Co-living emphasizes collaboration and connection among residents, fostering a sense of belonging and support. This includes shared spaces, encouraging social interaction and cooperation. Additionally, it often prioritizes sustainability, with shared resources leading to more efficient use of energy and materials.

Study   Rest   Eating   Cooking   Meeting   Play   Share

SPACE

The SPA Journal of Planning and Architecture

(Jan-March) & (April-June)
2021
www.spa.ac.in
ISSN 0970-0706

SPACE is a quarterly research journal of the School of Planning and Architecture, New Delhi. Papers published in this journal bring together cutting-edge knowledge and fresh insights in the fields of architecture, planning, design and technology. SPACE presents the scholarly works of academicians, researchers, professionals, and policymakers from India and abroad in the entire gamut of the built environments.

Contributors wishing to send in their papers for publication in SPACE may email their manuscripts in MS Word or pdf file for review and consideration to the Editor at space@spa.ac.in. The SPACE Journal editorial board reviews all work submitted for consideration. Prints of manuscripts may also be sent to the following address:

Prof. (Dr) Chitrarekha Kabre
Editor, SPACE
School of Planning and Architecture
4 Block B, I. P. Estate
New Delhi 110002, India
Email: space@spa.ac.in

SUBSCRIPTION PER ISSUE

Inland: INR 500 for institutions, INR150 for individuals, and INR 100 for students on the production of authentic identity. For all categories, INR 25 will be charged for postage.

Foreign: US$ 100 plus $10 will be charged for postage.

PUBLICATION OF ADVERTISEMENT

SPACE will accept a limited number of advertisements for each issue from renowned publishing firms, and academic and professional institutions on publications, announcements, notices or posters on academic programmes, conferences, competition projects and other academic and professional activities related to architecture, planning, design and technology. The following rates will apply with a 25 percent discount for educational institutions.
Inside half page: INR 2000; inside full page: INR 3000; special page: Negotiable

All payments should be made in advance through SBI collect in favour of the School of Planning and Architecture, New Delhi.

Cover picture credits: Mr Divyam Kandya, alumni, Dept of Housing, SPA, New Delhi

Disclaimer: The SPA New Delhi and Editorial Board are not responsible for any of the views expressed in the papers. This issue is published in June 2025.

SPACE, The SPA Journal of Planning and Architecture

Contents

Departments of Studies at the School of Planning and Architecture, New Delhi

The School of Planning and Architecture, New Delhi is one of India's leading research and teaching institutions. School offers planning, architecture and design courses both at undergraduate, and postgraduate levels. While the Bachelor of Architecture course is one of the oldest courses in the country, a highly successful Bachelor of Planning course was started in 1989. From 2019 batch, option of Integrated Master of Planning program is now available for students admitted in Bachelor of Planning after third year. School offers two undergraduate degree programs, ten postgraduate degree programs and one integrated program. Doctoral programs are offered by all departments of studies.

UNDERGRADUATE DEGREE PROGRAMS

- Bachelor of Architecture
- Bachelor of Planning

INTEGRATED DEGREE PROGRAM

Integrated Bachelor of Planning – Master of Planning

POSTGRADUATE DEGREE PROGRAMS

- Master of Architecture (Architectural Conservation)
- Master of Architecture (Landscape Architecture)
- Master of Architecture (Urban Design)
- Master of Building Engineering and Management
- Master of Design (Industrial Design)
- Master of Planning (Environment Planning)
- Master of Planning (Housing)
- Master of Planning (Regional Planning)
- Master of Planning (Transport Planning)
- Master of Planning (Urban Planning)

DOCTORAL PROGRAMS (all departments of studies)

Each Department of Studies has a research centre capable of handling advanced research in respective areas of interest. Each Department of Studies also has a Departmental Research Committee (DRC) and the Head of the Department of Studies is its chairperson. Each department through their Advisory Committees, chaired by the Head of Departments, can propose changes to their departmental agenda for research, curriculum and pedagogy.

In addition to regular faculty, a large number of visiting professors, visiting faculty and contract faculty contribute to academic programs of School. School offers opportunity for interdepartmental/inter-university credits including those from foreign universities under Memorandum of Understanding (MoU) with School.

Editorial

This issue of SPACE, SPA Journal of Planning and Architecture includes ten articles that offer insight into diverse research topics that aim to compare the architectural curriculum in Indian Institutions; to correct the expression for density of population in urban areas; to study of land readjustment mechanism in Madhya Pradesh; to study of unauthorized land Colonization in Madhya Pradesh; to evaluate the impact of Odisha Housing Policy; to map socio-physical realities of indigenous settlements in contemporary Mumbai; to conserve the vernacular heritage resources of Banal cultural landscape of Uttarkashi, Uttarakhand; to develop conservation strategies of the Gingee fort complex in Tamil Nadu; to study legislative provisions and seasonal River Systems of Vishwamitri River, Vadodara; and to study planning implications of emergence of gated communities in large cities like Delhi.

"Comparative Analysis of Architectural Curriculum in Indian Institutions: A Comprehensive Study" employs quantitative research methodology to understand the differences in curriculum design, course offerings, and educational approaches among six Indian institutions. The findings of this research have the potential to inform prospective students, educators, and policymakers about the diverse academic offerings in architectural institutions.

"Density – DenCity: Correcting the Expression for Density of Population in Urban Areas," questions the term 'density of population' is defined as the number of people living per unit 'area' (two-dimensional unit) and argues for adding the third dimension of space proposing the concept of Den*City*. Furthermore, the application of Den*City* is illustrated through two neighbourhoods, Prem Nagar, J-Block, Nangloi, in western Delhi, and Uniworld City, the new township of Gurugram in Haryana.

"Study of Land Readjustment Mechanism in Madhya Pradesh: Under the MPTCP Act of 1973 and 2019" delves into three Land Assembly models: the Land Acquisition, Mutual agreement, and the Plot Reconstitution methods under "Town Planning Scheme (TPS)" implemented in the state of Madhya Pradesh. The study focuses on the plot reconstitution method, which was amended in the year 2019 to a (50-50) model to the earlier (80-20) Split model.

"Unauthorized Land Colonization in Jabalpur, Madhya Pradesh: Study of Unauthorized Colonies and Regularization Rules" identified various factors responsible for 62% of the total housing subsystem as per the Master Plan 2021 of Jabalpur. Authorities, including the Municipal Corporation, Jabalpur Development Authority, TNCP, and the Land Revenue Department, have taken actions to curb its growth. The study aims to understand the development process, issues, causes, regularization policies, colonizers strategies, and potential problems in unauthorized colonies.

"Evaluating the impact of Odisha Housing Policy: Critical analysis of the models of affordable housing policy" discusses details of seven models for sustainable urban development introduced under Odisha's "Policy for Housing for All in Urban Areas, 2015" and its improved version "Odisha Housing for All Policy for Urban Areas, 2022." This paper examines the effectiveness of these policies in addressing Bhubaneswar's housing shortage through case studies and primary surveys. Recommendations include broadening the policy's focus to encompass all societal sectors, introducing microfinancing options, retaining land banks to increase affordable housing inventory, and facilitating transit accommodations and rental housing complexes.

"Mapping Socio-Physical Realities: Mumbai's Indigenous Settlements in Contemporary Times" presents three case studies of urban villages in varying contexts to gain a deeper understanding of the growing concerns in communities about shifting land uses and development pressures. The research methods employed are on-ground interviews, documentation, physical surveys, and both unstructured and structured interviews with residents. Data analysis highlights the relevance of development control and current real estate pressures on native communities and their livelihoods in the metropolis.

"Cultural Landscape of Uttarkashi, Uttarakhand: Case of Koti, Bakhreti, Gair and Pujeli Banal" research delves into the intricate tapestry of the Cultural Landscape of the *Banal* region, focusing on its renowned Earthquake-Resistant Architecture, also known as *Koti Banal* Architecture. Through comprehensive analysis, this research highlights the multifaceted challenges confronting the *Banal* settlements. In response, this paper advocates for holistic approach to the conservation management plan that balances the preservation of the *Banal* Cultural Landscape heritage with socio-economic development and

environmental sustainability.

"Conservation Strategies of the Fort Complex: Case of Gingee Fort, Tamil Nadu," delves into the integration and historical evolution of Gingee Fort's natural and designed military landscape, as well as its architectural ingenuity and functional role within the Deccan region. The research employs a methodical four-stage approach, commencing with a review of the historical context to establish a foundational map and timeline. This is followed by on-site inspections and the gathering of data to create a map of heritage resources. Key findings highlight the fort's distinctive architectural synthesis and its pivotal role in regional defense. The final stage proposes a master plan for sustainable development, conservation guidelines, and a management framework to preserve the fort's historical integrity while emphasizing the importance of promoting local traditions and environmental sustainability.

"Legislative Provisions and Seasonal River Systems: A Case of Vishwamitri River, Vadodara, Gujarat," adopts content and frequency analysis to examine disparities in the existing legislative provisions as outlined in the Development Acts, Regulations, Guidelines, and policies initiatives by various authorities pertaining to river-centric urban planning and their implementation in planning decision-making. Spatial analysis of the river system conducted through a longitudinal analysis of satellite images from 2000 to 2020 highlights the structural changes in the river systems due to shortcomings in the provisions. The findings underscore the urgent need to revise legislation and policies to incorporate a scientific understanding of seasonal river systems and environmental planning principles, thereby addressing the current water crisis.

"Planning Implications of Emergence of Gated Communities in Large Cities: Case of Delhi," compares gated community in Siddhartha Extension and non-gated community in Bhagwan Nagar in Delhi intending to understand social implications. The study highlights contrasts in the acceptance of outsiders, perceived security, amenities, ease of movement, public access, and community bonding between the two areas. The study suggests proper interventions to counter the implications of gated communities, there is a need to fulfil aspirations for security, privacy, and exclusivity while improving access, reducing segregation, and providing high-quality facilities. Proper interventions include management approaches, design interventions, and planning decisions surrounding gating and segregation.

(CHITRAREKHA KABRE)

Editor

संपादकीय

स्पेस, एसपीए योजना और वास्तुकला पत्रिका के इस अंक में दस लेख शामिल हैं जो विविध शोध विषयों में अंतर्दृष्टि प्रदान करते हैं जिनका उद्देश्य भारतीय संस्थानों में वास्तुकला पाठ्यक्रम की तुलना करना; शहरी क्षेत्रों में जनसंख्या के घनत्व के लिए अभिव्यक्ति को सही करना; मध्य प्रदेश में भूमि पुनर्समायोजन तंत्र का अध्ययन; मध्य प्रदेश में अनधिकृत भूमि उपनिवेशीकरण का अध्ययन; ओडिशा आवास नीति के प्रभाव का मूल्यांकन करना; समकालीन मुंबई में स्वदेशी बस्तियां की सामाजिक–भौतिक वास्तविकताओं का मानचित्रण करना; उत्तरकाशी, उत्तराखंड के बानल सांस्कृतिक परिदृश्य स्थानीय विरासत संसाधनों का संरक्षण करना; तमिलनाडु के जिंजी किला परिसर की संरक्षण रणनीतियाँ विकसित करना; वडोदरा की विश्वामित्री नदी का विधायी प्रावधान और मौसमी नदी प्रणालियों का अध्ययन करना; और दिल्ली जैसे बड़े शहरों में गेटेड समुदायों के उद्भव के नियोजन निहितार्थों का अध्ययन करना है।

"भारतीय संस्थानों में वास्तुकला पाठ्यक्रम का तुलनात्मक विश्लेषण: एक व्यापक अध्ययन," छह भारतीय संस्थानों के बीच पाठ्यक्रम डिजाइन, पाठ्यक्रम पेशकश और शैक्षिक दृष्टिकोण में अंतर को समझने के लिए मात्रात्मक शोध पद्धति का उपयोग करता है। इस शोध के निष्कर्षों में भावी छात्रों, शिक्षकों और नीति निर्माताओं को वास्तुकला संस्थानों में विविध शैक्षणिक पेशकशों के बारे में सूचित करने की क्षमता है।

"घनत्व – डेनसिटी: शहरी क्षेत्रों में जनसंख्या के घनत्व के लिए अभिव्यक्ति को सही करना," प्रश्न करता है कि 'जनसंख्या का घनत्व' शब्द को प्रति इकाई 'क्षेत्र' (दो–आयामी इकाई) में रहने वाले लोगों की संख्या के रूप में परिभाषित किया गया है और डेनसिटी की अवधारणा का प्रस्ताव करते हुए अंतरिक्ष के तीसरे आयाम को जोड़ने का तर्क दिया गया है इसके अलावा, डेनसिटी के अनुप्रयोग को दो पड़ोस, प्रेम नगर, जे–ब्लॉक, नांगलोई, पश्चिमी दिल्ली और यूनीवर्ल्ड सिटी, हरियाणा में गुरुग्राम की नई टाउनशिप के माध्यम से चित्रित किया गया है।

"मध्य प्रदेश में भूमि पुनर्समायोजन तंत्र का अध्ययन: 1973 और 2019 के एमपीटीसीपी अधिनियम के तहत" तीन भूमि विधानसभा मॉडल में गहराई से जांच करता है: भूमि अधिग्रहण, आपसी समझौता, और मध्य प्रदेश राज्य में लागू "टाउन प्लानिंग स्कीम (टीपीएस)" के तहत प्लॉट पुनर्गठन के तरीके। अध्ययन प्लॉट पुनर्गठन पद्धति पर केंद्रित है, जिसे वर्ष 2019 में पहले (80-20) स्प्लिट मॉडल के लिए (50-50) मॉडल में संशोधित किया गया था।

"जबलपुर, मध्य प्रदेश में अनधिकृत भूमि उपनिवेशीकरण: अनधिकृत कॉलोनियों और नियमितीकरण नियमों का अध्ययन" ने जबलपुर के मास्टर प्लान 2021 के अनुसार कुल आवास उपप्रणाली के 62% के लिए जिम्मेदार विभिन्न कारकों की पहचान की। नगर निगम, जबलपुर विकास प्राधिकरण, टीएनसीपी और भूमि राजस्व विभाग सहित अधिकारियों ने इसके विकास को रोकने के लिए कार्रवाई की है। अध्ययन का उद्देश्य विकास प्रक्रिया, मुद्दों, कारणों, नियमितीकरण नीतियों, कॉलोनाइजरों की रणनीतियों और अनधिकृत कॉलोनियों में संभावित समस्याओं को समझना है।

"ओडिशा आवास नीति के प्रभाव का मूल्यांकन: किफायती आवास नीति के मॉडलों का महत्वपूर्ण विश्लेषण," ओडिशा के "शहरी क्षेत्रों में सभी के लिए आवास नीति, 2015" और इसके बेहतर संस्करण "शहरी क्षेत्रों के लिए सभी के लिए ओडिशा आवास नीति, 2022" के तहत पेश किए गए सतत शहरी विकास के सात मॉडलों के विवरण पर चर्चा करता है। यह शोधपत्र केस स्टडी और प्राथमिक सर्वेक्षणों के माध्यम से भुवनेश्वर की आवास कमी को दूर करने में इन नीतियों की प्रभावशीलता की जांच करता है। सिफारिशों में सभी सामाजिक क्षेत्रों को शामिल करने के लिए नीति के फोकस को व्यापक बनाना, माइक्रोफाइनेंसिंग विकल्प पेश करना, किफायती आवास सूची बढ़ाने के लिए भूमि बैंकों को बनाए रखना और पारगमन आवास और किराये के आवास परिसरों को सुविधाजनक बनाना शामिल है।

"सामाजिक–भौतिक वास्तविकताओं का मानचित्रण: समकालीन समय में मुंबई की स्वदेशी बस्तियाँ," भूमि उपयोग और विकास के दबावों को लेकर समुदायों में बढ़ती चिंताओं की गहरी समझ हासिल करने के लिए अलग–अलग संदर्भों में शहरी गाँवों के तीन केस स्टडी प्रस्तुत करता है। शोध में इस्तेमाल की जाने वाली विधियाँ ज़मीनी साक्षात्कार, दस्तावेज़ीकरण, भौतिक सर्वेक्षण और निवासियों के साथ असंरचित और संरचित साक्षात्कार दोनों हैं। डेटा विश्लेषण विकास नियंत्रण और महानगर में मूल समुदायों और उनकी आजीविका पर वर्तमान अचल संपत्ति के दबाव की प्रासंगिकता पर प्रकाश डालता है।

"उत्तरकाशी, उत्तराखंड का सांस्कृतिक परिदृश्य: कोटी, बखरेती, गैर और पुजेली बनल का मामला," शोध बनल क्षेत्र के सांस्कृतिक परिदृश्य की जटिल टेपेस्ट्री में गहराई से उतरता है, जो इसके प्रसिद्ध भूकंप-प्रतिरोधी वास्तुकला पर ध्यान केंद्रित करता है, जिसे कोटी बनल वास्तुकला भी कहा जाता है। व्यापक विश्लेषण के माध्यम से, यह शोध बनल बस्तियों का सामना करने वाली बहुमुखी चुनौतियों पर प्रकाश डालता है जवाब में, यह पत्र संरक्षण प्रबंधन योजना के लिए समग्र दृष्टिकोण की वकालत करता है जो सामाजिक-आर्थिक विकास और पर्यावरणीय स्थिरता के साथ बनल सांस्कृतिक परिदृश्य विरासत के संरक्षण को संतुलित करता है।

"किला परिसर की संरक्षण रणनीतियाँ: तमिलनाडु के गिंगी किले का मामला," गिंगी किले के प्राकृतिक और डिजाइन किए गए सैन्य परिदृश्य के एकीकरण और ऐतिहासिक विकास के साथ-साथ डेक्कन क्षेत्र के भीतर इसकी वास्तुकला की सरलता और कार्यात्मक भूमिका पर गहराई से चर्चा करता है। शोध में एक व्यवस्थित चार-चरणीय दृष्टिकोण का उपयोग किया गया है, जो एक आधारभूत मानचित्र और समयरेखा स्थापित करने के लिए ऐतिहासिक संदर्भ की समीक्षा के साथ शुरू होता है। इसके बाद साइट पर निरीक्षण और विरासत संसाधनों का मानचित्र बनाने के लिए डेटा एकत्र करना होता है। मुख्य निष्कर्ष किले के विशिष्ट वास्तुशिल्प संश्लेषण और क्षेत्रीय रक्षा में इसकी महत्वपूर्ण भूमिका को उजागर करते हैं। अंतिम चरण में स्थानीय परंपराओं और पर्यावरणीय स्थिरता को बढ़ावा देने के महत्व पर जोर देते हुए किले की ऐतिहासिक अखंडता को संरक्षित करने के लिए सतत विकास, संरक्षण दिशा-निर्देश और प्रबंधन ढांचे के लिए एक मास्टर प्लान का प्रस्ताव है।

"विधायी प्रावधान और मौसमी नदी प्रणालियाँ: विश्वामित्री नदी, वडोदरा, भारत का मामला," विकास अधिनियमों, विनियमों, दिशा-निर्देशों और विभिन्न प्राधिकरणों द्वारा नदी-केंद्रित शहरी नियोजन और नियोजन निर्णय-निर्माण में उनके कार्यान्वयन से संबंधित नीतिगत पहलों में उल्लिखित मौजूदा विधायी प्रावधानों में असमानताओं की जाँच करने के लिए सामग्री और आवृत्ति विश्लेषण को अपनाता है। 2000 से 2020 तक उपग्रह चित्रों के अनुदैर्ध्य विश्लेषण के माध्यम से किए गए नदी प्रणाली के स्थानिक विश्लेषण से प्रावधानों में कमियों के कारण नदी प्रणालियों में संरचनात्मक परिवर्तनों पर प्रकाश डाला गया है। निष्कर्ष मौसमी नदी प्रणालियों और पर्यावरणीय नियोजन सिद्धांतों की वैज्ञानिक समझ को शामिल करने के लिए कानून और नीतियों को संशोधित करने की तत्काल आवश्यकता को रेखांकित करते हैं, जिससे वर्तमान जल संकट का समाधान हो सके।

'बड़े शहरों में गेटेड समुदायों के उद्भव के नियोजन निहितार्थ: दिल्ली का मामला सिद्धार्थ एक्सटेंशन में गेटेड समुदाय और दिल्ली के भगवान नगर में गैर-गेटेड समुदाय की तुलना करता है, जिसका उद्देश्य सामाजिक निहितार्थों को समझना है। अध्ययन बाहरी लोगों की स्वीकृति, कथित सुरक्षा, सुविधाओं, आवागमन में आसानी, सार्वजनिक पहुँच और दोनों क्षेत्रों के बीच सामुदायिक बंधन में अंतर को उजागर करता है। अध्ययन गेटेड समुदायों के निहितार्थों का मुकाबला करने के लिए उचित हस्तक्षेप का सुझाव देता है, पहुँच में सुधार, अलगाव को कम करने और उच्च गुणवत्ता वाली सुविधाएँ प्रदान करते हुए सुरक्षा, गोपनीयता और विशिष्टता की आकांक्षाओं को पूरा करने की आवश्यकता है। उचित हस्तक्षेपों में प्रबंधन दृष्टिकोण, डिजाइन हस्तक्षेप और गेटिंग और अलगाव के आसपास के नियोजन निर्णय शामिल हैं।

(चित्ररेखा काबरे)

संपादक

Comparative Analysis of Architectural Curriculum in Indian Institutions:

A Comprehensive Study

Pratyoosh Madhavi[1], Ankit Kumar[2], Paritosh Kumar[3] and Digisha Mehta[4]

[1]*Indian Institute of Technology, New Delhi Email: pratyoosh.madhavi@gmail.com*
[2]*School of Planning and Architecture, New Delhi*
[3]*School of Planning and Architecture, Bhopal*
[4]*The Maharaja Sayajirao University of Baroda*

Abstract: In the post-independence period, formal architectural education in India began to take shape, heavily influenced by global architectural trends and an increasing recognition of the importance of trained architects in urban development and infrastructure planning. Today, India hosts a diverse array of institutions and universities offering architectural education, significantly contributing to the country's architectural talent and industry. However, these institutions often harbour biases towards either technical or creative subjects, a fact not always evident to prospective students. This research presents a comparative analysis of the architectural curricula offered by six esteemed institutions of architecture in India. The study aims to provide a comprehensive understanding of the differences in curriculum design, course offerings, and educational approaches among these institutions. It further explores the overall inclination of the curricula towards creative thinking, technical subjects, humanities, research, skill development, and choice-based electives. The research methodology employs a quantitative approach, focusing on the comparison of curriculum structures based on the allocation of credits to different subjects as provided by the respective institutions. A web graph derived from this data offers a visual representation of the relative emphasis on various components within the curricula. As the architectural field continues to evolve, understanding how educational institutions tailor their curricula to meet the demands of contemporary practice is imperative. The findings of this research have the potential to inform prospective students, educators, and policymakers about the diverse educational offerings in architectural institutions. This information can guide students in making informed decisions about their architectural education and help institutions benchmark their programs against peers.

Keywords: Architectural Education, Institute Ideology, Course Curriculum, Curriculum Inclination

सार: स्वतंत्रता के बाद के समय में, भारत में औपचारिक वास्तु शिक्षा ने आकार लेना शुरू किया, जो वैश्विक वास्तुकला प्रवृत्तियों और शहरी विकास तथा बुनियादी ढांचे की योजना में प्रशिक्षित वास्तुकारों के महत्व की बढ़ती मान्यता से प्रभावित थी। आज, भारत में कई संस्थान और विश्वविद्यालय हैं जो वास्तुकला शिक्षा प्रदान कर रहे हैं, और ये देश की वास्तुकला प्रतिभा और उद्योग में महत्वपूर्ण योगदान दे रहे हैं। हालांकि, ये संस्थान अक्सर तकनीकी या रचनात्मक विषयों की ओर झुकाव रखते हैं, जो हमेशा संभावित छात्रों को स्पष्ट रूप से दिखाई नहीं देता। इस शोध में छह प्रतिष्ठित भारतीय वास्तुकला संस्थानों द्वारा प्रदान किए गए पाठ्यक्रमों का तुलनात्मक विश्लेषण प्रस्तुत किया गया है। इस अध्ययन का उद्देश्य इन संस्थानों के बीच पाठ्यक्रम डिजाइन, कोर्स की पेशकश और शैक्षिक दृष्टिकोण में अंतर की व्यापक समझ प्रदान करना है। यह शोध यह भी जांचता है कि इन पाठ्यक्रमों में रचनात्मक सोच, तकनीकी विषयों, मानविकी, अनुसंधान, कौशल विकास और विकल्प-आधारित ऐच्छिक विषयों की ओर किस प्रकार का झुकाव है। हमारे शोध पद्धति में मात्रात्मक दृष्टिकोण अपनाया गया है, जिसमें संबंधित संस्थानों द्वारा प्रदान किए गए विभिन्न विषयों के लिए क्रेडिट आवंटन के आधार पर पाठ्यक्रम संरचनाओं की तुलना की गई है। इस डेटा से तैयार किए गए एक वेब ग्राफ का उपयोग करते हुए, पाठ्यक्रम के विभिन्न घटकों पर सापेक्ष जोर का दृश्य प्रतिनिधित्व प्रदान किया गया है। जैसे-जैसे वास्तुकला का क्षेत्र विकसित हो रहा है, यह समझना आवश्यक है कि शैक्षिक संस्थान अपने पाठ्यक्रम को समकालीन प्रथाओं की मांगों को पूरा करने के लिए कैसे अनुकूलित करते हैं। इस शोध के निष्कर्ष संभावित छात्रों, शिक्षकों और नीति निर्माताओं को वास्तुकला संस्थानों में विविध शैक्षिक प्रस्तावों के बारे में जानकारी देने में सहायक हो सकते हैं। यह जानकारी छात्रों को उनकी वास्तुकला शिक्षा के बारे में सूचित निर्णय लेने में मार्गदर्शन कर सकती है और संस्थानों को उनके कार्यक्रमों को साथियों के साथ तुलना करने में सहायता कर सकती है।

मुख्य शब्द: वास्तुकला शिक्षा, संस्थान की विचारधारा, पाठ्यक्रम संरचना, पाठ्यक्रम झुकाव

1. Introduction

Architectural education, the cornerstone of a thriving profession, stands at the intersection of creativity, technology, and cultural evolution. The architectural curriculum plays a crucial role in shaping the designers of tomorrow, influencing the trajectory of the built environment and societal well-being. As the practice of architecture evolves to meet changing global challenges, it is essential to examine how educational institutions adapt their curricula to prepare graduates for this dynamic landscape.

Globally, architectural education is regulated by organizations such as the Royal Institute of British Architects (RIBA), the National Council of Architectural Registration Boards in the USA, and the Council of Architecture in India. These bodies play a vital role in shaping the curricula that train the architects of tomorrow (Desai

2006). Additionally, international organizations like the International Union of Architects (UIA) and UNESCO have established guidelines for architectural education. These guidelines emphasize the importance of subjects such as Architectural Design, Building Construction, Energy Efficiency, Project Management, and Professional Practice in the curriculum. They emphasize the need for architectural students to engage with complex design projects and stay updated with the evolving profession (Kumar 2010).

In India, architectural education is overseen by the Council of Architecture (COA), which has witnessed a significant increase in the number of architecture colleges in recent years (COA 2023). However, this expansion has raised concerns about the commercialization of architectural education at the expense of quality. The COA envisions architectural education as a holistic blend of humanities, science, art, and technology, embracing multidisciplinary interactions and addressing national priorities such as energy conservation, environmental protection, and low-cost housing (COA 2023). The current architectural curriculum structure in India, largely unchanged since the 1980s, faces the challenge of adapting to the changing educational landscape and the availability of vast online resources. It is not only the content but also the learning environment that matters, as it provides students with a platform for knowledge acquisition and broadens their horizons (Desai 2006).

The purpose of this study is to conduct a comparative analysis of the curricula offered by six eminent Indian institutions, with a specific focus on the allocation of credits to different subjects within these curricula. This research aims to explore the nuances of these educational approaches, seeking to answer fundamental questions about them. How do these institutions emphasize creative thinking, technical knowledge, humanities, research, skill development, and choice-based electives within their curricula? What does the distribution of credits reveal about the priorities and inclinations of these institutions in shaping the architects of the future?

The significance of this study extends beyond academic inquiry. It has practical implications for prospective architectural students, offering insights into the diverse educational offerings of these renowned institutions. For educators, it provides a platform for self-assessment and benchmarking against peers. Policymakers can benefit from a deeper understanding of the educational landscape, facilitating data-driven decisions to advance architectural education in India.

The following sections will discuss the literature review, research methodology, data analysis, and the findings of this comparative study, offering a comprehensive view of the architectural curriculum in these institutions and their implications for the future of architectural practice and education.

2. Theorizing Knowledge, Skills, and Research in Design Studio

The current generation of students' approach to design studios is different from that of traditional scholars. Many researchers are exploring various aspects of architectural pedagogy. Architectural education comprises two major components: imparting theoretical knowledge and the testing of this knowledge through practical application in the form of Architectural Design Studios. Many researchers have worked on the efficacy of traditional studio-based pedagogy in architectural education. Al-Hagla (2012) has explored the role of design studios in architectural education. Burkay Pasin's (2017) study investigates the theoretical bases and practical challenges of the knowledge/skill dichotomy in the design studio. Ryan Hargrove (2012) has researched design pedagogy, particularly the role of design studios in fostering innovation and creativity in architecture education. His work emphasizes that studying creativity as a self-regulatory metacognitive process is timely and important for design education.

Ashraf Salama (1995) has conducted extensive research on architectural education, including the evaluation of studio-based learning as a means to enhance design education and creativity in students. There are researchers like Levent Kara (2015), Soliman et al. (2019), Doyle and Senke (2017), and Goldin et al. (2022), who have made significant contributions to the understanding of how technology and digital tools can be integrated into architectural education, offering insights into the transformative potential of technology in the design studio and the learning experience of architectural students (Doyle and Senske 2017; Goldin et al. 2022; Kara 2015; Soliman et al. 2019). Some researchers have worked on multidisciplinary and experiential learning in architectural education. Researchers such as Bing (2001), Duarte (2007), Cheng (2014), and Fortin (2022) have collectively contributed to the

domain. Their studies emphasize the advantages of collaborative projects that involve students from various disciplines, real-world engagement, and community-based initiatives. These researchers emphasize the value of interdisciplinary collaboration and hands-on experiences as effective educational tools, highlighting on how architectural students can benefit from and contribute to resolving of complex urban, environmental, and societal challenges.

Few studies conducted in the West have undertaken direct comparisons of the strengths, weaknesses, and outcomes of different pedagogical models within architectural education (Fokdal et al. 2020; Leathem et al. 2019). While existing literature offers valuable insights into individual pedagogical approaches, a noticeable gap remains in comprehensive comparative studies. These gaps leave educators, students, and institutions without a clear understanding of the relative advantages and disadvantages of various pedagogical approaches.

Institutions of higher education should provide students with clear insights into the pedagogical models they adopt and the anticipated learning outcomes. Despite the variance in pedagogical approaches among architectural schools, prospective students often lack a comprehensive understanding of the potential consequences of their choice of institution. The present research aims to address this concern through a comparative analysis of four case studies, providing comprehensive examination of the pedagogical landscape in architectural education and its implications for student development.

3. Methodology

This study conducted a comparative analysis of the curricula in six Indian architectural institutes, utilizing course content available on their official websites. The year chosen for the study is 2022. The curriculum content was systematically categorized into six key areas: i) Design-Oriented Subjects: Core subjects that foster the development of individual design ideas and innovation, ii) Technical Subjects: Courses building a robust technical and logical foundation, encompassing topics such as building materials, construction technology, and climatology iii) Humanities: Subjects related to comprehending socio-cultural evolution, including architectural history, sociology, and economics iv) Skill Development: Courses tailored to equip students with practical architectural skills, including graphic representation techniques and computer-aided design v) Research-Oriented Subjects: Subjects designed to stimulate undergraduate research, such as research proposals and theses vi) Choice-Based Electives: Specialized subjects enabling students to explore specific interests beyond the core curriculum, spanning design, technology, and skill development.

These categories constitute the foundational structure of architectural education, encompassing essential knowledge and skills. To analyze the curricula, weights were assigned to each category based on the number of credits it held in a particular semester. This weighted data was further visualized through bar graphs and web diagrams. The use of visual representations, such as bar graphs and web diagrams, allowed for a clearer understanding of the distribution of curriculum content across the identified categories. However, it's essential to acknowledge that this research is restricted to the six selected case studies and may not represent the entire spectrum of architectural education in India.

4. Comparative Analysis of Various Schools of Architecture

4.1 Indian Institute of Technology, Kharagpur

The Indian Institute of Technology, Kharagpur, was founded soon after independence in collaboration with the Massachusetts Institute of Technology. The department started its journey in 1952 with an undergraduate course in architecture.
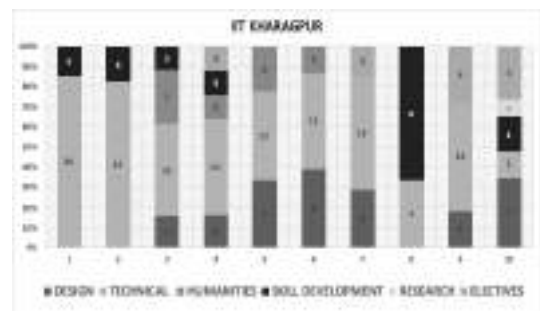

Figure 1. Distribution of subjects in various semesters in IIT KGP (Based on the syllabus of IIT Kharagpur 2020).

As shown in Figure 1, a greater weightage is given to technical subjects in the initial three years with weightage of 34%, 49%, and 52%, respectively. The weightage given for the 4th and 5th year is 10-15%. The weightage of design

studios remains constant across all semesters at approximately 25-30%, each. The credits for the Design Studio were higher in the first year, and they decreased in the second and third years.

More emphasis is given to the technical subjects rather than the design courses. In the final year more weight is given to the design studio, with a weightage of over 60%. The research component and electives are relatively fewer with, a weightage of approximately 10-15%, and are only offered in the advanced stages of the course curriculum. The skills development component is relatively negligible and is only provided in the foundation years.

4.2 Indian Institute of Technology, Roorkee

The Architecture Course started at the Indian Institute of Technology, Roorkee, in 1956-57. The B.Arch. The Indian Institute of Architects recognized the course in December 1961.
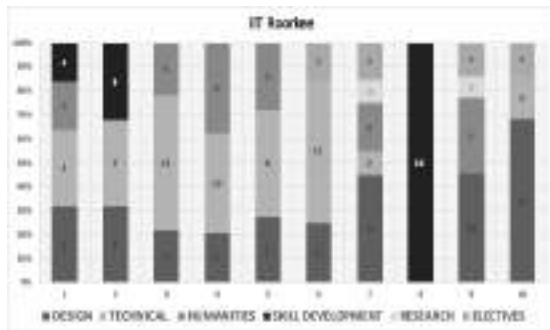

Figure 2. Distribution of subjects in various semesters in IIT Roorkee (Based on the syllabus of IIT Roorkee 2020)

As shown in Figure 2, a greater weightage is given to technical subjects in the initial three years with weightages of 34%, 49%, and 52%, respectively. The weightage given for the 4th and 5th year is 10-15%. The weightage of design studios remains constant across all semesters at approximately 25-30%, each. The credits for the Design Studio are more in the first year, and they are reduced in the second and third Years. More emphasis is given to the technical subjects rather than the design courses. In the final year more weight is given to the design studio, with a weightage of over 60%. The research component and electives are relatively fewer, with a weightage of approximately 10-15%, and are only offered in the advanced stages of the course curriculum. The skills development component is relatively negligible and is only provided in the foundation years.

After analyzing the overall semesters at IIT Roorkee, there is a greater inclination towards technical subjects rather than design and research. The focus shifts more towards technical

subjects rather than choice-based subjects in the higher semesters, with a constant weightage of 35-40 % allocated to technical subjects.

4.3 National Institute of Technology, Calicut

The National Institute of Technology, Calicut, was established set up in 1961 as the Regional Engineering College Calicut (RECC), the ninth of its kind and the first to be established during the Third Five-Year Plan period. Until the formation of the University of Calicut in 1963, the institute was affiliated with the University of Kerala. The Department of Architecture was started in 1990.
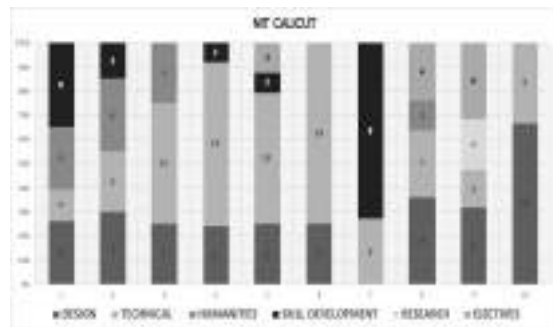
Figure 3. Distribution of subjects in various semesters in NIT Calicut (Based on the syllabus of NIT, Calicut, 2020)

Figure 3, shown above, reveals that the technical course weightage at NIT Calicut is distributed more heavily in the initial three years, with weightage of 18%, 59%, and 64%, respectively. More weightage is given to technical subjects in the advanced years, with a weightage of 20-30%. The credits of Design studios are consistent across all semesters, with a weightage of 25% except in the final year, where it increases to 45%. The choice-based electives are being offered from the third year only. Approximately 15-20% of the weightage is allocated in the form of choice-based electives. More skill-based courses are offered in the first year, with a weightage of 25%. The Research component is very weak and only offered in the final year, with an overall weightage being 10% of the total credits.

The analysis reveals that the curriculum design at the National Institute of Technology, Calicut, is designed to develop an attitude for research, exploration, and creativity in the design studio. Electives are also offered in the form of choice-based theory electives from the initial years, i.e., third year. The complexity in Design studios also grows incrementally with the semester. The final year culminates in a research-based thesis in the ninth semester and culminates in a design thesis in the tenth semester.

4.4 School of Planning and Architecture, New Delhi

The School of Planning and Architecture, New Delhi, is one of the oldest institutions in India, producing eminent professionals in the field of Architecture since 1941 and later in the field of Planning as well. It was also recognized as the 'School of National Importance under an act of Parliament' in 2015.
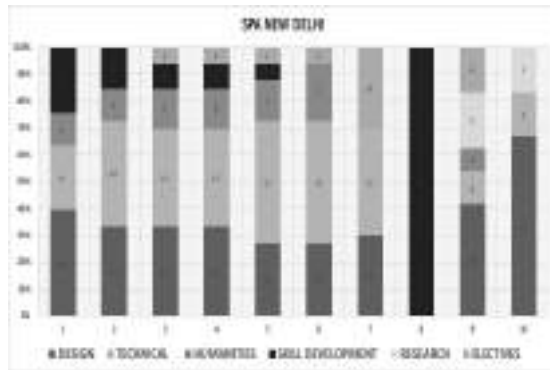

Figure 4. Distribution of subjects in various semesters in SPA New Delhi (Based on the syllabus of SPA, New Delhi 2016)

Figure 4 shows that the technical courses receive more emphasis in the initial three years of architecture, with weightage of 31%, 36%, and 45%, respectively. The weightage for advanced years for technical subjects is 10-15%. The choice-based elective courses are also offered from the second year, and more flexibility in electives is offered in the higher semesters. The weightage of electives is 10-15 % across all semesters. Some of the electives offered are also research-based. The research is also offered with a weightage of 10-20% in the higher semesters. More skill-based subjects are introduced right from the first year with a weightage of approximately 20%. More subjects are also taught in the higher semesters.

The curriculum offers choice-based learning at both Stage 1 (First to Third year) and Stage 2 (Fourth to fifth year), where up to 25% of the hours provide various choices for students to explore their areas of interest through elective subjects and research work. At Stage 1, choice-based learning is introduced through electives offered during the Semester III to Semester VI. At Stage 2, students are offered two electives per semester as well as choice-based studios and research work. Core subjects are compulsory and account for 75% of the hours.

A lot of importance is given to the Architectural Design Studio, emphasizing learning by doing rather than the approach of

copying and pasting. The students are given the freedom to think and question. The hierarchy of design studios is systematically and thematically connected to create a rich studio experience for students. The attempt to connect all the design studios is to integrate the knowledge gained from all the courses with their practical application in studios.

4.5 School of Planning and Architecture, Bhopal

the Government of India set up the School of Planning and Architecture, Bhopal in 2008.
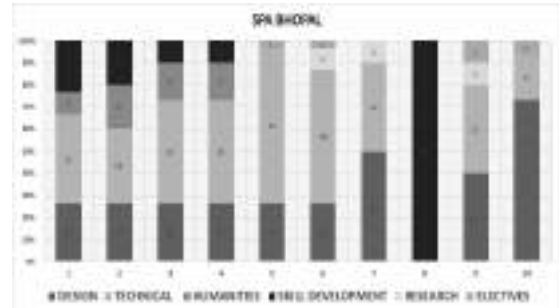
Figure 5. Distribution of subjects in various semesters in SPA Bhopal (Based on the syllabus of SPA, Bhopal 2016)

Figure 5 shows that the technical courses' weightage is given more emphasis in the initial three years of architecture, with weightages of 36%, 46%, and 65%, respectively. More weightage is given to technical subjects in the advanced years, with a weightage of 20-30%. The credits of Design studios are seen as constant across all semesters, and the weightage is 25% except in the final year, where weightage exceeds 50%. The choice-based electives offered from the fifth semester to the final year. The weightage of credits is at approximately 5%. The Research components are introduced from the advanced years, and their weightage has been 5-10%, respectively.

The course curriculum is also designed in two parts. The initial years are mainly focused on knowledge and skill development, whereas in the higher years focus on attitude development. The interlinkage between theory subjects and design studios is systematically developed, allowing students to apply the knowledge and skills they have acquired in previous semesters in the ongoing studios.

The major subjects are aligned into various vertical components, with the architectural design studio forming the central vertical of the entire curriculum, alongside verticals focused on building construction and building materials and techniques. The intricacies in the design studio and building construction increase incrementally

in scale and proportion with each passing semester. The students are also provided with choice-based theory elective subjects from the initial years only. The curriculum design promotes a research culture from the initial years, where students are encouraged to explore their interests and connect the knowledge with design studios, eventually culminating in an Architectural Thesis.

4.6 Institute of Architecture and Planning, Nirma University, Ahmedabad

The Institute of Architecture and Planning at Nirma University (IAPNU) was founded in 2014. The Institute aims to impart high-quality education in designing built environments and human settlements through the disciplines of Architecture and Planning.
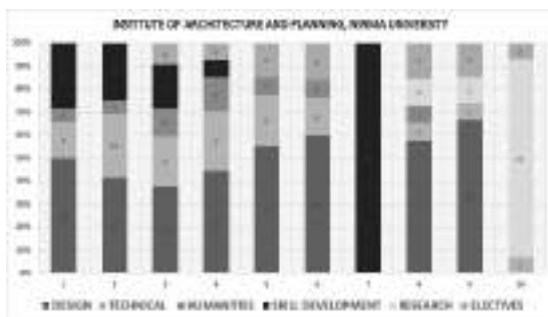

Figure 6. Distribution of subjects in various semesters in IAPNU, Nirma University (Based on the syllabus of IAPNU, Nirma University 2020)

Figure 6 shows that more weightage is given to the design-based subjects and gradually increases in the higher semesters. The weightage of the design-based courses is 45%, 40%, and 58% for the initial three years. And gradually reduces to approximately 30% as more weightage is given to research-based subjects in the advanced years. More flexibility is offered to students in the form of choice-based electives, which are available from the second year onwards. The weightage of the electives offered varies from 10 to 15 % across all semesters. The component of technical subjects is approximately 25-30% offered in the initial years, and more flexible electives are offered to the students. The students are more oriented towards research in their advanced years, and more than 50% of the is given to research-based subjects in the final years.

5. Discussion

The comparative analysis of credit distribution across six distinguished architectural colleges in India has provided valuable insights into the fundamental pillars that underpin architectural education (Figure 7). Each of these colleges,

while sharing the overarching goal of producing skilled and innovative architects, approaches this objective in distinctive ways, as reflected in the allocation of credits across various subject categories.

Design-oriented subjects form the core of architectural education, fostering creativity, innovation, and the practical application of knowledge. IAP-Nirma University leads in this category, underlining the institution's emphasis on studio-based learning and mentorship. SPA-Bhopal and SPA-Delhi closely follow, highlighting their commitment to hands-on experience and peer collaboration. Technical Subjects contribute to building a strong technical and logical foundation in students. SPA-Bhopal excels in this domain, demonstrating a dedication to enhancing technical knowledge. IIT-Kharagpur and SPA-Delhi also prioritize technical expertise with substantial credit allocations. Humanities subjects play a crucial role in sensitizing students to societal concerns and providing them with a theoretical understanding of the challenges they face in society. IIT-Roorkee stands out in this category, showcasing its commitment to holistic education. Other colleges, including SPA-Delhi, NIT-Calicut, IIT Kharagpur, SPA-Bhopal, and IAP-Nirma University, follow suit in emphasizing humanities.

Professional Skills are essential for the immediate employability of students. IAP-Nirma University takes the lead in this area, allocating significant credits to subjects focused on skill development. SPA-Bhopal, SPA-Delhi, IIT-Kharagpur, NIT-Calicut, and IIT-Roorkee also prioritize equipping students with practical skills for the industry. Research-oriented subjects offer students early exposure to research and innovation. IAP-Nirma University demonstrates a strong commitment to this aspect. SPA-Delhi, SPA-Bhopal, NIT-Calicut, IIT-Roorkee, and IIT-Kharagpur also allocate credits to promote undergraduate research and inquiry. Choice-based electives stimulate innovation and research in specific areas of interest. IAP-Nirma University leads in this category, showcasing its commitment to providing students with opportunities to explore diverse fields. SPA-Delhi follows with a significant allocation of credits.

6. Conclusion

Understanding the relationships between different schools of thought in architectural education and their corresponding outcomes is

crucial for shaping effective curricula, preparing students for the demands of the profession, and advancing architectural knowledge and practice. As can also be seen in the study, there is a clear inclination of different institutes towards different subjects. This inclination can be attributed to various aspects, including their origin, inspiration, philosophy and ideology. Often, students who graduate from these institutes pursue specializations that manifest the inclination of the institutes they belong to. Given the wide range of aspects covered and the nature of this field, there cannot be a fixed or rigid

system of weightage assigned by each institute. However, one also feels the need to have clarity in the ideology and philosophy behind the inclination of the curriculum. The curriculum outlines the course contents for various semesters. Still, this study reveals that an underlying guiding philosophy or ideology exists within the syllabus, driving its formulation and development. Therefore, a gap exists in the curriculum that needs to clearly state its philosophy, ideology, and pedagogy along with its contents.
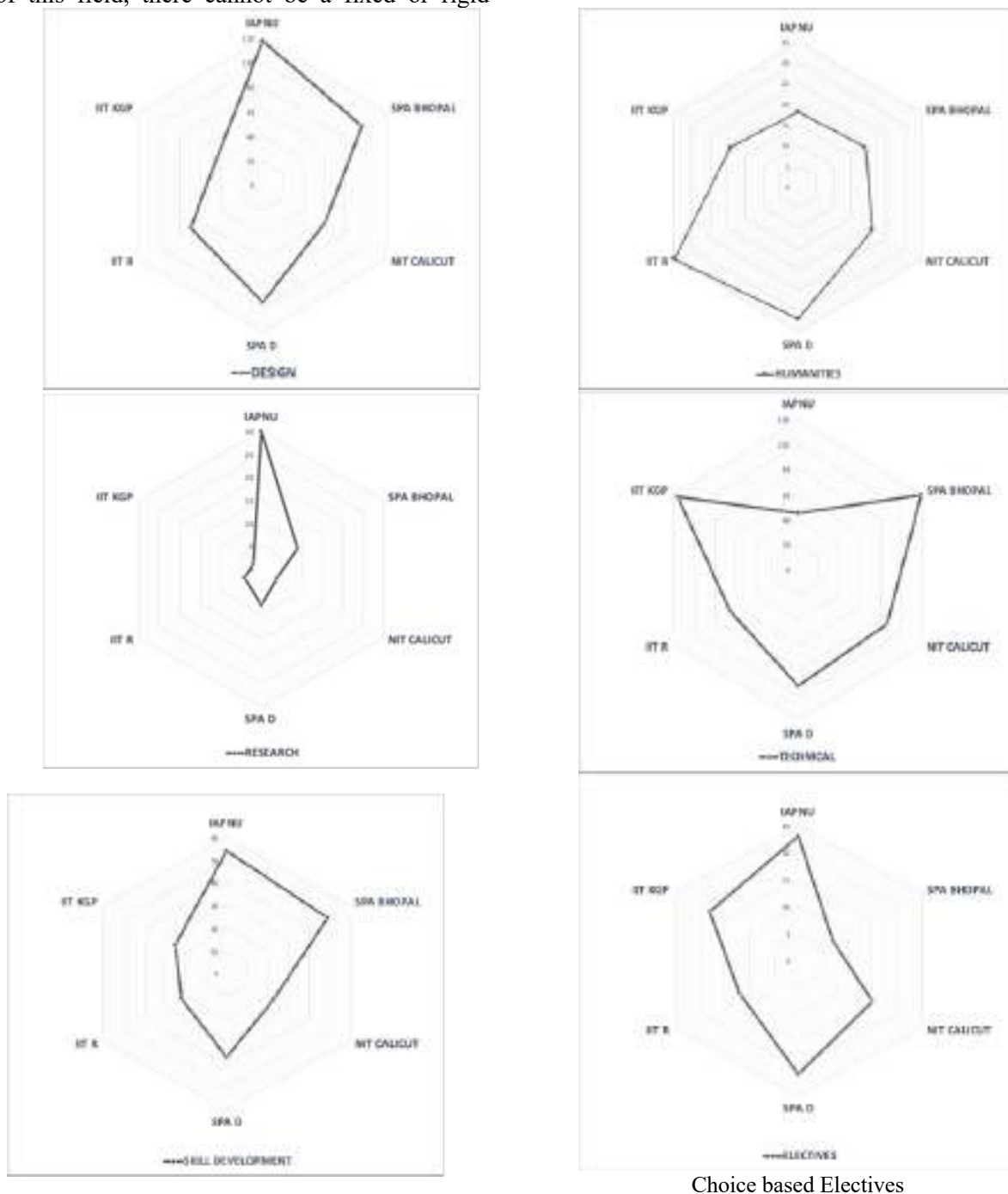

Figure 7. Comparative analysis of credit distribution across six distinguished architecture colleges in India
Source: Developed by Scholar

Students joining such reputed Architectural institutes should have some clue of the school's inclination. Instead of the idea of joining an institute based on its ranking, a student should be more concerned over which school of thought he would like to be a part of. Future studies can focus on the perspectives of students who have experienced different schools of thought in architectural education. How do students perceive the value of their education in terms of their career trajectories and job opportunities? Are there noticeable differences in the professional outcomes of graduates from programs emphasizing distinct schools of thought?

