

Smart Innovation, Systems and Technologies 154

Amaresh Chakrabarti *Editor*



Research into Design for a Connected World

Proceedings of ICoRD 2019 Volume 1

Smart Innovation, Systems and Technologies

Volume 134

Series editors

Robert James Howlett, Bournemouth University and KES International,
Shoreham-by-sea, UK

e-mail: rjhowlett@kesinternational.org

Lakhmi C. Jain, University of Technology Sydney, Broadway, NSW, Australia;
University of Canberra, Canberra, ACT, Australia; KES International, UK

e-mail: jainlakhmi@gmail.com; jainlc2002@yahoo.co.uk

The Smart Innovation, Systems and Technologies book series encompasses the topics of knowledge, intelligence, innovation and sustainability. The aim of the series is to make available a platform for the publication of books on all aspects of single and multi-disciplinary research on these themes in order to make the latest results available in a readily-accessible form. Volumes on interdisciplinary research combining two or more of these areas is particularly sought.

The series covers systems and paradigms that employ knowledge and intelligence in a broad sense. Its scope is systems having embedded knowledge and intelligence, which may be applied to the solution of world problems in industry, the environment and the community. It also focusses on the knowledge-transfer methodologies and innovation strategies employed to make this happen effectively. The combination of intelligent systems tools and a broad range of applications introduces a need for a synergy of disciplines from science, technology, business and the humanities. The series will include conference proceedings, edited collections, monographs, handbooks, reference books, and other relevant types of book in areas of science and technology where smart systems and technologies can offer innovative solutions.

High quality content is an essential feature for all book proposals accepted for the series. It is expected that editors of all accepted volumes will ensure that contributions are subjected to an appropriate level of reviewing process and adhere to KES quality principles.

More information about this series at <http://www.springer.com/series/8767>

Amaresh Chakrabarti
Editor

Research into Design for a Connected World

Proceedings of ICoRD 2019 Volume 1

 Springer

Editor
Amaresh Chakrabarti
Centre for Product Design and
Manufacturing
Indian Institute of Science Bangalore
Bangalore, India

ISSN 2190-3018 ISSN 2190-3026 (electronic)
Smart Innovation, Systems and Technologies
ISBN 978-981-13-5973-6 ISBN 978-981-13-5974-3 (eBook)
<https://doi.org/10.1007/978-981-13-5974-3>

Library of Congress Control Number: 2018966842

© Springer Nature Singapore Pte Ltd. 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Sponsors

Centre for Product Design and Manufacturing, Indian Institute of Science,
Bangalore, India
Indian Institute of Science, Bangalore, India
Springer

Endorsers

The Design Society, UK
Design Research Society, UK

Part I
Design Theory and Research
Methodology

Chapter 2

The Ethno-Cultural Influences on “Assam Type” Building Typology— A Case of Barduwa, Assam



Shiva Ji and Ravi Mokashi Punekar

Abstract Assam has peculiar geographical and climatic conditions; which has shaped its culture, practices and vernacular style. We see direct influences of such features on society which has remained self-sufficient for centuries and their reflections in ethnic styles in food habits, clothing, agriculture, fisheries, architecture, beliefs, recreation, etc. Objective of this research is to conduct studies on ethno-cultural influence mapping in evolution of vernacular architecture. Study was conducted to find existing conditions in various domains of public life, aspirations, occupational activities, supporting infrastructure, for system analysis and intervening areas which can maintain idea of sustainability around local building designs. Study resulted in identification of Acts, Actors and their Inter-relationships which are crucial for evolution of such typology and socio-cultural system. Design Directions on four perspectives are drawn.

