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Vernacular Settlement as the Smallest Unit in Sustainable Built Environment Research

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Abstract—The study of vernacular architecture is mostly focused on typology study, eco-friendly architecture, bioclimatic assessment, etc. with an aim to establish its stance on sustainable practices. The term sustainability is widely known; however, the term is more often used and understood in the context of the protection of the environment. The definition of sustainability or sustainable development is constantly evolving with an aim for more inclusivity. In the recent past, the definition of sustainability is being examined to include and represent various complexities of human society and its environment. The fundamental concept of sustainability revolves around preserving our resources for the benefit of future generations. This pertains not only to the environment, economy, and urban areas but also places significant emphasis on culture, which is increasingly acknowledged as a crucial component of sustainable development. Today, global institutions, scholars, and policymakers recognize the necessity of integrating cultural aspects or traditions into their strategies for sustainable development. This inclusion is considered vital in maintaining the stability of the other three pillars of sustainability. Vernacular settlements also referred to as traditional settlements, are renowned for their intricate symbiotic and interdependent dynamics. These settlements are not just environmentally sustainable but economically, socially, and culturally sustainable too. The research will explore this aspect of vernacular settlements through documentation such as settlement patterns, open space systems, the interaction of building typologies with the environment and social and traditional customs followed such as weddings, funerals, birth, and community festivals, and make an attempt to prove that the smallest unit of studying vernacular architecture through a qualitative and quantitative data analysis stating that sustainability should not be limited to eco-friendly typology or material but expand to include various facets of the community too for a more holistic and sustainable future.

Keywords: Vernacular Architecture, Settlement Planning, Culture, Housing, Sustainability

INTRODUCTION

History of settlement or settlement planning is studied across various fields of both science and social sciences to understand human relationship that led the foundation of various civilization of the world. Settlements provides a conducive base for a comfortable and safe living (Chen, Zhong, Li, 2023). However, with pressure of development and to cater to rising population, the definition of settlement in urban areas is now more often known as residential areas and dwelling units as accommodation categorising it into a physical unit with no or less social concept towards it.

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While peri-urban areas have become an extension of new ideas of residential development, rural areas have managed to remain more or less untouched with settlements and the various layers of relationship still intact. The core area of studies in research around settlement planning highlights the existence of various sustainable practices that exist to be able to draw lessons that can be further adopted by newer settlements or residential developments. These researches have also identified culture as one of the most important facets in retaining the value system that have managed to keep a number of sustainable practices alive till date.

While researches have continuously being highlighting the importance of settlement planning studies, vernacular architecture have been looked in isolation. Very few researches have not looked at vernacular architecture as part of a larger system. However, this is changing, the settlement study has gained a lot of momentum in various research field (Cusens *et al.* 2022). A study on spatial characteristics and influence mechanism of human settlement suitability by Chen, Zhong, Li (2023) highlights that while studies beginning to focus on human settlement suitability, most of these studies lack to study the underlying causes and influencing factors (Chen, Zhong, Li, 2023).

This study explores the gap in research of vernacular architecture as part of a larger system through a systematic keyword co-occurrent analysis using VosViewer and science direct database. The aim of the study is to draw attention to vernacular settlements and the various layers of systems that exist within it that ensures its sustainability both at ecology as well as social level through a study of selected traditional settlements of Northeast India. In this study we also highlight the disruption of social fabric of traditional settlements because of social housing policies. The VOSViewer analysis helps us in understanding research gaps that needs to be addressed for a more sustainable development policies and interventions as a way forward.

METHODOLOGY

This paper explores the critical role that settlement planning plays in the larger field of vernacular architecture research, highlighting the significance of comprehending historic settlement patterns by a thorough review of the literature. The goal of the study is to demonstrate how settlement planning influences vernacular architectural practices through an analysis of historical and cultural settings, with a focus on indigenous and culturally embedded communities. This study is a component of a larger PhD project that looks into the applicability of cultural studies to the planning and execution of social housing projects. The overarching objective of the project is to investigate how cultural elements might influence and enhance traditional settlement and how study of vernacular architecture should not be looked in isolation.