References

Al-Hagla, Khalid. 2012. "The role of the design studio in shaping an architectural education for sustainable development: The case of Beirut Arab University." Archnet-IJAR, 6. https://doi.org/10.26687/archnet-ijar.v6i1.75

Bing, Judith. .2001. "Ideas and realities: Rebuilding in postwar Mostar." *Journal of Architectural Education*. 54 (4). https://doi.org/10.1162/10464880152474556

Cheng, Renée. 2014. "Designers designing design education." *Journal of Architectural Education*, 68(1). https://doi.org/10.1080/10464883.2014.864895

COA 2023. List of Approved Institutions. Council of Architecture. 6th November.

Desai, Miki. 2006. Aspects of Curriculum in the Architectural education of India: A View Towards the Philosophy of it. In Workshop on Professional Program in Architectural Education. Bandung, Indonesia: Institut Teknologi Bandung.

Doyle, Shelby Elizabeth and Nick Senske. 2017. "Between Design and Digital: Bridging the Gaps." *Journal of Architectural Education*. Charrette, 4(1): 101-116.

Duarte, José. 2007. "Inserting new technologies in undergraduate architectural curricula a case study." Proceedings of the International Conference on Education and Research in Computer-Aided Architectural Design in Europe.

Fokdal, Josefine, Ratka Čolić and Danijela Milovanović Rodić. 2020. "Integrating sustainability in higher planning education through international cooperation: Assessment of a pedagogical model and learning outcomes from the student's perspective." *International Journal of Sustainability in Higher Education*. 21(1): 1-17. https://doi.org/10.1108/IJSHE-01-2019-0045

Fortin, David. 2022. "The Design Lodge: Reflections on the 'studio' and a Lexical Shift towards Life-Centred Architectural Education, Enquiry." *The ARCC Journal for Architectural Research*. 19(1): 47–61. https://doi.org/10.17831/enqarcc.v19i1.1133

Goldin, Thomas, Erwin Rauch, Corina Pacher and Manuel Woschank. 2022. "Reference Architecture for an Integrated and Synergetic Use of Digital Tools in Education 4.0." *Procedia Computer Science*. 200: 407-417. https://doi.org/10.1016/j.procs.2022.01.239

Hargrove, Ryan. 2012. "Fostering creativity in the design studio: A framework towards effective pedagogical practices." *Art, Design and Communication in Higher Education*. 10(1): 7-31. https://doi.org/10.1386/adch.10.1.7_1

Kara, Levent. 2015. "A Critical Look at the Digital Technologies in Architectural Education: When, where, and how?" *Procedia - Social and Behavioral Sciences*. 176: 526-530. https://doi.org/10.1016/j.sbspro.2015.01.506

Leathem, Thomas, Christina Hillesheim, Aressa Coley and Shane McGregor. 2019. "Student and teacher perspectives on a multi-disciplinary collaborative pedagogy in architecture and construction." *Higher Education, Skills and Work-Based Learning*. 9(1): 121-132. https://doi.org/10.1108/HESWBL-03-2018-0026

Pasin, Burkay. 2017. "Rethinking the Design Studio-Centered Architectural Education: A Case Study at Schools of Architecture in Turkey." *The Design Journal*. 20 (sup1): S1270-S1284. https://doi.org/10.1080/14606925.2017.1352656

Salama, Ashraf M. 1995. *New Trends in Architectural Education: Designing the Design Studio*. Cairo, Egypt: The Anglo-Egyptian Bookstore.

Density – Den*City*:

Correcting the Expression for Density of Population in Urban Areas

Mahavir[1], Aashutosh Gour[2], Amit Sarkar[3], Chavali Krishna Kumar[4], Nirjhar Ray[5], Pamarthi Nikita[6], Sai Rohanth Badiganti[7], Santwana Saira John[8], Sneha Susan Mathew[9]

[1]*Corresponding author: Former Professor, School of Planning and Architecture, New Delhi;*
Email: mahavir57@yahoo.com
[2-9]*Former students of Bachelor of Architecture, School of Planning and Architecture, New Delhi*

Abstract: In science, density is defined as the mass per unit 'volume' (three-dimensional unit) of a substance (Britannica 2024). For population calculations, mass can be equated to the number of people and the volume of space that the number of people occupy. In fields related to planning, the term 'density of population' is defined as the number of people living per unit 'area' (two-dimensional unit). The third dimension is missing in calculations relating to the real three-dimensional world. Focusing on the concept, this paper questions, and analyses the problems caused by not accounting for the third dimension in density of population calculations and suggests a corrective in the form of Den*City*.

Keywords: Density; Population; Third Dimension; Den*City*

सार: विज्ञान में, घनत्व को किसी पदार्थ की प्रति इकाई 'आयतन' (त्रि-आयामी इकाई) के द्रव्यमान के रूप में परिभाषित किया जाता है (ब्रिटानिका, 2024)। जनसंख्या के घनत्व की गणना के लिए, द्रव्यमान को लोगों की संख्या और उस स्थान की मात्रा के बराबर किया जा सकता है जिस पर लोग रहते हैं। नियोजन से संबंधित क्षेत्रों में, 'जनसंख्या का घनत्व' शब्द को प्रति इकाई 'क्षेत्र' (द्वि-आयामी इकाई) में रहने वाले लोगों की संख्या के रूप में परिभाषित किया गया है। वास्तविक त्रि-आयामी दुनिया से संबंधित गणनाओं में तीसरा आयाम गायब है। इसी अवधारणा पर ध्यान केंद्रित करते हुए, यह पत्र जनसंख्या गणना के घनत्व में तीसरे आयाम को ध्यान में न रखने के कारण होने वाली समस्याओं पर सवाल उठाता है और उनका विश्लेषण करता है और Den*City* के रूप में एक सुधारात्मक सुझाव देता है।

मुख्य शब्द: घनत्व; जनसंख्या; तीसरा आयाम; Den*City*

1. Introduction

Density of population has, for a long, been a popular measure for assessing the concentration of population in a given area. In addition, by giving an idea of crowdedness, the concept can help to provide a basic characteristic of an area (Dutta & Bhaduri, 2017). Density of population also helps in planning for social and physical infrastructure. In science, density is defined as the mass per unit volume of the substance (Britannica, 2024). Applying this definition to population calculations, mass can be equated to the number of people whilst volume equates to the amount of space that those people occupy. With regards to planning, the density of population is referred to as the mass (people) per unit 'area' (Keeble, 1969). This measure might be sufficient for a few aspects of planning, such as planning for roads, water, and sewerage infrastructure, but it creates a blind spot in other facets of planning, where the negligence of the third dimension creates an incorrect perception of the living conditions in an area.

What are the factors that affect the 'density of population' in an area? Why is it necessary to consider the volume to know the character of the spaces in which the people live? What aspects of planning does the neglect of the third dimension affect? Should the term 'density of population' be modified to take care of the vertical space? This paper addresses these four research questions and thereafter suggests a more scientific expression for the term 'density of population' with special regard to urban areas.

2. General usage of the term 'Density'

'Density' apparently is a simple, familiar term at first glance but upon closer examination, it is a complex concept. The complexity arises from the multiple definitions of the term in diverse fields and its usage in different contexts. Apart from substances in the form of solids, liquids and gases, the following are a few examples of usage of the term density, omitting one or two dimensions, which may or may not have created limitations in practice. Density in data storage is generally expressed as gigabytes per

inch (a unit of length) or gigabytes per sq. inch (a unit of area); density of textile fibres is generally expressed as mass in grams per 1,000 meters (a unit of length). The density of paper is typically expressed as gsm (grams per sq. meter), which is not exactly the density but grammage and requires to be divided by calliper. The concept of bone density is the mass of minerals per volume of bone. However, clinically, it is measured by proxy according to the optical density per sq. cm. of bone surface upon imaging, perhaps a limitation of imaging equipment.

In the case of music, the unit of measure is time, hence the unit of density is usually linear. Rhythmic density - the number of beats per second, becomes a linear measure, used by a percussionist to follow the beats of a song. Melodic density - the number of notes per set of beats or seconds is also a linear measure. Textural density - the count of the number of voices/ textures at a point in time also a linear measure, would be used by a sound engineer for mixing different tracks. Evidently, linear densities are enough for understanding the music.

Usage of the term density expressed in two dimensions, in some cases, might not be sufficient to get a wholesome idea. In some other cases, the third dimension might have been removed because the third (or the second) dimension might have been a constant value, and hence not affecting the numeric value. Many of these expressions are indeed measures of 'intensity' and not 'density'. Whether or not these have created limitations in practice is beyond the scope of this paper to examine.

3. Vertical and volumetric urbanism

As of 2018, 55% of the world's population resided in urban areas; a percentage that is predicted to increase to 68 per cent by 2050 (United Nations 2018). In recent decades, the number, size and density of the urban areas has increased at an accelerating pace. There has been a notable change in the morphology of the urban areas from low-density horizontal towns to high-density high-rise cities. Increasing verticality has brought to the fore concepts of vertical and volumetric urbanism (Bruyns et al. 2021).

Horizontal urbanization refers to where a city spreads out over the ground, increasing the urban surface at the expense of rural and natural grounds or reclaimed land. Vertical urbanization refers to building high rise (and possibly also underground), thereby concentrating urban functions within a smaller same square unit in terms of spatial footprint. Instead of building outwards, vertical urbanization builds upwards and is based on the premise that concentration leads to building more within a smaller area of land leading to compactness.

The concept of Vertical Urbanism diverges from the modernist notion of promoting tall buildings as the dominant urban typology to explore physically interactive and socially engaged forms of cities and also seeks to cities as multi-layered and multi-dimensioned organisms. This strategy is informed by contemporary systems which range from underground mass transit to futuristic urban forms and seeks to enable a holistic organization of infrastructure, space, and ecology in a three-dimensional framework. Density, complexity, and verticality are three keywords which are used to describe the characteristics of Vertical Urbanism.

The measurement of space within these interactive vertical spaces is volumetric urbanism which, according to Bruyns et al. (2021) is essentially based on the spatial interaction of five components: density, functional mix, compaction, compression complex networks and interaction intensity. Volumetric urbanism is seen as a tool to measure accessibility using various indices (Bruyns et al. 2018). A classic example of a volumetric city is Hong Kong, where, due to the compactness of the city, volumetric urbanism has made it possible to keep a balance between congestion and order, dynamic and confusion, historic context, and future development in high-dense cities (Schnabel 2016). The volumetric city is attributed to the relationships that exist between multiple buildings and the urban environment.

While both vertical and volumetric urbanism are concepts for better understanding and designing city spaces for a sustainable future, the measure proposed in this paper will determine the intensity of the use of space in the third dimension.

4. The missing third dimension

At a city scale, approaches to defining human settlements have been generally criticised because of their limited concern based on two dimensions. The third dimension of vertical space is often ignored even though people are distributed in three-dimensional space (Stewart & Warntz 1958). This neglect is clearly expressed in the manner in which physical planners use the word 'density'. Conceptually, in planning, density means the number of objects - houses, rooms, persons, etc. - per unit of space (Keeble 1969). However, in practice, three-dimensional 'space' is reduced to a two-dimensional 'area'. For planning purposes, it is the ratio between the population of a given area and the area (Caminos and Goethert 1978). Compared to areal dimensions, the vertical space that a human settlement occupies is negligible. However, in science, if the thickness of a sheet of metal is even less than a millimetre, its density is still expressed as 'mass per unit volume'. Perhaps, the hidden message in the caption of an advertisement (Figure 1) for tourism promotion in Portugal (Time 1996) was the inclusion of a 'vertical space'.

Figure 1. One Person per cubic mile – inclusion of the vertical space
Source: (Time, 1996)

Neglect of the third dimension, in spatial planning, may have originated in the times when most of the buildings in a human settlement had single floors. The third dimension may have been taken as a unit (say, 1 floor). Using the third dimension as a unit will not change the numeric value of the density of a human settlement as generally expressed, but it will affect the units causing a change from 'population per unit area' to 'population per unit volume (or space)'. Moreover, the assumption of the third dimension being unity itself can be challenged in the present-day context when residential buildings are routinely not confined to the ground floor and are multi-storied. The term 'density', as used today, is often no more than a measure of concentration or intensity of population per unit area (Mahavir 1996). This expression is only partially useful while planning for infrastructure in human settlements. For example, it does not serve any useful purpose for planning for stormwater drainage (Mahavir and Sokhi 1982). It also does not serve a purpose when comparing inter-settlement characteristics. It does not reflect on whether two cities having the same density of population are equally congested or whether their respective population reside on small plots of land or in high-rise apartment buildings. Such a major omission of the third dimension is incomprehensible in this era of 3D GIS, Smart Cities, City Digital Twins and 4IR. Even the developments in 3D city modelling are more a geometry than a geography (Batty 2000).

A few other expressions of 'density' have been developed by physical planners; for instance, Floor Area Ratio (FAR) and Floor Space Index (FSI). However, these are instruments for controlling building activity (Keeble, 1969), and are not effective tools for measurement. Accommodation density (e.g., persons per dwelling unit) (Keeble 1969) has been used as a measure, but the expression is not able to specify whether or not all the accommodation is available on the ground floor. Tobler (1969), Nordbeck (1971), Dutton (1973), Unwin (1981), Bolt (1983) and Batty & Longley (1994) have also illustrated the limitations to the current usage of the expression 'density of population'.

5. Current usage of the term 'density of population' and its limitations

Cities change with time and, in urban planning, there is a need to realise they cannot be planned based on absolute populations. According to the Master Plan for Delhi (DDA 2021), all infrastructural facilities such as parks, playgrounds, sports facilities, and so on have been planned based upon the population from the neighbourhood level to the sub-city level. In planning these neighbourhoods, the density of population is a critical factor. If it is too sparse, efficiency is lost, whilst if it is too dense becomes an uncomfortable space to live in; resulting in squatters and congestion. Moreover, when the population increases, there are fewer amenities per person.

Physical density, in urban areas, is a numerical measure of the concentration of individuals or the physical structures within a given geographical unit. It is an objective and quantitative neutral spatial indicator since it is not informative in terms of the built morphology, character, or the degree of openness between two different places with similar densities.

With regards to density of population where residential structures are not very high, the average height of structures would have been taken as unity (1), since most of the structures would have been single-storeyed. Today, where land to build upon is diminishing and the number of people is soaring, there is a tendency to build higher and higher. Given this, it is important to have adequate terms to define, and adequate methods to measure how people live in these spaces and how, why, and where they should be densifying spaces. It is important to derive a solution for the problem of the missing third dimension to capture the true picture of living conditions, especially in multi-storeyed residential structures. In the absence of the 'density of population' expression providing a true idea of congestion, an attempt was made by Park (2017) to describe 'overcrowding', as a situation where two persons of above 9 years of age, of opposite sexes, and not husband and wife must sleep in the same room. This expression has limitations and provides information about 'a room' only, and also does not elaborate on the size (volume) of the room. Keeble's (1969) attempt to express density, as the number of houses, rooms, persons, etc. per unit of space, also gets reduced to two-dimensional 'area' instead of three-dimensional 'space'. In other related fields such as urban geography, urban design, environmental and regional planning, housing, demography, and public health engineering, density of population is expressed as per unit area rather than per unit of volume, thus causing limitations of use. The conventional density of population metric restricts populations to a two-dimensional space, neglecting the vertically built ubiquitous contemporary cities (Perdue 2013). Through a cartographic example of Chicago, USA, Perdue (2013) demonstrated two parts of Chicago that have drastically different residential environments, yet the conventional density of population metrics imply that they are similar. Simplifying the complex vertical spaces of contemporary cities down to the flatness of conventional techniques leads to incomplete comprehension of urban spaces and inaccurate discernments between crowdedness and density (Perdue 2013). The flatness of the conventional 'density of population' creates representations of city space that confuse the concepts of density and crowdedness (Perdue 2013).

Patel (2013) prefers 'crowding' over density, and views it as a more accurate term in the case of indoor spaces, streets, amenities and open spaces. Patel (2013) also suggests the neutrality of the term 'density' could be qualified by adding a variety of descriptors such as excessively sparse, through comfortable, vibrant, crowded, difficult, to hopelessly congested. However, such descriptors might add to the confusion, bring in subjectivity and not resolve the issue of the missing third dimension.

Figure 2 shows two sites with the same area. The 'density of population' of the two sites is also the same. However, it can be observed that the kinds of spaces created on the two sites differ greatly. The differences can be observed in terms of the built form, spatial organisation and the quality of spaces. From this, it can be concluded that a basic idea of 'density of population' is not sufficient to perceive the complete and correct character of an area at all scales of planning, ie. local, zonal and city.

The current expression of area-based 'density of population' also causes inaccuracy

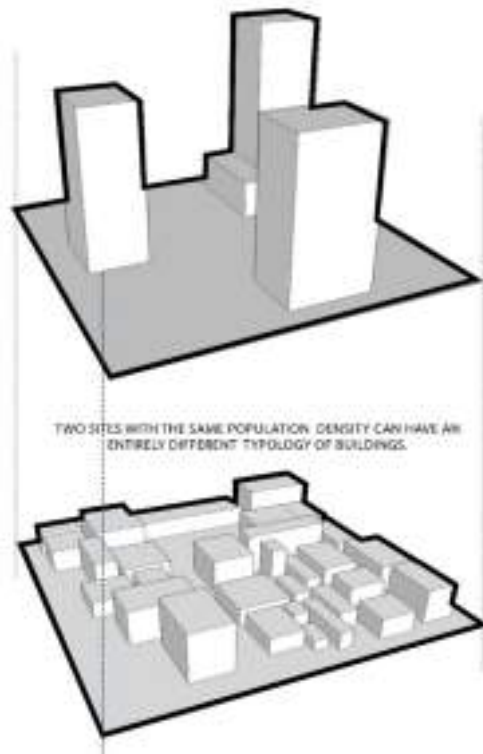while estimating the population in a given area based on satellite image interpretation (Mahavir 1996).

Figure 2. Similar densities on varying built form and living conditions (hypothetical diagram)
Source: Created by authors

5.1 Other limitations of the current expression of density of population

The present expression 'density of population' does not give any inference about the crowdedness or congestion of 'three-dimensional' spaces. Re-densification, a widely used development measure can be used to solve the increasing issue of 'two-dimensional' space crunch for the rapidly growing population. However, the value of density of population does not provide a clue whether the entire additional population is to reside on the same plot on one floor (indicating increased crowdedness) or whether it is to be housed on multiple floors thereby easing out congestion and making the living more open. This makes the process of justifying and marking out areas for re-densification difficult.

The expression of density of population also fails to clarify whether or not the vertical space available on a piece of land has been optimally utilised. It is important to account for and efficiently use vertical space and to reflect the same in the density expression. This is not achieved with regard to how the expression is presently used.

A study in Hong Kong (Chan 1999) suggested that occupants of spatially constrained dwellings do not necessarily feel crowded. While achieved privacy intervenes in the relationship between space and crowding, its effect is indirect and very moderate. Instead, dissatisfaction with the physical environment rather than the quantity of space itself is a major cause of the feeling of crowdedness. What is most often missing in peoples' perception is any clear understanding of the word 'density'. One person's high density may be another's sprawl; the same tall building may be experienced as oppressive or exhilarating; a 'good crowd' for one can be 'overcrowded' for another (Dovey and Pafka 2016). A Comparison of cities with similar densities of population but with varying built forms is provided in Table 1 to illustrate how 'density', in its present form, could be deceptive to understand built form

Table 1: Den*City* calculations for selected World cities; cities of seemingly similar densities but varied built forms and Den*City*

S. No.	City	Density of Population (pph) (in descending order)	Average No. of Residential Floors	Mahavir's Correction for Den*City*	Den*City* (pphf) Density x Mahavir's Correction
1.	Bnei Brak (Israel)	268	28.0	1/28.0	10
2.	Neapoli (Greece)	259	2.5	1/2.5	104
3.	Kolkata (India)	243	8.0	1/8.0	30
4.	Kathmandu (Nepal)	239	3.5	1/3.5	68
5.	Subang Jaya (Malayasia)	239	22.5	1/22.5	11
6.	Pasig (Philippines)	217	32.5	1/32.5	7
7.	Mexico City (Mexico)	60	12.0	1/12.0	5
8.	Sao Paulo (Brazil)	72	25.0	1/25.0	3

Source: Developed by authors; and Demographia (2022) and Mindmapcharts (2023)

6. Attempts to redefine density of population

While there is much literature available which has discussed the limitations of using the current expression 'density of population', far less literature has attempted to provide an alternative or corrective to the same.

Batty and Kim (1992) argued that the most appropriate form for urban population density models is the inverse power function and that this should be largely based upon the negative exponential. Their main argument is based on the notion that a density function should describe the extent to which the space available for urban development is filled. They introduced ideas from urban allometry and fractal geometry to demonstrate that the inverse power model is the only function which embodies the fractal property of self-similarity, a basic characteristic of urban form and density. However, the space and the form of the density function remain a two-dimensional space. Batty and Longley (1994) also discussed the fractal geometry of cities mainly as a two-dimensional phenomenon.

Perdue (2013) proposed a Personal Space Metric, (PSM), an extension of dasymetric techniques, to conceptualize and represent living spaces across a contemporary city. It helps to visualize the amount of space an individual inhabits. This metric allows for greater insights into both where and how people live in urban spaces. Recognizing the verticality of contemporary cities and visualizing unexplored residential spaces may lead to greater insights into the asymmetrical geopolitical, social, structural, and personal geographies of contemporary cities (Perdue, 2013).

The first step in determining the PSM is to separate residential from non-residential structures throughout the (given) city using a binary dasymetric approach. The second step is to calculate the total available living space for each residential building using the product of the square footage of the building footprint and the number of stories of that building. The final step is to populate the buildings with census data using a simple areal interpolation approach. PSM provides an effective new visualization for overcoming the flatness of conventional 'density of population' and enables an understanding of vertically produced residential spaces in contemporary cities to be garnered. A bivariate classification was used to compare the two metrics. Each was classified into three quantiles, thereby creating an index of high, medium, and low values across the extent of Chicago, USA (Perdue 2013). The PSM was further juxtaposed with the conventional density of population to produce new cartographies of Chicago which stressed the importance of developments in three-dimensional methods.

The approach outlined in the Building Footprint Technique and the PSM provides a unique visual alternative that moves beyond the limitations of 'density of population'. However, this method requires the use of another cartographic map, besides that of density of population, which would only aid in comparing the data, to reach a conclusion and hence does not become a simple solution, one which can be replicated. Densities of population in urban areas are rarely determined or used at a building footprint level and are, instead, typically applied at neighbourhood, zone, sub-city or city levels. The approach does not attempt to correct the expression of persons per unit area in the current usage of the term 'density of population'. Finding the footprint and verticality of each residential building would be a daunting task, and the resultant values would be much more difficult to understand as one moves from net density to gross density and overall town density.

Patel (2013) suggests 'street crowding' as an alternative to density, with street crowding being measured as the product of indoor crowding (the number of occupants per hectare of built-up area), the FSI (built-up area/buildable plot area) and the plot factor (buildable plot area/street area). The resultant figure (occupants/hectare of street area) still makes it per unit area and not per unit volume of space.

Other research undertaken by Koomen, et al. (2009) presented a new methodology called the 'Urban Volume Approach' that measures density in urban settings. By combining highly detailed height measurements with topographical data the authors were able to quantify the urban volume of a city. This new approach was tested in two separate case studies. The first focused on how density had changed over time in the city of Amsterdam

over the past century by comparing and analyzing data collected and comparing the densities and building heights. The second compared the densities and urban volumes of four different Dutch cities; Amsterdam, Rotterdam, The Hague and Utrecht.

The authors conducted a detailed analysis of the third dimension of the four cities. Using height data and other computational processes, they were able to compile and calculate the urban volume of the individual cities. Using indicators such as land area, built-up area, building area (all in km^2), population density per land 'area' and per building 'area' (both in persons/km^2), urban volume (in km^3) and average building height (in m), they observed that Amsterdam had the highest density of population per building area and the lowest building area density, with a high average building height. In contrast, Rotterdam had a lower density of population because of its predominance of commercial buildings but had the highest average building height among the other cities.

The 'urban volume indicator' (Koomen, et al. 2009) was also useful for characterizing the differences in urban density between various cities. It gave an idea of how the density of population was distributed throughout the cities, vertically and horizontally, but did not show how crowded or how the living conditions varied between different parts (study 1) or the different cities (study 2). They also did not attempt to correct the expression of 'persons per unit area' in current usage. Moreover, whether or how non-residential buildings were accounted for while dealing with 'urban volume' was not clear. There will have been instances when a few floors of a predominantly residential building may have been used for office and commercial uses, like in the case of Markthal in Rotterdam, The Netherlands (MVRDV 2014). There could also be cases where a huge portion of a vertical horseshoe-shaped arched building (Markthal in Rotterdam) is void (MVRDV 2014). Or the mixed land use New Babylon at The Hague, The Netherlands (MVSA 2012), where the first eleven floors of the 44 floored predominantly residential building are for non-residential use. Moreover, not the entire footprint of the building is utilised for exclusive residential use. Such scenarios mean that they misrepresented

'urban volume' based on a 'footprint' or 'building height'.

7. Den*City* - an alternative to express the density of population in urban areas

Given the limitations noted with regard to the present concept 'density of population', this paper proposes a different term 'Den*City*'. The proposed term Den*City* expresses the density of population as 'persons per unit volume'. In addition to providing an alternative to the current expression of density, Den*City* also provides a corrective that can be easily applied to existing or proposed densities of population at various levels of cities.

People occupy floor space of a residential unit, and irrespective of the height of a floor, the third dimension can be represented in terms of the number of floors of the residential building. Following this, the scientific expression for Den*City* can be derived as follows:

$$\text{Den}City = \frac{\text{mass}}{\text{volume}}$$

Replacing mass with the number of persons, and replacing volume with area multiplied by height in terms of the number of floors,

$$\text{Den}City = \frac{\text{number of persons}}{\text{area x average number of floors}}$$

Measuring area in ha., the Den*City* can be expressed as the number of persons per ha per floor (pphf). 'Area' being the area of the neighbourhood or zone or city, or as in Net Density or Gross Density or Overall Density; and the number of floors being the average number of floors of residential buildings in that neighbourhood or zone or city under consideration.

Since under the current usage, 'Density of Population' is persons per hectare, a correction factor can be applied to convert the same into Den*City*,

$$\text{Den}City = \frac{\text{number of persons}}{\text{area x average number of floors}}$$

$$= \frac{\text{number of persons}}{\text{area}} \ x \ \frac{1}{\text{average number of floors}}$$

= Density of Population x
  (inverse of the average number of floors)

The inverse of the average number of residential floors is the correction factor that the current 'Density of Population' can be multiplied by. Let this correction factor be known as Mahavir's Correction for DenCity.

The proposed measure is simple to apply to any area at any scale of city planning. The data for conventional 'density of population' is generally available for all localities. Since 'densities of population' and/ or the population and the area individually, can be available or estimated for almost any situation, and the average number of residential floors can be assessed through secondary data, ground pictures, traditional aerial photographs or satellite images and the likes, the DenCity measure could be as a universal solution. In situations where the existing or the proposed 'density of population' is already available, it can be quickly converted to the DenCity measure by applying Mahavir's Correction for DenCity, as explained above. DenCity values of different areas at various scales can be compared to obtain a better understanding of the amount of space that an individual occupies compared to the value obtained from the conventional measure of 'density of population' that neglects the third dimension. As in the case of Density, a higher numeral value for DenCity would indicate greater congestedness.

In suggesting the term DenCity, emphasis has been added to 'City' so as to underline the idea that the concept and expression are more applicable to urban areas. Theoretically, it could extend to rural areas or large regions as well. However, present case studies are limited to different hierarchies of plans in towns and cities.

8. Case studies to illustrate the relationship between density and DenCity

Application of the concept of DenCity and Mahavir's Correction for DenCity is illustrated via two neighbourhoods, as detailed in Table 2. The first neighbourhood, Prem Nagar, J-Block, is part of the general area of Nangloi, in western Delhi. The other neighbourhood, known as Uniworld City is in the relatively new township of Gurugram in Haryana, adjacent to Delhi, India.

Using the conventional term of 'density of population', the population density of Prem Nagar (Delhi) stands at 602 persons per hectare (pph) while Uniworld City is 798 pph. The 'density of population' gives the impression that the two areas might also have other similar characteristics. However, the reality presents a different picture.

Prem Nagar (Delhi) is generally a low-profile, low-rise neighbourhood with the average number of residential floors estimated to be 1.5. In contrast, Uniworld City is a relatively higher middle-class neighbourhood with an average number of residential floors estimated to be 15.

Table 2. Comparison of neighbourhoods in Delhi and Gurugram, India

Description	J Block, Prem Nagar Colony, Kirari Suleman Nagar, Delhi	Uniworld City, Sector 30, Gurugram
Layout		
Area	5.5 hectares	4.5 hectares
Total population	3,311 persons	3,591 persons
Density of Population	602 persons per hectare	798 persons per hectare
Average no. of residential floors	1.5	15
DenCity	401 persons per hectare floor (pphf)	53 persons per hectare floor (pphf)

(Source: Layout developed from satellite images from Google Maps, Other data from Navayuga (2010) and field observations)

Applying the Mahavir's Correction (Table 2), the Den*City* figures for the two neighbourhoods are 401 persons per hectare per floor (pphf) for Prem Nagar and 53 pphf for Uniworld City. These figures convey how Uniworld has a lower degree of congestion and better living conditions (in terms of spaces compared to Prem Nagar (Delhi). As a further illustration of the application of Den*City* and Mahavir's Correction, at the city level, the density figures were recalculated to provide Den*City*, as in Table 2.

9. Limitations

Despite its advances, there are several limitations to the Den*City* proposal. For instance, Den*City* does not consider the actual floor heights of individual buildings. Here, therefore, the floor height has been taken as a standard unit. This means, however, that in cases where there are extremely low floor height buildings like in the case of squatter-like conditions, and in cases where floor heights may exceed 5m (such as in old residential buildings), the difference in the living conditions and the kind of spaces are not expressed. Mixed-use areas and mixed-use buildings would also raise difficulties when it came to arriving at reasonably accurate figures for the average number of floors in a residential building. Instead of a 'simple average', a weighted average of the number of residential floors could provide a more realistic picture.

The present case study calculations are limited to neighbourhoods. More studies are required to be conducted at the level of zone and city, respectively, across various cities globally to understand the implications better.

In addition, the concept of Den*City* may not be directly applicable in rural areas and regions, where most residential buildings might be at most two floors (Ground+1). Further research would be required to validate this.

10. Conclusion

This paper has argued that understanding the distribution of population in an area cannot be properly undertaken through density of population values alone because it completely neglects the third dimension. This results in highly congested low-rise developments and barely congested high-rise developments

depicting similar densities. To overcome this deficiency a new approach was suggested. In short, there is a need for the incorporation of a correction factor that can be easily applied to both the existing and planned situations and becomes the best alternative. Den*City* provides a logical expression that can be arrived at easily. It takes into consideration the verticality of the development. Moreover, it has the potential to revolutionise how we perceive living conditions in terms of crowdedness, the ways in which we plan for infrastructure in urban neighbourhoods; and how we estimate population based on satellite images by using a three-dimensional 'Den*City*' rather than a two-dimensional one. It has the potential to revolutionise the way we theorise, practice and teach planning. It may also require changing the units and values in the norms and standards related to density of population.

The focus of this paper is not much on the accuracy of data and calculations but on the concept itself. Weaknesses remain; validation through more case studies under different development scenarios might open the scope for further refinement of the concept as well as provide additional guidance as to how to make it more practical.

Acknowledgements

References

Adam. 2020. *10 epic (and mostly free) things to do in a day in Sao Paulo.* Available at: https://www.worldpackers.com/articles/epic-and-free-things-to-do-in-sao-paulo [accessed 06 June 2023].

Barkat, A. 2020. *Quality of life: Seven reasons to live in Bnei Brak.* Available at: https://en.globes.co.il/en/article-quality-of-life-seven-reasons-to-live-in-bnei-brak-1001355176 [accessed 05 June 2023].

Batty, M. 2000. The New Urban Geography of the Third Dimension (Editorial). *Environment and Planning,* Vol. B:27: 483-484.

Batty, M. and Kim, S. K. 1992. Form Follows Function: Reformulating Urban Population Density Functions. *Urban Studies,* 29 (7).

Batty, M. and Longley, P. 1994. *Fractal Cities: A*

Geometry of Form and Function. London: Academic Press.

Bolt, D. 1983. *The Development Ratio: A Model for a Humane Urban Future.* Auckland: s.n.

Britannica, T. 2024. Editors of Encyclopedia. "density." *Encyclopedia Britannica*, June 20. https://www.britannica.com/science/density

Bruyns, G. J., Higgins, C. D. & Nel, D. H. 2021. Urban Columetrics: From Vertical to Volumetric Urbanisation and its Extensions to Empirical Morphological Analysis. *Urban Studies,* 58 (5): 922-940.

Bruyns, G., Nel, D. & Higgins, C. 2018. Flat City Versus Volumetric City, Re-application of the Layered Movement Network Approach. *Urban Landscape History and Socio-Cultural Transformations,* pp. 635-645.

Caminos, H. & Goethert, R. 1978. *Urbanization Primer.* Massachusetts: Massachusetts Institute of Technology.

Chand, L. 2021. *View of Kathmandu.* Available at: https://commons.wikimedia.org/wiki/File:Locus 3.jpg [accessed 08 June 2023].

Chan, Y. K. 1999. Density, Crowding and Factors Intervening in their Relationship: Evidence from a Hyper-Dense Metropolis. *Social Indicators Research,* Vol. 48:103-124.

Chau, H.-w. 2011. Vertical and Volumetric Urbanism: Hong Kong - A Conversation with A/Prof. Barrie Shelton. *HKIA Journal,* Issue 60.

DDA. 2021. *Master Plan of Delhi - 2021,* New Delhi: s.n.

Demographia. 2022. *World Urban Areas.* Available at: http://www.demographia.com/db-worldua.pdf [accessed 02 June 2023].

Dovey, K. and Pafka, E. 2016. *Urban Density Matters.* Available at:

https://www.citymetric.com/fabric/urban-density-matters-what-does-it-actually-mean-2118/ [accessed 09 September 2019].

Dutta, S. and Bhaduri, S. 2017. Density and Neighbourhood Environmental Quality - A Comparative Study in the Context of Indian Cities. *International Journal on Emerging Technologies,* 8(1): 315-323.

Dutton, G. 1973. Criteria of Growth in Urban Systems. *Ekistics,* 36 (215): 298-306.

Earth, G. 2019. s.l.:s.n.

Global, I. Q. 2021. *Top 3 Reasons to Purchase a Property in Pasig City, Philippines.* Available at: https://www.iqiglobal.com/blog/top-3-reasons-purchase-home-pasig-city-philippines/ [accessed 06 June 2023].

Gonzales, A. 2021. *Commercial and Public Spaces: Aerial Photographs and an Interactive Map Help to Explore the Tianguis of Mexico City.*

Available at:

https://www.archdaily.com/968551/commercial-and-public-spaces-aerial-photographs-and-an-interactive-map-help-to-explore-the-tianguis-of-

mexico-city/610069c2f91c8177e8000030-commercial-and-public-spaces-aerial-photographs-and-an-interactive-map-help-to-exp [accessed 06 June 2023].

Keeble, L. 1969. *Principles and Practice of Town and Country Planning.* London: Estates Gazette.

Koomen, E. Rietveld, P. & Bacao, F., 2009. *The Third Dimension in Urban Geography: The Urban-Volume Approach.* Available at: https://www.researchgate.net/profile/Fernando-Bacao/publication/46559683_The_Third_Dimension_in_Urban_Geography_The_Urban-Volume_Approach/links/02e7e52971320c7306000000/The-Third-Dimension-in-Urban-Geography-The-Urban-Volume-Approach.pdf [accessed 10 June 2023].

Lin, Z. 2018. Vertical Urbanism: Re-conceptualizing the Compact City. In: Z. Lin & J. L. S. Gamez, eds. *Vertical Urbanism: Designing Compact Cities in China.* London: Routledge, pp. 1-16.

Mahavir. 1996. *Modelling Settlement Patterns for Metropolitan Regions: Inputs from Remote Sensing.* Enschede: ITC.

Mahavir & Sokhi, B. S. 1982. *Drainage Characteristics of an Area as a Determinant of Urban Development.* New Delhi: Unpublished Thesis, MURP, School of Planning and Architecture.

Mindmapcharts. 2023. *List of world cities by population density.* Available at: https://www.mindmapcharts.com/index.php/gk/world-gk/6465-list-of-world-cities-by-population-density [accessed 01 June 2023].

MVRDV. 2014. *Markthal Rotterdam.* Available at: https://www.archdaily.com/553933/markthal-rotterdam-mvrdv [Accessed 06 June 2023].

MVSA, A. 2012. *New Babylon.* Available at: https://archello.com/project/new-babylon [accessed 07 June 2023].

Navayuga. 2010. *Prem Nagar Plan.* Delhi: Survey of India. *document/obo-9780195399301/obo-9780195399301-0407.xml.* Available at: https://www.oxfordbibliographies.com/display/document/obo-9780195399301/obo-9780195399301-0407.xml [accessed 06 August 2023].

Nevola. F., 2018. Urbanism. Available at: *https://www.oxfordbibliographies.com/display/document/obo-9780195399301/obo-9780195399301-0407.xml*

Nordbeck, S. 1971. Urban Allometric Growth. *Geografiska Annaler,* Volume 53B: 54-67.

Park, K. 2017. Environment and Health. In: *Park's Textbook of Preventive and Social Medicine.* 24th ed. s.l.:M/S Banarasidas Bhanot Publishers.

Patel, S. B. 2013. Life Between Buildings: The Use and Abuse of FSI. *Economic and Political Weekly,* XLVIII (6): 70-74.

Perdue, N. A. 2013. *The Vertical Space Problem: Rethinking Population Visualizations in Contemporary Cities.* Available at: https://www.researchgate.net/publication/27055 1348_The_Vertical_Space_Problem/fulltext/64 1da3c4a1b72772e422d792/The-Vertical-Space-Problem.pdf [Accessed 16 June 2023].

Reynolds, A. 2022. *Lost with Purpose.* Available at: https://www.lostwithpurpose.com/kolkata-favorite/ [accessed 08 June 2023].

Schnabel, M. A. 2016. Mapping Volumetric Urban Space: A Critical Development Analysis of Multi-level Morphology of High-dense Cities. *11th International Symposium on Architectural Interchanges in Asia (ISAIA).*

Stewart, J. Q. and Warntz, W. 1958. Physics of Population Distribution. *Journal of Regional Science,* 1(1): 99-123.

Tan, J. 2022. *SJ Echo.* Available at: https://sjecho.com.my/community/send-us-a-catchy-slogan-to-describe-subang-jaya-and-win-skating-bowling-passes/ [accessed 06 June 2023].

Time. 1996. *TIME International - The Weekly News Magazine.* Amsterdam Edition ed. New York: s.n.

Tobler, R. W. 1969. Satellite Confirmation of Settlement Size Coefficients. *AREA,* 1(3): 30-34.

United Nations. 2018. *2018 Revision of World Urbanization Prospects,* s.l.: United Nations.

Unwin, D. 1981. *Introductory Spatial Analysis.* London: Methuen

Study of Land Readjustment Mechanism in Madhya Pradesh:

Under the MPTCP Act of 1973 and 2019

Divyam Kandya[1] and Ruchita Gupta[2]

[1]*School of Planning and Architecture, New Delhi, Email: divyamkandya@gmail.com*
[2]*School of Planning and Architecture, New Delhi*

Abstract: One of the significant requirements for the development of cities is the availability of public land. However, with the current land acquisition act, acquiring land has become both challenging and expensive. The town and country development authorities therefore, have developed various alternative land management and acquiring mechanisms for the collection of land banks for public projects and city development. One such major successfully functioning mechanism is the "Town Planning Scheme (TPS)." As the master plan for Indore is prepared by the Town and Country Planning Organization Bhopal, the role of the Indore Development Authority is to implement the master plan through its town planning schemes. These schemes are implemented in the state of Madhya Pradesh under the Madhya Pradesh Nagar Tatha Gram Nivesh Adhiniyam 1973, which grants the authority power to implement TPS under three land assembly models: Land Acquisition, Mutual Agreement, and Plot Reconstitution Methods. The study focuses on the Plot Reconstitution method, which was amended in 2019 to a 50-50 model from the earlier 80-20 Split model. The study focuses on various town planning schemes under both models. This practice leads to controlled growth, limits unauthorized development, and promotes better economic growth, but it also has some limitations. The model is resulting in the non-usability of the reconstituted plots, and development through subdivision is hampering the overall density and character of the area. The research not only identifies the issues, causes, and consequences but also provides recommendations and strategies for implementation and planned development under TPS models.

Keywords: Town Planning Scheme; Land Readjustment; Betterment levies; Enhancement factor; IDA.

सार: शहरों के विकास के लिए महत्वपूर्ण आवश्यकताओं में से एक सार्वजनिक भूमि की उपलब्धता है। हालांकि, मौजूदा भूमि अधिग्रहण अधिनियम के साथ, भूमि अधिग्रहण करना चुनौतीपूर्ण और महंगा दोनों हो गया है। इसलिए, शहर और देश विकास प्राधिकरणों ने सार्वजनिक परियोजनाओं और शहर के विकास के लिए भूमि बैंकों के संग्रह के लिए विभिन्न वैकल्पिक भूमि प्रबंधन और अधिग्रहण तंत्र विकसित किए हैं। ऐसा ही एक प्रमुख सफलतापूर्वक काम करने वाला तंत्र "टाउन प्लानिंग स्कीम (TPS)" है। चूंकि इंदौर के लिए मास्टर प्लान टाउन एंड कंट्री प्लानिंग ऑर्गनाइजेशन भोपाल द्वारा तैयार किया गया है, इसलिए इंदौर विकास प्राधिकरण की भूमिका अपनी टाउन प्लानिंग योजनाओं के माध्यम से मास्टर प्लान को लागू करना है। ये योजनाएँ मध्य प्रदेश राज्य में मध्य प्रदेश नगर तथा ग्राम निवेश अधिनियम 1973 के तहत कार्यान्वित की जाती हैं, जो प्राधिकरण को तीन भूमि संयोजन मॉडल के तहत टीपीएस को लागू करने की शक्ति प्रदान करती है: भूमि अधिग्रहण, आपसी समझौता और प्लॉट पुनर्गठन विधियां। अध्ययन प्लॉट पुनर्गठन विधि पर ध्यान केंद्रित करेगा, जिसे 2019 में पहले के 80-20 स्प्लिट मॉडल से 50-50 मॉडल में संशोधित किया गया था। हालांकि यह अभ्यास नियंत्रित विकास की ओर ले जाता है, अनधिकृत विकास को सीमित करता है, और बेहतर आर्थिक विकास को बढ़ावा देता है, लेकिन इसकी कुछ सीमाएँ भी हैं। मॉडल के परिणामस्वरूप पुनर्गठित भूखंडों की अनुपयोगिता हो रही है, और उपविभाजन के माध्यम से विकास क्षेत्र के समग्र घनत्व और चरित्र को बाधित कर रहा है। अध्ययन दोनों मॉडलों के तहत विभिन्न नगर नियोजन योजनाओं पर केंद्रित है। शोध न केवल मुद्दों, कारणों और परिणामों की पहचान करता है, बल्कि टीपीएस मॉडल के तहत कार्यान्वयन और नियोजित विकास के लिए सिफारिशें और रणनीति भी प्रदान करता है।

मुख्य शब्द: टाउन प्लानिंग स्कीम; भूमि पुनर्समायोजन; बेहतरी शुल्क; संवर्धन कारक; आईडीए.

1. Introduction

The study delves into the land management process used for residential development in Indore. It analyses and addresses several issues, including implementation timelines, haphazard growth, inadequate infrastructure, and social and environmental challenges. The city is strategically important due to its rapid population growth and the need for effective land management to accommodate the increasing population.

Indore Development Authority (IDA), being the nodal implementation agency, oversees these town planning schemes. It led to controlled growth by limiting unauthorized colonies and fostered better economic development. However, a few limitations, such as limited land options for other housing suppliers, necessitate reform of the system for land supply by public authorities.

The study involves spatial and quantitative analysis of schemes developed by IDA while examining various modes of land supply for housing in Indore. It also requires a literature study of effective models of town planning schemes in India with similar implementation processes to analyse the existing town planning scheme framework for housing provision in Indore.

The paper also focuses on identifying issues and problems during the implementation process

of town planning schemes by analysing the processes of land assembly, development, and disposal, as well as the problems faced by other housing supply channels due to their implementation. The paper also develops a systematic and rational method for land distribution, promoting sustainable and inclusive housing supply.

2. About the city

Indore is the most populous and largest city in the state of Madhya Pradesh. The city's history spans early Indore, Holkar's Indore, British Indore, and post-independence Indore. It evolved from a trading center to a significant town under the Maratha Empire and later as the summer capital of Madhya Bharat. Various planning efforts, including the Indore Development Plans, have shaped Indore's development. It also stands out as an educational hub hosting prestigious institutions like Indian Institute of Technology (IIT) and Indian Institute of Management (IIM), and serves as the financial capital of the state. Some of the key economic drivers in Indore include the education sector, Special Economic Zones (SEZs), thriving business sectors, and a promising IT industry centered around the Super Corridor.

The Indore district encompasses the Indore Planning Area, which has a total notified planning area of 50,525 ha and is projected to have a population of 3.57 million by 2021. The city's administrative setup includes various wards and villages, expanding its jurisdiction to accommodate the growing population. The decadal evolution of the city is shown in Fig. 1.
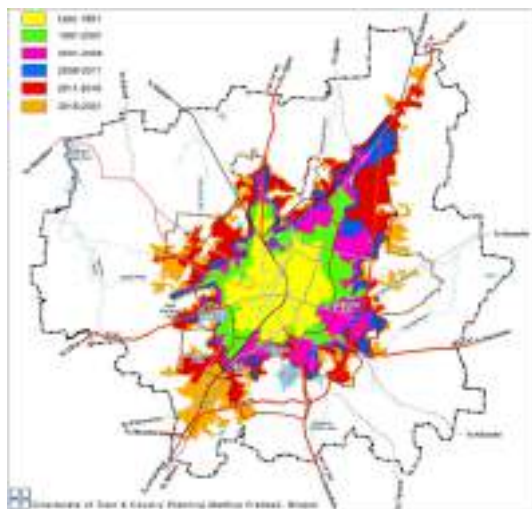

Figure 1: Expansion of Indore in Various Decades
Source: Directorate of Town & Country Planning Madhya Pradesh, Bhopal.

Indore experienced significant population growth due to industrialization and expanding job opportunities, with a notable influx of migrants from neighbouring states and districts since the 1960s. Consequently, Indore has experienced an increase in population density and pressure on its existing urban land and infrastructure.

3. Land readjustment mechanism

Land readjustment (LR) is a mechanism for assembling and developing land with amenities and services. The concept involves replotting or restructuring land to create it with the necessary infrastructure. The land readjustment (LR) mechanism, also known as the Town Planning Scheme (TP Scheme) in India, has been effectively implemented in Gujarat, showcasing its success in urban development. This concept involves replotting or reshaping land parcels to incorporate amenities like roads, parks, social infrastructure, and utilities.

The Bombay Town Planning Act of 1915, later updated by the New Bombay Town Planning Act of 1954, played a pivotal role in institutionalizing the Town Planning Schemes Scheme in India, particularly in Maharashtra and Gujarat.

Despite facing institutional and financial challenges in other models of TP Schemes, the Gujarat model has demonstrated significant success in implementing LR projects, resulting in a mature system in terms of approval processes, land replotting techniques, and financing, which leads to quicker and smoother implementation.

To analyse the land readjustment process, the study was divided into various models of different states, including the Town Development Scheme of Raipur, the land pooling of the Navi Mumbai Airport Notified Area, the Town Planning Scheme of Ahmedabad/Gujarat, and the Land Pooling of Amaravati, Andhra Pradesh.

Kamal Vihar Raipur, land pooling model operates under a 65-35 model, where approximately 35% of the land is returned to the original owners after reconstitution. A minimum area of 90 sq. m. is required for participation. The 65% of the area assembled is redistributed under roads, PSP, recreational, and other community spaces.

During the process areas for urban expansion are defined first, and infrastructure is planned according to the master plan. The plots are then divided into seven plot categories based on their

size. No development charges or registration charges are levied on the landowners. The Raipur Development Authority is responsible for scheme development and retains approximately 10% of the total scheme land as a sale component to recover the development cost. Figure 2 explains the land-use distribution of Kamal Vihar, Raipur.
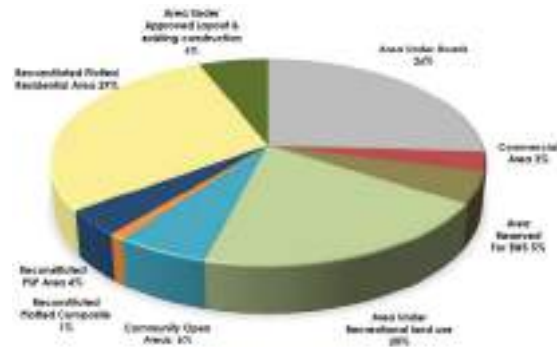

Figure 2. Land-use distribution, Kamal Vihar scheme Raipur (Mansuri and Roy 2014)

Amaravati Land Pooling Schemes have been implemented to facilitate the city's development. The scheme involves categorizing land into dry land, wetland, and semi-urban land, with a focus on providing returnable land to landowners. The allotment of plots would be category-wise and conducted through a lottery system, with the revenue village serving as the unit. Each owner is allocated a proportionate commercial plot in addition to their residential plot.

Around 5% of the total development area is reserved for the economically weaker sections as well as provision of housing shall be given in a proposed residential project of 4000 Sqm and above by reserving 10% (5% EWS and 5% LIG) built up area or 25% of no of dwelling units (12.5% EWS and 12.5% LIG) or shelter fee as prescribed by Commissioner. The scheme also offers stamp duty exemptions to landowners, further incentivizing participation in the land pooling Programme.

TPS No. 90 Vinzol, Ahmedabad/Gujarat, the scheme is situated near the Sardar Patel Ring Road, showcasing rapid development in the city, Figure 3. According to the Land pooling and readjustment approach under the Gujarat Town Planning and Urban Development Act, 1976, around 60% of the land is returned to owners for residential use as well as land reconstituted is placed as closely as possible to the original location. However, there are no specific categories during redistribution, and no additional Commercial Components are given to each landowner. Approximately 10 % of the total

area covered under the scheme is reserved for housing for EWS and LIG.

