SEMINAR PROCEEDINGS

ARCASIA FORUM 20 DHAKA 19

বাংলাদেশ স্থপতি ইনস্টিটিউট
INSTITUTE OF ARCHITECTS BANGLADESH

arcasia
Architects Regional Council Asia

"Architecture in a Changing Landscape"

Never before in the history of humanity has one witnessed such unprecedented speed and nature of change in every facet of human life as happening today. From the technological to the political, from climate to migration, and from cities to regions, unprecedented change and transformation, and at a remarkable rate, mark our epoch.

Architects are negotiating everyday with increasingly volatile contexts of shifting economic, physical, technological and geo-political landscapes. In order to address many facets of these undeniable phenomena, the theme, Architecture in Changing Landscapes, is expected to evoke thoughts, innovations and ideas appropriate for the present and future state of architecture.

Foreword

'Architecture in a Changing Landscape' is a well understood theme. With the multitude of changes that are happening, there are many aspects that one can address. There are changes that are collective and then there are smaller changes that matter.

The theme of the conference attracted responses from many authors on a wide range of topics. Almost all of them had to do with the way architecture relates to the changes that are occurring around us. Some of these are quantifiable leading to specific role of architects to adapt to the changes and on the other hand there are changes that cannot be measured but felt and perhaps understood.

The range of papers presented here are the ones that went through a rigorous review process, right from the abstract till final versions. The result of this is a rich collection of thoughts and approaches that challenge architecture today. While there are some which lean towards pragmatic attitudes while others tend towards the philosophical or that of vision.

The process of getting here has been arduous, it allowed us to get a glimpse of a very wide canvas of thoughts. The members of the seminar committee have worked tirelessly on this for the last few months and it is through their hard work that this volume comes together.

Prof. Fuad H Mallick
Convener
Seminar Committee
ARCASIA Forum 20

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Keynote Speakers

Emre Arolat

Founding Partner & Principal, EAA-Emre Arolat Architecture, Turkey

Emre Arolat is the design partner of EAA-Emre Arolat Architecture, founded with Gonca Paşolar in 2004, as the continuation of his architectural practice that began in 1987. Since that time, EAA is an internationally recognised practice with offices in New York, London and Istanbul.

Emre Arolat teaches and lectures widely both within Turkey and internationally. In 2017, he was Norman R. Foster Visiting Professor at the Yale. He has lectured at various institutions such as La Cité de l'Architecture et du Patrimoine in Paris and the Pratt Institute in New York. He taught a studio at The Berlage Institute in Delft. He was the co-curator of the Istanbul Design Biennale in 2012. He was awarded a professorship by the International Academy of Architecture, Sofia, in 2015.

EAA received international attention with the Minicity Theme Park (2004) selected by the Mies van der Rohe Award for European Architecture. Others include, the Aga Khan Award for Architecture in 2010. He was a member of the Aga Khan Award for Architecture Master Jury in 2016 and the Steering Committee (2017-2019).EAA's work has been published by Rizzoli NY in a monograph (2013), edited by Philip Jodidio and Suha Özkan. Their projects have exhibited at The Royal Academy of Arts. He is an Honorary Fellow of the American Institute of Architects.

Hanif Kara

Co-Founder & Design Director - AKT II, London, UK

Hanif Kara is co-founder and Design Director of AKT II, a design-led structural and civil engineering firm based in London. Hanif's particular 'design-led' approach and interest in innovative forms, pushing material uses, sustainable construction and complex analysis methods, have allowed him to work at the forefront of the many challenges facing the built environment. This leads AKT II to being associated with the most innovative construction projects, winning over 350 design awards over the last two decades including the Stirling Prize on three occasions, the latest being in 2018 for the Bloomberg Headquarters as UK's Best New Building, a project also accredited as the most sustainable office building in the world. Hanif is also Professor in Practice of Architectural technology at GSD Harvard and the first engineer to be appointed on the Steering Committee for the highly regarded international AKAA (Aga Khan Award for Architecture). Hanif currently sits on the UK National Infrastructure Commission's Design Task Force and Expert Advisory Group and is a member of the HS2 design review panel. He is a fellow of the Royal Academy of Engineering, a fellow of the Institution of Civil and Structural Engineers and an Honorary Fellow of the RIBA.

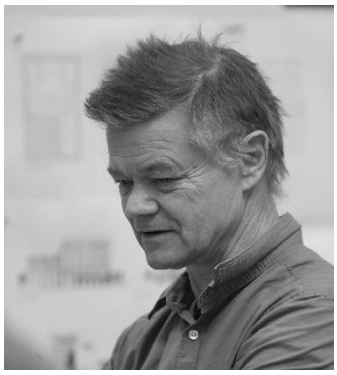
Marina Tabassum
Founder & Principal Architect
Marina Tabassum Architects, MTA, Bangladesh

Marina Tabassum is the principal of Marina Tabassum Architects, a practice established in 2005 based in Dhaka, Bangladesh. MTA began its journey in the quest of establishing a language of architecture that is contemporary to the world yet rooted to the place.

Ms. Tabassum graduated from Bangladesh University of Engineering and Technology in 1995. She founded URBANA where she was a partner for ten years. Most important project of this partnership is the Independence Monument of Bangladesh and the Museum of Independence and completed in 2013.

She is the academic director of the Bengal Institute for Architecture, Landscapes and Settlements. She taught at Harvard University Graduate School of Design, University of Texas and at BRAC University. She is teaching a design studio at TU, Delft, Netherlands.

She is a member of the Steering Committee of Aga Khan Awards for Architecture. She is also a member of the Board of Directors of Prokritee, a guaranteed Fair Trade organization that has empowered thousands of women artisans of Bangladesh. She won the Jameel Prize in 2018. She is also a recipient of 2016 Aga Khan Award for Architecture for the Bait ur Rouf Mosque in Dhaka. She received the AYA Award from India in 2004 for her project NEK10 in Dhaka. She is also a recipient of 2005 Ananya Shirshwa Dash Award, which recognizes Bangladeshi women of exceptional achievements.



Peter Clegg
Senior Partner, Feilden Clegg Bradley Studios, UK

Peter Clegg established Feilden Clegg Bradley Studios with Richard Feilden in 1978. Regarded as a pioneer in environmental design, he has over 40 years' experience in low energy architecture and is active in research, design and education. He was the primary author of 'The Environmental Handbook', a substantial account of the practice's sustainable design experience and a primer on the implementation of environmental best practice.

Peter works primarily in the education and cultural sectors. He has led projects at Yorkshire Sculpture Park, London's Southbank Centre and Brighton Dome. His involvement in schools and higher education projects includes a new School of Engineering in Toronto and an Academy in Bangladesh. Other international work includes a 900-bed student housing scheme for the University of Washington and the Leventis Art Gallery in Cyprus. He is Chair of the CABE-affiliated South West Design Review Panel and a trustee of the Yorkshire Sculpture Park, has chaired the RIBA awards nationally and internationally, and holds a professorship at Bath University. In 2010 was made a Royal Designer for Industry (RDI).

Saif Ul Haque

Principal Architect, Saif Ul Haque Sthapati (SHS), Bangladesh

Saif Ul Haque (b. 1958, Dhaka) is the Principal of Dhaka based architectural practice Saif Ul Haque Sthapati (SHS) and Director Research and Design Program at the Bengal Institute for Architecture, Landscapes and Settlements also at Dhaka, Bangladesh. He studied architecture at the Bangladesh University of Engineering and Technology and is involved in practice, research and education.

Saif Ul Haque's works include residential, institutional and industrial facilities at different locations in Bangladesh and have been published and exhibited in and outside Bangladesh. He has been a visiting faculty and reviewer at various institutions. His research interests include environment, architecture and urbanism and has written on these topics. He has also been involved in organizing a number of exhibitions on architecture.

Wong Mun Summ

Co-Founding Director, WOHA, Singapore

Wong Mun Summ is the co-Founding Director of WOHA, an international award-winning architectural practice based in Singapore. He is a Professor in Practice at the National University of Singapore at the Department of Architecture, School of Design & Environment. He sits on the Nominating Committee of the Lee Kuan Yew World City Prize and other design advisory panels in Singapore.

Wong Mun Summ founded WOHA with Richard Hassell in 1994. Rather than being overwhelmed by the challenges of climate change, population growth and urbanisation, the Singapore-based practice has evolved innovative new architectural and urban solutions to tackle the problems of the 21st century.

WOHA has accrued a varied portfolio of work and is known for its distinct approach to biophilic design and integrated landscaping. The practice has won a number of architectural awards, most recently the 2019 Urban Habitat and Best Mixed-Use Building awards from the Council of Tall Buildings and Urban Habitat (CTBUH) and 2018 World Building of the Year for Kampung Admiralty and 2018 Best Tall Building Worldwide for the Oasia Hotel Downtown.

WOHA's Platinum Green Mark-rated PARKROYAL on Pickering hotel has become one of Singapore's most iconic buildings, receiving the 2015 CTBUH Urban Habitat Award, the 2014 Design for Asia Award Grand Award and the 2013 World Architecture News Hotel of the Year Award.

WOHA are the designers for the new BRAC University in Dhaka, Bangladesh, currently under construction. The practice also has projects under construction in Singapore, India, China and Australia.

Invited Speakers

Alan Ricks

Founding Principal & Chief Design Officer, MASS Design Group, Boston, MA, USA

Alan is a Founding Principal and the Chief Design Officer of MASS Design Group, whose mission is to research, build, and advocate for architecture that promotes justice and human dignity. He leads strategy and design of the 120-person firm, which has projects in over twenty countries that range from design to research to policy—a portfolio that continues to expand the role of design in advancing a more just world.

Alan and MASS were awarded the National Design Award for Architecture from the Cooper Hewitt, Smithsonian Design Museum. And the Royal Institute of British Architects awarded Alan an International Fellowship in recognition of his contribution towards the field of architecture.

He has previously taught at the Yale School of Architecture and the Harvard Graduate School of Design. Chris Anderson, chief curator of TED, described his TED talk as “a different language about what architecture can aspire to be.”

Isandra Matin Ahmad

Principal Architect and Founder, andramatin, Indonesia

Andra Matin – both the man and the firm, **andramatin**, are known for their clean and modern approach to architecture. The works of andramatin has been a constant reflection of contemporary take on traditional values, that are based on its context and its sensitivity to the environment.

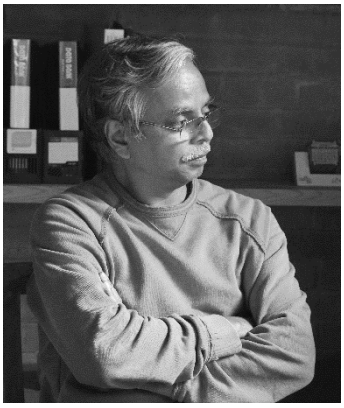
Aside from his architectural projects, Andra Matin is also one of the founders of *Arsitek Muda Indonesia* (AMI – eng: Young Architects of Indonesia), and has been a part of the progress in Indonesian architecture. He also have released books under *a.publication* that opens up discussions about architecture, along with being a frequent lecturer at universities, seminars, and architectural events both in Indonesia and in international events. His latest installation titled *Elevation* has been granted a Special Mention Award at the 16th Venice Biennale, for its traditional sense and its contemporary take. Inspired by his great love of travel, Andra Matin continues to search out more knowledge and experiences, in order to further celebrate the architecture of Indonesia.

Jeravej Hongsakul

Principal Architect and Managing Director, IDIN architects Co. Ltd, Thailand

Mr. Jeravej Hongsakul received a Bachelor of Architecture degree from King Mongkut's Institute of Technology Ladkrabang in 1998 and has been practicing in architectural field since 2000. His design philosophy is to merge the 'natures', with the architectural aesthetic by analyzing and prioritizing the different needs and requirements of each project. In which 'natures' is defined as ecology surroundings, urban context and also personalities of users. To express this philosophy, IDIN architects- Integrating Design Into Nature, was established in 2004.

In 2010, IDIN architects became well-known in Thai architectural field as 'Phuket Gateway' was awarded in ASA architectural design award. After that, many projects from this company has also been awarded with numerous prizes both national and international level: ASA Architectural design award in Thailand in 2016, ARCASIA in 2016 and 2018, American Architecture Prize in 2017, 2A Asia Architecture Award in 2017, German Design Award in 2018, A+Awards in 2016,2017 and 2019.



Nahas Khalil

Principal Architect , ARC Architectural Consultant, Bangladesh

Nahas Ahmed Khalil is a prominent architect from Dhaka, Bangladesh. He is the Principal Architect of ARC Architectural Consultants and has wide-ranging expertise in architecture, urban planning and architectural education.

Architect Khalil graduated from the Bangladesh University of Engineering and Technology in 1982. Initially he worked as assistant architect at CAPE under Architect Raziul Ahsan. Later he established his own architectural practice ARC Architectural Consultants. He has worked on a variety of projects including residences, apartment buildings and educational institutes. He is the recipient of several prestigious awards including the IAB Award in 2018 and the Holcim Green Award in 2010.

Architect Nahas Khalil has served as a respected juror for several prestigious architectural competitions. His work has been acclaimed in various international platforms as well.

Nguyen Hai Long
Co-Founder, Tropical Space, Vietnam

Nguyen Hai Long is one of the founding Architects of Tropical Space, which he established in 2011 along with his partner Tran Thi Ngu Ngon. Long graduated in architecture from the University of Architecture, Ho Chi Minh City in 2001 and completed his Master degree in 2008 from the same school.

Two design influences dominate in every Tropical Space project; sculpture and climate. The architects here also want to understand the story of the owners. Being consistent in their works and architectural languages, Tropical Space wants to inspire other people to live a simpler life, to use enough but not more than is needed. This is expressed in their architectural designs and material choices.

Tropical Space has received several international architecture awards such as Brick Award, ARCASIA Architecture Award, AZ Award, Fritz Hoger Award, A+ Award etc. Meanwhile, they have been also invited to present lectures at Columbia University,

Cornell University, National University of Singapore etc. and give several talks in different countries.

Shamsul Wares
Principal Architect, Shisrikkhu Sthapati, Bangladesh

Shamsul Wares is an eminent architect and acclaimed educator and critic. He has decades of pedagogic experience starting from his long career at the Bangladesh University of Engineering and Technology from 1972 to 2003. Later he joined the University of Asia Pacific. Currently he is Dean of the School of Environment and Design at the State University of Bangladesh in Dhaka.

Architect Wares works as an independent consultant for Shisrikkhu Sthapati in Dhaka. His eventful career as an architect and academician has brought him acclaim both at home and abroad. As a young graduate he had the rare opportunity to work as a Junior Architect under Architect Muzharul Islam (December 1968 to April 1971). Architect Wares has designed many Residential, Institutional and Public Buildings. He served as the President of The Institute of Architects Bangladesh (IAB) for two terms (1997-99 and 1995-97). He has been member of the Jury for assessment of several National and International architectural competitions. He has also worked as a member of the Technical Expert Committee in a number of Government Organizations of Bangladesh including Ministry of Public Works, Ministry of Cultural Affairs, Dhaka University, Export Promotion Bureau, etc. As a member of the Architects Regional Council of Asia he has represented Bangladesh as the leader of the delegation in five ARCASIA forums.

In 2009 Professor Wares was awarded the Life Time Achievement Award for Architectural Education by the Institute of Architects Bangladesh (IAB) in Association with Aqua Paint Bangladesh and Ice Today. He also received the prestigious IAB Gold Medal 2017, the highest honor for architects of Bangladesh.

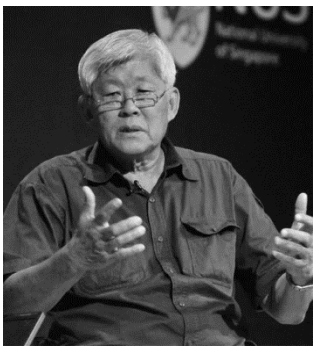
Sidhartha Talwar

Principal | Design Head, Studio Lotus, India

Sidhartha Talwar has been working as Design Principal in Studio Lotus from 2003 to present day. In the course of his working career of over 20 years, Sidhartha has headed and worked on diverse projects including Exhibitions, Retail and Corporate Interiors, and Thematic Events, taking them from concept to execution. His core strength and passion lie in articulating space, project detailing and implementation.

He gained interest in exploring other mediums of spatial expression that led him to work with Exhibition Design Firm Oriole in 1998.He is responsible for achieving revenue targets as a business unit head, guides his team and is involved in strategic design decisions, and programming. He plays a pivotal role in development of teams and manages multiple projects and teams
effectively.

An alumnus of TVB School of Habitat Studies, he won the National Architectural Design Competition held for the National Police Memorial, Shanti Path, Delhi in October 2011. He has been a visiting faculty member at the TVB School of Habitat Studies too. Sidhartha is also a part of visiting juries at the Sushant School of Architecture and other colleges



Prof. Tay Kheng Soon

Adjunct Professor,
Department of Architect at the National University of Singapore, Singapore

Tay Kheng Soon, born in 1940, is a practicing architect and adjunct professor at National University of Singapore Architecture School. He was president of the Singapore Institute of Architects from 1990-1993 and founding member and chairman of SPUR (Singapore Planning and Urban Research) in 1970-1971. Tay was also chairman of the Task Force for the long-term development of the National Museum of Singapore, founding chairman of the Substation, a cutting-edge arts centre, and headed the committee on heritage for the Singapore Advisory Council on Culture and the Arts.He graduated from the School of Architecture in 1964 and is currently undertaking fundamental design research about Rubanisation. Tay writes a lot and gives many public lectures. He is considered a public intellectual who is among the few who freely expresses critical views in a highly conservative and restrictive environment. Being a fellow of the World Academy of Art and Science, Tay owns Kem-Eco, a wilderness eco-education camp in Malaysia and developed Kampung Temasek, a rural “school of doing” in Johore. He understands “development” as the mechanization of economy and society in contrast to the need to develop a humanized economy and society.

Apart from architecture and design, Tay is also enthusiastic about volunteerism. He volunteered in the 2004 Tsunami relief efforts in Meulaboh in North Sumatra with Mercy Relief and the Red Cross and involved with the Augustinian Foundation in the Philippines in the rehabilitation of Kinatarkan Island devastated by typhoon Haiyan. Tay Received the SIA Gold Medal for achievements in architecture and the profession in 2010.

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Technical Papers

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"Sanrachna" + "Sahbhagita" – A Concept of S.M.A.R.T Village

Nazish Abid[1],
Mohd Resaal Ansari

Abstract: *Most of the tribes in India are in a vulnerable and dilapidated state. Some tribal communities have been categorized as primitive tribal groups on the basis of their extremely backward socio-economic status and other sociological traits. Sabar is one of such ignored tribe mainly found in Jharkhand, Chhattisgarh and West Bengal. The people still live according to their traditional primitive life lacking basic necessities such as shelter, sanitation, water supply etc. and mainly depend on resources from forests. The Sabar people are skilled artisans and excelled in mainly brooms, baskets, ropes etc. Their products/ artefacts could not fetch a good price lacking variation in the product's designs which has brought the languishing their crafts on the verge of extinction. The upliftment of the tribal people is not only necessary to improve the living conditions of the people and to revive their lost arts, but their upliftment will also contribute in increasing the country's GDP, thus improving the status of the nation globally. This paper looks at the adaptation to develop a self-sustaining community-based solution, with a holistic approach to improve the standard of living of the people by providing them the basic amenities at reasonable price and in a sustainable manner.*

Keywords: Tribal communities; Vulnerable and dilapidated; skilled artisans; primitive; self-sustaining community-based solution; Sabar Tribe

[1] Asst. Professor, REVA University, India

Introduction

India is a very diverse nation comprising of people from different ethnicity and cultural background. India is a house to several tribes or *Adivasis* viz. *Andh, Bhil, Gond, Chenchwar, Kammara* to name a few, residing in several parts of the country.

Figure 1: Tribes of India. Source: Tour my India

There are few tribes listed as primitive tribes on the basis of their socio-economic conditions and other sociological traits living in remote locations without basic infrastructure and necessities. They live in dilapidated houses and still depend on forests for food which is uncertain. Most of these tribes are skilled artisans and craftsmen specializing in crafts such as wooden toys, statues, bamboo works, clay models and ornaments, paintings etc. Due to lack of good price for their crafts, they are moving out of their profession in order to work as daily wagers leading them on the verge of extinction and bringing the identity of these groups to jeopardy. Although several initiatives both by the government and several NGOs have been taken to uplift and improve the conditions of these people still it has been not very effective.

Aim and Objectives

Aim

To improve the living and working conditions of the people of the Sabar community, a primitive tribe, with a holistic approach by providing them with the basic amenities at a reasonable price and in a sustainable manner.

Objectives

1. To study the existing living and working conditions of the Sabar tribe.

2. To study the conditions of their arts and crafts.

3. To provide solutions to improve the infrastructure and basic requirements of the people such as housing, health, education etc.

4. To provide solutions to improve and uplift the arts and crafts of the community.

5. To study the various models and tools for the implementation of the suggested solutions.

Tribes and Primitive Groups of India

The scheduled tribe (ST) population is 104.2 million, which is 8.6percent of the total population of India (Registrar General & Census Commissioner, 2011). Madhya Pradesh, Maharashtra, Orissa, Gujarat, Rajasthan, Jharkhand, Chhattisgarh, Andhra Pradesh, West Bengal, and Karnataka having a large number of ST populations.

The ST population are scattered all over the country depicting the heterogeneous culture and socio-economic status. There are about 700 tribes (with overlapping categories in some States/UTs) as per notified Schedule under Article 342 of the Constitution of India (Affairs, 2018).

There are about 75 such groups identified as Primitive Tribal Groups (PTGs) located in 17 States and in 1 UT. Most of these groups are small in number and generally inhabit remote localities having poor infrastructure and administrative support. Many of them are socio-economically under-privileged and not benefited much from developmental projects and other initiatives. (Paltasingh & Paliwal, 2014)

Sabar Tribe

The Sabars are one of the PTGs, mainly found in the Singhbhum district of Jharkhand, Midnapur and Bankura districts of West Bengal, Keonjhar and Dhenkanal districts of Orissa.

The main economic activities of Sabars are basketry, collection of minor forest produce, lac cultivation and agriculture. (Agarwal, et al., 2013)

The Sabar tribe finds mention in the Hindu epic Mahabharata (Nandi, 2019) and was declared criminal tribe in the colonial rule and still suffer from the stigma of criminality. Their exploitation and exclusion are discernable from all angles (Ghosh & Guchhait, 2017).

Arts and Crafts of Sabar Tribe

Figure 2: Crafts of Sabar Tribe. Source: The Hans India

From many generations the Sabars, depend on making products out of Bamboo, Palm leaves, Kanshi grass which are available locally in abundance, making a small number of items e.g. brooms, ropes, baskets etc. and sold them in the nearby markets or Haats as a means of their livelihood. Although skilled craftsmen, the demand of their products and the capacity were quite low which could never fetch good price bringing the craft of the PTG on the verge of extinction. Lack of marketing and reach to major markets have also led to diminish of the crafts. (Bose, 2016)

Issues and Challenges of the Sabars

These primitive tribe lives in extreme deprivation, according to their traditional primitive lifestyle and are deprived of basic amenities hence, suffer from stark poverty, starvation (with many surviving on not more than 30 grams of food per person per day). Very low level of literacy (For instance, only 1.73 percent of tribal literates in the state belong to PTGs, 88 percent of Sabars are illiterate and among other PTGs too literacy rate varies between 5 to 16%).

The PTG is ecologically and biologically endangered tribe. They are struggling for their very existence by braving the challenges of malnutrition, disease and natural calamities. Their population is fast declining and some of the primitive tribes are reduced to even 100 in numbers.

Living Conditions

Housing

The Sabar houses are tiny hut made of twigs, leaves and sticks, not tall enough for someone to stand (Sahu, 2015). Some have been allotted houses under Birsa Awas Yojana. There are no toilets in the houses and use the fields and waterfalls for bathing and toilet purpose.

Figure 3: Hamlet of Sabar Tribe. Source: Scroll.in

Remote and Inaccessible Habitats

Located in interior and remote regions and one has to travel quite a bit to reach these villages.

Electricity

Connection is almost non-existent. Those having connections have no access to electricity.

State of Economy

Once they were depended on their arts and craftsmanship. Now majorly work as labour and construction workers and some survive selling wood, hacked from forests. (Sahu, 2015), with an average monthly income between Rs. 500 to Rs. 1000.

Left-Wing Extremism

Tribal villages are scattered and many of them are located inaccessible areas where left-wing extremism prevails.

The need of the Project

The living conditions of the Sabar Tribe is very vulnerable lacking the basic amenities. Although skilled craftsmen, they are moving out of profession leading to migration and disconnecting them from their roots and culture resulting loss in their identity and extinction of their arts and crafts as well the tribe as a whole.

Figure 4: Sabar tribal harvesting Kurkut or the red ants' eggs in Amlasole, West Bengal. Source: Outlook Photo

Thus, rejuvenation and upliftment of these people is required, so as to upgrade their living and economic conditions by various means such as the revival of their dying crafts, providing them basic amenities and infrastructure in a cost-effective and sustainable manner.

Provision of Housing, Life and Livelihood

The Sabar people live in houses which are in dilapidated conditions lacking basic facilities, thus proper and planned housing along with facilities such as toilet, electricity, sanitation and still reflecting their tradition and culture to address their housing is required. The paper also looks at improving the lives and livelihoods of the tribe. The establishment of common workshop cum training centre, where these people could practice and exchange knowledge of their crafts and sell their products at local markets as well as globally through e-commerce platforms as compared to the present scenario (discussed earlier). The intention is to provide housing, livelihood at their place of living so that they can live a better lifestyle.

S.W.O.T. Analysis

Strength

Figure 5: Strength of the Sabar Tribe. Source: Author

Weakness

Figure 6: Weaknesses of Sabar Tribe. Source: Author

Opportunity

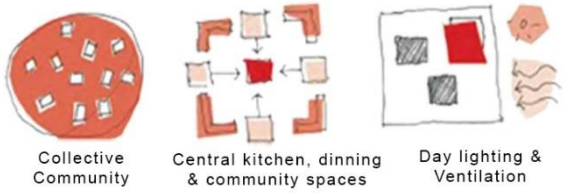


Figure 7: Opportunities for Sabar tribe. Source: Author

Threat

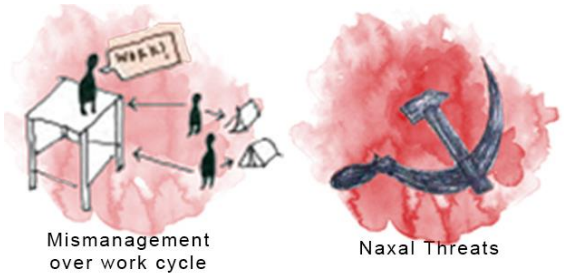


Figure 8: Threats for Sabar tribe. Source: Author

Project Proposal

"Sanrachna" and "Sahbhagita"

"Sanrachna" means creation and "Sahbhagita" means participation. The people of Sabar tribe have a very strong sense of community within themselves. Since the tribal people lack basic necessities and infrastructure, thus, Sanrachna and Sahbhagita, which is creating a better infrastructure and living conditions for the Sabar tribe with their participation and involvement at all stages of the project.

S.M.A.R.T. Village Concept – What and Why?

S.M.A.R.T. abbreviates for "Specific", "Measurable", "Attainable", "Relevant" and "Time Bound". The concept aims at creating a Village for the Sabar Tribe by using local materials and labours, renewable sources of energy and water supply, cost-effective for both the tribals as well as the investors, relevant and attainable physically and financially within a short span of time. The concept involves solving the lack of housing, education and aims at providing better livelihood by promoting their local crafts by establishing a common workshop for the village and selling their goods to local markets as well as global market through various e-commerce platforms.

Site Location

Pather Chakri, Chakulia

District:	East Singhbhum, JH
Nearest Town:	Chakulia (15 Kms.)
M.S.L.:	115 M (377 ft)
Population:	Males – 73
	Females – 82
	Children (0-6) – 26
Nearby Village:	Khayerbani, Bend
Connectivity:	Roadways, Public Bus

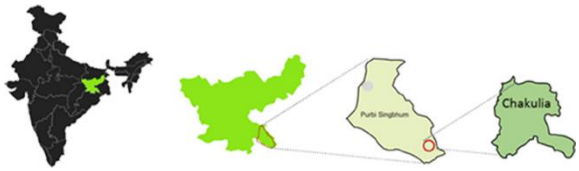


Figure 9: Contextual location of selected site. Source: Author

Strategies

Administrative level

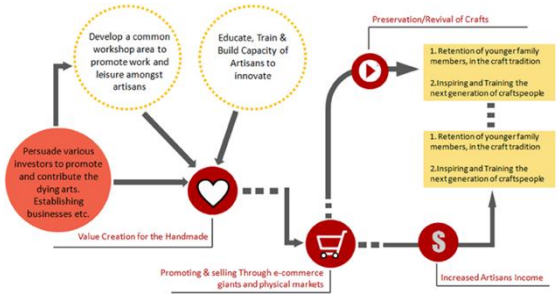


Figure 10: Administrative level strategies. Source: Author

Establishment of a training centre and introduction of marketing giants and e-commerce can help in expanding the horizons of the market for their products and sell their products at higher rates and with updated designs.

Carrying out the Legacy

The different generations of the tribe can work together and practice their art carrying their legacy.

Figure 11: Hierarchy of craftsmanship. Source: Author

Supporting element

Various bodies would play an important role in developing and sustaining the village. Such as

Central and State government: Releasing funds and monitoring.

Local government: monitoring and releasing funds from the upper tier of the government.

NGOs: would help with volunteers and a different vision.

Educational Institutions (SPA, NID, NIFT, IIT and others): The students would help in improving the designs of their products and updating their designs.

MNCs and Companies working in the field of sustainability: could help by providing new technologies and materials at a reasonable rate and help in installations and execution at various stage.

Public Participation: Most important is the involvement of the people of the tribe in all the stages of the project.

Community

Since the tribe hold a strong sense of community value and uphold their culture and traditions very strongly thus, several strategies are to be adopted and practised at the community level.

Figure 12: Strategies at the community level. Source: Author

Design

Adopting design and construction techniques to make better and sustainable spaces by putting less pressure on the environment as well as people.

Multifaceted Spaces:

- use of sliding pane; dividers to modulate room volume as per time and use.
- At site level, school doubles as community spaces, while workshops, dining areas have varying uses.
- The school building will have a flexible design in order to adapt it for various functions and events.

Figure 13: Design Strategies. Source: Author

Waste Recycling

All the organic wastes can be recycled and used for various purposes within the community.

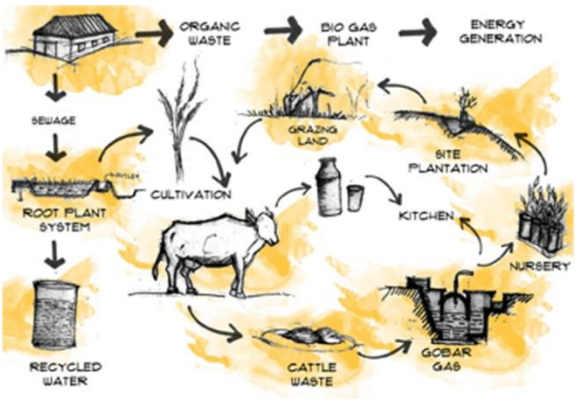


Figure 14: Waste Recycling Strategy. Source: Author

Solar Energy

Installing solar panels would generate electricity without any hindrance. The extra electricity produced can be sold to the city's electrical board and can be utilized during monsoon.

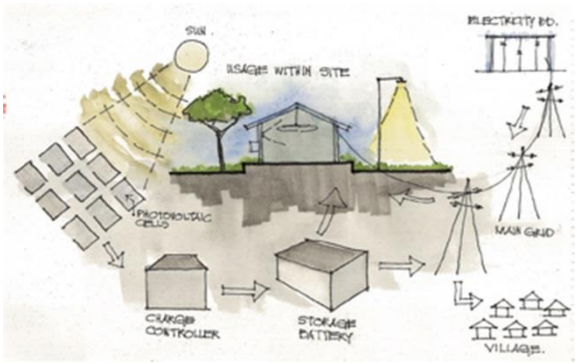


Figure 15: Strategy for Solar Energy. Source: Author

Water Recycling

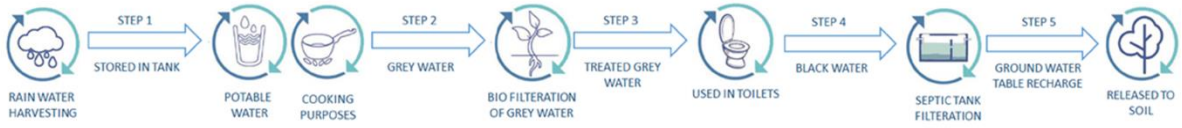


Figure 16: Water Recycling Process. Source: Author

Water is a very scarce resource and needs to be preserved. Thus, several methods have to be adopted so that wastewater can be recycled and reused.

Models and Tools of implementation

Public-Private Partnership Model

A Public-Private Partnership (PPP) means an arrangement between the government entity on one side and a private sector entity on the other, for the provision of public assets and/or services, through investments being made and/or management being undertaken by the private sector entity, for a specified period of time. (Telang & Kutumbale, 2014)

In this project the public sector i.e. government bodies viz. central, state and local governments would act as facilitator and mediator, monitoring the progress at different stages of the project. The private sector which are various companies and MNCs would act as investors and provider in this project.

Public Participatory Planning

It is an idea that could lead to the empowerment of the poor and marginalized through the fair redistribution of material resources, participation processes are capable of designing fair and equitable decision-making processes with similar material outcomes. (Kumar & Prakash, 2016)

Public participation is an important tool for the execution of the project as it will help in better understanding of the needs and issues of the people of the Sabar tribe and help in finding better solutions which are vernacular, sustainable and as per their culture and traditions; getting inputs from all the people of the community irrespective of the age, sex and other social traits.

The people of the tribe could also work as labour in the construction phase of the project so that

cost of the labour from outside could be saved and these people would get employment.

Master Plan

The master plan of the site accommodates both the newly designed housing for the people who live in dilapidated and primitive huts as well as existing houses, which would be retrofitted as per new strategies. The housing would surround the community spaces viz. school-cum-community hall; common workshop and dining space; constructed water pond, to store rainwater; and open ground for playing, recreation and conducting *panchayats*.

An axial road connecting the village to nearby towns and villages, with bus stops located at the periphery of the village, with a by-pass road for the movement of buses.

The village would be surrounded by farmlands, provided by the government to the tribe on lease. The entire village would practice the **Open-land farming system** which was successfully practised in England, where people would contribute different resources such as land, cattle, machineries and the produce would be equally divided among the contributors. The people would work in the farm on service basis and would get their wages accordingly.

Figure 17: Master Plan of the Proposed Village. Source: Author

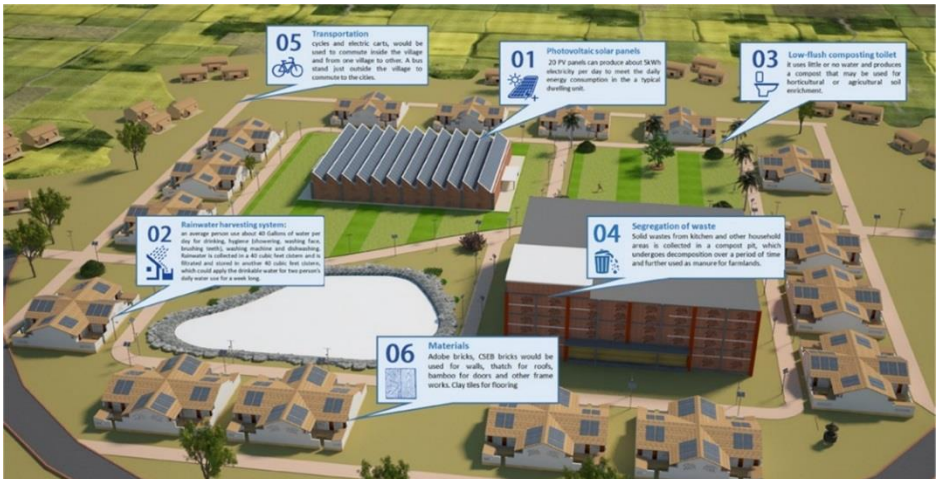


Figure 18: Bird's Eye View of the Proposed Village. Source: Author

Housing

The new housing is designed according to the vernacular architecture of the tribe in a cluster of four, with a courtyard, sloping roof with thatch, a cowshed for their cattle by using sustainable and locally available materials. The houses are climate responsive with *jaali* system for ventilation and solar panels for electricity.

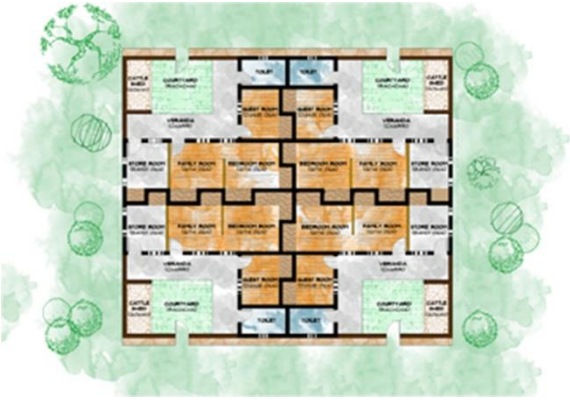


Figure 19: Floor Plan of the housing cluster. Source: Author

Figure 20: View of the proposed house. Source: Author

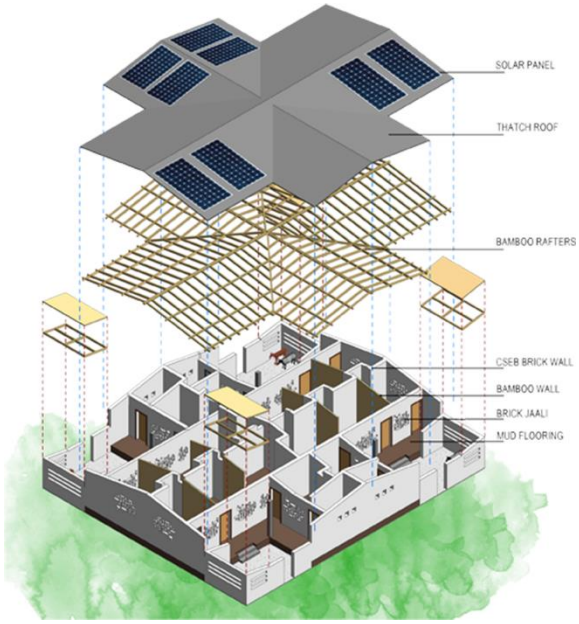


Figure 21: Exploded view of the House. Source: Author

School- cum- Community Center

Providing basic education up to pre-primary and primary level in the villages. The school will serve as both day and night school helping in attaining education for working adults and women. The school building will have a flexible design in order to adapt it for various functions and events such as marriages, festival celebrations, gatherings etc acting as a community centre.

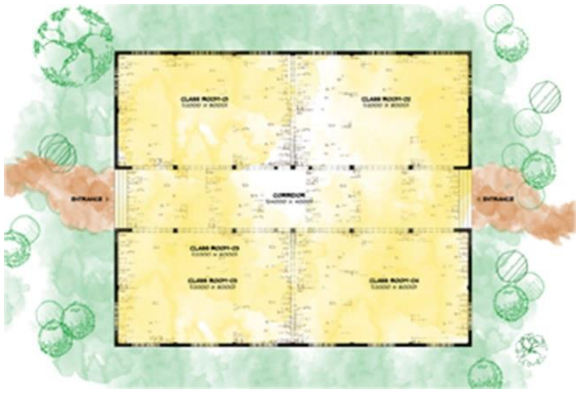


Figure 22: Floor plan of the School-cum-Community Center. Source: Author

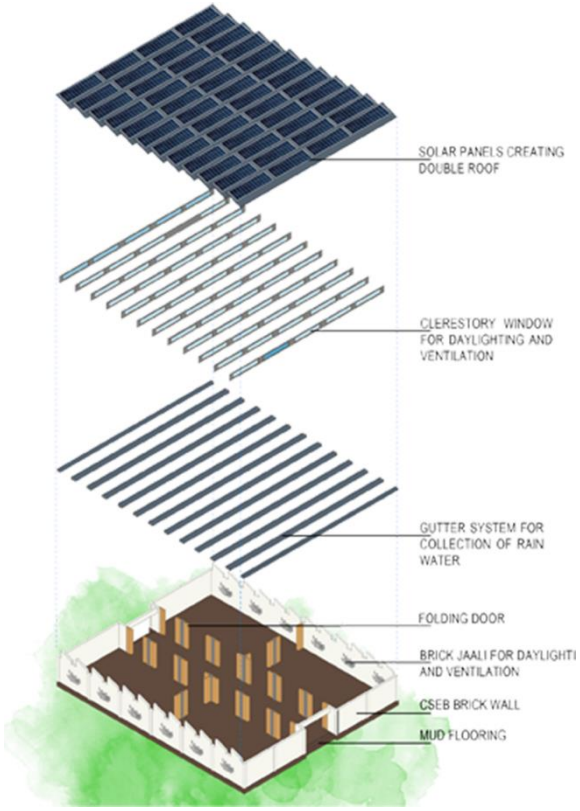


Figure 23: Exploded view of the School-cum-Community Center. Source: Author

Common Workshop/Common Dining/ Health Care/ Administrative Center

For promoting a sense of co-operative working and co-existing a common workshop is being proposed were artisans and craftsmen can come together and work under a common roof by making artefacts which would be sold in the market by various means including e-commerce website generating employment. The profits would be equally divided amongst the people giving a sense of equality.

Provision of common dining and kitchen areas for the community. The families would turn by turn cook food for the entire community giving them a sense of oneness and no one left hungry. These systems are running successfully in institutions such as the **Bohra community** and in **Gurudwaras** in form of **langars**. Each family would have to submit a small portion of their earnings for the smooth running of the common kitchen.

The centre would house health centre for basic treatments; and administrative centre with the panchayat office being located in the facility.

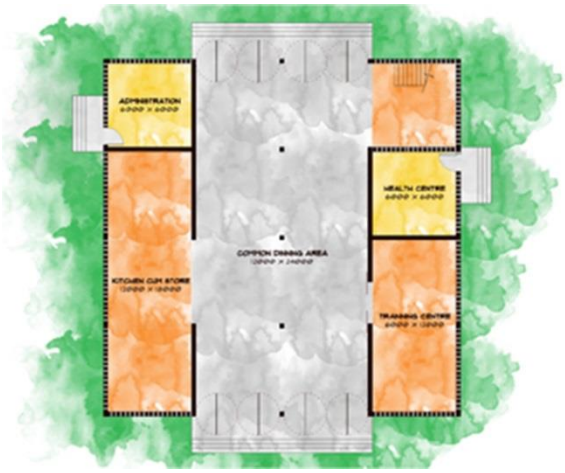


Figure 24: Floor Plan of Common Dining and Workshop Facility. Source: Author

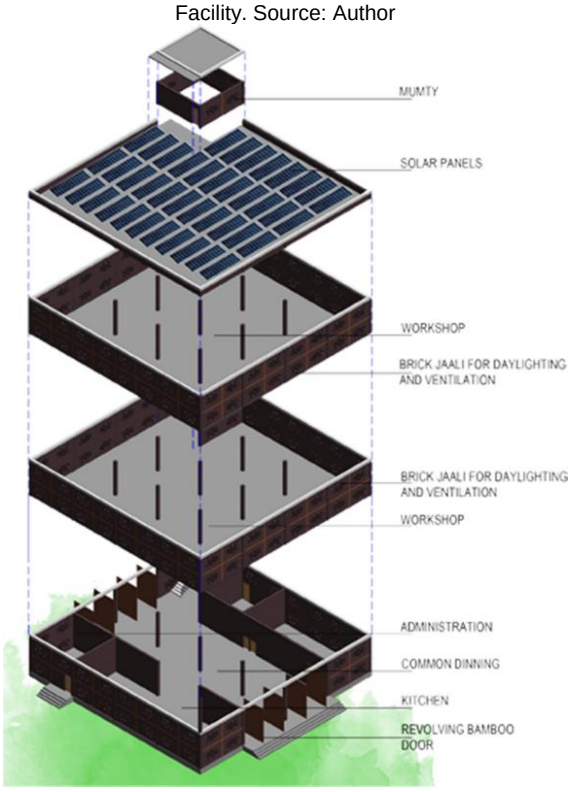


Figure 25: Exploded view of the Common Dining and Workshop Facility. Source: Author

Phasing of the Project

Phase I: Phase I of the development includes the excavation of the pond, from the mud of which the CSEB bricks for construction will be made. Followed by construction of the dwelling units, with CSEB bricks, bamboo frames, thatch roofs, installation of solar panels on the roof.

Phase II: Phase II of the smart village is the development, construction and operation of workshops, schools, medical facilities and other infrastructure such as roads, sanitation etc.

Phase III: Phase III is the retrofitting of the existing houses in the village, schools and other amenities according to the new standard and facilities such as solar panels, jaali work, compost toilets etc.

No further construction of houses beyond the designated number will be done. Beyond which a new village nearby will be established so that the pressure on the resources could be controlled. Different satellite villages will have a central bigger village which will have facilities of full functioning banks, higher secondary schools, post-offices etc. and will act as a central commercial hub for all nearby villages.

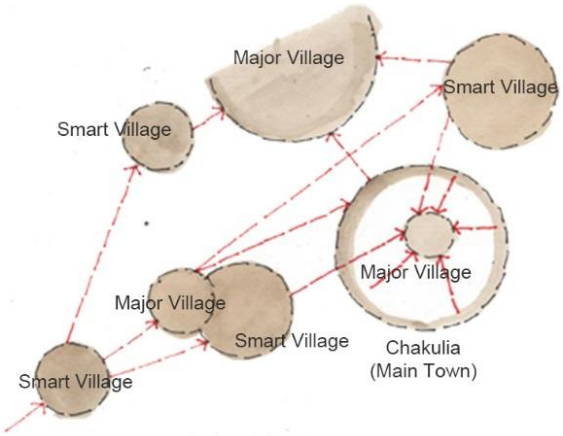


Figure 26: Schematic diagram of the project phasing. Source: Author

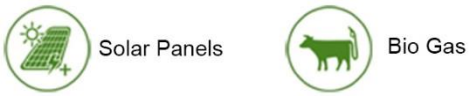
Post Design Analysis

A post design analysis conducted according to the IGBC Green Homes Guidelines to analyze the achieved norms.

1. Site Selection and Planning

2. Water Efficiency

3. Energy Efficiency



4. Material and Resources

5. Indoor Environmental Quality

Conclusion and Contextual Application

The model village would help in rejuvenation and upliftment of the living standards of the Sabar tribals by spatial interventions and providing them with basic necessities. The interventions would also help in the revival of the dying arts and crafts, by introducing new designs and skillset, will make them socially and economically stable and would preserve and intact the identity

of the tribe and provide them with a national identity. With improved literacy and skillsets and contribution to the nation's economy would help in increasing the GDP of the country thus, improving the status of the nation globally.

This model village can be easily implemented, operated and managed in any part of the country. Providing shelter, food to those who do not have it is the prime target. Different investors from different areas could be persuaded to invest in this project, thus all the investment will not be burdened on the central or state government. This idea would create a model village which would act as a context and reference for similar developments in any part of the country. It will also help in uplifting and upgrading the dying arts and crafts of the country such as Chamba Rumal Painting, Himachal Pradesh, Madhubani Art, Bihar.

References

Affairs, M. o. T., 2018. Annual Report 2017-18, New Delhi: Ministry of Tribal Affairs, Government of India.

Agarwal, R., Pruthi, M., Lodhi, P. & Kumar, P., 2013. Sustainable Livelihood Options For Primitive Tribal Groups in Jharkhand: CSR Initiatives by Tata Steel. AIMA Journal of Management & Research, VII(1).

Bose, A., 2016. XLRI biz whizz for Sabar craft, Jahrkhand: The Telegraph.

Ghosh, S. K. & Guchhait, D. S. K., 2017. Kharia Sabaras bearing the stigma of Criminality and Social Exclusion: a Study in South-Eastern Purulia, West Bengal, India. IOSR Journal of Humanities And Social Sciences (IOSR-JHSS), XXII(9), pp. 72-77.

Kumar, A. & Prakash, P., 2016. Public Participation in Planning in India, New Castle upon Tyne: Cambridge Scholars Publishing.

Nandi, C., 2019. Development, 'Unfulfilled' Promises to decide fate of candidates in Tribal Bengal, Kolkata: Outlook - The fully loaded magazine.

Paltasingh, T. & Paliwal, G., 2014. Tribal Population in India : Regional Dimensions and Imperatives. Journal of Regional Development and Planning, III(2), pp. 27-36.

Registrar General & Census Commissioner, I., 2011. Census of India 2011, New Delhi: Registrar General & Census Commissioner, India.

Sahu, S., 2015. In Jharkhand, a marginalized tribe lives in hamlets of misery and despair, Jharkhand: Scroll.in.

Telang, D. V. & Kutumbale, D. V., 2014. Public Private partnership in India - An overview of current scenario. research Front, II(4), pp. 13-26.

Conservation of French Colonial Heritage During the Transformation Process of Historical Urban Centres of Hanoi and Ho Chi Minh City

Nguyen Quoc Tuan

Abstract: *Hanoi and Ho Chi Minh city are two of a few cities in Vietnam that owns French colonial heritage assets, established from the second half of the nineteenth century, and primarily concentrated within the historic urban centres. Along with hundreds of colonial-style buildings, the urban setting of the French quarters brings values to cityscape and tourism. The unique urban landscape of the French Quarter in two cities, with the coexistence of the waterfronts and old buildings, and with lively activities of local people were creating their own identity images. These images are unique and different from other cities in Vietnam, even in Southeast Asia. This characteristic that has created a sense of place for Hanoi and Ho Chi Minh city that is full of identity, diversity and cultural harmony. However, degradation, demolition and replacement of heritages in historical urban centres of Hanoi and Ho Chi Minh city are consequences of uncontrolled economic development. The disappearance of precious urban heritage, and the domination of new, modern and high-rise buildings to serve the urban development needs, have dramatically changed the landscape of the historic urban centre. Recognizing the architecture and urban heritage in the historical urban's landscape means we must focus on the conservation, not only of the building but also the urban setting and the general built environment, the heritage landscapes and spaces around heritage area. This paper will analyze key aspects of French colonial urban heritage in Hanoi and Ho Chi Minh city in the transformation of the historic urban center. Through analyzing and proposing solutions to the management, conservation and promotion of synthetic values of urban heritage, we can exploit and integrate them into the flow of urban socio-economic development process. By building an inter-relationship between Culture + Heritage and Economy + Technology, it is believed that a smart solution for sustainably preserving and maintaining urban heritage in the development and continuous change of urban areas can be achieved.*

Key words: French colonial heritage, Historic centre, Urban landscape, Urban heritage, Landscape changing

Preface

Urban heritage is significant because this group of heritage is the most magnificent cultural heritage among other types of heritages created by the human being during our evolution. Urban heritage itself has historical and cultural value that can create the image as well as the brand name of an urban area throughout its formation and development process. Urban heritage also shapes places, traces and landscapes that are profoundly embedded in the consciousness of residents and visitors.

Hanoi and Ho Chi Minh City (HCMC) are two of a few cities in Vietnam that owns French colonial heritage assets, built from the second half of the 19th century, concentrated in the historic urban centre of each city. In Indochina, the French built and developed Hanoi and Ho Chi Minh City are the two largest cities. Along with thousands of colonial-style buildings, urban planning of the French quarter brings special values to cityscape and tourism.

The unique urban landscape of the French Quarter in two cities, with the coexistence of lakes, rivers and old buildings, and with lively activities of local people were creating their own identity images. These images are unique and different from other cities in Vietnam, even in Southeast Asia. Because during the colonial period, the French-occupied Indochina, while other areas in Southeast Asia were under the control of the British and the Spanish ... Therefore, it can be said that these are the two cities that have gathered the largest French architectural heritage found in Southeast Asia. This characteristic that has created senses of place for Hanoi and Ho Chi Minh city that are full of identity, diversity and cultural harmony.

However, degradation, demolition and replacement of heritages in historical urban centres of Hanoi and HCMC are consequences of uncontrolled economic development. The disappearance of precious urban heritage, the domination of new, modern and high-rise buildings to serve the urban development needs, has dramatically changed the landscape of the historic urban centre. Hanoi and HCMC, in some cases, has focused on the immediate development goal, such as focusing on more economic priority than maintaining the urban heritage fund.

This paper will analyze key aspects of French colonial urban heritage in Hanoi and HCMC in the transformation of the historical urban centre. Through analyzing and proposing solutions to the management, conservation and promotion of synthetic values of urban heritage, we can exploit and integrate them into the flow of urban socio-economic development process.

Methodology

1. Collection and retrospective methods are used to research documents about the history of the French Quarter's foundation and development process in Hanoi and HCMC.

2. Mapping method is used to identify the process of formation and development of French Quarters. Through the data obtained, it is possible to identify the transformation of cities and landscapes over time, detect its effects (positive and negative).

3. The analytical method is used to process data/information on the status of French towns in each aspect. In parallel with analytical research is an integrated method to recognize theoretical trends and what happens in practice.

4. Comparison methods are used to: a) Assess changes in morphology, structure and landscape of French towns in the historical urban space of Hanoi and HCMC; b) Evaluate the economic, social and living changes of local residents over time.

5. Structural analysis method is used to recognize the relationship between other urban structures and the French Quarter, on factors: density, morphology, transformation, uniformity...

6. Images analysis method is used to recognize changes in morphology, structure and landscape.

Overview of French Quarter in Hanoi and Ho Chi Minh city

- **Hanoi capital**

By collection and retrospective methods, we found that the French Quarter began to be built in 1875 in the Concession zone along the Red River, which originally was a narrow and long strip of land. The first expansion of this quarter took around Hoan Kiem Lake in 1884 – 1895. Intending to turn Hanoi into the capital of Indochina Federation, the French promoted the expansion of Hanoi's urban space with complete Western-style planning. During this period, the French Quarter was expanded to the north, especially in the west area of the old Imperial Citadel with many spacious streets and squares.

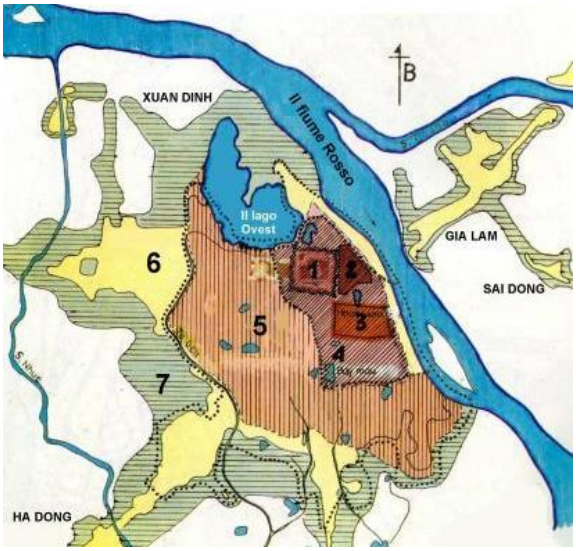


Figure 1: Map of Hanoi's urban structure / VIUP *1.Citadel; 2.Old quarter; 3.French quarter; 4.Urban area built before 1954; 5.Urban area built before 1980; 6.Urban area built from 1995; 7.Urban area built from 2000 to now*

At the early of the 20th century, the French Quarter Hanoi was shaped on the two sides of the Citadel and south of Hoan Kiem Lake. Using the mapping method, we see Hanoi was planned two times: the first time was archived by architect Ernest Hebrard (1924) and the next time by architect Louis Pineau (1943). The most significant work was laid by Ernest Hebrard, who had shaped Hanoi's spatial and urban landscape structure. [2]

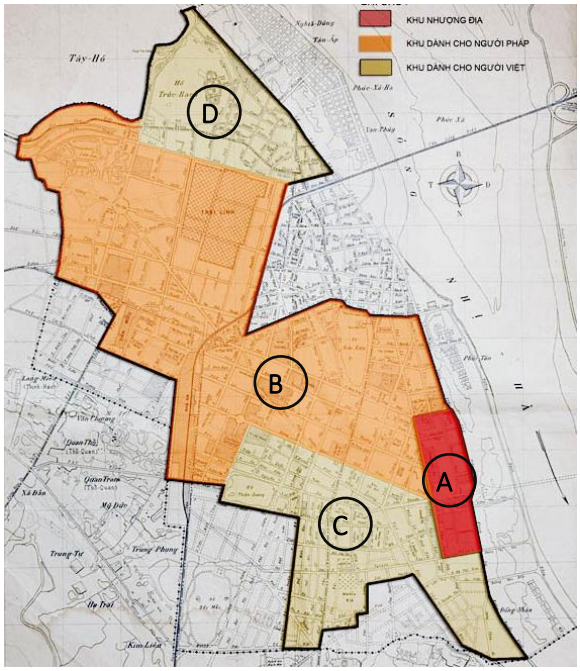


Figure 2: Boundary of French Quarter in Hanoi / GRAH - *A. Concession zone; B. French zone; C & D. Vietnamese zones*

- **Ho Chi Minh city**

By collection and retrospective methods, we found that, after conquering Gia Dinh citadel (1859), the French built an entirely new Saigon. On 8th January 1877, the French President signed an official decree to establish Saigon city, classified as "Grand City" ("Grande Municipalité") or "First-class city" ("municipalité première classe"). The premise for Saigon to become an important center, not only administrative but also economic, cultural and educational of the Indochina Federation, was named by the French as the "Far East Pearl" ("La Perle de l 'Extrême-Orient") or a "Little Paris in the Far East" ("Le petit Paris de l'Extrême-Orient"). [8]

In the past, Saigon-Cholon (*Cho lon* means a big market) was formed from two components, Saigon and Cholon. By mapping method, Dist.1, Dist. 3 (today) were the centre of Saigon along with Dist. 5 (today) - the centre of Cho Lon, became the artificial nucleus for the overall Saigon-Cholon in general (figure 3).

Besides creating an initial physical space for Saigon, the French also brought to this city Western-style urban planning and management.

Carrying the responsibility and bearing the most imprints of urban morphology and landscape, the old downtown Saigon is currently distributed in two districts. (1) Dist.1 plays a more critical role in the city because it gathers many essential urban facilities and infrastructure built by the French. (2) Dist. 3 contains a large number of residential buildings which served the officials in colonial apparatus as well as wealthy people with social status and good relations to the French.

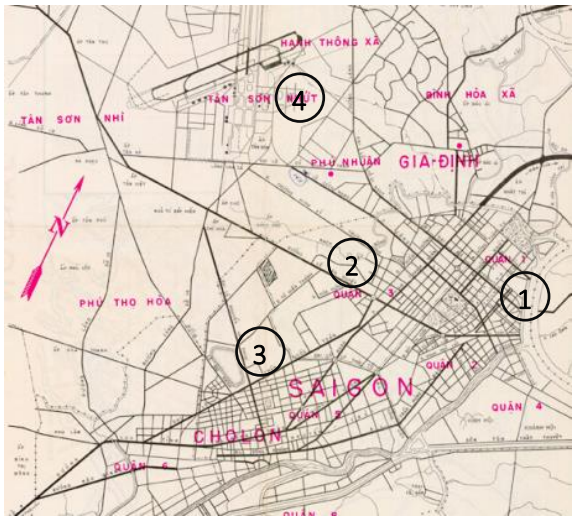


Figure 3: Map of Saigon's urban structure in 1960 / National Archives of Vietnam in HCMC
1.District 1: French quarter; 2. District 3; 3.District 5: Sino-Vietnamese's Quarter (Chợ Lớn / Big market); 4. Tan Son Nhat airport).

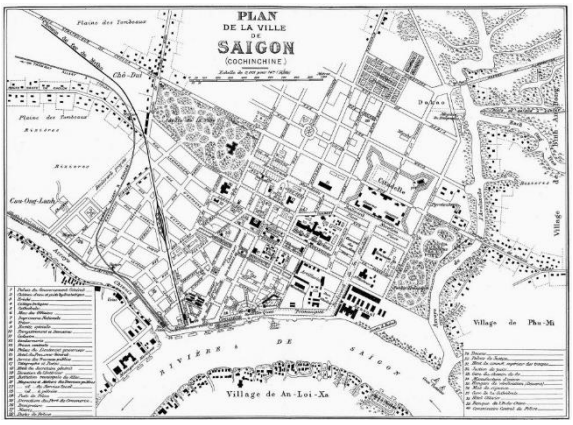


Figure 4: Map of District 1: French quarter in 1896 / National Archives of Vietnam in HCMC

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- **Outstanding values**

The French Quarters in Hanoi and HCMC have outstanding values of urban landscape and architecture:

- The street system, the scale and proportion of the architectural structures that are intertwined with the traditional urban body, transformed with the old streets of the city into an entity that is hard to separate through the streets, contributing to create a rich urban image. This soft transformation is a precious lesson in urban development for Vietnamese people.
- Architecture expresses creative exploration, from applying Western styles to tropical conditions, to create a new architecture style adapted to the characteristics of Vietnamese climate and aesthetics (the Indochine architectural style).
- Create an unprecedented diversity of urban and architectural DNA with new types of works such as stations, hospitals, hotels, libraries... that Vietnamese have not had before the appearance of the French.
- Attractive, bustling and vibrant streets, or the display of diverse living, production, business, and cultural activities of urban residents. [6]

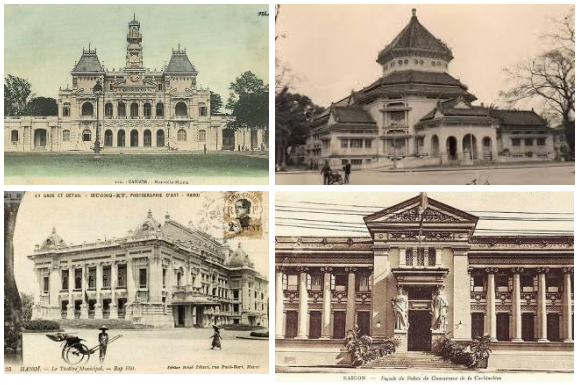

Figure 5: Some outstanding French colonial heritage buildings in Hanoi and HCMC / National Archives of Vietnam

Modernization, Pressure and Changing

In the process of modernization, historic French quarters are under pressure from means of transportation, development of urban infrastructure, etc... Along with that, the process of urbanization took place strongly in Asian cities, creating a different context to the traditional landscape architecture space and no economy can guarantee financial for integrity conservation ... Therefore, it is necessary to classify in more detail the objects that need to be conserved and preserved in the historic neighbourhoods in order to have appropriate behaviour. These objects can be a building, a street (street lines or scape), a garden, space or historic landscapes.