2.1 Introduction

The State of Assam has its peculiar geographical and climatic conditions; which has shaped its culture, practices, and has helped evolving a vernacular style of building architecture. Whether it is fertile fields, marshy river plains, rich ground water table, above average precipitation, specific produce such as rice, bamboo or fish, etc., they all have played integral role in gradual development of culture of Assam. We see their direct influences in our daily life here. The society has remained self-sufficient for thousands of years and we see their reflections in ethnic styles in food habits, clothing, agriculture, fisheries, building typology, religious/social beliefs and practices, recreational activities, etc. When Mahatma Gandhi visited Assam during

S. Ji (✉)
Indian Institute of Technology, Hyderabad, India
e-mail: shivaji@iith.ac.in

R. M. Punekar
Indian Institute of Technology, Guwahati, India
e-mail: mokashi@iitg.ac.in

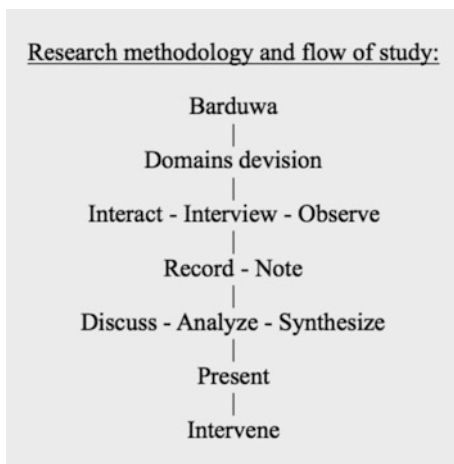
Indian Independence Movement, he was amazed to see already self-reliant families and societies here, which he was propagating that time. The self-reliance in occupational and basic necessities is the key for a sustainable model for growth. The example of Gamuchha (cotton towel) as a household weave and building their own houses in locally available materials is the key for the self-sustenance of Assamese society.

The land has strong influence of Barduwa Satra. Since the place is birthplace of social reformer Srimant Shankar devji and still has historical linkages of the past, it helps in establishing the context of place and local culture gets a strong derivation out of it. The place is currently one of the revered places of faith and equality preaching for Vaishnav Hindus of Assam and others also. The area lies on the banks of Brahmaputra and has rich fertile soil for vegetables, mustard, jute, fisheries, and paddy. The farmers and fishermen bring their produce to Dumdumia market.

2.2 Methodology

The study has been concentrated to rural set up of Barduwa village and surrounding areas, considering this the village level interactions, observations, and information have been gathered for the purpose. Barduwa village was taken as the first stage for study followed by Tuktuki village famous for household fisheries and Dumdumiya market a market center for local produce trading and transport. The exercise was divided into eight parts to cover up separate domains like Agriculture, Cottage/ Small-scale industries, Education, Habitat, Health, Sanitation, Transport, and Water (Fig. 2.1).

Fig. 2.1 Research flow



For Agriculture, we went to see fields, meet farmers, fishermen, labors, daily wagers, and owners of fields and fisheries. In cottage or small-scale industry, we met families who are continuing with their family inheritance of craft works, men and women, shopkeepers and people who are in touch with city businessmen who place order to them for their craft products, education; people and places like teachers, professors, NGOs, schools, and colleges were chosen, for habitat; houses, ponds, agricultural fields, etc., were analyzed, for health; we met doctors, chemists, ambulance in-charge, patients, asha workers, angan wadi workers, muslim communities, general public, etc., for sanitation we observed sanitation systems of houses, and other buildings, spoke to house owners, health workers, cleaners, etc., for transport we went to tempo stand, railway station, etc., and spoke to tempo drivers, truck drivers, handcart pullers, traders, labors, agriculturists and general people, for water we went to water supply plant, saw iron filtration plant and water distribution system, spoke to staff and people. The number of people to be interviewed or interacted were minimum 3–4 for any domain so as to gain variety of opinion. We held interaction sessions with local dignitaries like Barduwa Than Principal, Than Chief manager, a Professor in Barduwa college, and curator of Museum in Barduwa. They elaborated on great past of Barduwa, Srimant Shankar devji, its historical linkage, lifestyle, agrarian society, culture, modernity, and its implications and changes, etc. We got to learn about insights of place and people with long interactive sessions spanned over 4 days of our stay in Barduwa in yatri house.