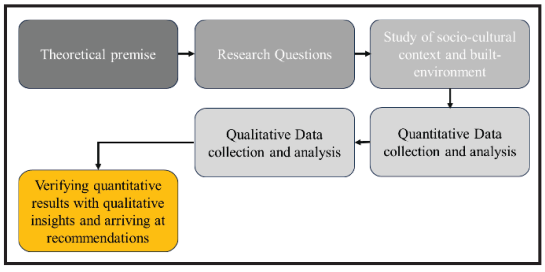


Fig. 1: Explanatory Researrch Design Flow

The research employs a mixed-methods approach, drawing on qualitative and quantitative techniques to obtain a comprehensive understanding of Assam and Manipur's vernacular settlements (as shown in Fig.1). While the quantitative technique may involve statistical data gathering, spatial analysis, and architectural surveys of existing vernacular structures, the qualitative part entails examining historical, social, and cultural impacts on settlement patterns. By combining these techniques, the study seeks to offer a comprehensive understanding of how regional cultural values, environmental factors, and social dynamics are reflected in and responded to through traditional settlement development. The purpose of this paper's conclusions is to aid in the creation of more inclusive settlement planning that are sensitive to cultural differences and uphold local customs while meeting modern developmeent demands.

Along with documentation of settlements, various activities, culture, and social construct were analysed as an integral part of the settlement. The research followed the following stages: (i) theories and concepts of traditional settlements were studied to highlight the sustainable systems of such settlements through literature study; (ii) a systematic keyword co-occurrence was conducted using VosViewer to understand the research focus in the field of vernacular architecture over the years; (iii) Vernacular settlements and systems of settings were explored through documentation of settlements; (iv) study of existing housing schemes and policies were studied and analysed to understand its impact on the socio-economic and built environment on the settlements.

RESEARCH FOCUS AND TREND IN VERNACULAR ARCHITECTURE

The focus of research in the field of vernacular architecture and sustainability lies mostly in the area of building performance and energy efficiency. This trend can be observed through the keyword concurrent map generated using VOSViewer. Keyword co-occurrence analysis helps the scientific research community to get an overview of various research trends especially to highlight the interdisciplinary linkages. Understanding and analysing the structure of the network helps research community to see thematic clusters or relevance of their own research across the global timeline.

Nodes in the keyword analysis represented by circles of various sizes and colours denotes a keyword that is extracted from the text. The size of the node represents the frequency of the keyword. Cluster or communities are represented by connecting nodes. Clusters highlight keywords that occur together more frequently. These clusters are a useful tool that can be used to understand research focus areas and the intensity of these research.

The keyword "Vernacular Architecture" and "Sustainability" were used from Science Direct database that gave a result of 831 papers that had the two keywords mentioned as shown in Figure 1. The keyword co-occurrence analysis was run using the RIS files downloaded. The network generated shows that research in and around the field of vernacular architecture is concentrated around the theme of thermal comfort, energy efficiency, sustainable architecture etc.

The cluster around "sustainability" shows keywords such as culture, conservation, heritage etc. Thermal comfort has a node size similar to the node size of vernacular architecture and sustainability highlighting the focus of research of vernacular architecture satisfying the three pillars of sustainability. Settlement planning or settlement on the other hand still hasn't made its way into the vernacular architecture and sustainability research in an impactful way.

Settlements and community living has played a critical role in the evolution of civilization ensuring the needs of humans are met at each stage of this evolution and ensuring these needs are met in the future too. The liveability of settlements has found to be linked with well-being and quality of life of its inhabitants playing an important role in the development process (Settijanti, Defiana, Setyawan, et.al, 2014). Traditional settlement are settlements are formed by the people living in them through transfer of knowledge and wisdom handed over generations (Dayaratne, 2018). A number of these traditional settlements were formed with collective efforts of the community and not through an individual vision. As stated by Akbar (1988), almost all the built form in traditional settlements showed uniformity such as choice of building material, design aesthetics, orientation among others (Akbar, 1988).

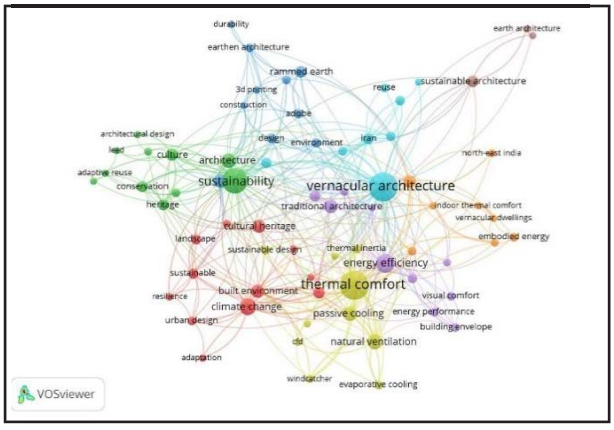


Fig. 2: Keyword Co-Occurrence Analysis of "Vernacular ***(Source:*** **Map generated using** ***VOSviewer)***

Apart from individuals need to feel as a part of the community through various conformity of norms to the built form, traditional settlements have a number of cultural and societal norms that is followed by each household and individuals that leads to a systematic and sustainable functioning of the society as a whole. These systems and norms are what comes under "cultural sustainability" where development is balanced and inclusive even with various external influences (Sachs, 1999). As an example, during the time of demise of a member of the community, other households or members come together to support the family of the bereaved. Among the Meitei community of the Manipur of Northeast India, a system called "Shinyen Marup", which is a small sum of money collected from each household of the settlement to pay for the wood used during cremation. A male member from almost every household takes part in the process of cremation. Similar customs exist in some form or the other in different communities of Northeast India.