Hanoi has 5,922 monuments - ranked first in the country in terms of number of historical and cultural relics. In particular, Hanoi owns 1 UNESCO World heritage, 13 special national monuments, more than 1,180 relics named by the Ministry of Culture, Sports and Tourism; more than 1,200 City-level monuments named by City's Government. Besides, there are hundreds of buildings built under the French colonial period (public buildings and more than a thousand French villas) that need to be recognized as urban relics/heritage, but so far only 3 buildings are named as di National Monument.

In HCMC, according to the survey data of the Center for Urban Research and Forecast (PADDI), from 1993 - 2013, the centre of Ho Chi Minh City has 207 buildings with heritage values being demolished or deformed. Specifically, in the 1993 survey of districts 1 and 3, 377 buildings were assessed by experts as valuable heritage. In 2013, when re-surveying only 14 buildings were restored, 96 buildings the process was preserved, 35 buildings with little change, 9 buildings were degraded and 207 buildings (56.3%) were demolished or deformed ... Another statistic has shown that Ho Chi Minh city has nearly 1,300 old villas (built before 1975) in need of conservation. However, a recent survey of the Center for Architectural Research (Department of Planning - Architecture of Ho Chi Minh City) shows that nearly half of ancient villas have been ... destroyed or renovated in the wrong way. [1]

In Vietnam, the "Doi Moi" in the 1990s has created a great opportunity for changes in economic, cultural, lifestyle and working spirits. Through analysis, we conclude that there are three factors influencing the morphology and landscape of urban areas in Vietnam:

1. *Economic development:* Development is always double-faced, one is creating opportunities for modernization, while the other is also creating challenges. Economic development creates opportunities for new urban development projects / urban renovation, and challenges for historic urban areas in preserving identity, controlling density, preserving urban structure and form, preserving heritage buildings and cultural-historical spaces, typical landscapes. Heritage should be considered economic resources, not just cultural and educational. The new point of view of the Government and professionals is that cultural heritage is a social capital because it contributes to long-term and sustainable spiritual and material wealth.

2. *Urbanization and density's increasing:* Along with economic development, a strong wave of urbanization has doubled the number of urban residents in just two decades. The high concentration of population in urban areas has increased the density, thereby increasing many demands for accommodation, workspaces, community spaces, needs for living and enjoyment of culture, and many other activities...

3. *Changing lifestyle:* The penetration of exotic cultural movements is welcomed by young people, leading to a change in lifestyle. It is the young generation and middle-aged young people who have created demand, leading to an adjustment in the organization of urban activities. Services provided entail changes in urban spaces/utilities/ facilities. This change takes place from a small scale, increasing with economic development and the growth of the middle class, and becoming universal on a large scale. This process starts with the transformation of "surface spaces" of streets and important public spaces in the urban centre. If the above

demand is not met, it is inevitable that there will be replacement and transplantation, increasing the density of buildings in the central areas which have the highest commercial potential. This has been and will change the landscape of historical spaces in the urban centre. French towns in central Hanoi and Ho Chi Minh City also show the same rules.

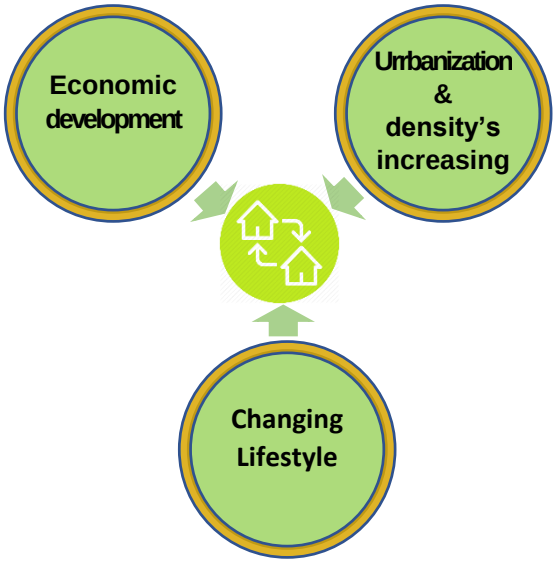

Figure 6: Three elements make changing in urban lanscape / Author

Transformation process of French Quarters

Today, the French Quarter together with the Old Quarter has been recognized as the historical core zone of whole Hanoi area (according to the Planning of Hanoi capital to 2030 and vision to 2050). Hanoi still retains values of landscape, culture and history of the centre. The most visible transformation in the French Quarter are the increasing density and lifestyle changes, which leads to changes in the spaces for activities.

By comparison methods and Images analysis method, we see Hanoi's Government had efforts to keep the landscape of historical urban zone stable for many decades. Although there are some changes, some new buildings built with modern functions to meet today's demands, they must integrate smoothly with the surrounding landscape. We ensure that architectural forms are similar to neighbourhoods, the size is not too big to feat with a sense of space and the function is suitable with resident's demand.

Figure 7: Trang Tien street, Hanoi / National Archives of Vietnam in Hanoi
(from above: in early of 20th century / in 1990 / in 2018)

However, because the commercial potential of the historic quarter is so attractive, investors always find a way /a particular door to place their projects in a fertile land where creating extremely high benefit. Due to not being allowed to build high-rise buildings in the historic quarter, investors placed their building right on the boundary of the Quarter. This inevitably affects the field of view, from a long-range view to panoramic view. In the 2000s, there were a few high-rise commercial projects that grew up inside the historical urban zone and dramatically changed the landscape of the city's centre.

Fortunately, soon after, the City's Government has firmly refused the construction requests of more high-rise buildings in the area of two districts of Hoan Kiem and Ba Dinh. [9]

For example, there are a series of high-rise buildings, banks, office buildings sprouting on the northern boundary of the French Quarter currently. With a distance of less than 1km from the Hoan Kiem lake - the heart of Hanoi, all these buildings will transform the overall landscape of the historic quarter forever.

Figure 8: One of five high-rise buildings sprouted on the northern boundary of the French Quarter / @mindark_nmd

In Ho Chi Minh City, the situation is more severe than Hanoi. Because the city is Vietnam's most prominent economic hub, the City's Government must prioritize economic development rather than preserving cultural and historical values. The most visible transformation of the quarter's morphology is height of the new buildings was built inside the area. The French Quarter is not preserved in structure's overall as Hanoi; instead, Ho Chi Minh city's Government focuses on preserving the most representative and most valuable buildings. This policy is consistent with the actual development of the city, in accordance with the requirements of both conservation and development, but still, regret many professionals and citizens who loved the historic French colonial space in the city's centre.

Although economic priority according to development requirements, we still have to talk about the downside of this policy. Specifically: the historical landscape of the city centre will lack uniformity if not said to be chaotic, messy. Newly built buildings will overwhelm historical buildings. The increase in density makes this dominance contrast, reducing the aesthetic and landscape of the downtown area. In installation art, a messy layout can create new aesthetic feelings, but in urban areas, messy only makes us realize that we are confused, out of control, or do not predict the future image of the city.

By Images analysis method, we can see the changing of HCMC's centre:

Figure 9: Left view, and right view of Ho Chi Minh City Hall / SGGP

Figure 10: French Quarter landscape before and after the construction of Vincom center Dong Khoi / Nguoi Do thi.

Conservation of French Quarters during transformation process

- **Hanoi capital**

In Hanoi, the preservation of the French Quarter has been discussed at many national and international conferences for nearly 30 years. Research groups of NUCE and some international experts/universities from France, Japan, Canada… have studied and statistics more than 100 valuable buildings. In the 1990s, the Chief Architect's Office of Hanoi had studied and adjusted the French Quarter as a basis for licensing the renovation works in this quarter. The City's Government has studied and issued a regulation on management of the French Quarter of Hanoi.

In fact, some of the preservation efforts have good results. Some valuable typical French colonial buildings have been recognized as National-level Monuments (Hanoi Opera House, Presidential Palace, Government Guess house, History Museum...). However, Hanoi is now facing the following problems:

- The Southern area of Hoan Kiem Lake has been interlaced with many high-rise buildings leading to the change of urban spatial structure.
- The renovation following the direction of retrospective and ancient imitation increases the risk of falsifying heritage values, changing the original values of the heritage.
- According to a research of UAI-NUCE completed in May 2011, Hanoi has 229 class 1 French colonial villas, 432 class 2 villas, 644 class 3 villas; 235 class 4 villa, but housing policy with historical factors has created the multi-ownership of villas, uncontrollable encroachment, expansion of the structure, morphology of buildings, landscapes and streets.

Some key solutions for conservation of the French Quarter in Hanoi during transformation process:

- To reduce population, return the original architecture for buildings, especially villas. In fact, from 1999 to 2009, the City's Government successfully reduced population density of Hoan Kiem district from 36,684ppl/km2 to 27,792ppl/km2. [5]
- To upgrade and to restore the surrounding environment, both in terms of architectural aesthetics and structure.
- Newly built/interlaced constructions must be integrated with the original architecture in terms of scale, height and style which are not too contrasting. The old architectural context must be respected, new ones must not be broken, but must be perfected.

Hopefully, with the formation of a full legal corridor, the French Quarter will be preserved and exerted its value in the continuous development of Hanoi city.

- **Ho Chi Minh city**

The preservation of French colonial heritage in Ho Chi Minh city is not only architecture but also social issues. We must consider the development demand because this city is the "locomotive" for the economy of the whole country. Ho Chi Minh city now facing some following problems:

- Increasing population and urbanization process put pressure on the infrastructure system and threatening the sustainable existence of heritage.
- Private owned villas and tube houses in districts 1, 3 and 5 are deformed, destroyed, give way to new buildings, most of which are high-rise and unfamiliar.
- Criteria and regulations to preserve urban structures, heritage projects are not clearly defined. This leads to conservation works reducing the dynamics of the city, becoming a drag on the industrialization - modernization process.

The preservation of French colonial architecture in Ho Chi Minh City must not only consider the city's socio-economic capabilities for conservation, but also the urban heritage conservation strategy as a throughout policy for

future urban development. Here are some key solutions:

- Recognizing some areas in the center of the city as "urban heritage zone" is very necessary and urgent. It is a legal basis to carry out the next steps in conservation process. (Hanoi has zoned the historic quarter and implemented appropriate conservation and development plans for nearly 10 years).
- Preserving the entire historical environment of heritage as an important role in the diversity of culture. Focusing on heritage appraisal, heritage rankings and recognizing.
- Promoting the economic value of heritage by perfecting *the inner city / urban heritage ecosystem.*
- Establishing the *Management board for Urban Heritage*. This department should be responsible for conserving and controlling heritage, as well as managing urban development activities related to heritage. (Hanoi has established similar management board for its historic quarter for 20 years ago).
- The city needs to quickly establish a framework of regulations on preservation of urban heritage (in which the French colonial heritage has a large proportion), including the following main contents: 1/ Regulation for urban planning and space; 2/ Regulations for architectural buildings; 3/ Regulations for management of urban activities in heritage spaces; 4/ Regulation for applying methods to regulate urban space resources (figure 11).

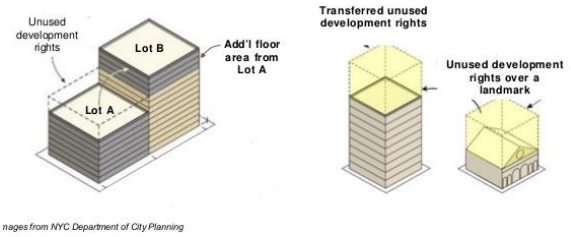

Figure 11: Model of space use transfer between high-rise new building and low-rise heritage projects / Department of City Planning of New York

As we mentioned above, for both cities, we should think about the economic value of heritage. Today, conservation works (buildings, urban landscapes) will be difficult to succeed if only focusing on the technical aspects. Heritage's economy must be considered as one of the solutions involving many components of heritage conservation, the most important of which is the community. People will not be willing to protect the heritage, preserve the landscape, even fight with investors to retain the heritage if they do not feel it is closely related to their lives.

To estimate the economic value of heritage, economists use some of the following calculation methods:

- Contingent valuation method (CVM)
- Experimental selection method (CE or CM)
- Hedonic pricing method (HPM)
- Travel cost method (TCM)
- Total economic value (TEV)

When looking at the economic value of urban heritage, conservation must be considered as a long-term but smart investment strategy for the future. It is necessary to have an overall view in the preservation and promotion of heritage values, appreciating the resources that urban heritage can create, not only from it's intrinsic but more / more important is from urban synergies to create the momentum for total development, attraction/attraction, image and brand for the city. [10]

Conclusion

Conservation is a highly socially specialized area. Any conservation solution that does not receive the consent and support from the residents is unsuccessful. Conservation of the French Quarters in the process of urban development and transformation requires the participation of many experts. Research on urban areas in general and conservation of urban heritage in particular needs interdisciplinary participation, with interdisciplinary thinking.

Studying morphology of the French Quarters and sensibly utilizing the experience will help Hanoi, Ho Chi Minh City and many other cities with French Quarter in Vietnam to find out solutions

for conserving and promoting the quarter's values in urban planning and setting up future architectural identity. By connecting the historic quarter with new urban development areas, each city could inherit the precious characteristics of a historic quarter to establish a unique image of new urban areas.

Through analysis of the transformational maps, we find that the French Quarter always plays an important role in the core area of the historic urban centre. Never separating urban structure preservation and preserving valuable architectures with the exploitation of economic, tourist and cultural activities... The success of urban activities is not only by the impact of the State but by the residents with their traditional activities that determine the prosperity of the historic quarter such as the French Quarter.

City is always sophisticated with many components, but it has uniformity in space and organization of activities such as economy, society, resource allocation and living environment,... This requires a recognition of the city as a living entity, with a multitude of potentials, so that it can become a fundamental driver of economic and social development. Through creating interactive relations between Culture, Heritage and Economy, the city will find smart solutions in preserving, revitalizing and promoting total values of urban heritage ■

References

1. Gia Thuan (2018), "Promoting the value of cultural heritage in Ho Chi Minh City: The potential is left open", Vietnam News Agency, vol. 16 Dec 2018, Hanoi.

2. Hanoi City People's Committee (2013), Regulation on management of architecture and planning of the Old Quarter (French Quarter) of Hanoi, Hanoi.

3. Luigi Croce (2019), "Restoration between repair and replacement", International conference on Cities of the future and Heritage preservation, Hanoi.

4. Ngo Viet Nam Son (2019), "The impact of new development projects on heritage and environment preservation in Vietnam cities", International conference on Cities of the future and Heritage preservation, Hanoi.

5. Nguyen Quoc Anh (2017), "Problem of overloading urban population: Solution from population's allocation policy", Gia Dinh newspaper, Hanoi.

6. Nguyen Quoc Tuan (2019), "Managing and promoting the economic value of French colonial urban heritage in the development process of Ho Chi Minh city", Vietnam Journal of Contruction (Ministry of Construction – MOC), vol. 03.2019, Hanoi.

7. Patricia M. O'Donnell (2015), "Employing Diverse Tools toward Sustainable Urban Heritage Management, Linking Urban, Peri-urban and Rural Context", UNESCO International Conference on Sustainable Culture and City, Hangzhou, China.

8. Tran Anh Tuan (2016), "French architectural heritage in District 1 – Ho Chi Minh city: Value, status and management orientation", Journal of Architecture (Vietnam Association of Architects - VAA), vol. 10.2016, Hanoi.

9. Van Que (2018), "Challenging on conservation and development of Hanoi old town in the direction of urban modernization", ANTD newspaper, Hanoi.

10. William C.C. Wright & Florian V. Eppink (2016), "Drivers of heritage value: A meta-analysis of monetary valuation studies of cultural heritage", Ecological Economics - vol. 130, issue C, 277-284.

Green Homes: Design Strategies and Socio-Economic Analysis

Anjana Shrestha[1]

Abstract: *The study is structured to identify design strategies of green homes in their local context and study the factors that shape their social and economic aspect. The study describes three case studies: a contemporary home, a traditional green home and a modern green home, all built inside Kathmandu, Nepal. Firstly, the study shows that the contemporary home has highest annual energy consumption which is 30.34% more than the traditional green home and 37% more than the modern green home. Secondly, the economic analysis shows that NPV of cost of the contemporary home is more than the traditional green home by 3.15% and more than the modern green home by 1.64%. This is because of the lesser heating- cooling load required in green homes. Moreover, the green home eventually balances the initial high cost by reducing the annual operating cost. Thirdly, green homes have good social impact which starts from user and impacts the society. Through a questionnaire survey, it is known that 54.6% agree and 31.2% strongly agree to live in a house that doesn't require appliances for heating and cooling, by achieving its own thermal comfort. Similarly, 53% are willing to pay extra investment for solar home system.*

Keywords: Kathmandu, Green homes, Energy, Economy, Social

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Introduction

Background

In Nepal, with new municipalities added in 2014/2015, the urban population accounts for 40% (Muzzini et al., 2015). The residential sector in Nepal consumes 80.36% of total energy as shown in Figure 1.

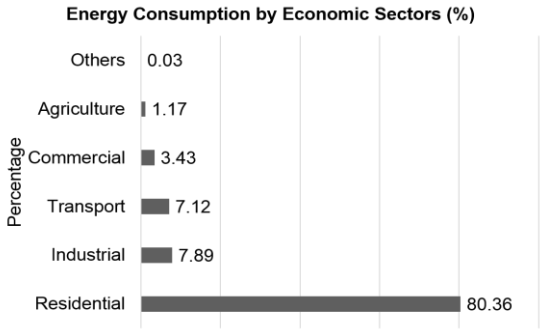


Figure 27: Energy Consumption by Economic Sectors in Nepal 2011/2012 (Source: Malla, 2013)

Green homes are designed to reduce the overall environmental impact during and after construction in such a way that we can meet the needs of the present without compromising the ability of future generations to meet their own needs (UN-Habitat, 2014). This can be accomplished by efficiently using resources like energy and providing energy savings.

Low energy use homes have been associated with higher construction and lower energy use costs (Anderson et al., 2007). As per a feasibility study conducted for solar powered net zero energy houses for Southern Europe, it is found that for an 11% initial cost increase, a net zero energy home has a simple payback of between 11 and 18 years (Graca et al., 2012).

The Study Area

The study focuses on three residential buildings- residence of an environmental engineer Mr. Hemendra Bohora known as 'Mato Ghar' located at Budhanilkantha which is a traditional green home, residence of Architect Ujjwal Man Shakya located at Maharajgunj which is a modern green home and a contemporary residence of Ms. Rekha Vaidya located at Kuleshwor. All the residences are in Kathmandu, Nepal having similar climatic conditions. Focus is on their state of art in terms of green design strategies and energy consumption. The traditional green home of Mr. Bohora is constructed of rammed earth with passive design features and few energy efficient technologies. The modern green home of Ar. Ujjwal Man Shakya is built of RCC structure with brick cavity wall, using passive design features and many energy efficient technologies. The contemporary residence of Ms. Vaidya is a RCC structure with brick masonry without any passive design features and energy efficient technologies. Besides analyzing in the built scenario, analysis has been done in the improved scenarios for both traditional and modern green homes. Improvement has been done by reducing the unnecessary capacity of the installed Solar PV which is presently more than required as explained in the findings and discussions section of this paper. Better water and waste management have been proposed in the improved scenarios which is explained in the findings and discussions section of this paper.

Objectives of Study

General Objective

- To review and analyze the design strategies of green homes and their socio-economic aspects.

Specific Objectives

- To conduct economic analysis of green homes based on Net Present Value of cost.
- To analyze the social impact of green homes in local context based on the case studies and a questionnaire survey.

Net present value of cost of a component is the present value of all the costs of installing and operating the component over the project lifetime, minus the present value of all the revenues that it earns over the project lifetime (Woodward, 1997). In this research, the gradual reduction in the annual fuel cost for building

lifespan is the revenue of the building. The fuels used in the study are LPG gas and electricity from solar PV or Nepal Electricity Authority.

Methodology

This research is based on case study methodology. Case study methodology combines different methods with a purpose of illuminating a case from different angles: to triangulate by combining methodologies (Johansson, 2007). It allows analytical generalizations to a subject than only statistical generalizations. Data is collected in quantitative and qualitative method.

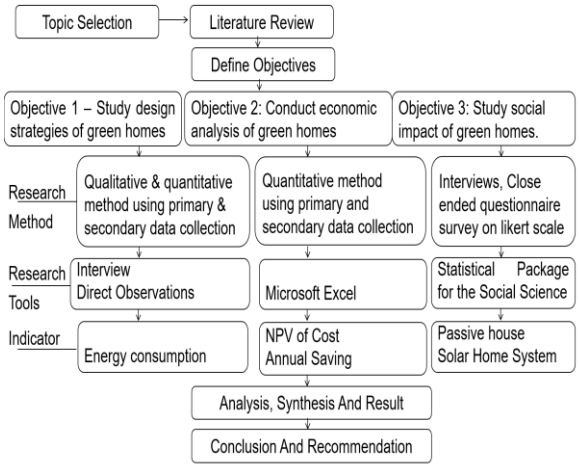


Figure 2: Conceptual Framework of Study

Research Method for study of design strategies of green homes

Through structured and unstructured interviews with the architect and owner, tangible aspects of green design such as planning, building form and design strategies have been studied. Direct observation is done to study the passive design features, renewable energy and energy efficient technologies.

Research Method for economic analysis

As shown in figure 3, the economic analysis has been conducted in terms of NPV of cost for 40 years life of building using the following procedures.

- Primary Data Collection: Calculation of energy consumption of appliances for cooking, lighting, heating and cooling is done using data collected from households. For example, daily schedule of appliances use, monthly electricity, water and waste bills are collected from each household.

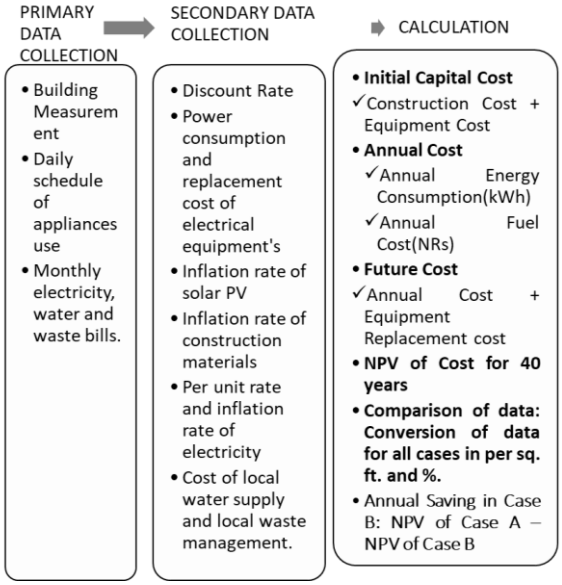


Figure 3: Method of Economic Analysis

- Secondary Data Collection: They are used to calculate the life cycle cost by projecting the present cost to 40 years life of building. For example, the present per unit rate of electricity is taken as Rs 12/- (NEA, 2015) and yearly increment rate of electricity has been taken as 3.5% per year (NEA, 2015). Other secondary data's considered for the calculation are,
  - Nepal Rastra Bank discount rate of 10% referred by taking an average of ten years from 2006 to 2016 (NRB, 2016).
  - Replacement cost of equipment calculated by taking annual 5% increase in dollar value taking the data from 2005 as Rs 70/- to 2015 as Rs 109/-.
  - Inflation rate of Solar PV in yearly decrement rate of 6.5% (Taylor et al., 2016).
  - Inflation rate of construction materials considered to be 6.3% per year calculated from the annual percentage change of 2008 to 2015 (NRB, 2016).

• Calculation: Calculation of energy consumption and annual fuel cost is done for 40 years life span of house which includes,

  - Initial Capital Cost (NRs) including construction cost and initial equipment cost.
  - Annual energy consumption (kWh) and annual fuel cost (NRs)
  - Future Cost (NRs) calculated by projecting the annual cost to the 40 years life span of building using inflation rates.

• Net Present Value (NPV) of Cost for 40 years calculated as the sum of the initial and the future cost. Annual saving is calculated by subtracting the NPV of one case with another. Payback period is calculated by dividing the extra investment cost required for green design by the annual saving.

Research Method for study of social impact of green homes

The social impact of the studied green homes is analyzed through interviews. Furthermore, a questionnaire survey was conducted using the results of the case studies as a reference for the questions. For a population between 10,000 and 25,000, a sample size of 192 to 195 is recommended, giving results with a 7% margin of error at the 95% level of confidence (Krejcie et al., 1970). Considering for a population of 20,000, this reference was used to decide the number of samples. A pilot test was done. The corrected questionnaire was distributed among 260 respondents. 70% of them were residents of Kathmandu valley and 30% were of outside Kathmandu valley, having 84% between the age group of 30 to 50 years. 32 questionnaires were not returned and 23 of the returned questionnaires were unsuitable. 205 questionnaires were selected for analysis.

Findings and Discussions

Design Strategies

a. Mato Ghar

It is a traditional green home with a built-up area of 2263 sq. ft.

Figure 4: View of Mato Ghar

Building Material: It is built of mud using rammed earth technology and bamboo truss. Openings are double glazed UPVC windows. Styrofoam insulation is provided in flooring along with PVC sheet.

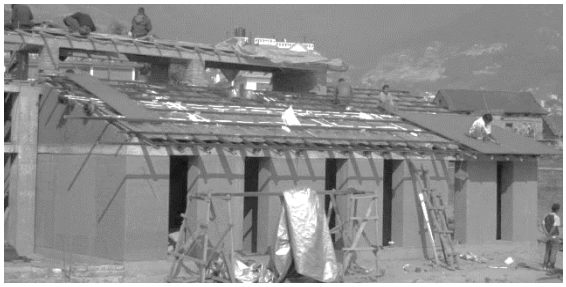


Figure 5: View of Mato Ghar during construction

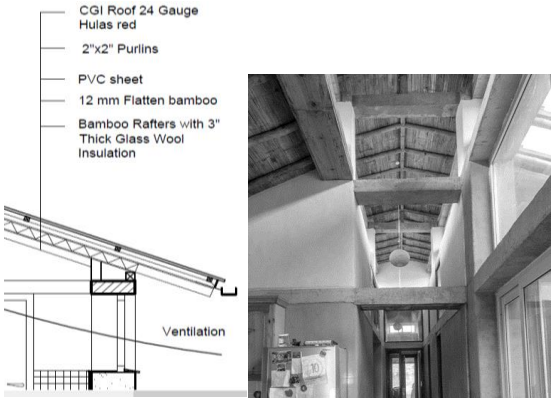


Figure 6: Roof details of Mato Ghar

Passive building design: Building is oriented EW longitudinal, to receive maximum sunlight from South. Landscape and a natural pool in South allows air exchange creating its own pleasant micro-climate.

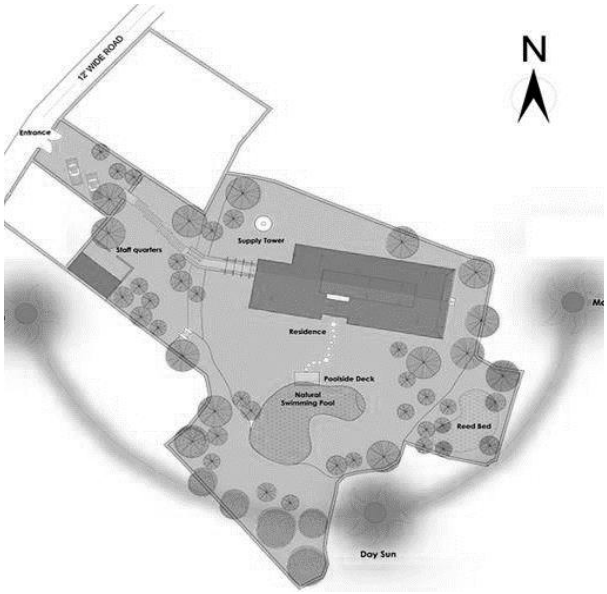


Figure 7: Site Plan of Mato Ghar

Figure 8: Aerial View of Mato Ghar

Building is rectangular with larger windows on southern side and smaller windows on northern side. In the longitudinal floor plan, bedrooms are located on south and utilities/services on north. Wind stack effect is created through clerestory windows in the center of the building, which are opened during summer and closed during winter.

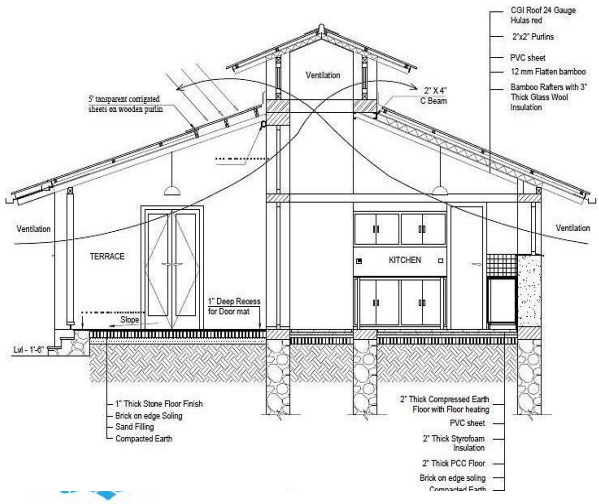


Figure 9: Building Section of Mato Ghar

Energy Efficiency: Renewable energy technologies like solar photo-voltaic and solar water heater are used. Solar photo-voltaic panel system is designed to produce 2.8 kW of electricity. Programmable thermostat is used to detect the electricity consumption pattern from Solar PV. But the energy use calculation of present scenario shows that only 2 kW electricity generation is enough and hence only 2 kW solar PV is used in the improved scenario.

Water and Waste Management: Grey water is carried through drainpipes to filtering beds and then to REED plants with gravel bed 40 cm, which absorbs the solid nutrients and usable water is collected in soak pit. This water is used for gardening purpose. Underground water is used after filtration for drinking and household purpose. Rainwater harvesting is done. Any improvements are not required in improved scenario.

B. Residence of Architect U.M. Shakya

It is a modern green home with a built-up area of 3906 sq. ft.

Building Material: Exterior Wall has 4.5” thick brick outer leaf, 4.5” thick brick inner leaf with 2” cavity in-between. Floors are constructed of RCC with plaster layer on 19mm thick ply board and 25 mm thick softwood. Roof has carbon fiber with extruded polystherene foam and fiber cement board. The openings except the windows of the solar room on third floor are double glazed with UPVC windows.

Figure 10: View of the modern green home

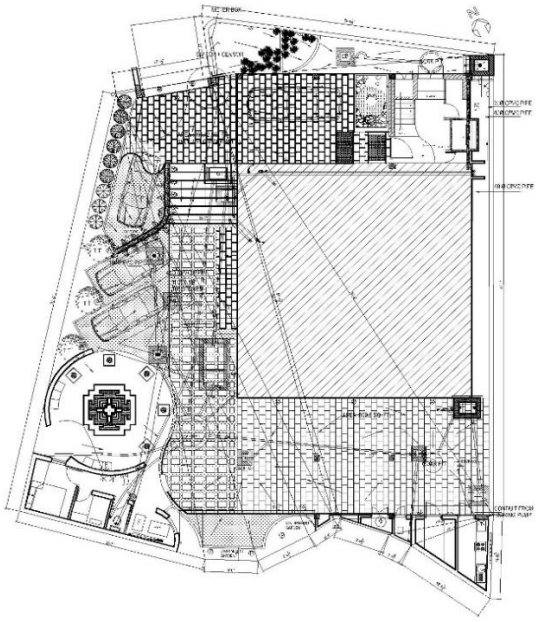


Figure 11: Site Plan of the modern green home

Passive building design: Building is oriented to South, with proper garden with trees and vegetation. Building is rectangular with slope roof for solar PV and has a roof garden.

Figure 12: View of solar house

Solar space is provided for passive solar heating system for two south facing bedrooms at second floor, whereas bigger solarium of 200 sq. ft. is provided to supply hot air to lower floors and cloth drying room. This heating system is operated by a blower using solar energy. Any space doesn't need artificial light during daytime. Large windows are provided in south direction and small windows in north direction for cross ventilation.

Energy Efficiency: Renewable energy technologies like solar PV and solar water heater are used. Rainwater discharge is also done, which supplements for underground water recharge. Solar Air Panels (SAPs) are used for heating purpose. Cooling system during summer is achieved by using cool air generated at duct adjacent to 40 feet long concrete wall of the lap-pool.

Figure 13: Lap pool to cool hot air during summer

Solar energy is used for water heating up to 800 liters. Solar photo-voltaic panel is designed to produce 3 kW of electricity. But the energy use calculation shows that only 2.6 kW electricity generation is enough and hence only 2.6 kW solar PV is used in the improved scenario. Black painted metal fireplace is installed for space heating with additional use of fan for hot air blow.

Figure 14: Duct to supply hot air in winter and cold air in summer

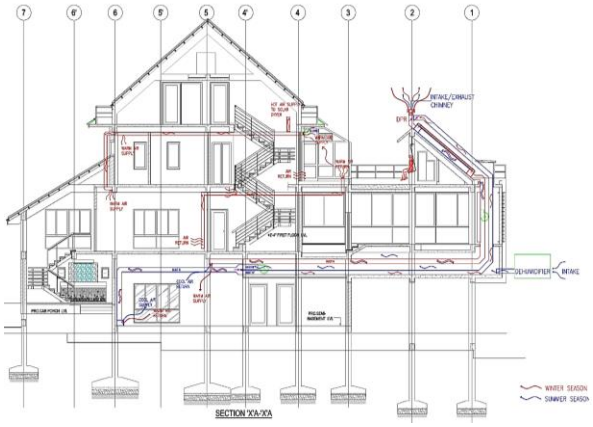


Figure 15: Building section showing air supply using ducts, dehumidifier and intake/exhaust chimney

Water and waste management**:** At present, rainwater and surface water is recharged. But the building additionally uses local water supply. Waste is not reused in the present scenario.

C. Residence of Ms. Rekha Vaidya

It is a contemporary residence with a built-up area of 3214 sq. ft. The building is oriented towards west. Building materials used are RCC structure with brick. Flooring is marble. Opening is single glazing. The building has no consideration to passive design features in terms of site planning, space planning and building form. Any renewable energy and energy efficient technologies have not been used. The building is fully dependent on Nepal Electricity Authority and local water supply. It has no waste management techniques.

Figure 16: View of the contemporary home

Economic Assessment

As mentioned earlier in the methodology section, the economic assessment has been conducted using the primary and secondary data collection. Calculation has been done in terms of initial cost, present annual cost and future cost. Ultimately, the Net Present Value of cost is calculated for 40 years life of building.

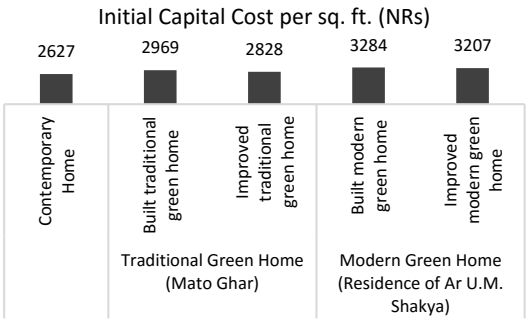


Figure 17: Comparison of initial capital cost

Above graph shows that the traditional and modern green home have higher initial cost than the contemporary home, which includes construction and equipment cost. The modern green home has highest initial capital cost especially due to the high-power Solar PV.

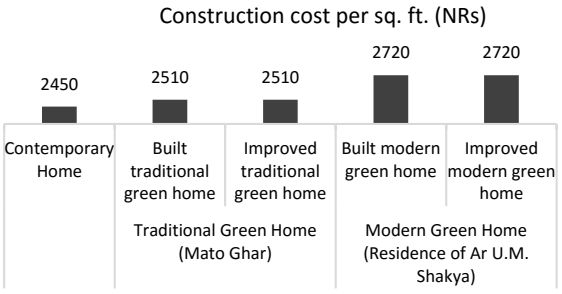


Figure 18: Comparison of construction cost

The rammed earth building technology and floor insulation used in traditional green home has higher construction cost than the contemporary home. And the modern green home with cavity walls, floor insulations, solar room and hot/cold air supply ducts have the highest construction cost.

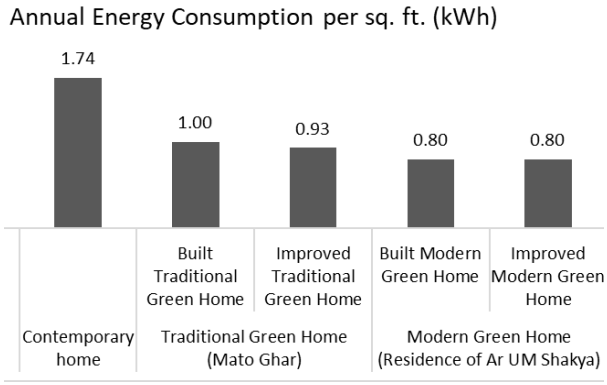


Figure 19: Comparison of energy consumption

Above graph shows that the contemporary home has the highest annual energy consumption which is 30.34% more than the improved traditional green home and 37% more than the improved modern green home. This is due to the lesser heating and cooling load required in the green homes due to the use of passive design features. However, the electricity generated through the solar PV has been excluded from the calculation as it only replaced on-grid energy consumption. For traditional Mato Ghar, the energy consumption is lesser in improved case than the existing case because of replacement of LPG gas with induction cooker for cooking while modern green home uses induction cooker at present.

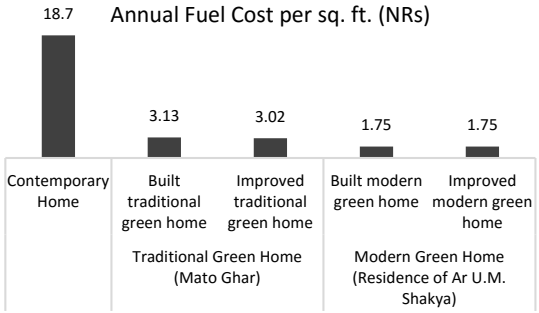


Figure 20: Comparison of annual fuel cost

Above graph shows that the contemporary home has the highest annual fuel cost. Fuel includes LPG gas for cooking and electricity supply from Nepal Electricity Authority for lighting, heating and cooling. The renewable energy from Solar PV has no electrical generation cost but only installation and maintenance cost.

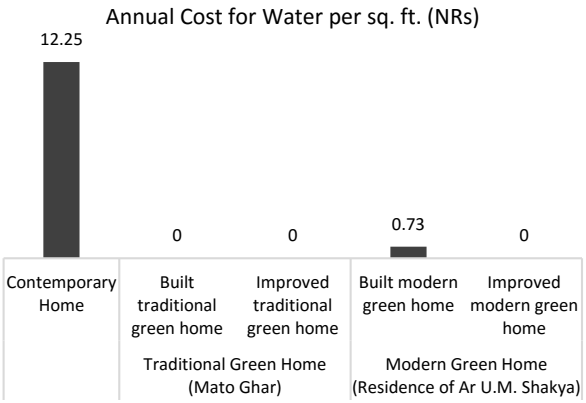


Figure 21: Comparison of annual cost for water

Above graph shows that annual cost for water is highest for the contemporary home due to the need to buy additional water along with the monthly payment to the local water supply authority. The traditional green home is fully independent of water supply, due to its own provision of well that gives clean water through filtration, reed plants that recycle grey water for gardening and the provision of rainwater harvesting. The modern green home has rainwater harvesting and boring but is inadequate and is dependent on local water supply. However, improved modern green home is self-sustainable for water using same principles of the traditional green home.

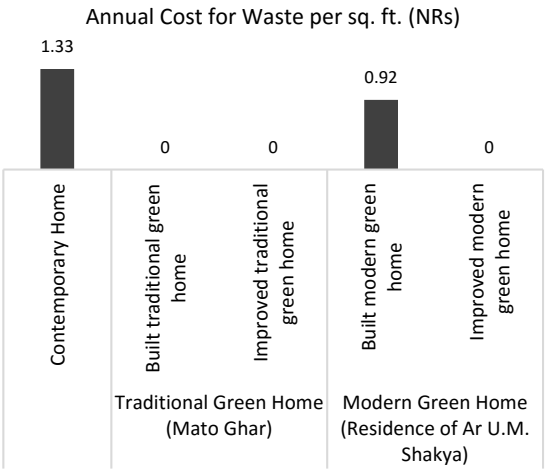


Figure 22: Comparison of annual cost for waste

The traditional green home reuses its waste for manure and undergoes grey water recycle. The built modern green home doesn't undergo any waste reuse while the improved green home undergoes solid waste reuse for manure and grey water recycle too.

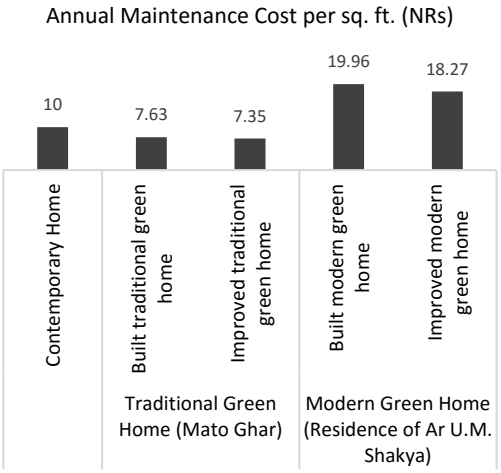


Figure 23: Comparison of annual maintenance cost

Annual maintenance cost is high for the modern green home due to expensive active technologies used and their timely maintenance. In case of the traditional green home, the building materials and technologies are such that it doesn't need regular maintenance comparatively.

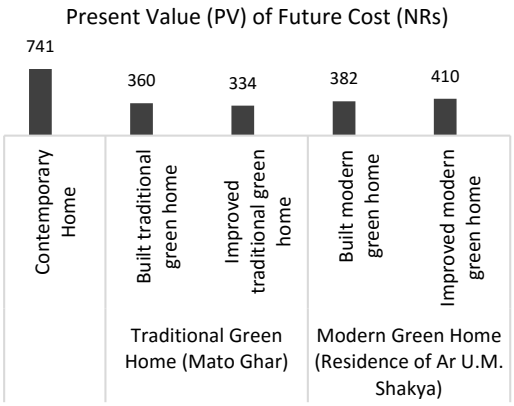


Figure 24: Comparison of present value of future cost

Above graph shows that the present value of future cost is highest for the contemporary home. The modern green home has higher PV in comparison to the traditional green home, which is especially due to highest maintenance cost.

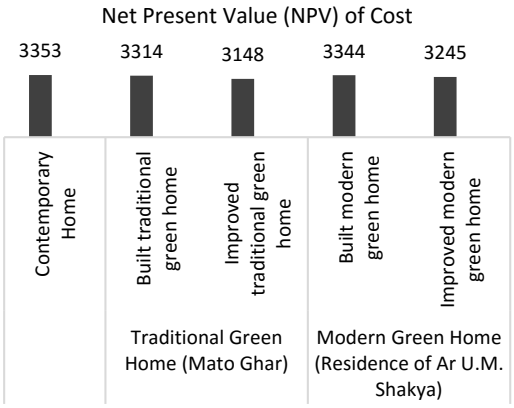


Figure 25: Comparison of NPV of Cost

The NPV of cost of the contemporary home is more than the improved traditional green home by 3.15% and more than the improved modern green home by 1.64%. The traditional green home has the lowest NPV of cost especially due to lowest initial cost and lowest annual maintenance cost.

Total saving in the green homes has been achieved by subtracting the NPV of cost with the contemporary home, which gives annual saving for the life cycle of the building. The traditional green home has an annual saving of NRs 47,264 and the modern green home has an annual

saving of NRs 24,945 while the contemporary home has no saving. The payback period for the extra investment required in the traditional green home is 9.5 years and in the modern green home is 25 years. The result shows that the payback period can be achieved within the 40 years life cycle of the building.

Social Impact

Mato Ghar is a prototype of a green home in our local context. The owner is an environmental engineer, who after constructing his house, started the company 'Mato Ghar Builders'. Presently, he completed a two storied Kopila Valley School at Surkhet under the foundation of Maggie Doyne, a former CNN Hero. Similarly, the modern green home owned by an Architect Ujjwal Man Shakya himself is an exemplary justification to his clients.

The survey conducted on user's perspective towards green home shows validity to the research as shown in Table 1.

Table 1: Result of survey based on user's perspective towards energy efficient house

Questions Asked	Strongly Agree	Dis-agree	Unsure	Agree	Strongly Dis-agree
I prefer to live in a house that doesn't require appliances for heating and cooling, by achieving its own thermal comfort.	7.3%	2.5%	4.4%	54.6 %	31.2%
I would be willing to pay 10%-15% more in initial cost to prevent using appliances for heating and cooling that will also reduce operating cost of electricity, appliances and fuel in future.	-	2.4%	19.5%	51.2 %	26.9%
I would be willing to pay NRs 500,000/- to NRs 1,000,000/- more for a home with solar home system that a home without solar home system.	4.4%	4.0%	31.9%	53%	6.7%

The quantitative data as mentioned in the questions have been referred to the quantitative results from the case studies.

Conclusion & Recommendation

Conclusion

Through the case studies, it is known that the design strategies of green homes follow five principles – sustainable building materials, passive solar design, water conservation, waste management and energy efficiency.

Through the economic analysis, it is known that the traditional and modern green homes have higher initial cost and lower future cost in comparison to ordinary contemporary homes. The initial cost is high because of the higher construction cost required for insulating materials and building technology. Moreover, such green

homes have used renewable energy technologies like solar home system. But, in the total life cycle of the building, such green homes have much lower operating cost because they have onsite renewable solar energy, energy efficiency and are self-sustainable for water and waste.

Regarding the social impact, it is known that such green homes have been influencing the society including the owners and the designers. The company 'Mato Ghar Builders' established after the influential impact of Mato Ghar is one of the best examples. Through the questionnaire survey, it is known that people today prefer to live in a green home understanding the cost analysis and other benefits.

Recommendation

Since there is lack of other proper green homes for study in the local context, this project couldn't include sampling of green home for greater validity. However, since few green homes are under construction, similar study of such homes can be done after their completion to achieve greater validation on the data developed in this project.

References

Anderson, D., Haines, A., Smith, K.R., Epstein, P.R., McMichael, A.J., Roberts, I., Wilkinson, P., Woodcock, J. and Woods, J. (2007). Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change. The Lancet, 370(9594), pp.1264-1281.

Graca, G.C., Augusto, A. and Lerer, M.M. (2012) Solar powered net zero energy houses for southern Europe: Feasibility study. Solar Energy, 86(1), pp.634-646.

Habitat, U.N., (2014) 'Green Homes, Promoting Sustainable Housing in Nepal', UN Habitat.

Johansson, R. (2007) On case study methodology. Open house international, 32(3), p.48.

Krejcie, R. V., & Morgan, D. W. (1970) Determining sample size for research activities. Educational and Psychological Measurement, 30 (3), 607-610.

Malla, S. (2013) 'Household energy consumption patterns and its environmental implications', Assessment of energy access and poverty in Nepal Energy policy, 61, pp.990-1002.

Muzzini, E. and Aparicio, G. (2013) 'Urban growth and spatial transition in Nepal: An initial assessment', The World Bank.

NEA (2015) A Year in Review: Fiscal Year 2014/2015. Nepal Electricity Authority: Kathmandu, Nepal.

NRB (2016) Nepal Rastra Bank Economy. Occasional Paper, 20.

Taylor, M., Ralon, P. and Ilas, A. (2016) The power to change: solar and wind cost reduction potential to 2025. International Renewable Energy Agency (IRENA).

Woodward, D.G. (1997) Life cycle costing: theory, information acquisition and application. International journal of project management, 15(6), pp.335-344.

Temporary City, Forever Forest: Study on the Sustainable Architecture Design of Petroleum Exploration Campsite Towards a Desert Oasis

Wang Xuerui,
Geng Yue

Abstract: *The desert has long been considered as unfavorable habitations for human activities, however, for the need of resource exploitation, developing and living in the desert has become an inevitable choice, especially for aborigines, and explorers. This paper deliberates a design research of desert campsites: how to provide a sustainable building environment for explorers under extreme geographical conditions, and contribute to the ecological and landscape improvements. Firstly, the legacy of desert vernacular dwellings was covered and traditional architectural syntax was translated by the method of reconstructing and shifting the courtyards. Then the way to comprehensively applying a series of ecological means and energy-saving technologies to the models was established. The results showed a petroleum exploration campsite which promisingly motivates the desert towards an oasis, by the methods of accumulating snow and nourishing trees. Compared to existing temporary, lacking-in-design-featured campsites, these modular architecture groups are developed to perform more effectively on vernacular architecture translation, ecological restoration, and residential experience by a large margin. In the future, it is believed that they hold great promise for the improvement of the desert environment, and space expansion under extreme conditions.*

Keywords: Desert, Campsite, Sustainable-Architecture, Energy-Saving, Modular-Architecture

1 Introduction

The desert, a natural environment characterized by extreme temperatures, strong winds and severe drought, has long been considered as unfavorable habitations excluded from human activities. However, for the need of resource exploitation, developing and living in the desert has become an inevitable choice for aborigines, and explorers especially. The concern of ecological protection, architectural intervention, and human comfort has become a long-standing challenge in the research of desert domains consequently. Firstly, regarding the prominent value of the resource including petroleum, thermal and solar energy in desert areas, an essential problem is how to conduct moderate exploitation while activate ecological restoration. Secondly, concerning the desertification as a globally-suffered problem, is it possible for the architectural intervention becoming a catalytic triggering the improvement of desert environment? Thirdly, in terms of the current situation of unstable campsites, which are often lacking in design owing to their short service cycle, the comforting experience and psychological pleasure of desert explorers should be taken into consideration.

Based on the above concerns, this paper delibe-rates a design research of sustainable desert campsite: how to provide a sustainable building environment for desert explorers under extreme geographical conditions, and contribute to the ecological and landscape improvements. On one hand, desert architecture is a vital premise for human beings adapting and improving the physi-cal geography of desert areas. On the other hand, if we can build more high-performing sustainable desert architecture, it would be a crucial tech-nology for infrastructure applications including resource exploitation and environmental govern-ance, etc.

1.1 Site Analysis

The campsite is located in Laofengkou area, the northwestern margin of Xinjiang Province, China. Lying between two mountains with a length of 25 km, Laofengkou is an important passage of

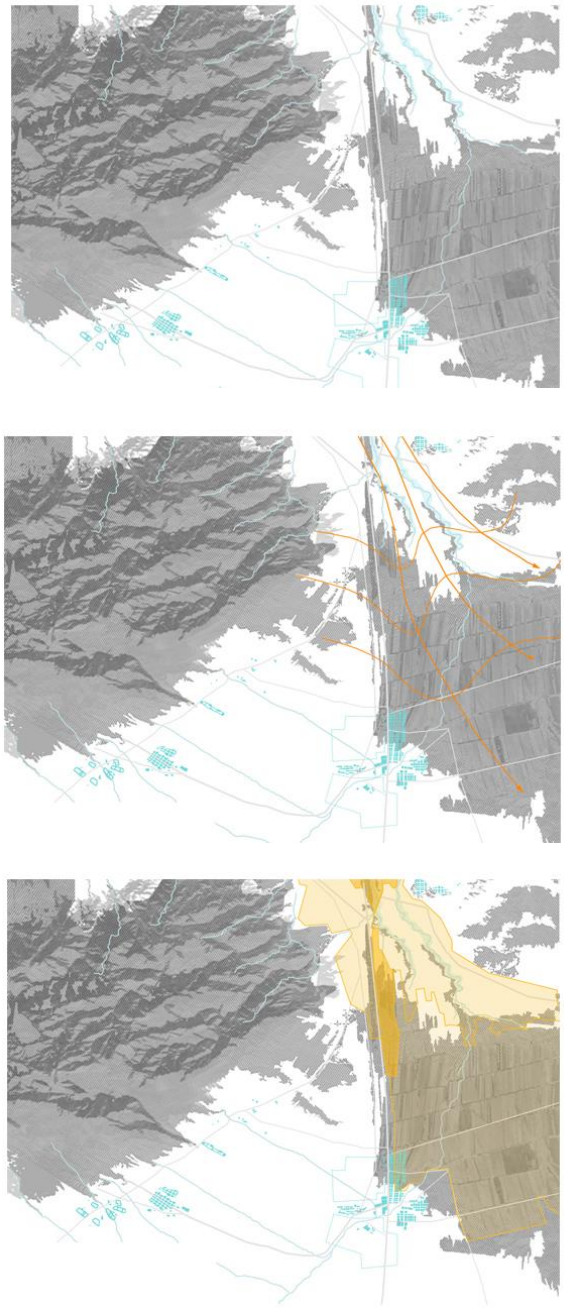


Figure 1: Site analysis of Laofengkou Area. From Above: Diagram of Current Situation, Wind Direction, and Wind Damage Grade. Drawn by X. Wang.

Tarbagatay Prefecture. In the seasons of spring and winter, blizzard roars through here, making it one of the most severely naturally-damaged areas in Xinjiang Province. **(Figure 1)**

Simultaneously, the rich petroleum resource makes Laofengkou embrace a huge opportunity

of petroleum development. Generally, the initial exploitation phase lasts for 3 to 5 years, and after that, the second phase will be determined based on the underground petroleum storage. If it is insufficient for long-term exploitation, explorers will move to the next destination. This relatively short-lived, highly-uncertain campsite is often neglected by architectural design.

In this case, the campsite design not only faces the harsh natural challenges, namely the extreme geographical conditions such as the blizzard, giant wind and extreme temperature, but also struggles to improve the living environment of explorers, provide them with a temporary yet memorable city.

2 Vernacular Wisdom as Architecture Design Resource

There is a long history on research of desert architecture. As early as the 1960s, Hassen Fathy advocated extending tradition and locality to modern times, creating a localized environment which can improve the Egyptian rural economy and life quality with limited inputs (Hassen Fathy, 1969). In recent years, some studies present the essence of desert vernacular from the perspective of geography and history (Hanafy, 2006), some other research focuses on revealing their archaeological or environmental significance (Kobusiewicz, 2010, Gado & Osman, 2010). However, research on investigating and documenting desert vernacular architecture are insufficient (Defilippi, 2006, Defilippi, 2010). Moreover, there are limited attempts to carry out research on vernacular buildings conservation, or on developing effective proposals and technical solutions for promoting the comfort level of local residents.

Traditional vernacular dwellings are the tangible representations of practical wisdom and cultural spirituality. **(Figure 2)** For instance, Kazakhs in Xinjiang Province are well-known for building homes that fitted the environmental and ethical conditions by using local materials. While the international modern architecture get used to the industrialized materials, the traditional Xinjiang aborigines have always struggled to drive desert into a better environment for living after developing over thousands of years.

2.1 Syntax of Traditional Vernacular Architecture

For as long as people lived in Xinjiang, various traditional dwellings have provided them as shelters coexisting with the extreme climate. The remains found in Yili, Khotan and Turpan show that the dwellings have evolved from caves, tents to mud, stone and wood houses during almost 2,000 years. During the long evolution, dwelling design syntax are generated, and interacted with various culture and lifestyle. Nomad dwellings (the tents), and sedentary houses (especially those with courtyards) are two of the most common accepted archetypes.

Figure 2: A common way for desert aborigines to temporarily create a place free from wind and sand is to put up a tent corner

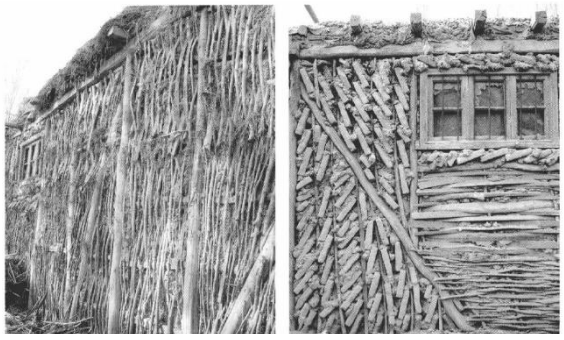


Figure 3: In northern Xinjiang, reeds and willow branches are used for permanent fences and walls of desert vernacular.

Tents, *Kyiz yu* as local Kazakhs called, are still widely used in desert areas across the northern Xinjiang. The *Kyiz yu* serves as portable dwellings to fit the nomad lifestyle since it takes

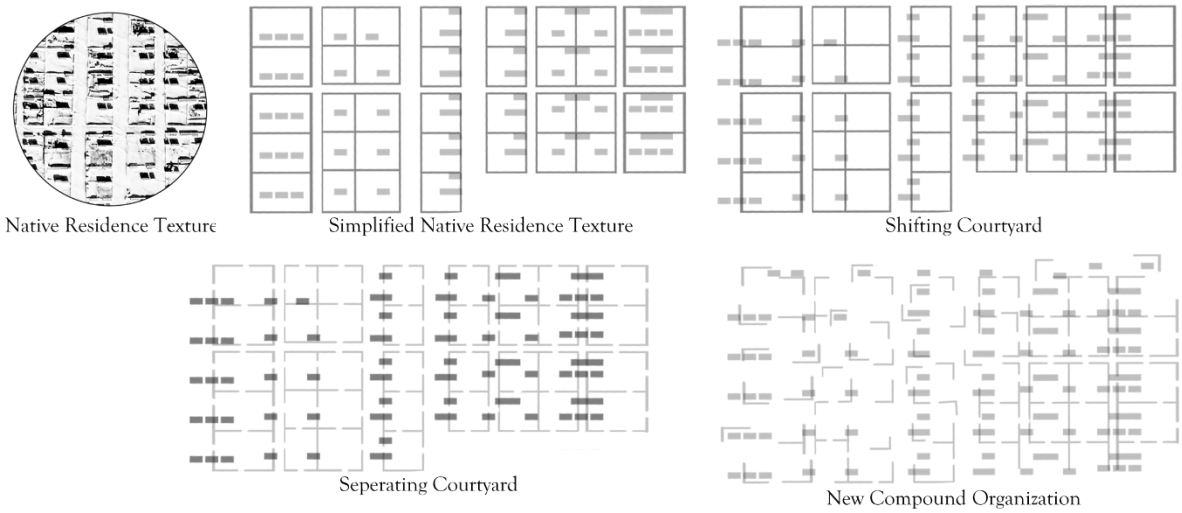


Figure 4: Process of vernacular translation_ shifting courtyards. Drawn by Y. Geng.

light-weight wooden stakes as the main structure. The wooden materials, mainly willow and poplar, are light enough to be put up by two women within one-day work. With limited recycling construction materials, *Kyiz yu* obtain a rather sturdy yet eco-friendly structure. Reeds and willow branches, nearly the most common available construction materials in arid northern Xinjiang, are also strong enough to be woven into fences and walls and to build enclosed structure in permanent houses. **(Figure 3)** Besides, courtyards are essential elements of sedentary houses across the northern Xinjiang. Aborigines take the courtyard as a snow catcher in winter and as a mini field in summer. The snow accumulated in corner of the courtyard melts into water in summer to nourish plants. Thus, the houses are mainly organized in L-shape, U-shape, and O-shape to enclose the courtyard. Some living instances in Yili suggest even trees have been planted in the courtyard in this way. In traditional design, the courtyards are important for its microclimate around the houses.

2.2 Comtemporary Translation of Vernacular Architecture

The different characters of nomad tents and sedentary houses are the living instances adapting to the extreme climate in northern Xinjiang, which can be applied in petroleum exploration campsite in the future. As light-weight wooden material enables *Kyiz yu* become as portable as possible, temporary dwellings for petroleum workers can take sustainable light-weight material as the main material. As the courtyard plays an important role in mediating the microclimate for sedentary houses, its critical part, the corner, where snow could be accumulated, is worth translating in the petroleum camp. **(Figure 4)** By converting the original texture of native village from square into four L shapes, the corners are kept. Meanwhile, the relationship between the dwellings becomes more flexible. In addition, the L-shape wall interweaving with the dwellings reinforces the structure of dwellings against the harsh winds. Translation of traditional dwellings in temporary petroleum exploration camp promotes the living environment for residents as well as the microclimate for the landscape.

3 Desert Campsite as Ecological Restoration Strategy

The desert is constantly changing in the capricious climate and landform conditions, in which the people always pursue better lives, shelters and environment. The role of architecture is to create a poetic working and living space for the endless stream of human life, regardless of how long it serves. In this part, we investigate the way to comprehensively apply a series of ecological means and energy-saving

technologies to the desert campsite. We primarily formulated an immigrating living territory for desert explorers with a service cycle up to 3-5 years, which motivates the desert towards an oasis. In particular, we oriented two directions: 1) how we combine architectural design with ecological restoration by means of defending winds, accumulating snow and nourishing trees; and 2) how we provide a comfortable living and working environment equipped with ideal thermal, electrical, plumbing systems, and keep the portable and recyclable characteristics simultaneously. In the end, we conceived the possibility of these approaches towards an open-domain discourse.

3.1 Conceptual Ecological Methods

The conceptual ecological methods are derived from viewing the tradition from the perspective of technology. It also led us to reflect on the simplest and most common way in local daily life, in order to excavate the design wisdom which has been inherited for generations.

a) Defending Winds: to stand a perpendicular corner is the easiest way to defend winds in the desert area. We place perpendicular reed barriers around the building to filter cold air and accumulate sands at the same time, so that the barriers would be stronger as time goes by. Then we arrange the partition according to the site conditions and disperse the building to avoid concentrated airflow.

b) Accumulating Snow: as the Figure. 5 demonstrates a derivation of varied forms of blocks under the condition of wind and snow, we see that the semi-closed block has the relatively best performance quality comparing to central, dispersed and enclosed layouts. **(Figure 5)** Moreover, the courtyard corners will be efficient on ecological functions. The horns and leeward sides protect the building from winds, yet the corners and windward sides accumulate snow.