The cost of the scheme is wholly or in part recovered by a contribution levied by the authority on each plot included in the final scheme calculated in proportion to the increment. Infrastructure development is the responsibility of AUDA.
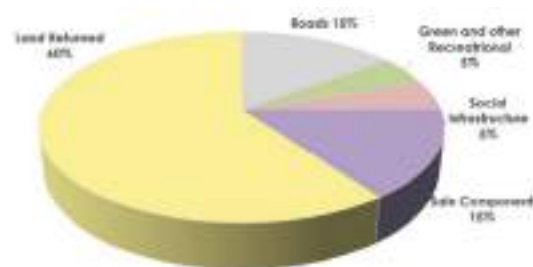

Figure 3. Land-use Distribution, Vinzol Ahmedabad town planning scheme, Town Planning Mechanism in Gujarat, India (Ballaney)

The Navi Mumbai Airport Influence Notified Area (NAINA) Scheme, introduced in 2014 following the proposal for the Navi Mumbai International Airport, designated a 20-kilometer radius around the airport to prevent unplanned development, Figure 4 (CIDCO n.d.). Minimum area of land required for participation is around 10 Ha although voluntary pooling of lesser land in exceptional cases.

This scheme encourages landowners to voluntarily pool their land parcels for readjustment and redistribution, aiming to create larger and more useful land parcels for development. Around 40% of the net land is allocated to landowners with an FSI of 2.5, and 15% of commercial activity is permitted to be planned within the same residential plot.

Figure 4. Land Readjustment distribution, NAINA (Mathur 2020)

Final plots are allotted through a tender (sale component) and a lottery system. The same owner with scattered land parcels shall be given a single plot, provided they consent to its amalgamation. For amalgamated final plots, the final plot, to the extent possible, shall be located at the place of vacant land parcels having the

largest land holding area. Cost-recovery is done from charges by leasing land in growth centers sale or lease of plots for schools and community centers to other government bodies. Floor space-linked premiums imposed on nonparticipating landowners are also part of the cost-recovery components.

A comparative analysis of various town planning schemes highlights the strengths and weaknesses of each approach, providing insights into effective land management practices. Overall, these case studies highlight the successful implementation of land pooling and readjustment mechanisms in various regions of India, emphasizing the importance of the returned percentage of land and the betterment charges for a successful implementation.

Financial frameworks are also essential to ensure the functioning of TPS; the Gujarat model turns out to be the most efficiently functioning model, but it also has its drawbacks, as the model fluctuates with its percentages prescribed for return and other amenities, as well as it lacks public spaces and it is a loss-making model for the developing agencies.

The analysis also reflects the minimum size required for the successful implementation of a TPS and improved land use bifurcations.

4. Town Development Schemes in Indore

The Madhya Pradesh Nagar Tatha Gram Nivesh Adhiniyam, 1973 (henceforth referred to as MPTCP Act 1973 ~ Madhya Pradesh Town and Country Planning Act), outlines the preparation and implementation of town development schemes in Indore, including land acquisition methods, mutual agreements, and plot reconstitution. Figure 5 explains the process the Town Development Scheme.

The process involves declaring the intention to prepare a town development scheme, notifying it in the gazette, preparing a draft scheme, inviting objections, and finalizing the scheme after considering objections.

Furthermore, the Act specifies three methods for land assembly, which include land acquisition, mutual agreements, and plot reconstitution. However, various challenges are identified in implementing town planning schemes, including issues related to land assembly, development, and disposal.

Town Development Schemes in Indore are implemented to establish self-sufficient areas

with essential infrastructure and amenities while also curbing unauthorized development. These schemes are crucial for urban planning and development, ensuring that areas are equipped with the necessary facilities to support the growing population.
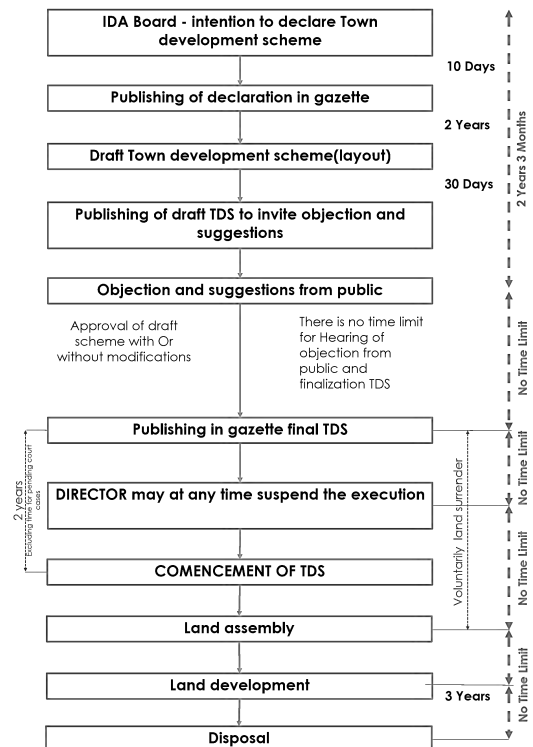
Figure 5. Town Development Scheme Preparation Process with timeline, MPTCP Act, 1973

Figure 6. Land Redistribution (80-20 model) as per MPTCP Act, 1973

The preparation process for these schemes is outlined in the MPTCP Act 1973, which provides a framework for creating and implementing town development projects.

The Act empowers the Town and Country Development Authority to undertake various development initiatives, including the redevelopment of existing areas, implementation of ongoing development projects, and formulation of future development plans. The land readjustment mechanism of the TDS was operating under the 80-20 model, where approximately 20% of the land was returned to the landowners, as shown in Figure 6.

In 2019, with the amended model, the Act specifies that 50% of the original plot should be returned to the landowner as a final plot; within the remaining 50%, 20% of the land is allocated for roads, 5% of the land for parks and social infrastructure each respectively, as well as 20% of the plots, are reserved as the authority plot as sale component by the authority, Figure 7. Additionally, the Act allows for modifications in the land distribution percentages based on the type of development and specific requirements.

The updated legislation introduced betterment levies, compensation mechanisms, and guidelines for land distribution. Landowners may be subject to betterment levies based on the increased value of their properties resulting from infrastructure development. Charges imposed aim to recoup the costs of infrastructure and other implementation costs.

Figure 7. Land readjustment distribution (50-50 model), as per MPTCP Act, 1973, amendments of 2019

The Act specifies that the contribution should not exceed half of the increment in value, ensuring a fair and reasonable assessment. Additionally, the legislation outlines the process for estimating the net cost of the scheme, providing transparency and accountability in the financial aspects of the development projects. However, it does not specify the percentage split of the cost to be borne by the appropriate authority and the landowners.

Overall, town development schemes play a vital role in shaping the urban landscape of Indore by creating sustainable and well-planned communities. These schemes not only address the immediate infrastructure needs but also consider long-term land requirements and social welfare aspects. The amendments in 2019 have further enhanced the effectiveness and efficiency of these schemes by introducing mechanisms for fair compensation and equitable land distribution, transitioning from the 20% return model to the 50% return model.

5. Land Readjustment Model case studies

Several case studies are analysed based on the implementation models to compare the older mechanism with the amended model of 2019. To analyze both models, scheme no. 140 is selected as it is one of the largest and most successful cases of the earlier model. To understand the changes within the model, the earlier one is compared to three cases of various scales within the newer model.

The case study of TPS No. 9 is selected because it's the largest, as well as one of the areas with the most private developments nearby. TPS no. 10 has been chosen because it is located along one of the TOD corridors in Indore, with many positive factors aligned with it. TPS no. 4 has been selected because it is situated in one of the city's significant growth directions.

The first case study, Scheme No. 140 "Pipliyahana - 1997," was developed under the MPTCP Act of 1973, featuring a blend of residential and commercial land uses. It is situated on the eastern ring road. This TDS was declared by IDA in 1997. IDA was able to assemble the land in 2007, while land development commenced in 2008 and is now complete.

The net planning area of the TPS is 65.99 ha; after all exempted land, around 60.14% (39.69 ha) of the scheme area of comes under residential use. It was designed for a population of 9,099 with a density of 137 people per hectare, accommodating around 2,226 plots.

The land was assembled through a mutual agreement as per Nagar Tatha Gram Nivesh Adhiniyam 1973, section 50 (2) and rule 18 (1) MPTCP 1975. The land owner got 30 % (through mutual agreement) of their land in return as compensation for the development of land parcels. As well as the plots being disposed of as per Vyayan Viniyam 1987, the plots reserved for EWS were disposed by allotting them to the affected slum population.

The payment options are either a one-time payment or a 1st instalment of 25%, a 2nd instalment of 25% within 4 months and, a 50 % instalment within 3 to 5 years with an interest rate of 10% to 10.50%. However, there are no provisions anywhere for the equitable distribution of land supplied except the mandatory 15% reservation of developed plots for EWS as per the state's Madhya Pradesh Housing Board policy of 1995.

The plots for social infrastructure have also been disposed of with time; six plots for education institutions are reserved and disposed of but not yet developed; for the health sector, a plot have been reserved and disposed but not yet developed, although 15 plots are disposed for commercial and the scheme is developing into a commercial hub.

Around 41.43% of the net cost for the scheme development was borne by the landowners. IDA acquired 21.85 ha of residential Land and 4.17 ha of commercial land as the final plot; the remaining net cost of the scheme to the authority will be met by the sale of the final plots allotted to the authority, with a minimum value of 4.75 crore per Hectare.

Moving on to Case Study 2, TPS No 9 "Kanadiya, Tigariya Rao, Bicholihapsi - 2019," developed under the MPTCP Act Amendment 2019, Figure 8. TPS no. 09 was declared by IDA in the year 2019. It is situated east of the Indore bypass road. The case study highlights the challenges in plot redistribution due to irregular shapes in plot reconstitution, Figure 9.

The scheme is developed under residential land uses, with a total area of 263.13 ha, out of which 59.88 % (157.51 ha) of the scheme area comes under residential, while the circulation area in the scheme is higher than prescribed in the act that is around 27% (72.95 ha) as several non-contiguous roads are included in the scheme area. It is designed for a population of 36,819 with a density of 156 people per hectare, accommodating approximately 942 plots (752 owner plots and 190 Authority plots).

The land was assembled through the TPS Mechanism of the MPTCP Act Amendment of 2019, where land owners received 50% of the land back, subject to certain betterment charges. The 50% land deducted is further divided between roads and social infrastructure. The authority kept 20% of the land as final sale plots, IDA was able to assemble the land much faster due to the increased return percentage. In particular, the percentage for the roads is higher, as connecting master plan roads is also part of the scheme, to maintain the return percentage, the authority (FP) area is reduced to 15%.

Around 8.26 ha of land are reserved for infrastructure, with 5 and 6 plots allocated for physical and social infrastructure, respectively for the mentioned specific project type, nine plots are assigned for amenities.

Figure 8. TPS. No.09, Kanadiya, Tigariya Rao, Bicholi Hapsi - 2019 after land redistribution

Figure 9. Implementation level problems, irregular shape Readjusted plots, subdivision of contiguous authority plots, means of access passage from a higher road width.

After readjustment, around 95% of the total plots of the landowners are under 0.5 ha. These smaller, uncategorized plots of variable size led to small plotting projects ranging from 5 to 20 Plots through subdivision resulting in unorganized development. As a result, approximately 45% of the plots are neither

suitable for independent dwelling units nor group housing. Plots reconstituted in the TPS are regular in shape but are not in uniform orientations. Thus, such subdivisions results in spaces with inadequate ventilation and limited access to direct sunlight.

After the reconstitution of the scheme plot, the owners consider a base selling price, that is twice the original value, which makes the merger and assembly of large plots difficult for the developer, as it is not financially viable for them.

Contiguous authority plots are subdivided, such that parts of the plot may have a lesser width means of access to low enhancement factor, resulting in lower cost contribution by the authority as well as smaller frontages are given on higher road widths, to achieve built-up benefits aligned with higher road widths.

No plots are reserved for EWS housing at the scheme level; however, every group housing scheme needs to provide 15% of the total units as EWS units as per the MPHB norms.

Around 47.13% of the net cost for the scheme development was borne by the landowners, while IDA acquired 39.50 ha of residential land as the final plot to recover 53% of the net cost of the scheme by selling the final authority plots.

Case Study 3, TPS No. 10 "Bada Bangarda, Palakhedi, Tigariya Badshah - 2019," is also implemented under the (50-50 model) of the MPTCP Act Amendment 2019. This case emphasized categorized plot redistribution for group housing and infrastructure development.

TPS No.10 was declared by IDA in 2019 and the scheme is primarily developed for residential land uses. The net planning area of the site is 221.12 ha, with no exempted land within the scheme area and around 70% (154.81 ha) of the scheme area comes under residential, which is higher compared to other schemes.

Around 76% of the total plots of the landowners are under 0.5 ha, these smaller uncategorized plots of variable size can lead to small plotting projects; through subdivision, resulting in unorganized development with increased density. Around 32% of the plots are preferred size for individual dwelling units, while 27% of the plots are in a range; that can be subdivided into smaller plots ranging from 6 to 15 units and the remaining plots can be subdivided into more units.

In the case of the plot sizes for the final authority plots, 45.36% of the total authority plots are above 1 Ha after TPS redistribution with preferential locations over 30m and above roads.

Although in this particular case, the redistributed plots are arranged in such a way that similar plots are aligned closely, this creates a character that concentrates group housing on one side and individual plots on the other side.

In the current situation, plots are being merged by developers for group housing projects. Developers are entering the scheme as it is more financially viable, as large plots are also available without merging. In addition to being a growing market due to its status as an IT hub, the percentage of authority plots exceeds the specified limit in the Act. At the same time, the area under amenities is reduced; that is, it needs to be provided under social infrastructure. This increases the saleable area, thereby enhancing the financial viability.

Around 24.65% of the net cost for the scheme development was borne by the landowners, while IDA acquired 49.79 Ha of residential land as the final plot to recover the remaining cost of the scheme by selling the final authority plots.

In the fourth case study, TPS No. 4, "Nipaniya - 2019," developed under the (50-50 model) of the MPTCP Act Amendment 2019. In this case, challenges in plot redistribution were noted, along with a higher cost burden on landowners.

This town development scheme was declared by the IDA in 2019. The net planning area of the site is 83.58 ha, with no exempted land within the scheme area.

Around 62 % (51.96 ha) of the scheme area is used for residential purposes; the road area is higher, with around 22.6% of the scheme area allocated to it. The area is being developed by both the public sector through TPS and the private sector by developing small-scale group housing projects on land under the 1 Ha range.

The percentage of open plot area is fixed as per the act in the TPS development. However, the area allocated for roads is higher, as the construction of connecting master plan roads is also part of the scheme. To maintain the return percentage, the authority (FP) area is reduced to 18%.

Around 80% of the total landowners plots are under 0.5 Ha, while the plots are within the range of 0.5 to 1 Ha. (15%) are higher than other schemes, leading to small-scale plotted housing projects with around 20-50 units.

3.50 Ha of land has been reserved for the infrastructure, with specifically four plots allocated for Physical and social infrastructure, each with the mentioned specific project type, while two plots are assigned for amenities, and around 4.18 Ha. of the open spaces area is provided under the TPS is divided into seven pockets across the scheme area.

Around 53% of the net cost for the scheme development was borne by the landowners while IDA acquired 15.16 Ha of residential land as the final plot to recover the remaining cost of the scheme through the sale of final authority plots. As most of the authority plots are located on master plan roads with road widths higher than specified in the enhancement factor calculation, even after this, no such plots are given an enactment factor of 4.0, resulting in a lower cost share by the authority.

The comparative analysis across the case studies highlighted the use of different approaches towards the implementation of TPS for land assembly, varying challenges in plot redistribution, distribution of infrastructure land, and the distribution of financial burdens between landowners and the IDA.

The case study also reflects how the implementation affects and twists and uses the legislation to the benefit of the development authority. These case studies provided valuable insights into the complexities of town planning schemes, emphasizing the importance of efficient land assembly, strategic plot redistribution, usability of plots, and collaborative efforts between stakeholders to ensure sustainable and organized urban development in the Indore region.

6. Issues and potential

Various issues at the framework, scheme preparation, and plot levels are identified, including land assembly challenges, non-utilization of reconstituted plots, and financing issues.

The Study analyses various issues and potentials related to Town Planning Schemes (TPS) for housing development in Indore, Madhya Pradesh. It identifies framework-level problems, such as land notification mechanisms and delays, as well as challenges in scheme preparation including plot positioning and area delineation.

At the plot level, issues include subdivision difficulties, and non-utilization of plots due to size constraints as well as the lack of plot-level reservations for economically weaker sections. Concerns regarding the division of development costs between owners and the IDA are also major concerns.

At the framework level, challenges arise due to the absence of a direct notification mechanism for land allocation after the development plan notification, which leads to unauthorized developments. To counter these, potential improvements include the preparation of zonal plans and the establishment of density norms to control development.

Moving to the scheme preparation level, issues such as plot positioning difficulties and the lack of delineation guidelines for areas are highlighted. Potential solutions involve creating guidelines for plot positioning and planning contiguous areas to address these challenges.

At the plot level, concerns are raised regarding the impact of plot subdivision on density and the non-utilization of plots. To mitigate these issues, the analysis suggests establishing density norms for controlled growth and early development of social infrastructure to enhance occupancy by owners.

In terms of scheme finance, variations in cost division and limited payment options are identified as some of the major issues. Potential improvements include defining valuation mechanisms and revising payment options for betterment charges to ensure optimal outcomes.

Additionally, the study touches on issues related to court jurisdiction clauses and scheme maintenance. Overall, the document emphasizes the need for strategic planning, clear guidelines, and effective mechanisms to address the challenges.

7. Recommendation

The recommendations focus on various levels of the planning framework and clauses under the MPTCP Act of 1973. These recommendations aim to enhance the efficiency and effectiveness of the development process.

At the act level, suggestions include defining estimated valuation mechanisms of reconstituted plots and allocating costs between owners and the authority within a specified range. Amendments in payment options, such as restructuring of payment instalments, are proposed. These

recommendations emphasize the importance of the development authority functioning as a facilitator rather than a developer.

Furthermore, the study recommends a process that involves conducting demand and feasibility analysis in multiple areas before declaring intentions to develop a TPS. This analysis aims to improve the utilization of the town development scheme and establish a workable cost bifurcation for scheme implementation.

Drafting the Town Development Scheme (TDS) along with proposed betterment levies based on valuations is also recommended, along with a structured process for receiving objections and suggestions.
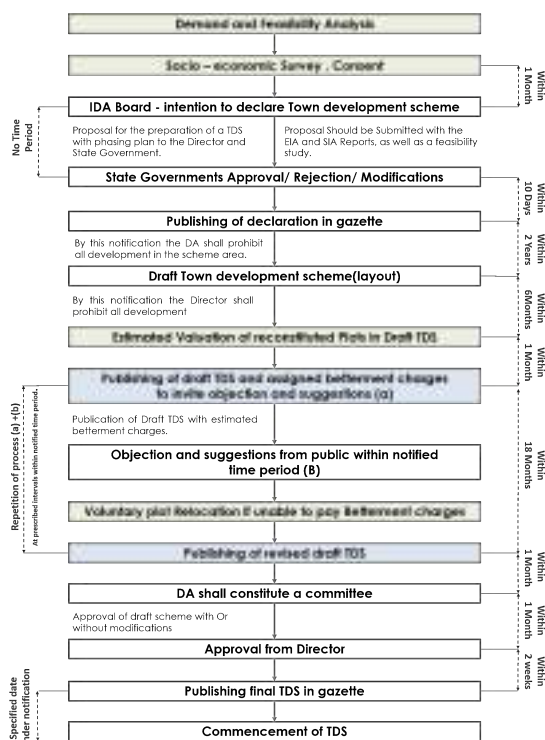

Figure 10. Recommended process and timeline for town development scheme implementation

At the framework level, recommendations include preparing zonal plans as an intermediate framework for project sanctions before TPS notifications. It also suggests that individual sanctions shall be granted after obtaining a No Objection Certificate (NOC) from the development authority to ensure better infrastructure planning for future schemes. Density specifications under the master plan for fringe area development are proposed to regulate overall development and plan physical infrastructure accordingly.

Development control regulations should establish norms for minimum area for group housing, prescribe plot sizes for subdivision and merger, and specify density norms for plot-level subdivision and merger.

Moreover, recommendations address the non-utilization of developed plots by proposing the removal of penalties on landowners for non-utilization. It is recommended that social infrastructure should be developed within eight years of the commencement of development to boost residential development.

Post-implementation recommendations suggest transferring the scheme to the local body upon completion of development and disposal of all plots, with the total amount collected by the IDA as maintenance charges.

In conclusion, the recommendations for town planning schemes in Indore aim to streamline the development process, enhance financial sustainability, and improve the overall effectiveness of the schemes, Figure 10.

8. Conclusion

The study concludes that while town planning schemes in Indore have led to controlled growth and economic development, there are significant challenges that need to be addressed through systematic reforms in land management and public land supply mechanisms. The recommendations provided aim to enhance the effectiveness of town planning schemes and promote sustainable and inclusive residential development in Indore.

Acknowledgements

References

Andhra Pradesh Capital Region Development Authority. *Pooling Land for Development in Andhra Pradesh.* Available at https://crda.ap.gov.in/apcrdav2/views/AboutAmaravathi.aspx

Ballaney, Shirley. 2008. *Town Planning Mechanism in Gujarat, India*. The World Bank Institute, Washington, DC.

CIDCO. *Part A Report On: Town Planning Scheme No. 3, NAINA*. Available at: https://cidco.maharashtra.gov.in/pdf/SPA/english_naina_cidco.pdf

Knight Frank and REPL. 2018. *Indore Smart City, ABD Master Plan*. Available at https://www.smartcityindore.org/wp-content/uploads/2019/11/ABD-Master-Plan-Smart-city-Indore_Final-TCP_21.06.2018.pdf

Madhya Pradesh Nagar Tatha Gram Nivesh Adhiniyam. 1973. Directorate of town and country planning, Madhya Pradesh

Madhya Pradesh Nagar Tatha Gram Nivesh, Niyam 1975 published M.P. Gazette Part 4 (Ga) dated 9.1.1976 available at https://mphed.nic.in/TCPNiyam-1975.pdf

Madhya Pradesh Nagar Tatha Gram Nivesh (Sanshodhan) Vidheyak, 2019, Pub. L. No. Madhya Pradesh Bill No. 35 of 2019.

Mansuri, Noman and Uttam K. Roy. 2014. "Town Development Scheme as a Tool to Build Infrastructure – Case Study: Kamal Vihar, Raipur." *International Journal of Research*, 1(5): 426.

Unpublished Sources

Emoliya, Hemant. 2016. *Land Supply option for housing in Indore.* SPAD Thesis.

Mali, Ajit. 2006. *Land supply options for public authorities in Madhya Pradesh.* SPAD Thesis.

Mathur, Bhavya. 2020. *Housing Development in NAINA Area, Navi Mumbai*. SPAD Thesis.

Unauthorized Land Colonization in Jabalpur, Madhya Pradesh:

Study of Unauthorized colonies and Regularization rules

Rimzim Jain[1] and Dr Rashi Gupta[2]

[1]*School of Planning and Architecture, New Delhi, Email: rimzimjain04@gmail.com*
[2]*School of Planning and Architecture, New Delhi*

Abstract: Unauthorized development in Jabalpur is a growing issue, with almost 55% of the population living in unauthorized settlements. This illegal subdivision of land and housing, known as Unauthorized Colonization, covers 62% of the total housing subsystem planned as per the Master Plan 2021. Authorities including the Municipal Corporation, Jabalpur Development Authority, TNCP, and the Land Revenue Department have taken actions to curb its growth. There are 736 unauthorized colonies listed by the municipal corporation, with only 173 of these being regularized. The research aims to understand the phenomenon of unauthorized land colonization, government interventions, and their impact on development over the years. Various factors contribute to the growing number of unauthorized colonies, including a lack of permissions from competent authorities, inadequate land registration, and failure to adher to Master plan proposals. However, delays in formal housing supply have led to the development of unauthorized colonies as an alternative to affordable housing. The study aims to understand the development process, issues, causes, regularization policies, colonizers strategies, and potential problems in unauthorized colonies.

Keywords: Unauthorized colonies, Colonization, Regularized colonies, Development Charges

सार: जबलपुर में अनधिकृत विकास एक बढ़ती हुई समस्या है, यहाँ की लगभग 55% आबादी अनधिकृत बस्तियों में रहती है। भूमि और आवास का यह अवैध विभाजन, जिसे अनधिकृत उपनिवेशीकरण के रूप में जाना जाता है, मास्टर प्लान 2021 के अनुसार नियोजित कुल आवास उप-प्रणाली का 62% हिस्सा कवर करता है। नगर निगम, जबलपुर विकास प्राधिकरण, टीएनसीपी और भूमि राजस्व विभाग जैसे अधिकारियों ने इसके विकास को रोकने के लिए कार्रवाई की है। नगर निगम द्वारा सूचीबद्ध 736 अनधिकृत कॉलोनियाँ हैं, जिनमें से केवल 173 को ही नियमित किया गया है। शोध का उद्देश्य अनधिकृत भूमि उपनिवेशीकरण, सरकारी हस्तक्षेप और वर्षों से विकास पर उनके प्रभाव की घटना को समझना है। अनधिकृत कॉलोनियों की बढ़ती संख्या में कई कारक योगदान करते हैं, जिनमें सक्षम अधिकारियों से अनुमति की कमी, अपर्याप्त भूमि पंजीकरण और मास्टर प्लान प्रस्तावों का पालन न करना शामिल है। हालाँकि, औपचारिक आवास आपूर्ति में देरी के कारण किफायती आवास के विकल्प के रूप में अनधिकृत कॉलोनियों का विकास हुआ है। अध्ययन का उद्देश्य विकास प्रक्रिया, मुद्दों, कारणों, नियमितीकरण नीतियों, कॉलोनाइजर्स की रणनीतियों और अनधिकृत कॉलोनियों में संभावित समस्याओं को समझना है।

मुख्य शब्द: अनधिकृत कॉलोनियाँ, उपनिवेशीकरण, नियमित कॉलोनियाँ, विकास शुल्क

1. Introduction

The study focuses on unauthorized land colonization for housing in Jabalpur, Madhya Pradesh. It highlights the increasing trend of unauthorized development for speculation and residential purposes in the city. It examines the identification of stakeholders and forces that influence decision-making in this process. The study specifically examines at the illegal subdivision of land and housing, commonly referred to as Unauthorized Colonization. As those developed without necessary permissions, affecting vacant and agricultural lands in Jabalpur.

The paper also focuses on the analysis of growth, emergence, and causes of unauthorized colonies, with a particular emphasis on the process of illegal land subdivision for housing and its implications for urban development, housing affordability, and regulatory compliance. By understanding the stakeholders, causes, and impacts of unauthorized colonies, this study aims to provide policymakers, city authorities, and urban planners with valuable insights to effectively tackle unauthorized development and promote sustainable urban growth in Jabalpur.

2. Literature Study

The inadequate planning and governance of peri-urban areas by local governments lead to the growth of unauthorized colonies and illegal structures. Urban migration and the demand for affordable housing, especially among the lower-income segments, further fuel the development of unauthorized settlements. The private developers primarily focus on higher-income groups. Additionally, the scarcity of land and high land values in urban areas prompt landowners to overlook development controls and building

regulations, leading to unauthorized land development. These illegal subdivisions often occur due to a combination of factors, such as the lucrative nature of investments in unauthorized colonies.

The time and cost savings associated with avoiding approval processes, as well as the potential for regularization through compounding fees or penalization schemes. Residents of unauthorized colonies may seek regularization later to gain legal recognition. The causes and growth of illegal developments are multifaceted, with some attributing them to a mismatch between housing demand and supply, lower entry costs of informal land, efficiency of housing land delivery, better locations, economic gains, and speculation in land driving forces. Speculative practices, lack of enforcement of regulations, and the exploitation of vulnerable populations looking for housing contribute to the proliferation of unauthorized settlements.

The state governments have introduced regularization policies to address the issue, aiming to provide legal status to existing unauthorized colonies. However, these schemes often lack well-defined evaluation indicators and clear implementation strategies, hindering their effectiveness. The attractiveness of unauthorized colonies lies in their affordability, location advantages, and the potential for quick and affordable housing solutions. Buyers and investors are drawn to these settlements due to the cost savings, time efficiency, and the possibility of regularization in the future.

3. City Profile

The city of Jabalpur is located on the banks of the Narmada River. The tier 2 city with a rich history, cultural heritage, and significant infrastructure development. The population of Jabalpur, as per the 2011 census, was 10,55,525. In 2014, after including 55 villages, the estimated population increased to 12.62 lakhs. The municipal area expanded significantly from 129.2 sq.km to 263.49 sq.km, with the number of wards increasing from 70 to 79. The housing shortage is projected to be 42,614 houses by 2024, with a total projected housing need of 1,12,523 houses for the increased population from 2011 to 2024, highlighting a substantial gap in demand and supply of housing stock in the city.

The spatial evolution of Jabalpur over the years has shown growth and expansion in various directions, Figure 1. Before 1990, the city's

development commenced from three nodes, with subsequent rapid growth in population and development in the northern areas from 1991 to 2000. The unauthorized development for speculation and residential purposes increased between 2001 and 2010, leading to further expansion towards the northwest direction and the Western side. The growth is restricted by the Narmada River in the South and Cantonment in the Eastern Part.
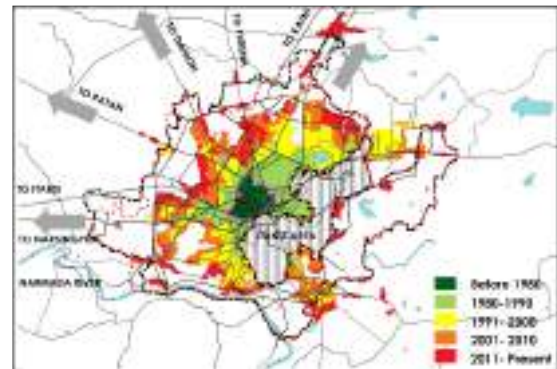

Figure 1. Spatial Growth of Jabalpur in various Decades

4. Housing Scenario in Jabalpur

The city's housing subsystem distribution reveals that 3% is organic development, 26% is planned development, and a significant 71% is unplanned development, Figure 2 and 3. The planned development is divided into 12% public development and 14% private development. And the unplanned development is further divided into 9% slums and 62% unauthorized development.
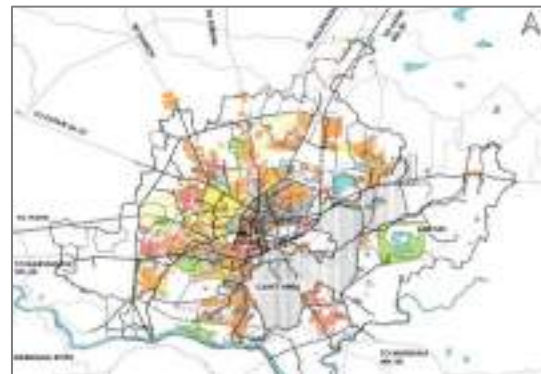
Figure 2. Housing Subsystem in Jabalpur

Subsystem		Area (in Ha)	%
Organic (3%)	Old City	106	1 %
	Urban Villages	145.9	2 %
Planned (26%)	Public	676.08	12 %
	Co-operative	9	
	Employer	81.2	
	Private	788.74	14 %
Unplanned (71%)	Unauthorised	3493.08	62 %
	Slums	507.08	9 %
Total		5634 Ha	100

Figure 3. Housing Subsystem Distribution

The public sector, represented by the Jabalpur Development Authority (JDA), has transferred residential schemes over the years. The existing schemes cover 938 ha, and the proposed schemes total 1,205 ha. However, delays in notifications and transfers have led to unauthorized colonies. The Housing Board developed 14 colonies over a six-year period from 1992 to 1998. However, there was a significant gap in development, and only one colony was created in 2016. The total area developed by the Madhya Pradesh Housing and Infrastructure Development Board (MPHIDB) amounts to 122 ha, indicating a slower pace of public sector development compared to the private sector.

Private development in Jabalpur accounts for 14% of the total residential area. The total area developed with permission is 788.76 ha of the total residential area as per the master plan. The private sector housing development in Jabalpur involves a process where colonizers must obtain permissions from the TNCP and the colony cell. Private developers typically follow a phased development approach, seeking permission for the initial phase of development, which usually covers areas of less than 0.809 to 6.07 ha (2-15 acres), and then proceed with subsequent phases without requiring additional permissions. The development process by private colonizers is time-consuming, taking 6-10 years to initiate and complete plot sales. Additionally, there is no minimum area specified for colonization norms.

5.   Unauthorized Land Colonization

The area of 736 unauthorized colonies was identified by municipal corporations, covering a substantial 62% of the total housing subsystem, Figure 4. These colonies have a population of 7.47 Lakhs and span across 3493 Ha under various land uses. There are a total of 173 regularized colonies to date. The 86 colonies regularized under the Colonizer Registration Act, 1998 (Rule no. 15A), and 87 Colonies were regularized under M.P Nagarpalika (Colony Development) Rules, 2021.

Before 1998, illegal colonies were considered as Gandi Basti. In 2002, the number of colonies following the regularization policy increased. The regularization policy has not been effective in preventing development. The growth of unauthorized colonies has been notable, with a doubling in numbers between 2002 and 2005 and a subsequent growth rate of 5% per annum after 2010. The nature of these colonies varies, with 60% driven by land speculation. These colonies

fulfill 44% of the city's housing requirements, with a distribution of 40% for LIG, 35% for MIG, and 19% for HIG.
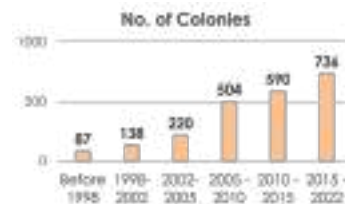

Figure 4. Rate of growth of unauthorized colonies

Significant trends in the area of formation of unauthorized colonies from 2.02-8.09 ha (5–20 acres). The development of small colonies leads to growth in scattered pieces rather than an integrated manner. These small colonies lack open spaces and other facilities. The colonizer develops the project in phases, obtaining permission for the first phase and then proceeding with the remaining phases without seeking further permission. The majority of colonies have an area of less than 2.02 ha (5 acres). The variations in plot sizes correspond to the changing demand for popular housing in the city. The present demand ranges from 41.806 to 139.35 sq. m. (450 to 1500 sq. ft.) in plot size.

Figure 5. The trend of Areas in unauthorized colonies

The process followed by colonizers for unauthorized development typically involves developing near-planned areas, seeking regularization, and implementing phase development strategies. This approach enables them to maximize profits while shifting the pressure of infrastructure and road access to approved phases until regularization is achieved. The study also highlights the spatial location and character of unauthorized colonies, emphasizing their presence along major roads and in peripheral areas of planned colonies. The development process in unauthorized development by colonizers is often faster, as it takes less time to initiate and complete plot sales. The factors contributing to reduced time spent on unauthorized development are no approval process is involved, and the colonizer saves time in site development.

Comparing the costs incurred in legal and illegal development, it is noted that unlawful

development can save time and costs. The time taken for development in the planned colony is 6-10 years (Figure 6), while in the illegal colony, it is 2-4 years (Figure 7). Additionally, it maximizes profits compared to legal processes. This timeline includes site selection, land assembly, layout preparation, approval processes, and on-site development, each phase requiring several months to years to complete.

Figure 6. Timeline for development in legal colonization

Figure 7. Timeline for development in illegal colonization

However, the study highlights the complexities and challenges of regularizing unauthorized colonies, particularly those located on recreational, public, and transportation lands. Since only a portion of the total unauthorized colonies are eligible for regularization due to land-use conflicts.

6. Regularization

The regularization process involves the preparation, finalization, and approval of regularization plans by competent authorities, ensuring the provision of infrastructure. It includes a physical survey of settlements, provision for acquisition of land for infrastructure, internal development of colonies, and collection of development charges from beneficiaries. Regularization in Jabalpur occurs at the colony level. At plot level regularization is available to plot holders who deposit compounding fees for existing unauthorized construction or obtain building approvals prior to commencing construction. Figure 8 shows unauthorized and regularized colonies in Jabalpur.

Figure 8. Unauthorized and Regularized Colonies, Jabalpur

The Colonizer Registration Act 1998 introduced regularization in 2002 under Rule 15A. The criteria for regularization are based on a minimum of 10% construction, and residential land use, as well as cut-off dates. For the development of illegal colonies, a provision was made to charge development fees at the rate of Rs 150/- sq. m. (approximately Rs 14/- sq. ft.). Later, amendments to the rule in illegal colonies where more than 70% of the residents are from LIG, the colony will only have to pay a 20% development fee. In other colonies, residents will pay 50% of the development fee, and the concerned body will share the remaining 50%. And Imprisonment of not less than 3 years and not more than 7 years and a minimum fine of Rs. 10,000/- to be charged from the colonizer.

In 2019, this rule became void and the M.P Nagarpalika (Colony Development) Rules, 2021 came into existence. The criteria for regularization are the same, based on more than 10% construction of plots in a colony, cut-off dates, and consideration of only residential land

use or a change in land use to residential land use for regularization purposes. The eligibility criteria in the M.P. are the lowest among all the states. The development charges are calculated based on the total expenditure required for development in proportion to the plot area. If more than 70% of the residents of LIG present a minimum of 20% of the development charges from residents and 80% by the body concerned, in other colonies, residents and the concerned municipality will share a 50-50% share of the development charges. The fine for colonizers increased from Rs. 10,000 to Rs. 10 lakhs, which is also very low when compared to the profits they earned. The regularization focuses solely on providing civic infrastructure, and no norms are specified for the provision of social infrastructure.

Following the 2021 rule, 87 colonies received regularization status in 2023 due to political influence. Additionally, it is observed from case studies that majority of colonies are partially regularized with the provision of physical infrastructure at different stages. The lack of willingness among people to pay development charges, and delays in depositing development charges lead to revenue losses for authorities. In very few cases, green areas are demarcated in regularization plans, which are later subdivided due to inadequate monitoring.

7. Unauthorized colonies case studies

Several case studies are analyzed to gain understanding of the development of unauthorized colonies. The study focuses on typology, infrastructure provisions, development status, regularization process and implementation. The first case study is Jai Prakash Nagar, Adhartal. The colony developed in two phases as an unauthorized settlement adjacent to nearby planned JDA schemes, namely Scheme No. 15 and 3. Initially, in 1968, after the JDA scheme was announced, surrounding farmland was subdivided into plots without permission, with developers capitalizing on the perceived opportunities presented by the upcoming JDA schemes. Phase 1 began in 1975, with plot sizes ranging from 41.81 to 139.35 sq. m. (450 to 1,500 sq. ft.), sold at Rs 1291.67 per sq. m. (Rs 120/- per sq. ft.). It gained popularity due to confusion with JDA developments. By 1982, Phase 2 commenced on adjacent land, including areas within the JDA scheme boundary. Despite being unauthorized, the area received amenities in 1990 due to political influence, which led to further unauthorized developments.

Phase 1 was regularized in 1999, followed by Phase 2 in 2004, excluding parts on public and transportation land uses. Regularization rules, introduced in 2002, required plot holders to pay Rs. 150.69 per sq. m. (Rs. 14/- per sq. ft.) as development charges, yet infrastructure remains inadequate even after regularization. Plot-level regularization remains a challenge, as residents must pay compounding fees or secure building permissions, leading to continued informal development patterns.

The second case study is Avani Vihar, located in Shastri Nagar, near JDA Scheme No. 2B. Shastri Nagar is primarily developed through unauthorized colonies. Many colonizers have subdivided farmlands into plots since 1980. In 2013, the colonizer developed Avani Vihar colony near Balsagar Talab, obtaining permission from TNCP and Nagar Nigam for parts 1 and 2. Part 3 was developed without permission, making it unauthorized. Some areas in residential land use, as well as others; such as those covering Balsagar Talab, remain largely unauthorized due to non-compliance with land-use regulations, creating significant infrastructural challenges. The Balsagar Talab, located on a privately owned plot, began to dry up gradually in 2015. The colonizer purchased and filled in the land to extend the colony. Since 2017, colonizers have begun selling plots on unauthorized land; almost 60% of the colony is unauthorized, and a major portion of the colony cannot be regularized due to land-use restrictions. The plot sizes vary 55.74 to 139.35 sq. m. (600 to 1500 sq. ft.) and were started selling at Rs 6996.54 per sq. m. (Rs 650/- per sq. ft.) in unauthorized parts and, TNCP-approved part plot sizes vary from 74.32 to 92.90 sq. m. (800 to 1000 sq. ft.) and started selling at Rs. 17,222.26 per sq. m. (Rs. 1,600/ sq. ft.).

The colonizer saves costs on-site development and approval fees and gains a larger profit in the event of unauthorized development resulting in a more saleable area. The additional costs to be paid by the plot holder to access facilities like bore well, septic tank, and roads are Rs 79,000 plus regularization charges. For part 3, regularization is not possible, leading to challenges for development. Plots are constructed in part 3 of the unauthorized colony and 36% are occupied to date. Plotting is continued by the colonizer to the available extent. Since the colony cannot be regularized and the colonizer does not provide any infrastructure facilities. There is huge pressure on the existing infrastructure, which was developed in the TNCP-approved part. The colonizer capitalized on the lower costs

and higher profitability of unauthorized development, while residents faced additional costs for basic amenities and regularization. The authorized part of the colony suffers from infrastructural strain due to the unauthorized sections.

Unauthorized development of various scales has already happened along the NH-30 and Amkhera road before any scheme notification. To control the growth of these unauthorized colonies, the JDA proposed its town development schemes in the adjacent areas from 2020 onwards (Scheme No. 62, TDS 03, 05). However, due to the lengthy process of the scheme development, a certain percentage of the land is already occupied by various unauthorized colonies. With the preliminary notification of the TDS, various small-scale developers have undertaken unauthorized development (>= 5 acres~2.02 ha) with the intention of land speculation along the schemes, as these developments are mostly exempt from development changes when developing the schemes. The settlement is owned by pure speculators whose sole reason for making such an investment is speculative profit, and they are not residents or end-users of the settlement. A significant percentage of residential land ownership is driven by investment.

In the JDA Scheme no. 62, encroachment of unauthorized colonies increased from 9.5% to 15% of the scheme area after the notification date to the present. In these unauthorized colonies, the majority of plots are sold for speculative profits. No action by the JDA, a lack of monitoring of ground activities, and a lengthy process for developing the scheme resulted in an inefficient formal supply of housing. These settlements have increased over the years since the scheme notification despite no action being taken by the JDA to control unauthorized development within the scheme area. Further creating challenges in the implementation of road networks and developing schemes. In JDA TDS-03, the encroachment of unauthorized colonies increased from 14% to 27% of the scheme area between the notification date and the present and is still growing. The lack of effective monitoring and enforcement by the JDA exacerbated the problem, resulting in an inefficient formal housing supply and challenges in implementing the scheme.

The development of unauthorized colonies, as illustrated by the case studies of Jai Prakash Nagar, Adhartal, and Avani Vihar, Shastri Nagar, reveals a pattern of informal settlement growth driven by speculative investment, regulatory inefficiencies and delayed formal development, contributing to the persistence and growth of unauthorized colonies.

8. Issues and Potentials

Unauthorized land colonization in Jabalpur presents a complex array of issues and potentials across multiple levels of governance. At the city level, the presence of 736 unauthorized colonies comprises a substantial portion of the residential area and population. The rapid growth was fueled by both land speculation and housing demands. However, the absence of a comprehensive database for quantifying these colonies poses a significant challenge in effectively addressing the issue and implementing targeted interventions. At the rule level, the extension of cut-off dates for regularization applications has led to a surge in requests. Indicating a preference for this process over the more stringent building approval route, thereby highlighting the need for strict regulations and oversight to curb unauthorized development. Moreover, the lack of minimum standards for physical and social infrastructure in regularized colonies reveals a critical gap in ensuring sustainable and equitable urban development. The small unauthorized colonies merge, resulting in scattered development, which necessitates the implementation of stringent guidelines and enforcement mechanisms to promote responsible land use and development practices.

Administratively, the lack of coordination between government organizations and the inadequate monitoring and enforcement post-regularization contribute to the perpetuation of unauthorized colonies and the proliferation of informal settlements. To address these systemic challenges, establishing a coordination committee to facilitate communication and collaboration among relevant departments and ensure policy compliance could enhance governance efficacy and streamline decision-making processes. Additionally, strengthening the enforcement wings of local bodies to conduct real-time monitoring of unauthorized construction and development activities could enable prompt intervention and enforcement of regulations, thereby preventing further unauthorized land colonization and promoting adherence to urban planning norms and regulations.

At the layer level, the emergence of new unauthorized colonies in proximity to regularized ones and the inadequate provision of infrastructure in settlements. There is a pressing need for strict regulations, enforcement mechanisms, and sustainable development practices. The trend of unauthorized colonies lacking essential infrastructure and open spaces, coupled with colonizers exploiting the regularization process to maximize profits through cost-saving measures. The urgency of implementing stringent regulations, monitoring mechanisms, and penalties to deter unauthorized land colonization and promote sustainable urban development practices. Potential solutions to address these challenges include the imposition of vacant land taxes to discourage speculation and incentivize responsible land use practices. In addition to implementing GIS documentation for improved identification and mapping of unauthorized development, this enables proactive intervention and control at the early stages of development.

Furthermore, the formulation of zonal plans aligned with regulatory acts. The acquisition of vacant plots for infrastructure purposes during regularization layouts. It could help mitigate unauthorized development and ensure the provision of necessary infrastructure at settlement levels. Enhanced penalties for colonizers based on the area of development and the establishment of penalties for non-compliance with plot-level regularization within specified timeframes could serve as deterrents and promote adherence to regulatory frameworks and sustainable development practices.

9. Recommendations

The recommendations focus on various levels of the planning framework under the M.P. Colony Development Rules, 2021. These recommendations aim to enhance the efficiency and effectiveness of the regularization process, Figure 9. The criteria for regularization are based on residential land use and categorization by the percentage of plots sold. Allowing authorities to acquire plots for infrastructure provision based on the level of development. The categorization is as follows:

- Category A: where up to 25% of plots are sold,
- Category B: where above 25% to 50% of plots are sold,
- Category C: where above 50% of the plots are sold and
- Category D: where more than 75% of plots are built up.

The minimum standards for infrastructure provision are proposed, with norms based on categorization to ensure the development of physical and social infrastructure.

Figure 9. Recommendation for Regularization Process

The paper also suggests penalties for colonizers, such as fines and recovery processes, including the sale of unallotted plots and buildings for non-payment of taxes. It advocates for penalties based on market value and fees for land use changes, with heavy penalties for amenity failures and charges for unplanned open spaces. The penalty proposed to the colonizer is based on percentage of the market value of the land (as per collector guidelines) + Fees for changes in land use (if applicable). Development on-site as if the colonizer can provide the amenities as per categorized norms by himself, penalty charged to be Rs. 10 Lakhs and addition of Rs.10 lakhs for every subsequent category, in case of available open space area, the colonizer fails to provide amenities as per its category, the penalty would be as per above clause + cost of required development as per above categories based on CPWD norms. If an open space area cannot be planned in the colony, an estimate of the required land is made, and a 2.0 times recovery is charged to the colonizer. Furthermore, the regularization process is

outlined in a flowchart, ensuring a clear timeline for the process, Figure 8.

There is a need for strict monitoring post-regularization to prevent unauthorized expansions without approval. Subdivision after regularization is highlighted as a potential issue that could increase density and strain infrastructure, necessitating vigilance and enforcement of penalties. The periodic and random checks on on-field improvements to ensure compliance with approved land use, with provisions for change in land use applications and potential demolition for non-compliance. It also addresses unapproved subdivisions, outlining actions by the JMC/TNCP to verify authorization and prevent unauthorized developments. Notices are issued for plot-level regularization, to control unauthorized construction, and penalties and disincentives are after the notified time.

The recommendations at the rule level include public notice restrictions, maintaining cut-off dates, and timeframes for regularization layout preparation. General recommendations emphasize the importance of strict monitoring, of acquiring vacant land for social infrastructure, and imposing high penalties for violations and encroachments. City-level recommendations propose GIS documentation for unauthorized colonies, zonal development plans for planned growth, and controlling unauthorized construction before regularization to ensure compliance with regulations and sustainable urban development.

10. Conclusions

In conclusion, the unauthorized land colonization and housing are a complex phenomenon driven by a combination of socio-economic, regulatory, and governance factors. Addressing this issue requires a comprehensive planning and policy interventions that includes the effective enforcement of regulations, and the provision of affordable housing options for all income segments. The regularization policies with defined aim and objectives and evaluation mechanisms enhance the efficiency and effectiveness of the regularization process. By understanding the root causes and implications of unauthorized settlements, policymakers can work towards sustainable urban development and inclusive housing solutions.

While the public sector faces challenges with delays and gaps in development, the private sector follows a phased approach, developing initial phases with permission and later phases without it. The recommendations provide guidance on development strategies for both the public and private sectors in the city. Norms and standards play a crucial role in guiding planned development, ensuring that infrastructure and social amenities are in place to support residential growth in the region. The study underscores the ineffectiveness of current regularization policies, which often lack strict enforcement and comprehensive planning for infrastructure and social amenities.

Overall, addressing unauthorized land colonization requires a comprehensive and multifaceted approach that encompasses regulatory reforms, administrative coordination, enforcement mechanisms, and community engagement, promote sustainable urban development, and ensure equitable access to essential infrastructure and services for all residents in Jabalpur, M.P.

Acknowledgements

References

Colonizer-Registration-Act 1998 and M.P. Colony Development Rules 2021

Leonie Sandercock. 1979. The Land Racket: The real costs of property speculation.

Madhya Pradesh Bhumi Vikas Rules. 2012.

Madhya Pradesh Nagarpalika Vidhi (Sanshodhan) Vidheyak, 2021, Part 1- Amendment to the Madhya Pradesh Municipal Corporation Act, 1956 (No. 23 of 1956)

Payne Geoffrey. 1998. Illegal cities- Low & Urban Change in Developing Countries.

Srirangan Sc, K. B. 2000. Public land and property development and cross-subsidisation for low-income housing in Delhi

Srirangan Sc, K. B. 1997. Land policies in Delhi: their contribution to unauthorized land development.

UN-HABITAT and UNESCAP. 1997. Urban Land Policies for the Uninitiated.