Traditional settlement's role in sustainability is not limited to environment responsive solutions but plays a key role in understanding the importance of social value systems that ensures collective community effort towards protection of the environment remains intact. Currently the focus of development around the theme of sustainability are towards newer technology that could provide environment friendly solutions, innovative building material and economic and affordable solutions (Dayaratne, 2018).

The concept of "home" can be examined from the perspectives of its relationship to the community it belongs to as well as the individuality it symbolizes. The premise that "home mirrors a wide variety of environmental and cultural influences" (Gauvain & Altman, 1982) is the dimension that the paper highlights. The issue of personality vs. society then comes up, and is it reasonable to believe that these effects will never be perfectly balanced? Even though their existence varies in degree, cultural influences—whether at the individual or social level—are an obvious fact. Therefore, it is assumed that the system is extremely dynamic and that it can have both short-term and long-term components. This study examines three general aspects of homes in different cultures: (i) façade and siting; (ii) thresholds and entranceways; and (iii) interior layouts and uses. The study, which drew conclusions from a variety of case studies from various geographical areas, was able to establish a significant influence in the built environment. Settlements in the kin-based hamlet of Tarong in the Philippines (Gauvain & Altman, 1982) built up their homes to guarantee social connection and the well-being of their members, as seen in one of the research's examples. The common area is maintained neatly and with pride by the inhabitants.

The research identifies areas in which housing and culture research could advance for a more methodical approach in this field that can be quantified and to understand how culture and families respond to typical life cycle changes, but it does not reach a conclusion on how or should culture influence the built environment. The study opens up a significant field of inquiry by emphasizing the requirement of comprehending the mechanisms influencing home design across cultural boundaries. A person's boundaries are defined as "self/other boundary mechanism that involves personalization or marking of a place or object, and communication that it is 'owned' by a person or a group" (Altman, 1975). This territorial model was adapted from various studies on animal ecology and human behaviour. Additionally, the necessity of property ownership is explained as a territorial behaviour (Sebba & Churchman, 1986).

DATA COLLECTION AND ANALYSIS

The case study area was chosen to encapsulate the intricacies of cultural context, since culture is defined as “a complex whole that includes knowledge transferred through generations, belief systems, laws, customs, and any other habits developed by humans as part of society” (Tylor, 2010) that influences society and settlement pattern. Two selected study areas concentrated on clusters of houses in a traditional settlement that further facilitated purposive sampling using a theory-driven approach to identify "manifestations of a theoretical construct to elaborate and analyze the construct and its variations" (Palinkas *et al.*, 2015). The survey was executed in one district of Manipur (Bishnupur) and one district of Assam (Baksa). A household survey questionnaire was created to gather data from the designated area.

Bishnupur was one of the three administrative divisions of the Manipur valley established in 1901; however, due to population expansion, Manipur comprised nine districts according to the 2011 Census of India. Bishnupur possesses a robust historical and cultural heritage, complemented with a distinctive topographical configuration that has influenced and characterized the constructed environment.

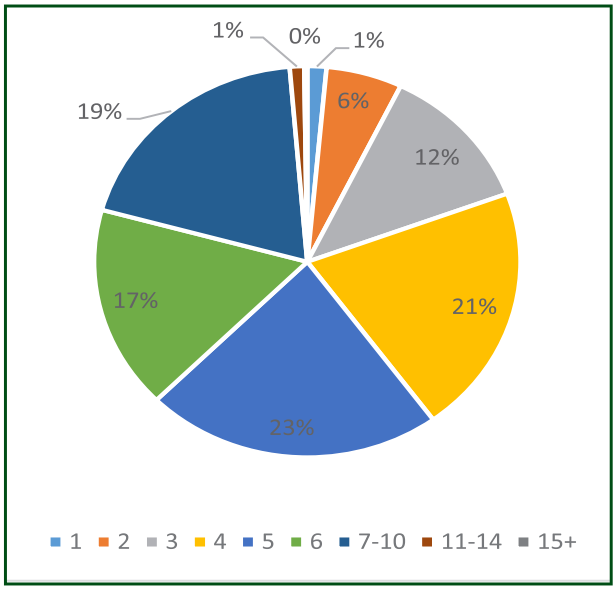


Fig. 3: Household Size Distribution of Bishnupur District (*Source* : Census 2011)