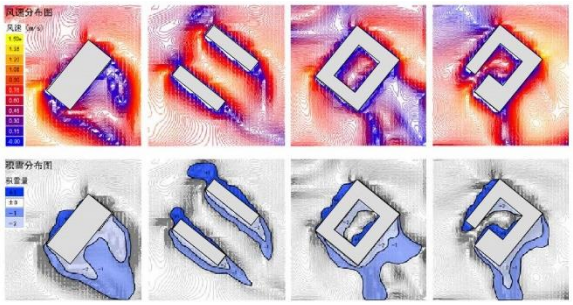


Figure 5: Layout derivation of varied forms of blocks under the condition of wind and snow, drawn by B. Liang

c) Nourishing Trees: after purification, part of the snow water would be stored in the concave compartment under the camps, and the rest would be used for plant drip irrigation. We arrange the grass squares with seeds at the courtyard corners, heat the snow water collected in winter for irrigation. Then we may nourish vegetation, and trees hopefully, above the special water pipelines and grass squares. We hope it will be beneficial for blocking sands and improve desert ecology. **(Figure 6)**

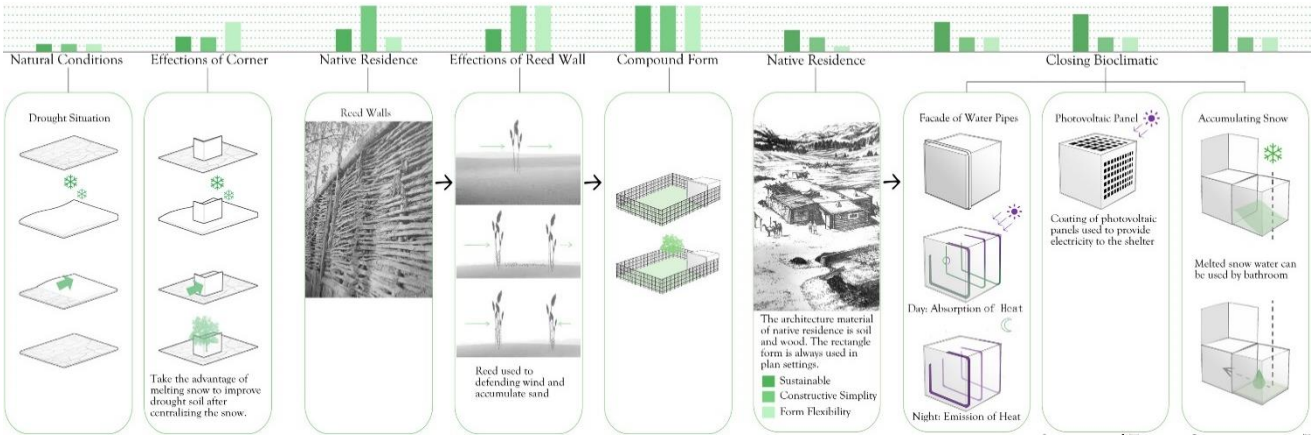


Figure 6: Conceptual ecological methods and qualitative evaluation. Drawn by X. Wang.

3.2 Living Modular Design

The architecture itself is not only a shelter but also a mediator in helping creatures to coexist in harmony. As for the relationship between architecture and environment, we prefer an aboriginal philosophy which is also cited by Richard Horden: “Touch the earth lightly.” When we conceived the living module, the impulse of self-expression was abandoned, while the movable, stackable and removable features are mainly stressed.

a) Movable: we adopt pointing pile foundations and sliding rails under the modules, which reduces the contact area between the module and the ground, while improve the flexibility of movement and combination.

b) Stackable: the form of the module changes according to the functional requirements, such as living room, drawing room, café, studio, and bedroom. When it's necessary, the single-story module can be stacked into the double height, which adapts to more variable use.

c) Removable: modules are prefabricated by lightweight panels. When the campsite finishes its serving circle, the modules could be easily turned into panels and carried to another destination by truck. **(Figure 7)**

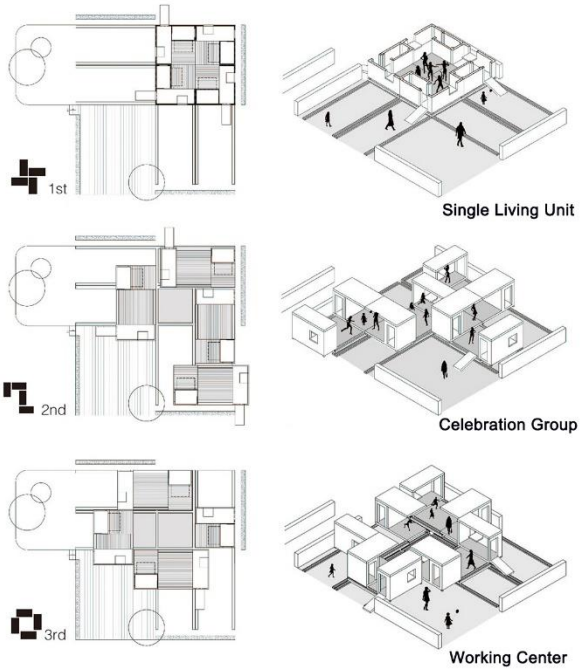


Figure 8: 3 modes of functional group organization, Drawn by Y. Gao

3.3 Functional Group Organization

After setting up the prefabricated modules, we set three basic functional modes: single living unit, celebration group and working center, so that the scale of architecture adapts to the type of activities. **(Figure 8)**

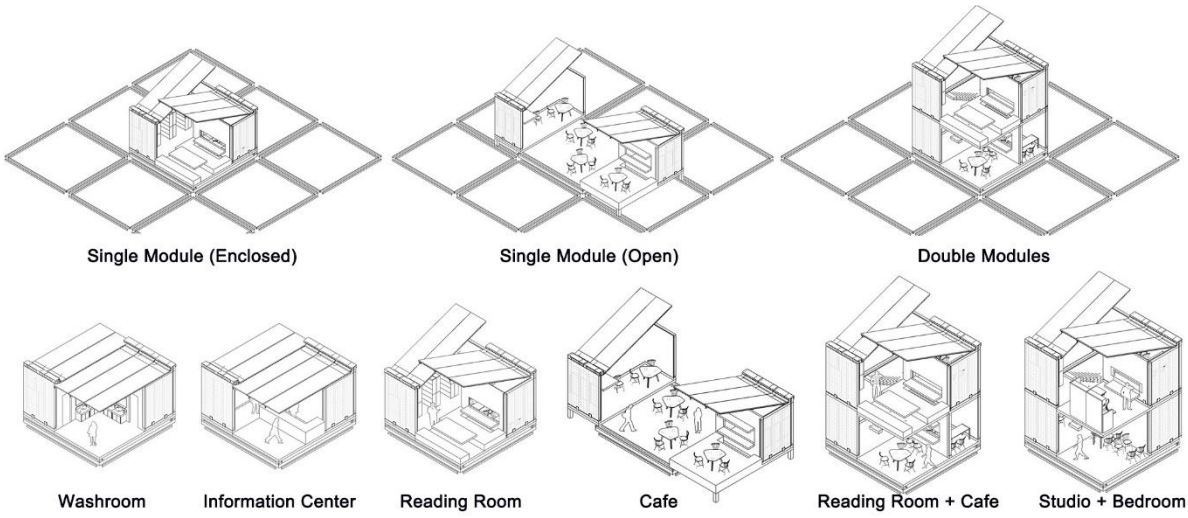


Figure 7: Living modular design with varied functions. Drawn by Y. Gao

a) Single living unit: the module presents a rectangle form with inner open space. The cohesive form protects people from natural changes while reserves a place for small-scale public activities.

b) Celebration group: explorers hardly go back home when the festival comes. So we may change the composition of modules by track to create a relatively lively atmosphere. Compared to a single living unit, the celebration group is much more public on form, space, and interfaces, which activate functions including display, feast, sale, and communication, etc.

c) Working center: the public characteristic of the working center is between a single living unit and celebration group. Its central courtyard has the same design genre with the single living unit, while the scale enlarges to allow more public activities to happen. Perpendicular composition motivates the possibility of "seeing and being seen", while the interfaces are more enclosed than the celebration group. When a natural disaster occurs, the working center takes the responsibility of reunion and protection within a rather large scale.

4 Temporary City, Forever Forest

Architecture is not just an element against the environment, but an instrument curing nature. In the design of petroleum campsite, as the sustainable modules being built, damaging snowstorm get settled as resource for the sake of trees. When the petroleum exploitation finishes, people leave here for a new camp, temporary city vanishes, while trees grow into forever forest, as an evidence of its existence. **(Figure 9)**

By translating traditional architectural syntax and applying a series of ecological technologies, architecture modifies nature and thus becomes an environmental restoration method. It provides a way to benefit from tangible and intangible vernacular architecture values in contemporary and future times, and to ensure the continuation of the natural desert vernacular architecture in the long run. Besides, it converts the relationship between architecture and nature from opposition to unity. Architecture is the crystallization of human wisdom and effort, nevertheless, it concentrates on human needs and destroys nature if without sensitive attention and design philosophy. But when architects take environment needs into design, it will become an effective machine to heal the earth.

This research has potential application for other extreme climate regions, such as polar space and marine space. Some specific methods could be effective to apply in those extreme climate areas. Furthermore, the general design thinking behind the specific methods, taking architecture as an environmental restoration method, extends as architecture changes the landscape spontaneously. This research offers a design framework to intervene in unfavorable natural factors and converts them into a useful resource by architecture. In alternative to the eco-friendly campsite, an ecological improving architecture and landscape system will be built.

Figure 9: Narrative line of Temporary City, Forever Forest. Drawn by X. Wang.

Human activities changes the living space. Architecture is one of the most important results also the reasons for the changing environment. This research enlightens architects to take a new perspective of architecture and the relationship between architecture and environment. With related methodology, we will enjoy better living environment as architecture changes it.

Reference

Rudofsky, B.,(1964) Architecture Without Architects. New York: Museum of Modern Art.

Correa, Charles, (1987) "Transfers and Transformations." In Charles Correa, 165-175. Singapore: Concept Media Ltd.

Hassen Fathy,(1969) Architecture for the Poor. University of Chicago Press

CHEN Zhendong, (2009) Xinjiang Dwellings, China Architecture & Building Press

Ana Molinar-Ruiz,(2017) Cold-Arid Deserts: Global Vernacular Framework for Passive Architectural Design, University of HAWAI'I AT MĀNOA

Dabaieh Marwa,(2011) A Future for the Past of Desert Vernacular Architecture, Lund University

The Permanence in Temporality within Home and House: A Case of the Fishing Village of Vellayil, India

Soumini Raja,
Reshma Mathew

Abstract: *Coastal communities depend on the forces of nature, nurturing their temporal existence. Temporality is a structure of inter-relationships in which past, present and future cannot be isolated or thought apart from one another. The element of permanence in the built environment of a coastal settlement relies on the morphology of its architectural form, its physical attributes, social practices and human values associated with it. The territories are seldom indelible and are often temporal in coastal geographies that are formed, destroyed and reconstructed constantly. The research focuses on Vellayil village in Kozhikode that revealed a certain degree of multiplicity of identity and spacial quality. Two aspects of spatial appropriation were studied: Production of Space through inhabitation and interstitials, and, generation of Social Space through age and gender determinants. Through an approach encompassing mapping of typo morphological, territorial and socio-psychological characteristics, the notion of home is explored in three settlements in Vellayil that comprise of approximately 30 households. The paper questions the notion of permanence through a morphological and territorial distinction as well as the temporal dimension of a 'home' for the inhabitants. The study concludes that the social location of an individual determined by age, gender and occupation unveils the degree of continuity and manner of associations. For a settlement like Vellayil, a house isn't necessarily the home and the home isn't necessarily the house.*

Keywords: Coastal communities, Inhabitation, Interstices, Home

Introduction

Figure 1: Vellayil Village, Kozhikode

Figure 2: Vellayil Village, Kozhikode

Human organisms create social and physical structures that are notionally permanent through processes of exchange and co-evolution (Raja,2016). This holds weight especially in an ecosystem dependant on the sea, where there is an element of unpredictability that governs morphological conditions. There are several unspoken ways in which built environment transcends time (Habraken, 2000, p.6). In such unpredictable conditions, how does temporality shape the idea of home? Beyond a clustering of space filled with walls, the cluttered memorabilia collected through the journey of life or a physical manifestation of human relationship web, a "house may seem built for practical purpose but in fact it is a metaphysical instrument…with which we try to introduce a reflection of eternity into our momentary existence" (Nesbitt,1996, p.452).

In coastal geographies that are formed, destroyed and reconstructed constantly through human-nature interactions, territories are seldom indelible and are often temporal in nature. The identity of a place is unequivocally associated with cognitive processes, social activity and formal attributes (Abel, 1997, p.141). A 'place' is a mental construct governed by sensory stimuli from the outside world and its intangible attributes such as seasonal changes and materiality (Tuan, 1975, p.151-165). For the people of Vellayil who live close to the sea and the city of Kozhikode, the scale of exploration straddles between the personal, community and the city.

Vellayil is located along half a kilometre on Kozhikode city's coastline. It is a moderately dense fishing settlement located within

Figure 3: Vellayil Village, Kozhikode

Kozhikode City Corporation's jurisdiction. Being an integral part of the city's morphology and historic continuity (having been one of the areas that came under the Beach Blossoms Project aimed at the uplifting of the coastal proletariat in the 1970s), Vellayil was found to exert a perceptibly autonomous identity outside and alongside that of Kozhikode. Vellayil exists in a state of multiplicity: a multiplicity of identity and quality in terms of space; they are either communal spaces or private spaces that acquire a collaborative nature through their use by the inhabitants.

Methodology

In order to better understand the constant calibration of Vellayil's redefined edges, an agency is identified in the bifurcation of the

Figure 4: Areal view of Vellayil village bifurcated by Beach Road

settlement following the widening of the Beach Road. This essentially divided the community into two (old and new) thereby playing a decisive role in the demarcation of a boundary and subsequent definition of domestic space. The framework of the study addresses two aspects of spatial appropriation: Production of Space through inhabitation and interstitials, and generation of Social Space through age and gender determinants. Through an approach encompassing mapping of typo morphological, territorial and socio-psychological characteristics, the notion of home is explored in three settlements that comprise of approximately 30 households.

The three clusters were identified based on proximity to sea and the road: Cluster 1: at close proximity to the sea, Cluster 2: Abutting the road on the western side, Cluster 3: On the eastern side of the road.

The enquiry is conducted through an ethnographic process aiming to understand the temporalities of human actions and their physical manifestations called 'Home' in this fragile ecosystem.

The temporal structure: Habitation, Productive Interstices and Spatial Determinants (Age and Gender)

Deconstructing the idea of a home in Vellayil - far from being a resilient structure representing refuge, permanence and continuity, may take various forms depending on the inhabitants. In such settlements, home isn't just an area of control but a space of reflection. From an apparatus of permanence and continuity experienced along time to the locus of intense emotional and social experience, and a place that is owned to an indicator of social status, the meaning of home can take on several manifestations (Després, 1991, p.98-99). Home and its plurality of meaning become 'the concrete embodiment of different aspects of one's self-identity' (idib,1991, p.101).

Every instinctual act of settling or inhabiting is how living organisms exercise control over their environment and built form. " The house is an institution, not just a structure, created for a complex set of purposes…a house is a cultural phenomenon, its form and organisation are greatly influenced by the cultural milieu to which it belongs." (Rapoport,1969,p46).In a constant attempt to achieve permanence, humans engage in an act of continuous transformation. Yet 'the very durability and transcendence of built environment is possible only because there is continuous change' (Habraken, 2000, p.7). Thus, an act of inhabitation is fundamentally territorial in nature. The expression of territory can be 'explicit by means of building physical boundaries and markers or implicit as custom and culture dictate within the artificial landscape of the built environment' (idib, 2000, p.132). Organisms cannot exist in isolation and social life is a resultant of the interweaving or interpenetration of lines (lines, in this case, means growth and movement). This correspondence of lines is the armature that supports social life (Ingold, 2015, p.18).

Apart from the human behavioural perspective, cultural setting also plays a pivotal role in determining the essence of one's dwelling space and condition. Personal space is a universal phenomenon, although the particular dimensions of such spaces are culturally determined (Habraken, 2000, p.128). In most houses in South Asia, the spatial and functional aspects of domestic activity are housed in different halls or spaces, and not in rooms (Widiastuti,2005,p.6). This is reflected in Vellayil as well. The morphological makeup of individual territories

and markings of neighbourhood territory are determined by both tangible and intangible factors. Markers, the most tangible elements in domestic spaces, are symbolic expressions that sometimes replace action and discourages incursions. The coastal life in Kerala shows a distinctive pattern of socio-economic-cultural development. The conglomerative and interdependent nature of the settlement is distinctive of the coastal communities irrespective of their occupation, be it trade or fishing (idib, p 9). These social, cultural and economic interdependencies affect the way in which space is utilised, identified and appropriated in coastal villages such as Vellayil, resulting in the blurring of boundaries and creation of liminal spaces in settlements.

The character of such in-between spaces seems to emulate a 'transient resilience' rather than permanence achieved through 'containment'(Mathur, da Cunha, 2009). Such an understanding of place and spatial negotiation is derived from the works of Dilip da Cunha and Anuradha Mathur and their extensive research on the blurred boundaries between land and water, the drawing, forming and new visualisation of terrain through landscape. Landscape in this context, apart from being drawn realities, also means "new and latent relationships that can be seen amongst the various extracts in the field"(Corner, 2002, p230). Place here is articulated not by land uses and spatial programming but material practices (overlaid notations), (Mathur, da Cunha, 2009) according to Mathur and da Cunha. Thus everyday acts of communal behaviour in Vellayil can be seen as acts of spatial negotiation, constantly adjusting and recalibrating boundaries between personal space and the interstices between houses.

Age and gender are the most distinctive socio-cultural characteristics that determine the structure of a house. When a household is considered as a basic unit for the study, the influence of gender on the understanding of form needs to be acknowledged. The meaning of home depends on three factors: display of wealth and status, organisation of family life, and quest for safety and security; all three coalesce in different proportions (Madigan and Munro, 1991) depending on the age and gender identities within the community. Patriarchal values are reflected in the built spaces (Desai, 2001). In such spaces, physical and metaphysical space are products of male experiences, consciousness and control, while, women's spatial needs are produced and created in a transitional manner than a fixed one (ibid, 2001).

Vellayil Settlement: Analysis and findings

A historical study of the Vellayil settlement

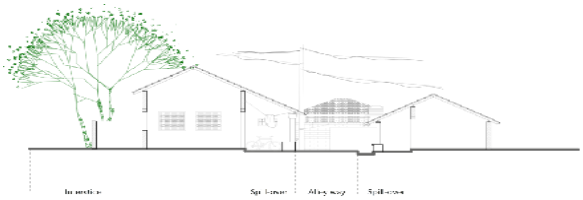


Figure 5: Atypical section of Cluster 3 to

Figure 6: Productive interstice in cluster 1

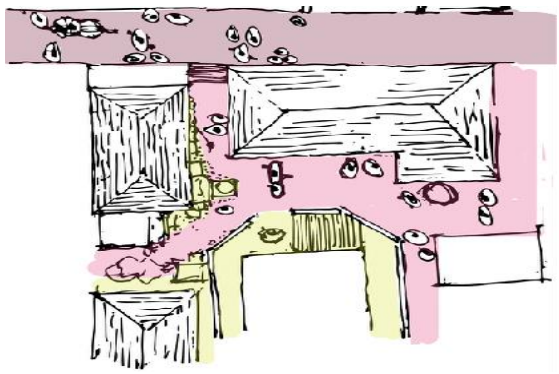


Figure 7: Productive interstice in cluster 1

reveals the gradual formation of several parcels both in the built morphology of the settlement and in the adjoining waters. Starting from the 1960s,

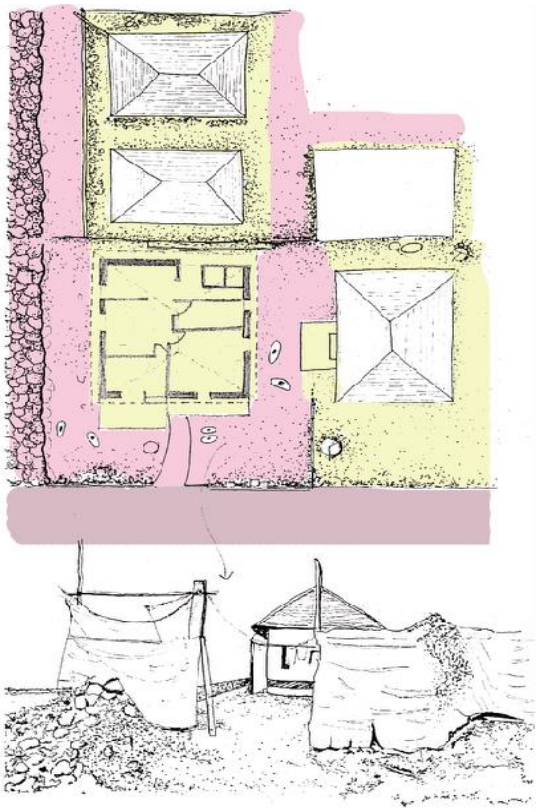


Figure 8: Productive interstice in cluster 1

several NGOs and trade unions initiated social movements aimed at the emancipation of the fishing community from the nexus of exploitation. Around this time, the earlier huts in the dense Vellayil community, on the Eastern side, underwent renovations from thatched kaccha houses to pucca houses. Additionally, nominal boundary walls and markers, although understated, began to appear in the form of thick shrubbery, tarpaulin sheets, aluminium sheets, etc., delineating micro territories within the otherwise undivided settlement.

In the 1980s with the Kerala Government enacting the trawling ban during the Monsoon months, territories were drawn and parcelled waters were allocated exclusively for country crafts, small mechanised boats and large trawlers. The traditional ways of the work organisation and the fabric of the fishing economy took a shift.

The widening of the Beach Road and building of the breakwater on the shore to create the existing harbour further demarcated the settlement into the two quadrants on either side of the road. Pattern of change in the fabric of the settlement as a resultant of these events and subsequent materialisation of unprecedented class structures between the old and new settlements are some of the observations recorded from the survey.

The Western settlement abutting the coast harboured semi pucca and kachha houses for migrants and the older clusters situated closer to the road more or less retained predominant social structures. 69 year old **Bicha Aysha, residing in cluster 3, recollects a time before the construction of the breakwater when the frontiers of the ocean swept across much of the present

Figure 9: Map of the clusters

day shore. “Those days we could watch the sea from our home and it was all right for little girls to go down till the last few houses on the edge of the village,” she says.

The morphology of the microclusters within Vellayil, can be considered as a collective entity that while maintaining individual ownership insinuates relations that transcend this individuality. Everyday activities in the verandah, kitchen, living area spill out into the non-programmed in-between spaces, compound walls become venues for clothes drying and weaving of nets, common spaces are identified for collecting water, washing, cooking and so on. Such a collaborative life structure with an empathetic gesture of joining ‘with’ rather than joining ‘up’ leads to ‘the dynamic in-between-

ness of social relations rather than the static between-ness of an assemblage' (Ingold, 2015, p.148).

In Vellayil, habitation is divided along the lines of age, gender and lifestyle. For instance, the fisherfolk, comprising men from the village, spend most of their time either out in the sea or on the beach, retreating back to their 'homes' solely for a few hours of sleep before they are out in their boats early mornings. For them, home is either the sea, the one that sustains and protects them, and/or the physical walls of the house where their women and children await their safe return. This dual approach to the notion of home is different for men of various ages. The systematic interview with the local population suggested that the younger generation of fishermen identify land and the physical existence of a house as their home, as against the perception of their fathers and grandfathers. "The sea is life and death for us at the same time. My life is one of truth, the food I earn everyday is of truth" - Razakh**, 65 years old.

For the women and children, however, their homes, units within the dense neighbourhood, constitute their entire world. Indeed, it is fascinating how a majority of them have not even had a glimpse of the sea which is otherwise such a salient part of their lives.

"My home is within the four walls of this house, the last time I visited the beach is when I was 5yrs old." - Pathumma**, 85 years old

Interviews with residents in cluster 2, in close proximity to the road, revealed a gradual shift in attitudes towards the socio-cultural context of Vellayil. The newer migration of outsiders is often less than welcomed and a general tendency to relocate to different settlements in order to delineate oneself from the perceived class structure of Vellayil is observed. ** 47-year-old Hamsa Koya, a fisherman, expressed uncertainty over the possession of his house. There are ongoing government schemes aimed at rehabilitating the fishing community, although nothing had so far materialised. He also seemed keen to move to another locality so he may secure suitable grooms for his daughters approaching 'marriageable age'.

"The house is one of the greatest powers of integration for the thoughts, memories and dreams of mankind" (Bachelard,2014, p.6). Bachelard goes on to elaborate the significance of memory and lived experience over time in establishing a sense of belongingness and thereby the notion of home. Residents interviewed in both cluster 1 and 2 reiterated this hypothesis and expressed familiarity with neighbours and the built landscape, an identity of belonging to the immediate community and the fear of being called outsiders if they relocate as powerful determinants to stay in Vellayil. One such case was 47 years old **Fathima, who after having been alienated from her family for years and eventually separated from her husband nine years ago, still fostered faith and trust in her neighbours and the safety of her micro cluster.

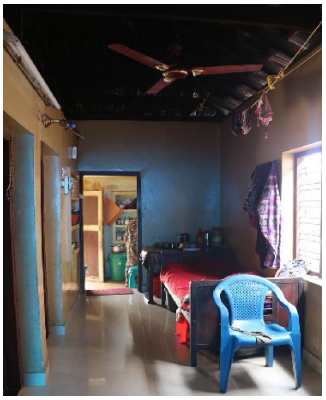


Figure 10,11: Fluid space within

Figure 12: Alternative perspectives of age and gender

Figure 11: Alley-ways manifesting as productive interstices defined by both physical markers and daily

Figure 12: Temporality of interstices and territoriality, the yellow represents territories and the red liminal interstices

Often times, homes are occupied by joint families with several micro lives occurring in parallel. The kind of spaces occurring within exhibit inhabitation as territorial and not functional in nature. Vernacular homes are not organised on the basis of functions or moulded by a program. Instead, each architectural element or space encourages settlement which creates territorial zones within. This is evident in the ways living spaces merge with sleeping spaces, children finding their own nooks within the larger rooms and so on. Here, domains of privacy are seldom concurrent with accepted norms. Life, practices and activities often overflow and seep out of the fragile territories between individual homes. These in-between spaces question the ideas of privacy.

The clusters on either side of the road exhibit typo-morphological variations influenced by proximities and social structures. The older settlement towards the east of the road maintains a traditional vocabulary enclosed within the semi-private domains demarcated explicitly by compound walls or using other markers. The house comprises of traditional verandah like transition spaces opening into the private domains of the family unit. Here, a family is a social unit comprising man, woman, their children and parents. Family as a social unit is also exhibited at a cluster level where every house is an extension from a 'parent house' located within the cluster itself. Thus, in such clusters, the interstitial spaces are extensions of the semi-public domain where members of the extended family appropriate their spatial and social needs. These expressions are often found in the way material and activities are used as tools for appropriation, for example, storage of equipment, cloth hangers, mending of nets, etc. Thus, in such clusters, interstitials are inhabited by the larger 'family' and 'home' is the expression inside and outside the four walls of a house/a cluster of houses. The newer settlement on the western side of the road demonstrates a different morphological negotiation of spatial appropriation. Lack of a compound wall or markers of privacy creates interwoven spaces outside the home that seem more permanent than the fluid spaces within. The interstices hold a unique programmatic potential to catalyse social interactions and therefore initiate de-territorialisation. In this light, the alleys and junctions become spaces of cooperation highlighting aspects of self-generation and adaptability. They become gestures for holding life.

Conclusion

To conclude, the sea and its ecosystem can be viewed as a striated space, constituting a complex mixture of nomadic forces and sedentary captures. These striations, as receptacles of 'holding' and as conditions of unpredictability, are imagined in this case, as spatial production by way of inhabitation and interstitials respectively. The case of Vellayil demonstrates the contradiction of territories and deterritorialisation co-existing to paint a bricolage of 'homes'. It re-establishes the heterogeneous nature of the notion of 'home' as spaces for control and reflection simultaneously. For the people of Vellayil, the house is a physical expression that contains the emotions of home, but not exclusively the only 'home'. Here inhabitation and interstices act as a single continuum produced by a locus of emotional and social experiences. The social location of an individual determined by age, gender and occupation unveils the degree of continuity and manner of associations. For a settlement like Vellayil, a house isn't necessarily the home and the home isn't necessarily the house. At a time when architects spend millions on designing

houses, this understanding of home can re-define the methods to approach a design.

Key References

Abel, C. (1997). 'Architecture and Identity: Towards a Global Eco-culture.' Oxford: Architectural Press.

Bachelard, G., and M. Jolas. (2014), The Poetics of Space. NY, NY: Penguin Books.

Corner, J. (2002) 'The Agency of Mapping: Speculation, Critique and Invention" in Mappings, ed. Denis Cosgrove, London: Reaction books.

Deleuze, Gilles, and Félix Guattari. (2017) A Thousand Plateaus: Capitalism and Schizophrenia. London: Bloomsbury.

Desai, M. (2001). 'Gender and the Built Environment', in Architecture: Time, Space & People, Vol. 1, Issue 6. New Delhi: The Magazine of the Council.

Després, C. (1991) 'THE MEANING OF HOME: LITERATURE REVIEW AND DIRECTIONS FOR FUTURE RESEARCH and Theoretical Development'. Journal of Architectural and Planning Research, Vol. 8, No. 2, Special Issue: The Meaning and Use of Home

Habraken, N. J., and Jonathan, T. (2000) 'The Structure of the Ordinary: Form and Control in the Built Environment'. Cambridge, MA: MIT Press.

Ingold, T. (2015) 'The Life of Lines'. London: Routledge.

Nesbitt, K. (1996) Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory: 1965-1995. New York: Princeton Architectural Press.

Madigan, R. And Munro, M. (1991) Gender, House and Home: Social Meanings and Domestic Architecture in Britain. Journal of Architectural and Planning ResearchVol. 8, No. 2, Special Issue: The Meaning and Use of Home (Summer, 1991), pp. 116-132

Mathur, Anuradha, and Dilip da. Cunha. Soak Mumbai in an Estuary. New Delhi: Rupa & Co., 2009.

Raja, S. (2017) 'Human vulnerabilities to disasters in coastal areas: A case of Chellanam, Kerala', Unpublished thesis, Ahmedabad: CEPT University.

Rapoport, A. (1969) 'House, Form and Culture'. New Jersey: Prentice Hall Inc.

Tuan, Y. (1975) 'Place: An Experiential Perspective'. Geographical Review, Vol. 65, No. 2.

Widiastuti, I. (2005) 'The living culture and typo-morphology of vernacular traditional houses in Kerala'.

Sustainability of Building Material, a Review of Burnt Clay Brick in the Context of Bangladesh

Md Shafique Rahman,
Redowan Kabir Kaushik

Abstract: *Minimization of energy consumption has become a primary concern today in every aspect of human civilization. Buildings, building materials and components are significant in consuming both renewable and non-renewable sources of energy. Nearly 40% of global energy annually is expended in building's life cycle stages, such as production and procurement of building materials, construction, operational energy and demolition. To mitigate the energy embedded into a building, it is fundamental to evaluate less energy intensive technologies for construction, as well as low environmental impact building materials. However, assessment of environmental sustainability of the same material is not comparable in every context. Based on the production technology, method of procurement and type of energy used in the production; the environmental footprint of any material should be different in different regions. The aim of this research is to appraise the environmental sustainability of the most prominent building material in South Asian countries, especially in the context of Bangladesh. In the South East Asia, the most used building material is Burnt Clay Brick. With the high rate of infrastructural development, production of brick is increasing every year. In Bangladesh, about 4,500 brick industries are in operation, producing about 9 billion bricks per year. For a sustainable future it is important to assess the environmental impact and embodied energy of this widely used material in the South Asian context. This paper investigates the EE (Embodied Energy: the amount of total energy required to produce a material or product), water consumption, emissions and environmental footprint of burnt clay brick based on the LCA Life Cycle Assessment: Cradle to Grave) methodology and a program based assessment in Simapro 8.1. A comparison between previous research and current study apprises the feasibility of burnt clay brick in this region, in terms of environmental sustainability.*

Nomenclature: EE: Embodied Energy, LCA: Life Cycle Analysis, IA: Impact Assessment

Keywords: Sustainability, Building Material, Brick, Impact Assessment, Life Cycle Analysis, LCA, Embodied Energy

Introduction

2.1 Background of the study

Today world is facing major environmental problems i.e. global warming, ozone layer depletion and waste accumulation. Over the last few decades, the research indicates that the global climate is changing rapidly (Ipcc, 2001). One major driving factor behind environmental damage is the unprecedented consumption of energy derived from non-renewable resources. The process of extraction of fossil fuel and various stages of utilization discharge an enormous amount of solid, liquid and gaseous waste into the environment.

Buildings, building materials and components consume nearly 40% of global energy annually in their life cycle stages, e.g. production and procurement of building materials, construction, use and demolition (Dixit, Fernández-Solís, Lavy, & Culp, 2012) (G., 2004). One-third of related global greenhouse gas (GHG) emissions are attributable to the building sector as it creates significant economic, environmental and social impacts. (Ibn-Mohammed, Greenough, Taylor, Ozawa-Meida, & Acquaye, 2013)

Sustainable development is viewed as development with low environmental impact and high economic and social gains. (Ramesh, Prakash, & Shukla, 2010) To achieve the goals of sustainability it is important to adopt a multi-disciplinary approach covering a number of features e.g. energy saving, improved use of materials including water, reuse and recycling of materials and emissions control. As the global ecosystem has no border, it is therefore essential for the building construction industry to achieve sustainable development in every single region to mitigate the overall environmental damage of the world.

Building material is significant toward the emergence of energy-efficient and low environmental impact buildings. Examples are found in various researches, which shows that the construction phase of a building consumes a larger proportion of building energy in its overall life cycle. In consequence, construction stage, production and procurement of building material also has a substantial emission. In the UK, Engin and Francis reported that embodied energy is 30–35% of 100-year life-cycle energy demand based on different building options (Engin, A. 2010). Thus, sustainability of building material should be a major concern in rapid urbanization of the 21st century.

This study focused on the EE (Embodied Energy) and the environmental footprint of burnt clay brick, one of the oldest and widely used building materials around the world. Recently, air pollution emission from brick kilns has gained international attention. (Anh, Nguyen, & Kim, 2010) However, brick production technology is not similar in every region. And based on the production technology, i.e. type of raw material, extraction, transportation, fuel consumption and mechanism, the environmental impact and EE of brick differs widely from region to region. The manufacturing of bricks is an energy-intensive process. All developed countries and some developing ones have shifted away from traditional low-efficiency manufacturing processes to modern high-efficiency ones. A few countries in Asia still remain in traditional brick production technologies.

A few studies conducted earlier have found fluctuating value of EE among bricks produced in different regions. The kilns used in South-Asian countries including Bangladesh are extremely crude, and as a result, are energy-inefficient and polluting.

A recent study (Chadwick, n.d. AIA02A), has shown that the specific thermal energy consumption varies from 1.3 to 9 MJ/kg of brick depending on the type of technology and fuel

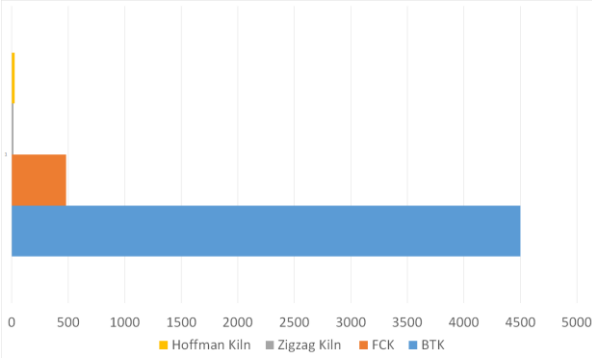


Figure 1: Proportion of different type of brick industries in Bangladesh.

In Bangladesh, bricks are the main building material in urban areas. It has also become a significant building material in rural areas. Brick making in Bangladesh is repetitively reported as

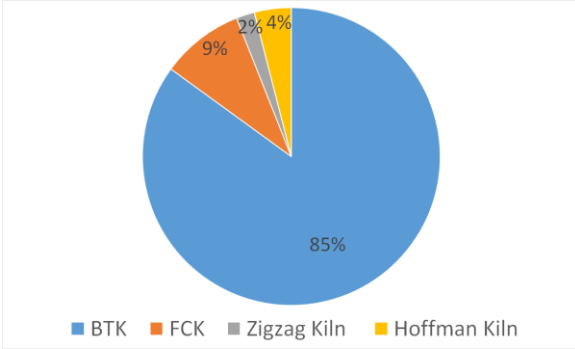


Figure 2: Amount in percentage produces in four different technologies in Bangladesh.

used in firing; the higher values are for the kilns in Vietnam, while Chinese and Indian kilns have lower specific energy consumption. The study further states that Vietnam's high energy consumption is due to the use of biomass, such as wood and rice husk in the kilns, which are inefficient. On the other hand, Bangladesh has a different scenario in production. Brick manufacturing in Bangladesh is more human labour based and also different regarding energy consumption.

In Bangladesh, according to data presented by Bangladesh Brick Manufacturing Owners Association (BBMOA), by 2017 there were 6000 brick industries in operation, producing about 8.6 billion bricks per year. Since there is a substantial amount of production in this region to accumulate the fastest-growing infrastructural development, it is essential to assess the environmental sustainability of burnt clay brick in the South-Asian context. The aim of this research is to assess EE and Ecological footprint of brick produced in Bangladesh, in order to find an environmentally more sustainable solution.

2.2 Traditional Brick Manufacturing Technology in the context of Bangladesh

one of the significant energy-intensive activities in Bangladesh. There are four major types of brick industries in operation. According to the survey presented by (BBMOA), cottage type brickmaking industries called Bull's Trench Kiln (BTKs) is the leading among all types of industries in operation. These industries employ extremely crude technology and use low-grade coal to fire bricks. Another report presented by National Strategy for Sustainable Brick Production in Bangladesh, 2017, published by Department of Environment Ministry of Environment and Forests Government of The People's Republic Bangladesh depicts that coal consumption by brick industries is estimated as 5.68 million tons and the emission of CO2 measured as 15.67 million tons per year. The emission from BTKs predominantly has reached higher proportions as BTK type of industries are 85% among all types.

Figure 1 shows the amount of different type of brick industries in Bangladesh, according to the record of *BBMOA (2001)*. According to the data represented above the most popular type of brick technology in Bangladesh is BTK (Bull's Trench Kiln) *(see* Figure 2). In this research production technology of BTK has been considered for the assessment.

2.3 Stages of Production, Cradle to Gate

Brick production technology is marked as a highly energy-intensive activity in Bangladesh. However, the major difference between brick production technology in other countries and that in Bangladesh is the human labour intensive process. As Bangladesh is a country with a high population and low labour cost, most of the industries are human labour driven in Bangladesh. In brick industries, most of the processing works are dependent on human labour. Based on the field survey an illustration (Figure 3) shows the typical steps in brick production in Bangladesh.

With the brick produced in this context, stages of production are the collection of raw clay, which is entirely done by excavation by human labour. Photograph 1 shows excavating the mud from which bricks are made. For the industries located in Dhaka, clay is transported by diesel truck. Clay unloading and processing are also entirely dependent on human labour. Processing raw clay involves moulding of clay with water and casing wet clay in brick cases for specific shape and size. The type of clay in this context is directly used for brick making. Photograph 2 shows clay unloading and processing, Photograph 3 shows casing of wet clay. After casing, the green bricks are dried in sun. In this region, brick manufacturing runs five months only in the dry season (November to mid-April). Photograph 4 depicts human labour involved in stacking of green bricks and unloading of burnt brick in a kiln site near Dhaka. After drying green bricks are placed in a burner, which is known as Bull's trench kiln (BTK).

Bull's trench kiln (BTK)

Bull's trench kiln (BTK) is essentially an elliptical-shaped dug-out area in an open field. The kiln is about 17-20 m long and 7-9 m wide and has two 10-15 m high movable chimneys. The bottom and the side-walls of the kiln are lined with bricks, with the top left open. Sun-dried bricks are stacked in the kiln in an orderly fashion, leaving enough room for fuel-stoking and air circulation. After arranging the bricks in the kiln, the top of the kiln is covered with fired bricks and pebbles.

The bricks are fired from the top and the fire moves forward towards the chimney. The air entrance opening (air hole) and the chimney are located at the two ends in such a way that combustion air is pre-heated by taking heat from the fired bricks, and the green bricks to be fired are pre-heated by the flue gas on its way out of the chimney. The bricks are fired all around the kiln, until all bricks in the trench are burnt. Bull's trench kiln doesn't require any input for electricity. The fuel type used are usually Gas and Coal. 25-30 tons of medium grade coal used for burning 100,000 bricks.

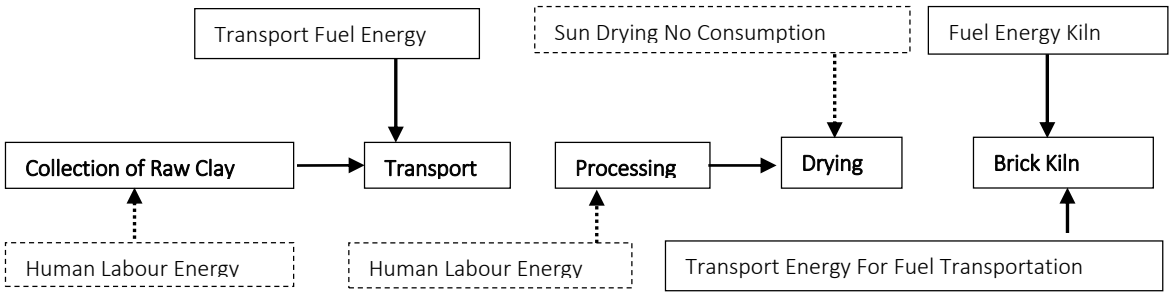


Figure 3: Stages of Production, Cradle to Gate

Stages of Production	Description	Consumption		
		Labour	**Fuel**	**Water**
Stage 1 Raw Mat.Procurement	In Bangladesh raw clay is directly used for brick. Clay is collected by human labour Photograph 1 Shows Human Labour engaged in the process	4 Number of labour X 4 Hours X Labour Energy per hour	No Consumption	No Consumption
Stage 2 Transportation of Raw Material	Raw clay is transported by Diesel Truck Standard Truck Capacity 450-500 cft/ 14.16 m3 Engine Capacity 5.5L Travel Distance (For industries in Dhaka) 120-150 km Travel Time 3 Hours	No Consumption	Fuel Type : Diesel Fuel Consumption Per Truck Travel: 30 Litre Clay for 1000 Bricks per truck. Net Fuel For 100,000 Brick= 100Trucks X30 Litre= 3000 Litre	No Consumption
Stage 3 Raw Material Unloading	Human labour used for raw material unloading	3 labours X 3 hours X Labour Energy per hour	No Consumption	No Consumption
Stage 4 Raw Material Processing	Clay mixed with water Human Labour worked in this process for moulding clay and water Clay is formed and shaped in the case by human labour Water Pump-High flow rates- Centrifugal pumps Flow rate up to 2200 l/min (132 m³/h)	No Consumption	2. 2.2 kwh=0.037 Kw/min Electricity 50000/2200=22 min 22X0.037= 0.81 Kwh	500X100=50000 L for 100,000 Bricks
Stage 5 Green Brick Drying	Formed green bricks are dried in Sun before sending to kiln	No Consumption	No Consumption	No Consumption
Stage 6 Brick Kiln (BTK)	Raw coal used for a brick kiln. Coal Type: Medium Grade Brown 26-30 tonnes of low-grade Coal per 100,000 bricks Wastage 10-12% Coal Transportation : 5 Tonnes Per Truck Travel Distance: 335-350 km	No Consumption	Coal consumption: 23-30 Tonnes per 100,000 Bricks Coal Transportation : Fuel (Diesel) per travel:70 Litre Fuel Consumption: 6TrucksX70L=420 Litre	No Consumption

Photograph 1
Excavate the mud from which bricks are made
(Mostafa, n.d.)

Photograph 2
Brick factory labors working in a typical brick industry in Bangladesh. (Mostafa, n.d.)

Photograph 3
Human labor processing brick for sun drying.(S. Bangladesh, n.d.)

Photograph 4
Human labour involved in staking of green bricks and unloading of burnet brick.(Mostafa, n.d.)

3. Methodology of Assessment (LCA)

A great number of tools are available for environmental assessment of the built environment, ranging from construction material selection, energy labelling and indoor air quality to a whole building assessment, and then to an urban-scale built environment assessment (Forsberg & Malmborg, 2004). The most appropriate and accepted method used to produce a holistic assessment of the environmental impacts associated with a building and building materials is the LCA (life cycle analysis) (Junnila, S. Horvath, A. Guggemos, 2006) (Cole, 1998)(DING, 2014). LCA is a method preferred by the international standards ISO 14040 and 14044 to analyse environmental aspects and impacts of product system. (Walter Klopffer, 2013)

The LCA of building relates to both embodied energy and emission of construction phase, operational energy in its overall life cycle and impact of demolition stage. The embodied energy of building materials includes initial and recurrent embodied energy. Initial embodied energy relates to the building materials used for construction, whilst recurring embodied energy is required during the operation stage. (DING, 2014) This process is collectively known as 'cradle-to-grave' analysis. However, apart from the overall impact assessment, LCA also used widely for the assessment of building material. The life cycle of building materials is often referred to as a 'cradle-to-gate' analysis. The material life cycle relates closely to the pre-use phase of a building and it includes the raw materials extraction and manufacturing process even before it is being used. (Forsberg & Malmborg, 2004) Identified as a consensus method, a 'cradle-to-gate' analysis has been used for EE and IA (Impact Assessment) of brick in this research. A 'cradle-to-gate' analysis of LCA includes the process of each raw material extracted for the production of assessed material. This extraction comprises both the raw material for the final product and fuel extraction engaged in the production process. Transportation of each raw material and fuel is also calculated in the process. Final energy use in processing and manufacturing is the major direct input in the process. Water consumption and emission in each stage are counted for the final collective output. This process is known as the input-output framework of LCA, which was chronologically developed from LCA triangle which was introduced by the Society of Environmental Toxicology and Chemistry (SETAC) in 1990-91 (Walter Klopffer, 2013). Input-output method has also been previously used by many researchers in leading sustainability researches. The "Input-Output" method adopted in the current research is illustrated in Figure: 4.

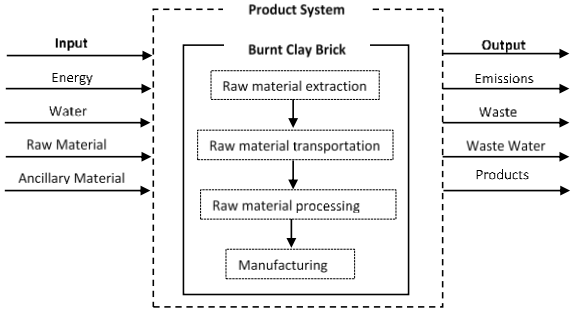


Figure 4: LCA "input-output" framework adopted in the present study.

In this research, input data have been collected from on-site surveys. Two major brick factories located in Dhaka were taken for data collection. Information from two industries were similar and considered as authentic information for this assessment. However, being a highly populated region, human labour is common for most industrial productions in Bangladesh, including in brick production. Human labour has no direct emission to nature and energy consumed for livelihood is a natural process for each species on the earth. In the input data, human labour was not counted. Apart from human labour, all other inputs are specific data based on the contextual practice in Bangladesh.

LCA analysis is a complex procedure that requires a large number of data from every stage of manufacturing. Due to this, it is recommended

to use a software application that makes the study much more efficient. (Uso, Scarpellini, & Bribia, 2009) At present, there are various assessment applications on the market which allow LCA studies to be carried out to various degrees of detail (Grace K.C. Ding, 2007). From among those, Simapro was selected to be used for this study as it was general purpose LCA software found to be most commonly used for research published in journals as portrayed in Figure 5. Simapro is a product system modelling and assessment software released in 1990, which is available worldwide. It is developed and distributed by the Netherlands-based Pre-Consultants.
.(PreSustainability,n.d.)(Herrmann&Moltesen,2015).

4. LCA Result Analysis and Discussion

The EPD (Environmental Product Declaration) 2013 method was used to study impact assessment categories as the ozone layer, ecotoxicity, acidification and eutrophication. This method is the successor of EPD (2008) and is to be used for the creation of Environmental Product Declarations (EPDs), as published on the website of the Swedish Environmental Management Council (SEMC). As a document designed to meet all the requirements of ISO 14025, an EPD offers an international standard of communication and is a summary report of all data collected in the LCA as specified by the PCR.

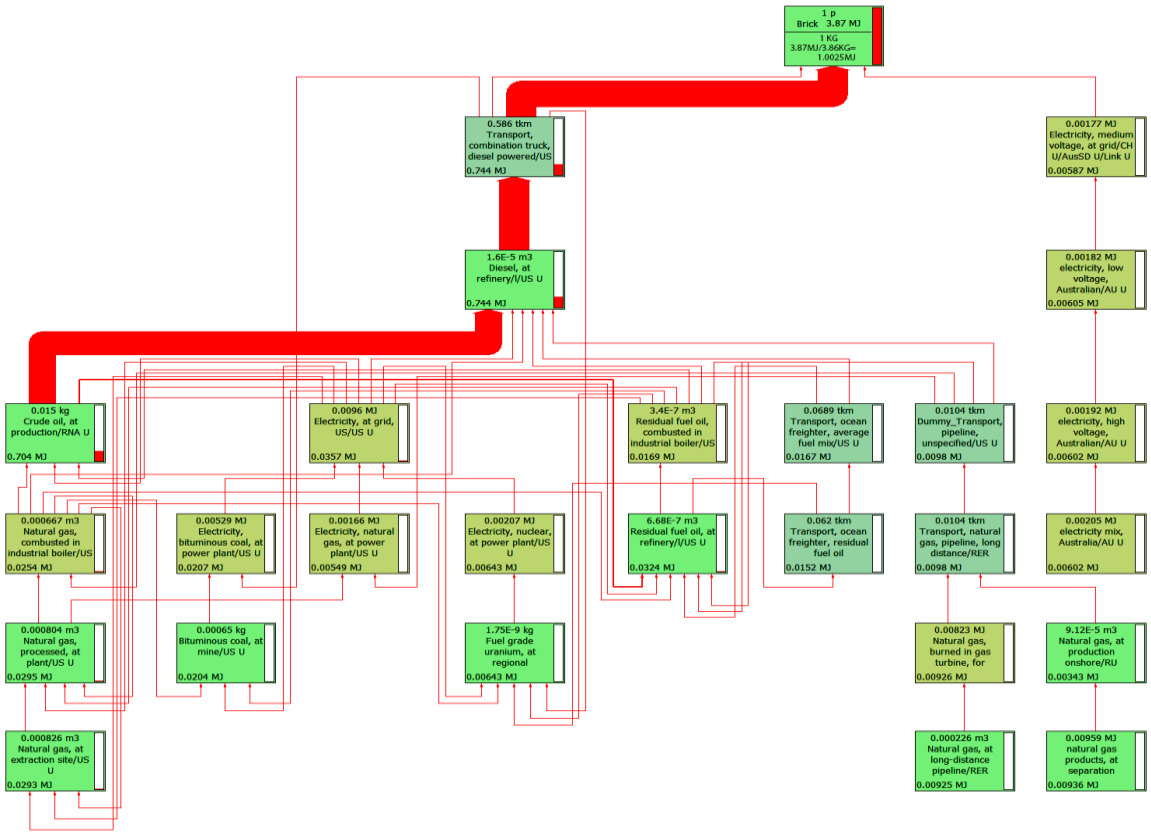


Figure 5: Communicative Energy Demand method for the assessment of EE in Simapro.

Table 3: EE and IA of Burnet Clay Brick (Produced in Bangladesh)							
Ref. Unit	**PEI Primary Energy [MJ] Non-Renewable**	**GWP Global Warming Potential [kgCo2eq]**	**ODP Ozone Depletion [kg R11 eq]**	**AP Acidification [kgSo2eq]**	**EP Eutrophication [KgPO4eq]**	**Ecological Footprint**	**Water Footprint**
1kg	1.0025	1.41E-3	3.87E-10	7.1E-9	1.26E-11	1.43E-6	2.24 E -11
Method	Communicative Energy Demand	EPD (2013) V1.01	EPD (2013) V1.01	EPD (2013) V1.01	EPD (2013) V1.01	Eco Indicator 99	Eco Indicator 99

For Ecological and Water Footprint, Eco-indicator was implemented. Eco-indicator 99 method is one of the most widely used impact assessment methods in LCA. It is the successor of Eco-indicator 95, the first endpoint impact assessment method, which allowed the environmental load of a product to be expressed in a single score. The emission from fossil fuel combustion has been estimated by the following IPCC (Inter-Governmental Panel on Climate Change 2013 guidelines). IPCC 2013 is the successor of the IPCC 2007 method, which was developed by the Intergovernmental Panel on Climate Change. It contains the climate change factors of IPCC with a timeframe of 100 years, where Total emissions = (Actual fuel consumption)*(emission factor)*(Fraction of carbon/ sulphur /nitrogen oxidized)*(Molecular weight ratio).

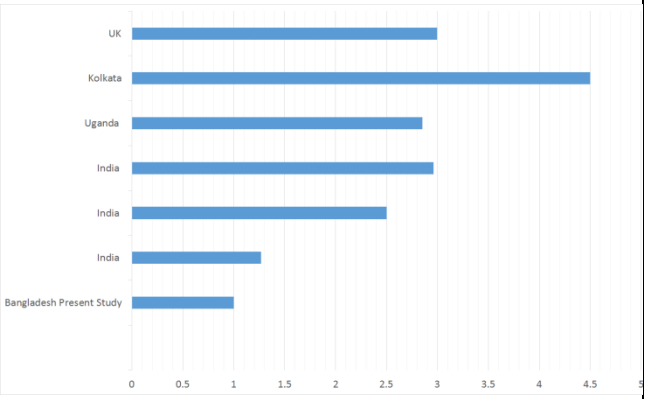
For the analysis of EE, the method used in the study is Communicative Energy Demand. This model provides breakdown fuel use. This is based on the fuel inputs across the system and includes fossil, renewable, nuclear, biomass and other energy sources. The model also provides a total sum of energy based on both low and high heating values. The breakdown of energy systems is given in lower heating values. Lower heating values (also known as net heating values) are the amount of energy available from combustion of fuel without recovering energy associated with water condensing vapour produced in the combustion process both from moisture in the fuel (especially for coals) and water produced as a result of combustion. High heating values (also referred to as gross heating value) includes the recovery of energy associated with condensing of the vapour and recapture of the latent heat of vaporization. Figure 6: represents the process of analysis of EE of Burnt clay brick. The impact assessment result derived from Simapro 8.1 is summarized in Table: 3.

This research aims to evaluate the environmental sustainability of Burnt Clay Brick- the most used building material in Bangladesh, Evaluating the environmental sustainability of Burnt Clay Brick is the aim of this research. Literature shows that the environmental sustainability of Burnt clay brick has been assessed by various researchers, however, they mostly considered emission factors only. A few were focused on EE. Evaluation of a material's environmental sustainability should take multiple approaches, such as assessment of EE and other damaging and consumption factors. Apart from energy consumption scenario, an evolution of GHG (Green House Gas) emissions is also an essential component of a sustainable global energy system. Reducing GHG emissions will also lower emissions of unhealthy air pollutants and increase energy security through increases in energy efficiency and diversification of energy supply (Ginley, David S.; Cahen, 2012). The present study evaluates EE, water consumption and emissions to evaluate the environmental sustainability of burnt clay brick. For the assessment a table is prepared, comparing EE found by other researches and that by the

Table 4 and Figure 6: Comparison of EE of Burnt Clay Brick between different contexts.

Birmingham, 18-19 December. Leeds: Institute for Large Businesses

Reference	Context and Technology	PEI [MJ]/kg
(http://www.greenspec.co.uk/building-design/embodied-energy/)	UK	3
(Pellegrino, Thakur, Guha, & Simonetti, 2011)	Kolkata	4.5
(Hashemi, Cruickshank, & Cheshmehzangi, 2015)	Uganda	2.85
	India	2.96
(Praseeda, Reddy, & Mani, 2015)	India	2.5
(Praseeda et al., 2015)	India	1.27
Present Study	Bangladesh	1.0025



current study. Table 4 illustrates the comparison of EE found among different contexts and literature.

From Table 4, it is seen that the Burnt Clay Brick produced in Bangladesh using BTK technology has the lowest amount of EE compared with the neighbouring countries and with other countries. In terms of Burnt Clay Brick in Bangladesh can be considered as less energy-intensive. The data used for simulation were collected from onsite surveys in three brickfields. Considering a breakdown of each energy-driven sector, electrical energy input used in the database has been simulated under Australian electricity production framework; this might have caused an inaccurate result in the net EE of brick in the specific research context. However, Figure 7 showing a breakdown of broad category of each energy inputs, depicts that the amount of electrical energy used in the production of brick is significantly lower in Bangladesh compared to other contexts. Therefore, electrical energy input has a very minimum contribution on net EE value of the simulation. As a result, in the present study 1.0025MJ/KG EE can be considered as a reliable value for burnet clay brick in Bangladesh. Human labour dependent industry, available source of raw material and less transport energy has turned the local brick in Bangladesh an energy efficient material.

Water footprint measured in the research was also found to be very low, 2.24 E -11 kg per kg of brick, which has minimum impact on global water system.

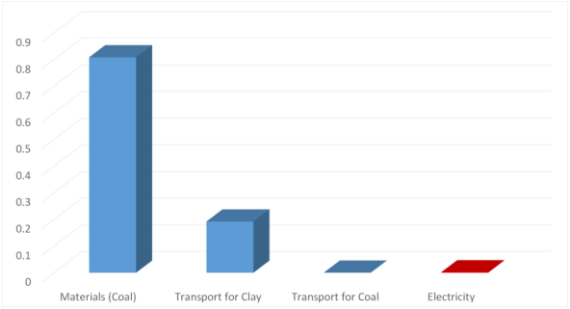


Figure 7: Breakdown of each energy input in the simulation.

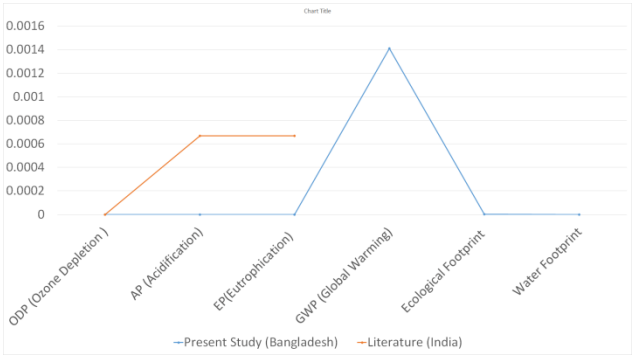


Figure 8: A comparison of emission factors between present study and previous research result adopted from (Procedia et al., 2014)

On the other hand, emissions from the production pose a threat on the environment and human health. Among the emissions factors, a few are substantial in the production of burnt clay brick. Global Warming Potential (GWP) and Ozone Layer Depletion (ODP) factor measured from the study is 1.41E-3 and 3.87E-10, the first of these (value of GWP) is a considerable amount in term of environmental damage. The other relevant researches, for example, Procedia, Bombay and Bombay, (2014) also constitutes the emission as the biggest percentage of all releases to the atmosphere. However, AP (Acidification) and EP (Eutrophication) were identified higher than the results found in other studies. Figure 8 represents a comparison of emission factors found in the present study and those in previous research result (Procedia et al., 2014).

Conclusion

The current paper deals in-depth with EE of Burnet Clay Brick in Bangladesh. Among the basic building materials, brick can be appraised as a much energy efficient choice. For example, (Praseeda et al., 2015) assessed a number of construction materials and reported the EE of Aluminium as 141.55 MJ/Kg, and of Glass as 7.88 MJ/Kg, whereas they measured Brick at 1.2-4.05 MJ/Kg. The present study found the EE of brick to be 1.005 MJ/Kg, which is 50% lower than that found by earlier researches. Generally, manufacturing of construction materials involves use of both electrical energy and thermal energy. Brick production in BTK technology mostly consumes thermal energy. Due to the very minimum electric energy used and human labour based production, brick has a very lower amount of resource consumption regarding non-renewable resources. According to the findings of this research, brick is a highly energy efficient choice among a range of building materials in the context of Bangladesh.

However, study shows that brick technology has a substantial amount of emission of both harmful gas and fume, which lead to the global warming potential. Other emission factors are apparently lower, but has the least amount of impact on human and environment. The emission factors often relate to the technology and efficiency of fuel used. There is an urgent need to mitigate the amount of emissions from the production of Brick in Bangladesh.

EE values revealed in literature in different contexts and that found in the present study has a wide difference. It is highly impracticable to arrive at a single unique value for EE of any building material. EE estimate of a material relates to the specific technology used in the specific context. Therefore, the environmental sustainability of each material should be assessed individually.

Assessment of Burnt Clay Brick in Bangladesh represents a range of consumption, emission and damaging factors. Thus, the current study provides most required environmental indicators of Brick and consumption scenario and thereby serves as a database to support future studies, reporting on EE for building materials and helps the relevant professionals to appraise brick as a building material for sustainable practice.

References

Anh, H., Nguyen, L., & Kim, T. (2010). Integrated assessment of brick kiln emission impacts on air quality, 381–394. http://doi.org/10.1007/s10661-009-1285-y

Bangladesh, G. of the P. R. of. (n.d.). Technical Specification For Buildings. Technical Specification For Buildings. Retrieved from http://www.lged.gov.bd/UploadedDocument/UnitPublication/4/12/2005_Technical Specifications for Buildings.pdf

Bangladesh, S. (n.d.). Photography. Retrieved from http://seafbv.com/news/29

Chadwick, M. (n.d.). The Asian Regional Research Programme in Energy, Environment and Climate – ARRPEEC.

Cole, R. j. (1998). Energy and greenhouse gas emissions associated with the construction of alternative structural systems. Build Environ.

DING, G. K. C. (2014). Life cycle assessment (LCA) of sustainable building materials: an overview. In Eco-Efficient Construction and Building Materials - Life Cycle Assessment (LCA), Eco-Labelling and Case Studies. Retrieved from

Dixit, M. K., Fernández-Solís, J. L., Lavy, S., & Culp, C. H. (2012). Need for an embodied energy measurement protocol for buildings: A review paper. Renewable and Sustainable Energy Reviews, 16(6), 3730–3743. http://doi.org/10.1016/j.rser.2012.03.021

Engin.A, F. . (2010). Zero Carbon Isn't Really Zero: WhyEmbodied Carbon in Materials Can't be Ignored.