Evaluating the impact of Odisha Housing Policy:

Critical analysis of the models of affordable housing policy

Satarupa Mohanty[1] and Dr Ruchita Gupta[2]

[1]*School of Planning and Architecture, New Delhi, Email: msatarupa1321@gmail.com*
[2]*School of Planning and Architecture, New Delhi*

Abstract: Urbanization is reshaping landscapes, economies, and societies globally, driving populations to cities in search of better opportunities. This rapid urban growth exacerbates housing challenges, leading to overcrowding, informal settlements, and homelessness, thus perpetuating poverty and social inequality. Effective housing policies are essential for ensuring fair and sustainable urban development, addressing housing shortages, and promoting social inclusion. In India, initiatives like the Pradhan Mantri Awas Yojana (PMAY) aim to provide affordable housing through partnerships, incentives, and subsidies. At the same time, the Rajiv Awas Yojana (RAY) focuses on urban regeneration and slum rehabilitation. Odisha's "Policy for Housing for All in Urban Areas, 2015" targeted affordable housing for underprivileged populations, introducing seven models for sustainable urban development. However, due to various shortcomings, an improved "Odisha Housing for All Policy for Urban Areas, 2022" was implemented, incorporating previous learnings and amendments. This Policy prioritizes "Housing for All" as a mission, with plans to establish a dedicated mission and allocate necessary resources. This paper examines the effectiveness of these policies in addressing Bhubaneswar's housing shortage through case studies and primary surveys. The findings suggest a need for increased government support to enhance access to affordable housing. Recommendations include broadening the policy's focus on all societal sections, introducing microfinancing options, retaining land banks to increase affordable housing inventory, and facilitating transit accommodations and rental housing complexes. These measures aim to improve housing conditions for both current and future projects.

Keywords: housing policy, affordable, slum, redevelopment, public-private partnership

सार: शहरीकरण वैश्विक स्तर पर परिदृश्य, अर्थव्यवस्थाओं और समाजों को नया आकार दे रहा है, जिससे आबादी बेहतर अवसरों की तलाश में शहरों की ओर बढ़ रही है। यह तेज़ शहरी विकास आवास चुनौतियों को बढ़ाता है, जिससे भीड़भाड़, अनौपचारिक बस्तियाँ और बेघर होने की समस्या पैदा होती है, जिससे गरीबी और सामाजिक असमानता बनी रहती है। निष्पक्ष और टिकाऊ शहरी विकास सुनिश्चित करने, कमियों को दूर करने और सामाजिक समावेश को बढ़ावा देने के लिए प्रभावी आवास नीतियाँ महत्वपूर्ण हैं। भारत में, प्रधानमंत्री आवास योजना (PMAY) जैसी पहलों का उद्देश्य भागीदारी, प्रोत्साहन और सब्सिडी के माध्यम से किफायती आवास प्रदान करना है, जबकि राजीव आवास योजना (RAY) शहरी उत्थान और झुग्गी पुनर्वास पर केंद्रित है। ओडिशा की "शहरी क्षेत्रों में सभी के लिए आवास नीति, 2015" ने वंचित आबादी के लिए किफायती आवास को लक्षित किया, जिसमें टिकाऊ शहरी विकास के लिए सात मॉडल पेश किए गए। हालाँकि, विभिन्न कमियों के कारण, पिछली सीखों और संशोधनों को शामिल करते हुए एक बेहतर "शहरी क्षेत्रों के लिए ओडिशा आवास नीति, 2022" लागू की गई। यह नीति "सभी के लिए आवास" को एक मिशन के रूप में प्राथमिकता देती है, जिसमें एक समर्पित मिशन स्थापित करने और आवश्यक संसाधन आवंटित करने की योजना है। यह शोध पत्र केस स्टडी और प्राथमिक सर्वेक्षणों के माध्यम से भुवनेश्वर की आवास की कमी को दूर करने में इन नीतियों की प्रभावशीलता की जांच करता है। निष्कर्ष किफायती आवास में सुधार के लिए बढ़े हुए सरकारी समर्थन की आवश्यकता को इंगित करते हैं। सिफारिशों में सभी सामाजिक वर्गों पर नीति का ध्यान केंद्रित करना, माइक्रोफाइनेंसिंग विकल्प शुरू करना, किफायती आवास सूची बढ़ाने के लिए भूमि बैंकों को बनाए रखना और पारगमन आवास और किराये के आवास परिसरों की सुविधा प्रदान करना शामिल है। इन उपायों का उद्देश्य वर्तमान और भविष्य की दोनों परियोजनाओं के लिए आवास की स्थिति में सुधार करना है।

मुख्य शब्द: आवास नीति, किफायती, बस्ती, पुनर्विकास, सार्वजनिक-निजी भागीदारी

1. Introduction

Housing is a civilizational aspiration as it is an essential need of a human being. With increased urbanization, the demand for housing has grown manifold. A report by the Technical Group on Urban Housing Shortage for the 12th Plan (TG-12) indicates that 18.78 million households in India lack access to adequate housing.

The need for an effective and efficient institutional mechanism was recognised to achieve the objectives of 'Housing for All' in urban areas and, AWAAS (Odisha Urban Housing Mission) was launched by the Hon'ble Chief Minister of Odisha on 11th October 2015.

The Government of Odisha approved the "Policy for Housing for All in Urban Areas, Odisha, 2015" to create a comprehensive, and holistic policy framework addressing all aspects of housing for the urban poor, including slum rehabilitation, redevelopment, new housing, and rental housing.

In 2022, due to the unfulfillment of the target set forth by "Policy for Housing for All in Urban Areas, Odisha, 2015" and to put in place a set of progressive and futuristic models of intervention for creation of Affordable Housing stocks

Government of Odisha approved the "Odisha Housing for All Policy for Urban Areas, 2022".

2.   Need of the study

The National Commission on Population, Ministry of Health and Family Welfare, projected the urban population of Odisha at 85.76 lakhs for the year 2022. Additionally, 115 Urban Local Bodies (ULBs) in Odisha are home to about approximately 18 lakh households. The demand survey conducted under the Housing for All Plan of Action-PMAY (U) in 2019 pegs the urban housing demand at 4,80,412.

There are 488 recognised slum settlements in Bhubaneswar (identified by the BMC) with 80,665 Households (IIHS 2017). The shortage, coupled with the presence of 436 recognised slum settlements, underscores the need to assess the policy's impact on meeting the growing demand for affordable housing, slum rehabilitation, and rental housing in Odisha.

3.   City profile

Situated in the Khordha district, Bhubaneswar is the capital and largest city of Odisha, India. Historically, the old town was known as Chakra Kshetra and Ekamra Kshetra. Known as the "Temple City," Bhubaneswar once housed around 700 temples. Today, it is a hub for business travellers and education. Bhubaneswar became the capital of Odisha on August 19, 1949, replacing Cuttack. The modern city was designed in 1946 by German architect Otto Königsberger. Cuttack and Bhubaneswar are often referred to as the "twin cities of Odisha," with a combined metropolitan population of 1.7 million in 2011. Bhubaneswar's metro area, with over a million residents, is classified as a Tier-2 city.

The Bhubaneswar urban development area encompasses the Bhubaneswar Municipal Corporation (BMC) area, 173 revenue villages, and two other municipalities, covering an area of 1,110 km². The BMC area alone covers 186 km². The city has a dumbbell shape, with growth mainly in the north, northeast, and southwest. Figure 1 is the map of Bhubaneswar.

The Kuakhai River and a wildlife sanctuary to the northwest limit growth in the east. The city is divided into the old town, the planned city (which serves as the state capital), additional areas, and various units and colonies.

Bhubaneswar offers a diverse range of housing options, including apartments, independent houses and, villas, catering to a wide range of needs and preferences. Property prices vary based on location, amenities, and property type. Prime areas, such as Patia, Khandagiri, and Nayapalli generally have higher prices. However, affordable housing is available in urban villages, serving as pockets for migrant populations. (Resources Flows in Indian Cities: City Profile of the Construction Sector in Bhubaneswar, 2020) A 2 BHK apartment typically costs between INR 25 lakhs and INR 1 crore, while a 3 BHK apartment ranges from INR 60 lakhs to INR 2 crores (Department)

Figure 1. Map of Bhubaneswar

The state government of Odisha has launched various schemes and policies to promote affordable housing aiming to make housing more accessible and improve living standards for the economically weaker section (EWS) and low-income group (LIG) of society.

An analysis of government schemes indicates a significant housing supply gap. The demand identified is approximately 89,043 units for the EWS and LIG segments of society. This gap highlights the need for affordable housing solutions to enhance living conditions for these socially disadvantaged groups. Practical strategies and adequate resource allocation are crucial to addressing the housing needs of the EWS and LIG segments. By focusing on inclusive and sustainable urban development, the government can work towards creating a more equitable, and liveable environment for all residents of Bhubaneswar.

4.   AWAAS- Odisha Urban Housing Mission

Recognizing the need for an effective institutional mechanism to achieve "Housing for All" in urban areas, AWAAS - (Odisha Urban Housing Mission) was launched by the Chief Minister of Odisha -on October 11, 2015. The mission has been prioritized by the Odisha government and is managed by the Odisha Urban Housing Mission (OUHM), an integrated directorate of the Housing and Urban Development Department (H&UD). OUHM is the department responsible for implementing the Policy for- Housing for All in Urban Areas, Odisha, 2015, - making policy choices, and establishing the required administrative and legislative procedures.

OUHM also serves as the state-level nodal agency (SLNA) for executing federal programs. Its objectives include providing permanent residential units for the economically weaker section (EWS) and low-income group (LIG), as well as rental housing for identified homeless individuals, including temporary migrants, and upgradation of existing housing infrastructure. Additionally, OUHM aims to generate surplus housing stock through various strategic development models.

The mission's objective is to collaborate with the government and allied institutions to ensure all urban residents have access to affordable housing. This involves implementing a system that consistently delivers results, creating a resilient housing ecosystem to meet the diverse needs of urban dwellers in Odisha. The Policy for Housing for All in Urban Areas, Odisha, 2015, approved by the Government of Odisha, provides a comprehensive framework addressing all aspects of housing for the urban poor, including slum rehabilitation and redevelopment, new housing, and rental housing.

OUHM has identified a shortage of 410,000 units in Odisha, with a need for 150,000 units in the Bhubaneswar-Cuttack region. The goal of the 2015 policy was to address this deficit by delivering 100,000 units within five years, i. e., by 2020, and achieving this ambitious target required strategic planning and collaboration with governmental bodies and allied institutions. In 2022, the Government of Odisha approved the Odisha Housing for All Policy for Urban Areas under OUHM to implement progressive models for creating affordable housing for the vulnerable section of society while improving overall city quality.

5.   Odisha Housing for All Policy for Urban Areas, 2022

The Odisha Housing for All Policy for Urban Areas, 2022, aims to address the comprehensive housing needs of urban residents in the State of Odisha. This policy ensures access to affordable housing options for all urban residents, utilizing a range of models and strategies to create a steady supply of affordable housing units and enhance the urban living environment. Through public-private partnerships, developer incentives, and targeted interventions for slum redevelopment and rehabilitation, the policy seeks to address the housing deficit and provide better living conditions for all residents. This will promote inclusive mixed housing development and leverage government resources to bring about positive change in the housing sector, thereby contributing to overall urban development.

The policy's goal is to ensure that all urban residents in Odisha have access to affordable and quality housing, with a system delivering consistent results over time. The mission is to create a systematic supply of affordable housing stocks to meet the increasing demand with the aim to address the housing deficit in urban areas within seven years.

The policy objectives are:

i)   Establish a comprehensive framework for housing the urban poor, including slum rehabilitation, redevelopment, new housing, and rental housing.
ii) Promote inclusive mixed housing development in all new projects.
iii) Encourage mixed land use in housing estates for neighbourhood shopping and retail within walking distance.
iv) Utilize proactive-, market-led efforts to address the low and informal income market segment.
v)   Promote public-private partnerships (PPP) for affordable housing and slum rehabilitation.
vi) Ensure timely and regulated availability of land for housing projects.
vii) Set principles for transparent and efficient allocation of affordable housing units.
viii) Establish a single-window approval system for housing projects.
ix) Provide a platform for the operation and maintenance of affordable housing units.

x) Promote inclusive and participatory planning and implementation for slum redevelopment.

xi) Integrate livelihood programs with housing programs for socio-economic development.

xii) Ensure the provision of municipal services to improve living standards for the urban poor.

xiii) Facilitate the formation-of housing societies by existing slum dwellers.

xiv) Minimize relocation of slum dwellers to maintain existing economic and social linkages.

xv) Develop a framework for affordable rental housing to prevent the development of new slums.

xvi) Address operational issues arising during policy implementation.

Strategies to achieve these objectives include mandating affordable housing provisions in all new projects, providing incentives for market-based affordable housing solutions, and establishing a framework for public-private partnerships (PPPs) in the affordable housing sector. The policy integrates frameworks for slum rehabilitation and redevelopment with affordable housing to ensure comprehensive urban development.

Affordable Housing Facilitation Centers will streamline beneficiary registration, profile verification, and home loan access, ensuring fairness in housing project allotments. A structured responsibility framework will integrate and coordinate government agencies to provide basic services at housing locations developed by Project Development Agencies (PDAs). Mandating registered housing societies will foster cooperation in affordable housing and slum rehabilitation projects, with private sector involvement under public-private partnership (PPP) arrangements enhancing the capacity for repair, maintenance, and management. Revenue from private developers will support the CDP Infrastructure Development Fund (CIDF) or State Housing Fund for housing initiatives.

Efforts to preserve socio-economic ties within informal settlements include in-situ redevelopment or nearby relocation, with public transport links connecting housing units to key city nodes. Mixed housing zones will promote socio-economic connections, and vendor markets may be established based on community needs. Resident participation in estate maintenance and management will be encouraged through skill enhancement programs, and urban livelihood programs will be integrated to enhance options

for the urban poor.

Regulatory reforms include amending the Odisha Land Reforms Act 1960 to facilitate land conversion for urban development, reserving at least 20% of housing land for affordable housing, and establishing a single-window system for timely approval of layouts and building permissions. Pre-approved layouts and building plans will facilitate construction, and a rent control law akin to the Model Tenancy Act will be enacted. Incentives like additional FAR, FSI, TDR, and relaxed density norms will support slum redevelopment and low-cost housing projects.

The Government of Odisha envisions seven models for intervention under this Policy, which can operate independently or in combination with one another, (Mission 2022).

i) Model 1: Mandatory Development of Affordable Housing

ii) Model 2: Incentives for market-based development of Affordable Housing

iii) Model 3: Development of Affordable Housing Projects

iv) Model 4: In-situ Slum Redevelopment

v) Model 5: Relocation and Rehabilitation

vi) Model 6: Beneficiary-Led Individual Housing Construction or Enhancement

vii) Model 7: Rental Housing

5.   Model 1: Mandatory Development of Affordable Housing

Model 1 emphasizes the mandatory integration of affordable housing units in all housing projects. The policy mandates that for projects exceeding 2,000 sqm, a minimum of 10% of the approved or constructed carpet area must be allocated for Affordable Housing Units to secure building plan approval. Developers can exclude the Floor Area Ratio (FAR) consumed by these units from the overall built-up area calculation, receiving compensatory FAR equivalent to 100% of the area used for Affordable Housing. This additional FAR can be utilized within the same project, subject to regulations, while the remaining area can be allocated for other housing categories and commercial purposes.

However, challenges persist in the implementing of this Model. By 2024, only 20 EWS housing units have been constructed, each costing INR 8,39,364, falling short of the policy's goal, Figure 2. Developers often find it more cost-

effective to pay the Shelter Fee, which is one-fourth of the construction cost of affordable units, rather than building the units themselves. Concerns also arise regarding the transparency and accountability of Shelter fee utilization, as information on allocation and usage is limited in the public domain.

Figure 2. Case Study of Surekha Niwas in which 20 units of EWS units have been constructed

Case studies conducted under Model 1 revealed both successes and challenges. For example, in one case study, the developers faced difficulties in providing Affordable Housing Units on the site due to site constraints. As a solution, they preferred to pay the Shelter Fee, which contributes to the CDP Infrastructure Development Fund. However, concerns were raised about the use of the Shelter fee by the development authority in comparison to the cost of constructing affordable units. This highlights the need for a more balanced approach to motivate developers to build affordable units on-site.

In another case study, the lack of microfinance options for beneficiaries, affected their ability to afford the EWS housing units constructed under the policy. This disparity between the prices of the units set by the authority and the actual construction costs poses a significant challenge to achieving the policy's affordability goals by the developers. Therefore, addressing the financial barriers faced by beneficiaries is crucial to the success of Model 1 in providing affordable housing options for economically weaker sections of society.

To address these issues, it is proposed to decrease housing unit prices to meet policy guidelines, provide microfinance options for beneficiaries to afford the units, and designate specific land parcels in master plans of the city for constructing affordable housing units. These strategies aim to incentivize developers to include affordable units in their projects effectively, ensuring that the policy's goals of providing

affordable housing for marginalized communities are met. Promoting transparency in Shelter fee allocation and its usage is crucial to improving the impact of the policy. While the Model 1 of the Affordable Housing policy in Odisha shows promise in promoting inclusivity and affordability in housing projects, there is a need for continuous monitoring and refinement to ensure that the policy addresses the housing needs of all segments of society effectively.

6. Model 2: Incentives for market-based development of affordable housing

Model 2 aims to promote proactive market-driven initiatives to meet the housing requirements of Economically Weaker Sections (EWS) and Lower-Income Group (LIG) households in urban areas of Odisha. This model provides an incentive structure, including market-based pricing and benefits, for private developers and Project Development Agencies (PDAs) to promote the construction of projects with 100% Affordable Housing Units.

Under this model, private developers undertaking projects with 100% Affordable Housing Units are eligible for various incentives. Incentives include the allowance of the maximum permissible Floor Area Ratio (FAR) for the entire project site without the need for Transferable Development Rights (TDR) or purchasable FAR. Additionally, developers receive a FAR equivalent to 100% of the Built-Up Area (BUA) utilized for Affordable Housing units, provided in the form of Transferable Development Rights (TDR). A portion of the built-up area is allocated for neighbourhood shopping and community facilities within the Affordable Housing Units area to enhance the overall liveability of the project.

However, challenges exist in the implementing of Model 2. Developers are required to adhere to standard facility provisions, such as open spaces and infrastructure, in EWS projects without any exceptions or relaxations. While developers typically include additional amenities in their projects, these costs are usually covered by the buyer. The sale of EWS units at government-prescribed rates often does not cover the construction costs, making it unprofitable for developers to focus solely on affordable housing projects. Furthermore, there is a lack of housing schemes targeting the Lower-Middle Income Group (L-MIG) and Upper-Middle Income Group (U-MIG) segments of society, as well as

affordable plotted development models.

Case studies could not be conducted under Model 2 due to the limited number of projects in the city that fit this model. Overall, Model 2 of the Affordable Housing policy in Odisha presents opportunities to enhance the availability of affordable housing options through market-driven initiatives. By addressing the challenges and leveraging the potential incentives, this model can play a significant role in meeting the housing needs of economically weaker sections and lower-income households in urban regions.

7. Model 3: Development of Affordable Housing Projects

Model 3 focuses on constructing of affordable-housing units in urban areas to cater to the housing needs of Economically Weaker Sections (EWS) and Lower Income Group (LIG) households in Odisha. This model aims to provide accessible and affordable housing options for marginalized communities through dedicated projects.

Since 2015, two projects have been initiated under Model 3 in Bhubaneswar, namely the Chandrasekharpur and Subudhipur affordable housing projects. The Chandrasekharpur project, led by Paramitra Smart Infra Pvt Ltd, is the largest of its kind in Odisha, spanning 8.09 ha (20 acres) and comprising of 2,600 dwelling units, Figure 3. The Subudhipur project spans 0.603 ha (1.49 acres) and includes 342 dwelling units. (BDA 2022)

Figure 3. Case Study of Buddha Vihar, Chandrasekharpur affordable housing project

Despite the initiation of these projects, concerns have been raised regarding compromised construction quality and the size of allocated units. Beneficiaries are provided with units having a carpet area of 23 sq. m., which is smaller than the area of their previous dwellings in the slums. This raises questions about the overall quality of housing provided under Model 3.

Case studies under Model 3 shed light on both successes and challenges. In the Chandrasekharpur project, the allocation and occupancy of dwelling units have commenced, with residents beginning to move into the units. This shows progress in providing housing solutions for EWS and LIG households. However, the construction quality and unit size highlight the importance of ensuring that affordable housing projects meet the necessary standards to enhance the living conditions of beneficiaries. The development of 342 dwelling units on 0.603 ha (1.49 acres) in the Subudhipur project demonstrates that efforts are underway to utilize limited land space efficiently for affordable housing initiatives. The successful implementation of this project demonstrates the potential for creating affordable housing solutions in urban areas with limited land availability.

Model 3 of the Affordable Housing policy in Odisha focuses on ensuring the quality and adequacy of housing units for beneficiaries. It emphasizes the importance of meeting the required standards in terms of size, amenities, and liveability. Continuous monitoring and evaluation are necessary to assess the impact of these projects on improving housing conditions for targeted communities. By addressing case studies and focusing on quality construction, this model can significantly contribute to meeting the housing needs of economically backward populations in urban areas.

8. Model 4: In-situ slum redevelopment

In-situ slum redevelopment focuses on the redevelopment of existing slum areas in urban areas of Odisha to improve living conditions for residents. This model involves the redevelopment of slums on viable land owned by government authorities, such as the Central Government, State-Governments, urban-local bodies (ULBs), or Public Sector Undertakings (PSUs) if the land is not essential for significant public purposes.

Three in-situ slum rehabilitation projects have been undertaken in Bhubaneswar under Model 4. The largest project is the Shanti Nagar Awas Yojana, which covers 4.05 ha (10 acres) of land and includes 840 dwelling units, Figure 4. Phase 1 of this project has been completed, and beneficiaries have been allotted their dwelling units. Possession has also started. The second project, Nilamadhav Awas Yojana in Niladri Vihar, has a site area of 3.31 ha (8.18 acres) and

includes 1,200 dwelling units that are currently under construction. The third project, Mahaveer Awas Yojana in Gadakana, has a site area of 1.55 ha (3.82 acres) with 400 dwelling units, approved by the Bhubaneswar Development Authority (BDA), and the construction is yet to start.

Figure 4. Case Study of Shanti Nagar Awaz Yojana, an in-situ slum rehabilitation project

Case studies conducted under Model 4 provide insights into both the challenges and successes of the model. The completion of Phase 1 and the initiation of beneficiary allotment in the Shanti Nagar Awas Yojana project demonstrate progress in addressing housing needs in the slum. The ongoing construction of 1200 dwelling units in the Nilamadhav Awas Yojana project indicates efforts to expand affordable housing options for residents in Niladri Vihar (BDA 2023). By utilizing available land for in-situ redevelopment, this project aims to enhance the quality of housing and infrastructure in the area, thereby contributing to the revitalization of the urban environment. The Mahaveer Awas Yojana project in Gadakana, although approved by the BDA, is yet to commence work. This highlights the importance of timely implementation and coordination among stakeholders to ensure the proper execution of in-situ slum redevelopment projects.

To address challenges in Model 4, such as delays in project initiation and coordination issues, adequate measures are essential. Timely execution, stakeholder engagement, and monitoring mechanisms can improve the efficiency and impact of in-situ slum redevelopment initiatives. By prioritizing the needs of slum residents and ensuring the sound quality of housing provided, Model 4 can significantly contribute to sustainable urban development and inclusive housing solutions in Odisha.

9. Model 5: Relocation and rehabilitation

Model 5 of the policy focuses on the relocation and redevelopment of slum areas in urban areas of Odisha to improve living conditions for residents. This model involves identifying viable land for relocation sites and developing transit accommodations to create temporary housing for slum dwellers during the redevelopment process.

Transit accommodations have been proposed at five locations in Bhubaneswar under Model 5: Subudhipur (1.21 ha ~ 3 acres), Niladri Vihar (2.02 ha ~ 5 acres), Pandara (2.02 ha ~ 5 acres), BJB Nagar (0.81 ha~ 2 acres), and Dumduma (1.25 ha ~ 3.09 acres). The transit camp at Kanyashram is currently operational with 1000 dwelling units, providing temporary shelter for residents affected by slum redevelopment projects. (Express, 2015)

Case studies conducted under Model 5 provide insights into the challenges and successes of the model. The operational transit camp at Kanyashram showcases the adequate provision of temporary housing for slum dwellers during the transition period. By providing essential infrastructure, such as safe drinking water supply, community toilets, and childcare services, the transit camp supports the relocated residents during the transition process. The proposed relocation sites at Subudhipur, Niladri Vihar, Pandara, BJB Nagar, and Dumduma are strategically located throughout the city, ensuring that residents' livelihoods are not disrupted during the relocation process. These sites aim to provide adequate housing options and essential amenities, ensuring a smooth transition for the affected population (Express, 2015).

Challenges in the implementing Model 5 include the need for efficient coordination among stakeholders, the timely completion of transit accommodations, and the provision of necessary infrastructure at relocation sites. Ensuring the availability of basic services, such as healthcare facilities and educational institutions, is crucial for supporting the resettlement process.

To address these challenges, measures such as regular monitoring, stakeholder engagement, and community participation are essential. By prioritizing the needs of slum dwellers, Model 5 can contribute to sustainable urban development and inclusive housing solutions in Odisha. Model 5 plays a vital role in addressing housing challenges in slum areas by providing temporary housing solutions and facilitating the transition of residents to improved living conditions. Through

effective planning, coordination, and infrastructure development, this model can enhance the transit process and quality of life for marginalized populations in urban Odisha.

11. Model 6: Beneficiary-led individual housing construction or enhancement

The objective of Model 6 is to enable recipients to build or renovate their own homes in Odisha's metropolitan regions. The model aims to provide financial assistance and support to individuals who require housing solutions, allowing them to take responsibility for the development process and improve their living environment.

Out of the 1266 units approved under Model 6, 892 units in Bhubaneswar are completed; 52 are at the excavation stage, 78 are at the plinth level, and 226 are at the roof level, Figure 5. This shows that the process of empowering recipients to build or renovate their own homes is making headway toward the ultimate objective of inclusive housing development.

The difficulties and achievements of beneficiary-led home construction projects are highlighted on through case studies carried out under Model 6. This strategy empowers individuals to take control of their housing needs and enhance their quality of life by involving beneficiaries in the construction process and providing financial support.

One concern with Model 6 is that there is no waiting list for beneficiaries. Problems with document submission or verification might result in project rejection without providing an opportunity to resubmit within a given timeframe. Furthermore, recipients face financial difficulties and project completion delays due to inadequate funding and lengthy construction durations of 40–50 weeks.

To address housing issues, raising awareness and increasing governmental contributions are crucial. Urban Local Bodies (ULBs) can help more people in need by promoting outreach initiatives and providing financial support. Government-backed home mortgages and funding assistance can make it easier for beneficiaries to access homes. Model 6 aims to promote self-reliance and empower marginalized populations by prioritizing beneficiary-led housing building and upgrading. This concept can improve the standard of living for disadvantaged populations in Odisha through efficient coordination, financial support, and

capacity-building activities. Model 6-Beneficiality-Led Individual House Construction or Improvement encourages community involvement and self-help in resolving housing issues, achieving equitable housing solutions, and sustainable urban development.

Figure 5. A house constructed under the Beneficiary-Led-Individual Housing Construction Scheme in the Laxmisagar Ward of Bhubaneswar

12. Model 7: Rental housing

In the metropolitan regions of Odisha, Model 7 focuses on offering rental housing alternatives to economically weaker sections (EWS), lower-income groups (LIG), and medium-income groups (MIG). To accommodate a range of tenant demands and encourage the development of affordable housing alternatives, this model offers flexible housing designs, including one-room and two-bedroom homes, as well as dormitory options.

Three rental complexes for migrants and construction workers under Model 7 are located in Bhubaneswar. The Bhubaneswar Smart City Limited is in charge of the fully operating complex in Kharvel Nagar, whereas the two complexes in Ghatikia and Gadakana are now non-operational, Figure 6. These rental properties are designed to provide short-term, cost-effective housing- options for people in need of a place to live.

Figure 6. Rental Housing Complex in Kharvel Nagar

The accomplishments and challenges of rental housing programs are clarified through case studies conducted under Model 7. Established under Project Kutumb as part of the Smart City initiative, the Social Equity Centre at Kharvel Nagar in Bhubaneswar is a 200-bed rental housing plan. The center, which charges a daily fee of INR 50 and a monthly cost of INR 1,000, offers affordable accommodation options managed by an NGO selected through a bidding process. The center, which offers one room and two-bedroom apartments, is expected to have 247 male tenants in 2024. The center's central position guarantees easy access to public transportation and other necessities, which is essential for the quality of life and sense of security in their homes for inhabitants. This complex meets the housing needs of many groups in society by providing rental units with a range of facilities and layouts.

One of the challenges with Model 7 is that ensuring that rental complexes have access to basic utilities and amenities. Another is that monthly fees will increase at a rate of 10% each year, according to the state government and the Odisha Urban Housing Mission (OUHM). Encouraging inclusive urban development requires preserving the accessibility and affordability of rental housing alternatives for marginalised populations.

To overcome these obstacles, it is essential that rental housing be accessible to all societal sectors and that rental complexes located on the outskirts of the city have improved public transportation links. Rental housing projects have the potential to enhance the well-being and standard of living of renters from diverse backgrounds by providing easy access to essential services, facilities, and job centres. To close the gap in housing affordability and accessibility for marginalised individuals in urban areas, Model 7 offers rental options with variable designs and affordable prices. Rental housing developments in Odisha can support equitable housing solutions and sustainable urban development through direct initiatives by Project Development Authorities (PDAs) and public-private partnerships. Encouraging social inclusion and providing more affordable housing alternatives are two key objectives of Model 7-Rental Housing in metropolitan areas. This strategy helps to improve the standard of living and housing security for people living in Odisha by catering to the housing demands of all income groups and guaranteeing the provision of basic amenities.

13. Conclusion

The comprehensive evaluation of Odisha's Housing for All policies reveals a multifaceted approach to addressing the diverse housing needs of urban populations through various models. Each model, from the construction of affordable housing units (Model 3) to in-situ slum redevelopment (Model 4) and beneficiary-led initiatives (Model 6), plays an important role in tackling the challenges posed by rapid urbanization and housing shortages.

Model 1 emphasizes the importance of partnerships and incentives, while Model 2 explores market-driven initiatives to enhance affordable housing availability. Model 5 focuses on providing temporary housing solutions for slum dwellers, helping in their transition to improved living conditions. The introduction of rental housing options (Model 7) diversifies the strategies available to meet the needs of different income groups, ensuring that housing solutions are accessible to all segments of society.

Overall, these models underscores the importance of community involvement, funding, and efficient coordination for the realisation of sustainable and equitable urban housing development in Odisha. Odisha can make further progress towards its objective of providing suitable and affordable housing for all societal groups by removing obstacles, raising awareness, and expanding rental housing options. For these housing projects to be successful and positively impact the quality of life for Odisha's urban residents, cooperation among government agencies, urban local authorities, and other stakeholders is crucial.

References

BDA 2023. *Bhubaneswar Development Authority Annual Report.*

BDA 2022. *Bhubaneswar Development Authority Annual Report.*

Department, H. a. n.d.. *Urban Development Handbook Odisha.*

Express, T. N. 2015. *Plan Okayed to Resettle Evicted Slum Dwellers.*

IIHS. 2017. *Planning, 'Violations', and Urban Inclusion:A Study of Bhubaneswar.*

Mission, O. U. 2022. *https://has.odisha.gov.in/ouhm_cms/.*

Resources Flows in Indian Citie: City Profile of the Construction Sector in Bhubaneswar. 2020.

Mapping Socio-Physical Realities:

Mumbai's Indigenous Settlements in Contemporary Times

Sarvesh Nandgirikar[1], P. S. N. Rao[2]

[1]*School of Planning and Architecture, New Delhi, Email: sarveshnandgirikar@gmail.com*
[2]*School of Planning and Architecture, New Delhi.*

Abstract: The research seeks to investigate a unique problem in built infrastructure and physical planning. Three case studies of urban villages in varying contexts are examined to gain a deeper understanding of the growing concerns in communities about shifting land uses and development pressures. The research methods employed were on-ground interviews, documentation, physical surveys, and both unstructured and structured interviews with residents. Data is analyzed and reviewed to identify concerns related to the negative consequences of globalization and current real estate pressures on native communities and their livelihoods. The report goes on to highlight the relevance of development control and current issues faced by the communities in the metropolis.

Keywords: Changing land uses, Transformation Globalisation, Real Estate pressure, Urbanisation.

सार: यह अनुसंधान बुनियादी ढांचे और भौतिक योजना से संबंधित एक विशिष्ट समस्या की जांच करता है। भूमि उपयोग में बदलाव और विकास के दबावों के प्रति मूल समुदायों की बढ़ती चिंताओं को अधिक गहराई से समझने के लिए, विभिन्न संदर्भों में शहरी गांवों के तीन मामलों का अध्ययन किया गया है। अनुसंधान के लिए अपनाई गई विधियाँ ऑन-ग्राउंड साक्षात्कार, दस्तावेज़ीकरण, भौतिक सर्वेक्षण, और निवासियों के साथ असंरचित और संरचित साक्षात्कार शामिल थीं। डेटा का विश्लेषण और समीक्षा वैश्वीकरण और वर्तमान रियल एस्टेट दबावों से संबंधित चिंताओं के मूल समुदायों और उनकी आजीविका पर नकारात्मक प्रभावों की पहचान के लिए की गई है। यह रिपोर्ट विकास नियंत्रण की प्रासंगिकता पर और महानगरों में मूल समुदायों द्वारा सामना किए जाने वाले वर्तमान मुद्दों पर प्रकाश डालती है।

मुख्य शब्द: भूमि उपयोग में परिवर्तन, परिवर्तन, वैश्वीकरण, रियल एस्टेट दबाव, शहरीकरण

1. Introduction

Kolis, Gaothans, and Adivasis are among the Indigenous populations dispersed across the east-west regions. The Kolis engage in fishing and similar occupations, whereas the Gaothans and Adivasis are often inclined towards farming, agriculture, and animal husbandry due to their housing locations and topography. These ethnic groups are at risk of extinction.

Koliwadas and Gaothans have been defined; however, Adivasi padas are yet to be discovered and demarcated according to the designs. In the Brihanmumbai Municipal Corporation, these indigenous villages were not even included in the city's growth planning process or the subsequent growth Plan 2034.

The study seeks to study the examples of such Indigenous settlements and identified case studies to understand the exact current situation considering various parameters of the physical and economic development for these settlements in the 21st century in the metropolitan city of Mumbai.

2. Literature Review

Similar developments can be observed across India. It is essential to understand the development and transformation that occur in such developments to comprehend various factors and points that are similar in nature and can serve as a basis for further study. The literature review highlights the concept of Lal Dora and explains the development and transformation that are occurring in the urban village of Hauz Khas in South Delhi

Hauz Khas, situated in South Delhi, has undergone significant evolution over the decades, transforming from a primarily residential and institutional area into a vibrant commercial and cultural hub. Known for its 13th-century reservoir and complex built by Alauddin Khilji, Hauz Khas, which translates to "Royal Tank," initially featured structures like madrasas, mosques, and tombs, making it a quiet residential neighborhood with significant historical attractions. The area's land use initially comprised residential buildings, educational institutions such as IIT Delhi, and recreational spaces, including Hauz Khas Deer Park and the

Hauz Khas Complex. However, driven by economic opportunities, cultural shifts, and broader urbanization trends, the early 2000s saw Hauz Khas Village emerge as a cultural and commercial center. Artists and designers were drawn to its historical ambiance and low rents, leading to a proliferation of cafés, restaurants, and boutiques that attracted a young, cosmopolitan crowd. This commercialization led to a surge in property values, as many residential buildings were converted into commercial spaces, including offices and co-working areas. The municipal authorities had to upgrade infrastructure to keep pace, addressing issues such as traffic congestion, noise pollution, and waste management. Today, Hauz Khas Village is a bustling commercial hub with numerous dining and shopping options. However, some residential areas and cultural attractions, such as the Hauz Khas Complex and Deer Park, remain. The transformation has brought economic benefits and cultural vibrancy but also challenges such as rising property prices, gentrification, and environmental pressures. Moving forward, balanced urban planning and community engagement are crucial to ensure Hauz Khas remains a sustainable part of Delhi.

Lal Dora areas in Delhi, demarcated in 1908 by the British to define village habitation lands, have historically been exempt from strict building regulations and zoning laws, leading to distinctive patterns of land use and development. Initially intended to cater to basic residential and agricultural needs, these areas underwent significant transformation post-independence due to rapid urbanization and population growth. The lack of stringent regulations made it economically attractive for property owners to develop land, resulting in a shift from agricultural to residential and commercial uses. As Delhi expanded, many Lal Dora areas, initially peripheral, became part of the urban landscape, further propelling their conversion to urban uses. Government policies introduced to control development often had lax enforcement, resulting in the continued existence of informal settlements. In areas like Najafgarh, traditional village houses have been replaced by dense, multi-story buildings and commercial establishments, straining the infrastructure and causing environmental degradation. The demographic and social fabric of these areas has also changed, with an influx of new residents and activities altering traditional community dynamics. The transformation of Lal Dora areas highlights the complexities of urbanization,

underscoring the need for comprehensive urban planning, effective governance, and sustainable development to strike a balance between economic growth and social and environmental sustainability.

3. Database and Methodology

The study has selected one site each in Koliwada, Gaothan, and Adivasi Padas within the Municipal Corporation limits of Mumbai. Various parameters are considered to study the areas, and these are described in the subsequent sections.

3.1 Koliwada- Versova Koliwada, Mumbai

3.1.1 Introduction

Versova Koliwada is situated on the western coastline of Versova in the western suburbs of Greater Mumbai, known for its rich history as a fishing community. The locals originally called it "Visava," meaning "rest" in Marathi language. Versova has been the site of significant historical events. During the medieval period, Versova came under Portuguese rule, resulting in the construction of the Our Lady of Health Church and the conversion of many Kolis, the indigenous fishing community, to Christianity. By 1720, the village had grown into a small town with a fort and a thriving market for dry fish. In 1739, the Marathas took control of Versova from the Portuguese, further strengthening the settlement. The Koli community, primarily consisting of Son Koli and Malhar Koli groups, has historically and continues to occupy the majority of the land in Koliwada. Fishing remains their primary occupation, with about 60% of the community depending on it for their livelihood. Over time, many original inhabitants have expanded their homes vertically to accommodate the growing population. This vertical expansion has also led to the development of rental services within the community.

3.1.2 Land ownership

The land of Koliwada has been subdivided into various CTS (City Survey Numbers) as detailed in the Development Plan 2034. According to this plan, these CTS numbers and the associated land parcels are owned by a private entity, granting sole ownership to the private owner. Meanwhile, the government retains ownership of the amenities and public infrastructure within the area. The land use division is as shown in Figure 1. Koliwada has also experienced an influx of immigrants, primarily non-Kolis, drawn by its strategic location, which offers easy access to city

workplaces and relatively affordable housing options. This demographic shift has increased the community's diversity, blending traditional Koli culture with newer influences. The percentage of original – Koli residents to non-Koli residents is as indicated in Figure 2.
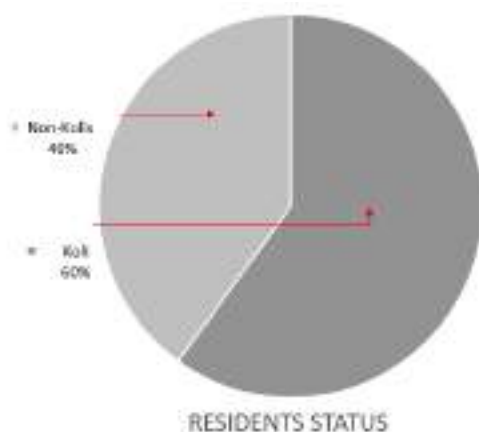

Figure 1. Various land use, Versova Koliwada

Figure 2. Resident's % Status in Versova Koliwada

3.1.3   Housing and Structural Conditions

Versova Koliwada is home to approximately 7 lakh residents and features a diverse range of housing styles, including individual houses, bungalows, chawls (multi-story tenements), and apartment complexes. On average, each household consists of 4 to 5 individuals, with homes averaging around 42 square meters. This results in a per capita residential built-up area of approximately 9.7 square meters. The variety of housing types reflects the dynamic social fabric

and evolving residential landscape of Versova Koliwada as indicated in Figures 3 and 4.
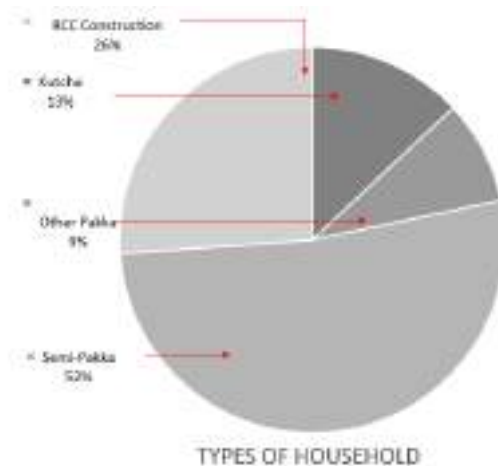
Figure 3. Types of Households in Versova Koliwada

Figure 4. Types of Households in Versova Koliwada

3.1.4 Occupational Pattern

In Koliwada, over 60% of households are engaged in fishing and related activities, while others work in the government and private sectors as indicated in Figure 5. Approximately 2,500 Kolis participate directly in fishing. The community benefits from five functional jetties dedicated to fishing boats. While traditional methods persist, the introduction of modern technologies, such as faster boats, advanced trawlers, and LED lights for fish attraction, has significantly boosted catches and profitability for some fishermen. However, these advancements have also marginalized traditional fishermen, leading to reduced yields. Both men and women in Koli communities actively contribute to

livelihoods; men typically fish while women play crucial roles in selling the catch. Figure 6 shows women sellers at fish market. Recent surveys among the Kolis have highlighted concerns about conflicts over fishing zones and a noticeable decline in fish populations attributed to severe pollution in local waters over the past few years. These challenges highlight the complex dynamics that influence the livelihoods and sustainability of fishing communities like Koliwada.
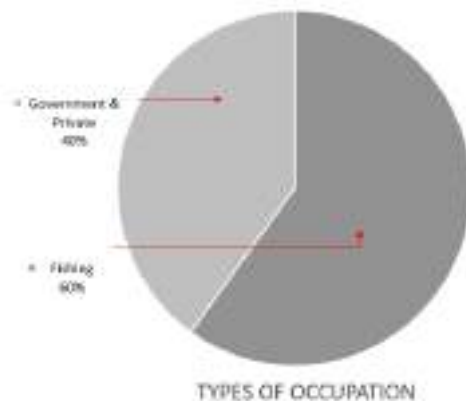

Figure 5. Types of Occupation

Figure 6. Fishermen and women selling fish at Versova Koliwada fish market.

3.1.5   Utilities

i) Water Supply - Versova primarily relies on municipal piped water, delivered daily between 6-8 pm for durations ranging from 15 to 60 minutes. The distribution network primarily faces challenges such as inconsistent water pressure and varying pipe sizes, which disrupt water flow. Recent outbreaks of waterborne illnesses, such as jaundice and typhoid, among residents are attributed to inadequate sanitation and contamination of water pipelines due to insufficient separation between water and sewer lines. These issues underscore the urgent need for enhanced water infrastructure and improved sanitation practices in Vrsova to protect the health and well-being of its residents.

ii) Sanitation and Stormwater Management - During the monsoon season, Versova Koliwada experiences recurring water accumulation in low-lying areas, which leads to mosquito breeding and an increase in malaria cases. The area's inadequate stormwater drainage system exacerbates these issues, often becoming blocked by garbage, which causes rainwater and runoff to overflow into the wastewater network. These drainage challenges not only contribute to localized flooding but also contaminate the wastewater system, posing health risks and environmental concerns for residents. Addressing these issues is crucial for mitigating health hazards and improving overall living conditions in Versova Koliwada, particularly during the heavy rainfall characteristic of the monsoon season.

Figure 7. Solid Waste dumped near the Versova -madh jetty.

iii) Solid Waste Management: Versova Koliwada faces challenges in achieving comprehensive door-to-door garbage collection due to its dense and often hard-to-reach layout. Additionally, the community lacks centralized waste disposal bins, resulting in residents discarding garbage near public toilets, which leads to a significant accumulation of solid waste in these areas, Figure 7. The buildup of solid Waste at public restroom entrances has created unsanitary conditions around these facilities. Moreover, there is a noticeable absence of dustbins inside public toilets, leading to improper disposal of sanitary Waste on toilet floors and window sills. These issues exacerbate the cleanliness and hygiene conditions within the settlement. Addressing these sanitation challenges is crucial for Versova Koliwada to improve waste management infrastructure and practices. Doing so will enhance cleanliness, raise hygiene standards, and ultimately improve the overall quality of life for its residents.

3.1.6 Social Amenities

i) Healthcare- Versova Koliwada provides access to small clinics and dispensaries for primary healthcare needs. Dr. General Hospital, located approximately 20 minutes from Hingla Devi Temple, is commonly visited by residents. Additionally, facilities such as RN Cooper Municipal General Hospital, Kokilaben Dhirubhai Ambani Hospital, and Brahma Kumari's Global Hospital are preferred for their quality primary and secondary healthcare services. Many residents opt for private healthcare facilities over municipal options for serious illnesses, considering them more reliable, despite government healthcare being perceived as more affordable. About 65% of the community has health insurance coverage.

ii) Recreational - Versova Koliwada's perception of open spaces and public areas diverges from that of typical residential regions in Mumbai. These spaces encompass fronts of houses, streets, alleys, and gaps between buildings, serving as centers for diverse community activities, including fishing tasks, children playing, and social interactions. They enhance community security through natural surveillance, as non-residents stand out amidst daily activities. Many homes keep doors open during the day, blurring public-private boundaries and fostering a semi-public environment that redefines privacy norms. Cultural preservation is crucial in any development plans for Koliwada.

Additionally, religious sites, courtyards, and markets are pivotal for communal gatherings, from fish drying to festivals. Events like the Versova Koli Seafood Festival held at locations such as the House of Charity NGO and the Ganesh Temple, attract visitors citywide. However, formal recreational spaces, such as playgrounds and parks, are notably lacking in Koliwada, underscoring the community's need for improved leisure amenities.

iii) Connectivity: Versova Koliwada has good connectivity to Mumbai via various transportation options, including buses, autorickshaws, and taxis. Figure 8 indicates the existing road network. Key transport hubs include Versova Jetty, Versova Bus Depot, and a bus stop near Masan Devi Temple, offering routes to Andheri Railway Station, Goregaon, and other parts of Greater Mumbai. The nearby Versova Metro Station (2.5 km away) and Andheri West Railway Station (5 km away) further improve accessibility. The jetty offers ferry services to Madh Pathwadi Koliwadas every

5 to 10 minutes but lacks amenities such as proper ramps and restrooms, which impacts its cleanliness and comfort. Buses serve as affordable first-mile connections to metro and railway stations, although their frequency averages 15 to 20 minutes, which affects commuting convenience for residents.

Figure 8. Map showing road hierarchy in Versova Koliwada

3.1.7 Transformation of Land Uses and Real Estate Pressure:

Impact of proposed projects- Projects like the Coastal Road raise significant concerns about their impact on the livelihoods of fishing communities along its route. According to the Environmental Impact Assessment (EIA) report, areas like Cormoval Koliwada are expected to face numerous challenges, including disruptions to local marine ecosystems and changes in sea access dynamics. The recovery of these micro-ecosystems to sustainable fishing levels may take years. The project's environmental impacts are substantial, with anticipated reductions in mangrove habitats that are critical for a variety of fauna, including crabs, shrimp, egrets, herons, kingfishers, spoonbills, ibises, terns, and other species. Furthermore, the construction is expected to disturb approximately 33.37 hectares of mangrove forest land. To mitigate these impacts, the Municipal Corporation of Greater Mumbai (MCGM) plans to undertake compensatory afforestation by replanting three times the number of mangroves in consultation with the Forest Department.

3.2 Gaothan- Chuim Village, Khar-Danda, Mumbai

3.2.1 Introduction and Settlement Pattern

In the 16th and 17th centuries, the Portuguese referred to the village as 'juvkem', later known as Chuim. During the 1940s, it was a small farming hamlet of approximately 70 dwellings. The village was formerly inhabited by Koli fishermen, Christians, Mahars, and Bhangis. Many of the original locals were converted to Catholicism under the Portuguese reign in both the 16th and 17th centuries. The majority of residents now are East Indians, Maharashtrians, and Sunni Muslims.

3.2.2 Land ownership

The entire land of Gaothans has been divided into various CTS numbers (City Title Survey Numbers), which are represented in DP 2034. It is understood that the CTS no. and associated land belong to a private entity. As a result, ownership is solely with the private owner. During an interview with a resident of the urban village, Mr. Rudolph Alves (76 years old) stated that the first house no. 1A in Chuim Gaothan is his ancestral home. The government owns utilities and amenities in the area.

3.2.3 Housing and Structural Conditions

The architecture is a mix of Portuguese and Koli-style cottages. Chuim has a few 150- to 200-year-old traditional bungalows, Figure 9. Currently, these structures require repairs and frequent maintenance. Individual structures of Chuim Village have been marked as Grade-III heritage structures. Figure 10 show the footprint of the different type of buildings based on their type of construction. The land use has transitioned from residential to mixed-use, featuring rental options for tenants, cafés, boutiques, homestays, and youth hostels. These rental flats are reasonably priced, especially compared to the vicinity of Bandra and Khar.

3.2.4 Occupational Pattern

Earlier, until the 1950s, the Koli residents were primarily involved in fishing. The Maratha Kubis were farmers and cultivators. Chuim's women were sewers who made garments for their families and fisherman folks in the neighbourhood. The majority of the inhabitants now commute to the city for work.

Figure 9. Old bungalow, Chuim Village

Figure 10. Type of construction in Chuim village

3.2.5 Utilities

i) Water Supply: In the past, some houses had access to a water connection. There were five wells in various areas, and those who could not afford the connections drew their water from these wells. Water was accessible for ancillary purposes from the Chuim Tank. The BMC H/W Department now manages water distribution in the Chuim gaothan.

ii) Sanitation and Stormwater Management: The BMC SP Department manages sewage collection through subterranean pipelines. Few houses have stormwater pipes to collect rooftop water, but it is not disposed of or processed for reuse. No system is designed for stormwater management or rainwater collection in the neighbourhood.

iii) Solid Waste Management: Bins are provided in the neighbourhood. The residents allot waste pickers. However, the same system of waste collection is not available at certain parts of Chuim village as indicated in Figure 11.