Historically, a significant portion of the area was governed by the "Moirang clan," one of the seven clans of the former Kingdom of Manipur. Bishnupur served as a significant cultural confluence in ancient times, functioning as a gateway for visitors entering or exiting the state through Cachar in Assam (District Census Handbook Bishnupur, 2011). According to the 2011 Census of India, the district's population is 2,373,999, constituting almost 12% of the state's total population, with a density of 821 individuals per square kilometer. Of the overall district population, 63.1% resides in rural areas. The district experienced a 13.9% decadal growth, the lowest among the state's

districts (District Census Handbook Bishnupur, 2011). The district comprises 46,413 homes, including 29,199 rural households (Census, 2011). The mean household size in the district's rural parts is 5.1.

Baksa is a district that was established in 2003 from four districts of Assam. The territory was governed by multiple monarchs, notably the British, as it was en route to the Northeast region. The district encompasses an area of 2400 square kilometers. Baksa shares an international boundary with Bhutan and features a gradual slope extending from the foothills of Bhutan to the Brahmaputra River basin. Several perennial rivers traverse the region to converge with the Brahmaputra River. The district is situated within the alluvial plains of the Brahmaputra River system and the River Manas sub-basin. The area comprises a combination of little hillocks and lowlands (Ground Water Information Booklet Baksa District, Assam, 2013). Baksa has a total population of 950,000, with 99% residing in rural areas. The district had a ten-year growth rate of 11% from 2001 to 2011. The region's ethnic composition includes Bodo, Rabha, and Garo, with Bodo constituting the predominant ethnic group in the district. The district has a significant Hindu population comprising 35%, while Muslims constitute a minor percentage. Scheduled Tribes comprise approximately 58% of the population, and Scheduled Castes constitute around 13% (District Census Handbook Baksa, 2011). The district comprises a total of 191,701 houses, with 189,249 located in rural areas. The mean household size in rural Baksa is 4.9 persons.

The research employed purposive selection to pick the panchayats, as the samples were distributed over a broad geographic area. This sample method is employed in qualitative research for the "identification and selection of information-rich cases pertinent to the phenomenon of interest" (Palinkas *et al.*, 2015), specifically regarding the influence of culture in traditional settlements. A purposive sampling employs an approach designed to "most likely yield appropriate and useful information while effectively utilizing limited research resources" (Bourgeault *et al.*, 2010). The sampling relies on evolving notions, specifically that housing units are a component of a system of settings that encompasses the entire community and settlement, with the objective to "explore the dimensional range or varied conditions along which the properties of concepts vary" (Campbell *et al.*, 2020).

The sample size was determined using Slovin's formula: $n = N / (1 + Ne^2)$, where "n" represents the sample size, "N" denotes the population size, and "e" signifies the permissible margin of error, set at 5%. A total of 225 households were surveyed throughout the four Panchayats.

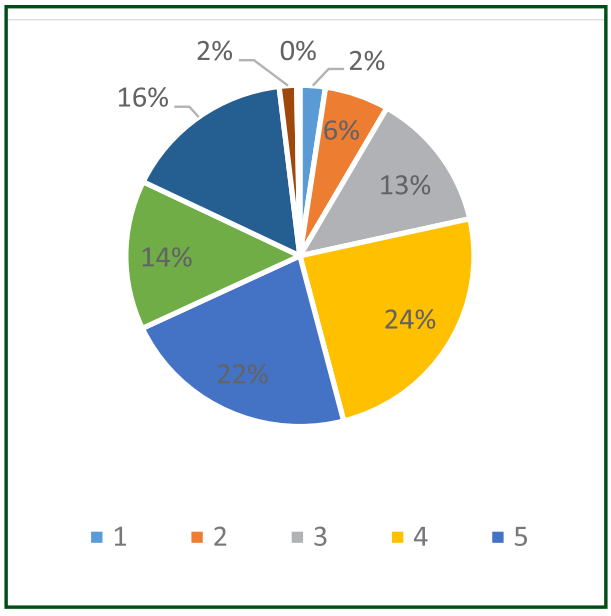


Fig. 4: Household Size Distribution of Baksa District (*Source :* Census 2011)

Table 1: Sample Size

State	District	Panchayat name	Sample size
Manipur	Bishnupur	Kha Thinungei	51
Assam	Baksa	Athiabari	174
The jamovi project (2012), jamovi. (Version 2.3) [Computer Software].			

