accessibility (ease of movement, inclusivity features)

8. Which aspect of your home make you feel most comfortable or relaxed?

- Spaciousness
- Natural lighting
- Calm color scheme
- Good soundproofing
- Comfortable furniture
- Personalization of space (décor, layout)
- Access to outdoor spaces
- Quiet environment
- Other

9. Do you feel that the layout of your home helps reduces your stress levels

- Yes
- No
- Maybe

10. Do you think culture affects in housing layout? & how?
11. What changes in your living environment would improve your mental well-being
12. Is there anything about your living space that causes you discomfort or stress
13. Can you describe a specific feature in your home that positively affects your mood?

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Photos of the Valedictory Event: Dated 1st March 2025



Photo with Volunteers of the Conference



Group Photo at the Conference

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Certificate Presenting sessions at the conference





Convenor and Co-Convener at the conference

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BRH

BRH is a hub of activites conducted at BNCA related to Research in Architecture and allied / specialized disciplines working on individual and collaborative research. BRH aims to become a versatile, inclusive, and holistic Knowledge building platform not only at the local and national level but also at international level. BRH intends to provide varied scales and types of opportunities for the students, researchers,innovators, mentors, experts, professionals, and funding agencies across the city, state, nation, and world to participate, conduct, collaborate, publish and to execute their research potentials and innovative concepts through forming and evolving Research Clusters of various subjects domains as a long term objective. This platform is envisioned to act as Regional Research center to facilitate and nurture the culture of research in architecture and allied disciplines, encouraging collaborative and participatory research from academia and industry / practice.

Swati Sahasrabudhe , Professor , Head,
BRH (BNCA Research Hub)

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