Figure 11. Solid Waste dumped on the streets of Chuim

3.2.6   Social Amenities

i) Recreational: Chuim has open areas, religious places of worship such as the St. Vincent de Paul Church, Khar, temples, and a gymkhana.

ii) Commercial: Schools, banks, police stations, hospitals, marketplaces, and other essential amenities are all within a 2 km proximity of Chuim village.

iii) Connectivity: Chuim village is accessible by main road networks from various areas of Bandra and the MMR Region. The Gaothan is situated in a strategic location in Mumbai, with well-connected road networks and multiple modes of transportation, including buses, taxis, and autorickshaws. The airport is 5 km away from the settlement.

3.2.7   Transformation of Land Uses and Real Estate Pressure:

i) Concerns regarding the redevelopment work: During the survey visits in 2023, it was observed that ground-floor and one-story structures have been converted into high-rise buildings, as indicated in Figure 12. The owners have renovated the entire structure with permission from the BMC to carry out repair work, as new construction is not permitted in the Gaothan demarcation due to heritage conservation regulations. Figure 13 shows division of different land use present currently at Chuim village.

ii) Threat to the ancestral homes of Chuim: In recent years, urbanization has had a significant impact on the community that lives in these Gaothans. Due to the high land value in crores, local builders and land mafias attempt to acquire the old structures. For years, the developers have tried to mislead and urge the inhabitants to sell their generational properties.
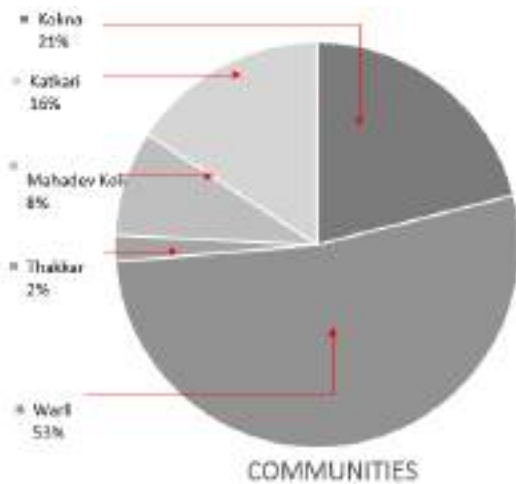

Figure 12. Building Heights, Chuim Village

Figure 13. Land Use, Chuim Village

3.3   Adivasi Pada: Kelti Pada, Aarey Forest, Goregaon Mumbai

3.3.1   Introduction and Regional Setting

There is a total of 27 Adivasi Pada in Aarey Forest and a total of 222 in Mumbai. None have been demarcated and declared as adivasi padas in the development plans of Mumbai. Kelti Pada is one of 27 padas, or hamlets, in the forests of Aarey. There is no demarcation of village or hamlet boundaries made on a micro level. Currently, Adivasi residents across the city have possession rights but lack documentation proving land ownership. The Warli and Konka tribes comprise the majority of the communities in the Adivasi pada. Due to the rapid expansion, it has been noted that the number of non-adivasi living in the padas has increased. Figure 14 shows the percentage of different communities present at Kelti Pada. Buddha, Maratha, Koli, Madrasi, and Banjari are a few of the castes that have begun residing in Mumbai's adivasi padas on a rental basis.

Figure 14. Types of Communities, Kelti Pada

3.3.2 Land ownership

Forest dwellers have the right to hold and reside on forest land under individual or collective ownership for habitation purposes. The forest and its resources provide the best way for tribal people to survive, and many tribes, including women, engage in activities such as agriculture and food collection. Any member of a Scheduled Tribe or Other Traditional Forest Dwellers has the right to cultivate their land for a living. The tribals of Aarey have paid tax to the government at the rate of Rs. 1 per guntha, but the present government has declared them as slum dwellers encroaching on the vicinity.

3.3.3 Housing and Structural Conditions

According to the primary household survey conducted in 2023, Kelti Pada has approximately 80-90 households. The houses are built from local materials, including mud, wood, Karvi reeds, and corrugated sheets, Figure 15. Many people have remodelled their homes as their families have grown.

Figure 15. Warli House, Kelti Pada, Aarey

3.3.4 Occupational Pattern

Earlier, the tribals were solely involved in farming. Due to the growing opportunities in the city, the new generation has shifted from the primary sector to the secondary sector. Figure 16

shows the percentage of occupational diversity at Kelti Pada.

There are businessmen, servicemen, homemakers, retired servicemen, students, and farmers in the padas of Aarey.
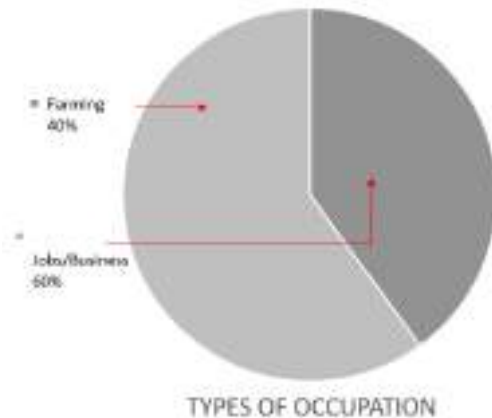

Figure 16. Occupational Pattern, Kelti Pada

Figure 17. Waste Water recycled to use for growing vegetables, Kelti Pada, Aarey

3.3.5 Utilities

i) Water Supply: The BMC HE Pipelines (Local body: Water pipelines) are connected in some houses. The water is available twice a day/ sometimes once a day. The tribals need to rely on alternative sources, such as borewells, community taps, and hand pumps. The water available is fresh and rarely muddy. Tanks, drums, utensils, and barrels are used to store water in the households. The residents store waste water and use the same for watering the vegetables grown at the farmlands. Figure 17 shows one of the open storages of waste water and pumping unit installed for watering purpose by the residents of Kelti pada.

ii) Sanitation and Stormwater Management: During the primary survey (year 2023), open, partially open, and blocked drains were noted. Drains connected to the main sewer system are well connected. The BMC SP Department

delivers water to the location. Individual household toilets, community toilets, septic tanks, and bio-toilets have all been observed. Some difficulties include unsanitary conditions in CT, water shortages, insufficient urinal and seating capacity, a lack of sanitary equipment, and a lack of power. Aarey has no waterlogging concerns due to its high percolation levels.

Individual rooftop drainage pipe networks were found in a few residences. Rainwater collection systems do not exist. Some utensils or objects are intentionally placed to collect rainwater that falls over the roof or pipes. The drainage system is not developed throughout the pads. Household drains become blocked during heavy monsoons.

iii) Waste Management: Every family collects kitchen waste and uses it as organic manure. The tribe does not pay agencies or garbage collectors. It was observed that some residents or non-residents encroaching in the forest area throw their garbage outside. Plastic garbage is dumped on open land, harming forest soil. Due to the lack of a proper disposal system, non-biodegradable Waste is burned, causing air pollution in the city's green zone. Figure 18 shows solid waste dumped near the forest area.

3.3.6 Social Amenities:

i) Recreational: Shiva Temple, Gaondevi Temple, Tapeshwar Mandir, and Picnic Point are some of the open and religious spaces inside the Aarey Forest.

ii) Commercial: There is no allocated market space in Aarey. Female vendors sell forest vegetables and fruits on the roads or near their own houses, which they source from their farms.

Figure 18. Waste dumped, Kelti Pada

iii) Connectivity: Lack of internal connectivity is observed due to the topographical conditions. There are no appropriate roads (semi-pukka/pakka) linking the padas. Main roads are constructed for easy mobility from Aarey, connecting different parts of Mumbai that lack streetlights during night time, resulting in wildlife loss due to road crossing accidents.

3.3.7 Transformation of Land Uses and Real Estate Pressure

i) Transforming Boundaries: Over the years, the original purpose of the milk colony has evolved for various other uses. Following the Aarey Milk Colony project, sponsored by the government, various other projects were being developed without consideration for the ecosystem and legal regulations. This led to the shrinking of the land from its edges after independence, resulting in the loss of Adivasi padas and the community's territorial rights.

ii) Land grabbing: For the past few years, it has been observed that adivasi padas have been notified as slums and shifted to SRA development housing to accommodate new projects within the forest. Failure to address the land tenure and administrative rights of all stakeholders in land development or land reform has caused problems and inequalities. Increase in the number of migrants. Increase in the number of temporary settlements and slums in the forest.

iii) Environmental impact: Reduction of the forest area due to the shift in land uses inside the forest boundaries. Increase in the number of migrants. Increase in the number of temporary settlements and slums in the forest. Pucca houses: The new construction and renovation of houses utilize materials such as RCC, glass, aluminum, and asbestos sheets to build within the forest context. The use of sustainable materials has been reduced.

4.   Results and Suggestions

The study aimed to examine the three case studies and present the following macro-level findings, which are attributed to globalization and the rise in real estate pressure.

4.1   Koliwadas

4.1.1   Environmental degradation

Climate change poses a significant threat to fishing communities and the broader ecological system. Due to expanding infrastructure demands, the CRZ zones do not adequately protect or safeguard the unique ecosystems of coastal and marine areas, thereby affecting the livelihoods of the Kolis. The influence of real estate has resulted in the destruction of

mangroves along the shore owing to solid Waste and chemical effluents produced by the city's residential and industrial zones. The shift of the Hazard Line (HL) has resulted in increased sea levels or High Tide Line (HTL) damage to houses and jetties, as well as an impact on fishing and other coastal operations.

4.1.2 Livelihood damage

Koli and East Indians rely on the seawater and shore for their daily sustenance and survival. These communities have been severely impacted by coastal development projects, artificial fishing methods, large trawlers, as well as water contamination caused by municipal garbage disposal, which have threatened the livelihoods of local fishing communities. These recent issues have resulted in a lack of sustainable fishing practices and a depletion of fish catch along the Mumbai's coastline.

4.2 Gaothans

4.2.1 Illegal encroachments:

The residents staying in the Goathans of Mumbai claim that the heritage Goathan prescient is being converted into slums due to illegal infringe in the area. Due to the lack of strict rules and regulations by the BMC (municipal corporation), development within the existing Goathans' boundary has increased, resulting in high-rise structures with narrow lanes and no conventional setbacks. This has resulted in a risk of mishaps and a low quality of life.

4.3 Adivasi Padas

4.3.1 Rights of Indigenous People

Before the government declared Aarey a forest, tribals made individual and communal claims to forest rights. Due to the government's negligence at the BMC's ward level, the individual and collective forest rights claims submitted by the tribals have not been considered. A recent example is that the municipal corporation declared in a letter that the forest rights claims of the tribals of a pada in Aarey (Habal Pada) have been rejected.

Suppose the government establishes the rights of the land of the tribal in accordance with this proclamation. In that case, the land rights should be immediately handed over to the tribe by taking a tribal resolution in accordance with Article 13(3) of the Constitution. Then, the collective forest rights claims should be approved on all the remaining forests (land used for agricultural purposes by the natives).

4.3.2 Public Participatory Approach: The boundaries of the Adivasi padas should be demarcated in the presence of Adivasis staying in the hamlets.

The forest department and Aarey administration employees are demarcating boundaries in the absence of a native community organization known as the Aarey Lok Samiti. As a result, land uses are changing, and Adivasi padas and their farming lands are being excluded to better suit the needs of local governments. On each Adivasi Pada's hamlet boundary, a Vaghaya (Vaghdev) and a village god (Gaondev) have been placed to protect the hamlet. The border marking should take place.

4.3.3 The Mumbai Development Plan lacks a clear demarcation of Adivasi Padas.

The government has not marked a single Adivasi Pada in the development plan. This is a historical injustice committed against the tribals who have lived in the forests of SGNP and Aarey since before independence. The indigenous are primarily exploited for voting reasons, and the government does not give them basic civic services or government plans to help them survive in the city.

4.3.4 No new developments shall be permitted that will endanger the biodiversity in Aarey

The new developments in the forest region are having a significant impact on the tribal cultural heritage, Warli art, and the overall biodiversity of the ecosystem.

5. Conclusion

Indigenous groups struggle to preserve their traditional livelihoods while preserving their identity in a metropolitan city. The pressures of urbanization lead the younger generation to give up their ancestral lands while rising family sizes cause encroachment in urban villages. However, as the city's real estate demand grows, these villages risk extinction.

It can be seen from the study that the settlements lack basic infrastructure, maintenance, and public facilities, resulting in a look equivalent to slums, which leads to a loss of character and importance.

Due to their traditional lifestyle and working practices, these villages rely on cities just as much as cities rely on them. Since the Real estate market plays a major role in city development, Mumbai's urban villages have undergone

measures such as plot-level redevelopment, as no comprehensive policies have been developed to cater to the diverse settlements separately.

As a result, there has been minimal emphasis on enhancing and maintaining the city's historic image. Local governments must examine and address all these current problems to preserve indigenous settlements while also providing proper urban development and infrastructure planning at the regional level that meets the requirements of such communities. They can also formulate options with public participation for new economic alternatives other than conventional fishing and allied activities.

References

Punekar, Vijaya B. 1959. "*The Son Kolis of Bombay*", Popular Book Depot, Bombay, 1 –5. "Bombay – The Joining of the Seven Islands (1668-1838)." INDIAN CULTURE, http://indianculture. gov.in/stories/bombay-joining-seven-islands-1668-1838.

The Multicultural Origins and History of Bombay's Seven Islands. Hornby Vellard Reclamation Project. The Urban Imagination. https://hum54-15.omeka.fas.harvard.edu/exhibits/show/hornby-vellard/themulticultural-origins-and-.

Nations, First. Terminology. 1 May 2024. https://indigenousfoundations.arts.ubc.ca/terminology/

Enthoven, 1922. "*The Tribes and Castes of Bombay*", Volume II: 243 – 260

Hegde, Sandeep. 2015. "*Son Kolis: The Aboriginal Inhabitants of Bombay (Now Mumbai) in Transition*." DocPlayer, https://docplayer.net/230225722-Son-kolis-the-aboriginal-inhabitants-of-bombay-nowmumbai-in-transition.html.

Survey Report of Adivasi Padas in Brihanmumbai Municipal Corporation & Mumbai Suburban District, Tribal Development Department, Government of Maharashtra, Published 09.05.2005

Conserving the Vernacular Heritage Resources of *Banal* Cultural Landscape of Uttarkashi, Uttarakhand:

Case of Koti, Bakhreti, Gair and Pujeli Banal

Swapnil Gupta[1], Anuradha Chaturvedi [2]

[1]*School of Planning and Architecture, New Delhi, Email: ar.swapnilgupta@gmail.com*
[2] *School of Planning and Architecture, New Delhi*

Abstract: The *Banal* Cultural Landscape, nestled in the *Rawain* Valley of Uttarakhand, represents a unique amalgamation of heritage, resilience, and environmental stewardship. This research delves into the intricate tapestry of the Cultural Landscape of the *Banal* region, focusing on its renowned Earthquake-Resistant Architecture also known as *Koti Banal* Architecture. These architectural marvels stand as testaments to the communities' ingenuity in addressing seismic vulnerability, climatic adaptability, and resource utilisation. Through comprehensive analysis, this research highlights the multifaceted challenges confronting the *Banal* settlements. These challenges range from the morphological decay of settlements to environmental degradation and the abandonment of vernacular earthquake-resistant structures, exacerbated by economic hardships that lead to outmigration. In response, this paper sheds light on a conservation management plan designed to safeguard the *Banal* Cultural Landscape and foster sustainable development. Central to this plan is the delineation of eco-sensitive zones aimed at preserving the region's delicate ecosystem. Furthermore, the designation of the villages as heritage villages is proposed to honour its cultural significance and stimulate local pride and engagement. Moreover, the plan advocates for the proposal of a Cultural Trail as a means to revitalise the local economy while preserving architectural heritage. By promoting rural tourism, small-scale enterprises, or community spaces, the trail aims to generate income opportunities and mitigate the forces driving outmigration. Ultimately, the research advocates for a holistic approach to conservation that balances heritage preservation with socio-economic development and environmental sustainability. Through collaborative efforts and community engagement, the proposed management plan endeavours to ensure the longevity and vitality of the *Banal* Cultural Landscape for generations to come.

Keywords: Himalayas, Cultural Landscape, Vernacular Heritage, Earthquake Resistant Architecture, Seismic Activities.

सार: उत्तराखंड की रवाईं घाटी में बसा बानल सांस्कृतिक परिदृश्य, विरासत, लचीलापन और पर्यावरण संरक्षण का एक अनूठा संगम है। यह शोध बानल क्षेत्र के सांस्कृतिक परिदृश्य की जटिल बनावट पर प्रकाश डालता है, जो इसके प्रसिद्ध भूकंप-रोधी वास्तुकला पर केंद्रित है जिसे कोटि बानल वास्तुकला के रूप में भी जाना जाता है। ये वास्तुशिल्प चमत्कार भूकंपीय भेद्यता, जलवायु अनुकूलनशीलता और संसाधन उपयोग को संबोधित करने में समुदायों की सरलता के प्रमाण हैं। व्यापक विश्लेषण के माध्यम से, यह शोध बानल बस्तियों के सामने आने वाली बहुमुखी चुनौतियों पर प्रकाश डालता है। ये चुनौतियाँ बस्तियों के रूपात्मक क्षय से लेकर पर्यावरणीय क्षरण और स्थानीय भूकंप-रोधी संरचनाओं के परित्याग तक हैं, जो आर्थिक कठिनाइयों के कारण और भी बढ़ जाती हैं जिससे पलायन होता है। जवाब में, यह शोध बानल सांस्कृतिक परिदृश्य की सुरक्षा और सतत विकास को बढ़ावा देने के लिए डिज़ाइन की गई संरक्षण प्रबंधन योजना पर प्रकाश डालता है। इस योजना का केंद्र क्षेत्र के नाजुक पारिस्थितिकी तंत्र को संरक्षित करने के उद्देश्य से पर्यावरण के प्रति संवेदनशील क्षेत्रों का चित्रण है। इसके अलावा, गांवों को विरासत गांवों के रूप में नामित करने का प्रस्ताव इसके सांस्कृतिक महत्व का सम्मान करने और स्थानीय गौरव और जुड़ाव को प्रोत्साहित करने के लिए किया गया है। इसके अलावा, योजना वास्तुकला विरासत को संरक्षित करते हुए स्थानीय अर्थव्यवस्था को पुनर्जीवित करने के साधन के रूप में एक सांस्कृतिक पथ के प्रस्ताव की वकालत करती है। ग्रामीण पर्यटन, लघु-स्तरीय उद्यमों या सामुदायिक स्थानों को बढ़ावा देकर, पथ का उद्देश्य आय के अवसर पैदा करना और पलायन को बढ़ावा देने वाली ताकतों को कम करना है। अंततः, शोध संरक्षण के लिए एक समग्र दृष्टिकोण की वकालत करता है जो सामाजिक-आर्थिक विकास और पर्यावरणीय स्थिरता के साथ विरासत संरक्षण को संतुलित करता है। सहयोगी प्रयासों और सामुदायिक जुड़ाव के माध्यम से, प्रस्तावित प्रबंधन योजना आने वाली पीढ़ियों के लिए बानल सांस्कृतिक परिदृश्य की दीर्घायु और जीवन शक्ति सुनिश्चित करने का प्रयास करती है।

मुख्य शब्द: हिमालय, सांस्कृतिक परिदृश्य, स्थानीय विरासत, भूकंप प्रतिरोधी वास्तुकला, भूकंपीय गतिविधियाँ।

1. Introduction

Banal Cultural landscape is a part of *Rawain* Valley (a valley between the Tons and Yamuna River), which is in the western part of the state of Uttarakhand in Uttarkashi district. *Banal Gad* is one of the tributaries of the Yamuna River which is an integral part of the *Banal* Cultural Landscape. The 12 settlements of the *Banal* region are along the *Banal Gad*.

The region is connected with the National Highway *507* through a motorable road. The major town nearest to the region is *Barkot*, located 25 km away. The region has been the epicentre of three Earthquakes in the past 20 years, and an active fault line lies within a10 km radius of the site, making it vulnerable to further seismic activity.

The pressing challenges facing the *Banal* settlements, including morphological decay, environmental degradation, and economic migration, underscore the urgency for intervention. By addressing these issues through a comprehensive conservation management plan, the study seeks to preserve not only the architectural heritage but also the socio-economic fabric and ecological integrity of the landscape.

The vision for this study is to catalyse a transformative approach towards the *Banal*

Cultural Landscape, envisioning a future where cultural heritage is preserved, environmental sustainability is upheld, and communities thrive. Through innovative conservation strategies and community-driven initiatives, the thesis aims to foster a sense of pride and ownership among inhabitants while creating opportunities for sustainable economic development. By embracing a holistic vision that integrates heritage preservation, socio-economic empowerment, and ecological stewardship

Figure 1. Physiographical Map of India Highlighting State of Uttarakhand (Source: USGS & Author)

Figure 2. Map of Uttarakhand Highlighting Rawain Valley and Banal Cultural Landscape (Source: USGS & Author

2. Historical Background

2.1   Natural History

The Indian subcontinent is known for its diverse landscapes, which can be classified into Six distinct geographical zones, each exhibiting unique geological features and environmental conditions. The Himalayas, one of these zones, stand out as a defining symbol of India's geographical heritage. These mountain ranges were formed over millions of years as a result of the collision between the Indian and Eurasian tectonic plates. Within the Himalayas lies the *Banal* Cultural Landscape in Rawain Valley (A valley between Tons & Yamuna River) of the Western Himalayan Range of Uttarakhand.

The Physiographical formation of the *Banal* region dates back to Neoproterozoic Geological time (1 Billion to 538 Million years ago). The Rock Formations of the region includes Phylite, Shale, Dolomite, Tuff and Dolerite (Bhukosh, 2024).

The study area is characterized by numerous meadows situated at an elevation of 2,000 meters and above, surrounded by dense deodar forests and adorned with water springs that give rise to meandering streams. Among these natural features, Surkha Bugyal, situated in the Byanli Deodar forest and near the *Banal* Gad stream (a tributary of the Yamuna River) is the most significant. The biodiversity within this region is notably rich, boasting a diverse array of flora and fauna. More than 300 species of ethno-medicinal plants flourished here, offering a testament to the area's ecological significance. Furthermore, the area served as a habitat for a wide variety of avian and mammalian species. Among the notable inhabitants are the resplendent Monal, the melodious Himalayan Cuckoo bird, the elusive Himalayan Musk Deer, and apex predators such as the Leopard and Cobra, which contributed to the area's ecological balance.

The native trees of the area include Deodar which grows from 1,200 to 3,050 m, being most common between 1,800 and 2,600 m. The

altitudinal range of what may be termed the deodar belt is usually higher on the southern than on the northern slopes. The pure forests are especially typical of the inner dry valleys. The tree grows best and reaches its largest dimensions in cool northern aspects (Tiwari 1995).

Deodar is locally known as "Devdar" locally and is considered sacred. The timber is now used only for religious activities and the construction of temples. The other common species found in the area of study are *Banjh* Oak and Walnut, which grow at the elevation of 1,300 m to 1,700 m. These two species are found near the water streams. *Banjh* provides fodder for the cattle, and walnut produce is used to sold at the local market.

2.2 Period of Transhumance Pastoralism

From prehistoric times until the 2nd century, the *Khasas* tribe embarked on a significant eastward migration from the Northwest Himalayas. Along their journey, they established transit huts strategically positioned along mountain spurs, allowing them to penetrate deep into the mid-Himalayan steppes, Figure 3. This migration marked a pivotal period in the region's demographic and cultural landscape (Saklani 1999).

Figure 3*. Settlement Pattern during the period of Transhumance Pastoralism (Source: Author, Prehistory to 2nd Century)*

Noteworthy Palaeolithic discoveries have shed light on the ancient history of the area. Among these findings are large pebble tools. These artefacts have been unearthed from the Fluvioglacial deposit atop the abandoned Terrace T1 of River Alaknanda near *Dang* village, Srinagar. Additionally, reports of rock shelters in *Dalband (Kumaun)* and *Kimni, Dungri (Chamoli, Garhwal)* provide further evidence of early

human habitation and activity in the region (Saklani 1999).

By the 1st century onwards, the dominance of the *Kunindas* and *Yaudheyas* in Uttarakhand became economically evident through the widespread circulation of coins. One such site of *Purola* stands out for its unique *Yagya* Vedica, reminiscent of a floating *Garuda*. This site not only served as a sacred space but also housed artefacts dating back to the *Sunga-Kushana* period and *Kuninda* coins from the 2nd century B.C. These archaeological finds provide glimpses into the religious and economic practices of ancient communities that inhabited the region, (Saklani 1999).

This era witnessed the flourishing of transhumance pastoralism, a livelihood characterized by seasonal migrations between different altitudes. The *Kol* and *Khasas* communities were integral to the social fabric of the area, migrating from the north-western side of the Himalayas. Their primary livelihood centred around pastoralism, leading a nomadic lifestyle dictated by the seasonal availability of fodder. During summers, they sought refuge in higher altitudes, while winters prompted a migration back to lower altitudes. To accommodate themselves and their livestock, they constructed semi-permanent structures known as *Kharaks* and *Chhans*, characterized by stone walls and thatched roofs. These structures served as vital shelters amidst the rugged terrain, reflecting the resourcefulness and adaptability of ancient inhabitants.

2.3 Period of Sedentary Shift (3rd to 16th Century)

A notable historical gap exists between the 2nd and 12th centuries, during which data and records are sparse, leading to a significant dearth of information regarding this period. This gap poses a challenge for historians and researchers seeking to understand the socio-cultural, political, and economic developments that transpired during these centuries.

The absence of documented evidence leaves a void in the understanding of the events and transitions that must have occurred within the region. Without access to historical records or archaeological findings, it becomes difficult to discern the intricacies of daily life, governance structures, and societal dynamics during this period.
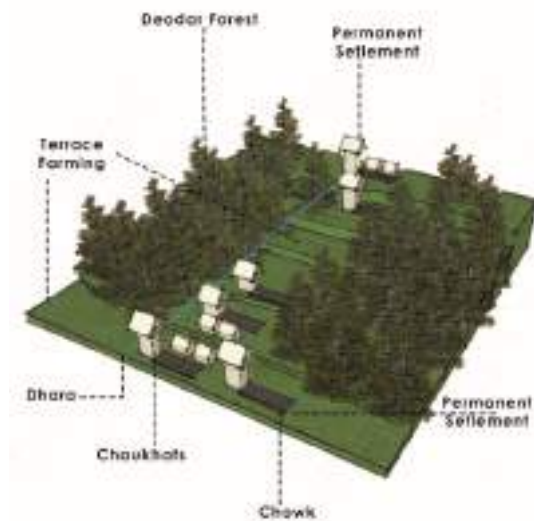
Figure 4. Settlement Pattern during the Period of Sedentary Shift (Source: Author)

Despite the lack of direct historical sources, it is speculated that this period was not devoid of activity or change. Societal evolution, cultural exchanges, and geopolitical shifts likely continued to shape the region, albeit without leaving behind tangible records for posterity.

In 1358, under the leadership of Ajay Pal, minor principalities scattered across the Garhwal region were unified, culminating in the establishment of the Garhwal Kingdom. Ajay Pal's reign marked a significant turning point in the region's history, with Devalgarh serving as the initial capital before being later shifted to Srinagar (Rawat 2017).

A notable evolution during this period was the transformation of traditional *Kharaks* and *Chhans* into permanent building typologies characterized by ground-plus-one (G+1) structures, Figure 4. These structures were ingeniously designed to accommodate livestock on the ground floor while reserving the upper floor for human habitation. Although four-storied and above houses were a rarity, they were primarily accessible to affluent families due to the associated construction costs.

This era also witnessed the zenith of *Koti Banal* Architecture, exemplified by the intricately designed *Sumer* and *Panchpura Chaukhats*. These architectural marvels not only showcased the region's artistic prowess but also served practical functions, including revenue collection. Revenue, often in the form of food grains, was collected and stored within the *Chaukhats*, symbolizing the economic administration under the *Garhwal* Kingdom.

Tax collection was a pervasive practice under the *Garhwal* Kingdom, with appointed officials responsible for the task. Known by various titles, including *Sayana, Thokdar, Kamin,* and *Bodho,* these tax collectors played a crucial role in maintaining the kingdom's fiscal stability.

In the 16th century, the construction of the *Rajgarhi* fort further solidified the kingdom's stronghold. This fortress, utilised by the *Garhwal* Kings for official meetings during their visits, represented both military strength and administrative authority.

These architectural endeavours were characterized by a cribbage wall system, utilising locally available resources such as deodar timber, slates, and mud. This construction method not only ensured structural integrity but also reflected the region's ingenuity in harnessing natural materials.

Amidst these developments, the *Rawanlta* community emerged as the first permanent settlers in the area, migrating from the *Kullu* Valley. This community, comprising *Rajputs, priests, Vishwakarmas,* and *Harijans*, played a pivotal role in shaping the social fabric of the region, contributing to its cultural diversity and resilience.

2.4 Gorkha Invasion (17th Century to 19th Century) and Post Independence

In 1791, the tranquillity of the *Kumaon* and *Garhwal* regions was disrupted when *Gorkha* forces from the Kingdom of Nepal launched an invasion, asserting control over much of the hill country and subduing local *rajas*. During this tumultuous period, the historic *Panchpura Chaukha*t at *Koti Banal* faced a formidable challenge when it came under attack by *Gorkha* forces in the late 1700s. Despite the onslaught, the structure stood resilient, serving as a refuge for the entire village populace.

During this period, infrastructure was developed to enhance the connectivity of the region, facilitating better administration. Construction of bridges over the Yamuna River near Barkot commenced, aiming to connect the region with the other side of the valley.

The *Garhwal* Kingdom, which had maintained its sovereignty from 823 to 1816, eventually became a princely state within the Union of India in August 1949. Following its integration into the Indian Union, there was a notable transformation in the usage of architectural features such as *chaukhats*, which transitioned into residential units. These

structures became occupied by families who identified themselves as inheritors of the noble class or the traditional chiefdoms.

The dawn of the 21st century witnessed significant developments in the region, including the formation of Uttarakhand as a state in 2000, marking its separation from the state of Uttar Pradesh.

Barkot emerged as a major town on the banks of the Yamuna owing to its strategic location along the national highway connecting *Yamunotri* with Dehradun and Vikasnagar. With changing times and evolving aspirations, traditional construction methods gave way to concrete structures in many villages.

Factors such as high maintenance costs, inaccessibility issues, and changing lifestyle preferences contributed to this shift. Government schemes such as the Pradhan Mantri Awas Yojana (PMAY) and funds from the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), have facilitated the construction of new residences, albeit often at the expense of preserving vernacular heritage, Figure 5.

Figure 5. Post-Independence Settlement Pattern (Source: Author)

Many vernacular *Chaukhats* were either demolished, with their raw materials sold off or left to decay and fall into dispair. The site faced further trials when it became the epicentre of two earthquakes in 2003 and 2009. Interestingly, while the traditional earthquake-resistant structures remained unscathed, the newer concrete constructions suffered damage, highlighting the resilience of indigenous architectural techniques. There are 257 contemporary structures in the area of study.

Cracks were noticed in 20% of the structures, 5% were highly damaged, whereas only 1 Chaukhat was harmed, which was abandoned in 2000 and has not been maintained since.

Adding to the complexities, the site is situated within a 10-kilometer radius of an active fault line, highlighting the inherent risks associated with its geographical location. Despite these risks, contemporary settlements are emerging along the fault line. The development began once the connectivity of the region improved, making new building materials, such as cement, steel, and brick more readily available compared to traditional vernacular construction materials. In recent years, the region has faced issues of wildfires and deforestation, leading to a water crisis and the abandonment of agricultural land.

Global warming is having a severe impact on the amount of snow and ice, which has profound implications for downstream water availability in both the short and long term, as up to 50% of the average annual river flows are contributed by snow and glacial melting.

Climate change is impacting mountainous regions, such as Uttarkashi, resulting in to unpredictable weather patterns, erratic rainfall, and ecological imbalances. These changes can adversely affect agriculture, water availability, and livelihoods, forcing communities to consider migration as an adaptive strategy.

However, the transition to modern construction methods, spurred by improved connectivity and accessibility to new building materials, has led to a significant shift in the region's architectural landscape. This shift, compounded by environmental challenges such as declining rainfall, wildfires, and global warming, has exacerbated issues like water scarcity and agricultural abandonment. The ongoing struggle between preserving vernacular heritage and adapting to contemporary needs is evident in the face of socio-economic transformations and environmental pressures. As the region continues to develop, it is crucial to strike a balance between modernisation and the preservation of its rich cultural and architectural heritage, ensuring sustainable growth while honouring its historical roots.

3. Analysis of the current state of Heritage Resources on Site

3.1 The Natural System Analysis

The natural system analysis of the study area reveals a diverse array of geographic features, settlement characteristics, and ecological components. Spanning an elevation range from 1,300 m to 2,500m, the terrain exhibits slopes ranging from 10° to 170°, with predominant rock formations including Phyllite, Shale, Dolomite, Tuff, and Dolerite (Bhukosh 2024).

Settlements, strategically perched on slopes with inclinations of 25-30%, rely heavily on water streams, which serve as vital geographical markers as village boundaries.

Integral to the local ecosystem are the Deodar forests, namely *Byanli, Bagari*, and *Kuninda,* which play a crucial role in maintaining the area's ecological balance. Springs originating from these forests are essential water sources for the community, yet deforestation activities have led to a decline in meadows and water springs, posing a significant threat. This decline has led to a decreased in agricultural activities and outmigration, affecting the livelihoods of the majority of the community, which is primarily engaged in farming.

Moreover, these springs contribute to the formation of numerous water streams, which eventually merge into *Banal Gad*, the principal watercourse of the region. Notably, *Banal Gad* serves as one of the vital tributaries of the Yamuna River, underlining the interconnectedness of the local ecosystem with larger water systems.

The area boasts a rich biodiversity and is historically renowned for its ethnomedical practices, which utilise over 200 species of plants. Major native trees such as *Banjh* Oak, Walnut, Pomelo, Apricot, and Peepal contribute to the ecological wealth of the region, providing fodder, fruit, and religious significance.

Furthermore, the seismic history of the region presents another layer of concern. An active fault line within a 10-kilometer radius of the *Banal* region has experienced three earthquakes over the past two decades, indicating significant seismic activity in the area. The lack of adherence to seismic resilient design in modern building practices exacerbates the risk posed by these seismic events, potentially endangering human lives and infrastructure. In recent years, contemporary settlements have been emerging in areas near the Active Fault line.

3.2 Community Analysis

The *Rawanlta* community of the *Banal* Region traces its origins back to the 3rd century, when they migrated from the Kullu Valley of Himachal Pradesh, becoming the pioneering settlers of the area. Their arrival heralded a significant shift from a region inhabited by nomadic groups to one characterised by permanent settlements. Demonstrating a profound understanding of the terrain, the *Rawanlta* people strategically chose sites for construction, utilising locally available materials such as Deodar timber, stone, and mud. This resourcefulness in building techniques attests to their close relationship with the environment and their ability to adapt to and thrive in their surroundings.

The religious and cultural life of the region revolves around the temples dedicated to Raja Raghunath. There are further social divisions within the *Rawanlta* community, Figure 6.
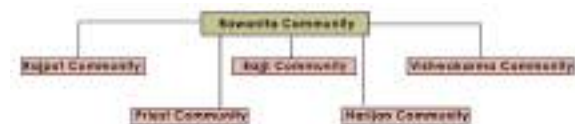

Figure 6. *Social Hierarchy of Rawanlta Community (Source: Author)*

The *Rajput* community primarily resided in the villages of *Koti* and *Bakhreti Banal*. The total population of *Rajput* people is 1316. They are predominantly engaged in agricultural activities and contribute to the cultural fabric of the region by crafting *mashals* for the *Devlang* festival.

The priestly communities of *Pujeli* and *Gair* comprise a total of 554 individuals. They are responsible for conducting rituals at the temples and are also involved in agricultural practices.

The *Bajji* community comprises 167 people who specialise in folk music and dance, adding vibrancy to major festivals such as *Devlang* in *Gair Banal* and *Maha Shivratri* in *Pujeli Banal*. They have a distinct settlement within Pujeli *Banal*.

The *Vishwakarma* community, comprising of 88 people, specialises in woodcraft, particularly for temple renovation, reconstruction, and new construction. However, due to ecological concerns and the inaccessibility of timber, this community is gradually transitioning towards contemporary concrete construction activities. They predominantly reside in *Arun Banal*.

Lastly, the *Harijan* Community, comprising of 157 individuals, primarily engaged in

agricultural activities and cattle herding. They reside in *Koti* and *Gaul Banal*.

Overall, the Rawanlta community's social hierarchy reflects a rich tapestry of cultural diversity and specialisation. Each section of the society plays a vital role in the economic, religious, and cultural life of the Banal Region.

The *Rajput* community traditionally engaged in agricultural activities within the *Banal* Region, faces a significant challenge as agricultural productivity decline. This decline has prompted members of the *Rajput* community to seek better economic opportunities in nearby towns. Consequently, many are now migrating away from their ancestral farmlands, leaving behind not only their agricultural practices but also valuable heritage resources.

The exodus of the *Rajput* community poses a dual threat to the region's cultural and economic sustainability. Not only does it signify a loss of traditional farming practices that have been integral to the community's identity for generations, but it also leaves farmlands abandoned, potentially leading to land degradation and loss of biodiversity. Moreover, the departure of the *Rajput* community further disrupts the social fabric of the region, impacting community cohesion and cultural continuity.

Another pressing issue facing the *Banal* Region is the erosion of traditional knowledge systems associated with building crafts. In particular, the young wooden craftsmen of *Arun Banal*, who have inherited the age-old craft of woodwork, are increasingly shifting their focus towards contemporary building construction methods. This transition represents a departure from centuries-old practices deeply rooted in the region's cultural heritage. The loss of traditional building crafts not only diminishes the aesthetic value of architectural heritage but also undermines the sustainable use of local resources. Moreover, it jeopardizes the transmission of invaluable skills and knowledge to future generations, further exacerbating the erosion of cultural identity and community resilience. Urgent efforts are needed to preserve and promote traditional crafts, ensuring their continuity as integral components of the *Banal* Region's cultural heritage and economic vitality.

3.4   Bulit and Open Space Analysis

Shelter is undeniably a foundational human requirement, particularly so in the *Banal* Region, where the unique terrain and cultural dynamics intersect to shape its architectural landscape. Beyond mere functionality, the built heritage resources and open transitional spaces within this region embody a rich tapestry of history, tradition, and social interaction. At the heart of *Banal*'s architectural legacy lies the distinctive *Koti Banal* style, locally known as *Chaukhats*, which not only lends an aesthetic appeal but also boasts seismic resilience—a crucial attribute given the area's susceptibility to earthquakes.

Central to each *Chaukhat* Structure is an open *Chowk* area, serving as a bustling hub for social exchange and practical activities. These spaces facilitate community gatherings, household chores, and post-harvest rituals, embodying the region's vibrant social fabric.

Moreover, public *Chowks* shows dispersed throughout the settlement play integral roles within temple complexes, fostering spiritual ambience and serving as focal points for religious and cultural events. These communal spaces nurture a sense of belonging and shared identity among community members, reinforcing the cohesive fabric of communal life.

The *Koti Banal* architectural style, characterised by its *Chaukhats*, demonstrates meticulous planning and craftsmanship rooted in seismic-resistant principles. These structures, constructed on elevated platforms using locally sourced materials like deodar timber and stone, reflect an advanced understanding of seismic forces. Key design components, such as simple layouts, robust platforms, and strategic use of wooden beams, contribute to the structures' seismic resilience. Incorporating shear keys, small openings, and semi-rigid joints, these buildings effectively minimize torsional forces during earthquakes, ensuring optimal seismic resistance.

Furthermore, the structural capabilities of *Koti Banal* buildings are enhanced by wood's elastoplastic properties, offering superior strength and energy absorption. Wood-frame construction, combined with rigid stone masonry walls, provides high stiffness and ductility, effectively resisting seismic forces, Figure 9. Flexible diaphragms and raised pedestals at the foundation level contribute to effective isolation, consolidating the soil and enhancing seismic resilience.
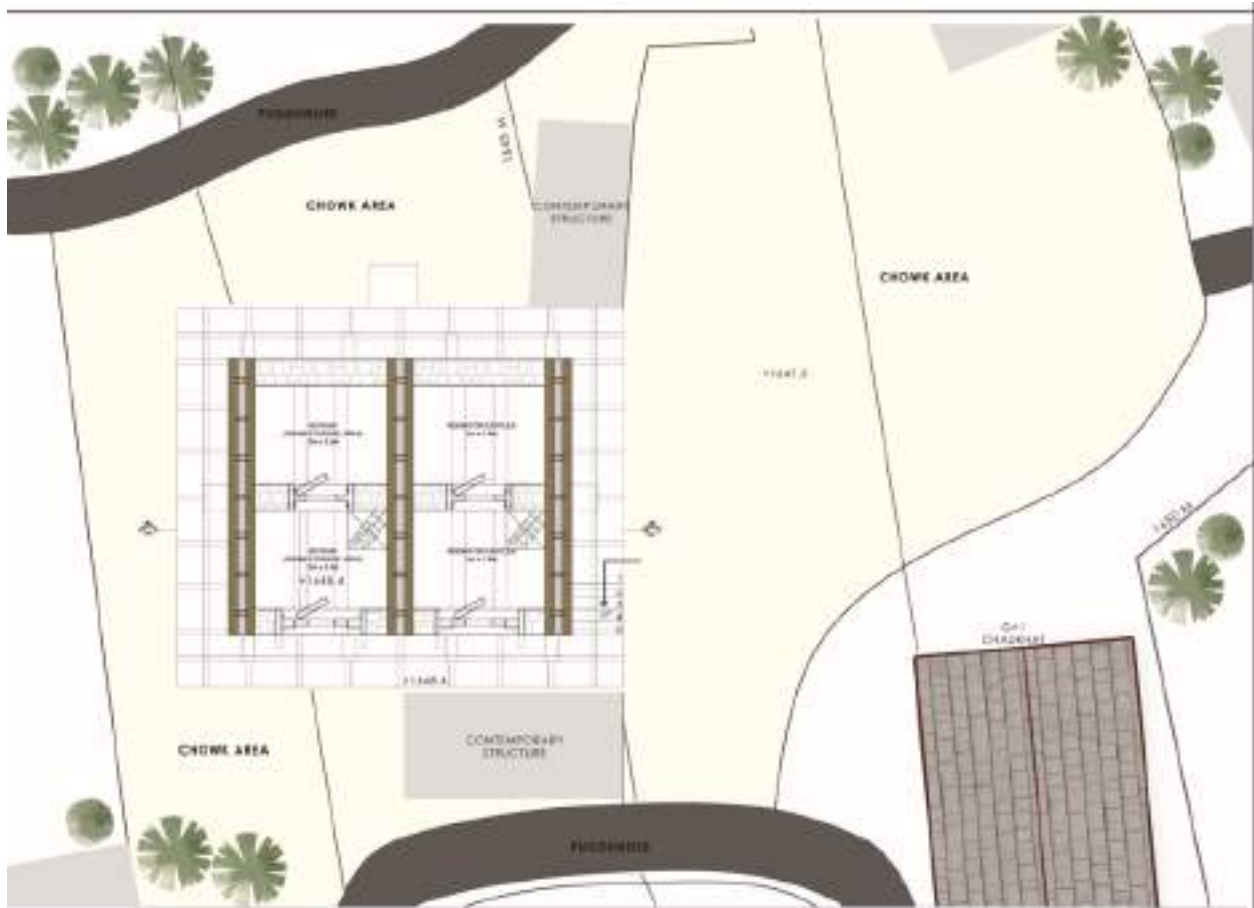
Figure 7. Site Plan of Panchpura Chaukhat along with Chowk area at Koti Banal (Source: Author)
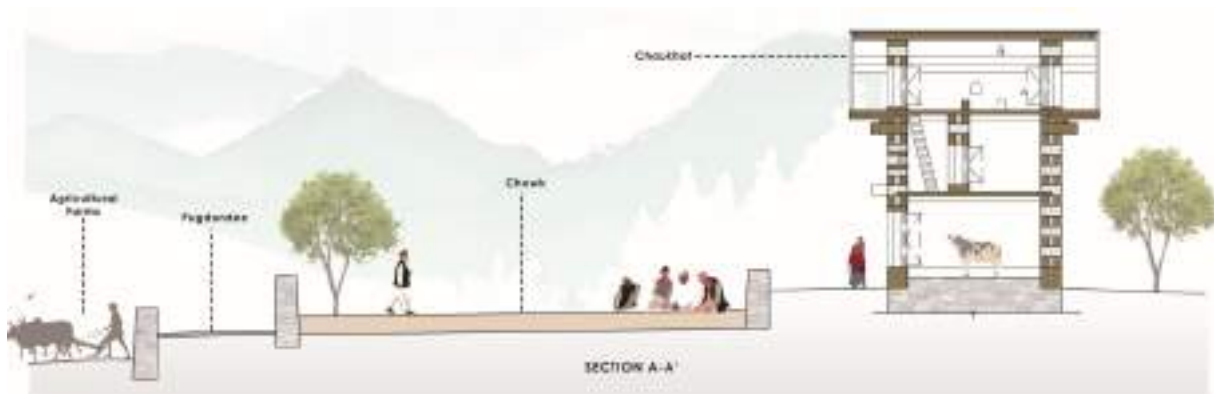

Figure 8. Section of a Chaukhat and the attached Chowk area (Source: Author)
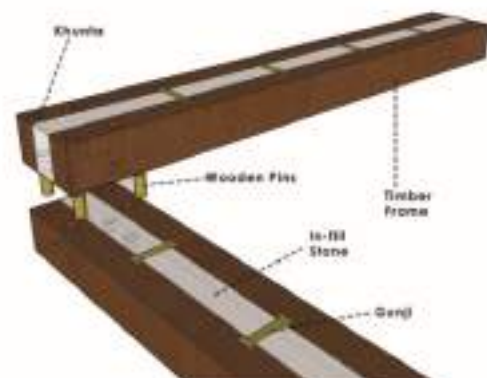

Figure 9. Koti Banal wall construction detail (Source: Author)

Despite their cultural significance, the *Banal* Region faces the challenge of preserving its architectural heritage. Site surveys reveal a dwindling number of *Chaukhats*, attributed to factors such as space constraints, evolving community aspirations, and difficulties in accessing raw materials for maintenance, Figure 10 and 11. The diminishing presence of *Chaukhats* not only signifies the physical loss of architectural treasures but also highlights the gradual erosion of traditional building practices and cultural heritage. Members of the community are now opting to construct new residences using contemporary materials such as brick and

cement. As a result, the previously open spaces are being utilised for the construction of these new residential units. This trend reflects a shift towards modern building techniques and signifies a transformation in the architectural fabric of the area.

Figure 10. *Chaukhats and attached Chowk Area (Source: Author)*

Figure 11. *3D-Model of the Structural system of the Panchpura Chaukhat (Source: Author)*

4. Issues Identification

4.1 Regional Level Issues

4.1.1 Environmental Degradation

Environmental degradation has emerged as a pressing concern in the *Banal* Region, characterised by the loss of biodiversity and the depletion of vital water springs and meadows. This degradation is primarily attributed to the escalation of deforestation and forest fires, driven by various factors, including unsustainable land use practices and climate change. The loss of biodiversity not only disrupts fragile ecosystems but also undermines the region's resilience to environmental stressors. Furthermore, the depletion of water springs and meadows poses a direct threat to the livelihoods of local communities reliant on agriculture and pastoralism.

Deforestation Activities: A 2021 report by the Uttarakhand Pollution Control Board (UEPCB) highlights the rampant deforestation in Uttarkashi. This leads to the widespread clearing of forested areas.

Forest Fires: The hilly terrain and dry weather conditions make Uttarkashi prone to frequent forest fires. These fires devastate large areas of woodland and wildlife habitats.

As per the information provided by the DFO of the area of study in the year 2023, 72 incidents of forest fires were reported in the reserve forest area, affecting 56 ha of land, whereas in the non-reserved forest, 66.53 ha have been ravaged by 62 reported incidents.

Degradation of Meadows: Overgrazing and unregulated tourism contribute to the degradation of meadows in Uttarkashi district. This not only affects the beauty of the region but also disrupts crucial ecosystems that are essential for biodiversity and services such as water filtration. The majority of streams originate from these meadows, which makes it crucial to conserve them.

Drying Up of Perennial Streams: The UEPCB report also warns about the drying up of perennial streams in the area near Barkot town. Another reason is the seismic activity, which changes the shape and depth of the water springs in the bedrock.

4.1.2 Unsustainable Development

Recent regional development initiatives pose a significant threat by encroaching on floodplains and areas near active fault lines, thereby increasing the risk of severe disasters such as floods and earthquakes. This encroachment raises alarm bells as it not only jeopardizes human settlements and infrastructure but also exacerbates the vulnerability of communities to natural calamities. The potential consequences of such development activities include increased exposure to flooding, landslides, and seismic events, with the potential for widespread devastation and loss of life.

These issues are interconnected. Unsustainable development practices often contribute to environmental degradation, which in turn can hinder future development.

4.1.3 *Consequences of Unsustainable Development*

The potential consequences of this unsustainable development approach are alarming:

i) Increased Flooding: Encroaching on floodplains has exposed settlements to floodwaters, causing widespread damage to property and infrastructure. In 2013, the region got disconnected from *Barkot* due to floods. A lot of agricultural land was washed away in the same year.

ii) Landslides: Deforestation weakens slopes, making them more susceptible to landslides during heavy rains and earthquakes.

iii) Earthquakes: Building near fault lines exposes residents to the direct impact of earthquakes, with a higher risk of building collapse and casualties.

4.2 *Settlement Level Issues*

4.2.1 *Out Migration*

Limited economic opportunities and a decline in agricultural activities due to water scarcity have created a challenging environment for the preservation of historical structures and sites. As inhabitants migrate away from the region in search of better economic prospects, valuable heritage structures are left vulnerable to decay and disrepair.

According to the Rural Development and Migration Commission Report, the district has experienced a substantial decline in population due to people moving to urban areas or other states in search of better livelihoods. This trend has led to socio-economic challenges, including labour shortages and a decline in local agricultural productivity.