The relationship between culture and the built environment that makes a traditional settlement a sustainable set-up is based on data sets derived from various questionnaire items that reflect culture in accordance with Amos Rapoport's definition: "the way of life of a people, including their ideals, norms, rules, routinized behaviors, etc." (Rapoport, 2005, Pg. 78). These items include (i) duration of settlement (ii) nature of support; (iii) nature of economic activity/income sources of family members; and (iv) cultural norms and regulations adhered to, if any.

The research employed a data triangulation strategy to utilize qualitative data gathered from the survey and professionals to corroborate the findings.

Table 2: Descriptive Statistics of "Culture" and "Built-Environment

Mean		
Variable	Bishnupur	Baksa
Culture	14.3	13.4
Built-environment	6.9	7.19
Standard Deviation		
Variable	Bishnupur	Baksa
Culture	1.18	1.31
Built-environment	1.71	1.55
Skewness		
Variable	Bishnupur	Baksa
Culture	-0.764	-0.639
Built-environment	-0.514	-0.728

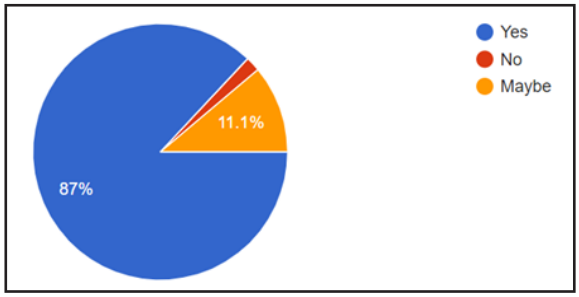
Table 3: Correlation Value

	Baksa	Bishnupur
Pearson's r	0.821	0.649
df	172	49
p-value	< .001	< .001
95% CI Upper	0.864	0.784
95% CI Lower	0.766	0.454

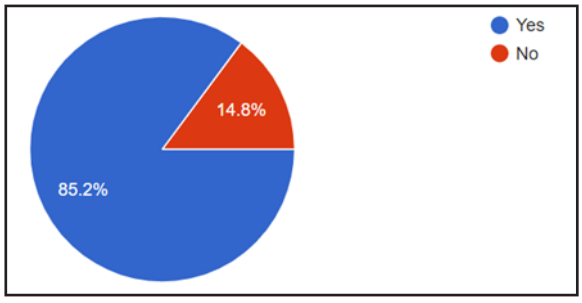
The data pertaining to "culture" and "built-environment" were analysed utilizing "Jamovi Project 2022, Version 2.3" [Computer Software] to conduct a correlation test employing the Pearson product-moment correlation coefficient. Pearson's correlation contains three assumptions: (i) both variables are regularly distributed; (ii) variables are measured at interval or ratio scales; and (iii) there exists a linear relationship between the variables (Schober and Schwarte, 2018). The coefficient values are emphasized in Table 3. Correlation analyses were conducted for the data obtained from the two districts.

While on the other hand, a concise questionnaire was distributed to 100 architects nationwide to ascertain their perspectives on the significance of cultural and traditional norms and to understand the its role in traditional settlements. This exercise was undertaken as nearly all architects participate in the design and construction of dwellings and are engaged in the entire process. They possess more awareness of the situational realities and must continually mediate between clients' requirements and practical, feasible solutions. The subsequent are the outcomes of some of the question:

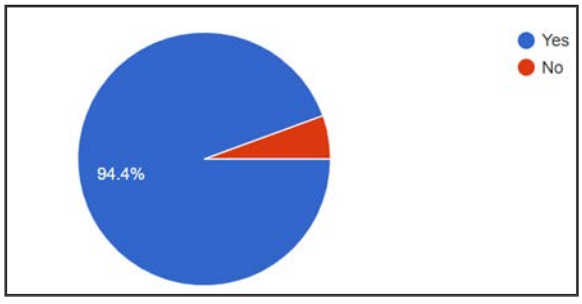
A. Do you follow any traditional norms or customary rules while designing a residence?