Forsberg, A., & Malmborg, F. Von. (2004). Tools for environmental assessment of the built environment, 39, 223–228. http://doi.org/10.1016/j.buildenv.2003.09.004

G., D. (2004). The development of a multi-criteria approach for the measurement of sustainable performance for built projects and facilities. University of technology, Sydney, Australia.

Ginley, David S.; Cahen, D. (2012). Fundamentals of Materials for Energy and Environmental Sustainability.

Gomes, E., & Hossain, I. (2003). Transition from traditional brick manufacturing to more sustainable practices. Energy for Sustainable Development, 7(2), 66–76. http://doi.org/10.1016/S0973-0826(08)60356-7

Grace K.C. Ding. (2007). Sustainable construction—The role of environmental assessment tools. Retrieved from

Hashemi, A., Cruickshank, H., & Cheshmehzangi, A. (2015). Environmental Impacts and Embodied Energy of Construction Methods and Materials in Low-Income Tropical Housing, 7866–7883. http://doi.org/10.3390/su7067866

Herrmann, I. T., & Moltesen, A. (2015). Does it matter which Life Cycle Assessment (LCA) tool you choose ? e a comparative assessment of SimaPro and GaBi. Journal of Cleaner Production, 86, 163–169. http://doi.org/10.1016/j.jclepro.2014.08.004

Ibn-Mohammed, T., Greenough, R., Taylor, S., Ozawa-Meida, L., & Acquaye, a. (2013). Operational vs. embodied emissions in buildings—A review of current trends. Energy and Buildings, 66, 232–245. http://doi.org/10.1016/j.enbuild.2013.07.026

Ipcc. (2001). Climate Change 2001: The Scientific Basis. Climate Change 2001: The Scientific Basis, 881. http://doi.org/10.1256/004316502320517344

Junnila, S. Horvath, A. Guggemos, A. (2006). Life-Cycle Assessment of Office Buildings in Europe and the United States, (Journal of Infrastructure Systems).

Mostafa, K. (n.d.). Photography. Retrieved from www.karimphoto.com

Pellegrino, M., Thakur, B., Guha, H., & Simonetti, M. (2011). Procedia Engineering Energy efficient choice of brick façade in Kolkata , India, 21, 737–744. http://doi.org/10.1016/j.proeng.2011.11.2072

Praseeda, K. I., Reddy, B. V. V., & Mani, M. (2015). Embodied energy assessment of building materials in India using process and input–output analysis. Energy and Buildings, 86, 677–686. http://doi.org/10.1016/j.enbuild.2014.10.042

Pre-Sustainability. (n.d.). Pre-Sustainability. Retrieved from http://www.pre-sustainability.com/simapro

Procedia, E., Bombay, T., & Bombay, T. (2014). Environmental Life Cycle Assessment of Traditional Bricks in Western Maharashtra , India Environmental Life Cycle Assessment of Traditional Bricks in Western Maharashtra , India, (September 2015). http://doi.org/10.1016/j.egypro.2014.07.269

Ramesh, T., Prakash, R., & Shukla, K. K. (2010). Life cycle energy analysis of buildings: An overview. Energy and Buildings, 42(10), 1592–1600. http://doi.org/10.1016/j.enbuild.2010.05.007

Uso, A. A., Scarpellini, S., & Bribia, I. Z. (2009). Life cycle assessment in buildings : State-of-the-art and simplified LCA methodology as a complement for building certification, 44, 2510–2520. http://doi.org/10.1016/j.buildenv.2009.05.001

Walter Klopffer, B. G. (2013). What is Life Cycle Assessment (LCA). In Life Cycle Assessment A Guide To Best Practice. Retrieved from

Jones, D. (1999) 'Developing big business', Large firms policy and research conference. University of Birmingham, 18-19 December. Leeds: Institute for Large Businesses.

Jones, D. (1999) 'Developing big business', Large firms policy and research conference. University of.

Creative Social Reconstruction in the Age of Flux
Role of Architecture in Defining the Identity of Future Cities of the Global South

Sonia Guha[1]

Abstract: *The paper underscores the role of architecture in creating 'Third Place' as cultural infrastructure for inclusive development. Cities in developed countries have successfully re-imaged themselves using culture and creativity as tool for urban regeneration, positively impacting local economy, quality of life and in creating city identity. Thus, it becomes important to understand how these cities are strategizing these ideologies and if the same principles can help consolidate the future of cities in the Global South. Exploring Cultural Policy trends in three European cities, the role of 'Third Place' is ascertained when seen that social reconstruction process is often catalysed through investing in inclusive Public Place and Architecture. This leads to the question how cities of the developing world still battling for primary infrastructure can afford investments in cultural intervention in the scale of European cities. As a possible solution the second part of the paper demonstrates using contemporary projects in India, how in its isolated private realm, architecture can be generous enough to include the community. This is necessary, as current development trends, especially in developing countries of Asia, are most often exclusive and private, where privileges extend towards a particular section who can afford it.*

Keywords: Third-Place; Community; Creative City; Cultural Asset.

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Introduction

In this age of constant flux, cultural resources act as raw materials for the city - the contemporary assets replacing coal, steel or gold (Landry, 2007). Thus making the driving force of economy not simply technological or organizational but human (Florida, 2002). To drive the continuity of a city's development it needs to attract and retain the highly skilled, talented people, who, owing to globalization and easy access to Information and Communication Technology (ICT) generally have choice about where to live. Social reconstruction using 'Third Place' Architecture as cultural asset to enhance the quality of life plays a vital role in attracting these people to live and work, thus business and investment follow people leading to economic growth.

According to Florida (2005) cities are natural "cauldrons of creativity", hence those cities which can harness their human creativity as the ultimate economic resource will flourish. The correlation between economic growth and creativity becomes evident when viewed through the perspective of World-Systems Theory[1] as proposed by Immanuel Wallerstein. If the Core, Periphery and Semi-periphery countries are mapped on the world map (Fig. 1) and compared with the map showing Creativity Index (Fig. 2) of different countries as per Martin Prosperity Institute [MPI] (2015), we see the countries with highest Creativity Index are the core countries, also having most Economically Powerful cities (based on economic output per capita from MPI). This underscores the need of emerging cities of the Global South to define their identity and retain the highly skilled human resource, who, are prone to job driven migration seeking a better quality of life.

With the launch of UNESCO's "Global Network of Creative Cities" in 2004, more cities initiated policies to promote creative and cultural activity for social reconstruction. As Comunian (2011) points out, Culture is used as a tool for urban regeneration (Evans and Shaw, 2004; M. Miles, 2005), economic development (Florida, 2002b;

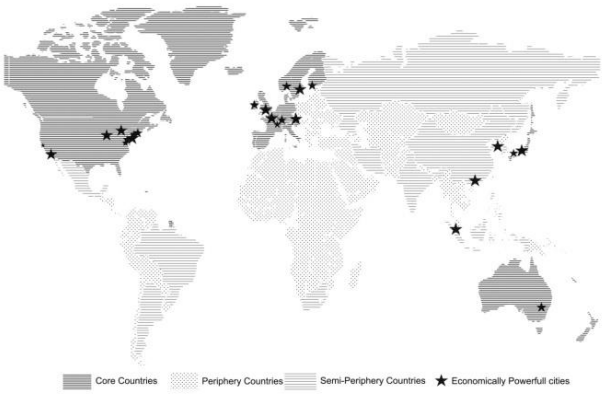


Figure 1: Map based on World-Systems Theory overlapped with Most Economically Powerful Cities.

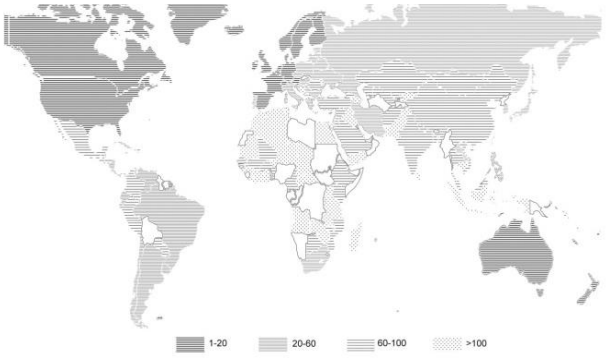


Figure 2: Map for Global Creativity Index.

Scott, 2000, 2004) and social inclusion (Belfiore, 2002; Merli, 2002) in Post-Industrial cities of the developed world. Acknowledging the positive impact of creativity and culture on local economy, quality of life and in creating city identity for promoting cultural tourism, this paper aims to understand how these cities are converting ideologies into intervention and if same principles can be applied to consolidate the future of cities of Global South.

The research questions addressed are: What is the common denominator among all tools and strategies that catalyzes social reconstruction in cities those are successful in regenerating themselves? How can it be implemented in cities of the Global South with their limited resources?

This paper emphasizes role of Architecture in enhancing a city's quality of life by revitalizing neighborhoods through inclusive design over large scale government implemented policy's

ability to generate wealth and increase job opportunities.

[1]*World-system theory is a macro-sociological perspective* by *Wallerstein where Core countries focus on higher skill, capital-intensive production and the rest of the world focuses on low-skill, labor-intensive production & extraction of raw materials.*

Methodology

The paper followed a linear methodology basing the theoretical framework on literature survey. Europe was selected for having decades of well documented systematic cultural policies. Primary interest being conceptual, cultural policy trends in European cities were evaliated by furthering prioir studies on Barcelona, London and Berlin by London Development Agency (LDA) using the parameters of – Catalyst, Approach, Strategies. The cities were selected because of their cosmopolitan character, diverse economic and planning circumstances in addition to recognized success in culture led urban regeneration. Journals, articles, books, statistics from government, official documents published by local authorities were consulted to get a socio-economic insight into these cities. Their strategies were grouped under generic categories. As possible solution to the second part of research question, case studies in Indian context, selected from prior knowledge were explored from publications and through correspondence with concerned Architectural practice, to identify design nuances reflecting those categories for social reconstruction through inclusivity.

Impact of Culture in European Cities

Formally initiated as 'The European City of Culture' at an intergovernmental level in 1985 and presently known as'The European Capital of Cultures'(ECOC), it exhibits a long-run impact of systematic cultural policies, eg. Marseille Provence, France (2013) revitalised the city by attracting 11 million individual visits and also raised €16.5 million in private sponsorship from 207 companies.In Europe,cultural and creative sector turned over more than € 654 billion in 2003. The turnover of the car manufacturing industry was €271 billion (2001) and by ICT manufacturers was €541 billion in 2003 (ECOC fact sheet,2015). However, the most significant impact is how culture and creativity prompted a regeneration process - renovating parts of the city, re-qualifying derelict buildings and the social logic of space utilisation (Stevenson,1998). This social reconstruction is the necessity of rapidly urbanising cities of the Global South.

Strategies for Creative Social Reconstruction

Strategies undertaken by each city vary ranging from physical transformation through capital project, like Mons (Belgium) which inaugurated 5 museums, 2 concert halls and 1 conference centre to public participation like in Linz 2009 (Austria) where local volunteers and students built 900 polythene animals as part of Flut (The Flood) in order to empower young adults, or like Barcelona promoting Events and Theme Years starting with 1992 Olympics Game. Therefore strategies employed can be grouped in two categories - Hard infrastructure focused (container) or activity focused (content). The built environment - or setting the container – is crucial as it gives the physical preconditions or platform upon which the activity and atmosphere of a city can develop. To understand the role of Architecture in Global South, strategies focus on improving quality of life through built enviroment is explored below.

Barcelona

The city developed a cohesive cultural strategic plan to intercept all resources and channelize their forces in the cultural sector since the World Exposition of 1888. The1992 Olympics catlysed its transformation from eighties to the present. It prioritized creation and rebuilding of public amenities as the main approach for social reconstruction. Some of the notable strategies:

• Open Public Space – Designed as outdoor living rooms, a network of 140 connected park or

urban space were completed between 1981 and 1997. These small, hard-surfaced squares and piazzas (“Plaza Dura”) use dramatic public art inderelict spaces and the hidden historic areas of the city to generate identity and foster socio-cultural integration.

• Public Architecture and generation of new cultural facilities – Barcelona invested heavily both on new capital projects and in renewal of its Architectural Heritage sometimes combining them as in the Borne Cultural Centre or Santa Caterina Market. The district of Santa Caterina underwent a social reconstruction catalysed by re-developing the derilict market and extending adjacent Avinguada Cambo as an axis with a sequence of public spaces. (Fig. 3,4)

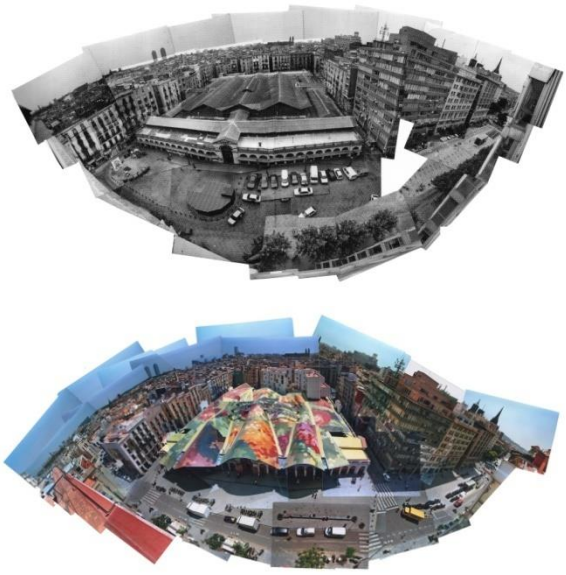


Figure 3: Before and After redevelopment of Santa Caterina Market and vicinity, Barcelona

• Move Museum to the Streets – The city has invested substantially in public art and ‘outdoor museums’ with over 1,000 sculptures created in city spaces, including installations by Miro and Calatrava.

Figure 4: Public Space in front of the market.

Berlin

The Re-unification of East and West Berlin in 1989 acted as the catalyst to make it a contender for global-city status for which it tried to redefine itself in terms of relationships between space and culture. Primary approach being regenerating derelict industrial heritage as shared space, strategies used:

•Reuse Industrial buildings as platform for “culturpreneurs”– Künstlerhaus Bethanienis one such example of adaptive reuse of a hospital to house 25 studios, 3 exhibition studios and a media lab turning it into a cultural ‘Third Place’.

Figure 5: Künstlerhaus Bethanienis Groundfloor Public Gallery as Third Place.

• Neighbourhood Management – Berlin Senate implemented Neighborhood Management initiatives (Quatiersmanagement) in 17 areas identified for “special developmental needs”. Of the approximately 2000 projects established between 1999-2003, many focus on developing creative potential, establishing and strengthening a sense of identity

• Public Architecture – Cheap, accessible space for working, performing, exhibiting and living. 7 million square metre of new office space, built between 1990 and 1998 alone provides cheap premises even in premium locations

• Infrastructure – Berlin offers a broad and high quality public transport infrastructure and has three airports. Also Berlin underwent a modernization of the entire telecommunications network after the fall of the Wall. The investment in transport and telecommunication makes compression of space and time possible, propelling into the realms of globalization.

London

"London's cultural industry is famous for its innovation and experimentation, its entrepreneurial energy and risk taking" (Boris Johnson, Mayor of London). Following the publication of 'London Cultural Capital – Realising the Potential of a World Class City' in 2004,the London Cultural Consortia was set up which was later renamed as The London Cultural Strategy Group (LCSG). This catalysed a major research-led initiative that developed an approach of capitalizing what they have and channelizing it to a cultural production chain. Strategies implemented:

• Extending Public Realm – Redesign of Exhibition Road, the street running between the national museums in South Kensington proves how a road blighted by unsightly traffic barriers and narrow, crowded pavements can be turned into a welcoming destination for the millions of pedestrians who visit each year. (Fig. 6,7)

• Creative Hub – Creative Hubs in 10 identified geographical location to promote the growth of networks, through providing shared space for work, participation and consumption. Example, Creative Lewisham, a creative hub, including higher education institutions (Goldsmiths, Lewisham College, Laban Dance), several theatre, galleries, art and design agencies, festival organisations and studio enterprises.

Figure 6: Exhibition Road Before and After.

Figure 7: Sackler Courtyard as an extension of Exhibition road.

• Safe-environment–Clearer signage, withimproved walkability or safer cycling provision along with efficient public transport.

• City Growth strategy for Inner City–A new approach to inner city regeneration that focuses on the positive advantages of the inner city rather than the social disadvantages was undertaken to make it a more competitive location for business which in turn will increase income, wealth and job opportunities for inner-city residents.

Discussion and Results

The key learning from European cities is – social reconstruction process is commonly catalysed through investing in inclusive Public Place and Architecture. These 'Third Place' are meant to strengthen day to day social relations which positively impact quality of life, create city identity thereby improving local economy by attracting the creative class and industry. In Barcelona

currently, the Arts and Creative Industries combined represent 6% to 8% of the City's GDP, and when combined with Cultural Tourism this rises to 17% of GDP(LDA,2006). In London 680,000 people work in the creative industries representing 15% of the London economy and nearly 20% of the workforce and a turnover of between £25bn and £29bn.

Overall the strategies implemented by the cities for social reconstruction can be broadly categories into -

• Public Space – Predominantly this was the key intervention in all cities studied.

• Public Architecture – Whether in creating new capital projects or adaptive reuse of old, 'third-place' is generated for the community.

• Built Heritage – Historic buildings play a central role by lending character to an area and having deep-seated associations for local communities.

• Infrastructure – Both physical and ICT based networking or connections allow compression of space and time which guarantees success of a city in global scale.

• Intangible Cultural Heritage – Requires minimum capital investment. A city needs to identify and market its intangible cultural heritage for city-branding strategy.

This leads to the question how can cities of the developing world still battling for primary infrastructure like healthcare, uninterrupted power supply, sanitation, effective mass transit and housing afford cultural infrastructure in the scale of European Capital of Cultures. In the context of limited resources, aspirations and dreams of a community is never on the development agenda. What needs to be focused is the common denominator for social reconstruction is reinforcing 'Third Place', this improves the quality of life of the community.

Architecture and Social Reconstruction

A generous gesture in design of the following case studies from India reveal the impact inclusive spaces can have in improving the quality of life by bridging private and public. The visionary intention of the following projects reflects the ethos of the categories identified earlier, consequently is fostering space for social interaction and communication.

City Centre 1, Kolkata - *Public Space + Public Architecture.*

Located in Salt Lake, a satellite neighbourhoodin Kolkata, architecture of this mall by Charles Correa Associates is celebrated for multiple reasons.With it's porosity ensured by various entry points, the 'bazaar' like shopping area and the 'kund' - a large OAT like gathering area, it exemplifies how a contemporary mall as a shopping space can establish a sociable connection with the city and builds on it's past spatial traditions. For example, before present municipal bylaws necessitating mandatory front open space (which results in boundary wall) were levied, interface of the public and private was softened with an expanded threshold or "rowk"(Fig.8).

Figure 8: Traditional neighbourhood "rowk". Source : Internet ; Photograph : Ayan Khasnabis

These were quintessential 'Third Place' which addressed the need for neighbours to gather, to exchange ideas, goods, and to find a place for representation.

In City Centre 1, the simple act of diminishing the boundary wall to a hedge and recede the ground floor in certain areas to create a colonnade enhance the spatial quality of its context. Irrespective of a person's affordability or need for visiting the mall, one can still enjoy a wide well maintained sidewalk (Fig.9, 10). This is crucial in developing countries due to the great socio-economic divide.

Figure 9 & 10: City Centre 1 with no boundary wall merging footpath and side open space

Source : Author

Star Theatre, Kolkata - *Public Space + Built Heritage*

Polaris through this project demonstrates how architects can go beyond the functional brief to improve quality of life by reinforcing cultural infrastructure. The project was to restore and rebuild a heritage theatre building from 1883, burnt down in 1992. The functional requirement was for a 650 persons seating auditorium but by converting the typically unused roof top into a public plaza, the architects ensured a breath of fresh air for the community in exisiting dense urban fabric. The plaza connects directly from the street is accessible to anybody irrespective of whether they are visiting the theatre. Being located in the vicinity of an existing cultural precinct with vibrant street markets and cinema halls, its thriving success proved the necessity of such a 'Third Space'. (Fig.11,12)

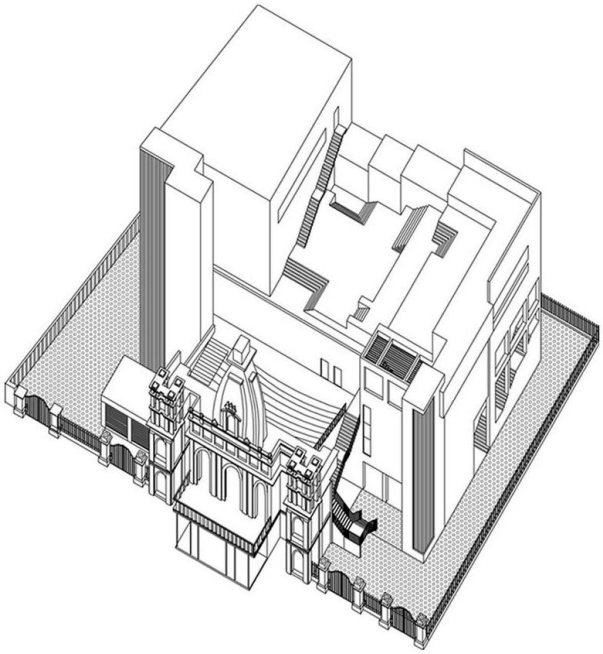


Figure 11: Star Theatre Showing roof top Plaza. Source : Polaris

Figure 12: Roof top Plaza in use. Source : Polaris

The Wall House, Bansberia - *Public Space + Intangible Cultural Heritage*

The Wall House by Abin Design Studio (ADS) is located in a corner plot of a busy junction in a dense and rapidly growing suburban city. The client's want of secure home, combined with minimal setbacks made a high boundary wall unavoidable. The Studio by integrating the wall into the architecture of the house,manages to 'un-wall' it. It becomes a sensitive intervention for the community as the client was inspired to leave a part of the setback land out making the junction wider and safer (Fig.13,15).

Across the junction, the studio also redesigned 'NarayantalaThakurdalan' – a community space for religious ceremonies, and a library with community hall with gallery seating leading up from the street(opposite to Wall House).These three when complete, will create an Urban Living Room acting as 'Third Place' (Fig.14). Also it emphasizes the intangible cultural heritage of the city - famous for annual Kartik Puja light show procession. The community library's terrace and entrance steps form a viewing gallery for the community.

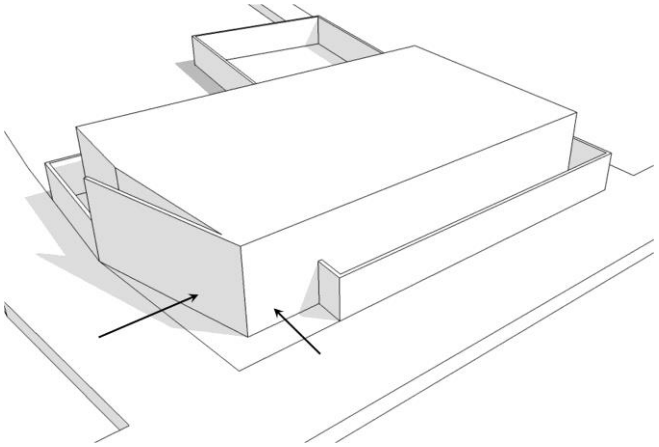


Figure 13 : Corner reed in Wall House. Source : ADS

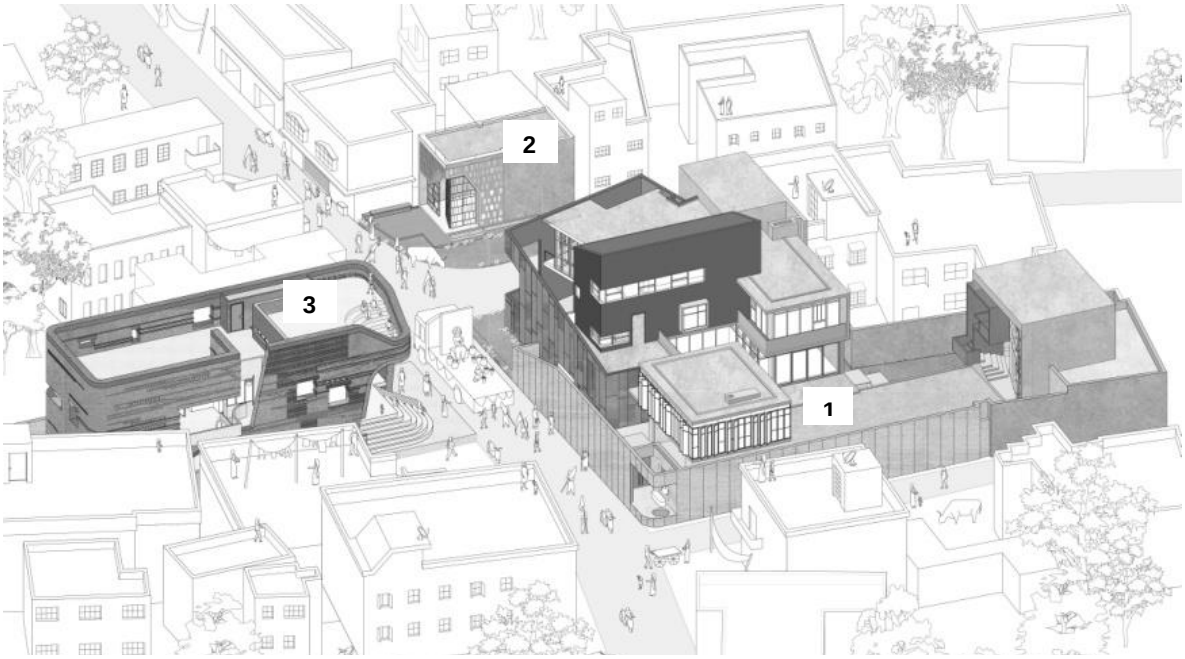


Figure 14: Three developments form Urban Living Room. 1 – Wall House. 2 – Narayantala Thakurdalan 3 – Community Library. Source : ADS

Figure 15: Widened Street Junction. Source : ADS

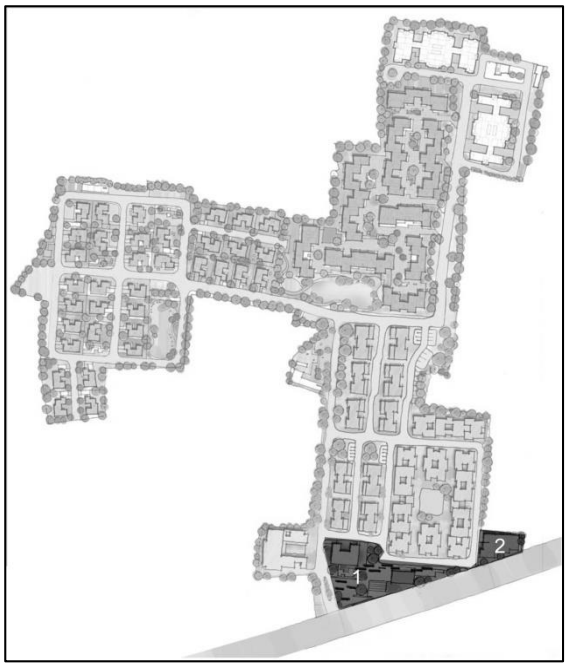


Figure 16: Bonochaya Masterplan.

1-Plaza,2.Experience centre. Source : ADS

Bonochaya Experience Centre, Shantiniketan - *Public Space + Public Architecture + Intangible Cultural Heritage*

The Experience Centre is part of Bonochhaya Housing Development, sprawling over 12 Acres of land targeting urban dwellers of Kolkata, Durgapur, Kalyani and Burdwan. Rarely such gated communities are inclusive, privileges only extended to those who can afford it.

Abin Design studio has tried to make it more inclusive by allowing the experience centre to be modified into a primary health care clinic for the locals of the surrounding rural areas in Shantiniketan and the adjacent plaza as a public domain accessible to all. Adjacent to the plaza will be the Art Galleries , together they will uphold the intangible cultural heritage of Shantiniketan, and enable exchange of the artisitic, musical and cultural legacy that it is known for. (Fig. 16,17,18)

Figure 17: Bonochaya Experience Centre. Source : ADS

Figure 18: Plaza visualisation. Source : ADS

Conclusion

This paper proposes consolidating the spatial tradition of 'Third-Place' as a driving factor for social reconstruction observing that when cities around the globe focused on culture led urban regeneration to drive economic and social development, they have heavily invested in 'Third-Place'as cultural infrastructure whether in the form of public space or public building. This resulted in improving quality of life, positively impacting local economy and thus creating identity for the city in the global market.

Therefore to retain and attract the highly skilled people to live and work, such that business and investment follow people leading to economic growth cities of the Global South should prioritize improving the quality of life at the policy and planning level by the government. Till the need for it is recognized and investments are directed towards the cause, individual architecture, can still imbibe the spirit of social restructuring using the identified broad categories from European cities.

The case studies demonstrated each project has the potential to facilitate social reconstruction using the identified categories when they venture beyond the functional brief. They have demonstrated the ability to create 'Third Place' as a cultural infrastructure for the community especially by how it addressed the interface with the context. In summary the architecture of Global south can improve the quality of life, collectively, expanding the sphere of influence to community level than just defining the visual and material culture of its immediate context.

Reference

Carta, M., 2008. Creative City //Dynamics/Innovation/Actions, List Lab

Comunian, Roberta., 2011. Rethinking the Creative City: The Role of Complexity, Networks and Interactions in the Urban Creative Economy. Available at : www.academia.edu

European Commission, 2016& 2018, ECOC Fact Sheet retrieved from www.ec.europa.eu

Florida, R., 2002, The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life, New York, NY: Basic Books.

Florida, R., 2005, Cities and the Creative Class. New York and London: Routledge.

Garcia, B., 2004, Cultural policy and urban regeneration in Western European cities:lessons from experience, prospects for the future. Local Economy, Volume 19, Issue 4.

Garcia,B., Cox, T., 2013, European capitals of culture : Success strategies and Long-term effects – retrieved fromwww.europarl.europa.eu/studies

Ingrosso, C., 2011. Barcelona : Architecture, City and Society 1975-2015, Skira

Landry, C. and Bianchini, F. (1995) The Creative City. London: Demos.

Landry, C.,1996. The Art of Regeneration : Urban renewal through cultural activity, Comedia

Landry, C. (2000) The Creative City: A Toolkit for Urban Innovators. London: Comedia/Earthscan.

Landry, C. (2006) 'Lineages of the creative city', Research Journal for Creative Cities 1(1):15–23.

Lerner, J., 2014. Urban Acupuncture: Celebrating Pinpricks of change that Enrich City Life, Island Press

London Development Agency (2006).Strategies for creative spaces: Berlin Case study

London Development Agency (2006).Strategies for creative spaces: Barcelona Case study

London Development Agency (2006).Strategies for creative spaces: London Case study

Martin Prosperity Institute, (2015). Official Website*. [online] Available at: http://martinprosperity.org/ [Accessed first 20 Jan. 2016]*

Stevenson, D., 1998, Agendas in place: urban and cultural planning for cities and regions, RESRC Central Queensland University Press, Rockhampton.

The Architecture of "Now": An Analytical Anecdote on "Adapting to Change"

Yashodha Perera

Abstract: *In hope of enlightenment upon the "Core Problem" that enhances the dichotomy between the practice of Architecture and the Real-World, this discourse is an analytical anecdote of the "way architects think" and the way "thought processes" are structured within the practice of architecture. The anecdote explores the ideological composition; "Architecture in a Changing Landscape" through the establishment of a robust theoretical foundation for the "Architecture of Now" while trying to understand the Nature – Human – Architecture relationship. It explores the impact of individualized notions of creativity upon the practice of architecture, the Architectural Positions of two renowned Sri Lankan architects; Geoffrey Bawa and Valentine Gunasekara were analysed under the three areas of Ordering Systems, Mass and Trabeation and Broader Social Obligations. The analysis concludes on a critical note upon the fatality of the establishment of specific rules within the practice which is detrimental to the fundamental understanding and enlightenment upon the core of Nature – Human – Architecture relationship, and thus impede the origination of an architecture of the real-world; an "Architecture of Now".*

Keywords: Practice, Theory, Creativity, Architectural Position, Education

Architecture in a Changing Landscape

Deconstruction is a strategic tool and a magnificent method to understand and gain perspective upon almost anything. Deconstructing; "Architecture – in – a – Changing – Landscape" could be perceived a much simpler and an effective approach to understanding the crucial meanings of Architecture, Change, Landscape in their splendid autonomy and most crucially as an ideological composition to be explored within a specific time, context or milieu.

Living, breathing and creating in an era of crisis, the only thing that matters "Now", had become nothing but *survival*. Hence, not only within the realm of creative arts, humans are compelled to tread beyond mere truism and navigate the sense and intellect towards seeking *meanings* of almost all aspects of life from their very core, in the very "Now". If only words are pursued and meanings are not sought; enlightenment that awakens consciousness; to *sense the unsensed* would be far-fetched. Thus, "Architecture – in – a – Changing – Landscape" will forever remain an ideological put-together trapped within the realm of conceptions which humans could never really comprehend.

Architecture of 'Now'

To its fortune or misfotune, definitions of architecture are casted in the crucible of personal understanding upon what it is and what it should be. whether it is based upon a standardized notion in architectural theory or upon the ethos of individual practice, it is definitively prone to interpretation and allows freedom of expression both in terms of theory and practice. There exists instances when theory is solemnly born out of practice, marking the origination of a novel.

But, the issue is, in there very *nature and core*, does any of these theories, practices and creative process obtain an inherent capacity to originate symbolic, exemplary and archetypal creations which could become credible resolutions to realistic conditions of the world, specifically and most critically at the forefront of crisis? Does these theories and practices explore the purpose of creativity and lead humans towards understanding the core of architecture as a creative sphere? Are they inherently equipped with the capacity to lead humans towards understanding the reality/real conditions of a specific time and mlieu?

Despite many answers and many ways of answering the above, within the discourse upon Architecture – in – a – Changing – Landscape, the two fundamental questions that could navigate the discourse towards enlightenment are; 1) what is the *nature and core* of an architecture that has innate potential in defining the "Architecture of Now", 2) what is the *nature and core* of an architect who could originate an "Architecture of Now" and thus define the "Architect of Now - Architect of the Present" (Creator of the *Present)*?

"Change" – The Natural Phenomenon

"Change is a general transition of something or phase to another state condition" – (Erçetin & Bağcı, 2016)

The definition of "Change" is as undeniable and definite as the ideology behind it. It is a natural phenomenon and simply how the "Nature" works.

In a critical point of view, the ideological composition; "Architecture – in – a – Changing – Landscape" – compels human thoughts to be navigated in the direction of understanding, sensing and responding to "Change" – with a tone of certain unusuality and uncommonness.

On the contrary, in its defense, "Change" is not unusual or unnatural. It is a natural phenomenon conferred within almost all discourses of the world – from Ecology to Neuroscience to Astrophysics; "Change" is perceived as an innate characteristic of nature.

Such a proposition enlightens a crucial understanding upon “Change” as reality; it has always been and it will continue to be so. Hence, the question arises, at which point of the history of mankind, humans began to perceive “Change” as unnatural and as a matter of unusuality and uncommonness.

Rain was there, and once in a while it rained hard, causing floods, landslides, destroying crop, shelter and taking life, but, only in a few parts of the world. Heat was there, and once in a while it became unbearable, brought extreme droughts and took away human and animal life, but, only once in a while, in a few parts of the world. Once in a while, earthquakes, hurricanes and cyclones occurred, destroyed man-made creations, took away life, but, only once in a while and in a few parts of the world.

In the history of mankind, humans noticed “Change”, only when it occurred in the manner of colossal catastrophes occurred only once in a while, only in a few parts of the world. It is the very reason why many failed and still fails to understand “Change” as a constant organic phenomenon of nature. It *has been* happening, and it *is* happening at this very moment as we speak. It is reality.

Whether in the name of Global Warming, Climate Change, Environmental Degradation, Earthquakes, Floods, Cyclones, Hurricanes, Tsunami, Poverty, Economic Crisis, Political Power Shifts or War, it is when these colossal catastrophes started occurring in unprecedented magnitudes and versions in many parts of the world, human thoughts were compelled to navigate towards understanding the core of Human – Nature relationship.

This is when notions such as Reduce, Reuse, Re-Cycle, Up-were brought into limelight in almost all discourses of the world. Specifically, within the architectural discourse, most narratives focused upon notions such as sustainability, adaptation and resilience as prime protagonists. However, this discourse is very much recent and does not span for more than 50 years.

Human – Nature; The Relationship

“Nature, in the broadest sense, is equivalent to the natural world, physical world, or material world. "Nature" refers to the phenomena of the physical world, and also to life in general. It ranges in scale from the subatomic to the cosmic.” (What is Nature?, n.d.)

“Nature is all the animals, plants, and other things in the world that are not made by people, and all the events and processes that are not caused by people.” (Definition of 'Nature', n.d.)

“The phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations.” (Definition of nature in US English by Oxford Dictionaries, n.d.)

Many understand nature as whatever is natural as opposed to what is man-made whilst many definitions of nature confer upon a solid separation between humans and human creations, as opposed to products of the earth (soil, water, plants, trees, animals and the landscape etc.). Only a few doctrines actually shed light upon nature as one, with a universal sense, as opposed to segregating and compartmentalizing the surrounding, the external construction in which humans inhabit.

Although nature is perceived as ecology, in the surface level, the process of dividing the whole of external construction into Social, Cultural, Economic, Political and Environmental components had invariably made ecology a mere component of the external construction we live in, under the label of “Environmental”. Thus, humans are compelled to think of nature by force as a separate constituent. However, it is crucial to understand that all these divisions are in existence due to the cognitive process of segregating, compartmentalizing and creating

private realities within one nature, one surrounding and one external construction.

What remains oblivious to humans is the fact that it is within the nature, the natural system, all human thoughts, decisions, and actions are generated and practiced. Extricating 'Change' from "Nature', and perceiving it as an "unusual", "uncommon" occurrence, will only mislead the creative process from treading towards the path of understanding and responding to the "real situation', and in that sense, architecture is of no exception.

Nature – The 'Changing' Landscape

Within the process of exploring the meaning of the ideological composition; "Architecture – in – a – Changing – Landscape", perceiving nature in a way that offers illumination towards the core of Human-Nature relationship is considered crucial to the process of "self-determining" the exact "Human" positioning in "Nature". Such self-enlightenment often equips humans with the acumen to understand the core of Nature-Architecture relationship – and thus – Think, Act and create accordingly.

The ability to design and to be conscious about this (i.e. to be retrospective and projective regarding one's own position in the surrounding world) seems to be the essential human characteristic, distinguishing us from the rest of the living world. The construction of models of the human position and ability of acting in relation to nature is one of the essential and unresolved challenges of modernity. (Jonas, 2007)

Jonas's words clearly convey the inevitable influence of the cognitive construction of humans that enables them to understand one's 'own position in the surrounding world' within the act of creation, while professing it as the 'essential human characteristic'. He accentuates upon the importance of a "Creation", or a "Design", which exists as an integral and a fundamental resultant of the human ability to act in-relation to nature, the surroundings, the time, the milieu; the "Now".

It is due to the compartmentalized state of minds of humans, the entire external construction is perceived in division as; Nature – Human, Human – Non-Human, Natural - Unnatural, Living – Non Living, Animate – Inanimate, or as Social, Cultural, Political, Economic, Environmental. This remains an unbreakable vicious cycle as and when a new thought, action and a creation is originated upon a hypothetical but a segregated external construction. The matter of fact is, did humans ever pause to raise these fundamental questions; does these segregations and divisions really exist? If so, where are they? what is the exact human positioning amidst these segregations and compartments?

As conferred by Jonas, as far as the realm of creative arts is concerned, the unresolved challenges of modernity; the "Now", is to create upon a state of mind that mitigates existing imposed hypothetical divisions to nature. Perhaps, the first step to this is nurturing a state of mind of oneness; one which understands the exact human positioning *within and amidst* a compartmentalized physicality, nature or surrounding.

Such a creation would be symbolic of the core of Human-Nature relationship, and certainly be derived through a notion of creativity and an "Architectural Position" that determines Architecture as Nature; of Nature; with innate and inherent capabilities to "Change", withstand pressure, and is organically robust with plenty of latitude for tolerance. Architecture; of which "Change" is an organic phenomenon.

Nature – Architecture; The Relationship

Within the discourse upon finding solutions to the current crisis situation of the world through architecture, or any creative process for that matter, understanding "Change" as a natural phenomenon and defining the core of "Human-Nature" relationship with no separation what-so-ever is crucial to the cognitive process of self-determining that 'Humans are the Nature' and 'Humans are the Creations they Create'.

Such a proposition that dismisses all physical and virtual segregations in existence would certainly instill the capacity to enlighten humans upon most critical, unanswered and untouched areas of the conception of self, human mind, creativity and human creations.

Architecture Vs Reality

Whether it is "Architecture – in – a – Changing – Landscape", sustainability, adaptability or resilience, despite the repeated play of words, concepts and positions, very little or no credible application of these theorems are visible in regions where such interventions are mostly relevant and required, especially within the so-called economically developing parts of the world. (Perera & Pathiraja, 2017)

With such criticality at hand, the question arises if the "Core Problem" lies within the inability of humans to understand and address "Change" as a natural phenomenon, and create architecture in which "Change" is an organic phenomenon. If the "Core Problem" lies in the way humans think, in the way thought processes are being structured and executed, it will naturally be translated and reflected in creations as confines of design thinking and design ethos within the practice of architecture.

This critical dichotomy between theory and practice in architecture compels one to question if humans misperceived the "Core problem" and spent their entire lifetimes finding solutions, establishing theories and formulating strategies to issues that are only mere by-products of the "Core-Problem".

Research Methodology

From 50 years of a timeline till "Now", sustainability, adaptation and resilience are the protagonists of many discourses all around the world, especially within the architectural discourse.

Many are exposed to these ideologies, and most architectural practices have their own interpretations upon them. If anyone becomes critical upon the architecture of "Now", despite the need to address current crisis situation as the realistic condition of the world, there is so much cliché embedded within the practical application of aforementioned theorems.

Hence, with the hope of understanding the confines of "thinking", the theoretical premise of the research invariably suggests a critical exploration upon the creator's notion of creativity; "thinking" in relation to the creative process, through an in-depth analysis of Architectural Positions. Thus, the analytical base of the research is upon the establishment of a formal language; the concept of stylistic consistency, and carves its way towards understanding the "Core-Problem" within the architectural practice and beyond. It critically analyses the formation of Heuristics; Operational/Methodological Rules within an architect's Programme of Action, thus, the formation of Architectural Positions.

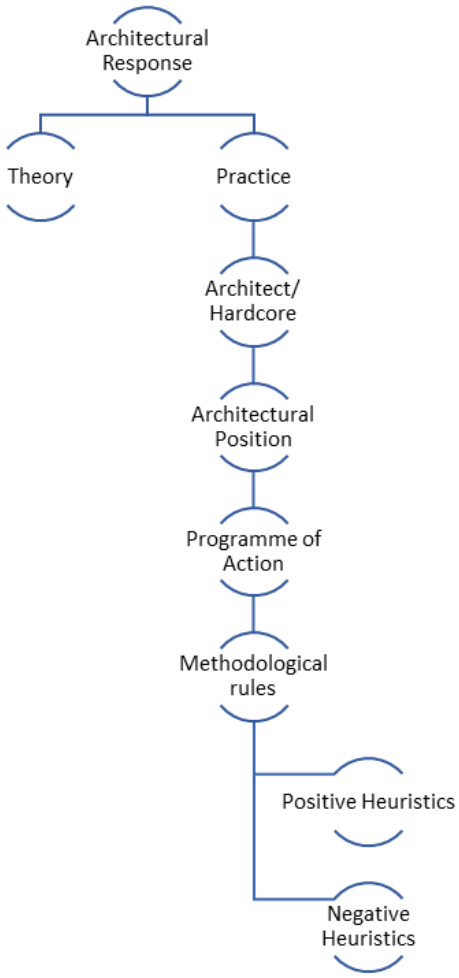
With the exposure to much cliché-d versions of these theories, prone to individualistic interpretations by many, then and now both, the research analyses Architectural Positions of two world-renowned Sri Lankan architects who practiced prior and way before the whole discourse upon sustainability, adaptation and resilience was initiated.

Architectural Position – Analytical Method

The position of an architect is established over a long period of time with practice, along with the development of an individualistic notion of creativity.

Most creations often depict a specified approach or a particular way of achieving creativity that leads to the establishment of a formal language, the concept of stylistic consistency, which is then defined as the Architectural Position of an architect.

As depicted in (Figure 1), the Architectural Position has a direct connection with the "Hardcore" of an architect.



The Figure 1: Analytical Method of Architectural Position

As these specific ways of achieving creativity is essentially based upon the "Hardcore" of the architect, analyzing the Architectural Position is perceived as an ideal mechanism to explore an architect's individualistic notion of creativity.

Case Study

Since the purpose of the research is to explore the over-powering individualistic notions of creativity which obscures the ability of the architect to create in-relation to nature, in which "Change" is an organic phenomenon, Architectural Positions of two world-renowned architects; Geoffrey Bawa and Valentine Gunasekara are explored through an in-depth analysis of Positive Heuristics (as a manifestation of the stylistic consistency/formal language), under the three areas of Ordering systems, Mass and Trabeation, Broader Social Obligations.

Ordering Systems: Plan, Section, Elevation

Elements and Principles concerned with a building's Spatial Layout and Volumes.

Mass and Trabeation: The Tectonic Organization

Elements and Principles concerned with the building's constructional logic; 'Tectonic' as a building's technological environment (2002)

Real and Virtual: Broader Social Obligations

This concerns with Elements – and Principles – that serve the organization of the building's social objectives. A building's – or for that matter, an architect's - social role is an idea that requires broader practical and intellectual investigation. Hence, this research explores the notion of creativity, Architectural Positions, in-relation to the ideology of nature as a "whole", but within an external construction in which all Social, Cultural, Economic, Political and Environmental segregations do exist.

As the selected practitioners emerged and practiced in an era prior to the architectural discourse of theorems such as sustainability, adaptation and resilience, their notion of creativity in-relation to nature as a whole was explored and analyzed in an optimum manner under the terminology of "Broader Social Obligations". For the purpose of this study, the subsequent social connotations and responses have been partitioned into two conceptual dimensions: Real and Virtual.

Responding to tangible, essential and critical issues pertaining to the socio-economic, socio-cultural and socio-technical environment of building production (of a given locality) as a direct – an immediate – objective of the building work is considered as 'Real'.

The indirect intellectual contribution to the society as a by-product of a specific architectural intervention is termed as "Virtual" social responses. In such light, the term "Virtual" is used with the meaning of "…. being a hypothetical particle, whose existence is inferred from indirect evidence (or contribution)" (Oxford Dictionary).

Although he did manage to pick up the vernacular which was concealed by colonization, and brought it back to the urban town as a "designed vernacular", the need of the hour was to experiment in coming up with creative resolutions in lifting up the subjugated and beleaguered lives of the local communities affected by colonization. (Pieris, 2007)

Table 1: Positive Heuristics – Architect Geoffrey Bawa & Architect Valentine Gunasekara

		Architect Geoffrey Bawa	Architect Valentine Gunasekara
Positive Heuristics	Ordering Systems	• Creation of a definite physical boundary • The composition of Pavilions • Experiential route • The Combinatorial Space • The play of solid and Void	• The Curvaceous Form • The Free Space • The Vertical Space
	Mass & Trabeation	• The Breathing Wall • The Cantilevered Section Form • The Extended structural frame • The Concrete Portal frames • The Colonnade	• Structural Expressionism • The Poetic Form • Geometric Fenestrations • The play of light and shadow • Modular Construction • Deconstruction of Structure

Case Study Findings

Real and Virtual: Broader Social Obligations

The early practice years of both Bawa and Valentine demanded the creative resolution of the issue of decolonization as one of the critical issues to be addressed in an age of post-independence. Bawa was successful in retrieving himself from the modernist concrete frame houses and took over the challenge of establishing the ideal tropical urban house in a metropolitan atmosphere.

In contrast to Bawa's regionalist, place-based idioms which in return served the new middle class or the elites, Valentine could be perceived as an architect who believed that modernism could be used in serving a critical social process in an era where regionalism was serving a nationally and politically motivated megalomania of globalization.

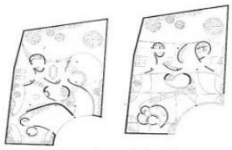
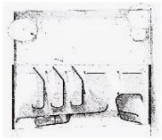
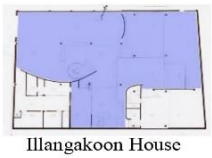
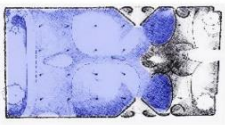
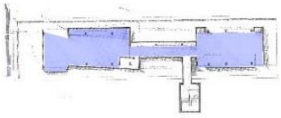
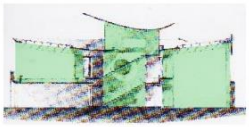
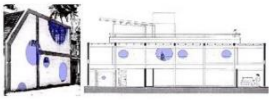
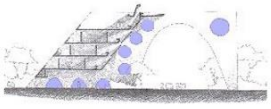
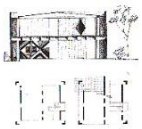
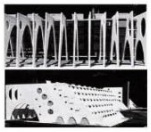
His assertive motive of creating a symbolic architecture was one of his inherent creative resolutions in lifting up the suppressed souls of the community.

Through his Architecture, Valentine offered the needed liberty to relieve one from the oppressive, class-bound aesthetics, the romanticized picturesque motifs rooted to colonialism and certainly was on an experimental journey in finding resolutions for the tropical grounds through modernism itself.

Though the mastery of concrete led him to the creation of monumental brutal architecture, he utilized the same intellect in catering to the low-income communities, through low-cost, labor-saving, time-saving architectural interventions.

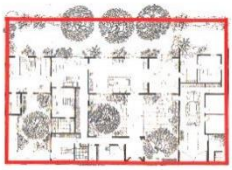
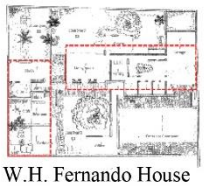
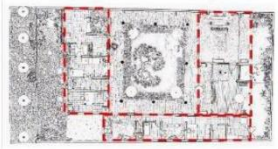
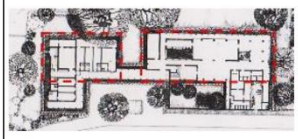
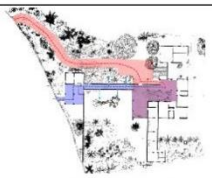
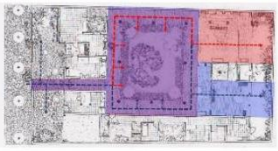
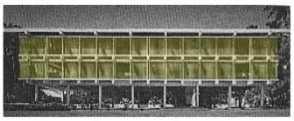
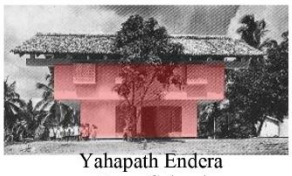
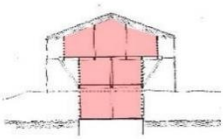
These creations were a mode of technology and knowledge transfer to the local contractors and laborers involved in the construction process, but

Table 2: Analysis of Positive Heuristics – Architect Valentine Gunasekara

Positive Heuristics (PH)		Case 01	Case 02	Case 03
Ordering Systems	**PH 01:** The Curvaceous Form	 Mahendrarajah House	 V.J.H. Gunasekara house	 Tewatte Chapel
	PH 02: The Free Space	 Illangakoon House	 Borella Montessori	 Galle Bishop's House
	PH 03: The Vertical Space	 Mahendrarajah House: Section	 Tharmaratne House: Section	 Galle Bishop's house chapel: Section
Mass and Trabeation	**PH 04:** Structural Expressionism	 Tangalle Bay Hotel: Interior Causeway	 Galle Bishop's House Chapel	 Horana Church
	PH 06: Geometric Fenestrations	 Tharmaratne House: Section	 Weeramuni House Exterior and Section	 Hotel for CDBI
	PH 08: Modular Construction	 Modular House, Nigeria: Section and Floor plans	 Hotel for CDBI: Model skeleton	 Tangalle Bay Hotel

concrete as a material might not be the most appropriate and harmless as far as the environment is concerned.

Table 3: Analysis of Positive Heuristics –Architect Geoffrey Bawa

Positive Heuristics (PH)		Case 01	Case 02	Case 03
Ordering Systems	**PH 01:** Creation of a definite physical **boundary**	 The 33rd Lane	 Stanley De Saram House	 A.S.H De Silva House
	PH 02: Composition of Pavilions	 W.H. Fernando House	 Ena De Silva House	 The Madurai Club: India
	PH 03: Experiential Route	 W.H. Fernando House	 A.S.H. De Silva House	
Mass and Trabeation	**PH 06:** The Breathing Wall	 St. Thomas's Preparatory School	 Bishop's College	 Steel Corporation Offices
	PH 07: The Cantilevered Sectional Form	 Yahapath Endera Farm School	 Steel Corporation	 Benthota Beach Hotel
	PH 08: The Extended Structural Frame	 N U Jayewardena House	 Madurai Boys' Town India	 Bishop's College

Though Geoffrey Bawa and Valentine Gunasekara had their own interpretations upon the notions of resilience and adaptation, in a critical point of view, the ideology of Broader Social Obligations, specifically in the sphere of Virtual and broader intellectual contributions of these Architectural Positions seem bleak,

especially within a discourse upon the definition of architecture at the forefront of realistic conditions of the world.

Conclusion

As shown in (Table 1), (Table 2), (Table 3), the Positive Heuristics of architect Geoffrey Bawa and Valentine Gunasekara are illustrative of the over-powering nature of individualistic notions of creativity upon the practice of architecture. Over time, the establishment and celebration of such rigid, un-bending and inflexible ways of problem solving within the design process of architecture had become inevitable due to many limitations of architectural practices.

The fatality of celebrating and blindly following Architectural Positions and practices, throughout history, all around the world, could only be measured when "Architecture" fails to address "Real-World" conditions, and is globally manifested as a prime contributor to many of the current crisis situations of the world.

Many architectural education systems expose young, emerging architects to popular, world-renowned, much celebrated architecture as precedence, but fail to create architects that could find credible resolutions to current crisis situations of the world, at least ones that would not contribute to crisis through their creations.

With such verdict, the question arises, in times of turmoil when the whole world is at the forefront of colossal catastrophes and at the verge of collapse, with the hope of finding credible resolutions, in which direction should humans be navigating, and most importantly, are humans looking at the right direction?

It is with the hope of understanding and gaining enlightenment towards the "Core Problem", this research was fundamentally based upon a theoretical premise that differed from what is usual. It consciously directed its narrative towards the "way architects think" and the way "thought processes" are structured within the practice of architecture, as opposed to analyzing architecture in terms of the practical application of theorems and ideologies such as sustainability, adaptation and resilience.

The research highlighted the following ideological queries within its discourse of understanding and gaining enlightenment towards the "Core Problem";

Are there architects, who could understand the meaning conveyed by an ideological composition; "Architecture – in – a – Changing – Landscape", in relation to "Real-World Conditions" of this era, and thus define the "Architecture of Now" through their creations?

Are there architects, who could comprehend "Change" as a natural phenomenon and create in-relation to nature? If such architects do exist, even after a 50-year discourse upon sustainability, adaptation and resilience, would humans still be provoking thought upon ideological compositions as "Architecture – in – a – Changing – Landscape", sustainability, adaptation and resilience, instead of creating them?

Fundamentally and most critically, unless the education systems of the world as a whole, and the academia of architecture in particular, are restructured towards the ultimate objective of nurturing human beings that could "Sense, be Sensible and be Mindful" upon Human-Nature relationship, the origination of humans who inherit the capacity to define an "Architecture of Now" through their creations would be a far-fetched reality.

Amidst such daunting individualized notions of creativity and architectural ethos in practices, the origination of architects and architecture with innate/inherent capacities to understand nature, perceive "Change" as a natural phenomenon, and "Self-Determine" the exact positioning of "Humans" in relation to "Nature" would be one of the most essential, fundamental and critical challenges of "Now", that remains unresolved, yet.

References

Anon., n.d. Definition of nature in US English by Oxford Dictionaries. [Online] Available at: https://www.lexico.com/en/definition/nature

ARCASIA. (2019). Arc Asia 2019 Dhanka. Retrieved from Arc Asia Dhaka: http://arcasiadhaka.com/

Definintion of 'Nature'. (n.d.). Retrieved from Collins English Dictionary: https://www.collinsdictionary.com/dictionary/english/nature

Definition of Nature in English. (n.d.). Retrieved from English - Oxford Living Dictionaries: https://en.oxforddictionaries.com/definition/nature

Erçetin, Ş., & Bağcı, H. (2016). Handbook of Research on Chaos and Complexity Theory in the Social Sciences. Retrieved from https://www.igi-global.com/dictionary/chaos-and-complexity-approach-in-management/3646

Ford, E. (2003). The Details of Modern Architecture. Cambridge: MIT Press.

Frampton, K. (2002). Rappel a l'ordre: The Case for the Tectonic. In K. Frampton, Labour, Work and Architecture: Collected Essays on Architecture and Design. London: Phaidon Press.

Jonas, W. (2007). Research through DESIGN through Research. Kybernetes, 9-10.

Landau, R. (1984). British Architecture; The Culture of Architecture: A Histography of the Current Discourse . London: International Architect Publishing Limited.

Perera, Y., & Pathiraja, M. (2017). Resilient Environments vs. Resilient Architects : Creativity, Practice and Education. GSTF Journal of Engineering Technology.

Pieris, A. (2007). Imaginig Modernity: The Architecture Valentine Gunasekara. Colombo: Lake House printers & publishers.

Venturi, R. (1977). Complexities and Contradictions in Architecture. New York: Museum of Modern Art.

What is Nature? (n.d.). Retrieved from Environment and Ecology: http://environment-ecology.com/what-is-nature/108-what-is-nature.html

Housing for Low-Income Communities: Promoting Social and Economic Sustainability in Slum Rehabilitation Approaches in the Urban Context of Dhaka, Bangladesh

Afrida Afroz Rahman

Abstract: *The objective of this article is to address the importance of and explore the means of achieving social and economic sustainability in designing housing for low-income communities. In this era of fast-paced urbanization, more than half of the global population live in cities and urban housing crisis has become a worldwide phenomenon, particularly prevalent in developing countries like Bangladesh. The biggest victim of this phenomenon are the urban poor, who are forced to seek refuge in highly dense informal settlements known as slums and in most cases, they lack proper infrastructure, legal tenure and fail to provide healthy living condition. Since liberation, the Government of Bangladesh has taken several attempts to address the issue of slum and low-income housing through slum upgrading, eviction or rehabilitation. But such attempts have failed in the past to serve their intended user group, resulting in gentrification. This paper argues that the reason behind the ineffectiveness of such projects lies in their failure to attain social and economic sustainability. The role of architecture in ensuring long-term social and economic sustainability of rehabilitation approaches is explored by looking at a government-initiated slum rehabilitation project at Mirpur, Dhaka.*

Keywords: Slum-rehabilitation, Society, Economy, Informal-settlement, Sustainability

Introduction

According to a report published by the United Nations Department of Economic and Social Affairs (UN DESA), 55% of the world's population now lives in cities. As for Bangladesh, 36% of the population lives in urban areas (Morshed, 2018) and the percentage is expected to exceed 50% by 2030. This increased urban population means more pressure on already scarce land and resources, which leads to the exacerbation of existing housing crisis and as per tradition; the urban poor will bear the brunt. Majority of the urban poor end up in informal and usually illegal settlements known as slums. These slums are unplanned, highly dense and usually characterized by the lack of infrastructure, sanitation, proper living condition.

According to the Census of Slum Areas and Floating population 2014, there are 2.23 million people living in 13935 slums all over the country among which, 643,735 people live in Dhaka city alone. However, this massive slum population occupies a very small portion of urban land. 70% of low-income people occupy only 20% of the residential land, whereas 28% of middle-income people occupy 65% of land, and the richest 2% occupy 15% of the land. (COHRE & ACHR, 2001)

Governments, in their efforts to address the housing shortage for urban poor and to provide alternate solutions to slums, have taken different approaches such as resettlement through sites and services scheme, slum upgrading program, rehabilitation through flats etc. (Mohit, 2011) But these attempts failed to serve their intended user group and beneficiaries selling their flats to move back to slums became a common phenomenon, which leads this paper to investigate the cause of the failure of such projects. Bhashantek Rehabilitation Project (BRP), a multi-storied residential development project at Mirpur, Dhaka has been chosen as the focus of the study as it exemplifies the failure of on-site rehabilitation approaches in a highly dense urban context.

Literature and a case study are presented to understand how social and economic sustainability influences the adequacy of housing and what parameters play a major role in determining the adequacy of a rehabilitation project. Based on those indicators, this paper attempts at evaluating Bhashantek Rehabilitation Project (BRP). It tries to determine BRP's effectiveness in providing adequate housing by applying indicator values derived from the respondents' socio-economic conditions and comparing it with the slums nearby as well as the slum that existed on the same site before to understand the opportunity cost of living in BRP. Through the study, this paper attempts to explore the role of architecture in making housing more socially and economically acceptable to the urban poor.

Methodology

This paper is based on both primary and secondary data. Secondary data sources include books, research journals, seminar papers, government census reports, newspaper articles and they provide the theoretical background and identify indicators of social and economic sustainability that are used to evaluate BRP by using primary data. Primary data sources include field surveys, questionnaire, and interviews conducted in 2019 in the focus area. Some of the data, including the data from surrounding slums which is used to draw comparison with Bhashantek, was collected in 2018 for the purpose of B. Arch thesis project. 16 households have been interviewed within BRP and they were chosen by random sampling method.