2.2.1 Aim, Research Questions, Hypothesis

The aim of this research is to get the insights for influences of ethnic cultural practices on the local Assam-type building typology that how it has evolved over time, climate, geography, and technology. This typology has survived for centuries overcoming earthquakes, heavy rains, high water table in ground, humid environment by using local materials and techniques, etc. The question here is what are those driving forces that have shaped it such. Inferring from this vernacular style can be useful for prevalent design and construction in rural and urban areas as it has shifted from vernacular to prevalent one. The modern structures require huge volume of materials which are industrially manufactured and come from far. Overall construction industry has risen to almost 40% share from global energy consumption. It is prone to seismic activities and has resulted into huge damages (Table 2.1).

Table 2.1 Research Paradigm used in Barduwa

Paradigm/Model used in Barduwa	Type of research	Methods	Techniques	Unit(s) of analysis
Interpretive (inductive, qualitative) from context of Barduwa	Descriptive	Ethnography (result of research aimed at Barduwa's social understanding)	Observation	Relationship between people of Barduwa and 8 domains
	Descriptive		Interviews	Relationship between people of Barduwa and 8 domains
Action (inductive, qualitative)	Exploratory	Exploratory Action research (action & theory result of research aimed at change)	Participation	People of Barduwa
	Exploratory		Interviews	Interconnectivity and effects on people of Barduwa and 8 domains

2.2.2 Data-Collection Method

First, a literature study was conducted to know about the place and map out its significance for the study. We met two scholars of the region to know more on behavioral experience of that place and what to look for once we are there. Two contacts were made there beforehand to convey our desire to visit and purpose of study. The Barduwa Satra committee agreed happily to host and facilitate us. A site visit and stay for 4 days in Barduwa were arranged for the total interaction. Government officials of Health Center, Ambulance, PWD, Water Filtration Plant, Primary School, Secondary and Senior Secondary School, Village Panchayat were interviewed for their respective inputs. Villagers were met casually in their homes with curiosity to know about their lifestyle, livelihood, and their perspective on life in village. The place was scoured for the visual tour and points were noted down (Fig. 2.2).

2.2.3 Setting

The village of Barduwa is 18 km from District headquarters in the district of Nagaon, Assam. The village Namghar has members from all strata of society, people from all economic levels, without having any barrier of caste and class.



Fig. 2.2 Activity organization and their linkages

It has worked to integrate everyone living in the area to bring them on a common platform and collaborate on social welfare activities and conduct administrative activities with consent of majority.

2.2.4 Object

The objective is to figure out the nicety of interactions of various domains with each other and they have shaped up the current way of designing and constructing the houses in which they live in.

2.2.5 Coding and Analysis Method

The data collected was pooled in one place and was discussed in daily evening sessions at our resting place. The bubble diagrams were made to draw the linkages of activities with others to identify the nodes. The data of personal interviews and agency answers were separated as per the domains. The homework of data on daily basis helped us to prepare for the next day works to fill in the gaps. Literary supports from books, literary supports from the Barduiya Satra premises in form of wall paintings, books and preachings also were categorized (Fig. 2.3).

The interviews of eminent persons were kept on the nodal like and data from people/farmers/villagers/fishermen were further elaborated on those nodes. It helped us draw the map in its entirety ranging from focal place of this village, nodes of functions to the last unit of individuals and their families. On this branch map of



Fig. 2.3 Activity organization and their linkages—graphic view

linkages of nodes and their phenomenon, we superimposed finer details from observations, which included social, occupational, and family lives. The nodes of trading, craft, agriculture, and transport were coded for inputs of marketing, infrastructure, income, and individual/family engagements. The vegetation of place, trees, construction materials, imports of materials from cities, etc., were carried out to keep check of material bases observations.

2.2.6 Verification of Methods

The three techniques given by Structured System Analysis and Design Method (SSADM), UK by SSADM vis-a-vis Logical data modeling, Data flow modeling and Entity event modeling were matched to map the existing scenario and a step-by-step stage reporting was carried out. The method of study and result from interviews/observations were verified with the SSADM model for its compliance with study of similar nature. It has been further strengthened that the method of study can be used as context-specific systemic mapping and analysis tool.