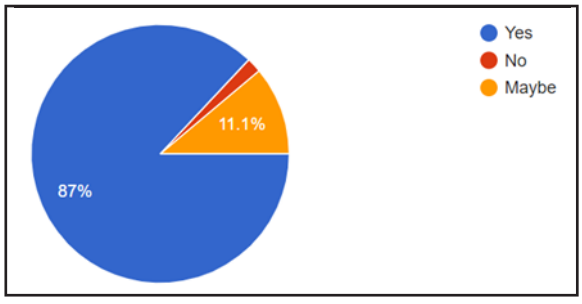
B. Do you think it is necessary to follow these traditional norms?



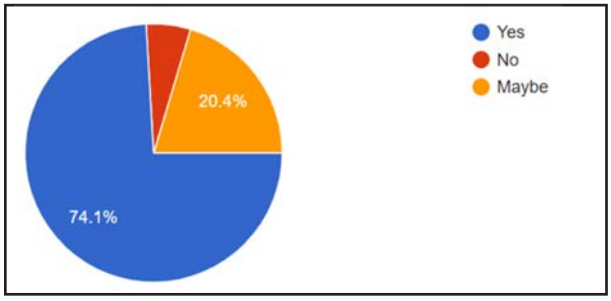
C. Should culture play any role in architectural practice?



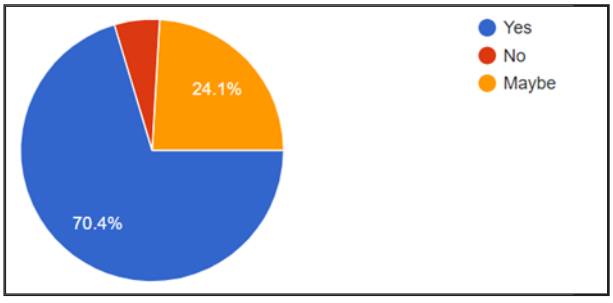
D. Do you think there is any science/rational behind the traditional norms that is followed in designing of a residence?



E. Do you think the traditional systems (not just building design but other day to day systems) were/are sustainable?



F. Do you think that the traditional building fabric encourages more community interaction than the current development system?



The data analysis indicated that culture affects human behaviour, which then modifies the built environment. The traditional system and environment significantly contributed to a sustainable ecosystem, wherein culture, closely tied to the value system, played a pivotal role. Engagement with professional architects indicated that numerous cultural norms and practices influencing the conventional built environment are underpinned by scientific principles or rationale, from which valuable insights might be derived. The notion of regarding culture as the fourth pillar of sustainability is significant in this context.

QUALITATIVE ANALYSIS

A well balanced built and open space ratio is a characteristic widely seen in many traditional settlements forming a sustainable community. Vernacular architecture and the settlement pattern's layout accommodated to not only cultural and religious activities but also to the day-to-day activity helping in generation of income along with daily functional needs of the household.

A typical Meitei settlement constitutes a well composed layout of open space network that is also used for various kind of activities and functions. The first level in this network of open space starts with a semi-open verandah infront of the house known as "mangol" in the local dialect. The concept of living room was non-existent in a traditional Meitei household, however the mangol served as the space where guest was entertained. Mangol find mentions in a book authored by British author R.Brown, F.R.O.S.E., a British documentation book of 1873 named "Native State of Manipur". In this book, the mangol is described as "a large open verandah, in which the family sits during the day, and in it all the work of the household is carried on, except cooking, which is performed inside; in the south side of the verandah is the seat of honor, here a mat or cloth is laid for the head of the family, upon which no one intrudes". Beyond this open verandah, was an open space with a "Tulsi plant" considered holy in Hindu culture. This open space called "shumang" was integral part of the built fabric where celebrations such as marriage, birth, funeral and other religious rite and festivals are celebrated.

Fig. 5: Troditional Settlement Fabric of a Meitei

Beyond the shumang on the eastern end of the plot, is a semi-covered platform with a roof on top facing the main house known as "shangoi". This place is used for weaving activity and other household activities. Traditionally, most houses had a rain fed pond in the front which caters to the water requirement of the households during dry season. Mangol is a private place while shumang which started as open space exclusive to a household became a shared space with increase of family size and married sons shifting out to start their individual households. However, the access to shumang is limited to the family.