Adequate housing and Sustainability

Housing is one of the basic needs of human life and access to housing falls under the category of "economic, social and cultural rights". According to the Vancouver Declaration on Human Settlements, "adequate shelter and services are a basic human right which passes an obligation upon governments to ensure their attainment by all people."(Cited in Leckie, 1992) Ensuring

access to safe, adequate and affordable housing by 2030 is a part of the United Nations Sustainable Development Goal of sustainable cities and communities. Leckie provided a definition of adequate housing based on six criteria: a physical structure that is habitable and culturally acceptable, built on a site that is safe and accessible, with necessary infrastructure to provide access to services, located at a place that allows access to employment, health, and education, have legal security of tenure and is affordable. (Leckie, 1992) So the right to adequate housing means the right to a habitable and culturally adequate, safe, affordable and accessible house with security of tenure and access to services. But most often government initiated low-cost housing schemes fall short of providing adequate housing in terms of accessibility and affordability, factors that, according to Leckie, are far more crucial than the physical structure of the house itself.

Indicators of social and Economic Sustainability

Accessibility and affordability are two of the many parameters of social and economic sustainability, which in turn are two pillars of sustainable development. (Kahn, 1995, as cited in Basiago, 1998) In case of housing, social and economic sustainability also have other interrelated and interdependent parameters and indicators. The following table reflects on the social and economic indicators of sustainable urban housing development as identified by several scholars. Since this paper focuses on low-income housing, indicators related to this particular area were chosen from the table by observing the extent of their effect on a case study of similar context.

Author	Category	Indicators
Arman et al., 2009b	Economic sustainability	Where housing expenditure does not exceed 30% of household incomes for the bottom 40% of income groups. Appropriate location ensuring accessibility Dwelling size and quality Not increasing the incidence of housing stress over the lifecycle of the house. Where individual and government financial obligations can be met on an ongoing basis without policy change
	Social sustainability	Social acceptability Minimizing social exclusion or polarisation
Winston 2007		Sustainable land-use planning Resisting scattered settlements Accessible housing close to employment and public transport Higher residential densities Sustainable construction High standards of energy efficiency in use of dwellings Housing availability, affordability and quality Access to green space A high quality residential environment
European System of Social Indicators		Availability of dwellings Size of dwelling Amenities State of repair of dwelling Tenure status Type of accommodation Affordability of housing Facilities in residential area Environmental quality of residential area Public safety Subjective evaluation of housing conditions Subjective evaluation of the residential area Regional disparities in housing conditions Income related inequality of housing conditions Homelessness Poor housing conditions Area used for settlement Energy consumption Preferences related to dwelling Preferences related to residential area
Pullen, Stephen & Arman, Michael & Zillante, George & Zuo, Jian & Chileshe, Nicholas & Wilson, Lou. (2010).		Energy Efficiency Construction Materials Construction Methods Affordability – Price Mechanism Desirability Density and Urban Form Dwelling Size Adaptability Social Acceptability
Chiu. (2003)	Social precondition for ecological sustainability	Values, Habits, Rules, Lifestyle, Environmental consciousness, Regulations
	Equitable housing distribution	Housing equity and accessibility, Housing standards, Affordability, Role of the government,
	Harmonius Social Relations	Landlord and tenant relationships, Haves and Have-nots relationships, Influence of the stakeholders
	Quality of housing and living environment	Internal housing condition, Immediate environment (includes neighborliness)

Figure 01: Socio-economic indicators of sustainable housing

As seen from the table, accessibility is a recurring indicator in the discourse of social and economic sustainability of housing. From a social standpoint, it is a fundamental measure of social equity (Barton, 2000a; Barton, 2000b, as cited in Dempsey), which has been identified as an indicator of social sustainability and signifies equitable access to key services, infrastructure, education, employment, etc. (Dempsey,2009; Littig; Cuthill, 2009) For the urban poor, accessibility is of particular importance as Dovey explains that informal settlements are located where they are because they have access to jobs and public transport. (Dovey, 2015)

So, to ensure accessibility, rehabilitation should be done on-site or in case of slums located in areas that are not safe, accessible or livable (Dovey, 2015), rehabilitation should be done at a place that has access to jobs, transport, and other services. But the high price of urban land coupled with the scarcity of available land for residential development renders locations within the city unaffordable to the slum dwellers.

Conventionally, housing is considered affordable if the housing expenditure does not exceed 30% of the household income of the bottom 40% of income groups. (Robinson, Scobie and Hallinan 2006, cited in Kabir, 2012) However, many scholars argue that the price to income ratio should not be the only indicator of affordability. (Mulliner et al. 2013) Mulliner et al. have found in their studies that location and ancillary costs of accessing key services, facilities and employment play an important role in determining affordability as well.

Rehabilitation schemes undertaken by Ethiopian government attempted to address the issue of affordability through providing subsidy where "End-user purchase is through three subsidized housing mechanisms: 10% down payment, 90% 20 year mortgage at 9% interest for studio and one-room units 25 – 40 m.sq., 20% down payment to own through 15 year mortgage for two-bedroom units of 60 m.sq., 40% down payment, 60% mortgage over 10 years for three-bedroom units of 100 m.sq." These projects used low-cost materials to minimize construction cost and created job opportunities by using labor-intensive technologies. (DW, 1015)

Dwelling size and quality are also important in determining affordability. Although large dwelling sizes reduce affordability, minimum floor area is required to ensure the well-being of residents. (Arman et al.) This conflicting issue can be addressed by providing adaptability in unit layout. Lack of adaptability also reduces social acceptability, for example, as the interior space layout and the modern kitchen fixtures of the condominium project in Addis Ababa did not suit the needs of the inhabitants' lifestyle, it reduced the social acceptability of the project. (Delz, 2016)

Social acceptability is one of the indicators that are frequently overlooked in rehabilitation approaches. The example from Addis Ababa, while sensible in terms of affordability, had a negative effect on social network as the layout of the high rise buildings failed to sustain the social interaction that a slum lane accommodates, therefore causing a loss of trust among the community (Teferi & Newman, 2017) Despite the attempts to give these projects a mixed-use character by providing commercial plots, it failed to integrate the projects themselves into the surrounding urbanscape, thus creating disconnected urban islands which invigorate social exclusion. (Delz, 2016) Dovey calls for integration of such settlements into the city since social exclusion prolongs poverty. (Dovey, 2015)

Access to open space and community facilities also affect the sustainability of housing. However, providing open green space in low-income housing requires a sensitive approach. The project in Addis Ababa created neglected open spaces that remained unused because of their scale, such large scale of spaces are not coherent with the socio-cultural lifestyle of the intended users. (Delz, 2016) Access to community facilities encourages community participation, which strengthens community sustainability. (Dempsey et al. 2011)

Energy efficiency and sustainable construction also positively influence affordability. However, active measures of efficiency may increase initial construction cost (Arman et al.) and reduce the desirability of the project, passive measures will be more suitable in that case.

Evaluation of the socio-economic sustainability of the rehabilitation project

Background of the Project

Bhashantek Rehabilitation Project (BRP) is one of the earliest attempts by the Government to rehabilitate slum dwellers through providing flats. In 1998, Government introduced an initiative to rehabilitate slum dwellers of Bhashantek, Mirpur who were illegally occupying Government-owned land. 47.9 acres of land was allocated to build multi-storied housing for slum dwellers and low-income families. The Government formed a Public-Private Partnership (PPP) with North-South Property Development Ltd in 2003 where

NSDPL was required to build 15,024 flats of which, 9024 flats would be for slum dwellers and the rest would be for low-income families. (Mohit, 2011) Flat type A was designed for slum dwellers with 215 sqft and the price was fixed at 1.90 lakh, whereas flat type B had 395 sqft with a price of 3.55 lakh and was designed for low-income families. (Hussain et al., 2015) Approximately 3260 slum dwellers were evicted from the site before construction began in 2003. (Kabir, 2012) However, the project remained incomplete and the partnership was revoked in 2010 due to several allegations of corruption and delay against NSDPL. NSDPL allegedly increased the price of the flats and reduced the payment period, taking it beyond the reach of the initial target group. A number of flats were sold to more affluent people for profit as well. (Arman, 2017) At the time of the termination of partnership, only 2 buildings with 288 flats were built for the slum dwellers and 8 buildings were built for low-income people. At present, there are 18 completed buildings.

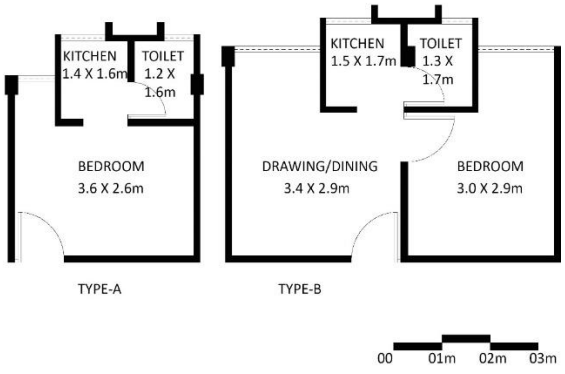


Figure 02: Unit plan

Profile of respondents

Four households were interviewed during 2018 and 15 households were interviewed during a follow-up visit in 2019. Among the 15 households, three were inhabitants of type-B apartment and the rest live in type-A apartments. The inhabitants of type-B apartments are all renters, while among the 16 households living in type-A, 9 of them are renters and the rest are owners.

Topic	Range	No. of respondents
Household size	2-3	02
	4-5	11
	6-7	03
	8-9	00
Tenure Status	Tenant	09
	Owner-occupier	07
Duration of stay	<1 year	04
	1-3 year	02
	4-6 year	03
	since the beginning	07
Whom they rent/bought the flat from	Bought from government	07
	Bought from other people	00
	Rented from beneficiary	03
	Rented from second-hand owner	06
Where they stayed before	Original Bhashantek slum	07
	Nearby slum in Mirpur	06
	Other slum in Dhaka	03
	Outside of Dhaka	00
Reason for moving to BRP (Asked to the tenants)	Eviction	04
	Risk of eviction	03
	Close to job	00
	Close to education	00
	Better facility	01
	Affordable	00
	Other	01
Reason for staying in BRP (Asked to the owner-occupiers)	Tenure security	03
	Close to job	00
	Close to education	00
	Better facility	00
	Affordable	04
	Other	00

Figure 03: Profile of respondents

It was apparent from the interviews conducted that a significant number of people have either sold or rented out their apartments and moved elsewhere. Tenants of both type A and type-B flats were previously slum dwellers living in numerous slums in Mirpur. Four of them moved here because they were evicted from nearby slums.

The income range for type-A respondents varies from 12000-20000 BDT, while the type-B respondents have an income range of 15000-25000 BDT. Respondents are employed in both formal and informal sector with occupations ranging from hawkers, street-vendor owners, housemaids to salesman, third and fourth class government employees, small businessman etc. Since this paper deals with slum rehabilitation,

data collected from the interviews of only the residents of Type-A unit that is designed for slum dwellers are taken into consideration.

Nuclear family structure is prevalent among the respondent households, with only two of them being of joint family structure. Household size of the respondents varies from 3 to 7 with an average value of 4.

Key findings

Accessibility:

In terms of job and education, the project is reasonably accessible since most of the respondents work and attend schools nearby as well as the school within the project. However, the quality of education provided in the school within the project is not satisfactory to the inhabitants. Moreover, the high-school fee is 525 BDT per month, which is higher than the neighboring schools. The project also provides access to infrastructure and basic services such as water, gas and electricity but at a price that is higher than what they used to pay in nearby slums.

But to have a comprehensive understanding of the issue of accessibility, a comparison between Bhashantek before rehabilitation and after rehabilitation was done. From respondents, it was found that although access to jobs near Bhashantek is retained, many jobs and small business opportunities such as shops within Bhashantek were lost after the rehabilitation.

Affordability:

	Range (BDT)	No. of respondents
Household income	12,000-15,000	11
	15,000-18,000	04
	18,000-21,000	01
	21,000-24,000	00

Figure 04: Household income of respondents

The owner-occupier respondents made an initial down-payment of 10,000 BDT followed by another down-payment of 50,000 BDT, and are paying a monthly installment of 1125 taka for ten years to gain ownership of their flats. This monthly installment along with the utility fee of 1100 BDT is less than 30% of their monthly household income. However, all of the respondents who were previous owner-occupiers in Bhashantek slum owned larger space for themselves, which can be considered as an opportunity cost that puts owner-occupiers at an economically disadvantageous position.

However, majority of the respondents are tenants who pay a rent of 4500-6000 BDT along with the utility fee of 1100 BDT that consists of water and gas supply, security and waste collection bills. This tips the price-to-income ratio over the affordable limit of 30%. Both the rent and the utility fee are much higher than those of the neighboring slums. (1500-2000 BDT per month as per a survey conducted in 2018 on two slums in Mirpur) From this perspective, BRP is a less affordable option.

Dwelling size and quality:

The type-A apartment has a gross area of 215 sqft, however, the living space is approximately 100 sqft with an additional 45 sqft of service space. Although the inhabitants enjoy individual service space as opposed to the shared services in slums, their living space is reduced. Besides, six of the respondents who were previously tenants in other slums had larger living space while paying much lesser rent. (Ranging from 2500-3000 BDT, inclusive of utility bills)

The quality of the dwelling unit is also not satisfactory. The living space has a 2'6" wide window which is widely inadequate to provide sufficient ventilation and lighting. During field visit, eight of the 10 units visited had their lights on during the day. Respondents also complained that due to the layout of the unit, the room becomes unbearably hot and stuffy while cooking. The kitchen is also very small, when asked about their previous cooking condition, 4

of the respondents mentioned that even though they used to share the cooking space, it was larger and comfortable while 6 of them mentioned that they had the freedom of extending their kitchen activities onto the road or the open space adjacent to their room.

Figure 05: Inadequate window blocked by appliance (left), small kitchen reduces functionality

Figure 06: Small room (with lights on)

Social acceptability:

To evaluate the project in terms of social acceptability, inquiries were made to the respondents to understand their level of satisfaction with their dwelling unit, and their relation with immediate neighbors and with people from surrounding areas in comparison to their living experience in slum. Most of the respondents had low levels of satisfaction with their unit, not only because of environmental discomfort but also because of the layout of the unit. In their previous homes located in slums, the respondents enjoyed greater flexibility in use of space and each space had multiple functions. They also used the immediate outdoor space in front of their house as space for hanging clothes to dry or to gossip with neighbors or as an extension of kitchen to deal with the limited space, which could not be done in the merely 4 feet wide corridor. Insufficient lighting also renders the corridor less desirable. However, the lack of alternatives leads the dwellers to use the corridor anyways, but there is a general sense of dissatisfaction among respondents.

The respondents, in general, maintain good relationship with each other. No trace of dissent among type-A and type-B inhabitants could be seen. However, 4 of the respondents commented on the lack of privacy and security within the project that is caused by people from neighboring areas who frequently use this project to take shortcuts, whereas, in their previous dwelling, they enjoyed a greater degree of privacy from the outsiders.

Figure 07: Corridor used for hanging clothes and studying (with lights on)

Access to open space & facilities:

The project has two large open spaces, one is the playground at the entrance, and the other is the playground in front of the school. The latter is used by children and teenagers to play cricket. Although the inhabitants enjoy this large open spaces, they are denied of the multiple scales of open space that they used in the slums they lived in. The immediate outdoor space they shared with their neighbors was used by women and children for socializing and playing as these spaces provide greater privacy. The roads along with roadside shops, tea-stalls became socializing spaces for men. These useful and meaningful small-scale and mid-scale open spaces of varying degrees of privacy are lost in the project and the result is gradual segregation in the neighborhood. While the inhabitants still use the internal road and the playground for socialization, the frequency is much less, and the women have a reduced social circle and their area of socialization is limited to their own home and for those staying in the ground floor, the space in front of the buildings. (Figure 10) The setback areas between the buildings are also underused, being used as dumping ground in some places. (Figure 11)

Figure 08: Entrance playground

Figure 09: Playground with school

Figure 10

Figure 11

Energy Efficiency:

The layout of the unit and corridor increases the use of artificial lighting, even during the day, leading to increased energy consumption.

Recommendations

A proper evaluation of the economic condition and affordability of the slum dwellers should be done to design a financial model that is feasible and accessible to the target group. Access to jobs, education and infrastructure at an affordable price should be ensured.

The complex social relations and activities occurring in the social spaces should be acknowledged and interpreted into the formal rehabilitation approach.

Dwelling unit layout should reflect the space use pattern of the inhabitants and allow flexibility while maintaining affordability and environmental comfort. The challenge lies in designing the limited space in an efficient manner.

Building and cluster layout should be designed so as to maintain the multiple scales of open spaces where social activities of varying intimacy can occur to that existing social relations can be retained.

The masterplan should be developed to integrate the rehabilitation project to the surrounding urban environment while ensuring the privacy of the users.

Conclusion

While government-led initiatives for low-income housing and slum rehabilitation are undeniably significant in a developing country like Bangladesh, they require a sensitive and comprehensive approach to address the complex urban issues of density, high land price, and land scarcity as well as the issues of adequate housing. The parameters of socio-economic sustainability that determine the adequacy of a rehabilitation project have been discussed above. These should be seen as variables rather than as constants and their values should be determined from the socio-economic profile of the target group. The social and economic opportunity cost that a slum dweller pays for rehabilitation should also be taken into account to ensure that slum dwellers are left in a better socio-economic position after the rehabilitation so that examples like Bhashantek Rehabilitation Project could be avoided. Therefore, assimilation of architectural knowledge with a deeper understanding of social and economic issues is of prime importance to build in an efficient manner in this fast-changing urban landscape. Design goal should be to facilitate the growth of a high-density mixed-use neighborhood that is well integrated with the city to enable the urban poor to improve their condition.

References

1. *UN DESA. (2018).World Urbanization Prospects: The 2018 Revision.*
2. *Morshed, A.Z. (2018). 'Is housing for the urban poor a mere dream? 'The Daily Star. 27 November*
3. *BBS. (2014). Census of Slum Areas and Floating population 2014*
4. *COHRE & ACHR. (2001). COHRE Mission Report Bangladesh 2001*
5. *Mohit, M.A. (2011).Bastee Settlements of Dhaka City, Bangladesh: A Review of Policy Approaches and Challenges Ahead.*
6. *Leckie, S. (1992). From Housing Needs to Housing Rights: An analysis of the Right to Adequate Housing under International Human Rights Law.*
7. *Basiago, A. D. (1998). Economic, social, and environmental sustainability in development theory and urban planning practice.*
8. *Dempsey, Nicola & Bramley, Glen & Power, Sinead & Brown, Caroline. (2011). The Social Dimension of Sustainable Development: Defining Urban Social Sustainability.*

9. *Littig, B., Griessler, E. (2005). Social sustainability: A catchword between political pragmatism and social theory.*
10. *Dovey, K. (2015). Sustainable Informal Settlements?.*
11. *Murphy, Kevin. (2012). The social pillar of sustainable development: A literature review and framework for policy analysis.*
12. *Pullen, S. & Arman, M. & Zillante, G. & Zuo, J. & Chileshe, N. & Wilson, L. (2010). Developing an Assessment Framework for Affordable and Sustainable Housing.*
13. *Winston, N., Pareja-Eastaway, M. (2008). Sustainable Housing in the Urban Context: International Sustainable Development Indicator Sets and Housing.*
14. *Chiu, R.L.H. (2003). 'Social sustainability, sustainable development and housing development: The experience of Hong Kong' in Forrest, R. & Lee, J. (ed.) Housing and Social Change: East-West perspectives.*
15. *Kabir, T. (2012). Housing Affordability of Slum Dwellers in Slum Resettlement Project- A Case Study of Bhasantek Rehabilitation Project, Dhaka, Bangladesh*
16. *Mulliner, Emma & Smallbone, Kieran & Maliene, Vida. (2013). An assessment of sustainable housing affordability using a multiple criteria decision-making method.*
17. *DW. (2015, February 18). Learning from Integrated Housing Development Program in Addis Ababa. http://www.dw.angonet.org/forumitem/learning-integrated-housing-development-program-addis-ababa*
18. *Teferi, ZafuAssefa & Newman, P. (2017). Slum Regeneration and Sustainability: Applying the Extended Metabolism Model and the SDGs.*
19. *Delz, S. (2016). Ethiopia's Low-Cost Housing Program – How Concepts of Individual Home-Ownership and Housing Blocks Still Walk Abroad.*
20. *Hussain., Saha., Rabbani., Pervin., Shamma., Khan., (2015). State and the Low-Cost Housing for the Poor: Fall of Bashentek Rehabilitation Project (BRP) in Dhaka City: Bangladesh*
21. *PPRC. (2016). Politics, Governance and Middle-Income Aspirations: Realities and Challenges.*
22. *Arman, T.U. (2017) 'Rehabilitation of slum dwellers: Taking the right approach', Dhaka Tribune, 03 March. https://www.dhakatribune.com/bangladesh/dhaka/2017/03/03/rehabilitation-slum-dwellers-taking-right-approach/*

Welcoming Water for Changing Urban Morphology: A Biophilic Design Approach

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Abstract: *Over time, water resources were important factors in the development of cities and their living environments. Consistently, urban inhabitants are neglecting its role and sometimes have overlooked vulnerabilities resulting water-related disaster, for instance, water scarcity, flooding, waterlogging, drought etc. Watercourses are not only essential for urban ecological environments but also significant in influencing and confining its surrounding urban development that performs in an inclusive way for the shaping of the societies. Notably, the use of water technology into agriculture, water transportation, water-based trade/business, even tourism development sectors are implicitly encouraged in water-based land development. Achieving sustainable urban water management (SUWM) for growing cities is a crucial aspect, especially for developing countries facing the challenges of environmental and contextual factors to utilize water resources and water-based architecture. Many researchers have addressed these issues and finding possible solutions through using water sensitive urban design (WSUD) tool to minimize immediate impacts. The gaps on connecting inhabitants with nature, and institutional practices are creating conflicts in sustainable landscape management. The main aim of this paper is to introduce design-based research to revive a Biophilic practice-based morphological paradigm which can reveal a challenging strategic approach to think and act out of the box to use a much higher range of practical solutions along waterscapes. Biophilia is humankind's inherent biological linkage with nature, which helps to articulate this relationship between the natural and built environment, so that people may experience the benefits through the design applications. The city of Chittagong is considered as the study space because it has worthy water-based landscape resources but waterlogging is an alarming phenomenon in the last decade or so. This has negatively affected the urban built environment, especially as a major threat to local business such as wholesale markets which are along natural canals. Improper water drainage systems and lack of water catchment areas in and around residential areas are suffering because of trapped water in an unpredictable manner. The study analyses the user's perceptions for measuring their attitude level on to use and/or consider water-landscape through a key informant questionnaire survey. The results show that less visual connectivity, limited physical accessibility, and building backdrop have created a psychological and contextual conflict to water landscape use. The potentiality of water landscape-based architectural morphology would be the fundamental approach for changing new urban morphology through transformin water-disaster (e.g., waterlogging, rain/storm-water runoff) to an opportunity.*

Keywords: Biophilic Architecture, Urban Morphology, Water-Landscape, Waterlogging, Water Sensitive Urban Design

Introduction

Over the past, waterways have been degraded by intense urbanization raising significant environmental challenges including extreme weather events, drought, flooding, waterlogging (Costa *et al.*, 2015). Such challenging conditions have been evident across many cities and towns in developing countries where societies have become less concerned to protect and manage the local environment. However, using as a dumping ground for solid waste, and encroaching for illegal constructions, natural waterways have become narrow and polluted, which affects the living quality of adjacent inhabitants(Akter, Mohit and Chowdhury, 2017). To protect the natural environment and minimize adverse impacts from extreme events, it is a fundamental issue to establish urban water management (UWM) in developing countries containing effective and efficient integrated tools for sustainable strategies (Yu *et al.*, 2018).

In the absence of such integrated tools, researchers and practitioners are facing challenges to create sustainable urban water management through improving water landscape. So, the paper attempts to fill up this gap by investigating empirical evidence to links water-edge design and professional practices. The main objective of this research is to create a built environment assist by professional practices considering water logging scenario through (1) identifying stakeholder's perceptions on to use and/or connectivity to water landscape, (2) analyzing building (residential and commercial) functions according to visual and physical linkage with surrounding (e.g. waterscape, roads, other side), and (3) designing possible parameters for built environment practices considering water logging scenario and related planning approaches suggested in literature.

The city of Chittagong is considered for a study region having worthy water-based landscape resources, whereas stormwater management (e.g. waterlogging) is a comparatively most alarming phenomenon. From the last decade, it has adversely affected the urban built environment especially threaten mostly to local business, wholesale markets, and residential areas which are placed on the edge of natural canals (Figure 1) (Akter, Mohit and Chowdhury, 2017). This is not a distant past when canals were used for shipping goods by boats laden.

Figure 1. The daily newspaper's highlight on storm water-disaster scenario around urban built environment.

As Chittagong city has hilly topography where west-side has sea (Bay of Bengal) and another side has Karnaphuli River, it might be performed as downstream water flow, but has not been such

evident. However, no responsive approaches have been found in professional practices alongside watercourses. Surprisingly, this city is located in the tropical region, where heavy rainfall of the summer season and tidal water stream as a general characteristic have been there for centuries. Annual rainfall of this city fluctuates between 2100mm and 3800mm, of which 2400mm occurs only during the monsoon (Mamun, 2018).

Literature Review

In recent trends of developed cities have addressed different terminology to accommodate UWM through integration of natural landscaping such as Sustainable Urban Drainage Systems (Liu and Jensen, 2018), Low Impact Development (Liu and Jensen, 2018), Water Sensitive Cities index (Chesterfield *et al.*, 2016), Water Sensitive Urban Design (Wong, 2006), Ecologically Sustainable Development (Wong and Brown, 2011), Green Infrastructure Strategies (Liu and Jensen, 2018) and Sponge city (Zhang, 2017; Liu and Jensen, 2018). Significantly, Water Sensitive Urban Design (WSUD) approach is a prominent concept used in Australia, Canada, Singapore, and UK whereas fewer cases of Asian developing cities have addressed in water-related disasters (Ashley *et al.*, 2013).

WSUD represents adaptive management employed by urban professional/practitioners who offer various footprints into urban morphology incorporating building architecture, and landscape architecture from local to global level (Wong, 2007). However, it plays a sustainable role in designing and managing urban water-edge by the prime principle of promoting and protecting natural waterscapes as the way to mitigate storm-water runoff and waterlogging scenario (Melbourne Water, n.d.; Wong, 2007). However, the large part of this tool depends on spatial and land use control, and the application of technical installation into built-form rather than architectural formation and design with landscape unit. Additionally, such concepts, especially WSUD offer a traditional theoretical approach which is still lacking to express a concrete vision for emerging inhabitants with waterscape. To date, integration between people and the biophysical environment have not been addressed for making city sustainability. Moreover, water channel morphology can be protected and restored by using the opportunities of disaster events (Vietz et al., 2016). Despite that scope, need an inclusive empirical framework to juxtapose between waterscape and adjacent spaces (e.g., inhabitant, living spaces). Besides, less empirical studies established an explicit relation with the waterscape and built form through how locals can access properly to use waterscapes and how they can interpret visually rather than using as a backdrop of built-form (Smith and Ferrari, 2012).

Architectural practices involve mainly designing building type for building style and using different materials and technologies instead of psychophysiology (Downton *et al.*, 2017). Nonetheless, how the cities can be achieved a balanced integration by reviving water-landscape using a psychophysiological approach into architectural practices that have to be investigated and instituted. Nowadays, contemporary practices of architecture ignore and/or abuse to use nature-based integrated design. So, there is an urgent need of landscape-based analysis for crafting and designing more sustainable urban environment along urban waterscapes.

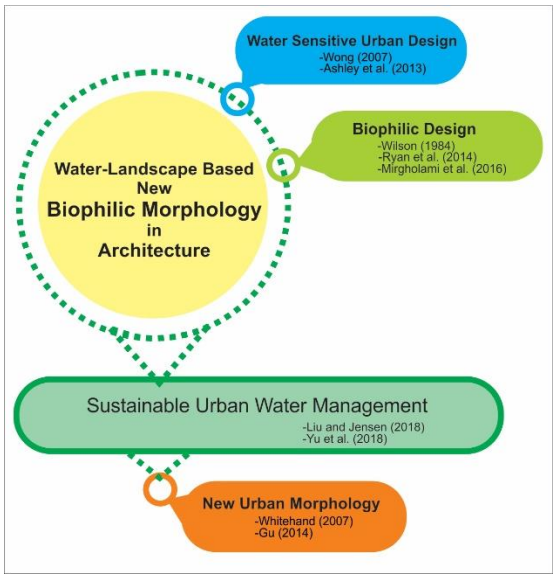

Figure 2: Conceptual framework (adopted from Ashley et al., 2013, Gu, 2014, Liu and Jensen, 2018, and Mirgholami et al., 2016)

According to Wilson (1984) and Ryan *et al.* (2014), 'Biophilic Design' approach is an alternative application that suggests an inherent bond between human and their living systems (Downton *et al.*, 2017). Therefore, this paper focuses on design-based framework aiming to create a water landscape-based architectural morphology through considering water-related extreme events as an opportunity (Figure 2). The novelty of this design research can link to the global context that enhances nature and will help in sequence to accelerate responsiveness among architects and urban designers in designing building and urban facilities.

Biophilia and Biophilic Design

The word Biophilia is formed of 'Bio' and 'Philia' where 'Bio' refers 'relating to living things or life' and 'Philia' refers 'affection with all thing in nature around them'. So, Biophilia refers to innate feelings with nature and another form of life, as opposed to 'fears'. In 1964 by Erich Fromm was used first to describe the psychological attraction to all things that are alive and vital (Mirgholami et al., 2016). Later, it is popularized by Harvard scientists and experts where Wilson (1984) defined Biophilia as 'the innately emotional affiliation of human beings to other living organisms' (Beatley and Newman, 2013). Nowadays, this concept becomes increasingly popular among architects, planners, and urban designers as to integrate built form to the natural environment through good design at a different scale (e.g. city, region, local, neighborhood, building to block). Biophilic design method and techniques are applicable as various forms of built structure and landscape design process that demonstrates Biophilic Architecture to Biophilic sensibilities which can restore biodiversity (Downton *et al.*, 2017).

On the other hand, many research works have discovered the benefits of physical fitness and psychological resilience strongly connected with natural settings and living environments. Beatley (2011) has indicated that humans need to interact daily with natural context for a prolific and healthy life. Besides, design experts Bill Finnegan and Stephen Kellert revealed that the application of Biophilic design brings inhabitants closer to nature through enabling the experiences of natural ventilation and natural lighting, resembling built form and natural landscapes (Duzenli, Tarakci Eren and Akyol, 2017). Despite this acknowledged aids, modern practices have enforced for separating societies from natural or living systems by disengaging natural settings and expressing the dominancy above nature. Figure 3 demonstrates the benefits of Biophilic design approach in urban planning and design perspective.

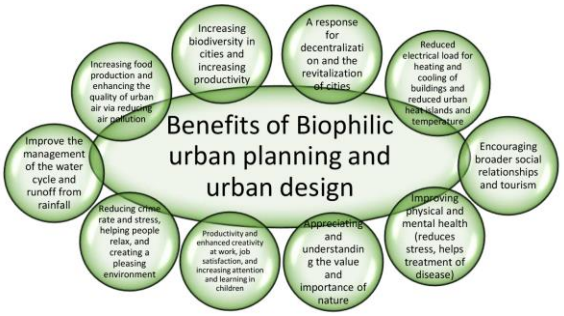

Figure 3: Benefits of Biophilic urban design/ adopted from (Mirgholami et al., 2016)

On health and wellbeing, Ryan *et al.* (2014) have proposed '14 Biophilic Design Patterns' where (1) visual connection with nature, (2) presence of water, (3) connection with natural systems, (4)

thermal and airflow variability, (5) dynamic and diffuse light, and (6) biomorphic forms and patterns are offered an alternative architectural morphological paradigm to enhance more sensitivity on water-based landscape management.

Materials and Methods

Study area

This research has selected a 2 km length of the upstream water canal (known as Chaktai Khal which is approximately 6.5 km length whereas its upstream is located at Bahadarhat point and downstream is connected to Karnafuli river) mention in Figure 4 where both side land use pattern is shown as mixed categories, for instance, residential buildings (private apartment, rentable building), commercial blocks (office buildings, shops, wholesale markets, warehouses), mixed-use buildings, institutions, religious buildings, vegetation, and open spaces. Novelty, the area is suffering from extreme water-logging during the rainy season. Due to water flow from upstream to downstream throughout the year, the upstream area has considered for preparing an alternative morphological paradigm.

Methods

To find out explicit urban morphological pattern adjacent urban watercourse for refining professional and institutional practices and theories, the research will follow exploratory and design based deductive research discovering a pathway through new insights, knowledge, practices come into being. Consequently, five analytical phases have conducted using primary and secondary data sources such as: (1) Reviewing literature for scrutinizing good practices using the search engine and database of scientific journals, (2) Examining physical accessibility and visual connectivity through land use map using satellite images and empirical survey, (3) Studying building layout/function and waterside façade's opening by selecting random building (50 no. of buildings from different land-use categories), (4) Conducting key informant questionnaire survey with inhabitants' settled adjacent waterways, and (5) Preparing Biophilic design parameters to one residential and one trading shop as a prototype guideline.

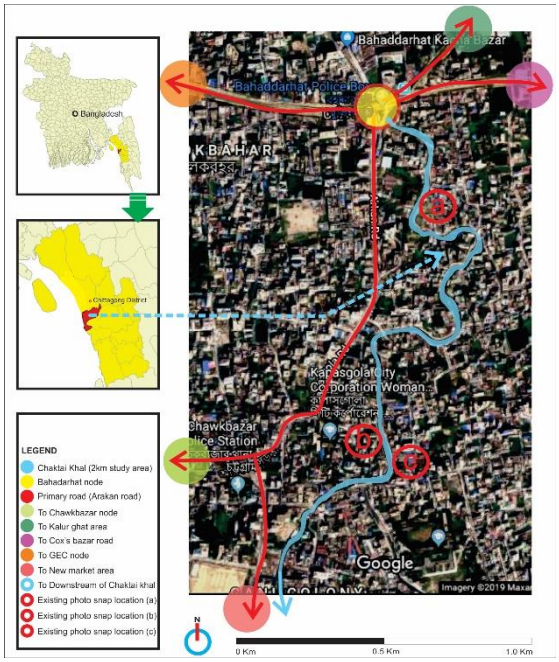

Figure 4: Location map of 2 Km Upstream Chaktai Khal/canal (study area)

Results and Discussions

From the empirical study, the results have shown three distinct pieces of evidence addressing no existence of water-based and/or water-oriented professional practices (see Figure 12 in appendix).

First and foremost, the functional analysis on random building of each category has almost no visual accessibility with watercourse at ground level separated by boundary wall and/or fence (Table 1). This relevant result of visual accessibility has demonstrated the intense ignorance to engage with nature affecting behavioral pattern to un-natural habits and insensitive waterfront design practices.

Table 1: Land-use at ground level along the watercourse

Land-use type (Nos.)	Ground-level uses (along waterside)
Residential (20)	Car parking/garage

	Residential unit
	Generator/machine room
	Caretaker room
	Toilet
Mixed-used (10)	Residential unit
	Warehouse/Godown
	storages
Commercial / Business center (10)	Daily groceries /retail shops
	Business shops
	Wholesale market
	Daily Bazar
Institutional (01)	Playground of school
Religious (02)	Outdoor praying area
	Ablution space
	Accommodation
Slum area (05)	Rentable unit
	Warehouse/Godown
Other Uses (02)	Vegetation
	Walkway
	Abandoned land
	Waste dumping zone

Analyzing functions of upper floor layout (typical level) on residential buildings among 20 no. of random selection, it is confirmed that secondary functions (e.g., kitchen, toilet, and guest bed) are placed near waterway because of having less aesthetical and pleasant value whereas roadside view is the most priority (Figure 5). For instance, about master bed (almost 60%), dining area (about 50%), and childbed (about 45%). Conversely, toilets, kitchen area, and guest bed are designed along waterside cannel about 65%, 55%, and 45% area respectively. Surprisingly, only 5% layout has been considered waterside for placing living room. However, less aperture is identified by designing windows for kitchen and toilet in waterfront facades frequently. Besides, some building facades have remained solid surface without compelling climatic benefits as well. Most of the cases, the reasons behind are mentioned by locals and experts such as intense waste dumping activities, smell, worst water surface, polluted airflow, intensity of harmful bugs, and unpleasant view to water canal, especially during the rainy season.

Secondly, another relevant result is illustrated from satellite image and empirical observation is that no physical accessibility has been established to connect adjacent waterways. Significantly, property boundary wall and canal side walkway have created barriers to physical accessibility resulting tendency for users to throw waste behind the wall as usual.

Based on user's perception (Figure 5), the final observation is coded the water canal is using as building backdrop. Almost 90% of inhabitants believe that the adjacent canal is retained as wastewater channel and dumping ground. However, connecting building drain including sewerage line have made that statement more validated. Moreover, no such evidence are found to link intense professional involvement for considering water landscape use and treating building elevations with surrounding built environment.

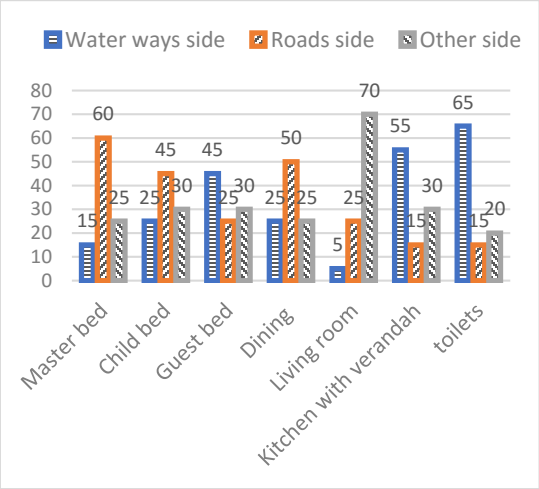

Figure 5: Percentage of residential building functions designed comparing with different sides

In Table 2, the study has proposed some parameters of Biophilic design where different land use and/or functional use has been replaced by explicit architectural illustration (Figure 6-10) which can maximize physical accessibility and reduced visual barrier. In that proposal, the study has considered two empirical plots with an actual sectional dimension. However, observed the maximum (4.5m) and minimum (1m) backside open space are examined.

Table 2: Proposed parameter of Biophilic design paradigm and performance criteria

Design scope	Proposed parameter	*(P), (V)
Boundary wall	No solid boundary wall	P
	Transparent fence wall	V
	Glass wall	V
Functional layout	Living, dining and study area should be placed along waterways due to daylong activities	V
	Toilets and kitchen should be relocated	V
Building facades	Maximum opening	V
	Minimize services opening	V
	Maximum lighting and ventilation ensure	V
	Outdoor terrace/verandah	V
	Used glass window/door	V
Ground floor function in residential building	Car parking with outdoor seating area	P, V
	Garden area	P
	Plantation	P
	Play zone for kids	V
	Ghatla/outdoor deck	P
	Community space	V
Ground floor function in commercial /business area	Product/goods display area excluding storage	V
	Accessibility from canal/waterside for loading and unloading goods	P
	An alternative way for shop access	P
	Reduce partition wall	V
	Ensure visual aperture for eye-level	V
School	Playground with open-air amphitheater	P, V
Walkway	Vegetation with seating area	P, V
Open Spaces	Recreational spaces/green park for public use, water bodies, water reservoir	P, V

*Physical accessibility = P, and Visual connectivity = V

In Figure 6, a schematic plan of a building plot has been illustrated for designing canal-side setback area proposing as reservoir pond and/or ghat and pedestrian way. Open terraces and verandahs are placed toward waterways including providing green landscape where 4.5m setback area has been designed by pond and/or ghat/seating area along there (Figure 7 and 8). In Figure 9, and 10, the drawings have redesigned waterfront accessibility for loading goods and trading business with pedestrian entrance, and however, created additional pond for daily necessity, and also ensure maximum visual connectivity from different floors. For creating maximum opening of building facades to ensure more visual connectivity, and for designing ghat along waterfront to get scope of physically accessibility, Figure 11 has proposed a typical elevation how the waterways can linkage for minimizing tendency to use as building backdrop.

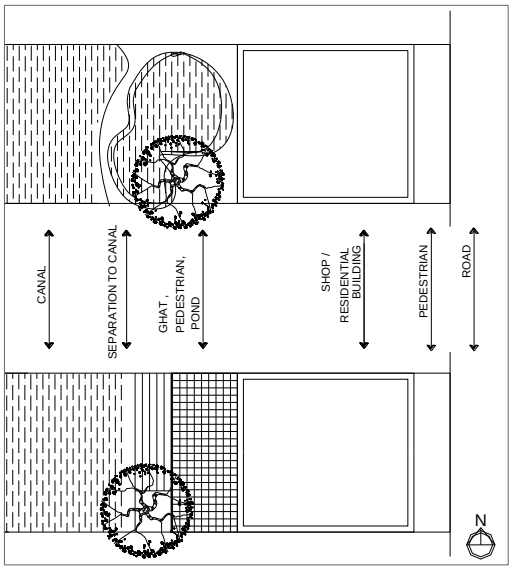

Figure 6: Typical site plan for proposing waterfront accessibility

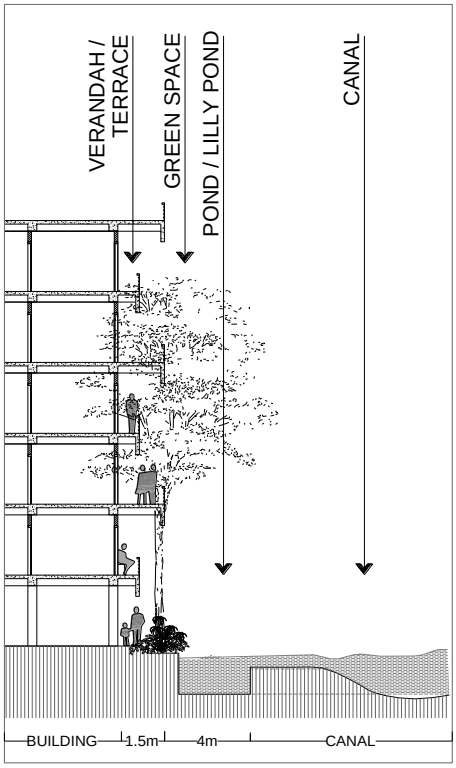

Figure 7: Typical residential building section with landscape feature and/or pond at existing 4m setback along canal

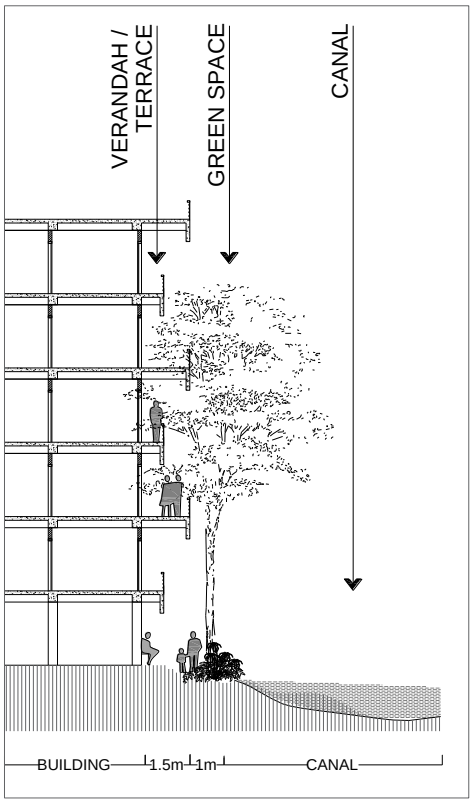

Figure 8: Typical residential building section with landscape feature at existing 1m setback along canal

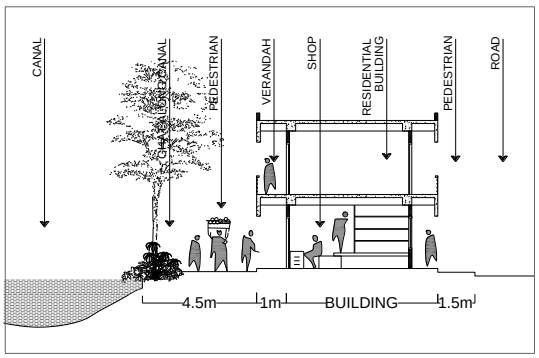

Figure 9: Typical mixed-used building (shop and residential use) section with landscape feature at existing 4.5m setback for waterfront accessibility both physically and visually

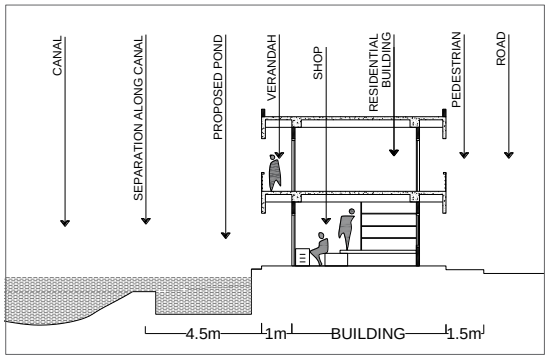

Figure 10: Typical mixed-used building (shop and residential use) section with landscape feature at existing 4.5m setback for waterfront accessibility both physically and visually

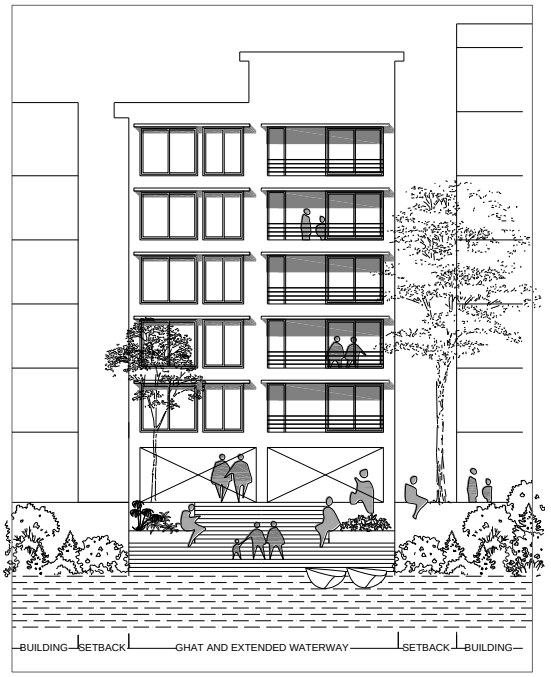

Figure 11: Proposed typical building opening pattern and verandah, and hat toward waterfront

Conclusion and Recommendation

This study has attempted to evolve a Biophilic design approach for demonstrating how natural watercourse can be restored and engaged through morphological interpretation supporting WSUD practice which can additionally promote sustainable urban water management. Biophilic design tends to reveal two primary focuses such as (1) in building design, to create more functional integration through visual linkage with outdoor environments, and (2) in landscape design, to create more water sensitive outdoor space targeting to change human behavior on water landscapes. So, if the inhabitants receive a scope to engage with the pleasures of waterscape rather than measure a space for accumulation of waste-channel, the urban fabric will exhibit inclusive contextual sensitivity. These design parameters will not only encourage an emotional engagement to water-based landscape settings but also ensure physical accessibility and visual connectivity with adjacent build environments through changing their attitudes. Therefore, Biophilic design is required for architectural harmony with nature. This concrete perspective through translate psychological behavior into architectural excellence by welcoming water events can equipped professionals involvement (e.g. architects, landscape architects, and urban designers) resulting in the new paradigm of urban morphology of Chittagong city, and the waterways can render clean, safe and enjoyable environments to healthy social-economic returns. Consequently, these possible directions should be added into building design strategies, such as ‘Bangladesh National Building Code (BNBC)’. However, more future research can be focused to measure the smart architectural design applications on the changing contextual landscape settings.

Acknowledgments

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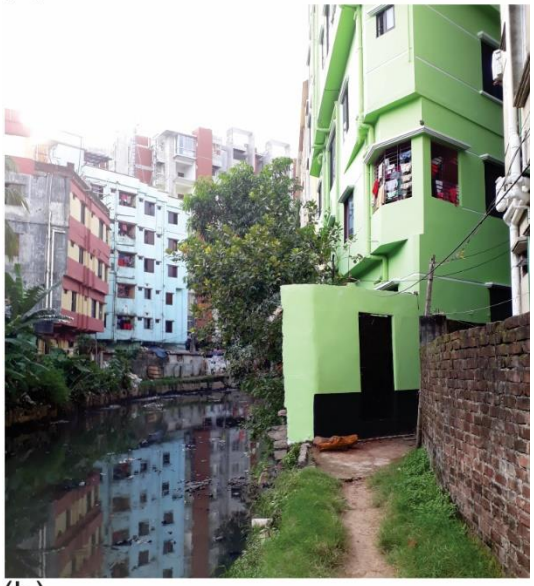
Appendix

(a)



(b)

(c)

Figure 12: Photos of existing area (a) no visual connectivity from ground and first floor level, (b) limited opening to water front, and (c) public activity along waterway with no physical linkage.

References

Akter, A., Mohit, S. A. and Chowdhury, M. A. H. (2017) 'Predicting urban storm water-logging for Chittagong city in Bangladesh', *International Journal of Sustainable Built Environment*. The Gulf Organisation for Research and Development, 6(1), pp. 238–249. doi: 10.1016/j.ijsbe.2017.01.005.

Ashley, R., Lundy, L., Ward, S., Shaffer, P., Walker, L., Morgan, C., Saul, A., Wong, T. and Moore, S. (2013) 'Water-sensitive urban design: opportunities for the UK', *Municipal Engineer*, 166(2), pp. 65–76. doi: 10.1680/muen.12.00046.

Beatley, T. (2011) *Biophilic Cities Integrating Nature into Urban Design and Planning*. Edited by E. O. Wilson. NW, Washington: Island Press. Available at: http://biophiliccities.org/what-are-biophilic-cities/birmingham/.

Beatley, T. and Newman, P. (2013) 'Biophilic cities are sustainable, resilient cities', *Sustainability*, 5(8), pp. 3328–3345. doi: 10.3390/su5083328.

Chesterfield, C., Urich, C., Beck, L., Burge, K., Charette- Castonguay, A. R. R. B., Dunn5, G., Haan, F. de, Lloyd, S., Rogers, B. C. and Wong, T. (2016) 'A Water Sensitive Cities Index - Benchmarking cities in developed and developing countries', *International Low Impact Development China Conference*, (September), pp. 1–9.

Costa, C. S., Norton, C., Domene, E., Hoyer, J., Marull, J. and Salminen, O. (2015) *Water as an Element of Urban Design: Drawing Lessons from Four European Case Studies*, *Sustainable Water Use and Management*. Edited by W. Leal Filho and V. Sümer. Cham: Springer International Publishing (Green Energy and Technology). doi: 10.1007/978-3-319-12394-3.

Downton, P., Jones, D., Zeunert, J. and Roös, P. (2017) 'Biophilic Design Applications: Putting Theory and Patterns into Built Environment Practice', *KnE Engineering*, 2(2), p. 59. doi: 10.18502/keg.v2i2.596.

Duzenli, T., Tarakci Eren, E. and Akyol, D. (2017) 'Concept of Sustainability and Biophilic Design in Landscape Architecture', *The Journal of Academic Social Science*, 5(June), pp. 43–49.

Gu, K. (2014) 'From urban landscape units to morphological coding: Exploring an alternative

approach to zoning in Auckland, New Zealand', *URBAN DESIGN International*, 19(2), pp. 159–174. doi: 10.1057/udi.2013.21.

Liu, L. and Jensen, M. B. (2018) 'Green infrastructure for sustainable urban water management: Practices of five forerunner cities', *Cities*, 74(October), pp. 126–133. doi: 10.1016/j.cities.2017.11.013.

Mamun, M. M. AL (2018) *Improve urban waterways management in Chattogram city - Op-Ed - observerbd.com*. Available at: https://www.observerbd.com/details.php?id=149108 (Accessed: 4 July 2019).

Mirgholami, M., Ghobadi, P., Shakibamanesh, A. and Medghalchi, L. (2016) 'Developing Criteria for Urban River Restoration based on Biophilic and water sensitive approaches* Developing Criteria for Urban River Restoration', *The Scientific Journal of Landscape*, 8(October 2018), p. 36. Available at: http://www.manzar-sj.com/?_action=showPDF&sc=1&article=44723&_ob=b5ce91d5236382f3dec1fceddb77dd49&fileName=full_text.pdf.

Ryan, C. O., Browning, W. D., Clancy, J. O., Andrews, S. L. and Kallianpurkar, N. B. (2014) 'Biophilic design patterns: Emerging nature-based parameters for health and well-being in the built environment', *Archnet-IJAR*, 8(2), pp. 62–76.

Smith, H. and Ferrari, M. S. G. (2012) *Waterfront Regeneration Experiences in City-building*. 1st edn. Edited by H. Smith and M. S. G. Ferrari. USA, Canada: Routledge.

Vietz, G. J., Rutherfurd, I. D., Fletcher, T. D. and Walsh, C. J. (2016) 'Thinking outside the channel: Challenges and opportunities for protection and restoration of stream morphology in urbanizing catchments', *Landscape and Urban Planning*. Elsevier B.V., 145, pp. 34–44. doi: 10.1016/j.landurbplan.2015.09.004.

Whitehand, J. W. R. (2007) 'Conzenian urban morphology and urban landscapes', in *6 th International Space Syntax Symposium*, p. ii-1-ii-9. Available at: http://www.spacesyntaxistanbul.itu.edu.tr/papers/invitedpapers/Jeremy_whitehand.pdf.

Wilson, E. O. (1984) *Biophilia*. Cambridge, Massachusetts, and London, England: Harvard University Press.

Wong, T. (2006) 'Water sensitive urban design - the journey thus far', *Australasian Journal of Water Resources*, 10(3), pp. 213–222. doi: 10.1080/13241583.2006.11465296.

Wong, T. and Brown, R. R. (2011) 'Water sensitive urban design', in Grafton, R. Q. and Hussey, K. (eds) *WATER RESOURCES PLANNING AND MANAGEMENT*. 1st edn. New York: Cambridge University Press, pp. 483–504.

Yu, H., Song, Y., Chang, X., Gao, H. and Peng, J. (2018) 'A Scheme for a Sustainable Urban Water Environmental System During the Urbanization Process in China', *Engineering*. Elsevier Ltd. doi: 10.1016/j.eng.2018.03.009.

Zhang, J. (2017) *Assessing the Application of Sponge City to Downtown Guelph*. The University of Guelph, Guelph, Ontario, Canada.

Charity Organized Youth Camp Contributes to the Reshaping of Rural Landscape_ A Case Study of Raleigh Guizhou Campsite Project

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Abstract: *Rural landscape has been one of the shared attributes of Asia. It is a comprehensive embodiment of natural, societal, economic and cultural ecosystem. In the past few decades, the decline of rural landscape in China has been seen as a result of the rapid urbanization with prioritized resource allocation to the cities. To address this situation, rural rejuvenation was proposed as a national strategy in recent years to redirect resource and attention to rural area. The key to rural rejuvenation is bringing back people and value-generating events. The specific approaches require diverse supports. Among these supports, charity organized youth camp can serve as a valuable intervention in rural development and contribute to landscape reshaping as it can effectively integrate social resources to promote interaction among people, events and places. The design, construction and operation of Raleigh Guizhou Campsite Project offers an example in this regard.*

Keywords: Rural Landscape Reshaping, Charity Organized Youth Camp, Vernacular Transformation, Experience-awakening Construction, Sustained Empowerment

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Introduction

Despite varied difference, rural landscape has remained a basic landscape of Asia. In most cases, it has been or is still being challenged by urbanization. In the past few decades, China underwent a rapid urbanization process along with prioritized resource allocation to urban, outflow of rural population and declining rural landscape. In recent years when rural rejuvenation was proposed as a national strategy (Government of China 2018), various resources were injected into rural area and keep reshaping the environment. This means both a policy-triggered opportunity and some potential risks. As rural landscape is a comprehensive embodiment of natural, economic and cultural ecosystem, single-dimensional and indexes-oriented resource allocation may have irreversible negative influence on it.

Charity organized youth camps such as Raleigh, have attributes i.e. flexible land utilization, quick construction, light intervention, people and events gathering. They can serve as an effectively intervention to bridge urban with rural, social organizations with local communities, youth development with rural activation.

Based on researches of the local conditions of Guizhou's mountainous area, construction experience of international campsite and the Raleigh mode, the paper introduced the case of Raleigh Guizhou Campsite Project, which combines youth camp with rural community center. It was illustrated from three perspectives i.e. vernacular transformation of the campsite typology, experience awakening with adaptable construction, and mutual empowerment by continuously introducing events. The paper also elaborates on how to renew people's cognition about the value of local resources through the implementation of the site-specific symbiosis concept, how to promote individual development and activate community through people-event-place interaction. Thus, it presented the potential on creating positive and sustained reshaping of rural landscapes.

China's Rural Landscape in Rapid Reshaping

Rural landscape is a comprehensive embodiment of natural, economic and cultural ecosystem where human integrate with land, industry, culture, lifestyle, tradition, etc. A good reshaping result means the improvement of the systematic interaction instead of the growth of some individual indexes.

Due to the urban-rural dual structure, China's rapid urbanization has exerted tremendous impact on both urban and rural areas. The urban area has been prioritized in national resources allocation, while the rural area served as strategic support. Such imbalanced development widened the gap between the urban and the rural. Many young and middle-aged rural people turned into migrant labors in cities, causing social problems such as rural hollowing-out and left-behind children. Along with the loss of vitality and charm of country life, the rural landscape declined unavoidably.

Therefore, although rural decline is a systemic issue, the key lies in the outflowing population. For rural rejuvenation, it is important to attract-return people and introduce value-generating events to inspire sustained interaction between people and individual development. Meanwhile, people's cognition about the value of local resources should be renewed to retrieve the sense of belonging. These are able to help activating the communities and reshaping a rural landscape full of vitality.

In recent years, China has seen a trend of re-balancing the urban-rural relation. Based on the targeted poverty-alleviation and "Beautiful Countryside" programs (Yang et al. 2018), the country proposed the rural rejuvenation strategy, making the rural development a concerned topic. Funds and resources flooded into the rural areas through the government-led poverty-alleviation projects and enterprise-invested tourism projects. The rural environment is undergoing a rapid reshaping process.

For rural areas, this means both a policy-triggered opportunity and some potential risks. The instantaneous distribution of single-dimensional and indexes-oriented resource, which usually seek quick return, may shake the already vulnerable natural and social ecosystem in rural areas and have irreversible negative influence on its landscape. For example, some "new rural constructions" are too politically driven. They duplicated some typical traditional residence form and resulting in a stereotype of identical village appearance. Some tourism projects directly convert the elements of traditional culture into consumption-oriented cultural symbols to cater for tourists' fantasy about villages, turning villages into stage scenes without original charms from real lifestyle. (Wang et al. 2019)

Therefore, the rural landscape reshaping should be subject to prudent consideration. At the same time, more diversified modes are to be explored to make it an open public realm toward sustained progress. Among these, charity organized youth camp residing in rural areas has the potential to help reshaping rural landscapes for its activity mode and architectural characteristics

Integrating Charity Organized Youth Camp with Nature and Community

The organized youth camp can be defined as "a kind of continuous experience that offers an opportunity for creation, entertainment and education. In outdoor group activities, venturers embrace physical, social, and spiritual growth by immersing in nature and receiving training from well-trained trainers" (ACA). Historically, the organized youth camp was originated from the urban expansion, and promoted as a youth development method. It enables participants to seek their relationships with companion, natural environment and social communities, and address mental and physical issues caused by "urban illness" (Bentley et al. 2014). Therefore, the organized camp itself, with place-duration and space-event characteristics (Hailey 2009), is actually an intermediary between city and nature.

The practice of landscape reshaping via the intervention of youth camp can be traced back to the 1930s. American National Park Service worked with Civilian Conservation Corps to build camps in national forest parks and transform the surplus agricultural and marginal land through abstemious and organized intervention (Carr 1998). The camp activities were promoted as the symbol of American pioneering spirit and traditional lifestyle. So cultural meanings were injected into the natural environment. In the 1950s, Eisui Village in Kumamoto-ken, Japan, joined hands with the Young Men's Christian Association (YMCA) in building the Kumamoto YMCA Camp. The village provided the land to YMCA for free. The camp organized youth develop activities for both young people in the community and beyond. It helped to promote the quality and moral level of the local young people, ease the pressure of young labor outflow and support the development of the local community. (Kumamoto YMCA Camp)

Founded in 1978 in UK, Raleigh International is a sustainable development charity organization focusing on creating lasting change through youth. Raleigh projects organize youth of diverse backgrounds to go deep into the underdeveloped regions and carry out activities of three themes: community, environment and adventure. Under the guidance of experienced volunteer, they learn and growth together with the local youth. (Raleigh International) The Raleigh mode shares something in common with the traditional youth camps while shows some distinctive features as well. It values the deep interaction with local communities and emphasizes the immersive experience with the natural environment and cultural customs of the project sites. So, this mode has the potential to create sustainable benefit for both participants and the local communities.

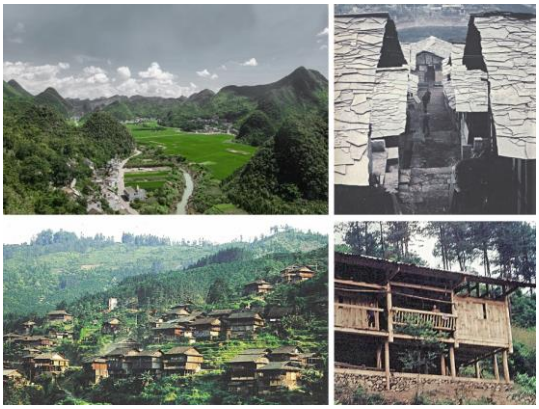


Figure 1: The mountainous environment and traditional architectures in Guizhou *(Qide Luo. (2012) Guizhou Residence (in Chinese). Beijing: China Architecture and Building Press.)*

In 2008, Raleigh China was established in Shanghai and began to launch charity organized youth camps. With years of organization experience in Guizhou, Raleigh China decided to build its first campsite in the southwest Guizhou Autonomous Prefecture in 2013. This project offers an opportunity to explore how to establish a platform for both youth development and community activation by design, construction and operation, so as to help reshaping a rural landscape full of vitality.