The site survey also reveals a concerning trend of out-migration from the district, extending beyond the previously discussed environmental challenges. Limited access to high-quality educational institutions compels younger demographics, a vital segment of any population, to seek superior educational opportunities elsewhere. This dearth of educational facilities acts as a significant push factor for out-migration. Furthermore, the inadequacy of healthcare services in rural regions necessitates the relocation of residents to urban centres with more robust medical infrastructure. Finally, deficiencies in infrastructure, particularly in the realm of transportation networks and communication systems, contribute to resident dissatisfaction. This lack of connectivity fosters a sense of isolation and restricts economic prospects, further incentivizing out-migration towards more developed areas.

4.2.2 *Degradation of Chowks (Open Spaces)*

The once-open spaces of *Chowk* are transforming as contemporary construction methods take precedence, leading to a shift in settlement morphology. This shift is altering the traditional layout and character of the area, marking a significant evolution in its rural landscape.

4.3 *Building Level Issues*

4.3.1 *Loss of Traditional Knowledge System of Building Craft*

The new constructions in this settlement lack responsiveness to climate challenges and are not built to withstand earthquakes, presenting a critical issue. Additionally, the scarcity of natural resources has led to a shift away from traditional construction techniques, resulting in the loss of valuable indigenous knowledge systems.

Based on primary data collected from the site, a settlement comprising 27 families known as *Arun Banal* exists, which has historically been engaged in earthquake-resistant building construction. However, traditional knowledge is now primarily utilized for constructing temples in the region, while the residential typology has shifted towards concrete structures. This shift is attributed partly to the scarcity of employment opportunities, leading craftsmen from *Arun Banal* also to adopt conventional construction techniques. *Naresh Judiyal*, the head craftsman of the village, has over three decades of experience in construction. In 2015, he led a team of eight craftsmen in reconstructing the *Raja Raghunath* Temple at *Gair Banal*, utilising traditional *Koti Banal* Style techniques. However, opportunities for timber construction are now limited to temple construction, occurring once every 15 years, and crafting door and window frames for residential units. Artisans involved in temple construction can earn between Rs. 1,000-1,200 per day. Crafting a single door or window frame commands a fee of Rs. 2,500-3,000. The dearth of economic opportunities in timber construction has prompted many artisans to transition to conventional building construction methods.

Out of the 27 respondents surveyed, 80% are aware of the traditional knowledge system of building craft in the region, with 75% expressing willingness to continue practising earthquake resistant construction methods. The custodians serve as essential guardians of the traditional

knowledge system underpinning earthquake-resistant *Koti Banal* architecture. Yet, a significant hurdle they encounter is the limited accessibility to timber, controlled by the forest department through strict regulations and a slow process of cultivation and sale. While this regulation is essential for safeguarding the environmental integrity of the region, it poses challenges for those seeking to uphold traditional building practices. Additionally, the high cost of Deodar timber further compounds the issue. Currently priced at Rs. 3000 per sleeper member, measuring 2'x7', Deodar timber is financially burdensome for many individuals and communities, hindering their ability to procure and employ it in construction projects.

4.3.2 Abandonment of Chaukhats and Lack of Maintenance

The traditional built heritage of *Banal* faces significant challenges due to a critical lack of maintenance guidelines. Without clear preservation directives, these architectural treasures risk neglect and deterioration. Many historical structures in *Banal*, which represent unique architectural styles and cultural history, are in dire need of conservation. The absence of standardized maintenance protocols exacerbates the problem, as unplanned or inappropriate interventions can further damage these structures. Additionally, limited funding and resources for heritage conservation contribute to the ongoing risk of losing these invaluable cultural assets.

Currently, 25 *Chaukhats* remain in the villages of *Pujeli, Gair, Koti,* and *Bakhreti Banal.* Out of these, 16 are abandoned and not in use, with two of them being structurally unstable. The remaining nine occupied *Chaukhats* are maintained annually during the *Devlang* festival, which has helped in the upkeep of these structures. Regular maintenance during this festival plays a crucial role in preserving the heritage of *Chaukhats.*

According to the onsite survey, in the past 10 years, 12 *Chaukhats* in *Arun Banal* have been demolished for new construction. In *Koti Banal*, five *Chaukhats* have been demolished, and in *Bakhreti Banal,* three *Chaukhats* have been taken down for new developments.

5. Proposals

5.1 Regional Level Proposals

i) Delineation of Eco-Sensitive Zones and Establishment of a Policy Framework for these Zones.

- Defining the boundary of Eco-Sensitive Zones
- Defining the Buffer area around Eco-Sensitive Zones
- Regulation for the zones focused on Management guidelines, restricted activities, and conservation initiatives.

ii) A proposal for implementing Social Forestry activities in the region aims to replenish groundwater for better spring management. Additionally, engaging in social forestry will address the challenge of limited access to timber for crafting buildings.

5.2 Settlement Level Proposals

i) Proposal of Heritage Villages

Proposing *Koti Banal*, Bakhreti *Banal*, Gair *Banal,* and Pujeli *Banal* as Heritage Villages
These villages will be officially designated as Heritage Villages, recognising their historical significance and cultural heritage.

ii) Proposal of Home Stays and Cultural Trails integrated the open and built heritage resources.

5.3 Building Level Proposals

i) Sustainable Construction and Indigenous Knowledge Revitalisation Initiative

Research and development initiatives aimed at exploring innovative and sustainable construction technologies suited to the local context.

ii) Development of Maintenance Manual

Collaborate with local communities, experts, and stakeholders to develop a comprehensive maintenance manual for heritage resources in *Banal*.

This manual will provide clear directives and guidelines for the preservation, upkeep, and restoration of *Chaukhats* and other traditional built structures, ensuring their longevity and cultural significance.

6. Conclusion

The *Banal* Cultural Landscape, with its *Koti Banal* architecture, stands as a powerful testament to human ingenuity and adaptation. This research has explored the intricate tapestry

of this cultural landscape, highlighting its unique heritage, resilience, and the pressing challenges it faces. While morphological decay, environmental degradation, and outmigration threaten the *Banal* way of life, this study proposes a multifaceted conservation management plan to ensure its longevity.

This plan strikes a balance between safeguarding cultural heritage and promoting sustainable development. The delineation of eco-sensitive zones protects the delicate ecosystem, while the designation of heritage villages fosters local pride and engagement. Moreover, the Cultural Trail breathes new life into the region by promoting responsible tourism, small-scale enterprises, and community spaces. These initiatives will create income opportunities, mitigate outmigration, and revitalize the local economy.

Ultimately, the success of this plan hinges on collaboration. Engaging with the community is paramount, ensuring their voices and needs are central to the conservation efforts. By fostering a sense of ownership and responsibility, the *Banal* community can become active stewards of their unique cultural landscape. This holistic approach, which integrates heritage preservation, socio-economic development, and environmental sustainability, has the potential to secure a brighter future for the *Banal* Cultural Landscape for generations to come. The enduring spirit of *Koti Banal* architecture serves as an inspiration, demonstrating the power of human ingenuity when communities come together to protect their heritage and build a sustainable future.

References

Gazetteers

Atkinson, Edwin Thomas. 1881-86. *The Himalayan Gazetteer (Vol 1, 2, 3)*. New Delhi: Cosmo Publication, 1980 edition.

Walton, H. G. 1910. *A Gazetteer of Garhwal Himalaya*, 1989 edition. Dehradun: Natraj Publishers.

Chopra, P. N. et al. 1979. *Uttar Pradesh, District Gazetteer: Uttarkashi.* Allahabad: Government Press.

Books

Bahadur, Rai Pati Ram. 1916. *Garhwal: Ancient and Modern*. Simla: Army Press.

Baluni, Dinesh. 2021. *Seemant Janpad Uttarkashi: Etihas aur Samaj.* Dehradun: Samaya Sakshaya Prakshan.

Dave, Bharat, Jay Thakkar, Mansi Shah. 2013. *Pratha: Kath Khuni Architecture of Himachal Pradesh*. Ahmedabad: SID Research Cell, CEPT University.

Handa, Omacanda C. 2001. *Temple Architecture of the Western Himalaya: Wooden Temples.* New Delhi*:* Indus Publishing Company.

Handa, Omacanda C. 2010. *Himalayan Traditional Architecture: With special reference to the Western Himalayan Region*. Chennai: Infinity Foundation India.

Rawat, Ajay Singh. 2002. *Garhwal Himalayas: A Study in Historical Perspective*. New Delhi: Indus Publishing Company.

Rawat, Dinesh. 2021. *Rawain ke Devalay ewam Devgathaye.* Dehradun: Samaya Sakshaya Prakshan.

Saklani, P. M. 1999. *Ethnoarchaeology of Yamuna Valley*. New Delhi: Pratibha Prakashan.

Thakkar, Jay and Skye Morrison. 2008. *Matra: Ways of Measuring Vernacular Built Forms of Himachal Pradesh.* Ahmedabad: SID Research Cell, CEPT University.

Tiwari, D. N. 1994. Monograph on Deodar (Cedrus deodara Roxb. G. Don). Dehradun: International Book Distributors.

Tripathi, Tara Chandra. 2012. Historical Geography of the Central Himalayan Kingdom. Nainital: Gyanodaya Prakashan.

Uniyal, Hema. 2020. *Jaunsar-Bawar,Rawain-Jaunpur: samaj, sanskriti, vaastushilp evm paryatan*. Dehradun: Uttara Books.

IS Codes

BIS 1993. IS 13828: *Improving earthquake resistance of low strength masonry buildings — guidelines*. New Delhi: Bureau of Indian Standards.

BIS 2003. IS 4326: *Earthquake resistant design and construction of buildings — code of practice*. New Delhi: Bureau of Indian Standards.

BIS 2016. IS 1893: *Criteria of Earthquake Resistant Design of Structures*. New Delhi: Bureau of Indian Standards.

Theses

Rawat Nagendra Singh. 2017. *An ethnographic, Archaeological and Geo-Informatics Study of Medieval Garhs/Forts of Garhwal Himalaya: A study in Politico-Geographic Perspective*. Thesis submitted to H.N.B Garhwal University, Srinagar, for the Award of Ph.D. Degree in History and Archaeology. http://hdl.handle.net/10603/397133

Zanden M. L. van der 2018. *Assessment of the seismic performance and sustainability of the Kath-Kuni building style in the Indian Himalaya.* Master thesis, TU Delft and IIT Roorkee https://resolver.tudelft.nl/uuid:6eeaa0c7-8d00-4a8e-ae80-79f6abf050bc

Conference Proceedings

Arya, Aanad S. 2000. "Non-engineered construction in developing countries –an approach toward earthquake risk prediction." In Proceedings of 12th WCEE.

Ceylan Aygul, and Z. Canan Girgin. 2014. "Earthquake Resistant Design and Sustainability Through Wooden Composites in Multi-Storey Structures." Second European Conference on

Earthquake Engineering and Seismology, Istanbul Aug. 25-29.

Hughes, Richard. 2015. *Cator and Cribbage construction of Northern Pakistan.* Proceedings of the International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey.

Popovski Marjan and Erol Karacabeyli. 2012. "Seismic Behaviour of Cross-Laminated Timber Structures." In Proceedings of 15th WCEE Lisbon

Sinha Ravi, Svetlana Brzev, Gayatri Kharel. 2004. "Indigenous Earthquake-Resistant Technologies – An Overview." In Proceedings of 13th World Conference on Earthquake Engineering, August 1-6, Vancouver, Canada, paper no. 5053.

Journal

Das Rishiraj. 2001. "Standing Firm: Traditional Aseismic Architecture in the Western-Central Himalayas." Dehra Doon: People's Science Institute.

Kumar, Ashwani, Pushplata. 2013. "Vernacular practices: as a basis for formulating building regulations for hilly areas." *International Journal of Sustainable Built Environment*, 2 (2): 183-192.

Rautela, Piyoosh, Girish Chandra Joshi, Yogendra Singh, Dominik Lang. 2008. "Timber-reinforced Stone Masonry (Koti Banal Architecture) of Uttarakhand and Himachal Pradesh, Northern India." In World Housing Encyclopedia: an Encyclopedia of Housing Construction in Seismically Active Areas of the World.

Rautela, Piyoosh. 2015. "Traditional Practices of the people of Uttarakhand Himalaya in India and relevance of the these in disaster risk reduction in present times." *International Journal of Disaster Risk Reduction,* 13: 281-290.

Rawat N. S., T. Brughmans, V. Nautiyal, D. Chauniyal. 2020. *Networked medieval strongholds in Garhwal Himalaya, India.* Denmark: Aarhus University.

Saklani P. M., V. Nautiyal, K. P. Nautiyal. 1999. *Sumer, Earthquake Resistant Structures in the Yamuna Valley, Garhwal Himalaya*, India. South Asian Studies

Research Papers

Langenbach, Randolph. 2015. "The earthquake resistant vernacular architecture in the Himalayas." In Correia, Lourenço and Varum (Eds) 2015. *Seismic Retrofitting: Learning from Vernacular Architecture* –London: Taylor & Francis Group. ISBN 978-1-138-02892-0

Report

Rautela, Piyoosh, G. Joshi. 2007. *Earthquake Safe Koti Banal Architecture of Uttarakhand, India.* Disaster Mitigation and Management Centre Department of Disaster Management Government of Uttarakhand

Magazine

Dhobekar, Namrata and Janmejoy Gupta. 2022. "Traditional Knowledge Systems help in creating Sustainable and Resilient Communities: Lessons from the hilly Garhwal region for the world." *Kalpa | RVCA Annual Magazine*, 3: 4-12.

Maps

Topo sheet 53J/1, Survey of India map, 1968 and 2005

Geological Survey of India Maps, Bhukosh Portal

Conservation strategies of the Fort Complex:

Case of Gingee Fort, Tamil Nadu

H Porani Abiraami

School of Planning and Architecture, New Delhi, Email: maghaa98hari@gmail.com

Abstract: Forts represent a significant aspect of military history, constructed with the purpose to safeguard power and cities, reflecting the pride and strength of the people and their rulers. This paper delves into the military landscape of Gingee Fort in Tamil Nadu, highlighting its historical significance and architectural ingenuity within the context of the Deccan region. Despite its recognized importance, the fort currently faces challenges, particularly inadequate conservation efforts that could ensure a vibrant future. This research aims to position Gingee Fort as a globally significant example of military architecture by developing conservation strategies. The primary objective of this research is to comprehensively understand the integration and evolution of Gingee Fort's natural and designed military landscape, as well as its functional role within the regional context. The research employs a methodical four-stage approach, commencing with a review of the historical context to establish a foundational map and timeline. This is followed by on-site inspections and the gathering of data to create a map of heritage resources. Key findings highlight the fort's distinctive architectural synthesis and its pivotal role in regional defense. The final stage proposes a master plan for sustainable development, conservation guidelines, and a management framework to preserve the fort's historical integrity while emphasizing the importance of promoting local traditions and environmental sustainability. The study underscores the significance of integrating cultural heritage conservation with modern developmental needs, aiming to establish Gingee Fort as a vibrant and enduring landmark of global importance.

Keywords: Fort Architecture, Military Landscape, Gingee Hill Fort, Sustainable Conservation Practices.

सार: किले सैन्य इतिहास के एक महत्वपूर्ण पहलू का प्रतिनिधित्व करते हैं, जिनका निर्माण सत्ता और शहरों की सुरक्षा के उद्देश्य से किया गया है, जो लोगों और उनके शासकों के गौरव और ताकत को दर्शाते हैं। यह पेपर तमिलनाडु में जिंजी किले के सैन्य परिदृश्य पर प्रकाश डालता है, और दक्कन क्षेत्र के संदर्भ में इसके ऐतिहासिक महत्व और वास्तुशिल्प प्रतिभा पर प्रकाश डालता है। अपने मान्यता प्राप्त महत्व के बावजूद, किला वर्तमान में अपर्याप्त संरक्षण प्रयासों और जीवंतता की कमी जैसी चुनौतियों का सामना कर रहा है। इस शोध का उद्देश्य संरक्षण रणनीतियों को विकसित करके जिंजी किले को विश्व स्तर पर महत्वपूर्ण स्मारक के रूप में स्थापित करना है जो इसके स्थायी भविष्य को सुनिश्चित करता है। इस शोध का प्राथमिक उद्देश्य जिंजी किले के प्राकृतिक और डिजाइन किए गए सैन्य परिदृश्य के एकीकरण और विकास और क्षेत्रीय संदर्भ में इसकी कार्यात्मक भूमिका को व्यापक रूप से समझना है। अनुसंधान एक व्यवस्थित चार-चरणीय दृष्टिकोण का उपयोग करता है, जो एक मूलभूत मानचित्र और समयरेखा स्थापित करने के लिए ऐतिहासिक संदर्भ की समीक्षा के साथ शुरू होता है, बाद में विरासत संसाधनों के मानचित्र के लिए साइट पर निरीक्षण और डेटा एकत्र करता है। मुख्य निष्कर्ष किले के अद्वितीय वास्तुशिल्प संश्लेषण और क्षेत्रीय रक्षा में इसकी महत्वपूर्ण भूमिका का संकेत देते हैं। अंतिम चरण में स्थानीय परंपराओं और पर्यावरणीय स्थिरता को बढ़ावा देने के महत्व पर जोर देते हुए किले की ऐतिहासिक अखंडता को संरक्षित करने के लिए सतत विकास, संरक्षण दिशानिर्देश और एक प्रबंधन ढांचे के लिए एक मास्टर प्लान का प्रस्ताव दिया गया है। अध्ययन आधुनिक विकासात्मक आवश्यकताओं के साथ सांस्कृतिक विरासत संरक्षण को एकीकृत करने के महत्व को रेखांकित करता है, जिसका लक्ष्य जिंजी किले को वैश्विक महत्व के एक जीवंत और स्थायी मील के पत्थर के रूप में स्थापित करना है।

मुख्य शब्द: किले की वास्तुकला, सैन्य परिदृश्य, जिंजी हिल किला, सतत संरक्षण प्रथाएँ

1. Introduction

Gingee is located between the Javadi Hills and Shervoy Hills, which are part of the Eastern Ghats in Tamil Nadu. The strategic location connects the area of the fort to the Mysore plateau, and the region is bounded by River Palar to the North, River Pennar to the South, and Bay of Bengal to the East (Figure 1).

The Sankaraparani river surrounds the hills, providing water for sustenance and as a defense element. The fort is surrounded by Dry Evergreen Forest for protection (Muruganandam S, 2016). It has been under the custodianship of the Archaeological Survey of India since 1914. Today, Gingee is a town panchayat situated in the Villupuram district of Tamilnadu, Figure 2, approximately 190 km away from Chennai.

Figure 1. South India map showing the location of Gingee (Source: Wikipedia)

Figure 2. Gingee in Villupuram district (Source: GISNIC-TNSU)

Gingee, initially known as Singapuram, is a town named after the Pallava king Singavaraman (Pillai 1952, Achari 1943). This could also be derived from the word 'Sanjivi,' a kind of elixir that Lord Hanuman took from the Himalayas to Sri Lanka, which is said to have fallen here. Another is 'srngin,' which means peaked, horned, and crested in Sanskrit (Deloche 2005).

The Gingee Fort (Figure 3) was a formidable stronghold in Southern India (Toy 1957). The fortified complex consists of three main hills and five zones — Rajagiri (Fort Zone) with two hillocks, Kunnikundru and Kuttarisikundru, Krishnagiri (Religious Zone), Chandrayan durgam (Cantonment Zone), and outpost zones Kurangu Durgam and Kusudurgam, along with the central Fortified Palatial Zone and Fortified City (Deloche 2005).

Figure 3: Gingee Fort (Source Author)

The valley between these hills is home to the Palace and City, accessible through Vellore, Pettah, and Vettavalam gates on the west, east, and south, respectively (Pillai 1952). Surrounding the landscape is a fortification wall, complemented by a moat, which unifies the complex's defenses. The Fort's water management system includes 'Cunai,', 'Eris,' 'Kulams,' 'Agazhi,' and earthen pipes channeling river water (Deloche 2005). Rajagiri's natural impregnability is enhanced by its separation from the upper plateau by a narrow cliff, symbolizing the fusion of natural and man-made defenses (Figure 4).

The historical background and the evolution of the fort from the tenth to the seventeenth century emerges in key works of literature. Scholars such as Narayana Pillai in 'Carnatic Rajakal Kavistana Charitham, 1952' and C.S. Achari 'History of Gingee and its Rulers, 1943 have detailed the contribution of the rulers to the fort complex and making it one of the unconquerable strongholds in the Southern part of the Subcontinent. Alf Hiltebeitel's investigation of Gingee in 'The cult of Draupadi: from Gingee to Kurukshetra, 1988' and Krishnamurthy's 'Senji pagudiyil samanam, 1994' on the Jainism in the region provide an additional layer to our comprehension of its historical and spiritual importance. George Michel's 'The Vijayanagara Courtly Style, 1992' gives the architectural influence of the structures in the fort. Jean Deloche, in his book 'Senji (Gingi) Ville fortifie'e du pays Tamoul (Senji, a fortified city in the Tamil country, 2005,' delivers its construction, strategic significance, and cultural relevance.

The methodology was structured into four stages, as shown in Figure 5. In the initial stage, an in-depth understanding of the site's historical and regional context was developed by reviewing available publications and generating a base map, historical timeline, and an overview of the fort complex's evolution. Questionnaires were also prepared for residents and tourists. The second stage involved a rigorous on-site study, documentation, conducting interviews with locals, and gathering data on foot traffic and existing management systems. This stage resulted in the creation of a heritage resource map. The third stage focused on analysis, where various parameters were mapped and examined using GIS tools to identify interconnections and key issues. The final stage involved proposing a development plan for the military landscape, establishing conservation guidelines, and outlining a management framework for sustainable preservation and development.

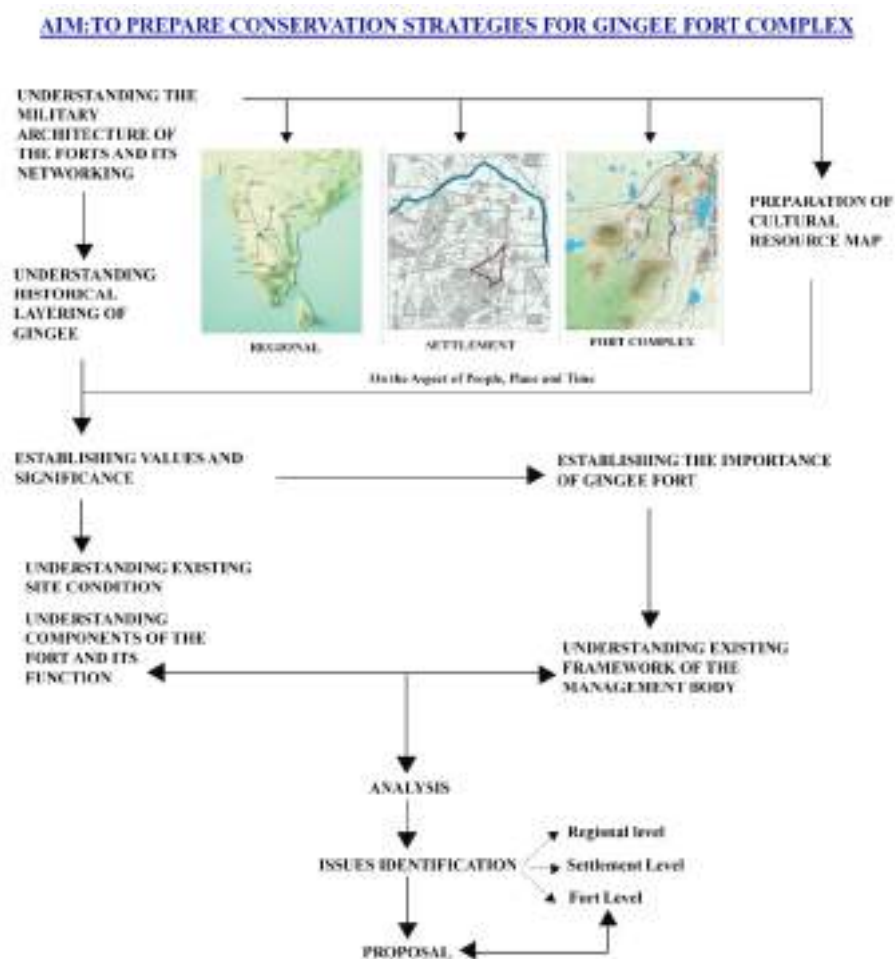**Figure 4**. Gingee Fort, 3D model (Source: Author, Generated in QGIS)

Figure 5. Methodology of research

2. The Natural Landscape as a Defense System in Gingee

Gingee's natural history is distinguished by its unique topography, which includes dissected hills, valleys, and geological formations such as pediments and migmatites, (Figure 6, Bhuvan 2023), resulting from tectonic activity, erosion, and weathering (Jaiswal 2022).

Comprising The hydrology of the region is delineated by the Varahanadhi basin, Figure 7 (Water resource organisation 2019), where the Gingee River plays a vital role in drainage, water supply, and historical defense. Both surface and groundwater sources are utilized in the area, with natural springs and man-made reservoirs, which support life within the fortress and enhance its resilience during sieges.

Figure 6: Geomorphological map of the Gingee settlement (Source: Bhuvan)

Figure 7: Drainage map of VarahaNadi Basin (Source: PWD)

Figure 8: Section of the Hills showing Natural defense (Source: Author)

The fort is surrounded by Siruvadi and Muttukadu Reserved forests, which boast a wealth of ethnomedicinal plants and biodiversity (Muruganandam 2016) which is the Dry Evergreen Forest, further strengthens Gingee's natural defense system, providing protection and habitation within the fortress, Balachandran (2015).

The land and water of Gingee are deeply intertwined with the deities Vishnu and Shiva, as reflected in the associated legends and folktales of the wild boar and the hill (Hiltebeitel 1988). These stories also underscore the sacredness of the natural features within the landscape. According to oral traditions gathered during fieldwork, Draupadi, along with seven guardian deities, is believed to offer spiritual protection to the fort and its surrounding areas. This is celebrated annually, with rituals performed, Draupadi Amman temple is shown in Figure 9.

Traces of human settlement in this area can be traced back to the Chalcolithic era, with cave paintings from approximately 1000 BC discovered in Devadanampettai and Settavarai (Figure 10, Ranganathan 2018).

In Gingee, Jainism can be traced back between the 2nd century BC and the 2nd century AD. Natural rocks served as beds and meditation spots for Jain practitioners, as evidenced by locations like Melachery (Figure 11) Paraiyan Pattu, Thirunadarkundru, Neganoorpatti, Thondoor, Melkoodalur, Oorani Thangal, Aluvarpettai, Thondoor, and Kanchiyur (Krishnamurthy 1994). The mutual relationship with the natural and sacred landscape fortifies the region as a physical and spiritual stronghold.

Figure 9: Draupadi Amman temple, Melachery (Source Author)

Figure 10: Rock paintings at Kilvalai and Sethavarai Rock Paintings (Source: Wikipedia)

Figure 11. 24 Jain Thirthangara, Melachery
(Source: Author)

3. History and Evolution of Gingee Fort Complex

The region surrounding Gingee has witnessed significant historical and cultural transformations from early tribal governance by the Thondaiyar and Aruva chiefs to the dominance of the Pallava and Chola dynasties from the 3rd to the 14th centuries AD. Initially, this area was characterized by dense forests and tribal settlements. However, it evolved into a prominent trade and religious center (Figure 12, Krishnamurthy 1994).

Figure 12. Settlements in the region during Pallava and Chola period (Source: Author)

The Pallavas established key settlements like Mandagapattu and Panamalai, known for their rock-cut temples, which marked the region's transformation into a prominent cultural centre. The Cholas further developed these temple-centred communities, enhancing prosperity through extensive land and river trade networks. Integral communities, including the Aruvar, Kurumbar, and Irular, played crucial roles in agriculture, animal domestication, and medicinal practices.

Figure 13. Ennayiram and Brahmadesam (Source: Author)

Figure 14. Fort development during Kon Dynasty (Source: Author)

During the Chola period, significant educational and religious institutions, such as Ennayiram and Brahmadesam highlighted the region's cultural richness, known as Rajarajachola Chaturvedi Mangalam, Figure 13. The Sankaraparani River facilitated trade, linking the area to key ports like Arikamedu. Despite legends of Chola-era fortifications, there is no concrete archaeological evidence of their existence.

3.1   Kon Dynasty (14th- 17th Century)

Between the 14th and the 17th centuries AD, the Kon dynasty achieved significant political consolidation and infrastructure development. Initially subordinates of the Chola Empire, the Kons, led by Ananda Kon and Krishnakon, established the Anandagiri Fort, later known as Krishnapura Fort. This fort, featuring Melkottai as the central fortress on Rajagiri Hill and Bhoomi Kottai as the palatial zone, was strategically positioned among three hills, providing natural defense. The Kon period saw advancements in communication networks, enhancing trade routes that connected Thrichy,

Vettavalam, Thindivanam, and Thiruvannamalai, Figure 14. River routes from Melechery flourished, becoming vital arteries for commerce and economic growth, reflecting the Kon dynasty's aspirations for regional dominance and prosperity (Pillai 1952, Deloche 2005).

3.2   Nayak Rule (1338-1647 AD)

Under the Gingee Nayaks, Gingee underwent profound transformations. Tubaki Krishnappa Nayak renamed the city Krishnapura and emphasized robust military architecture centered around the fortified Anandagiri. This period saw an influx of settlers and traders from Golconda and Vijayanagara, resulting in a fusion of Architectural styles from these regions with local designs, thus molding Gingee's unique urban scenery and enhancing the city's cultural and economic prosperity, Figure 15.

Figure 15. Communities and settlement during Nayak period (Source: Author)

Figure 16. Fort development during the Nayak period (Source: Author)

Figure 17. Structures during the Nayak period

Figure 18. Section Showing the water system during the Nayak Period (Source: Author)

The Gingee Fort, exemplifying the Nayak military prowess, featured a triangular fortification encompassing Rajagiri, Krishnagiri, and Chandragiri hills, fortified by a 6 m (20 ft) deep moat, stone walls, and garrison forts bolstered its defenses, Figure 16. This period also saw significant infrastructural developments, Figure 17, converting key routes into cart roads, enhancing trade and connectivity (Deloche 2005).

The fort's advanced water management (Figure 18) system utilized natural springs and purpose-built tanks, ensuring its resilience and sustained growth as a cultural, economic, and strategic hub in medieval South India (Deloche 2005).

3.3   Bijapur Sultanates (1648-1677 AD)

The Bijapur Sultans renamed Gingee to "Bashabad" and introduced advanced military features, including circular bastions for heavy cannons to be mounted and battlements, Figure 19. Significant Muslim migration led to the establishment of new settlements like Pettah (suburb) for accommodation. They introduced Deccani Islamic architectural styles, constructing religious structures and enhancing military architecture. Developments such as watchtowers and a sophisticated water management system transformed Gingee into a fortified, culturally diverse, and economically vibrant center, Figure 20.
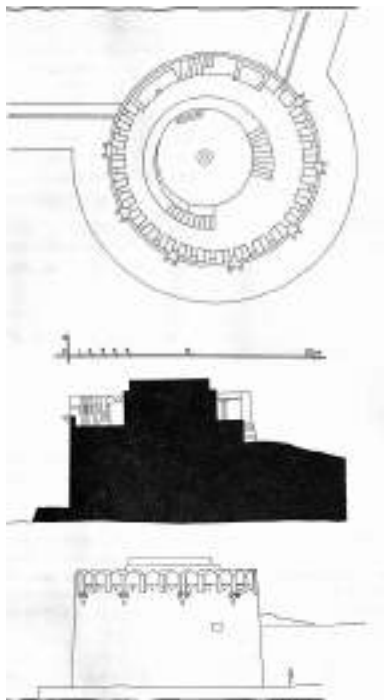
Figure 19: Bastion with Machicolation, on the South eastern side of the Second enclosure, Source: Jean Deloche's, Senji a Fortified City in the Tamil Country

Figure 20: Fort Development During Bijapur Sultanates (Source: Author)

3.4 Maratha and Mughal Rule (1677-1750 AD)

Between 1677 and 1697 AD, Gingee Fort was under Maratha control, serving as a crucial stronghold under Chhatrapati Shivaji and later his son, Chhatrapati Rajaram. The fort underwent notable improvements in its defenses after it was established as Shivaji's second capital following Raigad. These enhancements comprised reinforced fortification walls (Figure 21) and the development of the Vellore Gate, equipped with tactical elements to bewilder potential invaders as

the fort functioned as a pivotal headquarters for Maratha endeavours in the Carnatic area.
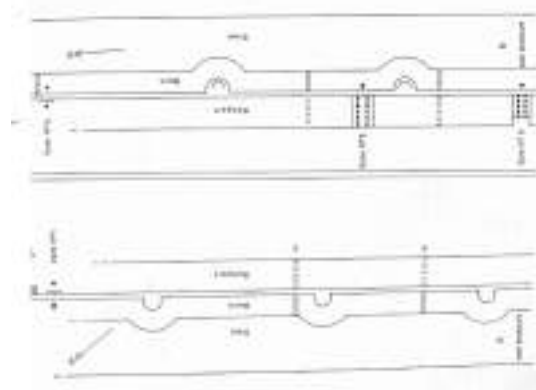
Figure 21: Rampart connecting Kuttarisi Kundru and Krishnagiri Hill (Source: Jean Deloche's, Senji a Fortified City in the Tamil Country)

After the Marathas lost Gingee in 1698, it was renamed "Nusratgarh" under Mughal rule. Later, it was under the Nawab of Arcot and saw innovations such as earthen pipes for water distribution and new military architecture, including a 7-arched bridge and the Sadatullah Khan Mosque, Figure 22.

Figure 22: Sadatullah Khan Mosque (Source: Author)

3.5 French and British Period (1750-1947 AD)

The French seized Gingee Fort in 1750, recognizing its strategic significance and modifying its defenses significantly, such as bastions, Figure 23. Despite these changes, the English captured Gingee in 1761, following the fall of Pondicherry. The fort changed hands several times, including under Tipu Sultan, before finally coming under English control after the Fourth Anglo-Mysore War in 1799. The English did not maintain the fort and constructed a road through the fort complex, and it became part of the Archaeological Survey of India in 1914, with some areas designated as Reserved Forest in 1920.
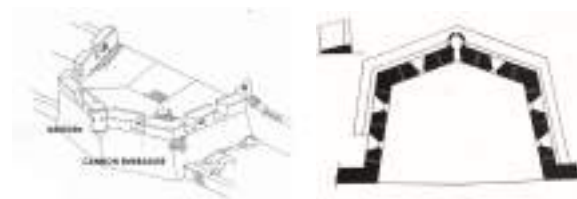
Figure 23. Pentagonal Bastion (Source: Jean Deloche's Senji, a Fortified City in the Tamil Country)

4. Analysis

4.1 Region

The region encompassing Gingee Fort, including areas such as Pennathur and Vettavalam, is analysed for its defence network, water system, and strategic views critical to the fort's functioning.

4.1.1 Natural System

The natural system around Gingee Fort is crucial for understanding its defense and strategic importance. The watershed surrounding the fort connects to broader river systems, where streams converge into a perennial river through a network of primary, secondary, and third-order streams, culminating in critical water bodies known as '*Eri*', Figure 24.

Figure 24. Drainage and water shed Analysis map of Gingee Region, Generated in QGIS (Source: Author)

Figure 25. Defence networking of Gingee Fort (Base map - 1770 Croisey Map of the South Indian Seat of War Between England and France, Sourced from Geographicus Rare map Antique maps)

These bodies are integral to the region's hydrological system but face issues such as drying due to development and obstruction of drainage channels, which increases flooding risks and ecological degradation. The transformation of streams into drainage systems and the infilling of man-made water bodies for construction

exacerbate these problems, leading to significant flooding, as seen in 1997. Addressing these challenges necessitates delineating eco-sensitive zones, implementing water treatment measures, promoting sustainable agriculture, and initiating water revival projects.

4.1.2 Defense Networking of the Region

Gingee Fort's defense system integrates a network of interconnected forts and entry points arranged in three tiers. The outermost tier includes forts like Thiruvanamalai and Arcot, forming a defensive circle around Gingee. The second tier facilitates troop and resource movement between the outer and inner defenses. In contrast the third tier includes main entry points connected to Gingee by underground passages, enhancing strategic connectivity. This tiered defense system ensures resilience against threats by regulating access and reinforcing the fort's military capabilities, Figure 25. However, the military landscape is not well-defined or recognized, which impedes understanding of its strategic importance.

4.1.3 Viewshed Analysis

Viewshed analysis reveals the strategic advantages of Gingee's elevated position, enabling surveillance and early threat detection. Outposts on hillsides extend the fort's visibility, functioning as early warning systems for monitoring movements and enhancing defence capabilities, Figures 26 and 27. Strategies to delineate the military landscape and fort precinct are essential to preserve this strategic advantage.
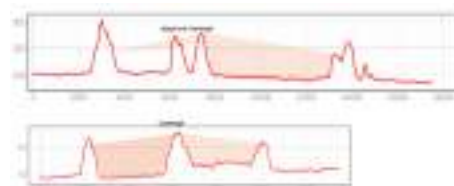

Figure 26. Sections showing the extent of the views from the Fort, Generated in QGIS (Source: Author)

Figure 27. View shed Analysis of Gingee Fort, Generated in QGIS (Source: Author)

Figure 28. Land Utilisation, Generated in QGIS

4.1.4   Land Utilization

The land around Gingee is predominantly agricultural, with reserved forests covering 10% and villages comprising 20%. These villages support agriculture, serve as community hubs, and maintain their cultural heritage, Figure 28. The lack of development guidelines and master planning is a significant issue, hindering holistic site management and the integration of historical military landscapes. Implementing policies for new development guidelines within the military landscape is crucial for preserving the region's strategic and cultural significance.

4.2 Fort Complex

Gingee Fort's intricate integration with its natural and built environment presents both a historical marvel and a contemporary challenge.

Figure 29. Natural System Analysis of the Fort

4.2.1 Natural System

Gingee Fort's hydrological system is intricately integrated with its surrounding landscape, nestled between the Chandrayan and Rajagiri hills. The fort benefits from gentle slopes and fertile catchment areas, with reservoirs like Chetikulam and Chakrakulam fed by natural springs. Rare deciduous trees, such as '*Premna wightiana*''and '*Drypetes porteri*', indicate water-rich zones. Strategically placed fortification steps on 15-30% slopes not only serve defensive purposes but also ensure efficient water flow, supporting the fort's water management. Perennial water bodies like '*Eris*' and '*Kulams*' collect water from second and third-order streams, ensuring a steady supply year-round. Palatial areas channel water to the Anaikulam reservoir, while the historical city utilizes natural depressions for drainage. The predominant 30-60% slope range demonstrates the fort's strategic use of topography for both water management and defense, Figure 29.

4.2.2   Built System

The built environment of Gingee Fort reflects its historical and cultural significance, with a diverse array of structures such as Fort gates, bridges, bastions, Queens' palace, granary, flag post, mosques, and temple; categorized by function and construction timeline. Military structures, which comprise 35% of the total, underscore the fort's strategic importance, while religious buildings, accounting for 28%, highlight its cultural and spiritual heritage. Water- structures account for 15%, indicating the importance of water management. Infrastructural components make up 12%, signifying the provision of essential services and amenities. Residential structures are divided into administrative dwellings 2% and, palatial residences 6%, and administrative buildings 2%, illustrating the governance functions within the fort. This typology highlights Gingee Fort as a fortified city with diverse elements crucial for its sustainability and cultural heritage, Figure 30.
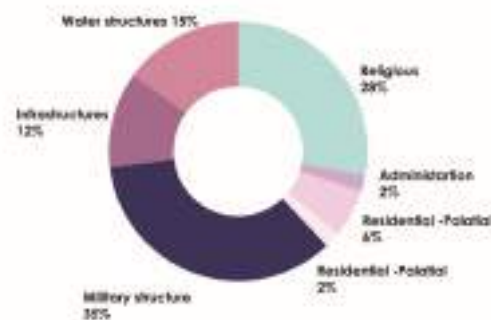

Figure 30. Pie Chart showing the distribution of the typologies (Source: Author)

The condition of these structures varies significantly. Around 60% of the buildings are well-maintained and structurally sound, showing minimal signs of deterioration. Approximately 30% are in fair condition, exhibiting some wear and tear but generally stable due to partial maintenance, as shown in Figure 31. The division of responsibility among various authorities poses challenges in maintaining these structures. Of the 97 structures under ASI is maintained, while the rest, including those under the reserved forest and town panchayat, suffer from neglect. Effective preservation requires better coordination among authorities and increased investment in conservation efforts, Figure 32.
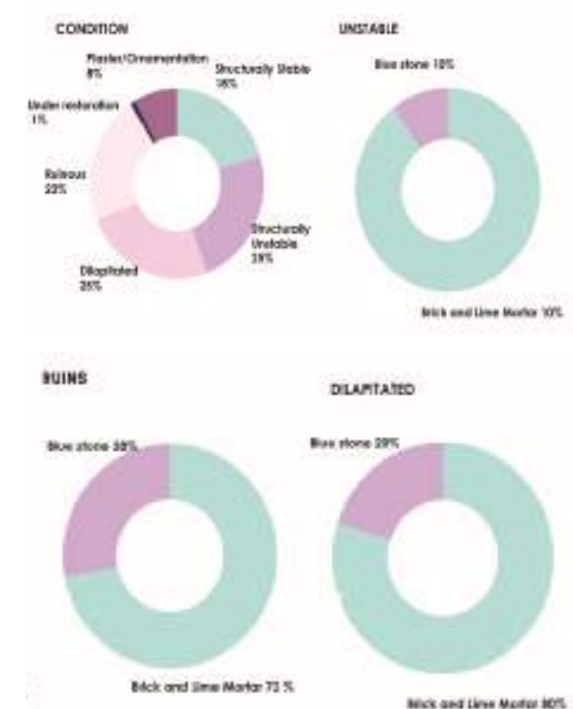
Figure 31. Pie Chart showing the condition of the built structure in Fort Complex (Source: Author)
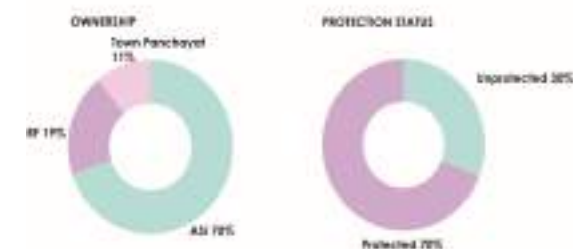
Figure 32. Pie Chart Showing Protection status and ownership of the Built System (Source: Author)

Figure 33. Circulation analysis (Source: Author)

4.2.3 Circulation System

Within the fort, circulation is a key aspect of its historical and current functionality. The fort complex features a historical and contemporary circulation system, with pedestrian pathways providing access to key areas, including the palatial zones and religious sites. Major thoroughfares connect significant landmarks, while secondary routes access ancillary structures. The fort is intersected by significant transportation routes, including the National Highway, which connects Madras to Tiruvannamalai and experiences heavy traffic. Historical routes now serve as bypasses to direct traffic to Arcot and Arni, Figure 33.

4.2.4 Tourism

Tourism is a vital aspect of Gingee Fort, attracting a diverse range of visitors, from local tourists to foreign travellers, Table 1. The peak tourist season is from November to February, with visitors ranging from school groups, who spend the least time, to foreign tourists, who stay the longest, Table 2. The fort is partially ticketed, with 30% under ASI jurisdiction.

Table 1. Tourism calendar for the Gingee Fort Complex

Month	Person to visit per day with	Access	Type of Tourist	Purpose
January	200	Ticketed	Local and international	Tour
February	150	Ticketed	Local and international	Tour
March	100	Ticketed	Local tourist	Tour
April	400	No ticket	Local residence	Festival
May	30	Ticketed	Local tourist	Tour
June	40	Ticketed	Local tourist	Tour
July	75	Ticketed	Local residence	Festival
August	45	Ticketed	Local tourist/residence	Tour/Leisure
September	50	Ticketed	Local and International tourists and local residents	Tour/Leisure
October	75	Ticketed	Local and International tourists and local residents	Tour/Leisure
November	150	Ticketed	Local and International tourists and local residents	Tour/Leisure
December	250	Ticketed	Local and International tourists and local residents	Tour/Leisure

Table 2. Tourism Information for a week in February

VISITOR TYPE	PURPOSE	AGE	FROM	TIME SPENT	PAX	MAIN DESTINATION	TOUR DAYS
School students	Educational tour	12-18	Vellore Govt school	5 h (3.5+1.5)	120	Fort	1
College students	Educational tour	19-22	Tiruvannamalai Engineering college	4 h (2.5+1.5)	75	Fort	1
Foreign visitors	Tourism	50-60	France-Puducherry		10	Puducherry	30
	Research	30-50	France-Puducherry		2	Fort	
		30-35	Annamalai University		1	Fort	
	Trekking enthusiast	40-55	London-Puducherry		1	Fort	
Local	Toursit-family		Vellore, Tiruvannamalai, Arcot	2-3 h (Rajagiri)	20	Melmalayanur	1
					55	Tiruvannamalai	1
	Tourist –2 to 3	25-35	Vellore, Tiruvannamalai, Arcot	2 h	10	Fort	1
	Picnic playing			6 h	15		Daily
	Religious		Within the town panchayat	6 h	4		Daily
	Shepherd			6 h	5		Daily
	Agricultural			6 h	15		Daily
	Cattle rearing			4 h	10		Daily
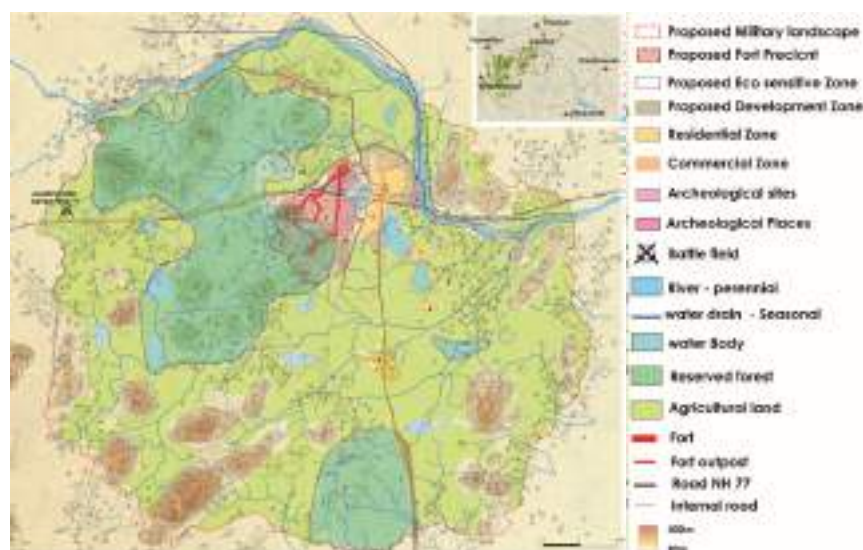
Figure 34. Delineation of the Military Landscape of Gingee (Source: Author)

5. Proposals

5.1 Delineation of Gingee Military Landscape and Regional Policy

The Gingee master plan prioritizes buffer zones along rivers and water channels, restricting new construction while allowing fishing and boating. Ecologically sensitive areas require protective zones, and encroachments must relocate to nearby villages. Development zones permit buildings up to 6 meters with traditional materials. Hotels should be near the bazaar, and no development is allowed in archaeologically sensitive areas, Figure 34.

Figure 35. Delineation of Gingee Fort Precinct
(Source: Author)

5.2 Fort Precinct Delineation and Policy

The fort complex extent includes archaeological sites, managed by a stakeholder committee. The master plan emphasizes resource management, conservation of heritage buildings, open spaces, and traditional water systems. Key activities include maintaining a resource database, safeguarding archaeological remains, and improving site accessibility and interpretation. Sustainable tourism will be promoted through a tourism circuit, enhancing visitor management and amenities without compromising site integrity, ensuring history and sustainability coexist harmoniously, Figure 35.

5.3 Archaeological investigation site for excavation

The primary objective of the archaeological excavation is to ascertain the archaeological potential of the area and to identify sites suitable for excavation, specifically focusing on the

'Pettai' and City areas, which are integral parts of the fort complex. Furthermore, the excavation aims to understand the spatial layout of the city. The cultural artifacts unearthed during the process provide valuable insights into the cultural practices of the inhabitants of the fort, including the bastion wall and gate of the city, as well as the presence of a moat, Figure 36.

5.4 Protection status for significant sites

The specified Archaeological Potential Site should be designated as protected due to its historical, architectural, and aesthetic value. This should be approached through a multi-faceted endeavour, including community consultation involving local stakeholders, experts from the Archaeological Department, and the Executive Officer of Gingee Town Panchayat. The identified sites should be brought under state or central archaeological protection, with a 100-meter protected buffer and a 200-meter regulated buffer. The remnants are of significant importance due to their potential to reveal aspects of the site's history. Non-invasive techniques should be preferred for archaeological investigations. All archaeological works must be meticulously documented, and these records should be maintained in Anna Library, ASI Chennai, Gingee Sub Circle, and the Tamil Nadu State Department of Archaeology.

Figure 36. Archaeological potential area for excavation
(Source: Author)

5.5 Revival of moat

The moat serves as both the initial and final

element of the fort's defensive system, playing a crucial role in water drainage. It faces issues like encroachments, blocked drains, and waste dumping, disrupting water flow. A comprehensive plan involves de-watering, removing invasive vegetation, de-silting, reclaiming agricultural areas, and re-establishing water links to lakes. Archaeological investigations will identify original channels. Stone pitching and relocating inhabitants are planned, Figure 37. A buffer zone will be transformed into a community park with native vegetation such as 'Portia, Banyan ', and 'Diospyros affinis' to restore ecological balance and aid in water retention and conservation.
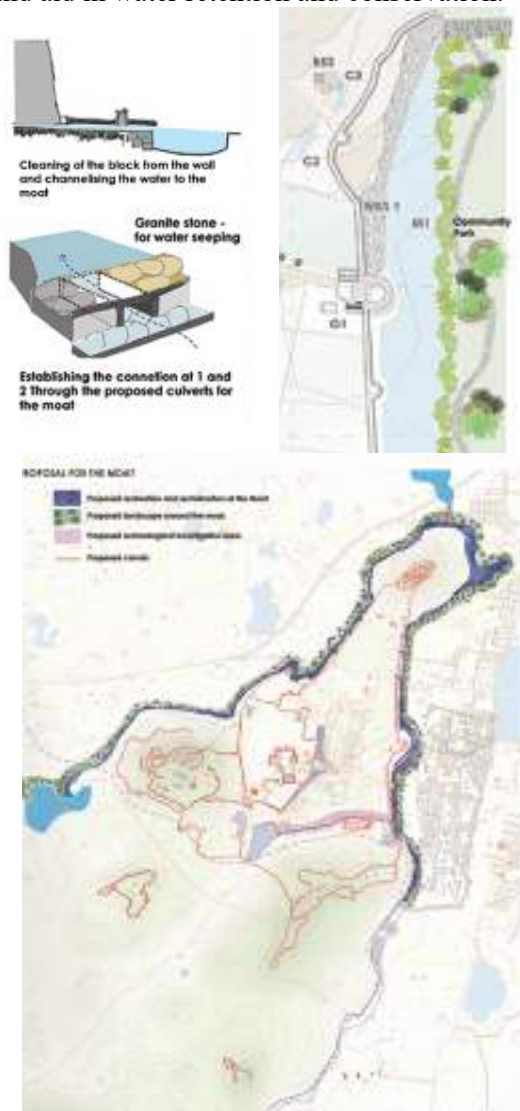
Figure 37. Proposal for the culverts of the moat
(Source: Author)

5.6   Conservation Proposal for Structures in the Fort Complex

Condition and material for all the structures in Krishnagiri, Rajagiri lower and upper fort are analysed, and conservation proposals such as restoration, consolidation, and preservation with the phase of intervention of immediate, necessary, and immediate are proposed.