A traditional Meitei settlement with several clusters of housing forms a community known as a "Leikai". A Leikai typically has about 15 to 50 clusters known as "kolup". A kolup consists of few households belonging to the same family. Depending on the number of dwelling units, the number of open space (shumang) can vary. Additional to shumang, there other kolup which have a temple and a semi-open space locally known as "Mantop" in front of the temple additional to the shumang. In terms of usage, while shumang is not shared between different kolups, Mantop on the other hand is allowed to be used by several kolups after

a request. These requests are mainly for functions such as marriage, funeral services, death anniversary etc. which are religious in nature. The Leikai (community) has a larger open space known as "Laimang" along with an adjoining temple dedicated to the Sylvan Gods or Goddesses. This community level open space was an integral part of the settlement and were used for community festivals, sports and as play areas. Laimang is an important social space that brought the community together through various activities. The built fabric of rural Assam stands almost the same in terms of relation of the dwelling unit to its open spaces, neighborhoods, economic extra. Dwelling unit do not function as a dwelling unit. It is an integral part of the environment that contributes to the day-to-day functioning of the household such as spaces of various economic and household activities, dedicated spaces for religious activities. The households in the settlement are known in each other and a number of social dependences exist within the community. Each house has a front court or open space that is used not only for functions and rituals but also used during harvesting season. Houses have dedicated space for a small temple in the open space, loom for weaving, storage area of grains, kitchen garden and animal rearing. The front verandah like the houses in Manipur are used for entertaining guest and for conduction various household activity.

Traditional settlements not only responded to the needs of the settlements in terms of community dependency and socio-political systems of the community but also responded to various space requirements for various activities which helped the community to sustain. Presence of open space, kitchen gardens, water bodies, weaving or grain storage space, sheds for animal rearing etc. makes traditional settlement an illustration of sustainable development of the four pillars.

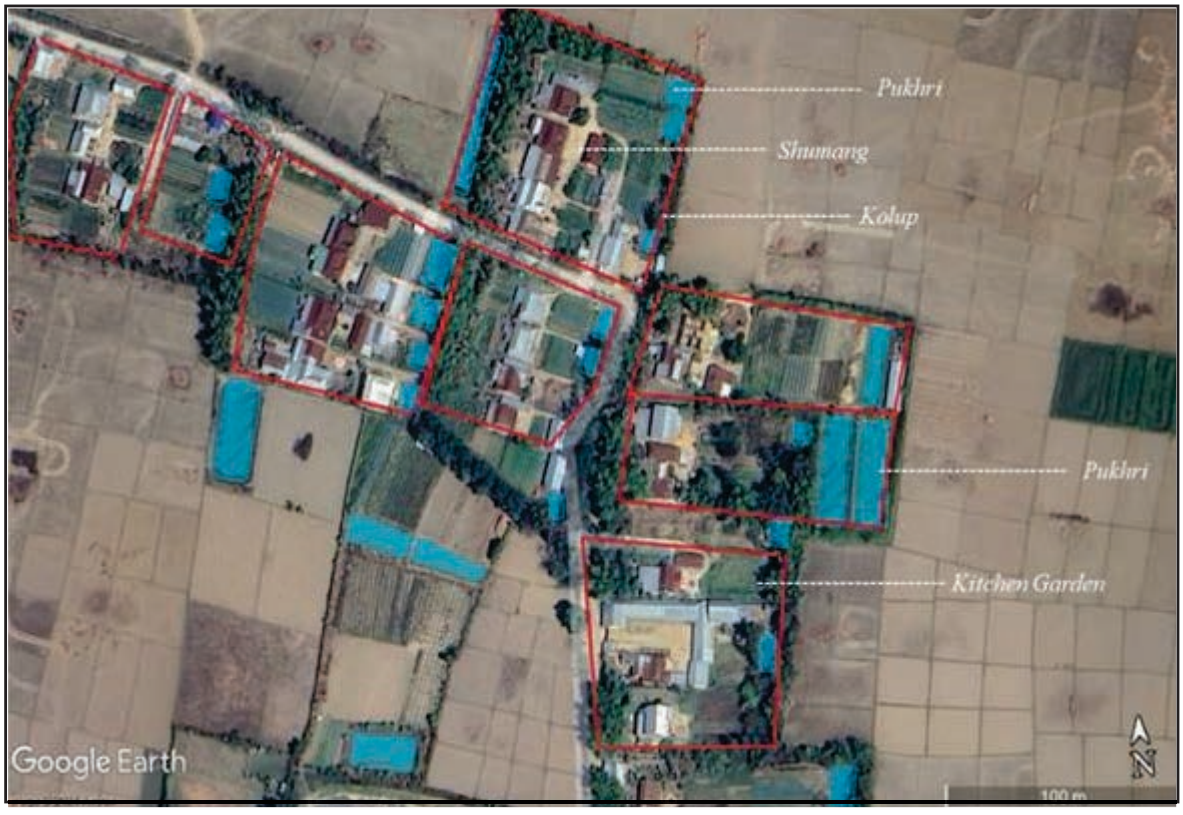


Fig. 6: Cluster of kolups in Rural Manipur (*Source:* Author)

DISCUSSION

Amos Rapoport (2005) in discussing the theory of "The Nature and Types of Environments" highlights the importance of interdependent empirical studies in the same way as how the study of buildings cannot be conducted in isolation (Rapoport, 2005). It further brings forth how "buildings relate as a part of system to open spaces, streets, other settings, neighborhoods, settlements, and sometimes even regions" (Rapoport, 2005). These system of settings as discussed in previous sections does not end with the dwelling unit itself but extends to both social as well as the physical environment.