Project Description

This Project is located in Pingqiao Village, Zhexiang Town, Zhenfeng County, “Miao” and “Buyi” Autonomous Prefecture in southwest Guizhou.

Located in the southwest China, Guizhou Province has a subtropical humid monsoon climate, enjoying warm weather with mild wind and abundant rainwater all year around. 97% of its lands are covered by mountains. (Yin et al. 2018) The vernacular architecture is in-stilt form and opened up on the ground floor, responding to the rainy climate and mountainous landforms. Building materials are mainly wood, bamboo and stone with rich local resource. These together shape a unique traditional landscape that interweaves the natural beauty with folk customs (figure 1). On the other hand, due to the traffic occlusion caused by the mountainous landforms, Guizhou has maintained the image of underdevelopment historically (Yin et al. 2018). In recent years, changes have taken place because of the implementation of rural rejuvenation policies. Large investments have been made in transportation and infrastructure projects. However, it seemed that the humanistic landscape in these areas did not make positive progress at the same pace. (China's National Editorial Committee of Humanities and Geography 2016)

Pingqiao Village is about 250km away from Guiyang, the capital city of Guizhou Province. “Buyi” and other minority nationalities live together with “Han” people in this community. Similar to many other villages in Guizhou’s mountainous areas, Pingqiao Village faced issues of hollowing-out and left-behind children. As a result of rural school integration, the village primary school was withdrew. The local education bureau and the village committee decided to donate the land use right to Raleigh China, converting the site into a Raleigh campsite. (figure 2)

Environment responding, demand meeting and experience stimulating were three important themes to be integrated in this project. The design was conducted following an overall concept of site-specific symbiosis:

Figure 2: Site status, a withdrew primary school. Children playing in a deserted classroom (Photographed by author)

Vernacular transformation of typology: Response to Demand and Environment

As a mature architectural type, organized youth camp has specific layout paradigm. Vernacular transformation of architectonic paradigm is required to integrate with the rural system in China. Its driving force mainly comes from the response to the specific project demand and the environmental characteristics of the site.

The project site is located on a narrow terrace, where the county road intersects with the village road. There is an existing building in the north and undulating mountains to the south. With an area of only 0.36 ha, the site divided into several irregular plots by the existing building and the terrain. (figure 3) The compact site generated a concentrated layout and general-purpose space, which are different from the decentralized layout of traditional youth camps.

The existing building was renovated into a command center. Taking it as the anchor, a multifunctional pavilion was extended on the south, which integrated functions of group activities, venturers' accommodation and dining. The assembly circle was set on its south for union use. The extending contours of the mountain are ended with semicircular theatres, transforming terrace reinforcement into activity places. These constituted the core area of the campsite, whose space is general-purpose for the possibility to serve as a community center. (figure 4)

A bathhouse was set to the north of the renovated building, with a washing area facing the village farmland. The kitchen slightly extended into the dining area to ensure service on rainy days. To serve the community during camp activities, a village library was provided for children year-round. The library stood on a slope near the campsite entrance. The reading room facing the village road and the reception facing the campsite entrance was connected through a little staircase. This strengthened the interaction between local children, venturers and volunteers. (figure 4)

Figure 3: Project site in Pingqiao village (Project information, drawn by author)

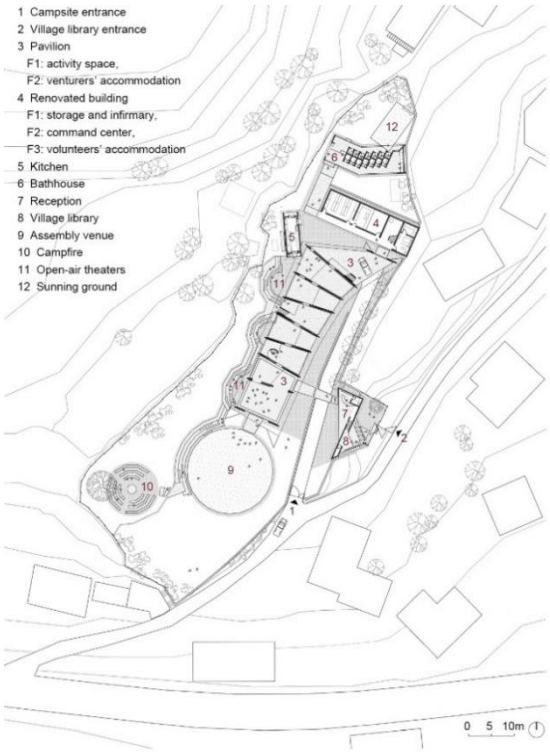


Figure 4: Campsite layout (Project information, drawn by author)

The mountainous environment calls for an open shelter that can establish dialogue with the context while presenting itself in the scale of landscape. The pavilion was roofed with a series of dynamically undulating tensile fabric to cover a continuous and open rain-proof space. The dynamic roofing sections were concluded into a "home-like" form facing the village and mountains, echoing with the mountains and local settlement scenery. (figure 5)

Figure 5: Responding to mountains and local settlement scenery. (Photographed by Yao Li)

An open and interactive relation was created between the campsite and the village. Watching the villagers working in the farmland, the venturers can experience the rural custom, meanwhile, the horizontally unfolding space and activities in it are also visible to villagers and children from the local community, emitting energy like a beacon. This settlement-form layout integrated different elements to create a series of scenarios of campsite blending with the nature and village. (figure 6)

Construction Awakening Experience: Bridging Mountain Landscape, Rural Custom, Camping Activity and Community Service

The key to rural rejuvenation is to draw back people. For this purpose, the project not only need to introduce activities and service continuously, but also provides participants with extraordinary experience that is worth experiencing at site.

For the venturers and volunteers of Raleigh, who are attracted by the concept of “stepping out of the comfort zone”, some real and profound extraordinary experience differing from the routine urban life are expected. For people in the local community, especially children, it is important to defamiliarize the everyday scenes and sharpen the passivated perceptions. Moreover, it is necessary to renew people’s awareness of the neglected local resources, to open up imagination and expectation of new possibilities. But here, the construction has to adapt to the backward-development situation in this area. Implementable construction strategies

Figure 6: The campsite blended with nature and village (Project information, drawn by author)

need to be explored at low cost and low construction accuracy. Following comprehensive consideration, we decided to intervene with the site through a combined approach of lightweight installation and local craftsmanship.

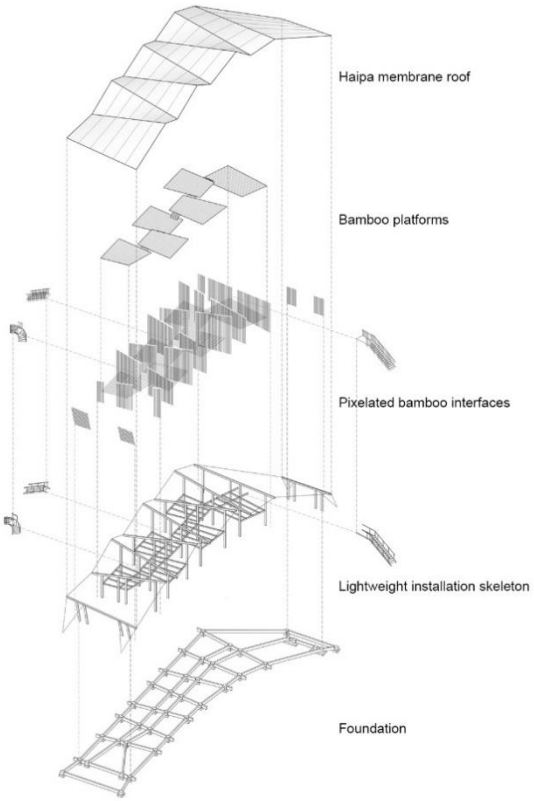


Figure 7: Layered axonometric drawing of the pavilion（Project information, drawn by author)

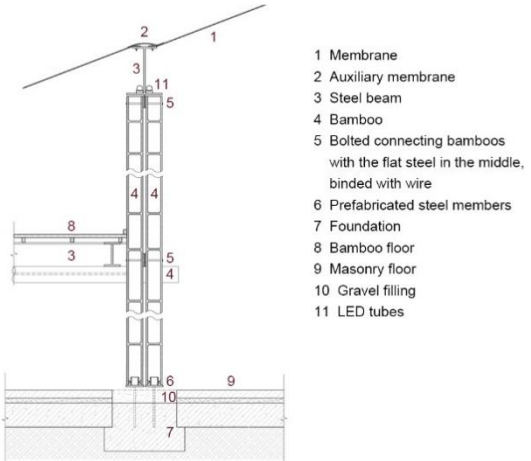


Figure 8: The section of the bamboo partition （Project information, drawn by author)

The tension fabric roofing with light-steel skeleton was manufactured in Guangzhou, and transported to the site for installation, providing continuous rain-proof space for the subsequent construction. (figure 7) The interfaces were made of local bamboos, a low-cost material which is easy to obtain, process and replacement. After processed by local craftsmen in a traditional way (without soaking in chemical reagents), the bamboos were installed onto the light-steel skeleton by Raleigh volunteers. Joints of the bamboo were designed concisely for smooth operation. (figure 8)

Figure 9: The sapce opened to the mountains and village (Photographed by Yao Li)

Figure 10: The bathhouse with a washing area facing the village farm (Photographed by Yao Li, Yang Xiaobo)

Non-orthogonal arranged partitions divided the activity areas on the first floor. Platforms rising slightly in section accommodated venturers on the second floor. This shared the same mode with the local residences, so the traditional lifestyle can be extended in the new architectural function and form. The pixelated bamboo interfaces allow wind, light and sound to pass through. Participants are able to percept the companion's activities, mountain scenery, rural customs, and experience the open and shared campsite atmosphere. (figure 9)

The structure of the service buildings, such as the bathhouse, kitchen and library, were constructed with bamboo-formwork concrete. Their enclosures were built by the craftsmen of "Buyi" ethnic minority with traditional masonry techniques. These merged a traditional and rural "palm print" with low cost. (figure 10) To adapt to the terrain of irregular steep slope, the library was designed into two triangular open frames at different elevations. The wooden flooring, shelf and furniture in the reading room were designed in appropriate scale of the children. The transparent façade presents the internal activities to the village. The library provides a warm place for children to read, play and seek help for their schoolwork. (figure 11)

Manufacturers, local craftsmen and Raleigh volunteers worked in cooperation in this construction system. Combining with the industrial system, the value of local materials and traditional crafts were redefined. The integration of the two offered awakening experiences to people from local communities and beyond.

Figure 11: Children from the local community playing, reading, and interacting with volunteers in the library (Photographed by Yao Li, Raleigh China)

Sustained Empowerment: Diachronic landscape for People-Event-Place Interaction

Launched by charity organization with support of local community, the project was designed by architects leading students as a volunteer team. With fund raised from enterprises based on the design scheme, the construction was jointly completed by manufacturers from Guangzhou,

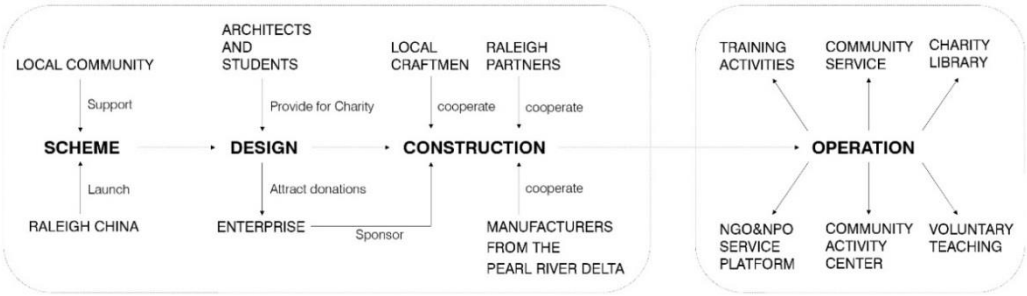


Figure 12: The project flowchart of Raleigh Guizhou campsite (Project information, drawn by author)

craftsmen from local communities and the Raleigh team. This process presents the integration of social resources through charity channels around the issues of rural rejuvenation and youth development. (figure 12)

In less than two years of operation, Raleigh campsite has support 656 venturers for rural practices, serving 23 community-construction programs and 12 environmental programs. (table 1) In addition to the achievements on infrastructure improvement, the process of venturers' community service also form a new humanistic landscape in the villages. (figure 13)

Table 1: Statistics of activities (Statistics came from Raleigh China)

Community program	Amount	Remark
Community road	1	174m
Culture square	6	120-480 ㎡
Community culture wall	1	30m
Community fence	1	223m
Community landscape	2	2X150 ㎡
Community stage	4	4X100 ㎡
School library room	2	12 rooms
School facilities	3	3X120 ㎡
School fence	1	185m
Village committee facilities	2	2X450 ㎡
Environmental program	**Amount**	**Remark**
Dry toilet:	6	6X20 ㎡
Water cellar	3	80-150m³
School trash pool	1	/
School landscape	2	/
Expedition program	**Days**	**Distance**
Longtou Mountain - Youth	7	65km
Baipan River - Expedition	6	80km
Baipan River - Juvenile	4	45km

With regular camping and charity activities, people, events and resources have been continuously attracted from outside into the mountains, promoting the mutual development through long-term interaction.

Raleigh campsite provides “activity areas” (Van Slyck 2006), whose attribute is defined by events and activities. It can be a rural base for Raleigh activities, a growth playground for local children, a community center, or a platform serving other charity organizations and local educational training programs. Thus, a landscape of shifting event is created. (figure 14)

Similar to other camps, Raleigh campsite is an organic entity. It keeps maintaining and adjusting its buildings, sites and facilities along with the changing environment, emerging needs and community feedbacks. The pavilion’s prefabricated structure can be adjusted, reconstructed or dismantled for new demands, while the service facilities will continue to offer stable services. The flexible layout and open boundaries constitute a durational landscape.

Figure 13: Raleigh activities in the villages (Photographed by Raleigh China)

Figure 14: The event-defined space in campsite (Photographed by Raleigh China)

Conclusion

In this case, charity organized youth camp established platforms for camping activity and community service through conducting light intervention in environment, gathering people and events. It bridged urban with rural, social organizations with local communities, youth development with rural activation. It contributed to create a diachronic rural landscape of sustainable interaction of people, events and places. Several cognitions are provided for discussing:

1. Rural rejuvenation is a systemic issue, the key lies in people. It is important to promote individual development and activate community through people-event-place interaction to reshape a rural landscape full of vitality.

2. As single-dimensional and indexes-oriented resource allocations are not long-term solutions. A mode in which both external participants and local communities can benefit from sustained interaction has the potential to activate self-driven rural ecosystems.

3. The images of the built environment are very important but not the ultimate destination of design. Architects may take the demands for systemic activation and the in-depth response to environment as the start-point of design. Construction can be used as an approach to introduce new elements and present the potential of rural resources. It contributes to renew people's cognition and create extraordinary experiences worthy of participation at site.

References

American Camping Association. (ACA) www.acacamps.org

Bentley, M; Mueller, M; Martin, B. (2014) Connect children to nature. Wood N Barnes Publishing & Distribution. P8,98

Carr, E. (1998) Wilderness by Design. United States : University of Nebraska Press. P249-251.

China's National Editorial Committee of Humanities and Geography. (2016) Southwest Guizhou (in Chinese). Beijing: China Cartographic Press. P246-267.

Government of China. (2018) National Strategic Planning for Vitalization of Rural Areas. China

Hailey, C. (2009) Camps -A Guide to 21st-Centure Space. London: The MIT Press. P17.

Kumamoto YMCA Camp. http://www.kumamoto-ymca.or.jp

Raleigh International. raleighinternational.org

Van Slyck, A. (2006) A manufactured wilderness: summer camps and the shaping of American youth, 1890–1960. Minneapolis: University of Minnesota Press. P xxxi.

Wang, C; Wu, Q; Wang, Z. (2019) Research on precise poverty alleviation path of characteristic tourism industry in Guizhou minority areas. Shanghai: Science and Technology Press. P53-54.

Yang, Q; Ma. Y; Jiao, T. (2018) Beautyful country construction (in Chinese). Beijing: China Agricultural Science and Technology Press.

Yin, H; An, Y. (2018) Geography of Guizhou (in Chinese). Beijing: Beijing Normal University Press. P3-25, 247-248

Ethos of Jaipur 'Society'

Tushar Sogani
Abhishek Jain

Abstract: *Here is a famous saying, 'the way we build is a reflection of the way we live.' What is often overlooked is that architecture contributes profoundly to shaping the society we live in today. The city of Jaipur is globally recognized as exemplar of eighteenth century urban planning and has been extensively studied for its* ***cohesive urban morphology*** *and* ***architectural identity.*** *For most, the walled city of Jaipur symbolizes the carefully laid out grid-iron plan organized into neighbourhoods and a* ***uniform urban fabric****. However, Jaipur has constantly re-invented itself, assimilating a range of social and cultural influences, visible in its vast repository of crafts, traditions and architectural expressions. The growing economy and population has led to enormous housing needs, driving the extent of architectural work. We need to work towards '****contemporary sensibility****'—a sensibility that takes the roots and ethos of Jaipur architecture and integrates them into contemporary vocabulary of our society. Changing lifestyles and* ***societal structure*** *have transformed the meaning of architecture for many. The perils of technological exploitation, excessive networking is leading to multiuse of spaces as it is shrinking and the diminishing importance given to culture and heritage are the challenges for architecture in Jaipur today.*

Keywords: cohesive urban morphology, architectural identity, uniform urban fabric, contemporary sensibility' societal structure

Preface

"The mother art is architecture. Without architecture of our own we have no soul of our own civilization." – Frank Lloyd Wright.

This paper examines the incrementally changing architectural identity of Jaipur through specific interventions that seemed to act as catalysts in the evolution of its form and style with the changes in society and its living, professional and hierarchical changes. This paper also traces the evolution of the city's urban form during the twentieth century focusing on the pre-independence and modern developments within Jaipur based on the societal changes in the city. This is done through the analyses of the patterns of urban expansion and the emergence of amalgamated architectural expressions in the society which draw upon multiple influences. Finally, the juxtaposition of new architectural styles in the within the historic fabric is examined along with evaluating its significance in creating the urban identity of modern Jaipur.

Introduction

Jai Singh II founded his city, Jaipur, on November 29, 1727. This city continues to attract visitors from all over the world, and is a part of the 'golden triangle' journey along with Delhi and Agra. Visitors come for handicrafts and art, museums, Rajasthani cuisine and, most of all, to experience the splendors of history and its architecture. The past is within easy grasp, what with the palaces, traditions followed over centuries, and forts in easy driving distance.

Even a cursory examination of Jaipur illustrates themes of power and kingship being articulated through architecture and urban planning. This 18th-century city demarcated by thick walls and gateways carries the palimpsest of centuries, rulers and the changing needs of times. However, Jaipur has constantly re-invented itself, assimilating a range of social and cultural influences, visible in its vast repository of crafts, traditions and architectural expressions perhaps most clearly reflected in the way. This is

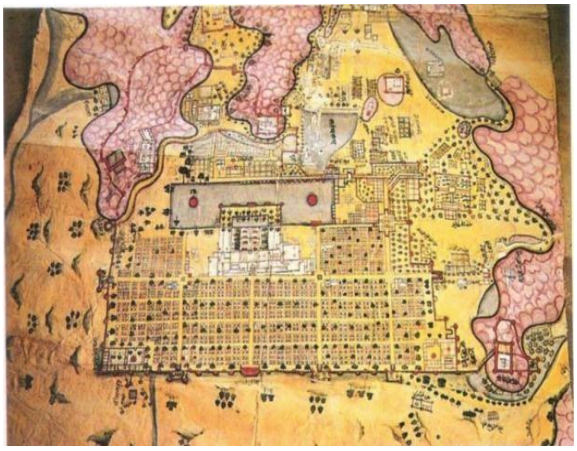


Figure 1: Evolution Of Jaipur

its architectural identity has transformed over three centuries.

The eighteenth century vocabulary drew upon prevailing Mughal and Rajput elements while the nineteenth century buildings show a distinct colonial influence which was merged with the pre-existing fabric. The twentieth century was a period of extensive experimentation for Jaipur. Chief amongst these was the introduction of the Art Nouveau and Art-Deco styles within Jaipur, seen in some of its now iconic urban precincts, including the Mirza Ismail Road. During this period, a number of new residential colonies came up beyond the extents of the walled city along with the newer landmarks of

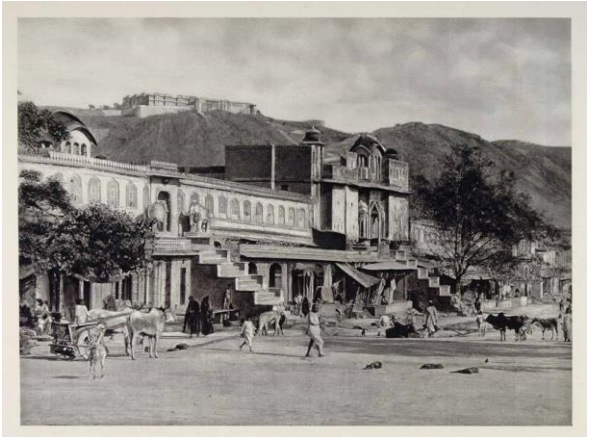


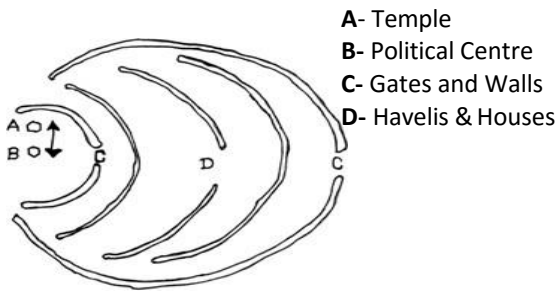
Figure 2: The view of the Choti -Chaupar and Gangori gate in 1875

Jaipur along its primary axes. At the same time, the walled city underwent significant changes.

Nineteenth Century Jaipur and the Evolution of the Indo-Saracenic Style

The latter part of Sawai Ram Singh II's reign (r. 1835-1880) saw the extensive modernization of Jaipur city heavily influenced by the developments in Britain, including a major impact on the traditional arts and crafts of Jaipur and the expansion of the city beyond its walls. The railway line was firmly established towards the western edge of the city and new highways and roads connecting Jaipur to other cities were constructed by the Public Works Department in the 1860s. **The opening of the railway line had heralded a new phase in Jaipur's development and it became a coveted destination, not only for trade and commerce but also for tourism and leisure.**

This campaign for modernization was not limited to urban expansion and the introduction of new institutions but soon became apparent in the buildings constructed within the walled city and elsewhere. The society shifted its focus to motion and transport, communication to different parts of the city.



A- Temple
B- Political Centre
C- Gates and Walls
D- Havelis & Houses

Figure 4: Planning Of Jaipur

One of the leading architects in Jaipur during the nineteenth century was Sir Samuel Swinton Jacob. The author of the Jeypore Portfolio, Jacob built extensively within Jaipur, in a career that spanned over three decades. This amalgamation of styles extended into the twentieth century and is clearly visible in the newer built fabric of the walled city. Individual havelis incorporated several smaller details such as the semi-circular arch, the engaged columns and pediments and the elaborate railing patterns that were characteristic of the prevailing Victorian style.

Jaipur was perfectly suited for this style of architecture and numerous elements introduced by Jacob and his contemporaries in Jaipur were soon seamlessly adopted. The Indo-Saracenic style continued to adapt and evolve well into the twentieth century and examples of this style can be found within the walled city bazaars as well as in buildings commissioned by the royal family. through the Imarat Department. In fact, this trend continued upto the 1940s with institutions such as the Maharani Gayatri Devi School, The Maharaja College and the Maharani College continuing to use adapted versions of the Indo-Saracenic Style.

Figure 3: city views- Street and public library, 1870-1890

At this very stage people were aware of the education system and blended work with the education in daily routine. People wanted to explore more.

At the turn of the twentieth century, the Imarat Department which was now headed by Chiman Lal, a draughtsman trained under Jacob was commissioned to design a reception hall for visitors within the City Palace Complex in Jaipur. This structure would come to be known as the Mubarak Mahal and was executed in 1900. The Mubarak Mahal represents a harmonious mingling of multiple influences and may be considered as one of the finest examples of the blending of colonial elements into the pre-

existing Mughal-Rajput architectural vocabulary of Jaipur. It also proved the fact that its execution heralded a paradigm shift in the way buildings were designed and executed in Jaipur.

Figure 5: Chandra Mahal, City Palace, 1870

The PWD 'Style' of Building

The society again saw a shift in architecture as now there were people commissioned to design the city which led to a different style of architecture. It is interesting to note, that while on the one hand, the 'Indo-Saracenic' style had become firmly entrenched within the architectural sensibilities of the Imarat Department in Jaipur, an altogether different style was being propagated on the outskirts of the city. These were structures of sprawling bungalows, hotel buildings and guesthouses. The PWD structures, for the most part, were utilitarian and almost Spartan in their approach to design, with the barest acknowledgement to the local architectural contexts. This could be attributed to the fact that the focus of the Department was primarily on extending communication and transport networks as a means of bolstering British influence.

Therefore, the first two decades of the twentieth century in Jaipur were beset by diverging schools of thought between the royal family and the British agents, a fact reinforced by the different kinds of architectural vocabulary emerging from the previously unified city**.**

Beyond the Walled City- Building Modern Jaipur

Figure 6: Amer Chowk, 1880

The population of the city was steadily increasing, from 1.2 lakhs in 1921, it rose to 1.44 lakhs in 1931, a substantial growth which could be attributed to the large scale migration that had begun towards the city. The walled city gates, which earlier effectively shut off the city each night, were no longer viewed as a convenient security measure and in 1923; the tradition of closing the gates was discontinued, allowing the city to becom more accessible to visitors.

These administrative changes translated into Jaipur becoming an attractive destination for new settlers; as a result, the boundary of the municipal limits had to be extended on all sides. From an area of seven square miles, the limits increased to eight square miles in1933-34. In 1941, Sir Mirza Muhammad Ismail (1883-1959) had arrived from Mysore as the first prime minister of Jaipur. Though his tenure in the state was brief, extending for a mere four years, he is remembered as one of the 'architects of modern Jaipur'. In Jaipur, his focus was on constitutional reforms and acting as a link between the royal family and the increasingly influential Congress Party. After his investiture with full ruling powers, Sawai Man Singh II had moved out of the City Palace within the walled city to the recently refurbished Ram Bagh Palace. The administrative buildings which had been housed within the Jaleb Chowk next to

the palace were also shifted outside the walled city. This shift of political and administrative power continued, as high ranking officials living began shifting into grand British style bungalows such as the Chaumoo House and the Nayla House.

The geographical location of Jaipur was conducive to expansions beyond its southern edge, beyond the Ajmer highway. It was only by 1941 that a systematic expansion was undertaken by the Municipal authorities to extend Jaipur beyond its original limits.

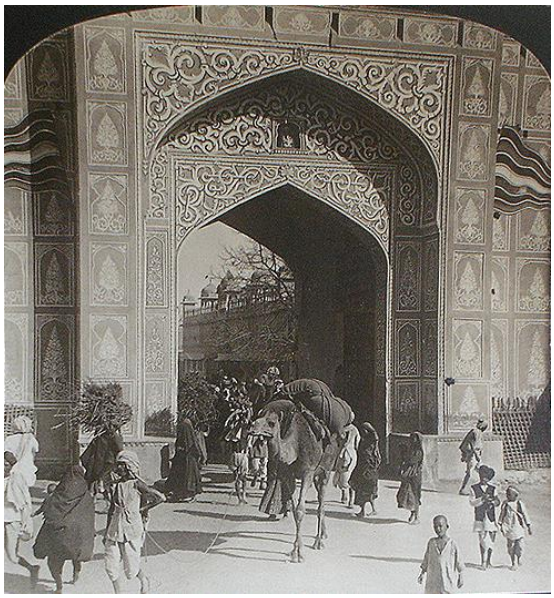


Figure 7: Chanpori Gate, 1907

Under this extension programme, five schemes were proposed:

A. Fateh Tibba
B. The Medical College and the Gangawal Park
C. Ashok Nagar
D. New Colony and Jalupura
E. Bani Park

Various incentives were offered to residents within the walled city to acquire land in these developing areas. In the eighteenth century, Jai

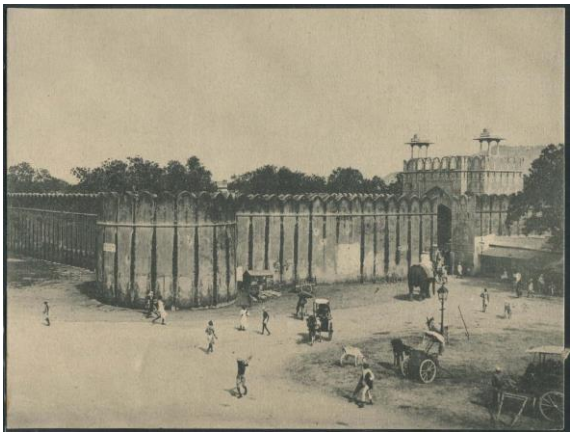


Figure 7: Chanpori Gate, 1907

Singh had envisioned a prosperous city with a thriving trade and a diverse culture of arts and crafts and offered lucrative incentives to prospective settlers. In the same vein, these newly developing areas were sold at deliberately low prices to attract people from within the city. Jaipur thus became home to a new set of residents, once again attracting migrants from surrounding cities and villages.

This level of expansion was unprecedented in Jaipur and in many ways; the twentieth century redefined not only the administrative significance of the city, but also its architectural identity. The compact urban fabric of the walled city begun to make way for a much sparser layout, focused on residential developments.

The typology of residences also underwent a paradigm shift; from the courtyard haveli, which had an immediate response to the street to the recessed private bungalows, distinctly separate from the public realm. The haste of development had gripped the entire country, and in Jaipur this resulted in a disregard for basic services such as water supply, sanitation and public open spaces.
Architecturally, the residential developments of the new schemes were an eclectic mixture of styles. While the planning was fairly consistent, with large setbacks and boundary walls separating the private realm from the street, the elements used to articulate the elevations showed a diverse range in style.

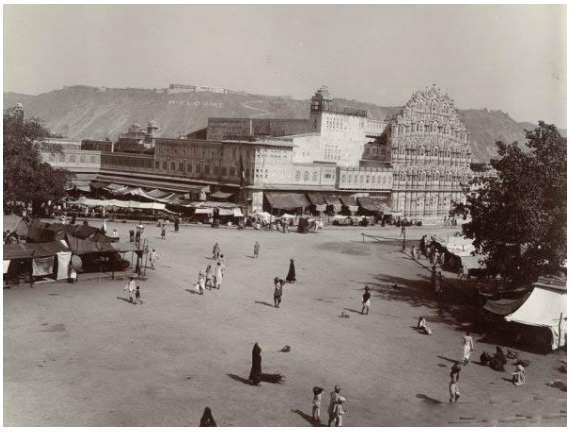


Figure 9: Hawa Mahal and Bazaar, 1905

Local architectural vocabulary was referenced selectively; singular elements such as the curved brackets and chajjas or the stone railings would be used in conjunction with a wholly westernized façade.

New and Renewed: Jaipur's Bazaars in the Twentieth Century

On the one hand, Jaipur's rapid urban expansion in the early twentieth century could be viewed as diminishing its rich architectural traditions. However, some of the city's most intriguing architectural developments also took place in this period. Chief amongst them is the development of the Mirza Ismail Road, one of the iconic market streets of modern Jaipur. With the development of the C Scheme, the highway's significance as a local connector grew and it became one of the prime commercial districts outside of the walled city. The Maharaja was so impressed with the exceptional contributions of Mirza Ismail that he named the road after him.

By the 1940s, several new buildings were constructed on either side of the road, each with the standardized colonnaded veranda module. The shaded verandas, though regularized by the state administration were privately owned and the upper floors were used for residential purposes. This systematic control of the entire road ensured that a cohesive proportional system was maintained, much like in the older bazaar streets within the walled city. Wide pavements were provided on either side of the road, along with ornamental lighting and other civic services. Several significant changes were also made within the walled city during Mirza Ismail's tenure, even though the emphasis was on development beyond the walled city.

The uniform terracotta 'pink' wash introduced in the nineteenth century was renewed after almost three decades. The urban fabric of the walled city was also changing, with the regularized streets and by lanes branching off the main bazaar streets while the inner street networks remained informal.

The bazaars of the walled city including traditional bazaars such as the Johri Bazaar, the Tripoliya Bazaar, the Chaura Rasta and the Sireh Deodhi Bazaar as well as the high-end Mirza Ismail Road together contribute to a specific image of Jaipur as a commercial haven.

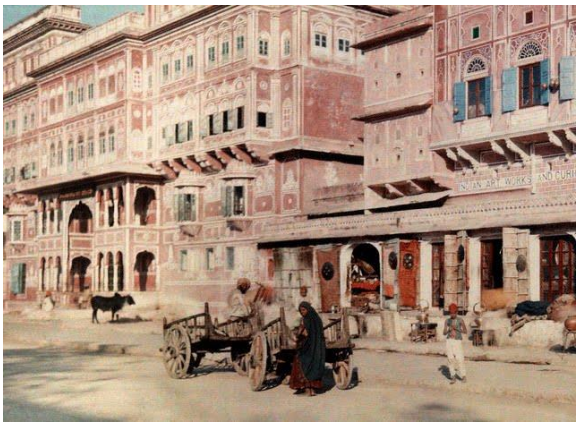


Figure 9: View of a street, 1926

While the bazaars of the walled city are a complex layering of additions and modifications over three centuries, the everyday visitor gets a sense of a unified urban precinct which goes beyond the use of a limited colour palate. The verandas offer a continuity of façade, but at no point do they overpower the individual structures themselves, acting instead, as a foil to the contrasting shapes and forms of the walled city skyline.

Internationally, the Arts and Crafts Movement had begun to dissipate and evolve into simpler and more industrial aesthetics such as the Art Nouveau and later, the Art Deco style. However, in Jaipur, the exuberance and ornamentation of Art Nouveau and Art Deco were far easier to adapt to, than the starkly modern buildings which came up in other cities. The two styles can most clearly be seen in Mirza Ismail Road, where most structures were built in 1940-1965. The streamlined curves of the Raj Mandir's exterior façade recalling nautical architecture stand out dramatically against the older Panchbatti Chowk, with its symmetrically ordered shops.

Jaipur's Art Deco legacy, much like its eighteenth and nineteenth century architectural traditions represents an attitude of openness to change while maintain strong links to the past.

Conclusion & Recommendation

The name Jaipur conjures up images of the eighteenth century walled city, with wide avenues, bustling bazaars and the changing mindsets which shifted the use of their built heritage from the beginning till date. The earlier separated zones for males and females are now unified. With time and growth over the years Jaipur stands strong clearly showing-off its heritage in modern times**.**

The emphasis on Jaipur's heritage has also been primarily on the walled city, with some remarkable initiatives undertaken by the local and state government authorities.

At the same time, there is a gap in addressing the contributions of the twentieth century to Jaipur's architectural heritage. There is an immediate impact of the events surrounding India's independence, the changes in mindsets of people in the society and the subsequent expansion of the city. These structures represent an important phase in Jaipur's history as it struggled between its own glorious past and an

Figure 10: Panchbatti Chowk, 2010

uncertain future and **c**ontinue to inform Jaipur's architectural tradition. The changing culture of architecture in modern Jaipur, both as a lifestyle and as a profession, has been eye-opening. In terms of lifestyle, we never predicted the extent to which architecture and design could affect us as well as the society and culture we live in, nor did we predict how deeply symbolic of our beliefs and attitudes they'd become.

As a society, the huge wave of development and technology that caused us to try and ape everything that didn't belong to us, has made us question and search for our own identity and provoked us to revisit the solid traditional roots and foundation of Jaipur's Architecture. The Indian government's massive Smart Cities Mission, which aims to develop 100 sustainable and citizen-friendly cities all over the country, has done very little to include architectural voices into the conversation. Same goes for our heritage structures that are being replaced by modern structures.

As a result, architects are making efforts and are regularly creating platforms that can give way to solutions to better architecture. Considering how architecture can affect the socio-cultural imprint of a city, our social responsibility is being profoundly displayed by a handful of citizens, who are working on community architecture and are passionately involved with restoring or conserving heritage structures. It is important to follow 'Contemporary Indian sensibility'—a sensibility that takes the roots and ethos of Indian

architecture and integrates them into contemporary vocabulary.

The growing economy and population has led to enormous housing needs, driving the extent of architectural work and creating massive opportunities in the country. It is also one of the reasons why the number of foreign architectural firms working in India has increased. In the aftermath of cities burdened by the lack of infrastructure, the opportunity to design and make a difference in India has become immense. This has also led to the increasing number of Indian architects, who, after receiving their architectural education overseas, have returned to India to practice and be a part of the shift the country is going through

.An influence from the West, glass and designer-shaped buildings began as design statements some years back, but are now shunned for their out-of-context implementation. Jaipur's architecture is seeing many explorations. Though globalization is widely influencing the architecture being built in India today, the need and anxiety to localize is also fiercely felt by many. Glass, steel and aluminum might remain as 'fashionable' materials, but there has been a shift in sensibilities with the revival of Indian crafts and the use of natural and alternative materials such as brick, mud, clay, bamboo, wood, stone, etc.

The concepts of sustainability and 'going green' have become commonplace. Discussions around the two have taken center stage at architectural forums, conveying the urgency felt by architects and planners in India to correctly interpret and use them. The importance of context, sustainability, nature, and creating an architecture that is true to our culture and cultivates an 'Indian identity' has gained much credence. The re-conceptualization of spaces has been a revelation too. Even once forgotten spaces like kitchens and bathrooms are now seeing makeovers as they become spaces of immense significance. Changing lifestyles have transformed the meaning of architecture for many. While changing lifestyles have impacted architecture, it is important for us to ruminate on how it can in turn make a lasting impact on transforming lifestyles.

References

Mishra, RL. 1985. The Forts of Rajasthan. Jaipur: Kutir Prakashan.

Sachdev, Vibhuti, and Giles Tillotson. 2002. Building Jaipur: The Making of an Indian City. New Delhi: Oxford University Press.

Roy, Ashim Kumar. 2006. History of Jaipur City. New Delhi: Manohar.

Tillotson, Giles. 2006. Jaipur Nama: Tales from the Pink City. Gurgaon: Penguin India.

Investigating Pedestrian Based Informal Economy and Its Impact on Walkability in Dhaka City

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Shaila Islam

Abstract: *Globally walkability in environmental planning and design is receiving increasing attention for its numerous benefits. Therefore, it is necessary to have in-depth knowledge about pedestrian walkability particularly in cities of the developing world. Due to several socio-economic, physical and car-oriented development strategies, issues like walkability often gets overlooked in these contexts and Dhaka, the capital of Bangladesh, is no exception. The city of almost 20 million has extreme inadequacy of pedestrian facilities. Moreover, massive pedestrian based informal economic activities is gradually causing informalisation of pedestrian behaviour. Although, such activities add richness to an urban environment but here those practices are ultimately hindering the fundamental purpose of having sidewalks. In the context of this problem, the study attempts to investigate the relationship between pedestrian based informal economy and levels of obstructions through a correlation analysis using Geographic Information System. A geo-referenced survey was conducted to collect primary data on obstacle points, types, and scales in the central commercial district Motijheel and in a residential area Mirpur. The analysis revealed that mostly three features of the pedestrians play key role to attract informal economy to concentrate and grow which are – adjacent land- use pattern, amount of traveling population, and scope of alteration.*

Keywords: Informal Economy, Walkability, Urban Complexity.

The Problem Context

Transport for London (TfL) defined walkability as the limit within which walking is secure, accessible, connected and pleasant for its users (TfL, 2004). Walkability can be considered as a key parameter to assess sustainability of any urban setting. Besides, it has numerous number of health, economic, social, and environmental benefits. A good walkable neighbourhood enhances social safety, increases cohesion, helps economy through decreased car use and fosters environmental quality by lessening emissions and waste (Littman, 2003; Frank et al. 2006). According to United Nations, around 55% of global population are dwelling in urban areas at present and by 2050 it is likely to increase near around to 70% (UN DESA, 2018). Concerns are there as the world getting more and more urbanized, cities and urban areas are more likely to become less walkable. Dhaka the capital of Bangladesh and one of the highly urbanizing cities in the world is no exception. The report of Dhaka City Corporation (2016) indicates only 600km footpath exists in the central region of Dhaka city which is far less than adequate. The city is already struggling with its massive population and based on the revised report of UN DESA (2018) it is expected that both urbanization and population growth rate will be increasing significantly as by 2020 and the city will be home of more than 20 million people. As Dhaka yet to have any planned transport and traffic regulation system, the streets are slowly becoming informal day by day. Highly concentrated density in an almost unplanned context triggers various scopes for informal economic activities targeting people who are on the move. As a result several informal economic activities are noticeable on the pedestrians of Dhaka city although the amount of those economic activities is not equally distributed throughout the entire city. Several experts and researchers pointed out pedestrian or street based activities add richness to urban fabric which is true to some extent especially for the contexts that developed in a planned manner but for Dhaka the scenario is totally opposite.

Therefore, in this problem context, this paper aims to investigate two specific research questions –

1. How pedestrian based informal economy is impacting on walkability in the context of Dhaka city?

2. As the concentration of informal economic activities is not equal, what are the key features of pedestrians that attract and allow informal economy to grow?

Literature Review

The most effective and efficient mode of transportation for short trips is ‘walking’, and as each journey starts or ends with a walking trip; every person is a ‘pedestrian’ at some point in a day. According to the Highway Capacity Manual (HCM, 2010), pedestrian facilities have been categorized as exclusive facilities like sidewalk, walkway, crosswalk and non-exclusive facilities like carriageway, bottleneck, queuing area, etc. Only the exclusive facilities were considered in this paper. Measuring the character and the performance of pedestrians the level of service (LOS) is a popular quantitative approach to measure the effectiveness of a pedestrian based on speed, flow, density, space, and other factors. A similar study conducted in India reveals that pedestrian flow characteristics were highly affected by age, gender, width and the location of the facility. Besides, researchers from several countries also found factors such as gradient, weather, temperature, physical and cultural differences to be highly significant in affecting walking characteristic of the pedestrians (Banerjee et al., 2018). In the context of Dhaka pedestrian based informal economic activities can be labelled as a cultural practice therefore, should have a certain relationship with walkability particularly in a high-dense condition. Numerous studies have been done on pedestrian behaviour but only a few have seriously considered and explored such contextual aspects associated with pedestrian's movements. Hence, this study aims to focus on that research gap and will try to

draw some relationships between walkability and concentration of economic activities.

However, mostly in the developing context, our car-centred modern perceptions of city subconsciously is making us unaware of the necessity that pedestrians require some functions for its efficiency and betterment of walking experience. In Dhaka city, the highest percentages of trips are made on foot yet the pedestrian hardly get any importance in formulating transport policies. Manuals of highway design suggest frequency and design of service area for motorized vehicles but what about the pedestrians? In his study Geetam Tiwari (2000) argued that pedestrian based economic activities like the street vendors and hawkers are just doing the same function for the pedestrian users. People on foot need cobblers on the road to have their shoes fixed, just as much as car owners need tire repair shops. All commuters need beverages, snacks and other services on the roadside. These services have to exist at frequent intervals, otherwise walking or bicycling would become impossible, particularly in a warm-humid climatic condition. As long as our urban roads are used by these various sections, street vendors will remain unavoidable.

In contrast with vehicular movements, the pedestrians continuously interact with each other and their surrounding environment, so ignoring the associated social practices planning and development may increase the flow and speed of the pedestrians but the long term sustainability will remain on doubt. Studying the process of accumulation of pedestrian based informal economic activities is necessary for future pragmatic planning and design intervention.

Action Area, Data, And Methodology

The central business district Motijheel, around the Shapla Square area to be exact, and a typical residential area Mirpur-10 were selected for evaluating walkability and how it is being impacted by the informal economy. Two opposite land use types were deliberately selected for having a more comprehensive understanding of the issue.

The research is an exploratory one mostly follows a quantitative approach. Data were collected via on-site physical survey and later a correlation analysis has been conducted using ArcGIS software. A physical survey was done in previously mentioned two different land-use zones where, for both areas, firstly, obstruction points caused by informal economic activities were detected and marked via geo-referencing using GPS. Relevant and other necessary information was also recorded along with its type and scale. The second phase is about co-relational analysis where the initially produced obstruction points' map has been incorporated with the land-use map and building use map of respective areas for tracing linkages and potential reasons of accumulation of those informal activities.

Analysis

In this paper, two specific action areas with contrasting land-use pattern have been selected for GIS analysis. As in most parts of Dhaka land-use characteristics are usually mixed, therefore, the action areas are classified as commercial dominating land use area and residential dominating land use area. For this research, the central business district Motijheel and Mirpur-10

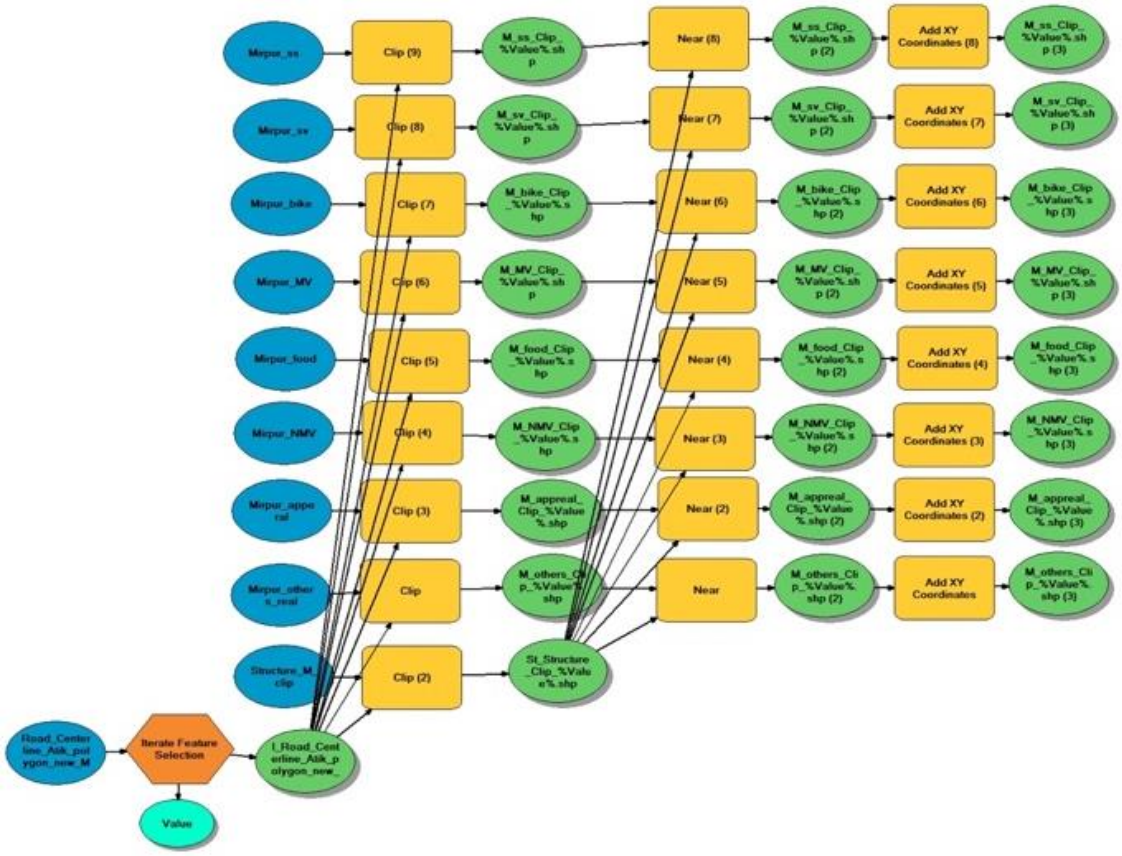

Figure 1. ArcGIS model for tracing pedestrian based informal activities.

have been considered as the commercial and residential dominating land-use area respectively.

To draw relationship between informal economy and pedestrian walkability firstly it is important to identify and calculate the number of pedestrian-based economic activity spots. Concerning walkability, in both action areas, two types of pedestrian obstruction can be identified, one caused due to poor infrastructure facilities can be called as physical obstructions and the second one is obstructions caused by informal practices like illegal parking or economic activities of hawkers and vendors. This research and also the analysis is focused on the second issue as physical obstructions can be settled anytime but such informal practices which already transformed into a social practice could be difficult to solve overnight since a substantial number of population and informal economy depends on it. Furthermore, these type of informal activities not only impacting pedestrian walkability but also have an inner relationship with surrounding urban areas.

Calculating the level of obstruction caused by informal economic practices primary data were collected via direct observation and a geo-referenced physical survey. Additionally, documentation was done by filming and note-taking whilst for getting a public response a questionnaire survey and structured interview were also conducted. Physical surveys were done during the working day within the office hours and during this time period, all types of permanent, semi-permanent, and temporary vendors and the amount of illegal parking were counted and marked. Utilizing GPS, the survey notes, and photo and video evidence all the vendors and illegal parking location points were transferred into ArcGIS 10.5 software by creating a dot on the building use maps of Motijheel and

Mirpur-10 area. Every dot represents an informal activity spot and also considered as an obstruction point on pedestrians. Then a model has been run in ArcGIS (Figure 1) to find out how the informal economy is impacting pedestrian walkability.

Findings

From the correlational analysis, it becomes evident that the concentration of pedestrian-based informal economy significantly varies due to surrounding settings and land use patterns. Findings from Motijheel and Mirpur-10 have been discussed respectively.

Motijheel Area: Commercial Dominating Zone

Motijheel is basically a business district of 4 square kilometres area with a population of over two hundred thousand people (BBS, 2011). Around 8634 establishments are located here including headquarters of several major public and private organizations (BBS, 2013).

Figure 2. Pedestrian based informal activities in Motijheel. (Source: Author)

Considering the characteristics, the analysis draws a connection between informal economic activities and level of pedestrian obstruction. A huge number of, 4673 to be exact, obstructions including vendors and parking lots have been found within the survey area and surprisingly all of them are illegal. GIS analysis also finds that the 16% circulation area is already occupied by the vendors and illegal parking hampering pedestrian flow and contributing in traffic congestion.

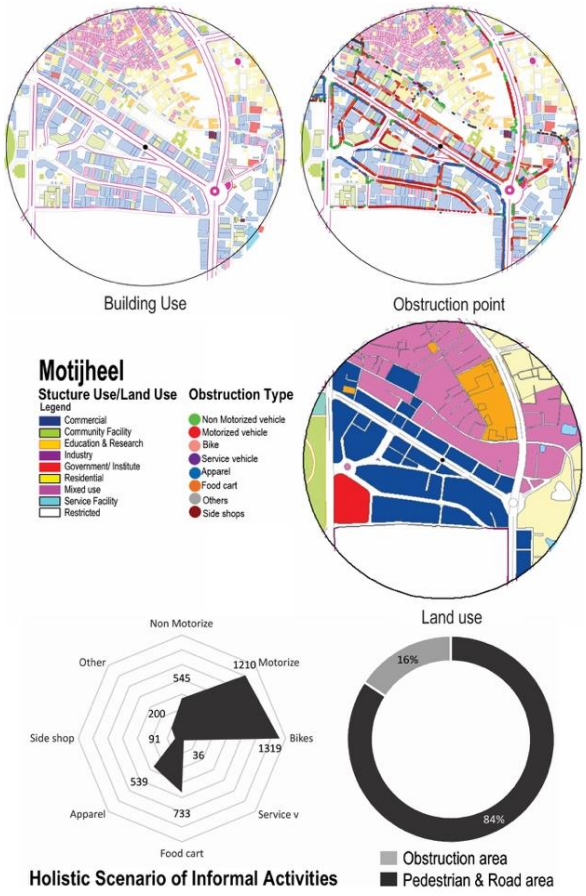

Figure 3. (On Top) Informal economic activity points and its relationship with land and building use in Motijheel area. (Bottom) Scenario of Obstruction in Motijheel.

Moreover, in the GIS model, investigating the informal economic activity spots it can be identified that most of the activities are concentrating alongside the arterial roads more specifically where formal commercial activities

are located (Figure 6). This indicates formal and informal economic activities are not two separate issues rather they are complementing each other in the context of Dhaka. The whole economic activities are acting as a loop and feed each other. For instance, at Motijheel several stands of non-motorized vehicle locally known as rickshaw are noticeable and targeting them, several small scale economic activities like tea stall or food cart are stemming obstructing the adjacent pedestrians. The analysis also reveals that due to the constant movement of bulk population nodal points, crossing points, foot overbridge connecting points attract informal economy more than rest of the places that is why in Motijheel informal economic activities are more concentrated in some specific points rather not being equally distributed throughout the region.

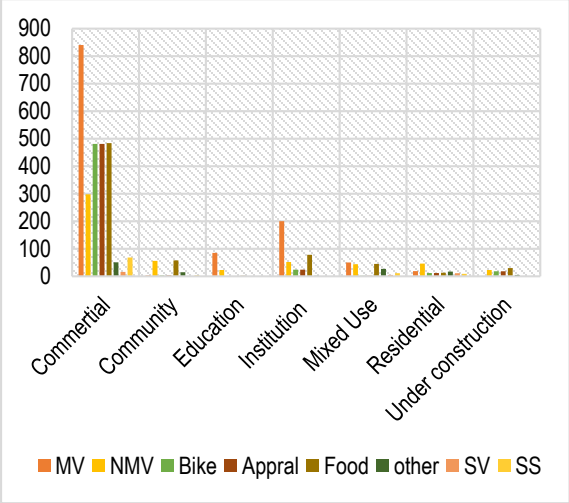

Figure 4. The relationship of obstruction with building use in Motijheel area.

Mirpur 10 Area: Residential Dominating Zone

In the residential dominating area Mirpur-10, the analysis identifies a total of 1585 informal economic activity spots occupying 5% of the pedestrian circulation area which is notably lower than Motijheel. In Motijheel where informal economic activities concentrated beside formal commercial zones and along with public intersection points but here such scenario is not that much prominent.

Figure 5. Pedestrian based informal activities in Mirpur-10. (Source: Author)

However, informal activity spots can be identified around educational institutes and mixed-use complexes in Mirpur area. In Motijheel primarily informal economic activities are based on streets and pedestrians where numerous number of people pass by throughout the whole day but in a residential dominating zone flow of people are very specific usually during office and school time, therefore, such routine discourages informal economic activities to grow here as a result only 5% of pedestrian circulation area getting occupied. Another important factor is that being a residential dominating zone all the plots and houses of Mirpur-10 are maintained by the owner or users which does not allow vendors or hawkers to sit in a particular spot and do business.

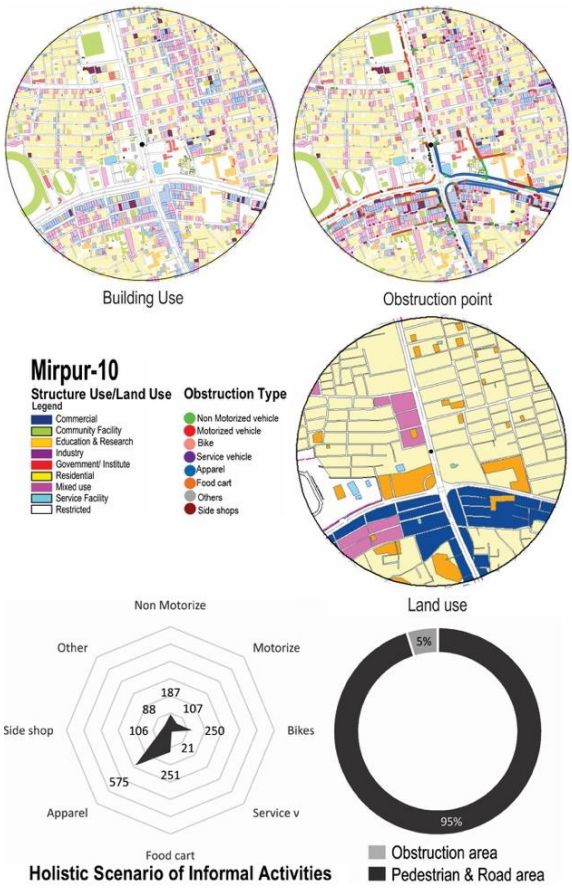

Figure 6. (On Top) Informal economic activity points in Mirpur-10 and its relationship with land and building use. (Bottom) - Scenario of Obstruction in Mirpur-10.

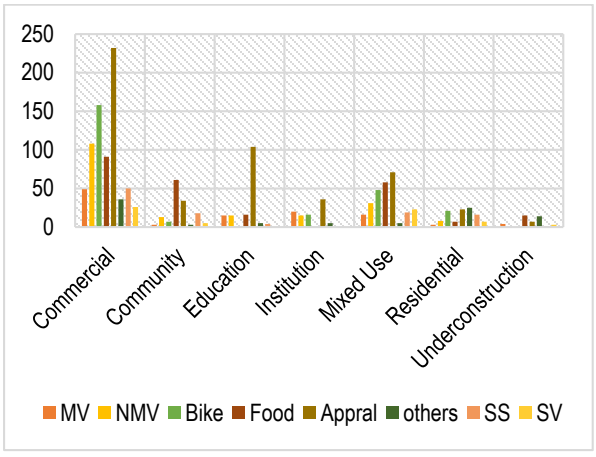

Figure 7. The relationship of obstruction with building use in Mirpur-10 area.

Discussion

From the scenario above some clear relationship between walkability and pedestrian based informal economy can be drawn. The analysis shows that regardless of the setting, informal activities are more related with its adjacent land use and building use. A cautious analysis of the number of obstruction points, its locations, and the type of services being provided shows that economic activities are needed since they run under completely 'free market' principles. If the services were not required there would have no reasons for accumulating any sort of economic activities. Additionally, land use is also responsible behind the concentration of informal economic activities, as for the commercial dominating zone public intersection points act as hotspots for informal economy whereas in the residential dominating zone any specific points are not discernible. However, from the correlational analysis key features of pedestrians that attract and allow the informal economy to grow have been identified and discussed below.

Adjacent Land and Building Use Pattern

What has been found through the analysis is that land use and building use pattern to be specific, plays key role triggering informal activities in an area. It has been noticed that informal economic activities usually grow nearby the plots owned or managed by multiple entities. Additionally, building blocks having mixed-use activities have lower control over the regulation or maintenance of pedestrians compared to single-purpose building blocks.

Amount of Traveling Population

Another key finding of correlational analysis between Motijheel and Mirpur indicates that the amount of traveling population plays a major role in the accumulation of informal economic activities. Although there is not much difference in the number of population in Motijheel and Mirpur but because of massive temporary

traveling population in Motijheel informal economic activities is a prominent feature there.

Scope of Alteration

Finally, it also has been identified that places and spots which allow modification or alteration attracts more informal economic activities than the places that do not. For instance, a background wall can work as a display stand, any electric poll or structural post can work as a support for the shade, and a tiny narrow space can help to allow extension of a display cart. Pedestrians with those features comparatively have a higher concentration of vendors and hawkers. That is why in the survey and analysis it has been found that underneath of a foot overbridge or any spaces with a background surface are certain accumulation points of various economic activities.

Conclusion

The analysis unfolds that in the context of Dhaka both informal and formal economic activities are working as a single loop. The formal system is creating scopes for some informal economic activities and eventually the practice is impacting the surrounding activities as well, like pedestrian walkability in this case. Condition of a residential dominating land use area indicates that if any plot is properly maintained by any concerned authority pedestrian walkability will improve for sure. As this research has identified some major points regarding the characteristics of informal economic activities and their process of expansion, strategies can be taken to reduce its impact on pedestrian walkability. Certainly, everyone desires such rich and vibrant street and pedestrian experience that we already have in Dhaka yet it is necessary to keep in mind that those features should not hinder the fundamental purpose of having or using pedestrians. For a healthy and efficient urban lifestyle, there is no alternative of a proper walking environment for all. In conclusion, pedestrian based hawkers or vendors provide several essential services in a city like making our cities safer and distributing goods and foods to the lower income group. Therefore, people associated with these activities should not be considered as illegal or law breakers, instead, our roads and pedestrians need to be designed in such a manner which will allow informal economic activities without disrupting other users. Eviction or resettlement will not bring any long term solution in highly dense cities like Dhaka unless the issue is properly acknowledged and embraced in the planning and design process.

References

Banerjee, A., Maurya, A. K., Lämmel, G. (2018) A Review of Pedestrian Flow Characteristics and Level of Service over Different Pedestrian Facilities. Collective Dynamics, [online] 3(0), pp.1–52. Available at: http://collective-dynamics.eu/index.php/cod/article/view/A17/23 [Accessed 10 Sep. 2019].

BBS (2011) Population and Housing Census 2011. Socio-Economic and Demographic Report. [online] Bangladesh Bureau of Statistics. Available at: http://bbs.dhaka.gov.bd/sites/default/files/files/bbs.dhaka.gov.bd/law_policy/6ed6b42c_2015_11e7_8f57_286ed488c766/Socio-Economic%20and%20demographic%20Report%202012.pdf

BBS (2013) Labour Force Survey 2013. [online] Bangladesh Bureau of Statistics (BBS). Available at: http://203.112.218.65:8008/WebTestApplication/userfiles/Image/LatestReports/LabourForceSurvey.2013.pdf

Dhaka City Corporation (2016) Dhaka Structure Plan 2016-2035. [online] p.92. Available at: http://www.rajukdhaka.gov.bd/rajuk/image/slideshow/1.%20Draft%20Dhaka%20Structure%20Plan%20Report%202016-2035(Full%20%20Volume).pdf

Frank LD, Sallis JF, Conway TL, Chapman JE, Saelens BE, Bachman W (2006) Many pathways from land use to health: associations between neighbourhood walkability and active transportation, body mass index, and air quality. J Am Plann Assoc 72(1):75–87

HCM (2010) Highway Capacity Manual 2010. Transportation Research Board, National Research Council, Washington DC. - References - Scientific Research Publishing. [online] Scirp.org. Available at: https://www.scirp.org/reference/ReferencesPapers.aspx?ReferenceID=1153839 [Accessed 8 Sep. 2019].

Litman T (2003) Economic value of walkability. Transp Res Rec 1828:3–11.

Tiwari, G., (2000) 'Encroachers or Service Providers", in Seminar, No. 491, July, pp. 26 – 31.