2.3 Findings

The findings of the study have been categorized in order to create a hierarchy of complexity and level of reach of people:

Ethno-cultural influences on Assam-type house typology at following levels:

2.3.1 Planning of Village

The main entry to the village is from the route which goes to the district headquarters and business center in district at Nagaon. The route further connects to the local vegetable market of Dumdumia which receives local produce for trading. On the left it goes to Brahmaputra side and other to the villages for fisheries, they all culminate at Barduwa taxi stand and has shops which offers for local needs, maintenance, services, etc. Nest to it comes the Governmental services like Banks, Post office, PDW office, Health center, NGO offices, Computer training centres, and other services, etc. After the commercial hub, the main road proceeds to the nearby market village and from this point there are two secondary roads leading to the patterns of row housing on both sides hence four major rows of row housing.

2.3.2 Organization of Activities

The focal point of settlement is the temple complex of Barduwa Satra, where both the secondary roads culminate. It lies at the end of the row housing layout and the extension of temple premises lies on the banks of mythological Akash Ganga Lake. Its in bow shape in plan and is sacred to Vaishnav Hindus for association to Srimant Shankar devji and beyond. There are stories and depiction of its existence in books of temple premises. The activities like morning prayers, festivals, celebrations, stage performances, storytelling, depiction of chapters of Bhagwat and Ramayan, social messages for education, health, practice sessions, religious discourses, social meetings, it all takes place in temple complex premises. The spread of such messages originate from here and participation of people increases its impact. The teachings of Satra is followed by people and they associate themselves with it. The placement of Lake, Satra, Namghar has prominence in organization of activities around the village and in their daily routine. They pray in Satra in morning every day and go back to their routine works. Again in evenings, they come to Satra for theatrics/drama sessions, if arranged for that day. The planning of this layout shows respect the Satra and no structure was seen beyond the outer edge of it or on the fringes of scared Lake. The significance of this place is reflected in their daily routine and activity placements. In plan it appears like a Garden City concept of neighborhood planning which integrates free open spaces on the end of inner side of individual site, creates dead end for traffic in cul-de-sac, keeps common activities of importance at one end. A similarity is seen here in planning.

2.3.3 Neighborhood Schema

The roads of 3 m in width serve as the main roads along which most of the row houses are planned on both sides. Its like an almost orthogonal plan with arterial movement along these two roads and tertiary feeder roads for inner sides. The ownership of houses shows no caste-based clustering as it was long abolished by Shrimant and equalized by giving a title of “Kalita” to everyone. The neighborhood bears no preference of any particular person of caste but a mix of all. For instance, the house of priest in close to the temple premises and next to him lives a household worker with equal rights for generations. The neighborhood has almost similar type of lands for each house and is different at the level of size of house constructed, its detailing and materials used. The economic capacity of family derives the kind of material to use in houses.

2.3.4 Elements of a Dwelling Units Given in Appendix A

On the fringes of house rows is a long stretch of segmented water bodies for each dwelling unit.

2.3.5 Site Organization and Features

One individual piece of land is flanked by open area in front of the house on the edge of road with green boundary and at the end by two kinds of ponds and expanse of agricultural fields afterwards.

The land houses a number of activities on it and those are derived by their routine practices such as planting betel nut trees which are considered auspicious and to be rich in iron and minerals. It is a daily habit of people consuming betel leaves and nut after meals. It is a household practice and visitors are offered with it as welcome gesture. Here the elements have a. religious, b. food, c. husbandry and d. social angles to it.