The structures within Krishnagiri Fort are experiencing significant weathering, overgrowth of vegetation, and neglect, requiring varying levels of intervention. High-priority actions include immediate structural reinforcement for key areas such as granaries, water tanks, and enclosure gates, which are suffering from severe deterioration. Restored buildings such as temples and the audience hall require regular maintenance to counteract weathering. Additionally, the ghee reservoir and open spaces need immediate cleaning and removal of waste and invasive plants. These measures are essential to maintain the historical and architectural integrity of the fort complex through consistent upkeep and targeted restoration, Figure 38, Table 3.In Rajagiri Lower Fort, Immediate attention is needed for the King's Palace (B9), Palace Complex (B16), Zenana Complex (B17.1), Platform (B18), and Darbar Mandapam (B19). These structures are in ruins, primarily due to external forces like war, weathering, and dampness. Immediate archaeological intervention and structural consolidation are crucial to halt further degradation. Critical water-related structures, including Cunai (C2 and C3) and moats (M1 and M2), are in poor condition due to eutrophication, waste dumping, and agricultural runoff, requiring comprehensive cleaning and restoration. The water tower (WT1) is severely impacted by vegetation growth and garbage accumulation, necessitating immediate removal and restoration of its water system revive its functionality and heritage value, as shown in Figure 39 and Table 4.

In Rajagiri Upper Fort, immediate intervention is essential for the Uppukaccham Mandapam (B34), Treasury (B35), and Granary 1 (B36). The Uppukaccham Mandapam, though structurally stable, has a collapsing roof and needs urgent restoration to address soil settlement issues. The Treasury is heavily damaged by vegetation and moisture, necessitating the removal of vegetation and structural reinforcement. Granary 1 faces severe weathering and water damage, necessitating immediate action to prevent further deterioration. Prompt preservation efforts are critical to maintaining the historical and architectural significance of these structures, safeguarding them from further decay, as shown in Figure 40 and Table 5.

Figure 38. Snap shot of the Conservation proposal for Krishnagiri

Figure 39. Snap shot of the Conservation proposal for Rajagiri Lower fort

Figure 40. Snap shot of the Conservation proposal for Rajagiri Upper fort

5.7 *Conservation Strategies for Anaikulam: The Most Vulnerable Structure*

Anaikulam, a historic royal bathing pool, features a mandapa supported by a trabeated system, transmitting the roof's load through pillars and plinths to the bedrock. This is the most vulnerable and requires an immediate action plan.

A detailed assessment reveals issues including roof collapse, plaster loss, and structural damage. The conservation proposal is phased, Figure 41 and Table 6. Phase I encompassing immediate repairs, such as replacing terrace roofing and restoring floors. Phase II focuses on cleaning and supporting stone slabs. Phase III involves extensive restorations, such as replacing chajjas, removing vegetation from parapets, and stabilizing columns.

Figure 41. Snapshot of the Conservation proposal for Anaikulam

The restoration plan for the retaining wall includes monitoring the wall's inclination, clearing the area, and addressing soil related issues. In cases of significant tilting, rubble masonry will be removed and replaced with a retaining wall equipped with a drain pipe, followed by soil compaction. For the water system, cleaning and relaying stone flooring, inspecting the water inlet, and clearing vegetation from the outlet pipe is crucial.

Figure 42. Restoration of the Palace Garden

5.8 *Conservation strategies for the palatial garden*

The central garden space, once an orchard garden accessible from the palace arcade, has been meticulously restored with minimal intervention, preserving its sense of enclosure and historical ambiance. The restoration emphasizes the use of pathways and indigenous tree species, enhancing the authenticity of the experience. A proposal to replace the existing lawn with Arughampul grass, native to the region, is under consideration. The visitors are directed to experience the enclosure first and take a tour of other buildings, Figure 42.

Table 3. Details of conservation proposal for Krishnagiri

S. No.	Description, Typology, Building material	Condition Cause	Historical	Architectural	Ecological	Cultural	Archaeological	Technological	Military	Intervention	Phase	Priority
B12	Krishna Temple Ranganathaswamy Temple	Restored weathering	■			■				Preservation and periodic maintenance	Desired	Low
B13	Dravidian style Temple surrounded with Mandapa surrounded with pillared Mandapa Stone Garbhagriha and decorative parapet Brick and lime mortar	Restored Missing element in decorative parapet Deterioration of Nayak period paintings weathering	■	■		■				Replacement of the missing element art conservation	Desired	Low
B43 and B46	Mandapa Pillared mandapa associated with Ranganatha swamy temple Stone pillared mandapa and roof	Collapsed roof and deformed column Structurally stable	■	■		■	■			Restoration of the structure		Low
B44	Unjal mandapa Pillared mandapa associated with Ranganatha swamy temple historically Stone pillared mandapa and pavilion on plinth of big and little maroon and lime plastered	Minor cracks in the plaster Dampness	■	■		■	■			Patch work in the plaster	Desired	Low
B45	Mosque Pilared mandapa associated with Ranganata swamy temple Converted into mosque with dome rising from a lotus shaped base Brick masonry wall and brick dome placed on squinch and lime plastered	Loose masonry / Loss of plaster Structurally stable Weathering	■	■		■				Consolidation of the masonry Replastering	Necessary	Low
B47	Audience hall Pillared hall Stone pillared	Restored	■			■				Preservation and periodic maintenance	Desired	Low
B48	Granary 1 Vaulted granary of 2.21 m x 1.1 m with 2 openings and sky light Stone masonry wall, Brick and Lime mortar roof Stone, Lime plastered floor Decorative elements in brick	Structural cracks in roof and wall Lose of plaster Lose of decorative element Weathering	■	■					■	Strengthening by crack stitching and grouting Re plastering Replacement of decorative element	Immediate	High

Table 3. continued

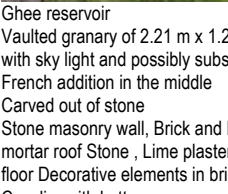| S. No.	Description, Typology, Building material	Condition Cause	Historical	Architectural	Ecological	Cultural	Archaeological	Technological	Military	Intervention	Phase	Priority
B49	Granary 2	Structural cracks in roof and wall Loss of plaster/ Loss of decorative element Weathering and Expansion	■	■					■	Strengthening by crack stitching and grouting Re plastering Replacement of decorative element	Immediate	High
B50	Ghee reservoir Vaulted granary of 2.21 m x 1.2 m with sky light and possibly subsidiary French addition in the middle Carved out of stone Stone masonry wall, Brick and Lime mortar roof Stone , Lime plastered floor Decorative elements in brick	Dumped with garbage	■						■	Cleaning and removal of the waste	Necessary	Low
B51	Cavalier with battery Cavalier for mounting cannon with battery Stone Masonry	Crack in the wall vegetation growth Weathering and Expansion		■				■	■	Strengthening by crack stitching and Removal of vegetation	Immediate	High
KG4	Enclosure gate 1 Gate site with 2 openings and a sentry box Gate-Stone masonry and sentry: Brick and lime mortar plastered	Loose masonry Missing element Minor Cracks in sentry box and subjected to dynamic load Weathering and Expansion	■	■				■	■	Replacement of the battlement element Patch work	Immediate	High
KG5	Enclosure gate 2 Gate with Mandapa Stone masonry	Loose Masonry Weathering and Expansion	■	■				■	■	Removal of vegetation reviving the water system	Immediate	High
WK1 and 2	Water tanks Water tanks associated to Krishna temple and ablution tank for the mosque Brick masonry and lime mortar	Dried and vegetation growth Weathering and neglect	■		■	■			■	Removal of the vegetation revival of the water system	Immediate	High
EN	Enclosure walls Open space	vegetation growth and dilapidated weathering and external forces, core expansion	■	■	■			■	■	Removal of the vegetation Consolidation	Necessary	Low
OS	wall of width 2 m and wall walk Core: Earth filling facing: stone	Invasive vegetation growth weathering and neglect	■		■					Removal of the vegetation and periodic maintenance	Necessary	Low

Table 4. Details of conservation proposal for Rajagiri Lower Fort

S. No.	Description, Typology, Building material	Condition Cause	Significance							Intervention	Phase	Priority
			Historical	Architectural	Ecological	Cultural	Archaeological	Technological	Military			
B6	Magalingeshwar Temple Rock cut temple dating Pallava period Stone	Garbhagriha is stable Ruined Mandapam External force [war]	■			■	■			Restoration of mandapa	Desired	Low
B8	Venupal swamy temple Palatial temple at higher elevation in the palatial zone constructed to storage a big tank. Wall: Stone masonry Wall : Brick Masonry Vault: Brick and Lime mortar	Part of the not restored External force [war]	■			■	■			Restoration	Desired	Low
B9	Kings Palace 7 story High place of the Kings Brick and lime mortar	Ruined External force [war]	■				■		■	Archaeological Intervention Consolidation of the exisiting	Immediate	High
B16	Palace complex Complex consist of portfolio of rooms, boat, and bath path Stone masonry	Ruined Complex Vegetation growth External force(war)	■				■		■	Archaeological Intervention Consolidation of the exisiting	Immediate	High
B17	Zenana complex Vaulted Rooms with Pathway Wall Stone masonry Roof: Brick and lime mortar Floor: Mud	Restored Misuse of the structures	■	■			■			Preservation and removal of the graffiti	Desired	Low
B17.1	Zenana complex Vaulted Rooms with Pathway Wall Stone masonry Roof: Brick and lime mortar	Roof Collapse Loose Masonry Vegetation growth Structurally unstable weathering, dampness	■	■			■			Archaeological Intervention Consolidation of the exisiting	Immediate	High
B18	Platform Stone	Ruined	■	■			■			Archeological intervention	Immediate	High

Table 4. continued

B19	Darbar mandapa Darbar hall beside king's palace Stone	Ruined				Archeological intervention	Immediate	High
B20	Gym Constructed as advisory hall later modified to gymnasium Roof has 3 circular skylights Front wall was added during Bijapur Wall: Stone masonry Roof: Vault: Brick and Lime mortar Floor: Stone Decorative element in brick and plaster	Partially restored Minor cracks on the roof Loss of Decorative element weathering, dampness				Patching the crack, Replacing the decorative element	Desired	Low
B21	Mosque Small mosque with projection on the west side to hold prayer with niche wall Brick and lime mortar	Ruined walls without roof weathering				Consolidation of the existing	Immediate	High
B22	Water pavilion Known as a stylish and tower of Sykes, from the Tower, the structure is erected to the Brick and lime mortar	Restored Minor cracks Removal of plaster Deterioration wall painting Weathering and insensitive plastering				Patching of the crack Replastering Art restoration	Desired	Low
B24	Royal Granary 4 Vaulted structure of 10,000 cu meter volume to store grain Wall: Stone and lime plaster Roof: Brick and lime mortar Battlement: Brick and lime mortar	Minor cracks on the roof Weathering and Dampness				Patching of the crack	Desired	Low
B25	Powder magazine Gun powder storage to the depth of 4m Caved out of stone	Vegetation growth exposed steps structurally unstable Weathering				Removal of Vegetation Restoration of steps	Desired	Low

Table 5. Details of conservation proposal for Rajagiri Upper Fort

S. No.	Description, Typology, building materials	Condition Cause	Significance							Intervention	Phase	Priority
			Historical	Architectural	Ecological	Cultural	Archaeological	Technological	Military			
B11	Ranganatha swamy temple Stone Masonry with Brick masonry for Garbhagriha	Restored	■			■	■			Preservation	Desired	Low
B11.1	Mandapa: Associated with Temple/ Kamalakarni Temple	Vegetation growth, Collapsing roof and beam, Dilapidated Dampness and neglect	■			■	■			Removal of vegetation	Necessary	Low
B29	Stone Masonry with trabeate system	Vegetation growth, Structurally stable Dampness and neglect	■			■				Removal of vegetation Preservation	Desired	Low
B30	Mandapa: Associated with Kamalakarni Temple Stone Masonry with Trabeated system	Vegetation growth, Dilapidated, Dampness and neglect	■			■				Removal of vegetation Preservation	Necessary	Low
B31	Bali peedam: Associated with Kamalakarni Temple Stone Masonry	Structurally stable	■			■				Preservation Periodical Maintenance	Desired	Low
B32	Kamalakanni amman temple Stone Masonry	Structurally stable	■			■				Preservation Periodical Maintenance	Desired	Low
B33	Kamalakanni amman temple wall painting	Intensive intervention by repainting with wall paints Water seepage	■			■				Art Restoration	Necessary	Low
B34	Uppukachin mandapam with central courtyard Stone Masonry with trabeated system	Collapsing roof, Deteriorated Column, tilting of the beam Structurally unstable Settlement due to soil loosening	■	■						Underpinning of the structure Restoration	Immediate	High

Table 5. continued

ID	Name	Condition							Intervention	Time	Priority
B35	Treasury Brick structure, vaulted 4 x 7 m	Vegetation on gable growth, Dampness: Moisture expansion and internal pressure							Removal of vegetation Strengthening by Crack stitching	Immediate	High
B36	Granary 1 Brick and mortar wall: Stone masonry, mud mortar and lime plastered, Vaulted Granary of 23 x 11 m with skylight and opening on roof	Vegetation growth: Structural cracks on the roof and from opening Structurally unstable Weathering and expansion							Arresting water seepage Stitching of the cracks	Immediate	High
B37	Granary 2 Brick and lime mortar: Smaller wall, Stone masonry and lime plastered Vaulted Granary of 26 x 12 m accessed via 2 stairs at front	Vegetation growth, Collapsed roof and Tilting, Crack on the wall, Structurally unstable weathering and Settlement								Immediate	High
B38	Granary 3 Roof: Brick and mortar wall: Stone masonry and lime plastered Structurally Unstable Granary of 21 x 21 m with flat roof supported by arches	Crack on the wall Deteriorated brick Decorative motif Structural crack on the roof Weathering, Dampness and Moisture expansion								Immediate	High

Table 6. Details of the Conservation proposal for Anaikulam

Element	Material	North	East	South	West	Cause	Intervention	Phase
Roof 	Lime concrete	minor crack and vegetation growth	Loss of roof at the SE Corner	vegetation growth Loss of roof at the SE Corner	Collapse of roof at the centre	Water seepage	Relaying terrace with appropriate slope and water proofing material	I
Parapet	Brick and lime mortar	Loss of plaster	water Kurra blocked with vegetation and loss of plaster	loss of plaster	loss of plaster		Removal of vegetation from Khurah building replastering	III
Slab 	4 layers - Granite Stone- 0.12 m in depth	Dampness and open joint	Dampness and blackening of the slab with open joint	Dampness and blackening of the slab with open joint	Dampness and blackening of the slab	Water seepage	Pointing and cleaning of the surface	II
Chajja	Granite Stone fixed between beam and roof slab	Missing chajja	Missing chajja	Missing chajja	Missing chajja		Replacing the chajja with water drop	III
Beam	Granite	Deteriorated	Deteriorated	Deteriorated	Deteriorated	Weathering	Restoration	I

Element	Material	Condition	Condition	Condition	Condition	Cause	Proposal	Priority
	Stone	stone beam	stone beam	stone beam	stone beam		wherever required	
Column	Granite Stone of size 0.35 m x 0.35 m	Deteriorated stone column Tilting of column at the NE Corner	Deteriorate stone column Loss of at the SE corner stone column	Deteriorated stone column Tilting of the column at SE Corner	Deteriorated stone column	Weathering dislocation of base due to settlement	Restoration of the Column after structural analysis	I
Wall	Stone rubble masonry	Dampness Loss of Mortar	Dampness Tilting of the wall	Dampness	Dampness	Pressure from the earth on the sides	Earth is cleared for 1/3rd of the wall and wall is restored	I
Floor	Stone slabs	Dampness is seen at the corners and in the earth filling	Loss of the floor slab Dampness is seen at the corners and in the earth filling	Loss of the floor slab Dampness is seen at the corners and in the earth filling	Dampness Vegetation growth Loss of Stone slab	Capillary Action Soil Expansion due to water intrusion	Relaying of the floor after soil compaction	I
Plinth	Core is filled with earth and finished with granite stone	Deteriorated stone at the plinth	Plinth is sinking at the centre and upward thrust is seen at the corners	Plinth is sinking at the centre and upward thrust is seen at the corners	upward thrust is seen at the corners and centre	Capillary action Soil expansion due to water Intrusion	Stabilising the soil, compacting, making sturdy subbase using crushed stone	I
Steps	Granite Stone	Upthrust at the corner	Settlement at the centre	Settlement at the SE Corner			Replacement wherever required	III
WATER Inlet	Earthen pipe from Chakra kulam			Present at the Southern side of the kulam				I
Outlet	Earthen pipe towards Excavated darbar		Present at the eastern side of the kulam				The pipe from and the kulam is checked and repaired	I

Figure 43. Lower fort proposed programme

Figure 44. Krishnagiri proposed programme

96

5.9   Activating the fort through interactive program

Fort complex is divided into zones and given with the function which would engage, learn and have experience. Comprehensive plan for enhancing accessibility and programming at a historic fort is proposed. Key accessibility features include safety grip wires, proposed paved routes, granite pathways with tactile pavement, and mats for easy removal. These elements are designed to ensure safe and inclusive access for all visitors, including those with disabilities. Routes in lower fort are designated for wheelchairs, and key points are equipped with amenities such as water ATMs and ticket counters. Activities include displays on the fort's history, interpretation of artifacts, cultural exhibits, archery, and weapon galleries. There are also designated areas for relaxation, learning ancient scripts, painting, community events, and a sound and light show, Figure 43 and Figure 44.

The plan effectively integrates accessibility and diverse programming to activate the fort as an inclusive, educational, and engaging historical site.

6.   Conclusions

Gingee Fort, a medieval hill fort in Tamil Nadu, is a rare example of military architecture that showcases the evolution of warfare methods and defensive tactics from the Kon dynasty to the French. The fort's strategic adaptations and natural landscape, with rugged terrain and abundant water sources, have made it nearly unconquerable and a physical and spiritual stronghold.

The historical significance of Gingee Fort is underscored by its role in trade, culture, and agriculture, supported by its strategic location and connectivity. Despite its importance, the fort faces challenges such as inadequate conservation efforts and a lack of vibrancy, awareness, and activities.

The identification of Gingee's military landscape emphasizes the need for conservation and sustainable development. The fort precinct policy focuses on resource management, heritage conservation, and improving site accessibility and interpretation to promote sustainable tourism.

Conservation plans require immediate, essential, and phased actions to prevent further decay and ensure preservation. Enhancing the visitor experience through interactive initiatives and accessibility improvements will foster a deeper understanding of the fort's historical importance.

In conclusion, the master plan aims to harmonize heritage preservation with sustainable progress, ensuring that Gingee Fort remains a vibrant, establishing as the monument of world importance due to its significance, promoting local traditions and environmental sustainability.

Acknowledgements

References

Achari, C. S. 1943. *History of Gingee and its Rulers.* Madras: Annamalai University.

Balachandran. N, K. R. 2015. "Occurrence of three Western Ghats elements in dry evergreen forest of Gingee Hills, Eastern Ghats of Tamil Nadu, India." *Journal of Threatened Taxa*, 7(14).

Bhuvan. 2023. Retrieved from Bhuvan: https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php

Deloche, J. 2005. *Senji (Gingi) Ville fortifie'e du pays Tamoul (Senji a fortified city in the tamil country).* Pondichery: nstitut Francais de Pondichery.

Gribble, J. 1924. *A History of The Deccan.* London: Luzac & Co.

Hiltebeitel, A. 1988. *The cult of Draupadi :from Gingee to Kurushetra.* Chicago : University of Chicago Press.

Indian culture. 2020. Retrieved from https://nvli.in/node/2637478#:~:text=The%20Gin jee%20or%20Senji%20Fort,the%20East%E2%80 %9D%20from%20the%20English.

Jaiswal, M. a. 2022. "Late quaternary evolution of lower Kaveri and adjoining river basins in Tamil Nadu, Southern India: A combined approach

using remote sensing and optical dating of fluvial records." *Elsevier* , 10.

Krishnamurthy. 1994. *Senji pagudiyil samanam.* Madras: Sekar padipagam.

Michel, George. 1992. *The Vijayanagara courtly style.* New Delhi: American Institute of studies.

Muruganandam S, E. K. 2016. "Ethnobotany of Gingee Hills, Villupuram District." *IESRJ*, 4.

N. Balachandran, K. R. 2015. "Occurrence of three Western Ghats elements in dry evergreen forest of Gingee Hills, Eastern Ghats of Tamil Nadu, India." *Journal of Threatened Taxa*, 7(14).

Pillai, N. 1952. *Carnatic Rajakal Kavistana Charitham.* Madras.

Mookerji, R. 1990. *Ancient Indian Education: Brahmanical and Buddhist .* New Delhi: Mothilal Banarsidass publications.

Ranganathan, D. J. 2018. "Rock Art Paintings in Villupuram District – A Study." *International Journal of Information Research and Review*, 5.

Rotzer, K. 1984. *Bījāpūr: alimentation en eau d'une ville musulmane du Dekkan aux*

Saravanakumar, D. A. 2020. "Trade and Commerce of Ancient Tamilagam." *Academia, Journal of Xidian University*, 14.

Sastri, K. 1955. *The Cola Vol 1.* Madras: University of Madras

Toy, S. 1957. *The strong holds of India.* William Heinsman Publication .

Verma, V. K. 2022. "Trade routes of Early Tamilagam -A study of the archeological sources." *Journal of History, Art and*, 6.

Water resource organisation, I. f. 2019. *Varahanadi watershed.* Chennai: PWD.

Legislative Provisions and Seasonal River Systems:

A Case of Vishwamitri River, Vadodara

Neha Sarwate[1] Meenakshi Dhote[2]

[1]School of Planning and Architecture, New Delhi, Email:neha.v.sarwate@gmail.com
[2]School of Planning and Architecture, New Delhi

Abstract: 'Waterlogging' and 'flooding,' a recurrent phenomenon in recent years, are reflective of human interventions devoid of scientific understanding of the natural systems, especially seasonal rivers, by both the decision makers and the civic society. This paper aims to identify disparities in legislative provisions and policies related to river-centric urban planning and their implementation in planning decision-making. Existing legislative provisions as outlined in the Development Acts, Regulations, Guidelines, and policy initiatives by various authorities pertaining to urban planning and rivers are examined through content and frequency analysis of these documents. Spatial analysis of the river system conducted through a longitudinal analysis of satellite images from 2000 to 2020 highlights the structural changes in the river systems due to shortcomings in the provisions. The study reveals ambiguities in legislative provisions, which are associated with administrative loopholes, leading to irresponsible interventions and subsequent disasters. It highlights the absence of ecological directives for formulating development plans. The Acts, Policies, and Guidelines continue to reflect the unilateral approach towards economic development. The findings underscore the urgent need to revise legislation and policies to incorporate a scientific understanding of seasonal river systems and environmental planning principles, thereby addressing the current water crisis.

Keywords: Governance; Legislative Provisions; Seasonal River Systems; Floods.

सार: हाल के वर्षों में बार-बार होने वाली 'जलभराव' और 'बाढ़' प्राकृतिक प्रणालियों, खासकर मौसमी नदियों के बारे में निर्णयकर्ताओं और नागरिक समाज दोनों द्वारा वैज्ञानिक समझ से रहित मानवीय हस्तक्षेपों को दर्शाती है। इस पत्र का उद्देश्य नदी-केंद्रित शहरी नियोजन से संबंधित विधायी प्रावधानों और नीतियों में असमानताओं की पहचान करना और नियोजन निर्णय लेने में उनके कार्यान्वयन की पहचान करना है। शहरी नियोजन और नदियों से संबंधित विभिन्न प्राधिकरणों द्वारा विकास अधिनियमों, विनियमों, दिशानिर्देशों और नीति पहलों में उल्लिखित मौजूदा विधायी प्रावधानों की इन दस्तावेजों की सामग्री और आवृत्ति विश्लेषण के माध्यम से जांच की जाती है। 2000 से 2020 तक उपग्रह चित्रों के अनुदैर्ध्य विश्लेषण के माध्यम से किए गए नदी प्रणाली के स्थानिक विश्लेषण से प्रावधानों में कमियों के कारण नदी प्रणालियों में संरचनात्मक परिवर्तनों पर प्रकाश डाला गया है। अध्ययन से विधायी प्रावधानों में अस्पष्टता का पता चलता है, जो प्रशासनिक खामियों से जुड़े हैं, जिससे गैर-जिम्मेदार हस्तक्षेप और बाद में आपदाएँ होती हैं। यह विकास योजनाओं को तैयार करने के लिए पारिस्थितिक निर्देशों की अनुपस्थिति को उजागर करता है। अधिनियम, नीतियाँ और दिशानिर्देश आर्थिक विकास के प्रति एकतरफा दृष्टिकोण को दर्शाते हैं। निष्कर्ष मौसमी नदी प्रणालियों और पर्यावरणीय नियोजन सिद्धांतों की वैज्ञानिक समझ को शामिल करने के लिए कानून और नीतियों को संशोधित करने की तत्काल आवश्यकता को रेखांकित करते हैं, जिससे वर्तमान जल संकट का समाधान किया जा सके।

मुख्य शब्द: शासन; विधायी प्रावधान; मौसमी नदी प्रणालियाँ; बाढ़

1. Introduction

The past two decades have been battering many cities and regions across India, with erratic rainfall followed by significant damages due to 'water logging' and 'flooding,' a recurrent phenomenon in recent years. While help and assistance pour in to aid the distressed people, little emphasis is given to recognizing the reasons behind such recurrent calamities. Vadodara, in Gujarat, is no exception (Thakkar 2012). In the current scenario, the climate crisis has been conveniently labelled as the cause of all disasters. Still, a little deliberation on the subject leads us to various multi-layered interrelated human blunders (Gadgil and Guha 1992, Jasanoff 2021, Arora et al. 2024). Human interventions over the last 100 years have altered ecosystems more rapidly and significantly than at any other time in the history of the planet (Carson 1962, Gadgil and

Guha 1992). Recent trends in the global scenario emphasize the conservation of freshwater ecosystems from a biodiversity perspective (Barouillet et al. 2023).

In contrast, water laws in India are embedded within environmental laws (Arora et al. 2024). This paper aims to identify disparities in the governance mechanism, mainly the legislative provisions, policies related to river-centric urban planning, and their implementation in planning decision-making to address Sustainable Development Goal 6.6. The objectives of this paper are to establish the linkage between the legislative provisions, their interpretation, and the recurring phenomenon of floods and waterlogging. This effort urges the multiple stakeholders in the city, especially the governance mechanism, to pause and reflect on the root causes of this devastating phenomenon.

To begin with, 'water logging' and 'flooding' are two independent events, not synonymous with each other but connected with the term "river systems" (Dutta et al. 2018). To distinguish between these phenomena, it is essential to understand the river system and its consideration in the planning and development process to identify the causes of floods and waterlogging.

1.1 River, a Living Entity

A river, as generally understood, typically consists of various orders of streams and rivulets (tributaries) converging to form upper, middle, and lower courses. A river is a living, dynamic entity that is an outcome of the natural drainage patterns of land, known as watersheds (McHarg 1969), which depend on various hydro-geological features such as slope, steepness, and soil characteristics (Forman 2005, Marsh 2010). The water availability within them relies on the amount of rainfall in the region and the extent of densely vegetated areas along the course of the river. Depending on all the above-mentioned factors, the course of the water flows from higher elevations through the plains and eventually to the sea. During its journey, it flows rapidly through some areas, gets detained in others, is retained in yet some more, and infiltrated into the ground, resulting in a network of various landforms that eventually constitute the river system (Forman 2005, Steiner 2008). Therefore, it can be recognized that the river system encompasses more than just the main river corridor but also includes tributaries, rivulets, floodplains, meanders, ravines, riparian areas, oxbows, and wetlands.

1.2 Seasonal Rivers

Technically known as Intermittent Rivers and Ephemeral streams, seasonal rivers vary considerably from their perennial counterparts. Rivers that flow 20%-80% of the year, with isolated pools that may persist till the end of summer and often support longer-lived aquatic life, are understood as intermittent rivers (Datry, Bonada, and Boulton 2017). At the same time, Rivers that flow for less than 20% of the time and run for short periods in response to unpredictable high rainfall events are known as ephemeral rivers, as they tend to receive only river runoff because the channel is always above the water table (Datry, Bonada, and Boulton 2017). In addition to the many natural (climatic) causes of intermittence, flow cessation can result from one or more human activities, including alterations of land use, encroachments, flow regulation, and surface and/or groundwater extraction (Palmer et al. 2008, Steward et al. 2012).

2.   Methods

To recognize the inclusion of river systems in the planning realm, this paper examines the existing legislative provisions and policy initiatives by the various authorities and agencies. Specifically, the Gujarat Town Planning and Urban Development Act, along with guidelines recommended by the Ministry of Jal Shakti, National Institution for Transforming India (NITI Aayog), and National Institute of Urban Affairs (NIUA), pertaining to urban planning and rivers are analysed through content and frequency analysis of the said policy documents. The keywords identified based on the scientific understanding of rivers have been identified and counted based on the number of mentions in the respective documents. The number of mentions is then compared to the total word count in the said policy documents and then deduced to the frequency of mentions per 100 words, as indicated in parentheses below the actual count.

Spatial variations in the river system are determined through a longitudinal analysis of satellite images from 2000, 2010, and 2023, along with successive Development Plans to identify the structural changes in the river systems that result in human-induced floods and waterlogging.

3.   Results

This paper examines the provisions of The Gujarat Town Planning and Urban Development Act in detail as it is statutory and lays the framework for development in the state of Gujarat. This paper also provides a comparative analysis of the policies and guidelines of various agencies in addressing river systems in planning initiatives. Table 1 shows the absolute frequency of the keywords in numbers and a comparative percentage in parentheses. It is important to note that seasonal rivers and their associated ecosystems are often overlooked in planning initiatives and guidelines by most authorities.

Table 1. Content and Frequency Analysis of Guidelines

|	Wordcount	Watershed	River	Flood	Seasonal Rivers	Tributaries	Waterways	Flood plains	Streams
NITI Aayog, 2021, "Report of the Committee constituted for formulation of strategy for Flood Management Works in entire country and River Management Activities and works related to Border Areas (2021– 26)"	33200	16 (0.048)	215 (0.648)	901 (2.714)	0 (0)	6 (0.018)	3 (0.009)	22 (0.066)	10 (0.03)
NIUA , 2020 – Urban wetland/water bodies management guidelines	25600	84 (0.328)	94 (0.367)	32 (0.125)	0 (0)	4 (0.016)	1 (0.004)	3 (0.012)	17 (0.066)
NIUA , 2021 – Strategic guidelines for Making River-Sensitive Master Plans	24895	3 (0.012)	655 (2.631)	84 (0.337)	1 (0.004)	5 (0.02)	8 (0.032)	36 (0.145)	15 (0.06)
TCPO, 2021 – River centric urban planning guidelines	6199	1 (0.016)	200 (3.226)	53 (0.855)	1 (0.016)	5 (0.081)	0 (0)	17 (0.274)	9 (0.145)
MoHUA, 2023 – Pathways to Amrit Kaal: Envisioning and Realising a New Future for Indian Cities.	19623	0 (0)	12 (0.061)	2 (0.01)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Source: Author
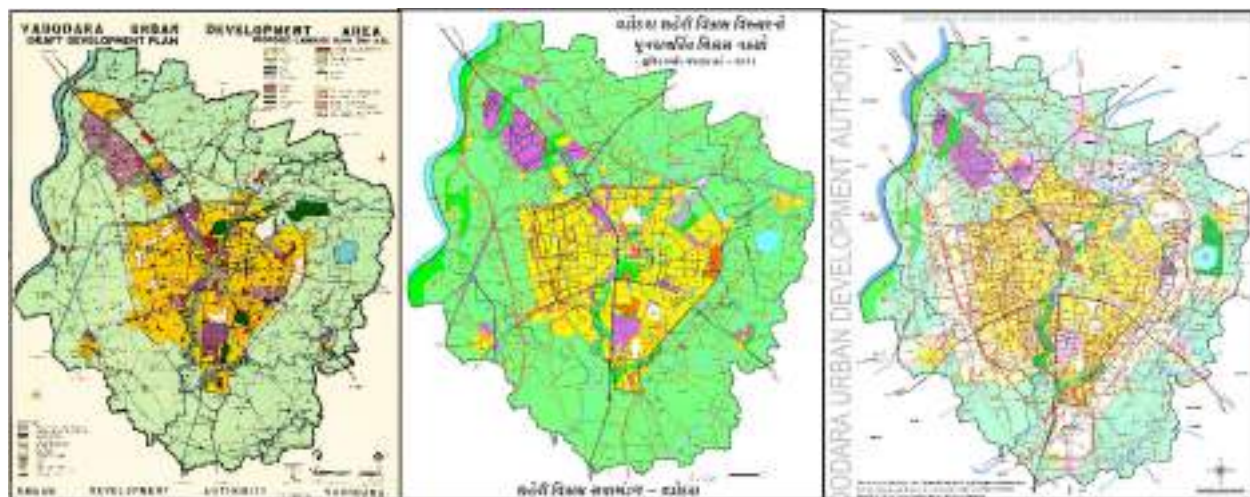
Figure 1. Successive Development Plans for Vadodara: ponds have been removed for developable land
Source: Vadodara Urban Development Authority (VUDA)

3.1 The Gujarat Town Planning and Urban Development Act (GTPUDA), 1976 and Development Plans

The GTPUDA institutionalizes the formation of Development Authorities, Development Plans (DP), and Town Planning Schemes (TPS). According to the Town Planning and Valuation Department (TPVD), Gujarat, the objectives of the Development Plan as facilitated by the GTPUDA are to provide for residential, commercial, transportation, and industrial needs of urban areas and to ensure systematic development in the "correct direction":

The objective of the Development Plan is to accommodate the growing population; however, it does not address any environmental considerations that will direct the formulation and implementation of the DP. However, Section 12 of the Act does include specific directives regarding environmental concerns. Section 12. (h), (i), (j), (l), (n) (Town Planning and Valuation Department 1976), the interpretations are largely misconstrued. The provisions in Section 12. (l) do not recognize the existence and importance of wetlands and ravines and consider them to be "low lying, swampy or unhealthy areas" and provide for reclamation and filling up of such areas for development. This provision suggests a lack of conceptual clarity regarding the environmental components, structure, function, and processes. The subsection of Urban Floods in the subsequent part of this paper will attempt to rationalize this claim. The provisions in Section 12. (j) do aim to mitigate the issues of land, water, and air pollution and prevention of floods, but on the other hand, they do not recognize the causative factors of pollution and floods.

The focus of the development plan is on the outward expansion of urban areas, incorporating fertile agricultural lands and natural regions into developable areas without evaluating the impacts of the previous plans. Figure 1 illustrates the incremental physical growth of the developable areas, and a closer examination of the proposed zoning reveals the conversion of lakes and ponds

While a Development Plan is intended to guide all development initiatives in a city, the Town Planning Scheme (TPS) serves as an implementation tool that regularizes land parcels through a land pooling mechanism. The primary objective of a TPS is also to provide for roads and basic services such as water supply, drainage, stormwater management, etc. The Town Planning Scheme Section 40 (3) b. of the GTPUDA also encourages the filling up of 'swampy" and "low-lying areas" for development. This provision discounts environmental and ecological factors such as floodplains, wetlands, ravines, riparian edges, naturally wooded areas, etc. It is due to this ignorance, neglect, and misinterpretation of the provisions that lead to environmental disasters, and we are forced to face the brunt of our actions. Additionally, the base data used to create a TPS is also not coordinated amongst the various data sources and agencies. For example, the Land Revenue Department has allotted revenue plot numbers to land parcels in notified water bodies.

The planning department uses this map as its base, excluding the notified lakes, and prepares the development scheme. This alters the topography of natural waterways and disconnects the environmental setup, leading to disasters, as discussed in the 'Urban Waterlogging and Floods' section of this paper.

3.2 Report of the Committee Constituted for Formulation of Strategy for Flood Management Works in Entire Country and River Management Activities and Works Related to Border Areas (2021–26), 2021

This report confirms that, according to constitutional provisions, the responsibility for flood management, including soil erosion control, lies with the states. The report recommends the adoption of detention basins, watershed management, and the floodplain zoning approach, along with non-structural measures, and cautions against the negative impacts of engineered solutions, such as channelization and river fortification (NITI Aayog 2021). While there is a total of 901

to residential zones. Parts of the existing natural corridor, due to the Vishwamitri River, have also been converted into a residential zone. The delineation of the river itself is questionable as the development plans have provided for and accepted the straightening of the river by the authorities under other planning initiatives.

mentions of 'flood' and 215 mentions of 'river,' the terms have been generally used with no scientific backing for reference or significant steps towards flood mitigation or enhancing the health of rivers. The report urges States to integrate the above recommendations into their planning acts and plan-making practices. While the States of Rajasthan, Manipur, and Uttarakhand have addressed them, other States, including Gujarat, have yet to consider this approach. This report, however, does not differentiate between perennial and seasonal rivers.

3.3 Urban Wetland/ Water Bodies Management Guidelines, 2021

These guidelines are presented in the form of a toolkit to facilitate stakeholders in protecting water bodies in the urban planning process and, in turn, uphold the ecological processes that sustain water resources in urban settings. This toolkit provides a step-by-step approach to identifying, prioritizing, and developing an action plan for protecting water bodies in urban areas (School of Planning and Architecture, New Delhi, 2021). The various stages include mapping of the wetlands and water bodies, identification of their ecosystem services, groundwater assessment, analysis of the impact of existing plans on the suitability of water bodies, and preparation of plans. This guide includes rivers as a type of wetlands but again does not differentiate between perennial and seasonal rivers.

3.4 Strategic Guidelines for Making River Sensitive Master Plans, 2021

These guidelines broadly reiterate the importance of considering catchment areas or watersheds in planning for cities. It focuses on urban rivers but emphasizes the stretch of the river that passes through urban areas. These guidelines strongly recommend that rivers and river zones be an integral part of master plans, as they are statutory. They identify various strategies and tools, such as localizing national policies within urban areas, zoning at multiple scales, and development control regulations for river zones as supporting master plans (NIUA 2021). The guidelines refer to streams and 'drains' but do not specify their

temporality. Instead, generic buffer widths are prescribed for the various orders of 'drains,' leaving their implementation to the interpretation of these guidelines by various authorities.

3.5 River Centric Urban Planning Guidelines, 2021

These guidelines stem from concerns about pollution and the neglect of rivers in urban contexts. The broad objectives of these guidelines are to conserve river waters through the development of riverfronts and devise zoning, strategies, and development regulations for riverfront development as part of sustainable urban planning and development (Town and Country Planning Organization 2021). These guidelines propose River Regulation Zones along the lines of Coastal Regulation Zones, with blanket buffer widths ranging from 100 m to 500 m without any scientific justification. The guidelines are very generic, and their implementation has been left to the will of the governing authority, as they recommend alternative approaches from conservation plans to River Zonal Development Plans. The various plans, along with their respective zoning, facilitate specific intrusive uses that defeat the very purposes of these zones.

3.6 Pathways to Amrit Kaal: Envisioning and Realising a New Future for Indian Cities, 2023

This report was released two years after the previous ones, which focused on rivers in the urban context. However, this high-level committee report focuses on capacity building of leadership and institutions, economic development, and riverfront development projects in cities (Ministry of Housing and Urban Affairs 2023). With an emphasis on recruiting urban planners at all levels to aid in urban development infrastructure, this approach aims to enhance and strengthen the statutory urban planning and design realm, thereby sidestepping addressing concerns related to mainstreaming rivers and their watersheds. Instead, the recommendations of the committee focus on commercial developments, transit corridors, waterfront redevelopments, and heritage precincts.

3.7 Cause of Urban Waterlogging and Floods

The current state of most urban rivers, including the Vishwamitri in Vadodara, is one of distraught and pity. Rivers are perceived as mere channels to transport water from one end to another. It is this misconstrued understanding of the river and its hydrological system that is the root cause of urban flooding problems. Urban rivers have been reduced to mere 'nallas' through systematic neglect in planning processes and misinterpretation of laws and guidelines.

Narrowing of the river section due to the encroachment of the floodplains and the ravines of the river by permitting the construction of buildings of various types and dumping of construction and demolition debris and other wastes along the river, its tributaries, ponds, runlets, ditches, wetlands, low-lying areas, and ravines; thus reducing the water carrying capacity and habitat values of these interrelated components of the river system. The primary reason for this is the lack of scientific demarcation of the river and its floodplains, as noted in both the Acts and the policy guidelines.

Deforestation, followed by urban development in the upper catchment areas, escalates water runoff, thereby increasing the velocity of flow and resulting in disturbances to the riverbed, which leads to erosion and lower groundwater levels. This phenomenon has a snowballing effect downstream, affecting vegetation and various habitats and deteriorating banks, rendering the river vulnerable to floods. Current planning practices devise fragmented plans for urban cities and rural areas, and although the guidelines call for a watershed approach, their implementation requires streamlined institutional changes.

Straightening of the river and severing off the meanders (naturally as well as through human intervention) from the river has given rise to 'ox-bow lakes' on either side of the river, which continue to serve as wetlands for the river system. These wetlands are perceived by existing legislation as *"swampy and low-lying areas"* that are permitted to be filled and developed under statutory policies. However, this has led to an increase in water velocity, inundation of downstream areas with water, and increased siltation due to soil erosion. In urban areas, including Vadodara, the meanders of rivers are often perceived as obstacles to water flow, and banks are modified or straightened, as seen in Figure 2. This again accelerates the flow and velocity of water, causing inundation and flooding in downstream areas.

Poor urban planning has altered the river course and reconfigured riverbanks, as well as those of their tributaries, ponds, and connecting

runlets and ditches, resulting in indiscriminate land-use changes in the catchment area of the Vishwamitri River to accommodate real estate development. The construction of retaining walls or hard pitching around the river, ponds (invariably in the name of so-called beautification), and channelizing tributaries and natural stormwater ways – these interventions

disconnect, destroy, and disrupt the river system from functioning effectively. Rampant urban development is increasing the impervious surface area of the city, which exacerbates stormwater runoff that is either diverted into stormwater drains or remains waterlogged, causing flood-like situations.

Figure 2. Channelisation of River – Change in Riverine structure between 1972 to 2020
Source: Author

4. Discussions

Recurrent episodes of natural disasters, such as floods, droughts, and epidemics, are indicators of flawed policies that continue to focus on hard-engineered infrastructure provisions that do not account for the natural system structure and the ecosystem services it provides. The river-centric planning guidelines by various authorities offer mere lip service. In contrast, funded missions such as JNNURM (Jawaharlal Nehru National Urban Renewal Mission), AMRUT (Atal Mission for Rejuvenation and Urban Transformation), PMAY (Pradhan Mantri Aawas Yojna), Smart City, etc. focus on allocating funds towards providing infrastructure and services to urban centres towards the provision of drains (stormwater and sewage), slum rehabilitation programs and roads.

Additionally, the authorities, under various government development initiatives, undertake large-scale planning initiatives that are not in coherence with the Development Plan. They include riverfront development projects, transportation projects (such as National Expressways, Highways, and Bullet Trains), slum redevelopment projects, and lake beautification projects in a public-private

partnership mode, where private developers are given authority to design, build, and operate for a specific period. To materialize these, mass demolitions and the felling of trees have been making way for the above real estate development projects, with disregard for the wildlife habitats and environmentally insensitive development of the water entities. These piecemeal, disjointed initiatives have significant city and regional-scale implications that render the DP ineffective and cause irreversible environmental damage. The three aspects of DP – plan formulation (content and process), implementation tools, and implementing agencies all need to be streamlined and integrated with due environmental considerations to achieve the sustainable development that we aspire to accomplish. This aspect is missing from the provisions and guidelines discussed above.

Worldwide, there is recognition and a growing consensus regarding planning as a multifaceted and interdisciplinary profession. The academic domain has progressed in innovating solutions that the professional practice domain and governance can implement, but these approaches often fall short due to a lack of institutionalization. The field of planning necessitates the application of pure natural

science research in an integrated manner with other disciplines, such as social science, political science, physical science, and economics. The high-level committee emphasizes the importance of engaging urban planners across all sectors. Therefore, training sensitive planning professionals to make lateral connections becomes a key responsibility of the academic domain.

5. Conclusions

There is a need to acknowledge the river ecosystem as a dynamic living entity that performs several abiotic and biotic functions. Rivers, as fluvial systems, do not recognize administrative and political boundaries; instead, they are shaped by the topography of the landforms, soil structure, and the presence of vegetation and habitats. Riparian corridors, ravines, floodplains, tributaries, and wetlands are the natural flood management mechanisms of rivers that need to be demarcated on cadastral maps.

Planning policies, legislations, and guidelines should explicitly incorporate the uniqueness of river systems as potential habitats for many endangered flora and fauna. Cities like Vadodara are among the few cities that have wildlife habitats in the heart of their urban areas. These habitats, through burrows and nests, also contribute to reducing velocity levels and increasing lateral infiltration rates by keeping the soil loose and moist. Restoring or increasing the protection of floodplains and riparian corridors will not only protect river ecosystems but will reduce the impacts of both floods and droughts.

The regulatory legislation and statutes should include these parameters as an integral part of planning and implementation. Provisions should also direct planning consultants, public agencies, and authorities to address this aspect while identifying and delineating planning boundaries for local area plans, development plans, regional plans, and perspective plans. For this purpose, the enabling legislations, especially the Planning Acts, must direct the various strata of governance to collaborate to form intra, inter, and cross-administrative coalitions while engaging qualified planners and other multi-disciplinary experts not only to conduct meaningful discussions within and amongst these authorities but also involve citizens in the decision-making process to derive cohesive planning proposals to build resilient systems. The enabling legislation and guidelines must facilitate an appropriate and accountable administrative structure with genuine, transparent, and proactive participation of experts and citizens in the city's development of all kinds, from inception to post-implementation evaluations and required corrections.

With the emergence of new development and urbanization trends, many environmental problems have arisen. In contrast, existing issues remain unresolved, as urbanization trends often overlook the Indigenous native ecosystem in decision-making processes. India is experiencing a "development" surge under the current government mandate, spearheaded by the development policies of Gujarat. The capitalist attitude of prioritizing economic gain has overshadowed all other considerations – including ethical, environmental, and social concerns. The existing and emerging planning processes must integrate environmental and natural system considerations to alleviate issues such as pollution, resource deficit due to overexploitation, human-wildlife conflicts, litigation, financial losses, and delays in project implementation, to name a few.

References

Arora, R., T. Balachander, I., Agrawal, R., Panda, D., Gupta, A., Kasturirangan, J., Vencatesan, et al. 2024. "Conserving Freshwater Ecosystems in India: A call to action." *Aquatic Conservation: Marine and Freshwater Ecosystems.*

Barouillet, Cécilia, David Juan González-Trujillo, Juergen Geist, Gísli M. Gíslason, Hans-Peter Grossart, Kenneth Irvine, Sonja C. Jähnig, e Philip J. Boon. 2023. "Freshwater conservation: Lost in limnology?" *Aquatic Conservation: Marine and Freshwater Ecosystems.*

Carson, Rachael. 1962. *Silent Spring.* New York: Houghton Mifflin.

Datry, Thibault, Nuria Bonada, e Andrew J. Boulton. 2017. "General Introduction." Em *Intermittent Rivers and Ephemeral Streams: Ecology and Management*, de Thibault Datry, Nuria Bonada e Andrew J. Boulton, 1-20. London: Academic Press, Elsevier.

Dutta, Venkatesh, Urvashi Sharma, Kashifa Iqbal, Adeeba, Ravindra Kumar, e Ajey Kumar Pathak. 2018. "Impact of river channelization and riverfront development on fluvial habitat: evidence from Gomti River, a tributary of Ganges, India." *Environmental Sustainability.* 2: 167–184.

Fageha, Mohammed K., e Ajibade A. Aibinu. 2013. "Managing Project Scope Definition to Improve Stakeholders' Participation and Enhance Project Outcome." *Procedia - Social and Behavioral Sciences* 154-164.

Forman, Richard T. T. 2005. *Land Mosaics: The ecology of landscapes and regions.* Cambridge:

Cambridge University Press.

Gadgil, Madahav, e Ramchandra Guha. 1994. "Ecological Conflicts and the Environmental Movement in India." *Development and Change* 25: 101-136.

Gadgil, Madhav, e Ramchandra Guha. 1992. *This Fissured Land: An Ecological History of India.* Oxford University Press.

GERI. 2014. *Study of Water Quality Fluctuation in River Vishwamitri.* Vadodara: Narmada, Water Resources, Water Supply & Kalpsar Department

Jasanoff, Sheila. 2021. "Humility in the Anthropocene." *Globalizations* 18 (6): 839-853.

Marsh, William. 2010. *Landscape Planning: Environmental Applications.* John Wiley & Sons.

McHarg, Ian L. 1969. *Design with Nature.* New York: John Wiley & Sons.

Ministry of Housing and Urban Affairs. 2023. *Pathways to Amrit Kaal: Envisioning and Realising a New Future for Indian Cities, 2023.* New Delhi: Government of India.

NITI Aayog. 2021. *Report of the Committee Constituted for Formulation of Strategy for Flood Management Works in Entire Country and River Management Activities and Works Related to.* New Delhi: National Institution for Transforming India.

NITI Aayog. 2018. *SDG India Index: Baseline Report 2018.* New Delhi: NITI Aayog.

NIUA. 2021. *Strategic Guidelines for Making River Sensitive Master Plans, 2021.* New Delhi: Ministry of Jal Shakti.