UN DESA (2018) United Nations 2018 Revision of World Urbanization Prospects. [online] Un.org. Available at: https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html [Accessed 25 Jun. 2019].

Transport for London (TfL) (2004) Making London a Walkable City: The Walking Plan for London'. Available at www. rudi.net/files/walking-plan-2004.pdf.

Case Studies of Spaces in Special Needs Schools, Japan

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Abstracts: *Recently, the number of children receiving special needs education is growing in Japan. So appropriate guidance and support for such children are necessary. However, the improvement of special needs school facilities is not enough. This study aims to clarify the improvement factors for special needs school by focusing on in and around the classroom. The research objects are a wide range of ages, types of disability, and facility types. The research methods are interviews of staff, mappings of furniture layouts and photos. Through the analysis of the furniture layout of classroom, it was found that classroom configuration could be divided into two types, which were "Centralized type" and "Dispersed type". In addition, the opinion about the environment and equipment of facilities were found through interviews. Required spaces, equipment and settings are different according to individual children's needs. So multiple functions tend to be provided in one space to deal with various disabilities and different disability typed children. In the surveyed schools, however, we found that they solved the problem at furniture level. There are many problems found even in new schools. It is important to design schools to be flexible corresponding to class type, class number, individual characteristics and disability type.*

Keywords: Education, School, Classroom, Disability, Age

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1. Background and Purpose

Recently, the number of children receiving special needs education is growing in spite of declining the birthrate in Japan. It means the number of special needs school, special needs classroom and special needs support service are all growing. Especially, children with multiple disabilities and severe disabilities are more increasing. The national survey in 2012 by Ministry of Education, Culture, Sports, Science and Technology, has shown that 6.4% of children in regular class might have LD (Learning Disabilities), ADHD (Attention-deficit / hyperactivity disorder), or high-functioning autism in elementary school and junior high school. As these backgrounds, the movement of inclusive education is accelerating. National Educational Institute has published the report on architectural considerations at various types of special needs school from the perspective of inclusive education (Saito etc. 2016) [1)]. However, there are not much concrete guidelines corresponding to the various type of school. Therefore, appropriate guideline and support for children with special needs are required.

For improvement of special needs education, it is important to solve the problems in not only education, organization and management, but also space, facility and equipment. Special needs education has become more popular especially since 2007, called “first year for special needs education”. There are several case studies on special needs school [2)]. However, there are not enough studies on special needs schools, and the facilities and equipment of special needs school have not been fully developed for corresponding to the growing number of children with special needs.

This study aims to clarify the current problems of spaces in special needs school, especially classroom.

2. Methodology

We researched 18 classrooms in 7 schools including 5 special needs schools and 2 regular schools promoting inclusive education. These are various schools with a wide range of ages and different types of disability. The process of choosing local governments and schools for our research as follows.

Step 1: choosing Chiba city for our first research body because it’s our home and well-connected. Chiba city is also one of most advanced government as promoting special needs education. We did the research on Chiba city’s education committee and surveyed also 3 schools including elementary school with special needs classes, special needs elementary school and special needs high school.

Step 2: choosing Osaka city for our next research body because Osaka city is most famous government for inclusive education in Japan[3)]. We did research on Osaka city’s education committee and surveyed the school known as innovative inclusive school.

Step 3: choosing other special needs schools for our research in Saitama, Miyagi and Fukushima prefecture. These schools were very unique from the viewpoint of facility’s design and planning.

Summary of surveyed schools and classrooms are shown in Table 1.

The research methods are follows.

1) Measuring and drawing the furniture layout of the classrooms by sketches on the formatted paper recording name and type of class, time, layout and additional information. Also taking photos to record the detail information of furniture and spaces.

2) Interviews to facility designer, school staff, and government officials in charge of special needs education. We prepared the structured interview sheet with several

questions according to the type of interviewee as follows.
To facility designer: design process, design concept, design and engineering feature, disaster prevention and other technical ideas.
To school staff: teaching methods, children's physical condition, type and degree of disability, educational and facility's problems, the use of classroom and other spaces, management problems, and other problems.
To government officials: policy for inclusive education or special needs education, the current condition and trends of special needs school, screening process and rule for choosing special needs education, the system of facility management and others.

3) Because of ethical reason, not disturbing children and classes, we carried out the research on the classrooms without children. And also not taking children's photo for keeping their privacy.

3. Improvement Factors of Special Needs School Facility

We made the furniture layout drawing by sketches and photos taken for recording the information at the schools. Then we wrote down characteristics from furniture layouts of surveyed schools and found 6 common points, and clarify the trends corresponding to types of facility, disability, age and classroom configuration. We wrote down characteristics and found 6 common points, and clarified the problems and ideas corresponding to types of facility, disability also from the interview. The classification results of trends, problems and ideas are shown in Table 2.

3-1. Classroom Configuration

Through the analysis on the furniture layout of classroom, we found that classroom configuration could be divided into two types, which were "Centralized type" and "Dispersed type". Examples are shown in Figure 1. "Centralized type" is the type of classroom with various living functions besides learning function. This type tends to be seen in classrooms for physical handicapped children because of their difficulty in moving. "Dispersed type" is the type of classroom with only learning function inside a classroom, and other functions are provided outside classroom. This type tends to be seen in classrooms with a lot of students. In this type, children with special needs can use an individual learning space outside classroom without interrupting other children's activities. This type is more popular in abroad, but not so much in Japan.

3-2. Furniture Layouts

We found 6 common points through classroom's furniture layout, and clarified the trends corresponding to types of facility, disability, age and classroom configuration. Results of analysis are follows and shown in Figure 2.

<Making a separated space by curtain in a classroom>
This space is used for controlling temper of children with intellectual disability, and also for assisting children changing clothes. It is common trend for a classroom at special needs school. There are soft mat and table in this space for relaxing children. It is important to provide such an independent separated space for children with special needs. It is one of the main features in "Centralized type", and seen it in a wide range of aged classroom, from elementary school to high school.

<Covering a shelf by curtain>
We should prevent children with intellectual disability from being distracted by visual stimulus. Because they tend to be very sensitive to such stimulus. In some of surveyed schools, the open shelves were covered by curtain for hiding many stimuli inside, especially at "Centralized type" classroom. Classrooms at a regular school also have these covered shelves to distract children with special needs.

<Making a space covered with a mat in a classroom>
This space is one of the main features in “Centralized type”, and more popular at an elementary school. It is mainly used for children’s play so having some toys. It is also used for controlling temper of children with intellectual disability, and also used for stretching body of physical handicapped children.
<Dividing a classroom by partition>
Some surveyed schools have movable partitions between two classrooms for making larger classroom by opening them. This is useful for combining two classrooms, and more common at special needs schools. For example, at one of the surveyed special needs high school, one classroom was used for a main learning space, and another classroom was used for a sub learning space in connecting two classrooms. Moreover, this is also useful for changing the number of classrooms corresponding to increase and decrease students.

<Installing a sink in a classroom>
It is common trend to have a sink in a classroom for physical handicapped children. They can wash their hands and brush their teeth in a classroom. It is convenient for children and teachers to reduce their movement. It is important for physical handicapped children and their teachers to minimize their movement.

<Connecting rest room directly to classroom>
One of the surveyed schools, there was a rest room between two classrooms for physical handicapped children to access directly from their classroom. It is convenient for children and teachers to reduce their movement. It is important for physical handicapped children and their teachers to minimize their movement.

3-3. Environment and Equipment

We found 6 common points against the environment, space and equipment through the interviews to the staff. We also clarified the problems and ideas corresponding to type of facility, disability. Results of analysis are follows and shown in Figure 3.

<Temperature control>
Temperature control is very important for children with special needs because they are very sensitive to temperature change. But there were no air conditioners in toilets, corridor, and gymnasium in many surveyed schools. It is necessary for all schools to install air conditioners everywhere besides classrooms especially for children with special needs.

<Safety>
Special needs school should have enough safety measures for preventing accidents, more happened at special needs school. In some surveyed schools, there were cushions set up in rest rooms for avoiding accidents such as hitting against the wall or toilet bowl. Putting glass safety film on a window was also seen for accident prevention in some surveyed schools.

<Preventing visual stimulus>
It is important to reduce visual stimulus for children with special needs because they are very sensitive to them. Some surveyed schools used curtain covering on a shelf not to seen inside. Addition to this, one surveyed school always switched off the light of elevator for reducing visual stimulus to children.

<Various equipment size>
Many problems about equipment size were pointed at surveyed schools. One of the surveyed schools had all same sized toilets bowls and same height sinks but not fitting to all children with different age and size. So, special needs school should provide various sized equipment including toilet bowls and height of sink corresponding to the age and size of children.

<Larger space needed>
In some surveyed schools for physical handicapped children, they could not use wheelchair and stretcher inside the narrow rest

room and elevator. The gymnasium and rest room at the surveyed high school, converted from elementary school, were not enough spacious for high school children.

<Comfortable design>
Comfortable design is very important for children. One of the surveyed schools used a wood and white texture for relaxing children with special needs. Physical handicapped children tend to look up a ceiling during swimming in an indoor pool, but the design of swimming pool's ceiling was boring for them. Therefore even the design of ceiling seems to be very important.

4. Conclusion & Recommendation

Required facilities, spaces, equipment and settings should be different according to age and size, type of disability, or individual children's needs. We found many problems even in recently built special needs schools we surveyed. corresponding to different disability types. We should consider better design in equipment, furniture and facility. We should also provide more flexible spaces in special needs schools corresponding to change in class type and number, individual characteristics and disability type.

5. References

1) *Fukuei Saito, Takeshi Isoyama, National Institute for Educational Policy Research "Basic research on school facilities for inclusive education system construction"*

2) *Facility Maintenance Casebook Review Committee to Promote Special Support Education (2008) "Aiming to Create a School Facility for Promoting Special Needs Education -Facility Maintenance to Promote Special Needs Education Case Studies-"*

3) *Osaka Prefectural Committee of Education "Education Support in Osaka Prefecture 2016"*

Table 2: The classification results of trends, problems and ideas from furniture layouts and interviews

We should provide various spaces

Common Points	Type of Facility (S: 11 R: 3 I: 1)	Type of Disability (I: 4 M: 5 P: 3 LD:2 A: 1)	Age (E: 11 J: 2 H: 2)	Classroom Configuration (C: 13 D:2)
from Furniture Layouts				
Making a separated space by curtain in classroom	S: 5 R: 1	I: 3 M: 3	E: 4 J: 1 H: 1	C: 6
Covering a shelf by curtain	S: 4 R: 2	I: 3 M: 1 P: 1 LD: 1	E: 6	C: 6
Making a space covered with a mat in a classroom	S: 5 R: 2	I: 1 M: 4 P: 1 LD: 1	E: 6 J: 1	C: 7
Dividing a classroom by partition	S: 5	I: 1 M: 4	E: 2 J: 1 H: 2	C: 4 D: 1
Installing a sink in a classroom	S: 2	M: 4 P: 3	E: 4 J: 2 H: 1	C: 7
Connecting rest room directly to classroom	S: 2	M: 2	E: 2	C: 2
from Interviews			type of facility S: special needs school R: Regular school I: Inclusive school type of disability I: intellectual M: Multiple P: physical LD: learning disabilities A: all types age E: elementary school J: junior high school H: high school classroom configuration C: centralized type D: dispersed type	
Temperature control	S: 3	I: 1 P: 2		
Safety	S: 2	I: 1 P: 1		
Preventing visual stimulus	S: 1 R: 1	I: 1 I and LD: 1		
Various equipment size	S: 3	I: 1 P: 2		
Larger space needed	S: 3	I: 1 P: 2		
Comfortable design	S: 1	P: 1		

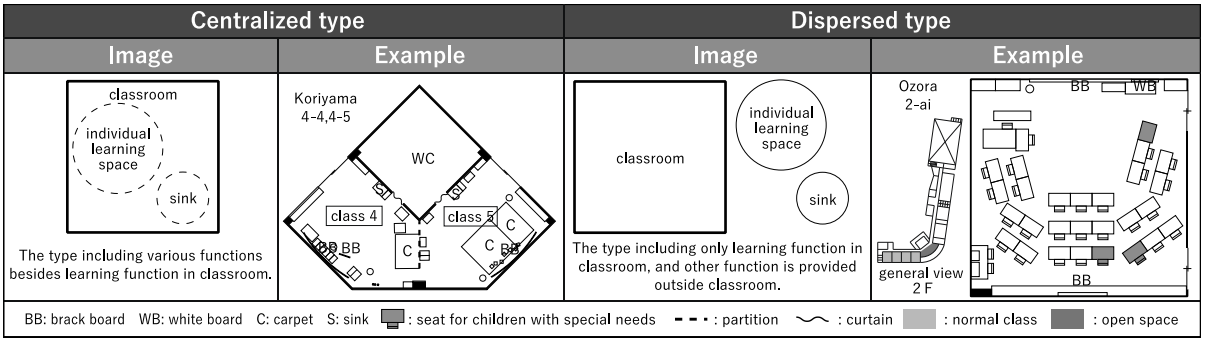

Figure 1: Examples of furniture layouts (2 of 18 classes)

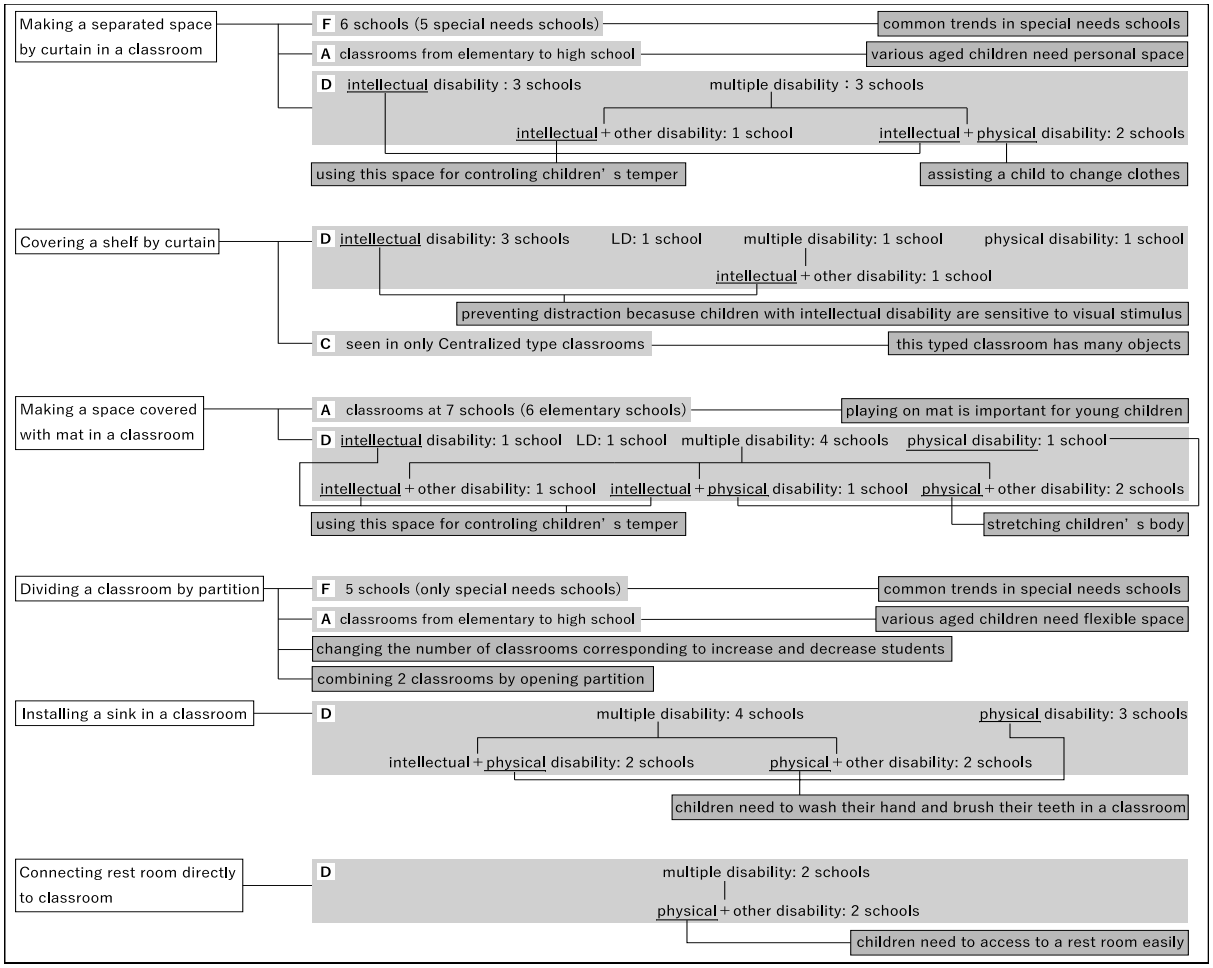

Figure2: The trends of furniture and space in a classroom

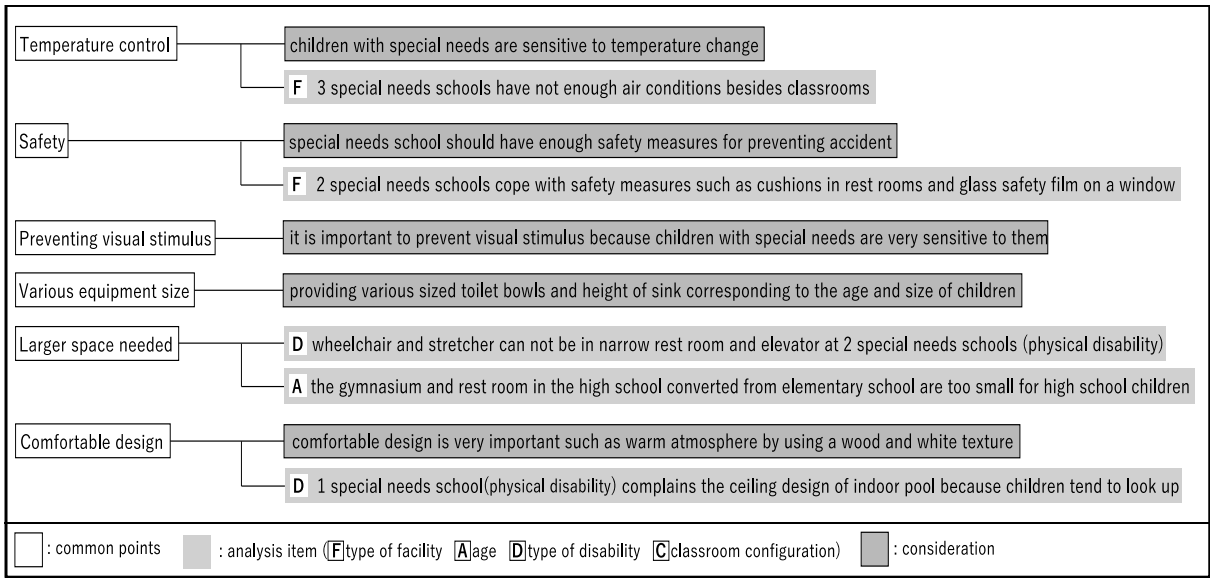

Figure3: The problems and ideas in surveyed facilities through the interviews

Table1: Summary of surveyed schools and classrooms

School Name	Second Special Needs School			Ayamedai Elementary School			Special Needs High School	Sakurasou Special Needs School		Ozora Elementary School	Koriyama Special Needs School			Takutou Special Needs School	
the Date of Research	07/06/2018			07/06/2018			07/06/2018	08/06/2018		28/06/2018	05/09/2018			07/09/2018	
Location (Prefecture)	Chiba			Chiba			Chiba	Saitama		Osaka	Fukushima			Miyagi	
Management	Chiba City			Chiba City			Chiba City	Saitama City		Osaka City	Fukushima Prefecture			Miyagi Prefecture	
Year School Opened	1978			1966			2013	2012		2006	1999			1972	
New Construction etc.	Building Extension			Building Extension			Building Extension, Conversion	New Construction		New Construction	New Construction			New Construction	
Designer	–			Japan Housing Corporation			Enomoto Architecture Design Office	Tanaka and Saitou specified Joint Enterprise		–	Yui Architectural Plan			Yamashita Design	
Facility Classification	Special Needs School (Elementary School)			Regular School with Special Needs Class			Special Needs School	Special Needs School		Regular School	Special Needs School			Special Needs School	
Type of Disability	Intellectual, Auditory			Intellectual, LD, Language			Intellectual	Physical and Intellectual		All Types	Physical			Physical and Weak	
Age(yrs)	6-12			6-12			15-18	6-18		6-12	6-18			6-15	
the Number of Students	78			Intellectual: 3 Emotional: 6 LD:26 (Own School: 3 Other School: 23) Language: 39 (Including Other School) (Entirely: 256)			92	36 (Elementary School: 20 Junior High School: 9 High School: 7)		53 (Entirely: 296)	164 (Elementary School: 72 Junior High School: 44 High School: 48)			32	
the Number of Teachers	54			7 (Entirely: 32)			49	61		32	117			43	
Class Organization	Regular Class: 13 Multiple Class: 2 Daycare Class: 1			Regular Class: 9 Special Needs Class: 2			General Course (Vocational Course): 12	Elementary School: 9 Junior High School: 4 High School: 3		Regular Class: 12	Elementary School: 28 Junior High School: 18 High School: 19			Elementary School: 10 Junior High School: 4	
School Summary	This is a special needs school which targets to children with intellectual disabilities. It built a prefabricated building in 2003.			This is a normal school which has special needs classes for intellectual, LD, and language disabilities. It has students from other school in the class of LD and language disabilities.			This is a special needs school which targets to children with mild intellectual disabilities. It is featuring vocational education.	This is a special needs school which targets to children with both of intellectual and physical handicap. From elementary to high school students are in this school.		This is an inclusive school. It is called "Everybody's School".	This is a special needs school which targets to physical handicapped children. It got many prizes AIJ award, and so on. It is called "Light School".			This is a special needs school for children with physical handicap and illness. It is next to prefectural hospital for children. The hospitalized children learn in the school.	
Surveyed Classroom (Grade-Class)	2-1	5-3	6-3	Sakura Class 1	Nobi nobi Room	Nobi nobi Room	2-C,D	Junior High School Multiple 3,4	High School Multiple 1,2	2-ai	Elementary School 4-2	4-4	4-5	Elementary School 2-A	Junior High School 1-A
Type of Disabilities (in the school)	Regular	Multiple	Regular	Intellectua	LD		Intellectual	Multiple	Multiple	All Types	Regular	Multiple	Multiple	Physical	Physical
Age(yrs)	7,8	10,11	11,12	–	–		16,17	12-15	15-18	7,8	9,10	9,10	9,10	7,8	12,13
Number of people	4	2	6	3	26		8 each	Room 3: 3, Room 4: 2	Room 1: 3, Room 2: 2	27	4	2	2	1	1
"Centraluzed Type" or "Dispersed Type"	C	C	C	C	C	C	D	C	C	D	C	C	C	C	C

An Empirical Study on Continuation, Transformation and Transfiguration of Homestead Layout and Space Organization of Handloom Communities in Bangladesh

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Istiaque Ahmed

Abstract: *Since the 17th century, handloom has had its predominance in Bangladesh with a rich heritage and is considered one of the finest aspects of the culture and ethnicity of the country. Integrated living and working environment and sequential process of the handloom triggered unique layout and the spatial organization providing the handloom community with a distinct characteristic. It reflects values and indigenous characteristics of a handloom community which are passed down from generation to generation. However, after the industrial revolution, due to several socio-political reasons, Bengal handloom industries gradually started to decline and continued till the Pakistan period. Throughout this long period, the handloom communities have gone through several phases of transition and transformation. Before getting extinct it is essential to keep such age-old culture and tradition alive, and for doing so, a proper perception of the spatial pattern is necessary. Hence, the core objective of this study is to recognize the indigenous practice of building and identify changes, transformations, and transfigurations in homestead layout and spatial patterns of handloom communities. Such findings will help to trace the transformation pattern in the house layout of handloom communities and find out possible architectural interventions towards a more sustainable handloom community.*

Keywords: Morphology, Spatial Pattern, Handloom Community

Introduction

Handloom industry in Bangladesh, a home-based industry is considered to be the oldest and largest industry after agriculture. The tradition of weaving cloth by hand constitutes one of the richest aspects of Bangladesh culture and heritage. The level of artistry and intricacy achieved in handloom fabrics are unparalleled and unique. The handloom can meet every need from exquisite fabrics of daily use.

The art of weaving is perhaps as old as human civilization. Bangladesh can proudly claim to have many branches of this ancient art, of which the best known and most popular is the speciality Jamdani, which is one of the varieties of the famous Dhaka Muslin or Mul-mul. Over the years, the weavers simplified the designs making them more stylized and geometric. Handloom products have shown a decisive upward trend in the export market since 1972 and Bangladeshi handloom products with their distinctive design and superior quality have created a niche for themselves in overseas markets (Sobhan, 1989). Still the handloom industry is a significant part of the textile sector of Bangladesh contributing a substantial percentage to the country's economy (Ahmed, 1999). Moreover, handloom industry is the biggest handicraft industry of Bangladesh and also the second-largest source of rural employment after agriculture. However, employment opportunity in this sector has been squeezed in the last 15 years yet this sector is offering opportunities to nearly 10 million weavers in the rural area (ADB, 2002). So it has become essential to shed light on this particular sector and find out the reason of its fall.

Historically, handloom industry had a glorious past but the current situation is questionable and the future prospects are uncertain because of some internal and external factors acting behind the scene. The sector occupies a distinct and unique place in the Bangladeshi economy, but the trend of modernization in this global era has placed its existence into a threat. As a response to this important yet overlooked issue, this paper attempts to concentrate on the characters of handloom communities from the perspective of built-environment with a notion to identify which characteristics are being changed, transformed or transfigured through the decades and glorifies this cultural sector as heritage.

Objectives

- To identify traditional, architectural and built environmental features of handloom community.
- To trace the architectural features that continued, got transformed, and transfigured in their house layout.
- To evaluate changes of spaces over time in different weaver communities.

Literature survey

Background History

The history of Bengal's textile traditions goes back to antiquity. Early centres of cotton manufacture in the Indian subcontinent led the way to this craft being introduced to Persia, Egypt and later to Europe. Among the fine fabrics produced in Bengal, muslin was one of the finest fabrics produced in the region. It was mostly tailored for the royal families of the region. The unrivalled quality of Dhaka's muslin was attributable to three important factors: its special cotton, the fineness of its hand spun yarn and the extraordinary skill of its weavers. In his report on Cotton textiles of Dacca, John Taylor identifies this unique quality of the cotton can only be grown along the banks of Brahmaputra and branches of the Meghna river as the best for muslins and believed that it could not be cultivated anywhere else in the world. Jamdani, one of the most expensive forms of muslin, was said to be a chef-d'oeuvre (masterpiece) of the Dhaka loom. Under the influence of the Mughals, muslins and jamdanis reached an unprecedented standard of excellence as it was the preferred fabric for the royalties.

The downfall of Mughal rulers caused the affluent market for muslin to end (Karim, 1975). Though manufacture and trade of muslin continued under

the British, it started to decline with the restriction of export of muslins into Britain and the importation of machine-made cloth into the Indian market.

Manpower of about 1.5 million weavers, dyers, hand spinners, embroiderers and allied artisans have been using their creative skills into more than 0.30 million active looms to produce around 620 million meters of fabrics annually. It shares 63% of the total fabric production in the country designed for home consumption, meeting 40% of the local demand for fabrics. Besides, it provides employment opportunities to a million rural people, 50% of whom are female (Wahid, 2016). Another half a million people are indirectly engaged in the industry. It contributes more than 10 (ten) billion taka, equivalent of more than 100 million USD, annually to the national exchequer as value addition (BHB, 2012). The greatest setback for the handloom sector in general and specifically jamdani was caused by the turmoil of the liberation war in 1971 (Saidur, 1993) and the subsequent years of economic crisis with the perennial shortages of yarn and dyes and absence of credit and the destruction of looms during the war led many weavers to abandon their crafts and look for other professions. The situation improved somewhat after the mid-70s where the government took steps but these efforts were quite inadequate and did not improve the condition of the sectors that much. For several decades now, the handloom sector in Bangladesh has been ailing, as weavers continue to abandon their traditional craft in search of more viable economic options (Habib, 2017). The reasons for this decline have been widely reported and are therefore well known. There is one aspect of the weavers' deteriorating situation that has not received the attention it deserves. This is the dilapidated condition of their homes and the worsening state of civic amenities impacting their clusters. Lack of attention to the interconnectedness between the weavers' tangible heritage (homes, cluster settlements, materials) and intangible legacy (relations of production, modes of inter-generational transmission of knowledge and skills and inspiration) explains in large measure the decline of the handloom industry. It may not be possible to keep it alive merely through input subsidies. A more sensitive conservation effort, based on appreciating these inter-linkages, seems called for, if we are to protect, revive and truly appreciate this iconic and uniquely traditional industry, and nourish it back to health and sustainable growth. To identify this home-based unique layout, there needs to be a proper enlistment of historical town having this unique heritage of weaving like Rupganj, Tangail, Rajshahi, etc.

The history of handloom industry from Bengal reveals how traditional production systems adapted to global trading patterns, it tells us also how village economies were influenced by corporate structures and their political power.

Methodology

Previously hardly any research has been conducted based on the socio-economic and architectural characteristics of handloom weavers. Therefore, on site reconnaissance survey was the core approach of collecting data in this study.

Total 5 zones (Rupganj, Tangail, Narsingdi, Mirpur-adi-Benarashipalli, Vashantek-benarashipalli) were surveyed and users were interviewed with a questionnaire. The questionnaire included 50 questions dealing with the demographics information, everyday routine, income range, family structure, religion, culture, construction techniques, ownership, use pattern, climatic comfort, and sociological aspects and other issues associated with living and working environment of the target group. Collected data from the survey were synthesized to have a brief understanding of the prevailing context.

Figure 1 illustrates the overall methodological procedure of this research.

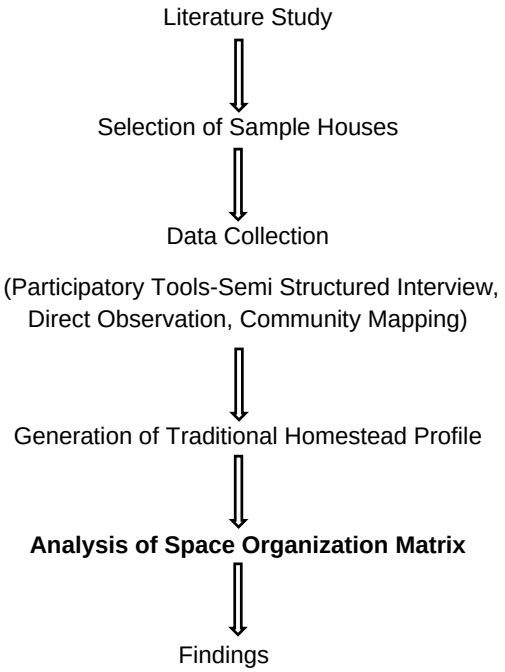


Figure 1: The Steps of Methodology

Adopting a multi-methodological approach, firstly, the study used participatory tools like semi-structured interviews, direct observation, and community mapping for understanding the holistic scenario of the context and recognize changes in handloom communities. In the second phase, based on previous findings and several case studies, a typical homestead profile is generated which eventually used to analyze the order of space organization and how it changed with time using a comprehensive order of space organization matrix. The analysis is done based on layout and space configuration only; the stylistic character was excluded from the process. The outcome of the first and second phase analysis helps to identify the built-environment components that got transfigured from past, components that were transformed to cope with changing time and components which are still remained unchanged.

Traditional Handloom Household Layout Analysis

As history and time are changing, the absolute traditional house layout of weavers is vanishing. So from questionnaire, interviews and observing the weavers, a traditional pattern had been figured out in figure 2. Those patterns follow the weaving the process from yarning, winding, warping, stretching, sizing and lastly weaving then sell the clothes in central flea market or frontal shops of their houses. Processes of production formulate the spaces like Backyard, Porch, Courtyard, Front-yard, factory Courtyard, Linear Street etc. Those are intangible architectural spaces which blurred the boundaries between living and working zones. Thus the spaces became the identical, ethnic and unique character of this heritage.

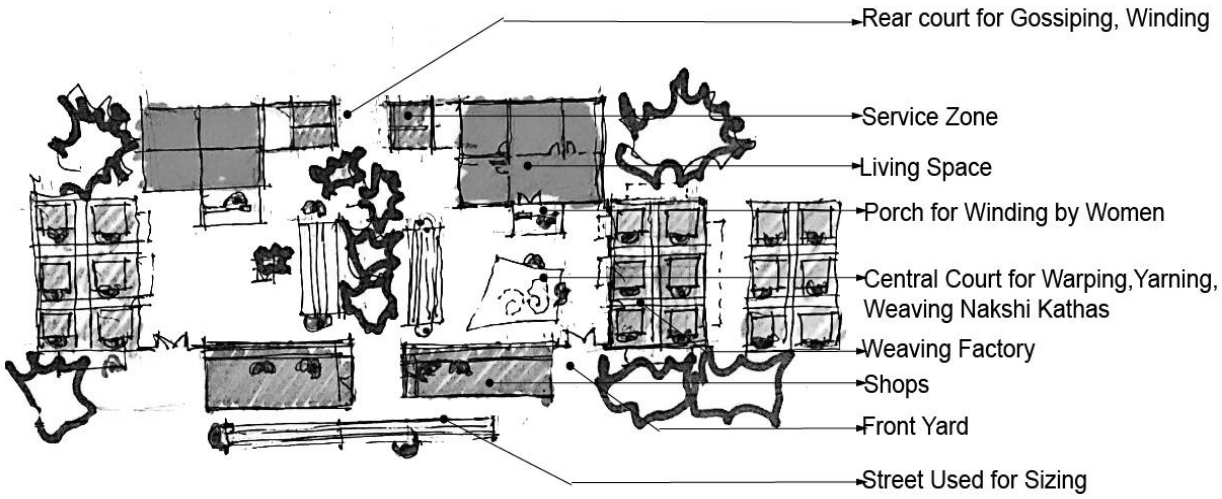


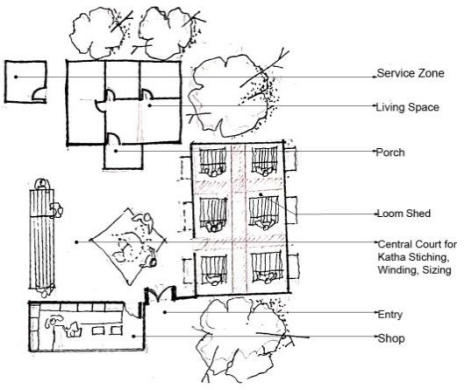
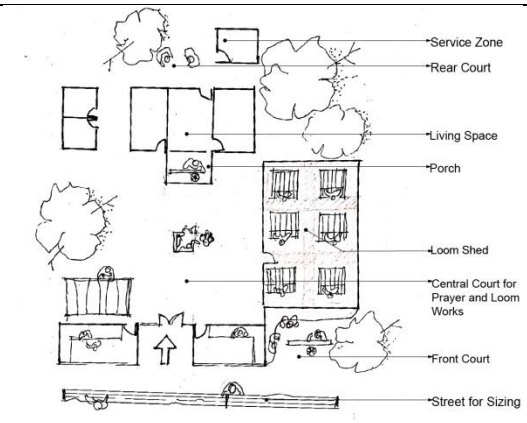
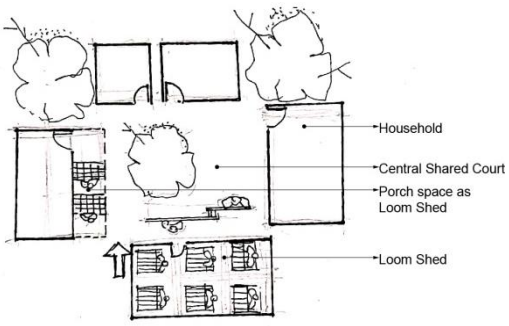
Figure 2: Ttraditional Handloom Household Layout (Source: Hand drawn by the author during survey)

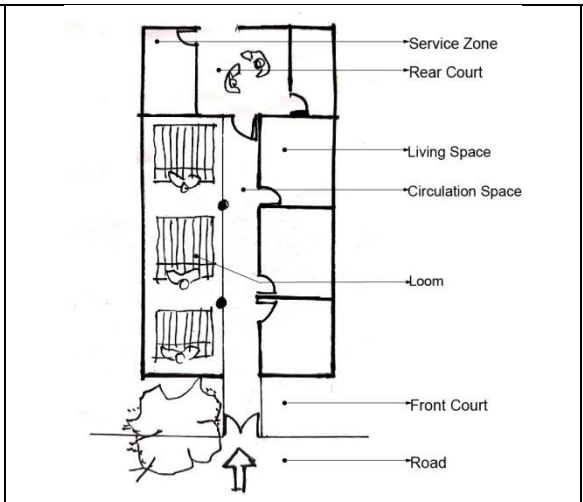
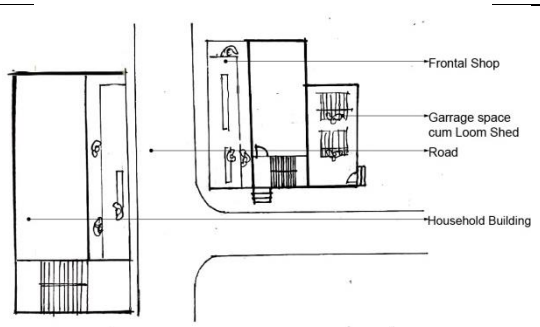
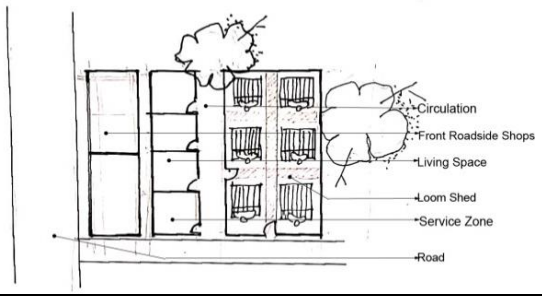
The handloom community works for hand on hand as well as their family members were integrated and associated with the living and working process. Those yards had a significant role in their working pattern. Women used to do work like weaving kathas, yarning, wefting, winding etc on courtyards, rear yards to contribute for their family. Moreover, this incorporation of dual pattern or working and living made these communities unique from others, and thus, they hold our heritage beautifully.

Analysis of Space Organization Matrix

From the survey report of 5 zones shows the difference between the patterns of different zones. These patterns have changed through many years of relocation, reformation, resettlement, reconstruction of communities. A table showing a comparison between traditional homestead layouts with the existing ones is given below-

Table 1: Analysis of Space Organization

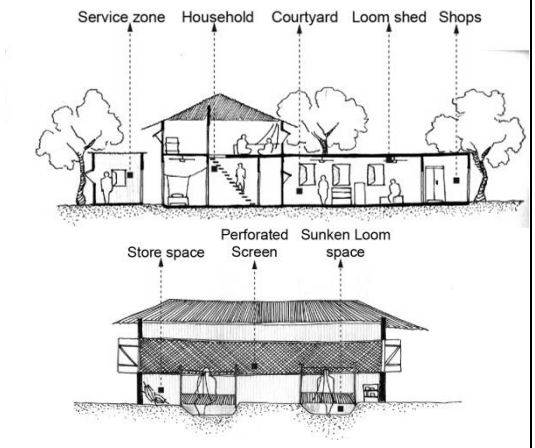
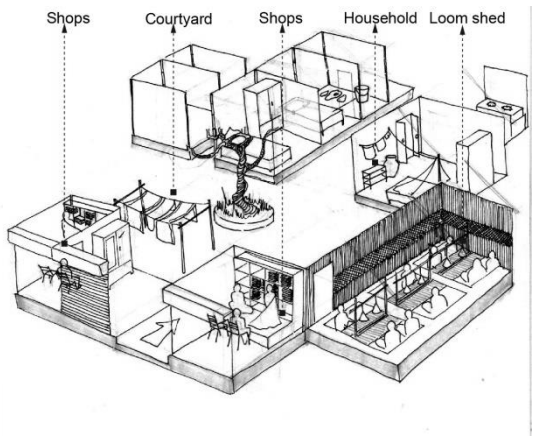
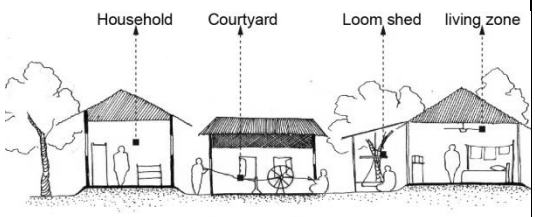
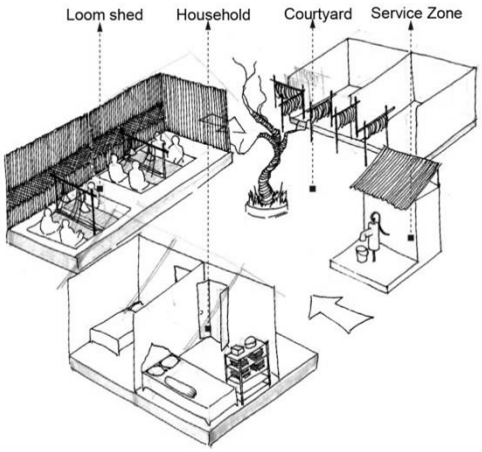
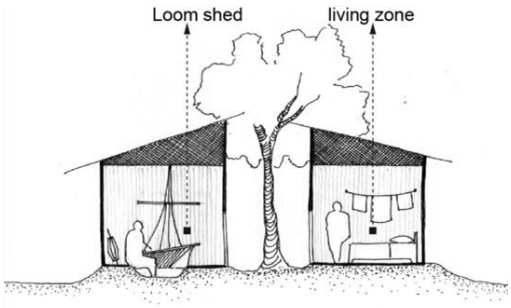
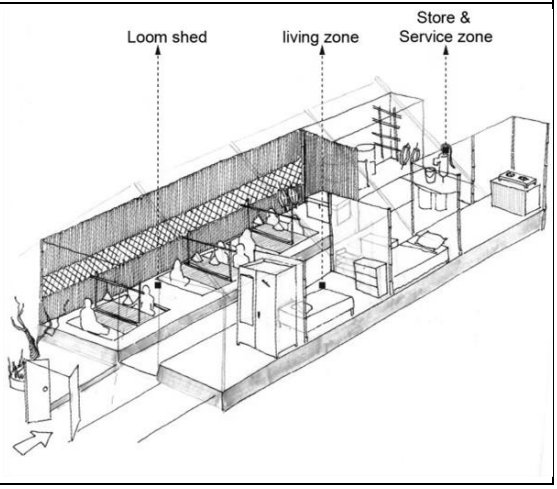
House Types (Region Based)	Plan Layout	Orientation	Built	Built-Unbuilt Ratio	Family Type
Traditional House Layout		North Facing	1971	40%:60%	Extended
Tangail Taatpalli (House A)		North Facing	1980	50%:50%	Nuclear
Narsingdi Taatpalli (House B)		No Specific Orientation	1995	60%:40%	Joint

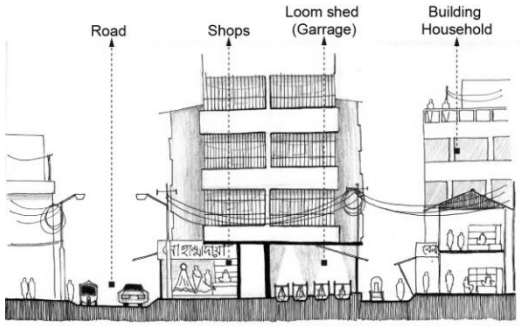
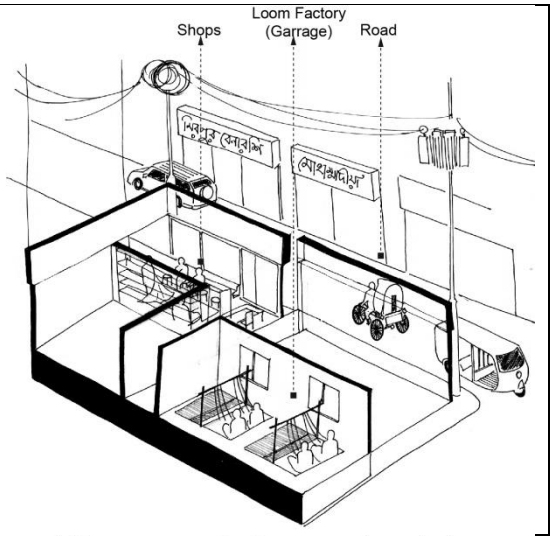
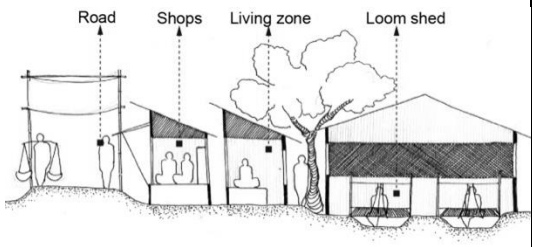
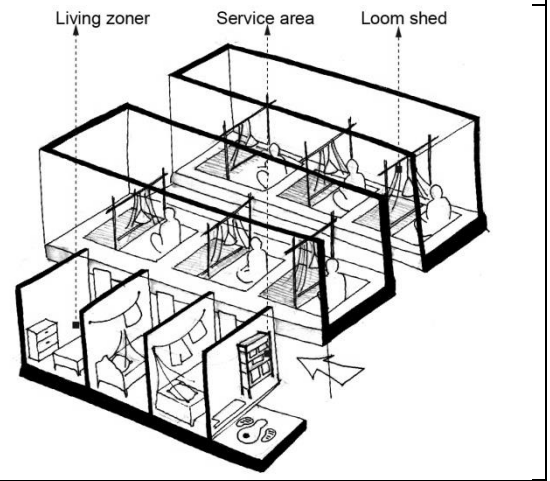
Rupganj Jamdani Palli (House C)		N-S oriented	2016	75%:25%	Row houses (nuclear family)
Mirpur Adi Benarashi Palli (House D)		No Specific Orientation	2000	80%:20%	Nuclear
Mirpur Vashantek benarashi Palli (House E)		No Specific Orientation	2011	85%:15%	Row houses (nuclear family)

Source: Hand drawn by the author during survey

From this table, this is showing that houses are losing their spatial character and productive spaces during the stages of changes. The trace of ethnicity has lost its indigenous practice of building. Quality of spaces was also being affected by this extinction. The 3-dimensional diagram in table 2 shows how this age-old culture is going forward on the verge of its disappearance.

Table 2: Three Dimensional Characteristics of Spaces

Type	Section	Axonometric View
Tangail Taatpalli		
Narsingdi Taatpalli		
Rupganj Jamdani Palli		

Mirpur Adi Benarashi Palli		
Mirpur Vashantek benarashi Palli		

Source: Hand drawn by the author during survey

Findings

Based on an understanding of how the requisites of weaving interlink with the principles of traditional architecture, Handloom is a profession where man and woman work with hand-in-hand. Previously, Women were the major source of this production process as there were spaces where they can generate their work. However, now those spaces where women of a family used to work, gossip doesn't exist anymore. The central court and the rear court were personal spaces which can rarely be seen. For architectural preservation, those transformed and transfigured spaces need to be addressed and re-adding those features will rejuvenate this ethnic identity with more economical prospect and ground.

Table 3: Findings from Analysis of Space Organization Matrix

Continued Features	Transformed Features	Transfigured Features
• Sunken spaces for weavers in the loom shed • Integrated living and working zone • Rear court	• Linear street for sizing transformed linear narrow circulation • Circulation becomes linear • Segmented house pattern transformed into a row house pattern • Loom shed area is shrinking • Yards are decreasing in number and sizes; central, rear and frontal court are not existing altogether	• Porch spaces transfigured and shrunk with circulation. • The central courtyard does not exist anymore in contemporary houses. • Interactive spaces of women and men.

Conclusion

The main purpose of this study was to explore the traditional and architectural features of the handloom community in order to evaluate the changes of spaces over the time. Throughout the analysis process, it has been identified that the traditional and existing patterns of weaver household differ from the point of spatial quality and layout organisation. Such changes can be outlined under the continued, transformed, and transfigured elements or features. Continued features, which are the core characteristics of these weaving communities, somehow managed to cope up with changes to a greater extent as these spaces are basic functional needs for weaver's community and those spaces also involved thermal comfort, smooth working condition. Transformed features can be considered from positive as well negative standpoint. For instance, shifting from the traditional organic way of development current circulation pattern is becoming more linear or regimental in a sense. On one side such adaptation easing accessibility but on the other hand it ultimately shrinking the productive space of weaving like street sizing or winding. Therefore, it can be ascertained that accessibility is getting priority over supportive workplaces. Spaces or features which are completely abolished have been titled as transfigured spaces. Courtyard and interactive spaces can be a prime example of transfigured spaces.

These communal spaces were soul of the weaving heritage. As a basic need of shelter, weavers do have a roof over their head but increasing family sizes generations after generations have led to a situation where they can neither move out of the existing living situation due lack of proper income and social bonding. Interactive character of such spaces played a dual role by integrating social space with the work place within a single household. Furthermore, the extinction of courtyards also limited the scope of work for the women, who previously contributed a major portion in the income. Therefore, it is a matter of concern that with the formation of transformed spaces along with continued spaces, there is a dire need of a revival of transfigured spaces which do not exist now. Rejuvenating these features can bring back the past glory of handloom from the clutch of destruction.

References

ADB, A. d. (2002). Strategic Issues and potential Response- Small and Medium Enterprise Development and export expansion. Bangladesh: Asian Development Bank.

Ahmed, M. U. (1999). Development of Smallscale Industries in Bangladesh in the New Millenium: Challenges and Opportunities. Asian Affairs, 21, No-1.

BHB. (2012). Bangladesh Handloom Board Profile. Dhaka: Bangladesh Handloom Board.

Karim, A. (1975). Dhakai Muslin. Dhaka: Bangla Academy.

Saidur, M. (1993). Jamdani. Dhaka: Bangla Academy.

Sobhan, R. (1989). Employment and social issues in the Formulation of policy for the Handloom. The Bangladesh Development Studies , XVII, Nos 2 & 1.

Wahid. (2016). THE TRADITIONAL EPIC ART OF BANGLADESH (INTANGIBLE CULTURAL HERITAGE OF HUMANITY). International Journal of Asian History Culture and Tradition , 3 (2), 33-40.

Habib, A. M. R. (2017). Jamdani Kotha : Weaving the Heritage (BRAC University). Retrieved from http://hdl.handle.net/10361/10244

APPENDIX

QUETIONNARE SAMPLE

1. Family Status:
    a. How many members are there in household?
    b. What is status of weaver?
        i. Master Weaver
        ii. Employ Weaver
    c. How many members of household are associated with handloom weaving process?
    d. Do women associated with handloom weaving?
    e. What is the type of family?
        i. Extended
        ii. Nuclear
        iii. Joint
2. Daily Routine:
    a. When do you start working on a day?
    b. What is process of work on whole day?
    c. How much time do you spend on weaving per day?
    d. When do you go to frontal shops?
    e. Where do you sell your clothes?
        i. Markets
        ii. Flea Markets
        iii. Frontal Shops
        iv. Household Premises
    f. Which timing is appropriate for weaving?
3. Salary:
   Master Weaver
    a. How much do you pay per cloth?
    b. Are you satisfied with the income that you get per cloth after selling?

   Employ Weaver
    a. How much do you get from per cloth?
    b. Are you satisfied with the wages that you get?
4. Religion
    a. What is your religion?
    b. Does any character of your house merge with your religion and your profession (weaving)?
    c. Do courtyards serve your religious needs and production needs?
5. Culture:
    a. Do your family associated with this weaving industry traditionally?
    b. Since when your family is associated with this culture?
    c. Do you think that it's part of your culture?
    d. How many generations of your family use handloom as their profession?
    e. How was the place they used to work?
    f. What pattern of cultural space serves their living and working environment simultaneously?
    g. Do you think you are in better space than them? Yes/ No
    h. If no, why are you not satisfied with the place you live now?
    i. Which element of your culture is missing?
    j. What is the way of revival of your culture?
6. Construction history:
    a. What kind of material do you use to make you loom shed and houses?
    b. Do your past generations use same kind of material?
    c. What is the difference between then and now in construction?
    d. Does this kind of changes affect your production process?
    e. Why weavers sunken their weaving space in floor?

f. Why do they use mud floor from generation to generation?

7. Legal Issues of Ownership:
    a. How many looms do you have? :
        i. Owned Looms
        ii. rented looms
    b. What is the status of your household space?
        i. Rental
        ii. Government subsidized
        iii. Owned
8. Land-Use Pattern:
    a. Where do you work?
    b. Do your living and working spaces are interconnected?
    c. Which spaces of your household connect your living and working shed?
    d. Are there any differences between your household and your past generation?
    e. What is lacking in your household?
    f. Which spaces of living and working of your ancestors differ from yours now?
        i. Rear Courtyard
        ii. Central Courtyard
        iii. Frontal Yard
9. Climatic Comfort:
    a. Why do your past generations live beside the water bodies?
    b. What do you do for climatic control in loom shed?
    c. Why mud is useful?
    d. How much light do you need for weaving?
    e. Which kind of screening do use for lighting and ventilation?
10. Sociological and other Aspect:
    a. What kind of spaces do they use for gathering?
    b. What were the spaces of socializing in the past?
    c. Which spaces had impact on their communal bonding?
    d. What kind of shared spaces both serve their working and societal environment?
    e. Do they have any traditional functions for community gathering?
    f. Do they want to teach their next generation loom work?
    g. Which spaces need to be preserved of handloom household?

Which spaces need to be revived from past?

Architecture as Stated in the Quran and Hadith, and Finding the Reflection in Islamic Architecture

Afrina Haque

Abstract: *Building design or architecture is a fast growing subject and a popular one. The main purpose of the building is to serve human beings so that they live their life comfortably. In design, there are many kinds of rules and regulations, concepts, guidelines, user pattern, etc. Climate and location also have a bigger impact on it. There are many kinds of theories that also influence architecture. One of them is called Islamic Architecture. Islam is the second largest religion in the world and Islamic architecture is very well known. The outcome of Islamic Architecture is sometimes contradictory with the main theme of Islam. The word "Islam" means "submission to the will of God." It teaches us that there is only one God and that Muhammad is the Messenger of God. The Holy Quran (the holy book of Islam) and Hadith (recorded sayings of the Prophet Muhammad) suggest that we live in a very simple way. Islam is called a religion of peace and in every part, teaches us to be very simple and peaceful. In the case of Islamic Architecture, the best example is the "Mosque". The design of the mosque was also very simple and plain, at the time of the Prophet Muhammad. It only had the elements that are needed and no extra components. On the other hand, Islamic Architecture has some distinct characteristics in the form of building, the decoration of surfaces made with calligraphy, geometry, and interlace patterns. These features were created by different Islamic rulers at different times. These do not always come from Islamic beliefs. This paper will try to find the real feature of architecture stated in the Quran and Hadith. These books are to guide people's lifestyle and do not have direct statements about architecture although there are many statements related to building design. The paper will use qualitative methodology for the whole analysis by following the statements of many experts and scholars. In addition, this paper will also try to evaluate some features of Islamic Architecture. Through these findings, it will become easy to relate Islam to Islamic Architecture, and to show how it does not correspond to the practice of Islamic Architecture.*

Keywords: architecture, Islam, guideline, the Quran, Hadith, Islamic architecture

Introduction

To understanding Islamic architecture one should first understand Islam and architecture separately. Islam is a religion; it is a constitution of living provided by “Allah”. It guided human being in their everyday life. It has all the solutions to any problem a human can face. However, they need to find the answers by searching the Holy Quran and the Hadith.

Architecture can be defined as the art and science of the design of structures or buildings such as houses, office buildings, market place, religious buildings, etc. (1). According to Bjarke Ingels “Architecture is the art and science of making sure that our cities and buildings actually fit with the way we want to live our lives: the process of manifesting our society into our physical world” (2). Another definition is given by John Portman "Architecture is not a private affair; even a house must serve a whole family and its friends, and most buildings are used by everybody, people of all walks of life. If a building is to meet the needs of all the people, the architect must look for some common ground of understanding and experience.”(2). The basic purpose of architecture is to provide shelter for human. Different kinds of function need different types of building and manifesting it depends on many other things, context, climate, etc.

Islamic architecture is a philosophy which is directly related to building form. As for the same way it seems to be followed the main theme of Islam. Though Islam has every solution to any problem, it does not have any direct statement about architecture. It provides some guideline about privacy, user pattern, cleanness, etc. from which one can define the rules about architecture.

This paper will try to define the main understanding of Islam than how the Islamic architecture was born and the features of Islamic architecture. Then it will try to deifier what was stated in the Quran and Sunnah about architecture by analyzing the main source and many scholars opinion. It will help people to relate or separate Islamic architecture with Islam.

The meaning of Islam

Islam is derived from the Arabic word "Salema" that means peace, purity, submission, and obedience. In the religious sense, Islam means submission to the will of Allah (God) and obedience to His Message/guidance in worldly life. It will help for achieving success and peace in this life and afterlife. The follower of Islam is called Muslim; they need to submit themselves to the will of Allah and practice Islam in their words and actions. Allah sends the first man Adam in the earth with an instruction.

God said, ‘Get out of the garden as each other’s enemy. Whoever follows my guidance, when it comes to you [people], will not go astray nor fall into misery. But whoever turns away from it will have a life of great hardship. We shall bring him blind to the Assembly on the Day of Resurrection. (3)

This Guidance or message was the most important one was given by Allah and it conveyed to the all nations by the Prophets and Messengers of Allah, including Abraham, Moses, Jesus, and Muhammad (peace be upon them). Whenever Islam's messages (holy books) are contaminated and the true teaching of Prophets are lost or misunderstood, the Almighty Allah send a new Messenger to restore it as this is the Heavenly way to guide humanity to the right path. According to Islam, the last messenger was sent by Allah is Muhammad.

“The central concept of Islam is tawhid or ‘unity’, ‘the unity of Allah’. According to Marwan Al-Kaysi, tawhid is the absolute ‘oneness and uniqueness of God’ and rejects all kinds of polytheism, whether primitive or evolved’.” (4)

An additional, the most important thing of Islam is five pillars. The first pillar is one has to submit himself to the will of Allah and worship Him alone, in a way that prophets and Massagers had taught to mankind. The second one is prayer. The

Muslim prays five times a day, bowing and kneeling as did the ancient Semites, and he fasts during a whole month (Ramadan) from sunrise to sunset. Fasting is the third one. Pilgrimage to Mecca is called Hajj and the last one is Zakat, the mandatory charity to Muslims.

Shariah the law of ISLAM

According to Islam, the life of a Muslims is compliant to the will of Allah and it is expected from a Muslim society that it will not break the law of God. 'The political order, social organization, culture, economic policy, and legal system of these societies must be tune with the code of guidance revealed by Allah in His Book (Qur'an) and the tradition of the Prophet (Sunnah). This code of conduct known as shariah.' (4)

Shari'ah or law of Islam is mainly focused on the standards for the orderly behavior of all aspect of Muslim life, both individually and communally. These guided various human activities such as religious ritual, personal behavior, morality, habits, family relationship, social and economic affairs, administration, the rights, and duties of citizens, the judicial system, the laws of war and peace, international relations, etc. ' In its objectives of facilitating daily life, shariah removes from people harmful, burdensome customs and superstitions'(4). This law will help human in all aspect of their life not only on the evil thing. 'These benefits apply to everyone, the rich and the poor, the rulers and the ruled, and the men and the women throughout the world and forever.'(4)

The Quran is known as the word of Allah and the main source of Islamic teaching. Though it is for Muslim anyone can read it. The Arabic word al means 'the book to be read'. In this book, Allah gives the solution to every problem by giving real examples. It is like a storybook containing the promise and the Threat.

The Sunnah is the lifestyle of the prophet Mohammed. It includes his deeds, words, advice and indirect commandments. The Arabic word, Sunnah means the 'method'. According to shariah, it is what the prophet said and did. 'The contemporary Muslim scholar, Husaini, defines Sunnah as the model pattern and behavior.

Islamic Architecture

Islamic Architecture has an interesting background of its creation. After the death of Prophet (632), His successors establish Islamic civilizations known as 'Caliphate'. Which means the country or state shall be ruled according to the Islamic law under a person considered a religious successor to the Islamic prophet, Muhammad (PBUH), and a leader of the entire community. The prime era of Islamic civilizations are known as Rashidun Caliphs (632- 661); Umayyad Caliphs (661-750); Abbasid Caliphs (750-1517) and Ottoman Caliphs (1517-1924). Among those Muslim rulers, only "Rashidun Caliphs" are known as "rightly guided" by Muslims. During Rashidin Caliphs, Muslim rulers were busy to the formation of government systems like political divisions, judicial systems, administrative system, law and enforcement, military activities, public allowance and social welfare system, taxation, and other financial activities. The architecture was less important during that time. In late 700CEs, Umayyad (661-750C.E) rulers started established the Muslim Kingdom. In this time Muslim rulers were starting to establish a city, palaces, forts from the influences of Roman and Persian lifestyle. They employed the same architects and masons groups from previous emperors. As a result, a new pattern of architecture was born with partisan influence but following some Islamic rules. According to Fletcher "Muslims were not blind imitators but were content to adopt each local style that they found, modifying it mainly in distinctive ornamental details, but also introducing several important new features of plan and structure. They adopted the construction techniques of the Byzantine and Sassanid empires (5) and developed some significant architectural styles and decorations (6).

Later this new approach in architecture spared widely across different countries and continents. Among these approaches, Certain Building

elements and styles are universally and distinguished throughout the world. Whether religious or secular the splendid style of known Islamic architecture can be defined by several common characteristics.