The installation of temple, betel nut, and banana trees have religious as well as food habits. The plantation of fruit trees such as banana, coconut, fish pond, cattle, fowls such as ducks/chicken, etc., on the individual lands are due to food habits. They are rich in basic nutrients and become wholesome diet as a whole for family supplying all they require. From carbohydrates, fats, proteins, vitamins, minerals, and fiber in ample amount. They grow in this environment and does not require special expertise to harvest and rear. So the adoption of trees and plants is on the lines of geographic abundance and climate. The temple has provision for bananas, sugarcane, gram, coconut, ginger, betel leaves, betel nut, etc., only which are locally grown. It does not ask for sweets or anything which is not easily available to

the person who may economically find hard to afford. It is a strong message to recognize and promote inclusive social sustainability. This acts as a comfortable limit by society which liberates people from obligations which may prove to be costly for them to fetch, buy, and prepare from outside. The offerings are available in abundance and cost less but still they continue to have higher value in comparison to imported items like sweets from outside. It is a value proposition promoted and nourished by thinkers to maintain the equilibrium in society. One who can afford should not be given with opportunity to prove others lacking at some point. Here every one offers the same to the deity and gets the same. Hence we see by the example of food items here that they can act like a common thread between the members of community. It promotes original form of items with minimal processing and decoration to save on resources. The concept of sustainable design by social equality and cohesion has been practiced here in this sense.

Every household has handloom for weaving of Gamuchha (cotton towel) and Dhoti/Saari, Makhela Chaddar, Kurta, Salwar Kameez, etc. One of the basic needs of life-clothing, is provisioned here to make as a house activity. Women who generally are housewives, take up this as work. The same Gamuchha is offered at temple and is being used as prasad and souvenir. In the time of pilgrimage in Holi and other festivals, pilgrim buy Gamuchha. Many of times its sold out from shops quickly. This creates a cycle of demand and supply in this micro-environment giving ample opportunity to weave more to satisfy the demand. But there is an interesting catch, people do not want to work more just for the sake of fulfilling demand and expanding their business. Surprisingly they feel satisfied with what they have do not want to join in the rat race of market. They say they are doing it for their own requirements or without straining themselves in production. They seem to be not interested in joining in the market requirements, supplying to the cities and establishing the homegrown enterprise. They say they are happy in this closed economic system of their village and do not want external stimuli. But at least they are independent and self-reliant in requirements of food and home clothing.

2.3.6 Assam-Type House Portions and Details Given in Appendix B

The structure constitutes of wooden members as main structural frame and filled in by reed reinforced (mud covered) thin walls in between the frames. The ikra walls are plastered with smooth mud to slide off the rainwater. Rainwater splashes wet the mud plaster and wall becomes damaged soon. To save on this, sometimes the wall till sill level is made up of single brick, plastered with cement. The main columns on the corners of the room go from foundation to ceiling and form major portal structure for the building. Tie beam goes at the floor level and ceiling level. Rest of the middle horizontal wooden members of wall are joined in between at four levels such as sill, lintel, lower level of ventilator and upper level of ventilator. Similarly,

rest of middle vertical wooden members rise from lower tie beam till ceiling level and form space for doors and windows in between. The space between them remains not more than 1000 mm in any case. The space between members defines sizes of doors, windows and ventilators on wall surface. Together they form a portal lattice structure which decides the wall surface into many small portions (visible from outside) and acts as bracing in case of earthquake. The king post system goes above ceiling level and form the roof structure with an angle between 30° and 35° from ceiling level. It incorporates a gap of up to 300 mm between ceiling level and pitched roof level to make provision for cross-ventilation from one side of building to the other. In swamps of Assam, they raise the whole house structure above by 300 to 1800 mm depending upon water logging pattern. It saves from waterlogging, wild animals, etc.

The language gap can be difficult to communicate with village people hence it is advisable to take along a local person.

2.4 Results

The place was observed on ethnic styles on chosen aspects. It is evident that this ethnic place has mark of its agricultural practices and philosophy of Srimant Shankar devji. People congregate for religious, ceremonial, festival, fairs, and recreational activities, seldom rely on virtual modes like TV and mobile, etc., they lean more towards original practices rather than modern. People are contented in their agriculture allied occupations. Keeping low profile and humble at roots has shown its effect on harmony the place boasts for. It has potential to become a model place in terms of sustainable living styles, keeping and coping with nature, deriving and returning back to nature, remain in touch with elements, and still not harm it. Keeping aspirations in check, refrain from materialistic aspirations, and aspire within the conscience of nature has made this place one of a kind.