Palmer, Margaret A, Catherine A Reidy Liermann, , Christer Nilsson, Martina Flörke, Joseph Alcamo, P Sam Lake, e Nick Bond. 2008. "Climate change and the world's river basins: anticipating management options." *Frontiers in Ecology and the Environment.*

School of Planning and Architecture, Delhi. 2021. *Urban Wetland/Water Bodies Management Guidelines.* New Delhi: National Mission for Clean Ganga, Ministry of Jal Shakti.

Steiner, Frederick. 2008. *Living Landscapes.*

Steward, Alisha L., Daniel von Schiller, Klement Tockner, Jonathan C. Marshall, and Stuart E. Bunn. 2012. "When the river runs dry: human and ecological values of dry riverbeds." *Frontiers in Ecology and the Environment.*

Thakkar, Himanshu. 2012. *Rivers of Gujarat.* New Delhi, 29 February.

Town And Country Planning Organisation. 2021. *River Centric Urban Planning Guidelines.* New Delhi: Ministry of Housing and Urban Affairs, Govt. of India.

Town Planning and Valuation Department. 1976. "The Gujarat Town Planning and Urban Development Act, 1976." Gujarat: Goverment of Gujarat.

Planning Implications of Emergence of Gated Communities in Large Cities:
Case of Delhi

Saksham Mishra[1] and Poonam Prakash[2]

[1]Graduate, School of Planning and Architecture, New Delhi Email: saksham4444@gmail.com
[2]School of Planning and Architecture, New Delhi Email: pprakash@spa.ac.in

Abstract: Gated communities are residential neighbourhoods characterized by controlled access and limited public entry, enclosed by physical barriers and often guarded gates. The rise of gated communities has historically been driven by several core needs: security evolved from insecurity and the fear of the unknown; privacy was desired to exclude unwanted elements; and exclusivity was sought by rising income groups who desired a new lifestyle. In the Indian context, court rulings have established a legal precedent against gating; however, policies often lack acknowledgment of the social implications stemming from the attitude that favours gating, and there is a lack of planning interventions surrounding the phenomenon. Current regulations remain overly focused on technicalities, thereby promoting privilege and inequality of access. Organizations are unwilling to consider the negative impact of gating on urban areas, reflecting an underlying preference for closing off spaces, differentiating between outside elements, and privatizing facilities. Furthermore, case study observations in Siddhartha Extension and Bhagwan Nagar in Delhi highlight contrasts in the acceptance of outsiders, perceived security, amenities, ease of movement, public access, and community bonding between the two areas. To provide proper interventions to counter the implications of gated communities, there is a need to fulfil aspirations for security, privacy, and exclusivity while improving access, reducing segregation, and providing high-quality facilities. Suggested interventions include management approaches, design interventions, and planning decisions surrounding gating and segregation.

Keywords: Gated communities, Delhi, Group Housing, Access, Development Regulations

सार: गेटेड कम्युनिटीज़ वे आवासीय पड़ोस हैं, जो नियंत्रित प्रवेश और सीमित सार्वजनिक पहुंच द्वारा परिभाषित होते हैं, और जो भौतिक बाधाओं से घिरे होते हैं। गेटेड कम्युनिटीज़ का उदय ऐतिहासिक रूप से कई आवश्यकताओं द्वारा प्रेरित है – अज्ञात के डर से सुरक्षा की इच्छा; अवांछित तत्वों को बाहर रखने के लिए गोपनीयता; और बढ़ते आय समूहों के साथ एक नए जीवनशैली की मांग के चलते विशिष्टता। भारतीय संदर्भ में, अदालतों के फैसले गेटिंग के खिलाफ कानूनी नजीर स्थापित कर चुके हैं, लेकिन नीतियों में गेटिंग के सामाजिक प्रभावों की पहचान की कमी है। वर्तमान नियम केवल तकनीकीताओं तक सीमित हैं और इसके परिणामस्वरूप विशेषाधिकार और असमानता को बढ़ावा देते हैं। संगठन शहरी क्षेत्रों में गेटिंग के नकारात्मक योगदान पर विचार करने के लिए तैयार नहीं हैं। दिल्ली के सिद्धार्थ एक्सटेंशन और भगवान नगर में केस स्टडी के अवलोकनों ने बाहरी लोगों की स्वीकृति, सुरक्षा की धारणाएं, सार्वजनिक पहुंच, और समुदाय के बीच संबंध में अंतर को उजागर किया। गेटेड कम्युनिटीज़ के प्रभावों को कम करने के लिए उपयुक्त हस्तक्षेप प्रदान करने के लिए, सुरक्षा, गोपनीयता, और विशिष्टता की आकांक्षाओं को पूरा करते हुए पहुंच में सुधार, अलगाव को कम करने और सुविधाएं प्रदान करने की आवश्यकता है। सुझाए गए हस्तक्षेपों में प्रबंधन दृष्टिकोण, डिज़ाइन हस्तक्षेप और गेटिंग से संबंधित योजना निर्णय शामिल हैं।

मुख्य शब्द: गेटेड कम्युनिटीज़, दिल्ली, समूह आवास, पहुँच नियंत्रण, विकास विनिय

1. Introduction

The rapid growth of gated communities in India has brought about a significant transformation in the urban landscape. This has given rise to a need for a comprehensive study of the social implications of gated communities in the Indian urban context. The surge in the popularity of gated communities is not unique to India; it reflects a global trend in urban development. Cities, once predominantly characterised by tightly-knit neighbourhoods and bustling streets, have witnessed a remarkable shift towards exclusive, controlled, and privatised residential spaces.

According to a report by Redseer in 2021, there are 1.3 lakh gated communities in India consisting of 1.6 crore households, which account for a share of 32% of total households in India. This share is projected to rise by 33% in the number of gated communities over the next five years, reaching 2.4 crore households in 2026 and further increasing to 3.2 crore households in 2031, with a share of 51%.

The decision to reside in a gated community is not solely a matter of personal preference; it is influenced by a multitude of factors. These factors encompass concerns related to security, lifestyle, amenities, social prestige, and even the perception of urban living. Focusing on gated communities necessitates dissecting these factors, illuminating the motivations and considerations that lead individuals or groups to

opt for a life within the confines of gated developments.

The impact of gated communities is a subject of critical importance in urban development, affecting communal interactions, the potential for city development, the spatial spread of residential areas, and stakeholder interests (Roitman 2010, Roitman and Phelps 2011). The connection between gated communities and urban development presents a significant challenge for planners, who must balance the growth and development of the entire city while catering to the unique demands and aspirations of gated community residents (Myers, 1970). The challenge lies in finding a balance that promotes the common good while respecting individual preferences and rights (Cherkes et al. 2023).

Gating as a phenomenon has been identified as stemming from a few key attitudes that drive social, psychological, and physical needs. The need for security is a primary motivator behind the establishment of gated communities. Residents seek protection from crime, theft, and other threats, leading to the development of secure, controlled environments (Blakely et al. 1997). Privacy is another crucial factor driving the popularity of gated communities. These communities offer residents a sense of control over their space, reducing unwanted interactions with outsiders (Manzi 2005). Further, living in a gated community is associated with a certain social status. The exclusivity of these communities can be a symbol of affluence and success (McKenzie 1994).

Hence, the need for a study on gated communities from a planning perspective is established as the impact of gated communities on urban planning is far-reaching and multidimensional. As urban planners grapple with the complexities of modern urbanization, they must consider how gated communities affect communal interactions, city development potential, the spatial distribution of residential areas and facilities, and the interests of various stakeholders.

Though the study will uncover various aspects related to gated communities over the course of its execution, the primary aim of the study will be -

Uncovering and understanding the dynamics of gated communities in an area, their larger urban implications, the perception of planners in their evolution, and planning measures to mitigate adverse impacts while preserving desirable elements.

Specific objectives of the research include examining the implications, processes, and role of planning in the development of gated communities; highlighting decision-making and quality of life differences between residents of gated and non-gated communities; exploring planners' perspectives on gated communities; and providing rationale-based recommendations based on arguments for gating versus opening communities. The study would focus on a case city and further utilise surveys and analysis of chosen communities in the city as well as rely on inputs from professional planners and relevant stakeholders in the city's development.

1.1 Methodology

The research first attempts to understand the evolution of gated communities and the driving forces powering the change. It aims to establish the need for a study on gated communities by delving into the characteristics and implications of these communities through an in-depth literature review of both international discourse and site-relevant discussions.

To understand the site-specific context, impact, and discourse on gated communities, in-depth primary surveys were conducted, encompassing residents, policymakers, urban planners, implementation officers, and representatives of the citizen body. The primary survey included qualitative, quantitative, and perception-based questionnaires tailored to suit targeted stakeholders. Figure 1 shows the methodology.

Figure 1. Methodology of the Study (Authors 2024).

The analysis of the various findings from the primary and secondary surveys led to the formulation of several proposals in the form of policy recommendations and design interventions, focusing on maintaining a shared identity, enhancing perceptions of safety, and providing access to high-level facilities.

2.   Evolution and Characteristics of Gated Communities

Gated communities have emerged as a relatively recent topic of debate in the realm of urban research. Scholars and urban theorists such as Blakely, Low, Davis, and Le Goix, among others, have grappled with the complex nature of gated communities, aiming to categorise, define, and analyse them.

The concept of gated communities began to take shape in the United States during the post-World War II suburban boom. This period saw a dramatic increase in car ownership and rising incomes, which facilitated the migration of middle-class families from urban centres to suburban areas (Schouten, 2022). Fear of crime and prejudice played a significant role in shaping the trajectory of gated communities. The heightened anxieties, particularly in the context of class and race dynamics, prompted people to seek refuge in gated enclaves as a means of insulating themselves from perceived social issues (Vesselinov, 2008). The evolution of gated communities was further nuanced by the concept of Common Interest Developments (CIDs), defined as communities in which residents own or control common areas and shared amenities, with reciprocal rights and obligations enforced by a private governing body (Judd 1995).

In the 1990s, the academic discourse surrounding gated communities initially focused on the issues of segregation, racial divides, and social isolation. These neighbourhoods, surrounded by walls and barriers, were seen as manifestations of societal disparities. Some key works, such as "The City of Quartz" by Mike Davis (1997) and various articles in "The City," frame gated communities as a consequence of the privatisation of public spaces, resulting in territorial segregation and isolation.

Mike Davis notably used terms like "white wall," "fortress," and "fortified cells of the affluent society" to characterise these communities. He emphasised the role of residents' associations in turning into barricaded communities in response to perceived threats and insecurities. Gilbert Lazar (1999), in his review of "Fortress America" by Blakely and Snyder (1997), expanded on these ideas, defining gated communities as "residential areas with limited access, designed with a desire to privatise public spaces and control entry."

As research progressed into the following decade, authors like Renaud Le Goix (2006) accepted the previously established definitions but added new dimensions to the discourse. They viewed gated communities as "enclosed residential neighbourhoods with controlled public access." Le Goix's approach integrated economic dimensions, considering gated communities as real estate products sold by developers.

The evolving interpretations and definitions of gated communities have transformed them from isolated residential enclaves into complex tools for understanding contemporary cities (Figure 2). They challenge traditional urban concepts and encompass a broad spectrum of issues, including urban sprawl, ethnic and spatial segregation, governance models, and the influence of economic factors.

Figure 2. Evolution and Discourse on Gated Communities (Compiled by the authors, 2024)

Literature and academic work on gated communities highlight the fact that the consequences of gated community development lie in direct contradiction to several key planning fundamentals. Gated communities are

fundamentally designed to regulate and restrict access, effectively keeping out external elements that are deemed undesirable (Low 2003). They contradict the goals of housing choice, affordability, a robust public realm, community welfare, and an open and inclusive community. Blakely and Snyder (1999) point out significant social consequences, including Division, Fragmentation, and Segregation. Division and fragmentation refer to the creation of physical and social barriers within urban spaces, leading to a sense of separation among residents. Segregation, as identified by the same authors, implies not only physical separation but also the inequitable distribution of resources, perpetuating social disparities. Low (2003) contributes to this discourse by identifying additional social implications, including Limited Access, Loss of Community, and Urban Deterioration.

Jane Jacobs, in her book 'The Death and Life of Great American Cities' talks about various elements that elevate a sense of security in the community through openness and community interactions. In stark contrast, gated communities adopt a strategy of limited public access through controlled entry points (Balčaitė et al. 2018). Atkinson (2008) adds another layer to the discussion by emphasising that segregation within gated communities is not only physical but also extends to the lack of resources necessary for ensuring security. This segregation, both physical and resource-based, contributes to a sense of exclusivity and privilege within these enclosed spaces. Moreover, gated communities often result in a concentration of wealth and higher property values within their boundaries. This concentration can distort real estate markets and contribute to wider economic disparities. As property values within gated communities rise, the surrounding areas may experience depreciation, creating pockets of affluence amid broader urban poverty (Touraine 2000).

Through the study, it can be primarily conceded that gated communities have become promoters of social differences in terms of fragmentation, accessibility, level of facilities, and security, among others. Its application in various countries and case studies has led to similar results in the form of disruption in the urban fabric of the impacted regions.

However, on the other hand, gated communities have also been thriving in providing certain benefits and positives to their residents that are unparalleled and influence residential choices, making it challenging to counter the increasing trend of people preferring a gated nature of development.

Through the literature study, it also becomes clear that there is a need for mitigation factors suited to local needs, which address the benefits offered by gated communities while providing viable alternatives. And replace the need for such communities by addressing the concerns and needs of the people. These measures must necessarily counter three core aspects: access control restrictions, segregation and exclusion, and privatisation of facilities.

Grant (2005) discusses several such measures identified by a survey of planners, including explicit plan policies to limit and discourage gating, fence height restrictions, transportation network integration, using development permit process to refuse requests for gating, use of urban design and landscaping elements against undesirable elements, persuading developers against gating and the use of council by-laws among other recommendations.

However, any such measures shall only be acceptable when they address the core needs that drive the creation of an exclusionary environment. Mitigating the growth of gated communities requires striking a balance between the central arguments of an inward-looking society and an outward-looking one by addressing the need for security, surveillance, and homogeneity while also promoting openness, inclusion, diversity, and shared spaces.

3.   Study Area Profile and Evolution

Delhi is the fastest urbanising city (4.1%) in the world and the largest city in terms of population (32 million) in India. This rate of growth makes the city vulnerable to the increased development of gated communities driven by rising pressure on resources and rising income. Delhi has both gated cooperative group housing societies and gated sectors or colonies wherein their composition and elements are highly contrasting. The city also has a well-established system of Resident Welfare Associations in the city, along with a proper planning and development administrative setup to support them. Gated communities, as an urban element, have already faced scrutiny in the past in Delhi and are, therefore, under the eye of the government administration.

Siddhartha Extension and Bhagwan Nagar in Delhi were chosen as case studies representing typical examples of gated and non-gated

communities in the city, respectively. Sidhartha Extension is being designed as a non-gated Delhi Development Authority (DDA) colony in which the Resident Welfare Association (RWA) has set up gates. Both sites have a similar property value and average income, making them comparable based on a common factor.

The sites were extensively surveyed through household surveys to identify perception and impact with respect to gating, observational surveys, and interactions with stakeholders, including DDA officials, RWA, senior citizen organisations, security guards, business owners, etc. 40 samples were collected for Siddhartha Extension and Bhagwan Nagar each in the household survey through stratified sampling with 95% confidence level and 10% margin of error.

3.1 Discourse on Gated Communities in Delhi

The evolution of gated communities in Delhi reflects broader trends in urban planning, housing policies, and social dynamics over the decades. Starting in the 1950s, Delhi's residential landscape was largely defined by low-rise government colonies and single-family homes. These early developments, built by the state, were characterized by open, accessible neighbourhoods with minimal restriction on movement.

By the 1960s, the city began to witness a shift toward more planned residential colonies. These low-rise and spacious developments continued the trend of accessible housing. Still, they were designed with better infrastructure and layout planning, resulting in the establishment of low-rise government colonies and single-family homes (Nath 1993). Gating in these early decades was limited and mostly restricted to individual plots. However, as the city expanded rapidly and underwent urban growth, a breakdown in social cohesion started to emerge by the 1980s. This period saw the rise of mid-rise group housing projects and redevelopment initiatives (Nath 1993).

The 1990s brought about a more marked transformation in Delhi's housing and social structure. High residential towers began to come up, and the concept of gated communities gained traction, especially in upscale neighbourhoods. As liberalisation reshaped India's economy, this brought about a surge in private investment in the real estate sector (Dupont 2011). This period was influenced by India's broader economic liberalisation and the creation of a knowledge economy, which had profound implications for urban planning, socio-economic dynamics, and housing policies (Mookherjee 2014). The involvement of private developers in constructing residential and commercial projects has become more prominent, reflecting a shift toward market-driven urban growth (Dupont 2011).

On the other hand, income gaps widened, and residents in wealthier localities sought more exclusivity and security. This desire led to the gating of posh colonies and High-Income Group (HIG) developments, effectively creating physical and social boundaries within the city (Dupont 2011). The widening income gap and the concentration of wealth in certain areas contributed to the growing socio-economic divide in the city (Ahmad et al 2011).

This trend continued to gain momentum in the 2000s, catering to the affluent (Sharma 2022). The 2000s marked a turning point as DDA projects themselves began incorporating gates, and more planned redevelopment projects in inner-city areas included gated developments. By the mid-2000s, the trend had gained sufficient momentum for the Municipal Corporation of Delhi (MCD) to introduce formal guidelines for installing gates in residential areas. However, the gating was still somewhat regulated, with only technical restrictions, including the times gates could be closed and specific road width requirements.
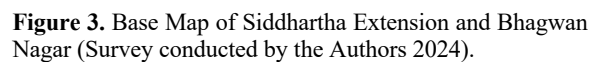
High-rise residential buildings and gated communities continued to proliferate in Delhi during the 2010s, with close to 50% of new buyers preferring multi-story or builder-floor apartments (Yadav 2013). Existing gated colonies began receiving official permissions to regularise their gates, cementing the gated community as a standard residential form in Delhi. However, concerns about the social implications of this trend began to surface. In 2016, the Ministry of Housing and Urban Affairs (MoHUA)'s High-Powered Committee on Decongestion raised concerns about the negative impact of gated communities on traffic flow and urban mobility. The committee also critiqued these developments for prioritising the privileged, highlighting the socio-economic divide created by such urban planning practices.

Despite these concerns, gated communities continued to expand in the city. In 2019, a significant policy shift allowed private builders to purchase DDA plots and construct group housing societies, with a stipulation that 15% of the Floor

Area Ratio (FAR) be reserved for community service personnel and Economically Weaker Section (EWS) housing. Moreover, the introduction of the Transit-Oriented Development (TOD) Policy that same year sought to create active frontage and establish setback norms, aiming to encourage barrier-free access in future developments.

The discourse around gated communities in Delhi mirrors broader global trends of urban privatization and socio-spatial fragmentation. What began as a response to housing demands and urban growth has evolved into a dominant residential form, shaped by policies and phenomena such as liberalization, widening income inequality, and increased privatization.

3.2 Site Characteristics

Developed in the 1980s under the DDA self-financing scheme, Siddhartha Extension offers a mix of Middle-Income Group and High-Income Group housing in two pockets. Initially constructed with boundaries, the colony added gates later, after 2000. It is estimated that around 50% of the original owners have since left the colony. Apartment sizes in the community range from 700 to 1200 square feet, with rents between 15,000 and 42,000 rupees per month.

In contrast, Bhagwan Nagar, previously a Scheduled Tribe (ST) colony, transformed from mostly barren land in the 1980s into a regularized DDA residential area. Today, it is home to a diverse community with varied economic and social backgrounds. Bhagwan Nagar offers a diverse range of typologies, ranging from 1 to 4 BHK options, with rents falling between Rs. 10,000 and Rs. 40,000 per month.

Before regularisation, Bhagwan Nagar didn't have proper facilities. The DDA built parks, playgrounds for children, and community centers, providing spaces for gatherings and interactions. Over time, shops were built along the main roads for easy access to everyday necessities, while the inner streets remained quieter and residential. In addition, hospitals, places of worship, improved public transportation, and specialised markets emerged.

Figure 3. Base Map of Siddhartha Extension and Bhagwan Nagar (Survey conducted by the Authors 2024).

Despite their geographic proximity, Siddhartha Extension and Bhagwan Nagar don't share a deep interdependency. While residents from Siddhartha Extension may occasionally visit Bhagwan Nagar's commercial spaces to fulfil specific needs, their interactions are limited beyond that. The primary advantage for both colonies is their strategic location. They offer easy access to various parts of the city and boast well-developed physical and social infrastructure. Additionally, the presence of numerous parks and open spaces provides residents with opportunities for leisure and recreation.

4.   Data Analysis and Findings

4.1 Site Characteristics

The boundaries surrounding Siddhartha Extension were constructed during the initial development phase in the 1980s. However, the community gates, which limit vehicular and pedestrian access, were installed much later, after 2000, according to resident accounts.

There are multiple gates along the perimeter, with Gates 4, 5, and 6 of the "C" pocket and Gate 1 of the "B" pocket opening towards the adjacent non-gated area of Bhagwan Nagar (Figure 4). At night, only Gate 3 of the C pocket and Gate 2 of the B pocket remain open for resident access in and out of Siddhartha Extension (Figure 5).

The installation and operation of these gates appear to lack formal approval, as the Resident Welfare Association (RWA) president acknowledged no permission was obtained despite legal requirements. However, the RWA justifies the gates as necessary for maintaining security while admitting they cannot legally prohibit any person from entering.

Figure 4. Circulation in the site during the day (Survey conducted by the Authors, 2024).

Figure 5. Circulation in the site during the night (Survey conducted by the Authors, 2024).

4.2 Residents' Perception

A questionnaire was developed to collect and assess resident perceptions across three key aspects—access control, community segregation, and facility levels —between Siddhartha Extension and the neighbouring non-gated area of Bhagwan Nagar in Delhi. The analysis is based on a stratified sample survey of 80 households, with 40 respondents from each locality.

The survey revealed significant differences in attitudes toward interactions with outsiders and access control. Bhagwan Nagar residents (NGC) showed a higher willingness to share spaces with outsiders, scoring 3.80 on a scale of 5 compared to Siddhartha Extension's 3.20 (Figure 6). Further, Siddhartha Extension (GC) residents exhibited a stronger concern for privacy, scoring 3.10 on privacy infringement by outsiders compared to Bhagwan Nagar (2.55). The concept of "outsiders" was also perceived differently; Siddhartha Extension residents regarded anyone beyond their boundaries as an intrusion, whereas Bhagwan Nagar residents did not share such rigid distinctions.

When it came to security, Bhagwan Nagar residents reported feeling safer in interactions with outsiders, scoring 3.92 compared to Siddhartha Extension's 3.35. However, residents of Bhagwan Nagar expressed more concern for their children's safety. Overall, the perception of security threats from outsiders was higher in Siddhartha Extension, where residents felt more cautious and defensive.
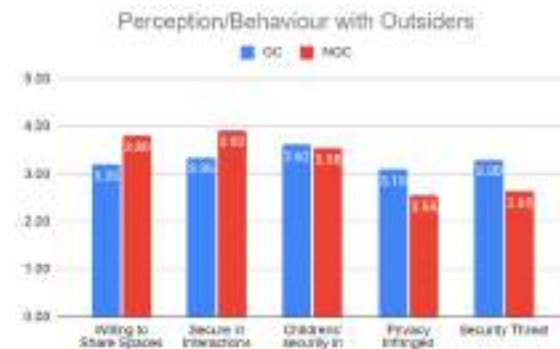
Figure 6. Resident Perception of Outsiders (Survey conducted by the Authors, 2024).

Through the survey, it was also observed that the boundary walls in Siddhartha Extension exceeded the 1.5-meter regulatory limit in several areas and featured barbed wires, contributing to a heightened sense of isolation (Figure 7).

Figure 7. Boundary Height in Siddhartha Extension (Survey conducted by the Authors, 2024).

Crucially, these gates and boundary walls were constructed without obtaining requisite permissions from municipal authorities, such as the MCD, highlighting regulatory violations. Despite acknowledging the hardships of closing routes at night, gated residents expressed a willingness to allow access only for themselves, underscoring the exclusionary attitudes reinforced by physical gating. Bhagwan Nagar residents also viewed the boundaries around Siddhartha Extension as an artificial divide, indicating that the impacts of boundary permeability extend beyond just the gated zones (Figure 8).

Figure 8. Boundary Condition in Siddharth Extension (Survey conducted by the Authors, 2024).

Community interactions in Bhagwan Nagar and Siddhartha Extension reveal distinct patterns of social cohesion, diversity perception, and conflict resolution. Bhagwan Nagar shows stronger community bonding, with more respondents rating bonding at the highest level, compared to Siddhartha Extension. Non-gated areas in Bhagwan Nagar also report more frequent community interactions. At the same time, Siddhartha Extension's gated environment limits these exchanges, leading to more conflicts, particularly over RWA matters and public space use. The sense of belonging is also stronger in Bhagwan Nagar, with residents reporting higher attachment to their neighbours and community compared to those in Siddhartha Extension, where residents indicated that they primarily value location and amenities over community ties.

Throughout the survey, Siddhartha Extension exhibited lower levels of community interaction, weaker bonds, and a greater sense of isolation. In contrast, the open layout of Bhagwan Nagar fosters stronger social ties, greater inclusivity, and a more collaborative approach to community-level issues (Figure 9). This highlights how gating impacts equitable mobility and community integration beyond physical boundaries.
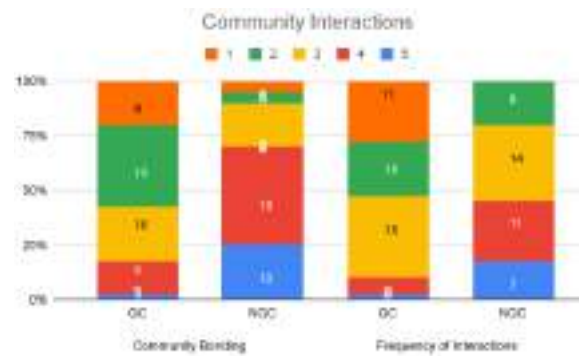
Figure 9. Rating of Community Interactions (Survey conducted by the Authors, 2024).

The survey revealed differing priorities in residential choice between Siddhartha Extension and Bhagwan Nagar. For Siddhartha Extension, location, infrastructure, security, and accessibility were key factors, while Bhagwan Nagar residents prioritised location, amenities, and accessibility. Notably, Siddhartha Extension residents emphasised security and infrastructure more, whereas Bhagwan Nagar placed higher importance on amenities, with limited concerns about security (Figure 10).
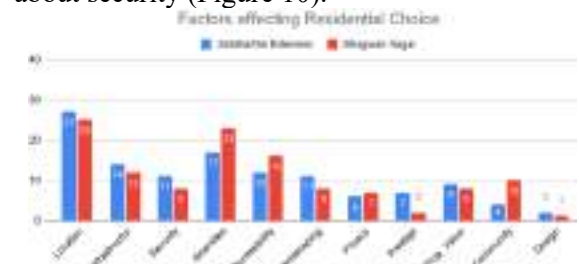
Figure 10. Factors Affecting Residential Choice (Survey conducted by the Authors, 2024)

In terms of facilities, Siddhartha Extension residents rated amenities, location, privacy, and infrastructure higher, while Bhagwan Nagar residents valued community and security more. Despite security being a key factor for moving to Siddhartha Extension, it was rated lower than in Bhagwan Nagar.

Interestingly, the differences in perceived amenities, security, and infrastructure between the gated and non-gated areas were not significant (Figure 11). Gated residents relied more on external amenities, while non-gated residents frequented community facilities within Siddhartha Extension. This suggests that gated communities may prioritise security, but they don't necessarily result in higher satisfaction or reduced reliance on external services.

Figure 11. Rating of Residential Conditions (Survey conducted by the Authors, 2024).

The survey of Siddhartha Extension and Bhagwan Nagar revealed key differences in access control, segregation, and facilities due to gating. Siddhartha Extension's gates restrict night-time movement, with most closed except for a few. These barriers create an exclusionary environment, and despite challenges, Siddhartha Extension residents favoured restricting access, while Bhagwan Nagar residents viewed these gates as artificial divides. Socially, gated residents showed a lesser willingness to share spaces with outsiders, thereby reinforcing access-related disparities. Despite prioritising security, Siddhartha Extension residents were less satisfied with it. Still, they had to rely on external amenities for various purposes, while Bhagwan Nagar residents made greater use of community facilities within the gated area. Gating, while emphasising security and exclusivity, did not result in greater satisfaction or reduced reliance on external services.

5. Conclusions and Recommendations

The current nature of gating and the resistance to opening up residential communities is a physical manifestation stemming from the various policies in place or the lack of relevant policies, which in turn is a result of hidden perceptions and attitudes that lead to decision-making favouring gated communities. The attitude supporting gating stems from a personal need for security, improved facilities, and exclusive living with the prestige associated with the type of lifestyle being led within these communities and the sense of control that accompanies the privatisation of such areas. Gated communities are considered a privatised solution to public problems and are seen as an opportunity to alleviate the public burden to an extent.

Case study observations in Siddhartha Extension and Bhagwan Nagar highlighted contrasts in acceptance of outsiders, perceived security, amenities, open spaces, ease of thoroughfare, access, and community bonding between the two areas. The inferences directly support the argument against gating while also providing lessons on the issues that need to be addressed before communities can be opened to prevent dissent and dissatisfaction among residents regarding their needs.

Effective planning interventions are necessary to manage the implications of gated communities. Planners should emphasise the importance of public access and the communal use of spaces. Addressing the lack of planning interventions involves developing clear policies and guidelines that regulate the growth of gated communities, focusing on creating a cohesive and inclusive urban environment.

To address the various implications arising from the growth of gated communities, a multi-pronged approach is proposed, encompassing interventions aimed at minimizing the growth of new gated developments, as well as measures to mitigate the impacts of existing gated communities. Upon categorizing the identified negative implications, it becomes important to formulate interventions that address access control, tackle segregation and exclusion resulting from gating, and finally ensure the de-privatization of facilities, Figure 12.

Figure 12. Rating of Residential Conditions (Survey conducted by the Authors, 2024).

5.1   Minimizing the growth of new Gated Developments

Discouraging Fortification and Encouraging Openness:

A fundamental shift in housing policies and master plans is necessary to promote the development of open, ungated communities. This should involve prioritizing the creation of inclusive and integrated neighborhoods through the implementation of appropriate zoning and development regulations. This would include:

Deferment of funds from public facilities held under private access promotes investment in open communities while encouraging private developments to open up through subsidies and financial/Floor Area Ratio based incentives in exchange for access to facilities. Requirements should be established to ensure compliance with edge and boundary-related regulations in addition to providing financial opportunities for residents through active uses and mixed-use potential.

Community Edges and Mixed-Use Zones:

The edges of residential areas should be utilized for creating active spaces and mixed-use zones that promote interaction between communities. This can be achieved through the strategic placement of facilities, such as parks, open spaces, and commercial activities along the fringes of residential neighbourhoods.

Utilize 'active street frontage,' which is defined as the ground-level frontage of a commercial building that simulates interest or activity on the adjacent street or to a public space. This utilizes various design and planning elements to ensure active usage of public spaces by creating an inclusive and safe public realm with permeable boundaries, transparent and layered façade, and shared green spaces for interactions and bonding (Figure 13).

Figure 13. Activating Community Spaces (Gold Coast Regulations, re-adapted by Authors, 2024).

Natural Surveillance and Active Frontage:

In order to foster a sense of ownership, it's essential to arrange physical spaces strategically. This involves maximizing visibility to facilitate the identification of suspicious activities. Implementing pedestrian-scale lighting and utilizing barriers can enhance visibility and promote safety (Figure 14). This approach involves adopting Crime Prevention Through Environmental Design (CPTED) principles. The development of guidelines, such as the 'Creation of Active Public Space,' emphasizes community engagement, natural surveillance, and designing active frontages. By incorporating these strategies, spaces can become safer and more welcoming environments for everyone (Figure 15).
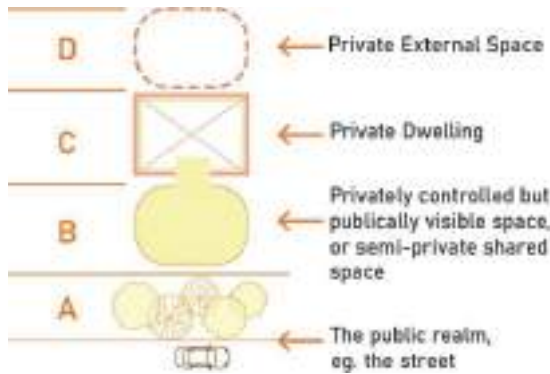
Figure 14. Creating a sense of ownership for spaces (Gold Coast Regulation, re-adapted by Authors, 2024).
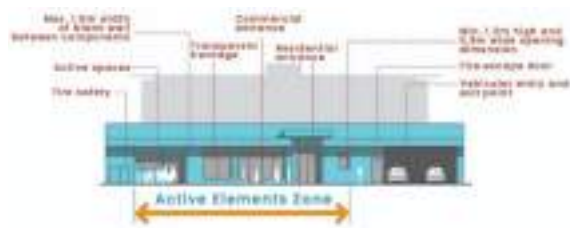
Figure 15. Active elements in the street (Northern Territory government, re-adapted by Authors, 2024).

5.2 Minimizing Impacts in Existing Gated Communities

Defining and Recording Gated Communities:

Creating an accepted definition for Gated Communities and recording the nature and number of gated communities in the city would enable the study of their impacts, trends, and demand.

Gated Communities in Delhi may be defined as "Residential neighbourhoods characterised by controlled access and limited public entry enclosed by physical barriers and gates set up in compliance with the gating conditions mentioned as per the MCD gating guideline."

There is a need for discourse on the Degree of openness in residential communities, referring to the extent of accessibility, connectivity, and interaction with surrounding areas. It would consider physical barriers, access points, and development regulations. Such discourse would shed light on the impact and desirability of gated communities in Delhi.

On-Site Interventions:

Site-specific interventions should be implemented to promote permeability and interaction between gated and non-gated areas in Siddhartha Extension and Bhagwan Nagar. These would include creating vending zones, activated open spaces, and pedestrian access points at strategic locations along the boundaries of gated communities.

Boundary Regulations:

Existing boundary regulations should be updated to promote permeability and visibility between communities, fostering a sense of shared identity and mutual understanding. This would involve mandating the replacement of solid boundary walls (Figure 16) with transparent or permeable fencing (Figure 17), subject to adherence to updated regulations for obtaining gating permissions. Updating boundary regulations to require 0.3m solid walls, with the option for transparent or alternative forms of fencing above that height, is crucial.

Figure 16. Existing Boundary in Siddhartha Extension (Survey conducted by the Authors 2024).

Figure 17. Proposed Boundary in Siddhartha Extension

(Authors 2024).

Traffic Calming Measures:

To address concerns related to thoroughfare and safety, traffic calming mechanisms such as vertical and horizontal shifts, roadway narrowing, and controlled one-way access during specific hours should be implemented in consultation with traffic authorities in gated communities.

To provide access at night to the ring road for thoroughfare from Bhagwan Nagar, Gate no.1 of Pocket B, Siddhartha Extension is proposed to be opened as vehicles would be directly visible from both ends and limited access to other parts of GC due to the location of the gate 1 and 2 as well as the closing of gate 3 which limits flow within the community. This opening would be accompanied by traffic calming measures such as bollards and footpaths (Figure 18).

Figure 18. Proposed Road Section in Siddhartha Extension to be opened at night (Authors 2024).

Human-Scale Design:

Principles of human-scale design should be promoted within gated communities to enhance community interaction and foster a sense of shared public realm. This could involve incorporating pedestrian-friendly elements, street furniture, and public art installations.

For Siddhartha Extension, a Vending Zone is proposed at a currently unutilized spot that residents from both communities can easily access (Figure 19). This initiative aims to encourage the utilization of shared spaces and create employment opportunities.

Figure 19. Human Scale Design (Gold Coast Citywide Streetscape Principles, re-adapted by Authors, 2024).

All proposed interventions aim to strike a balance between addressing the legitimate concerns and aspirations of gated community residents while mitigating the negative impacts on the larger urban fabric. By promoting inclusivity, shared identity, and equitable access to public goods and amenities, these measures endeavour to create a more cohesive and sustainable urban environment that fosters a sense of community and belonging for all residents.

References

Bernus, J. S. and M. A. Chase. 1990. 'Decision making in a networked environment'. In H. Eschenauer, J. Koski and A. Osyczka (eds.), *Technology and Communication.* Berlin: Springer-Verlag, 376–396.

Ahmad, Sohail and Mack Joong Choi. 2011. "The context of uncontrolled urban settlements in Delhi." *The German Journal of Contemporary Asia* 118: 75-90.

Almatarneh, Rana Tawfig. 2013. "Choices and changes in the housing market and community preferences: Reasons for the emergence of gated communities in Egypt: A case study of the Greater Cairo Region, Egypt." *Ain Shams Engineering Journal* 4: 563-583. 10.1016/j.asej.2012.11.003.

Awari, Mahesh babu, Muppidi Naveen, Ajith Kumar Esampally, Sathya Thoparam and Abhishake Polapally. 2022. "Planning of Gated Community in Urban Areas." IJRAR22C1094 *International Journal of Research and Analytical Reviews.* Available at https://www.researchgate.net/publication/362302725

Bal, Ellen, Kathinka Sinha-Kerkhoff and Ratnakar Tripathy. 2017. "Unequal Mobility Regimes of Indian Gated Communities: Converging Regional, National and Transnational Migration Flows in Indian Metropolitan Cities." *New Diversities* 19(3): 13-27. Retrieved from https://newdiversities.mmg.mpg.de/?page_id=3304

Balčaitė, Simona and Dovilė Krupickaitė. 2018. "Perspectives of gated communities' socio-spatial

integration: The case of post-socialist Lithuania." *Belgeo* 4. https://doi.org/10.4000/belgeo.23832

Beall J., O. Crankshaw and S. Parnell 2002. The people behind the walls: insecurity, identity and gated communities. In Beall J et al. (eds) *Uniting a Divided City*. London: Earthscan. 175–195.

Blakely EJ and MG Snyder. 1997. Fortress America. Gated Communities in the United States. Brookings Institution Press/Lincoln Institute of Land Policy, Washington, DC/ Cambridge, MA.

Blakely, Edward J. 2007. "Guest editor's introduction: Gated communities for a frayed and afraid world." Housing Policy Debate, 18(3): 475-480. https://doi.org/10.1080/10511482.2007.9521607

Blandy, Sarah and Diane Lister. 2005. "Gated Communities: (Ne)Gating Community Development?" *Housing Studies* 20 (2): 287-301. https://doi.org/10.1080/02673030042000331781

Blumm, Michael C. 2010. "The public trust doctrine and private property: The accommodation principle." *Pace Environmental Law Review* 27(3): 649. http://digitalcommons.pace.edu/pelr/vol27/iss3/3

Boonjubun, Chaitawat. 2019. "Also the urban poor live in gated communities: A Bangkok case study." *Social Sciences* 8(7): 219. https://doi.org/10.3390/socsci8070219

Cherkes, Bohdan, Yuliya Idak and Roman Frankiv. 2023. "The concept of 'gated community' and its explication in the theory and practice of urban planning: A literature review." *Architectural Studies* 9(2): 47-57. doi: 10.56318/as/2.2023.47.

Chitgopkar, Shantanu, Shanta Pragyan Dash, and Sonali Walimbe. 2020. "Gated Community Living: A study of contemporary residential development approach in Indian Cities." *PalArch's Journal of Archaeology of Egypt / Egyptology* 17(9): 7437-7451. https://archives.palarch.nl/index.php/jae/article/view/5528

Chiu-Shee, Colleen, Brent D. Ryan and Lawrence J. Vale 2023. "Ending gated communities: the rationales for resistance in China." *Housing Studies* 38(8): 1482–1511. https://doi.org/10.1080/02673037.2021.1950645

Davis, M. 1997. *City of Quartz: Los Angeles, capitale du futur*. La Découverte.

Debnath Mookherjee, H. S. Geyer and Eugene Hoerauf. 2014. "Dynamics of an Evolving City-Region in the Developing World: The National Capital Region of Delhi Revisited." *International Planning Studies*, https://doi.org/10.1080/13563475.2014.942515

Degoutin, Stéphane 2008. Le slogan « gated community.» *Cahiers des Amériques latines* 59: 17–32. http://dx.doi.org/10.4000/cal.1054

Dupont, Véronique D. N. 2011. "The dream of Delhi as a global city." *International Journal of Urban and Regional Research* 35 (3): 533-554. https://doi.org/10.1111/j.1468-2427.2010.01027.x

Grant, Jill. 2005. "Planning responses to gated communities in Canada." *Housing Studies* 20(2): 273–285. https://doi.org/10.1080/02673030042000331772

Grant, Jill 2005. "Planning the (dis)connected city: Why gated projects get approved." *Cahiers de Géographie du Québec* 49.

Hammad, Ahmed, Mengbi Li and Zora Vrcelj. 2024. "The infectious divide: A comparative study of the social impact of gated communities on the surrounding in the Middle East." *Journal of Housing and the Built Environment* 39: 1395-1421. https://doi.org/10.1007/s10901-024-10131-8

Jacob, Preetha and Sheeba Chander. 2020. "A Qualitative Analysis of Residential Satisfaction in Gated Communities – A Case Study of IT Corridor, Chennai." *International Journal of Advanced Research in Engineering and Technology* (IJARET) 11(3): 216-223. https://ssrn.com/abstract=3565704

Jacob, Preetha and Sheeba Chander. 2020. "Impact of Social Interaction on Residential Satisfaction in Gated Communities in an Indian Context." *International Journal of Advanced Research in Engineering and Technology* (IJARET), 11(2): 48-56. https://ssrn.com/abstract=3551989

Jacob, P. and S. Chander. 2020. "Post Occupancy Evaluation of Residential Satisfaction in Gated Communities – Case Study of Chennai Metropolitan Area." *International Journal of Advanced Research in Engineering and Technology (IJARET)* 11(2): 57-66. https://ssrn.com/abstract=3552000

Jha, Ramanath. 2023. "The rise of gated communities in Indian cities." *Observer Research Foundation*. https://www.orfonline.org/expert-speak/the-rise-of-gated-communities-in-indian-cities

Kaushik, Ajay. 2019. "Planning of Private Gated Development: An Analysis of Gated vs Non-Gated Neighbourhoods, City of Gurugram, India." *Planning Malaysia Journal* 17(10). https://doi.org/10.21837/pm.v17i10.643

Landman, Karina and M. Schönteich. 2002. Urban fortresses: Gated communities as a reaction to crime. *African Security Review* 11(4): 71-86.

Gilbert, Lazar. 1999. "L'essor des villes fortifiées – À propos de Fortress America: Gated Communities in the United States." *Futuribles Journal* 243. Éditions Futuribles.

Le Goix, Renaud and Chris Webster. 2006. "Gated communities, sustainable cities and a tragedy of the urban commons." *Critical Planning*. 13 (Summer): 41-64. https://halshs.archives-ouvertes.fr/halshs-00110046

Low, Setha. 2003. *Behind the Gates: Life, Security, and the Pursuit of Happiness in Fortress America*. New York: Routledge.

Low, Setha M. 2000. "The Edge and the Center: Gated Communities and the Discourse of Urban Fear." *American Anthropologist* 103 (1): 45-58.

Low, Setha and Neil Smith (Eds.). 2005. *The Politics of Public Space* (1st ed.). Routledge. https://doi.org/10.4324/9780203390306

Lemanski, Charlotte. 2005. "Spaces of Exclusivity or Connection? Linkages between a Security Village and its Poorer Neighbour in a Cape Town Master Plan Development." Islanda Institute, Kenilworth, South Africa, Dark Roast Occasional Paper Series 21

Manzi, Tony and Bill Smith-Bowers. 2005. Gated communities as club goods: Segregation or social cohesion? *Housing Studies* 20(2): 345–359. https://doi.org/10.1080/0267303042000331817

McKenzie Evan. 1994. *Privatopia: Homeowner Associations and the Rise of Residential Private Government*. New Haven/London: Yale University Press.

Nath, V. 1993. "Planning for Delhi." *GeoJournal* 29: 171–180. https://doi.org/10.1007/BF00812814

Roitman, Sonia. 2010. "Gated communities: Definitions, causes and consequences." In Proceedings of The Ice - Urban Design and Planning. 163: 31-38. 10.1680/udap.2010.163.1.31.

Roitman, Sonia and Nicholas Phelps. 2011. "Do Gates Negate the City? Gated Communities' Contribution to the Urbanisation of Suburbia in Pilar, Argentina." *Urban Studies* 48(16): 3487-3509. https://doi.org/10.1177/0042098010397395

Schouten, Andrew. 2022. "Residential relocations and changes in vehicle ownership." *Transportation*. 49. 10.1007/s11116-021-10167-7.

Sharma, Madhuri and Rajesh Kumar Abhay. 2022. "Urban growth and quality of life: inter-district and intra-district analysis of housing in NCT-Delhi, 2001–2011–2020." *GeoJournal* 87 (Suppl 4): 797–819. https://doi.org/10.1007/s10708-021-10570-8

Smets, Peer 2005. "Gated 'communities' - their lifestyle versus urban governance." 45th Congress of the European Regional Science Association: "Land Use and Water Management in a Sustainable Network Society," 23-27 August 2005, Amsterdam, The Netherlands, European Regional Science Association (ERSA), Louvain-la-Neuve

Sun, Cheng, Jianquan Cheng, Aiwen Lin, Mingjun Peng. 2018. "Gated university campus and its implications for socio-spatial inequality: evidence from students' accessibility to local public transport." *Habitat International* 80: 11–27. https://doi.org/10.1016/j. habitatint.2018.08.008

Vesselinov, Elena. 2008. "Members Only: Gated Communities and Residential Segregation in the Metropolitan United States." *Sociological Forum* 23(3): 536-555. https://doi.org/10.1111/j.1573-7861.2008.00075.x

Wang, Hongbing and Dorina Pojani. 2020. "The challenge of opening up gated communities in Shanghai." *Journal of Urban Design* 25(4): 505–522. https://doi.org/10.1080/13574809.2019.1625707

Wang, Q. 2010. 'The impact of gated community on connectivity & accessibility.' ScholarBank@NUS Repository. https://scholarbank.nus.edu.sg/handle/10635/22108

Webster, Chris, Georg Glasze and Klaus, Frantz. 2002. "The Global Spread of Gated Communities." *Environment and Planning B: Planning and Design* 29 (3): 315-320. https://doi.org/10.1068/b12926.

Unpublished sources

Myers, Ashley D. 1970. 'The social implications of gated communities and the planning process: A suburban case study.' Kansas State University. K-State Research Exchange (K-REx). Retrieved from https://krex.k-state.edu/handle/2097/8452

Regina, Emma Morales García De Alba. 2016. 'Middle-Class Gatedness: A Practice-Based Analysis of Middle-Class Gated Communities in Mexico.' PhD thesis, Faculty of Social Sciences, Department of Urban Studies and Planing, The University of Sheffield.

Yadav, Amit 2013. 'On buying behavior and consumer preferences in the residential real estate industry in Delhi NCR region.' MBA dissertation. Department of Marketing, Amity University, Noida. https://www.academia.edu/32676526/DISSERTATION_On_Buying_behavior_and_consumer_preferences_in_the_Residential_Real_Estate_industry_in_Delhi_NCR_region_Department_of_Marketing_In_Partial_Fulfillment_of_Award_of_Master_of_Business_Administration?source=swp_share

SPACE, The SPA Journal of Planning and Architecture

Notes for Contributors

1. The Editor of SPACE welcomes original contributions in the form of research papers, short position papers, viewpoints, case studies and reviews, book reviews, conference reports, etc. for consideration. Publishers may also send books for review to the Journal.

2. Contributions are accepted with the understanding that they are original manuscripts and have not been submitted elsewhere for publication.

3. Although there is no strict word count limitation for this journal, it will normally be expected to be within 6,000-8,000 words for a typical paper inclusive of abstract and references, 1,500-3,000 words for short position papers and reports, and 1,000 words for book reviews.

4. All manuscripts must contain the essential elements needed to evaluate a manuscript: abstract, author affiliation, figures, tables, funder information, and references. A research paper should be compiled in the following order: title page; abstract; keywords; main text-introduction, methodology, data collection and analysis, results, discussion; acknowledgements; declaration of interest statement; references; appendices (as appropriate); table (s) with caption (s); figure(s) with caption (s) -e.g. sketches/line diagrams, maps, photographs).

5. Manuscripts need to be submitted as single or multiple MS Word files and should be typed on A4 size paper with single line spacing and 2 cm margins all around. The first page of the manuscript should contain the title of the article, the name of the author(s) along with his or her affiliation, the corresponding author's email ID, a short abstract not exceeding 250 words and a minimum of five keywords. Spelling can be US or UK English so long as usage is consistent.

6. All submissions should be sent to the Editor, space@spa.ac.in or chitrarekha.kabre@spa.ac.in

References

References can be in Chicago style or format. Author name(s), journal or book title, article or chapter title, year of publication, volume and issue (where appropriate) and page numbers are essential. References should be indicated at appropriate locations in the text within parenthesis by the last name of the author(s) or the name of the appropriate organization if there is no person's name, year of publication and the page (s) referred to (except for paraphrased references). References should be arranged alphabetically at the end of the article. Entries should have the following items in order of sequence:

Name (s) of author (s) (persons and organizations) with last name (s) of person (s) appearing first, year of publication, title of article, title of journal, book, report (in italics), volume and issue numbers (for journals), location and name of the publisher (for book and report), inclusive page number (s) referred to in the text. The addition of DOI (Digital Object Identifier) numbers is recommended but not essential. In case of more than one publication by the same author in the same year, these should be distinguished alphabetically, like a, b, c etc. both in the text and in their complete entries.

Tables and figures

All illustrations including maps, diagrams, sketches, photographs, etc. should be mentioned as figures and numbered consecutively. Figures should be high quality (1200 dpi for line art, 600 dpi for grayscale and 300 dpi for colour, at the correct size). The table should present new information rather than repeating what is in the text. All figures and tables must bear captions and should be placed at their locations in the text. References to tables and figures must be mentioned in the text.

Abbreviations should be avoided as far as possible in the text. Repeated abbreviations should be introduced within parenthesis along with their full forms in their first occurrences in the text. Footnotes, except for tables and figures, should be grouped and arranged sequentially at the end of the text.

Large quotations should be placed in indented paragraphs in smaller font sizes with references in parenthesis at the end. Small quotations should be placed within double inverted commas in the font size of the text with reference in parenthesis at the end.

Units: Measurements should be given in SI units (non-italicized).

Contents