During survey and interaction with households of Manipur and Assam, the question on, "Do u get support from neighbors and community in day-to-day life?", majority of the respondents answered yes in both Manipur and Assam. The nature of these support includes exchange or borrowing of household items, exchange of kitchen items, childcare support etc. Festivals and rituals including weddings and funerals were performed in the open space in front of the house. Almost all households had dedicated space for weaving, animal rearing and kitchen garden. The functioning of the household beyond the dwelling unit is captured in the survey of housing condition conducted in the 69th round 2012 under the "Micro-environment section". The working paper series on Rural Housing in India: Status and Policy Challenges for Lokshraya Foundationin 2016 highlighted the existence of some form of shed either attached or detached and constituted almost 62.1 percent of the households (Kumar, Deka, Sinha, 2016).

Veenhoven (2004) links happiness with quality of life. The quality of life is divided by two criteria in the form of a diagram as shown in Figure 4. where the vertical criteria are based on opportunities and life's achievement horizontal criteria are based on internal and external qualities (Veenhovan, 2004). Hence, through this matrix, livability is defined the environment which arise from both quality of life and external opportunities making the term reflect the characteristics of the environment (Setijanti, Defiana, Setyawan, et.al, 2014). A number of researchers argues that the quality of residential conditions of housing includes the characteristics of the environment in creating "an attractive residential neighborhoods" that includes both tangible and intangible aspects (Throsby, 2006 and Leby, JL and Hashin, AH, 2010).

Dwelling unit or household when looked at as an isolated unit falls short in representing the complex system of the society. A vernacular settlement uniqueness lies in the existence of various layers constituting both intangible and tangible elements. The sustainability of vernacular architecture will remain an incomplete study if the study isolates the dwelling unit from the settlement. The foundation of human behavior is the social value system and it is this value system that ensures that all members of the society is taken care of and also takes care of the environment at large.

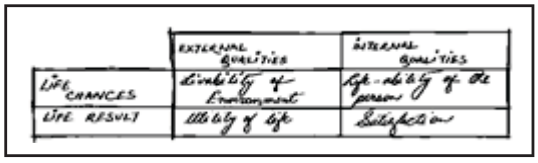


Fig. 7: Quality of life Matrix
(*Source* 1: Veenhoven R., Happiness as an aim in Public)

Indians view culture as an integral component of their own personal identity as well as the larger societal fabric, and they have a profound and nuanced grasp of it. They view culture as encompassing not only rituals and practices but also a person's relationship to their immediate environment, including their family, community, and environment, as well as their ties to the past. This past is viewed as a live component of present life, impacting beliefs, attitudes, and practices, rather than as something remote or unimportant. Indians also understand that culture is a dynamic process that must change with the times while holding fast to fundamental principles. Culture's ability to adapt lets it stay alive and relevant, allowing new influences and ideas to be assimilated without losing its core. This dynamic feature of culture demonstrates an understanding of the necessity for change, making traditions able to adapt to the demands of the modern world while maintaining their historical integrity.

Culture is frequently seen in Indian society as a reflection of one's standard of living. It includes social standards, values, music, literature, art, and language, all of which enhance the general wellbeing of the person and the community. A person's moral and intellectual standing are frequently deemed to be indicated by the breadth and depth of their cultural experiences. Therefore, a society's culture is evaluated based on how much it improves the lives of its citizens. Culture is ultimately the most valuable thing. It serves as a prism through which people evaluate both their own lives and the society they live in. It acts as a moral compass, teaching people how to coexist peacefully with the environment and other people. Thus, culture is viewed as "the ultimate value," essential to figuring out one's place in

the world, encouraging personal development, and creating a society that is fair and harmonious.

Change is an important element of culture and evolutionary process. These changes influenced by various external factors needs a strong policy backing as disappearance of many open system and traditional systems that made the environment sustainable have become redundant. The same can be said about vernacular settlement that unless it is not analyzed as the smallest unit of study in the field of settlement planning, architecture or rural development, the true essence of the vernacular architecture as a sustainable unit will remain ambiguous.

CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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