The region has challenges of earthquakes too (Zone-V) and has evolved the Assam-Type Buildings (Or Ikra House, named after reed which is called Ikra locally) which are locally made without much support from outside and have survived for centuries. People of rural areas still construct their own houses. This has been in practice for centuries and has saved lives and good in situations of damage during earthquake. We see this construction technique is within the reach of people and does not require much external manpower. This simplistic method of construction supports the economic capacity of people and has established itself as a resilient technique.

The notions of simplicity in the lifestyle and culture of this place have got reflection in their concepts and workmanship. The ideas of local sourcing, climatic considerations, vegetation-based economy, fewer imports, and ecological mitigation have shaped it as an independent system in itself which depends on its own. Though it has its own limitations also that it may not get chance of dialog with other cultures and might remain intrinsic. The exchange of ideas, concepts, and details

may get translation of totally new kind as interpreted by new society but largely it shows that the society which remains independent can preserve its sanctity and maintain a sustainable utilitarian approach towards material handling. The cycle of material life is complete in various aspects and end stage of one cycle becomes the start of the next cycle as we saw in food, building construction materials, fabrics, etc. It gives us clues for prevalent design directions.

2.5 Conclusion

The findings indicate that people have adapted well to their place and culture. Even youth and new generation are inclined towards the originality. They were found to be of having satisfaction, psychological stability, socially adjusted, and integrated. The combination of geography, climate, vegetation, materials availability, distance from cities, etc., has defined the framework for this style of living and coping with design and construction belonging to place. Several features in the Assam-type house construction were found to bear the direct linkage with cultural practices and geographic situations. People have evolved techniques to suit the conditions and ethnicity of the place and reflect it aptly.

Here, we are seeing convergence of many perspectives of various aspects in works of Assam-type house’s sustainable design. This convergence, of high performance with beautiful aesthetics or ecologically sustainable design with telling the story in a culturally significant way, is indicative of the kind of synthesis that is a first step on the path to of fully integral awareness in design. The sustainable design falls short when it ignores human interiors, both individual experiences and cultural meaning.

Each viewpoint takes its valuable and appropriate place in a wider perspective where nothing is missing-rich human experiences, significant cultural meaning, high technological performance and true ecological sense merge into something much richer, truer and ultimately more aesthetically pleasing. This should and will be the future of design.

Word definitions

Satra: congregation centres of Vaishnav people, particularly in Indian state of Assam. **Bhagwat:** one of the greatest Puranas of ancient scriptures of India. **Ramayan:** life history of Lord Ram written by Sage Balmiki. **Kalita:** is a common surname of people from Assam which was given by Srimant Shankar devji abolishing cast system. **Barduwa Than:** dedicated place of Barduwa satra.

Abbreviations used

PWD: Public Works Department. **NGO:** Non-Governmental Organization.

References

1. Cessation, F., Vezzoli, C., Zhang, J.: Sustainability in Design: Now! Challenges and Opportunities for Design Research, Education and Practice in the XXI Century, vol. 2. Greenleaf Publishing Ltd, Sheffield (2010)
2. Dekay, M.: Integral Sustainable Design Transformative Perspectives. Earthscan, London (2011)
3. Fiksel, J.: Sustainability and resilience: toward a systems approach. *Sustain. Sci.* **2**(2). Practice, & Policy. (2006). <http://ejournal.nbii.org>
4. Gundimedaa, H.: Natural resource accounting for Indian states—illustrating the case of forest resources. *ScienceDirect ECOLOGICAL ECONOMICS* **61**(2007), 635–649 (2006)
5. Mathijs, E.: Transition to a Sustainable Agro-Food System in Flanders: A System Analysis. Philippe D’Hondt, VMM D/2013/6871/009 ISBN 9789491385193 (March 2013) (2012)