- Ornamentation in the building is a well-known feature of Islamic architecture. The geometric pattern, curving and branching plants forms, and Islamic calligraphy: these three are frequently used as ornamentation. Other than these, specific ornamental forms, including mathematically complicated, elaborated geometric and interlace patterns, floral motifs like the arabesque, and elaborated calligraphy is also known as Islamic art. As figurative art was prohibited in Islam, people work on art in another dimension.
- Arch is another very prominent architectural element; it can be seen in most of the Islamic buildings. Ogee, Horseshoe, Pointed and Multifoil arch is very common in Islamic Architecture. The horseshoe shape and multifoil arches were developed by Muslims and widely used by most Umayyad buildings. In modern time arch is mostly used as a representation of an inevitable part of Islamic buildings.
- Dome was introduced in Islamic architecture to amplify structural and skylight benefit. It is a prominent symbol in Islamic Architecture, especially in mosque building. Single or multiple uses of the dome can be seen in the ancient and modern mosque.
- The courtyard is a quite common elements both secular and religious building in Islamic Architecture. All old mosque's the main prayer hall is adjoined to an open courtyard, called Shan. Most of the time the courtyard comes with a fountain, its waters both a welcome respite in hot lands and important for the ablutions (ritual cleansing) done before prayer. In Residence or other secular building, it is a private area with the garden as well as a source of light and ventilation. It also serves as a private open space for female households.
- One of the most visible aspects of mosque architecture is the minaret, a tower adjacent or attached to a mosque, from which the call to prayer is announced. It was first introduced at Umayyad mosque and progressively using till today as a symbolic structure of Mosque architecture. Not solely functional in nature, the minaret serves as a powerful visual reminder of the presence of Islam.

Architecture in Islam

The ultimate achievement in Islam is to get success in the afterlife, therefore, the sincere believers are always focused on his worldly affairs based on the guidelines from the Quran and Sunnah. As architecture is an interment part of our daily life, Islamic architecture should be for the purposes of the Islamic way of life and living. In Quran and the tradition of Prophet Muhammad (PBUH), there is some guideline directly connected with the construction of the mosque as well as building activities and there are many others teaching indirectly connected with building activities. Here this paper is trying to quote them from the holy Quran, hadith with some explanation of scholars.

Guideline for Mosques:

The mosque made by the prophet himself in Medina is the best example of mosque architecture, yet there are some other early mosques also consider as the foundation of Islamic architecture. Whatever the architectural value of a building is, it has to have the following criteria to become a mosque,

- The building must be made for only the sake of Allah's pleasure for the purposes of worshiping Him alone. The holy Quran clarifies it in several occasions like - "It is not right for the idolaters to tend Allah's places of worship (Mosque) while testifying to their own disbelief: the deeds of such people will come to nothing and

they will abide in Hell. The only ones who should tend Allah's places of worship are those who believe in Allah and the Last Day, who keep up the prayer, who pay the prescribed alms, and who fear no one but Allah: such people may hope to be among the rightly guided [7]"

- The Prophet Muhammad (PBUH) always encourage people to work with mosque and mosque-related activities one of this His famous quote about the mosque is, "He who built a mosque for Allah, Allah would build a house for him like it in Paradise. [8]
- From the design perspective, Prophet discoursed making monumental mosques and instructed to make it low in height. In his words "I see you building your mosque high after I am gone, just as the Jews built their synagogues high and the Christians built their churches high." [9]
- The cleanliness is a mandatory part of prayer. The place of prayer needs to be physically clean and also spiritually. Enough light and ventilation can make a place clean by spiritually [10] "Keep your infants, your insane and your evil ones away from your mosques. Avoid engaging in transactions and disputes, raising your voices, carrying out your prescribed punishments and unsheathing your swords therein. Make places for purification at their gates, and perfume them with incense on Fridays." [11]
- • In terms of decoration, the prophet does not like it because it takes attraction. Narrated `Aisha: The Prophet said, 'I was looking at its (Khamisa's) marks during the prayers and I was afraid that it may put me in the trial (by taking away my attention) [12]. On the other occasion, Prophet (PBUH) said that "It is not convenient for me to enter a home which is decorated excessively." [13] According to Dr. Spahic Omar "Obviously, due to the mosque's position in both society and every true believer's life, the Prophet (PBUH) was concerned about the theme of mosque decoration more than about the other aspects of Islamic built environment. In one of such traditions, he is reported to have said that whenever people's performance weakens, they then start decorating their mosques. [14]

Guideline for building:

Apart from the guideline for building the mosque, there are some guidelines found for secular buildings, especially for residences. In the Holy Quran, the good houses are marked as a reward (in haven) for believers and encourage them to works for it. Though the Quran and Sunnah do not have a direct code of designing one can relate the verses with it. Islam permits all houses to relate with own custom and regions as long as they do not conflict with the Islamic lifestyle. For example, the money, the land associated with the housing must come from a permissible source. And also the intention of making a house should come from the needs. Some other aspects are also very important which are overlooked by many Muslims. Privacy, cleanliness, safety, segregation, wastages, proper natural light and ventilation, the climate might be the guiding principle for making a Muslim house as well as Islamic architecture.

- The prophet lived a very simple yet comfortable life. His lifestyle is the best example of the optimum utilization of resources. His house in Medina was big enough to accommodate extremely really necessary things. He gave some suggestions about house building warn about wastage/exaggeration on house making. There should be a bedding for a man, bedding for his wife and the third one for the guest, and the fourth one is for Satan. [15]
- Islam has a special emphasis on honoring human privacy. Special concern is given in this particular area, therefore architectural design should have considered the household's privacy issues seriously. The privacy issue makes Muslim houses different from others. Believers do not enter other people's houses until you have

asked permission to do so and greeted that inside– that is best for you: perhaps you will bear this in mind. If you find no one in, do not enter unless you have been given permission to do so. If you are told, 'Go away', then do so– that is more proper for you. God knows well what you do. (16)

- The house privacy is an affiliation of the principles that separate owner's private life and public intercourse, it is also a part of the Islamic system of sex segregation. The aspect of privacy should be considered in order to make good social interaction between occupant and neighbors. The visual and acoustic privacy both are important design criteria for a Muslim house.
- There is direct instruction about the toilet. According to Dr. Spahic Omar "when planning and designing toilet, a Muslim Architect should bear in mind that Muslims are advised not to face the qiblah direction, nor to turn backs to it, whenever they defecate or urinate". (17)

Conclusion & Recommendation

Islam is very simple and clear as a religion. As the same, it prefers a clean and simple architecture. It does not require any decoration or symbols, though it does not forbid them either. It says not to show off or elaborate things. Which does not relate with the known Islamic architectural practice. So it is not justified to call it Islamic architecture, rather than it should be named as Muslim Architecture, because it was built by Muslim with some emphasis of Islam but not directly derived from it.

References

1. *https://simple.m.wikipedia.org/wiki/Architecture (Accessed 14 September 2019)*
2. *https://www.archdaily.com/773971/architecture-is-121-definitions-of-architecture (Accessed 14 September 2019)*
3. *The Quran, Surah Ta Ha (20) – verse 123,124. A new translation by M.A.S. Abdel Haleem, 2005; Oxford University Press, NY. p- 201.*
4. *Yusof Z. B., Islam And Architecture, Architectural Interpretation From The Values Of The Al Quran And Sunnah, https://www.academia.edu/2451718/ISLAM_AND_ARCHITECTURE_Architectural_interpretation from_the_values_of_the_al_Quran_and_sunnah*
5. *Talgam, Rina (2004). The Stylistic Origins of Umayyad Sculpture and Architectural Decoration. 1. Otto Harrassowitz Verlag.*
6. *Petersen, Andrew (2002).Dictionary of Islamic Architecture. Rout ledge.*
7. *The Quran, Surah At-Tawba (9) – verse 17, 18. A new translation by M.A.S. Abdel Haleem, 2005; Oxford University Press, NY. p- 117*
8. *(Sahih Muslim 533 b) Collected from https://sunnah.com/muslim (Accessed 17 Jun 2019)*
9. *(Sunan Ibn Majah 740) Collected from sunnah.com (Accessed 17 Jun 2019)*
10. *Sunan Ibn Majah 750 Collected from sunnah.com (Accessed 17 Jun 2019)*
11. *(Sahih al-Bukhari 373) Collected from sunnah.com (Accessed 17 Jun 2019)*
12. *(Abu Dawud, Salat,12) Collected from sunnah.com (Accessed 17 Jun 2019)*
13. *Omer S. (2012) Building and Decorating Mosques; Islamic City; Retrieved 17 Jun 2019 from http://www.islamicity.org/*
14. *Sahih Muslim 2084*
15. *The Quran, Surah Al Nur (24) – verse 27, 28. A new translation by M.A.S. Abdel Haleem, 2005; Oxford University Press, NY. p- 222*
16. *Sunan Abi Dawud 455; Retrieved 17 Jun 2019 from https://sunnah.com/abudawud/21/130*
17. *Omer S. (2011) "The Qur'an and Sunnah as the Foundation of Islamic Architecture' https://www.islamicity.org/4551/the-quran-and-sunnah-as-the-foundation-of-islamic-architecture/ (Accessed 07 April 2019)*

The Politics of 'Home' in Urban Informal Settlements

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Abstract: *Set within a context of many socio-spatial binaries like legal-illegal, planned-unplanned and formal-informal, and in the general absence of any clear answer to how within these binaries ordinary urban spaces are (re)created and (re)shaped, understanding rural-urban migrants' home-making in the urban 'informal' settlements incite the necessity for a comprehensive framework. Based on a recent Doctoral work and supplemented with ongoing empirical works in these settlements of Khulna, Bangladesh, this paper argues that such a framework must be devised in consideration of these conditions, while comprehending the key socio-spatial-political mechanisms underlying migrants' home-making. It hence proposes a conceptual framework – constructed of the concepts of 'home' and 'scarcity' to depict the acts of home-making by the migrants in Khulna more comprehensively. Here, scarcity is discussed first as a geopolitically constructed rather a real condition for control – manifested in the works of different authoritative regimes in Khulna settlements at its different scale levels. Second, the scarce conditions are also found to be used by the migrants for sustaining their present, often 'illegal' and 'informal' tenure, and therefore secure a dwelling. This research highlights a number of spatial-behavioural-social-political mechanisms and their physical outcomes as practiced in aforesaid settlements. It reveals that this constructed condition of scarcity is compensated by everyday acts of socio-spatial negotiation for territorial control – often transgressing the established boundaries of the aforementioned binaries, which manifest into alternative spatio-behavioral expressions. It is argued that the 'home' becomes a meaningful idea only when it's spatial thresholds and migrant peoples' many acts of negotiation are viewed in relation with the wider geopolitical circumstances (i.e. scarcity) underlying Khulna's migrant settlements. 'Home', in this context, thus manifest as a socially (hence politically and externally) constructed idea beyond its traditional 'internal' focus.*

Keywords*: migrants, slum, urban home-making, Khulna*

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Introduction

Driven primarily by rural-urban migration, informal settlement processes have, since 1960s continued to infuse an alternative order to the 'third world urban form'. Co-existence of contradictory/binary socio-spatial elements – the *formal-informal*, *permanent-temporary* or *legal-illegal* hence demands a critical scrutiny of this urban form in order to comprehend their spatial-physical implications. Assuming that urban informal settlements in today's city are somewhat a physical manifestation of such co-existences, this spatial-physical manifestation, i.e. the resulting urban form, both at the levels of the larger settlements and at the house, begins to make sense only as the role of these built environments as sites of various socio-political-behavioural interplays between the ordinary migrant and authoritative actors are realized. In the sheer absence of public/private provisioning of housing for the informal population, the key questions are: "how could these migrants still make a home for themselves against such contradictory coexistences and what spatial, social, political, behavioural mechanisms were used in that?"

Against this backdrop, we examine selected informal settlements in Khulna and argue that the concept of 'scarcity' has been used as a condition of control in the works of different formal bodies and authorities at the different levels of Khulna city, but also by rural-urban migrants to sustain their present, often 'illegal' and 'informal' tenure, and therefore secure a dwelling. The ways within and between which their co-existence operate help explain how ordinary urban forms are shaped in Khulna. We aim to explain how these concepts are sustained/compensated by everyday acts of socio-spatial negotiation for territorial control – often transgressing the established boundaries of the aforementioned binaries, which manifest into alternative -behavioral expressions. In this process, 'home' becomes a meaningful idea only when it's spatial thresholds and migrant peoples' many acts of negotiation are viewed in relation with the wider geopolitical circumstances (i.e. scarcity) underlying Khulna's informal settlements. 'Home', in this context, thus manifests as a socially (hence politically and externally) constructed idea beyond its traditional 'internal' focus.

Methodology

Khulna (Figure 1) was considered a setting for the research due to its significance as a *medium-sized* city, which according to UN (2008) is a category of cities where 23% of global population will be accommodated by 2025. Khulna is also the third largest city in Bangladesh with a population of around 2 million and with a density of 67,944 persons/km^2 within 45.65km^2 of its core municipal area (KCC 2012). With 37th ranking amongst the world's fastest growing cities (City mayors 2007), it also has the highest concentration of urban poor amongst all coastal towns and cities in Bangladesh (Ahmad 2005: 16), and has one of the largest concentrations of "poor settlements" in the country with more than a million (58.9%) people living there presently (CUS-UNDP-KCC 2011: ii).

The research methods used are qualitative, and the approach in generally inductive. The research was conducted considering 'types and levels' of settlements; 10 informal settlements based on tenure were selected (Figure 2). To comprehend migrants' everyday spatial/building practices, 34 dwelling units and adjacent neighbourhood tissues were also studied over a period of two years. Households were selected ensuring *variety* according to religion, ethnicity, rural origin, headship and in-house income generation. For data collection, literature review, *life history*, architectural mapping and drawings, semi-structured interviews and *FGDs* were used. *Content analysis*, *descriptive morphology, behavioural regularities in everyday life* and *social world analysis* were used for analysis.

In-between-ness and temporality

The possibility of urban land ownership by the migrants following their eventual uprooting from rural homes became even more impracticable in

the context of high priced land market in Khulna. In the near absence of formal/public activities in housing/infrastructure provisioning; a historical failure could be identified in realizing local socio-political-economic realities, which began with Khulna's first Master Plan of 1961. Whilst large portions of land were allocated to industry and housing in its bids to become East Pakistan's industrial city, the British planner failed to comprehend the nature of housing affordability for industrial workers. This left little choice for migrant-workers except to settle in areas around/between these industries, contrary to Master Plan's goals (Chaudhury undated: 5). Neither of the nationalized jute industries in Khulna were designed to provide adequate accommodation for its workers; nor even during their prosperous years.[1] Studies on three oldest and largest nationalized jute mills show that housing was available only to less than 10% of the overall jute mills workers (Shahed 2006: 31, 33, 35); of these 10% however, most relied on their '*deshi manush*' or political connections (with labour- or petty-leaders) to gain housing access (Hakim 2014).

In the later industrial developments like the private-sector-led shrimp industrialization that fuelled Khulna's economy in 1990s, no workers' accommodation or housing subsidy was provided for. Squatting on public land thus has continued to produce mosaic-like growth within Khulna's formal/planned areas (Figure 1: right).

And as government officials were involved in the settlement process by provisioning government land to these people, taking bribe was typical to ensure stay (Settlements 4, 8, and 10; Figure 2). Even for those having formal recognition

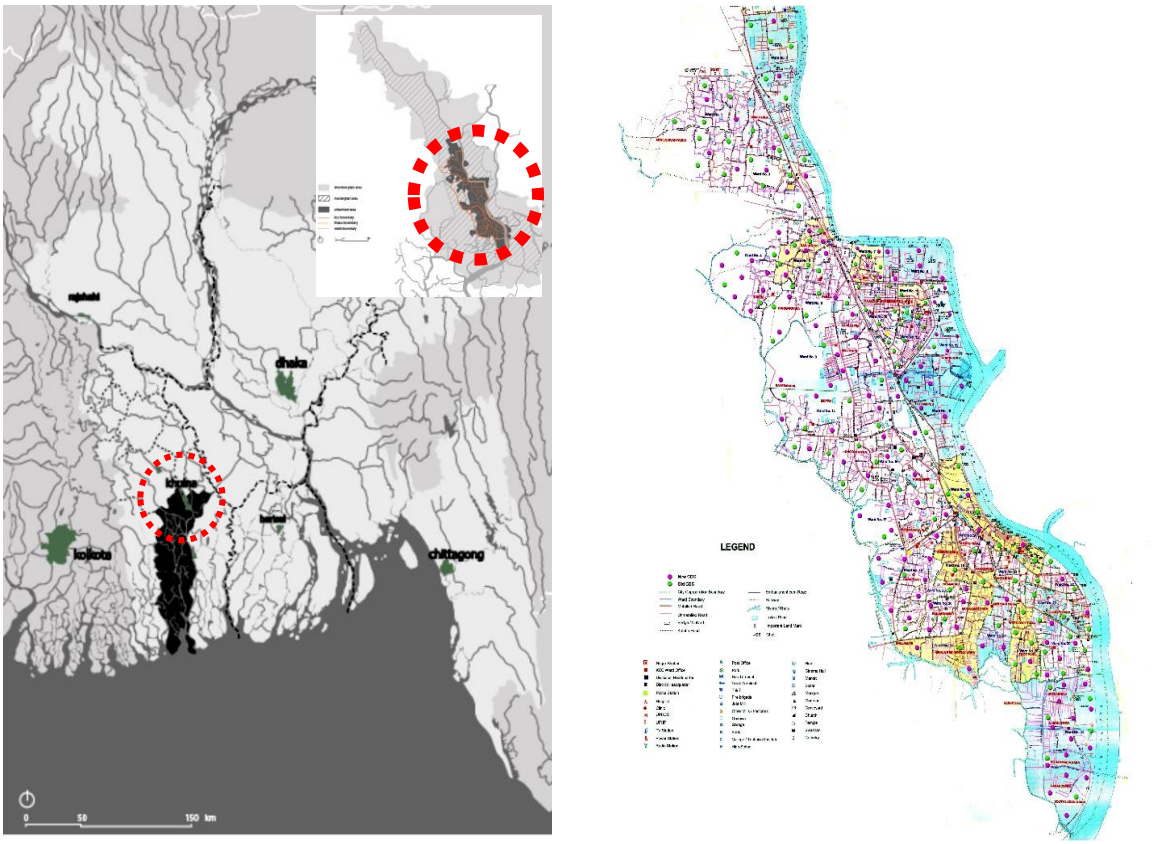
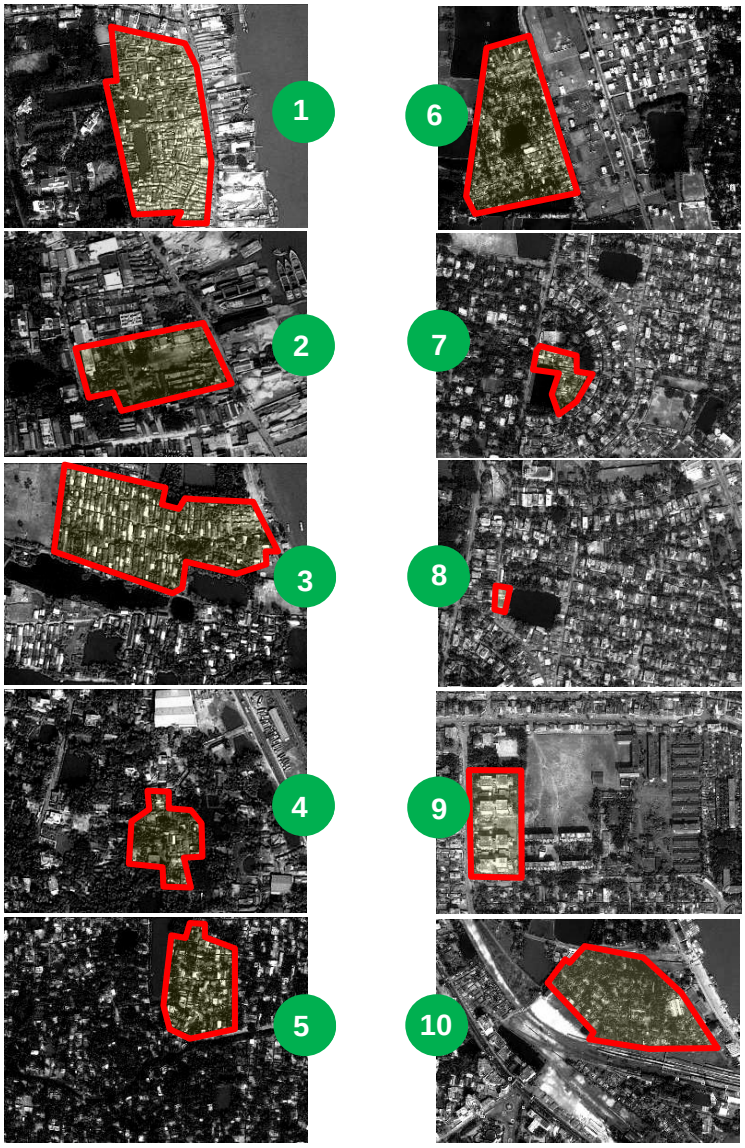


***Figure 1**: (Left) Khulna in relation to Bangladesh; (inset) administrative boundaries of Khulna – dark portion being the present municipal boundary; (right): mosaic-like (dots) distribution of 'poor settlements' within Khulna's present municipal boundary. **Source**: (Left) Dudek and Van Houtte (2008); (right) KCC-LGED-UNDP (2009).*

1. Between early- to mid-1970s, Jute export contributed around 80% to national export revenue (Rahman and Khaled 2011: 2).



Tenure-based typology of 10 high-density low income informal settlements in Khulna: (1) Government land developed by migrants – no agreement between government and tenants; only active support from political leaders; (2) Private land is rented to people with same regional root; tenants build (and un-build) their own houses and pay rent accordingly; (3) *Bangladesh Railway*'s land squatted by migrants where tenants are not landowners; informal arrangement made with the influence of a *Mastan* (mafia boss); after he perished local politicians bargain with government offices in support of migrant tenants; (4) Government land leased (long-term) to landless migrants from a particular region location following decades-long political and bureaucratic lobbying by inhabitant labour leaders; (5) Privately developed small informal settlement cluster on city periphery where land is cheap and so is rent; tenants pay monthly/weekly rent; the owner of these plots are also ex-migrants who not became the landlord him/herself; (6) Government initiated *site and services* project for the once-landless; inhabitants enjoy ownership of land still without a formal title; (7) *Bihari Refugee Camp* within the planned township of *Khalishpur*; some Bangladeshi migrants also live alongside non-Bangali *Biharis*; (8) Squatter settlement formed and maintained within the planned township of *Khalishpur* by ex-labour leader; (9) Government-built mid-rise apartments for lower-level government employees squatted by current & former jute mill workers; and (10) *Bangladesh Railway* staffs' residential quarters & adjacent land modified by Railway's staff themselves.

***Figure 2**: (Left) KCC jurisdiction map. Green dots showing spatial distribution of 10 migrant settlements; Red and Yellow dots are showing locations of export-oriented industries of post-partition and post-SAP phases respectively; (Right) Migrant settlements develop alongside industries (post-partition: 1, 2, 4; post-SAP: 7, 8, 9); settlements develop on Bangladesh Railways land (3, 10); on site and service plot (6); on private property of city periphery (5). **Source**: KDA 2012a; image courtesy Google Earth 2012*

(Settlements 3, 5, 6; Figure 2), political patronage was still required. Local-level politicians, from both ruling and opposition parties, were persistently lobbied by migrant-tenants. These politicians often visited settlements and looked after their immediate needs (repair roads, construct baths). But in cases where disputes about land ownership appeared resoluble,

process was intentionally lingered by these same personnel.

materials like brick and RCC (Figure 3 – bottom right). Despite the history of negotiation with elites and officials, and being allowed by the

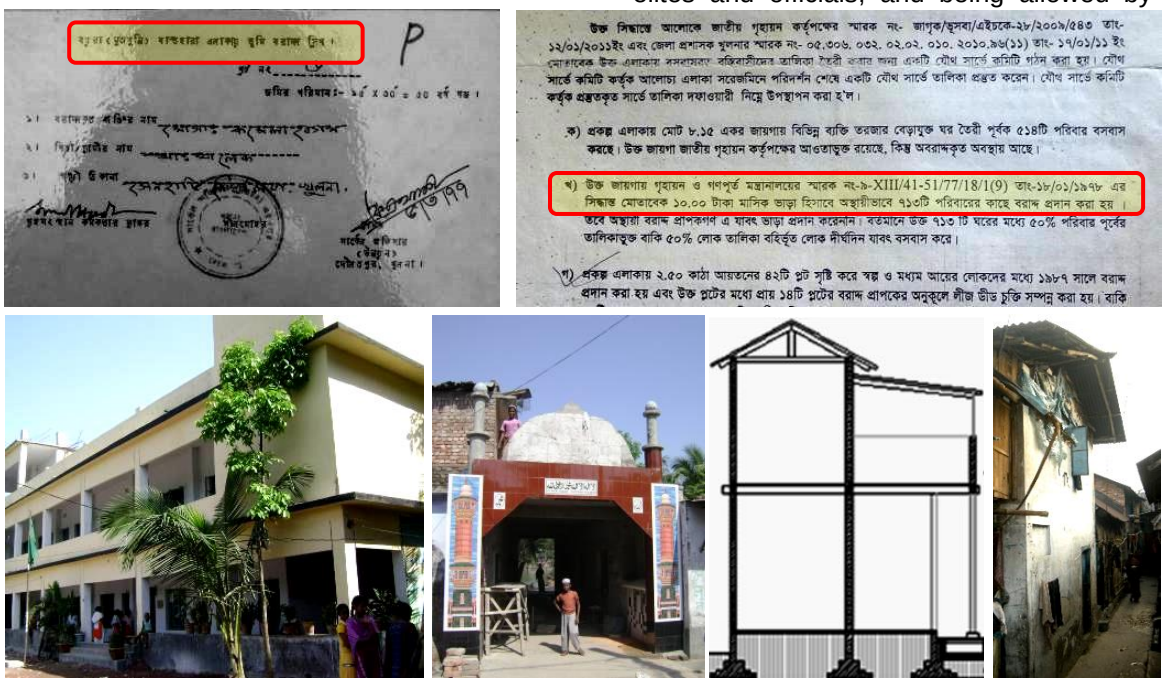


Figure 3: (Above-left) Land Allotment Slip given to Vastuhara residents in 1977; (above-right) portions of page 2 from proceeding from a 15 April 2011 meeting; this formal meeting was held between NHA officials, Khulna's land administrator, local political leaders from present ruling regime, and Vastuhara's elders. The meeting was intended to update the current land tenure situation in Vastuhara, and discuss a government proposal for replacing present land tenure with government funded mass apartment blocks; (bottom – from left to right) Vastuhara High School, Vastuhara Central Mosque and brick house with wooden floor and CI sheet roof in settlement 1.

As in settlement 6 – the government-provided low-income site and service project allotted to the homeless in mid 1970s, formalization of title has still been deliberately kept unresolved for almost 4 decades. It was only the 'Land Allotment Slip' (Figure 3) that was issued to migrants for 45m^2 plots in 1977 instead of a formal title deed ('*Dalil*' in *Bangla*). Although entitled for such a *Dalil* by Government decree, the holders of these slips (i.e. the actual owners) are still kept in a dilemma with a tenure status being formal and informal at once. Noteworthy to mention that the recent UNDP-KCC led UPPR project (UNDP 2007) has been based on this same concept of in-between-ness where its success owes mainly to ensuring temporary 'tenure security' – not by ensuring permanence.

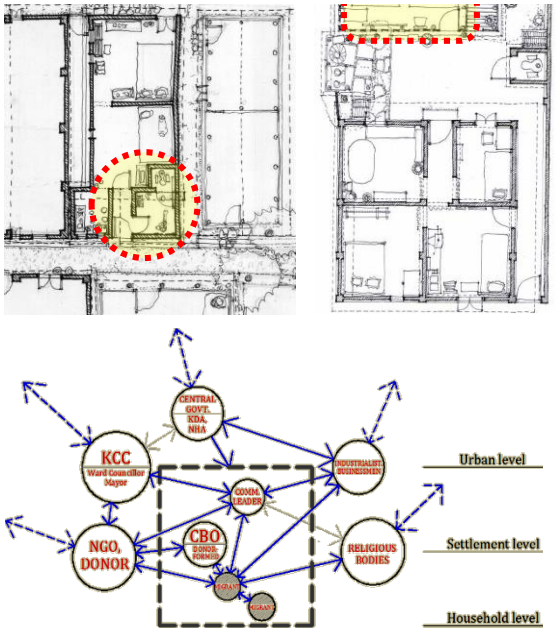


Figure 4: Compromised control: (top-left) part of house premise given up for community bath in settlement 7; (top-right) previously vacant in-house space transformed into NGO-run pre-school in settlement 1; (bottom) complex decision-making structure of larger migrant settlements like settlement 1 and 3.

Similar in-between-ness can also be found, what we call the '*politics with plinths and roofs'*. Here 'illegal' migrants also refrain from constructing permanent roofs despite many buildings (often two-storied) being constructed of permanent

latter to do almost everything akin to a normal owner: buy/sell property, construct buildings, infrastructure and utility etc., building of permanent roof was never approved and acceptable. This kept giving the impression that migrants are not to stay there permanently. As a metaphor, this highlights a crucial spatial-physical dimension of informal settlements and their rather '*slippery*' tenure status (as in settlements 1 and 7, Figure 2).

Politics of control

As 'in-between-ness' and deliberate preservation of 'greyness' appear to be the most predominant form of control for the politicians, social elites, NGOs and government officials, the settlements' decision-making structure (e.g. for house or road construction) appear to be one quite hierarchical and complex (Figure 4).

We have found the migrant dweller often giving up portions of their spatial-territorial claim or allow neighbours to use certain 'private' space, for example, portion of dwelling unit/space in order to gain higher social control. Even with severe deficiency of space as in the 28'X11' house in Figure 4 (left), a 6'X6' veranda space has been given up for constructing a community bathroom cum water collection point. Giving up of a tenth of what is already scarce according to most definitions of 'standard', certainly indicates a different set of priorities for this owner. As a community cluster-leader for UPPR project in settlement 7, this would certainly reinforce her external social position and reputation namely: community elders, neighbours (users of the new bathing/water facility) and UPPR officials. This construction legitimizes community's position as the key decision-making body and re-affirms its authority over the control of socio-spatial activities within the settlement.

Similar has been viewed in the 'rural-like' environment where neighbours living in the deeper areas of the settlement (1, 3) are typically allowed to use the street-front owners' private courtyard to reach their homes. Such 'negotiated control' in a different form is also noticed in another example (Figure 4, left). Here the Christian owner has permits the Christian Missionary-led NGO (CSS) to construct a pre-school within her house premise. In these settlements where people are ever more anonymous than an average urban citizen, such territorial compromise can only be seen as pieces of an effort toward the formation of some sort of identity. Any form of structure portraying these negotiated control mechanisms, even if they are made of bamboo and thatch, can be seen as important landmarks toward identity formation for these poor migrants in the city.

Politics of infrastructure

In order to corroborate their present status and remain 'visible', migrants often practice the 'politics of infrastructure'. Often at settlement/public level, migrants put in efforts to legitimize their 'illegality' by trying and getting recognized by as many formal public- (such as water/electricity supply, postal service etc.) and private-sector institutions (e.g. NGOs) as possible (Figure 5). Installation/erection of physical infrastructure becomes the most practiced means in achieving senses of permanence and claim. Infrastructure of any size, quantity or quality, even if unfit or less required, are all accommodated. Infrastructures, which are at once visible and permanent investments from the part of official bodies, are perceived to leave a 'formal stamping' on these otherwise informal and illegal spaces. All forms of external interventions, including NGO- or Donor-led infrastructure projects (e.g. *Slum Upgrading*) hence are welcomed and actively pursued.

Infrastructures may have strong political implication, therefore, are often self-financed. In large settlements like settlement 6, secondary schools, Madrasah and *Yatimkhana* are built, managed and promoted by the community itself which outsiders can also attend/access (Figure 3 – bottom left & middle). Likewise, in the *Harijanpara Kali Mandir* in settlement 3 – self-financed by the *Harijan* community, where a Muslim woman from a distant district is seen sitting before this Hindu temple (Figure 5) waiting

for a spiritual healing session to begin. Although the *Mandir* primarily serves the ritual purpose of the *Harijan*, people even from other faiths are also invited. The non-monetary transactions and information flows between host and outside

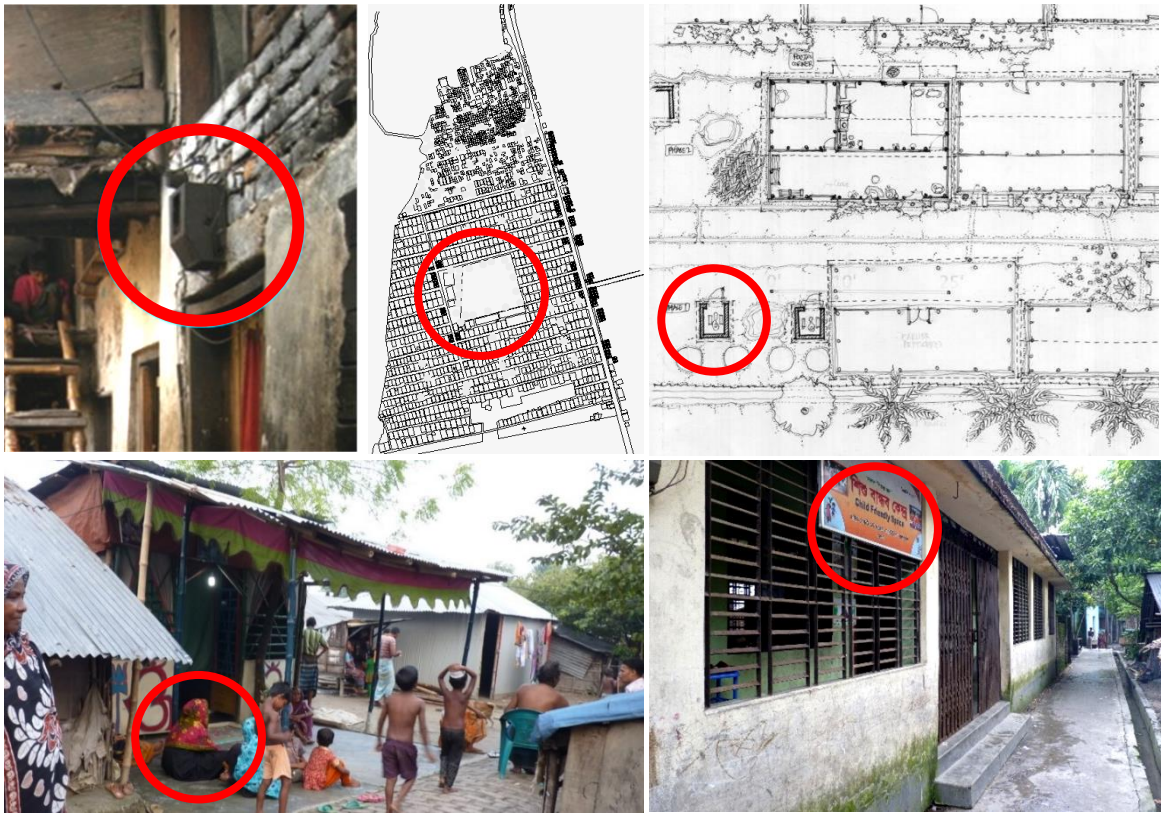


Figure 5: Infrastructure politics (clockwise, from top left corner): electricity meter at settlement 1; less used toilet structure at settlement 3; school, *Madrasah* and orphanage at settlement 6; community building at settlement 4; Hindu *Mandir* in settlement 3.

communities by making use of the sites of both modern and traditional/religiously institutions and edifices help earn a good name for the host community. Unable to make any decisive claim on the land yet, migrant community's establishment of these apparently 'benevolent' public infrastructures then start to make sense. One realizes how their many socio-financial investments in these infrastructures are aimed at elevating their status to the level of any other 'normal citizen'. As widely held by tenant migrants, these interventions are also acts of 'territorial compromise', which allow outsiders to penetrate and help them positively transform their host environment. In the naive eyes, these are simply outside assistances, mere donations made to compensate for the lacks. Yet a critical reading into this strategic loosening of territorial control shows it is also a means of sanitizing these settlements' present negative image of a '*Bastee'* or a '*Colony'*.

Scarcity, home and a negotiated urbanism

As both 'real' and 'constructed' scarcities are worked out through the negotiation of spatial claims and in the 'quiet interplay' between the subaltern and elite (Bayat 2000), low income settlement forms continue to evolve. Opportunist maneuvers from different actors in response to different scarcities also influence form-making. The politics of in-between-ness is therefore mediated by politics of infrastructure and control at the level of communities.

At the household level, rural migrants use of the strategies in the same way as the rural landless population makes "innovative use of kinship and other ideologies (to) legitimating reciprocity and mutual aid to re-establish themselves rent-free

on the land of others" (Indra and Norman 1997: 26). With cultural approval, such practices remain rooted in the vernacular customs. These can be viewed as creative acts manifested in the way people make use of their social world ingeniously, and play with control-mechanisms through acts of compromise, negotiation and occasional resistance in times of need. Nevertheless, these events of reciprocity hitherto also substantiate that people still tend to satisfy their wants using alternative logics that incorporate reciprocity, redistribution and exchange (Bronfenbrenner 1962: 265). People also cooperate with each other in times of adversity to avoid high transaction costs associated with their failure to comply (Southerton 2011: 1247). Decades ago, Castells and Portes (1989: 26) wrote: "(informalities are) flexible, ad-hoc form of economic activity that, while reviving old methods of primitive exploitation, also provides room for personal interaction. The small-scale and face-to-face features of these activities make living through crisis a more manageable experience than waiting in line for relief from impersonal bureaucracies". Under constructed conditions of scarcity in Global South cities, this 'revival of old methods', and 'cooperation' therefore can be likened with the ongoing reciprocal relation between the elite and the ordinary migrant. In addition, terms such as 'flexibility' and 'alternative logic' emerge as expressions in response to a particular context of scarcity under modernity, which in Khulna, are the spatial-physical compromises that migrants make while making their urban home.

Prominent literatures on 'home' that we reviewed (Werlen 1988; Lawrence 1995; Rapoport 1995; Somerville 1997) can be criticized for being incapable to delineate any clear indicators to explain someone like ordinary migrants' home-making processes in an mid-sized Global South city like Khulna. Works are also limited which examine 'home' in relation to wider socio-political-economic conditions that historically prevails in a particular society – as we did against the concept of land/resource 'scarcity' in modern Bangladesh context. At the higher-level of migrants' urban home, i.e. at the level of settlements, the notion of ownership/tenure remains the most important component for home-making. The policy-process necessary for obtaining any sense of ownership, i.e. upgradation from illegal/informal to legal/formal, however, have intentionally been kept complicated and lingered. This can be viewed as one form of scarcity – a 'neither-nor' condition, which is mendable, yet constructed by national-level politicians and persistently maintained by local level party officio (e.g. Mayor, Ward Councilors, party cadres etc.) and government bureaucracies (e.g. Planning machines such as KDA). Although migrants living in different 'illegal' settlements (as in Settlement 1, 3 or 4) have continued to convey their preparedness for paying off any sort of fees or instalments for acquiring a formal ownership, little changed over the years. The same politicians (e.g. rule-makers such as MPs) who could have solved the problem by implementing favourable bylaws for settling the ownership issue for the hundreds of thousands of these 'slum-living' migrant dwellers, rather prefers leaving options open for an on-site negotiation of issues chief amongst which is the issue of land/house ownership/tenure.

This process, through which one acquires and maintains the ownership outside the formal mechanisms as in Western societies, has been largely unspoken of in the key western discourses of home. On the other hand, although scholars like Rapoport (1995: 45) views home as a manifestation of sets of relationships between people and system of settings, 'setting' does not necessarily comprehend a 'man-made' condition that scarcity instils. Yet at large, scarcity as a socio-political creation of modern times appears to be a successful concept that aids the authorities to control ordinary migrants' tenure and ownership situations, hence home-making in the larger of the illegal/informal settlements. Scarcity thus promotes and upholds 'informality', and it is the informal and 'unsettled' status of home that serves best the purposes of scarcity in the particular 'setting' of Khulna's informal settlements. Since informality persistently seeks to become formal and scarcity prevails, this

negotiated form of relationship continues to remain an unrelenting process that underlies all home-making efforts by the migrant.

In terms of home-making, these facts remain significant. In terms of post-displacement consequence under modern (globalized) conditions, “new use of public as private”, “juxtaposition of forms, habits and conventions in host environment”, “re-codification of signs” and “creation of a closed system” become immediately evident of the migrants’ spatial practices. One finds “ambivalent meanings” associated with the architectural forms and spaces of migrant dwelling units and settlements, where Bricolage (e.g. rural forms in the city) and Hybridity (Cairns 2003) often become obvious. Dwelling units and settlements are used commonly as a stage, where they become spaces and forms for mediation and negotiation while leading to the formation of new social relations (Heynen and Loeckx 1994).

Conclusion

In Khulna, migrants’ home-making, particularly ‘following’ migration – may be viewed as responses to the many real and constructed conditions of scarcity in a context characterized by the different challenges posed by modernity. Particularly in their post-migration phase in Khulna, evident ‘lacks’ and ‘deficiencies’ such as lack of resources, lack of legality (e.g. illegal status of tenure) or lack of formal recognition (e.g. informal economic activities and building) thus have been worked out by the migrants to (re)make themselves a home. The socio-spatial negotiations for controlling territorial boundaries therefore come only as a realistic outcome to many constructed conditions of land/housing/resource shortages. These conditions made various actors to assume different paths/strategies of negotiation and compromises. The discussion on ‘mechanisms’ against this particular backdrop hence imparts a deeper understanding of home-making in Khulna settlements over the ones with no context or in different contexts.

References

Ahmed M. 2005, “Living in the Coast URBANIZATION”, Living in the Coast Series 4, Integrated Coastal Zone Management Plan, Government of the People’s Republic of Bangladesh, Ministry of Water Resources, PDO-ICZMP, Dhaka.

Bayat A. 2000, “From ‘Dangerous Classes’ to ‘Quiet Rebels’ Politics of the Urban Subaltern in the Global South”, International Sociology, Vol. 15(3), pp. 533-557.

Bronfenbrenner, M. 1962, “The Scarcity Hypothesis in Modern Economics”, American Journal of Economics and Sociology, Vol. 21(3), pp. 265-270.

Castells, M. and Portes A. 1989, “World Underneath: The Origins, Dynamics, and Effects of the Informal Economy”, in: Manuel Castells et. al (eds.) The Informal Economy: studies in advanced and less developed countries, The Johns Hopkins University Press, Baltimore, pp. 11-40.

Chaudhury A. H. (Undated), METROPOLITAN PLANNING IN BANGLADESH WITH REFLECTIONS ON KHULNA CITY MASTER PLAN 1961 AND THE CURRENT TREND. Retrieved from: mapbangla.com/mapadmin/publications/6_Metropolitan%20Planning.pdf, accessed on Nov 2012.

Cairns S. 2003, “Introduction” in: S. Cairns (ed.) Drifting: Architecture and Migrancy Routledge, London and New York, pp. 1-16.

Citymayors 2007, The world’s fastest growing cities and urban areas from 2006 to 2020, Citymayors Statistics. Retrieved from, http://www.citymayors.com/statistics/urban_growth1.html

Dudek P. and E. Van Houtte 2008, “The riverfront of Khulna (Bangladesh) A designerly investigation”, Undergraduate Dissertation Report (published), Department of Architecture, Urbanism and Planning (ASRO), Katholieke Universiteit Leuven.

Hakim S. S. 2014. “CONTROL, NEGOTIATION AND FORM OF MIGRANTS’ URBAN HOME”, PhD Dissertation (unpublished). Department of Architecture, SDE, National University of Singapore.

Heynen H. and A. Loeckx 1998, “Scenes of Ambivalence: Concluding Remarks on Architectural Patterns of Displacement”, Journal of Architectural Education, Vol. 52(2), pp. 100-108.

Indra D. M. and N. Buchignani 1997, “Rural landlessness, extended entitlements and inter-

household relations in south Asia: A Bangladesh case", Journal of Peasant Studies, Vol. 24(3), pp. 25-64.

KCC 2012, Map. Official website of Khulna City Corporation, Bangladesh. Retrieved from: http://www.khulnacity.org/Content/index.php?pid=30&id=22&page=About_KCC.

KCC-LGED-UNDP 2009, Interviews with Settlement Information Assistants, UPPRP Project, Khulna City Corporation.

Lawrence R. J. 1995, "Deciphering Home: An Integrative Historical Perspective", in: D. N. Benjamin (ed.) THE HOME: WORDS, INTERPRETATIONS, MEANINGS, AND ENVIRONMENTS, Avebury, England, pp. 53-68.

Rahman M. and N. Khaled 2011, "GLOBAL MARKET OPPORTUNITIES IN EXPORT OF JUTE", Occasional Paper 93, Dhaka: Centre for Policy Dialogue (CPD).

Rapoport A. 1995, "A Critical Look at the Concept Home", in: D. N. Benjamin (ed.) THE HOME: WORDS, INTERPRETATIONS, MEANINGS, AND ENVIRONMENTS, Avebury, pp. 25-52.

Southerton D. 2011, "Scarcity", Encyclopedia of Consumer Culture, London: Sage, pp. 1247-1249.

Shahed M. I. 2006, Housing Problems for Industrial Workers in Khulna City, (unpublished BURP Dissertation), Urban and Rural Planning Discipline, Khulna University, Khulna.

Somerville P. 1997, "THE SOCIAL CONSTRUCTION OF HOME", Journal of Architectural and Planning Research, Vol. 14(3), pp. 226-245.

UN 2008, AN OVERVIEW OF URBANIZATION, INTERNAL MIGRATION, POPULATION DISTRIBUTION AND DEVELOPMENT IN THE WORLD. UNITED NATIONS. Population Division, Department of Economic and Social Affairs, New York: United Nations Secretariat, 21-23 January.

UNDP 2007, FINAL REPORT. Retrieved from:

http://www.undp.org.bd/projects/prodocs/UPPR/LPUPAP%20Final%20Report%202007.pdf

Werlen B. 1988, Society, Action and Space (translated from German by G. Walls), Routledge, London and New York.

In Pursuit of Well-Being; 'Architecture for Displaced Children'

Md Abdul Kader

Abstract: *According to the UN refugee agency, the world is currently facing the maximum influx of refugees and internally displaced people than any time since World War II due to political conflict and environmental calamities. This paper focuses on displaced Syrian people living in the Greek island Lesbos, which due to its size and proximity to Turkish mainland has become a very popular destination for them migrating to Europe. Almost half of the displaced population are children who have not only been chased by horrendous experience of torture and destruction but also deprived of education at their formative stage of life. How can architecture promote welfare and provide inspiring learning environments for the displaced children living in the island is the core investigation of this paper? Simultaneously, this paper would also like to show strategies for the Syrian community to become integrated and gradually assimilated within the surrounding Greek community. In doing so, this paper analyzes case studies, interviews of social workers, children's drawings and literature review to gather the supporting knowledge required for the design process that intervenes in the displaced life of refugee children far away from their home.*

Keywords: Refugee, Welfare, Education, Culture, Synthesis

Introduction

The refugee crisis is in its peak since the World War II and children are the worst sufferers of the crisis whereas they are the prospects for the future. Only 50% of refugee children receive primary education compared to the worldwide percentage of 91. Surprisingly, only 22% among them receive secondary education[2]. Education is a basic human right that not only protects the individual but also empowers and enlightens. We cannot leave our prospective future generation in perilous conditions, where they are deprived of basic education and care that are crucial for their development and wellbeing. It's our humanitarian duty to confirm that the vulnerable children are getting the proper care during their psychological and physiological formative life. This paper focuses on Syrian refugee crisis being the most catastrophic one at the current moment.

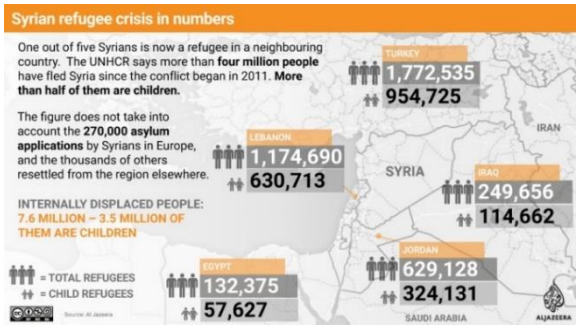


Fig 1: Statistic on Syrian refugee population

This research is particularly considering the displaced Syrian population living on the Greek island of Lesvos as the primary concern group. Almost half the migrants to have entered Europe have arrived via Lesvos. The distance between the Turkish mainland and Lesvos's east coast is only 18 miles. Its size, status as the third largest of the Greek islands and pxoimity to the Turkish mainland makes it a desirable destination. It's capital, Mytilene, on the east coast has become a focal point in the crisis, with the Moria refugee camp north-west of the town.[3]


Fig 2: Migration route and proposed site

How can architecture promote welfare and provide inspiring learning environmnet to the diplaced children living in the island is the core investigation of this paper? Simultenoulsy this research would also like to develop a strategy for the Syrian commuity to get integrated and gradually assimilated within the surrounding Greek community. In doing so, building styles and typologies both in Syria and in Lesbos island have been studied along with their lifestyles to support the cultural synthesis during the design process. Parametric design approach has also been incorporated for the iteration of exciting and inspiring space for children.

Methodology

This paper uses four methodologies which are Interview, Case study, Literature review and Site and contextual analysis. Through further research using these methods, design guidelines are identified to start the design process that will work as a paradigm in similar situation.

A) Stories, Interviews, Drawing Task

This paper considers interviews of the affected children taken by 'Save the Children' and analyse interviews of social workers worked with displaced children in order to understand their actual state of mind and true need. Syrian children have undergone terrifying experience of destruction, torture and massacre. Many of them saw their loved ones dying right in front of them. The children have become unexpectedly habituated seeing the armed militia invading their communities, neighborhood and houses demolishing them to the ground. Ironically many Syrian children have been taken to their school

[2] UNHCR report from 2015-2017 on 'Global Trends' of forced displacement

[3] Lesvos Island–Greece Fact Sheet, 12 November 2015, UNHCR

and being tortured. They were hung up from the ceiling and beaten indiscriminately in the same place where they used to learn and play. Undoubtedly this will cause a serious negative and terrifying experience about school. Many children express that they are afraid of going to school as they experienced the bombing and shelling while attending school. Inevitably school doesn't appear to be a safe place for them. Many young children have become mute because of what they have seen in their eyes.[4]

Moreover, Children's drawings have been analyzed carefully to understand their own perception about learning spaces.

Fig 3: Drawing by Children about their dream school

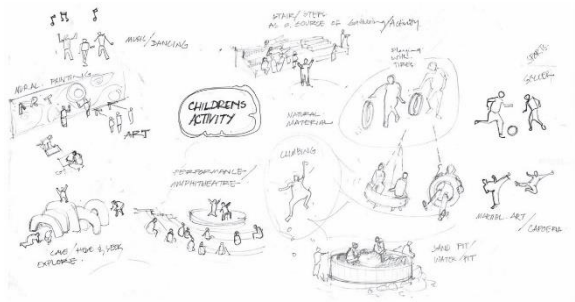


Fig 4: Children's favorite activity study

B) Case Study

This paper considers several relevant projects in different regions as case studies that encompass the refugee issues as well as learning and playing spaces for children.

B1. Jarahieh Refugee School

'Catalytic Action' designed this School in 2015 which was funded by 'Save the Children' located in Lebanon. It is an excellent example of temporary constructions with multiple functional use simultaneously that can be dismantled and reassembled elsewhere. During the daytime it is a school for children and after 4 pm it serves adults, and on weekends it functions as a public gather (for movie show) and a site for aid distribution. Extensive use of local material such as locally sourced sheep wool as insulation made the project a sustainable educational and social facility space. It utilizes a courtyard-based design that offer a good public space, however, the introvert interior as learning space is not as inviting and stimulating as it should be.[5]

Fig 5: Aerial View (top), Section (bottom)

[4] Save the Children, 'Untold Atrocities- The Stories of Syrian Children'

[5] Ariana, Zilliacus. 'With the Jarahieh Refugee School, Catalytic Action Demonstrates the True Potential of Temporary Structures'

B2. Lycee Schorge Secondary School

It was designed by Kere Architects in 2016, located in Burkina faso of West Africa. It utilizes locally sourced building material and characterizes courtyard-based design. Its unique wind tower, exterior buffer space and overhanging roof altogether lowers the temperature of the interior classrooms.
Wooden Screen works as a second facade and at the same time makes the buffer space transparent as well as dramatic by drawing light and casting shades and shadows. It breaks the dust, wind and sun and creates an informal yet active gathering and break out space.[6]

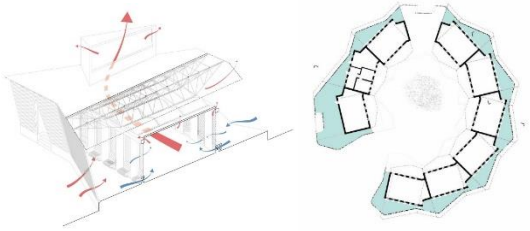


Fig 6: Windflow (left) and Parti Diagram (right)

Fig 7: View from the courtyard (Top), peripheral buffer space as break out space (bottom)

B3. Floating Pavilion at Taiwan

The pavilion was designed by 'Shen Ting Tseng Architects' in 2016, and located in Taipei City, Taiwan. This is a splendid example of a prefabricated, temporary, lightweight pavilion which dramatically changes the existing condition of the museum plaza by creating it as one of the centers of attraction and activity. The two most intriguing parts of this pavilion is the *curved-conical shaped mound on the deck with an attention drawing pink spherical void* and the lightweight white colored canopy above it.

320 individual box-shaped kites form the entire white canopy giving a swaying motion during the prevailing breeze, providing a sense of relaxation for the space. The kites also draw the light in such a way that it creates a magnificent interplay of light, shade and shadow within the space throughout the day.[7]

Fig 8: Perspective views showing activities in both day and evening time.

[6] Arch Daily, 'Lycee Schorge Secondary School / Kéré Architecture'

[7] Arch Daily, 'Floating Pavilion/Shen Ting Tseng Architects'

C) Literature Review

While designing space for children, inevitably it is required to understand what type of spaces is most suitable for them in terms of stimulation and driving imaginations. These understandings are essential to underline the various design parameters that help to enhance CHILDREN'S learning process. This paper considers the findings of several research papers identifying the impact of classrooms design on pupil's learning process as well as various strategies of built environment to promote well-being. Besides, there are studies on building typologies and lifestyles both in Syria and Lesbos Island which are essential for the cultural synthesis during the integration process of the refugee community in the island.

C1. Architecture for Well Being

The design of our built environment has a significant effect on our health and well-being and can have long-term implications for quality of life. In fact, Context can strongly influence our behavior. Even though the science of well-being is comparatively a recent field of enquiry and research, the UK Government's 'Foresight' project provides the critical evidence that eventually comes up with the idea of Five Ways to Well-Being. Those are:

Connect: The quality of social connections is directly correlated to wellbeing. Talking and listening to friends, family or strangers can be terms as such social connections which influence the person's physical health as well.

Keep Active: Being active is another key to wellbeing as recent studies indicates that physical activity lessens symptoms of mental and physical ill-health.

Take Notice: Symptoms of stress, anxiety and depression can be attenuated by paying attention to present as well as being aware of feelings.

Keep Learning: People with higher ambition tend to come up with better outcome. Evidence also shows that, people who are participating in new activities are more likely to be happy and.

Give: Evidence indicates that pro-social behavior has a positive influence on happiness rather than self-centered behavior. Such benevolent behavior can be achieved through offering selfless help to others and through volunteering. This is contrary to egocentric attitude.[8]

C2. Architecture of School

Young children spend fairly a significant amount of time of a day in school and hence the impact of school architecture and the spaces associated with it is quite far reaching. School spaces and classrooms need to be designed with great care and attention, specifically focusing on the true need and character of its user group. Recent research reveals 3 key characteristics that are fundamental for classroom design. They are:

a) Naturalness: Naturalness indicates the need of good daylight as well as possible views of greenery from it.
b) Individualism: Individualism refers to the changeability and adaptability of the space for providing range of activities within this space
c) Appropriate Stimulation: To achieve an appropriate level of stimulation, there should be a balance between quiet visual environment and certain level of complexity and interest[9]

C3. The Impact of classroom design on pupil's learning

Recently, several studies found evidence for demonstrable impacts of school building design on the learning rates in primary school children. Seven key design parameters are identified that

[8] Koen, Steemers 'Architecture for well-being and Health'

[9] Dudek,Mark 'The Architecture of Schools'

significantly predict the pupils' learning progress. These are:

Light: Light is the most vital parameter as it has the highest impact on the learning progress regardless of the size of the window and openings.

Temperature: People come up with better performance in the room where the temperature is easily accessible. That indicates correlation between the learning process and factors affecting the temperature.

Air quality: People usually perform better in a room with large air volume and large window openings. Air exchange rate has a significant impact on pupil's psychological attention as the lower air exchange rate and higher CO_2 Level in classroom slows down the attention.

Ownership: Ownership and sense of belongingness is correlated to overall learning process. Classrooms with unique design characteristics; personalized display and high-quality furniture are more likely to contribute to the sense of ownership.

Flexibility: Flexibility also plays key role in pupils learning process. Large and simple open areas are suitable for older pupils, however more varied plan shapes of composite manner are befitting for younger pupils. Attached and easily accessible breakout spaces, age-appropriate learning zone, defined wall area for display is also instrumental for their learning process.

Complexity: Layout of the room, ceiling type and pattern can draw the attention of pupils with a certain degree of order and balance.

Color: Color posits a great impact on pupil's mind. Such as, White walls having highlighted (with light or vivid color) feature wall stimulates the mid to great extent. Bright colors usually make the overall environment feel prominent.[10]

D) Cultural & Contextual Study

Building Typologies, Urban fabric and spatial configuration study of Syria:

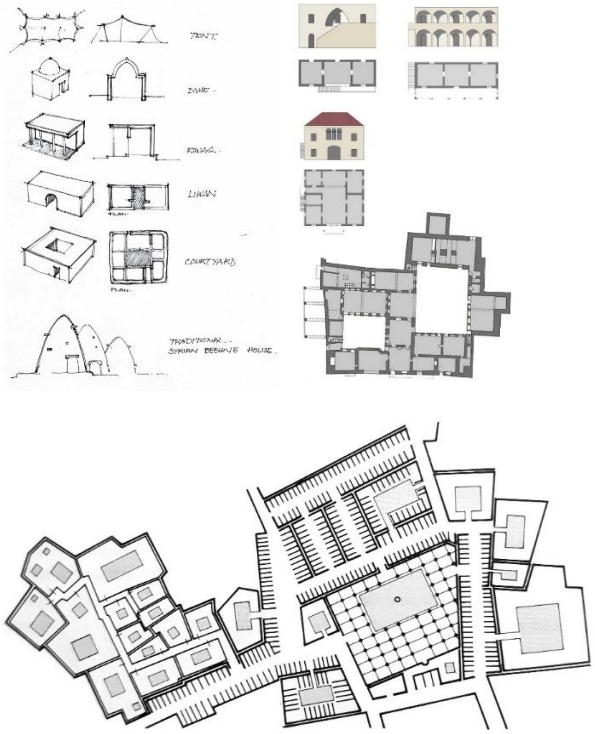


Fig 9: Building form, typology and layout study (top) urban spatial configuration study in plan (bottom)

Contextual Study of Lesbos Island (Culture, Lifestyle, Built form, Architecture):

Life

Lesbos people are very passionate about their ancient history (associated with the god and goddess of Greek Mythology) in a typical village, life revolves around the main square and the cafe eons around it. Ozu Factory, Yogurt shop and Small traditional looking cafe for coffee are very famous. Market Place, Agora, Antique shops are also very common there.

[10] A holistic, multi-level analysis identifying the impact of classroom design on pupil's learning

Architecture

Narrow stone streets in village and boardwalks in the beachfront are two of the characteristic features of the island. Shallow Room Configuration. Less formal Courtyards, Hip Roof. Wooden bay window that extends at 2nd floor
Popular Building Material: Stucco & Sedentary Stone, Clay Tile for roof.
Popular Vernacular Elements: Patio, Portico, Pergola, Small opening etc.

Fig 10: Buildings in Lesbos Island (Left)

Design Proposal

Entire Master plan

The site is adjacent to Pangodeu village which is almost 6-7 kilometer away form the capital Mytilene. It is preferable for the displaced community to start their integration process from an off center site which will give them more freedom and choice. The most challangeing part here is to design for a diplaced community which posseses a strong culture and at the same time design for them in a location which is not their home and quite different and distinct in terms of culture, lifestyle and built form. It's important to make sytheiss of the two cultures through design, so that the diplaced commuity feel at home and at the same time the local community feel safe and respected.

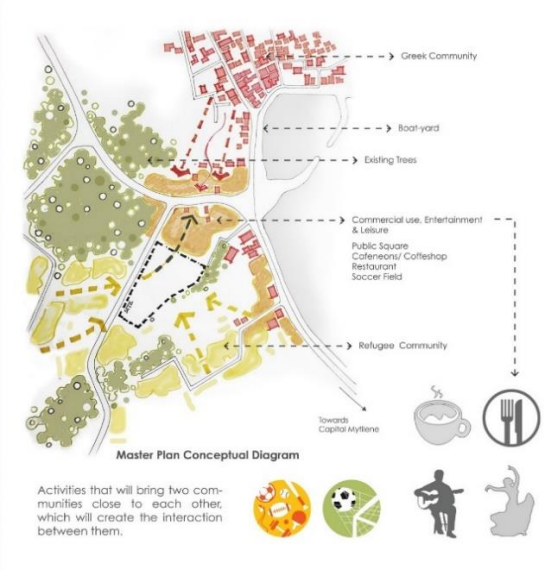


Fig 11: Conceptual diagram of master plan

The school is considered as the pivotal point where interaction between two communities (The Greek and the Syrian) will start talking place. It will serve as bridge for communication. Sports and Culture are some of the best ways to connect people regaless of race,ethnicity and language. Public squares and cafes are also a great source of gathering .The soccer field has been placed strain such a position that it will not only serve the school but also the surrounding community as well. Cafenion, public square are are placed adjacent to the soccer field with a view to drawing people here for leisure and fun. Another way of interaction is performance. The school has an open amphitheatere which is a millennia old element of Greek Culture. It will host cultural programs like dance, drama etc that will bring two communities closer to each other.

Fig 11: Phases of master plan development

Fig 12: Masterplan of the School

The School

The school has been designed in such a way that it becomes an extension of their village life, house life. Functions are not stacked up in a single building: rather the calssrooms and facilites are clustered in separate aggregates which break down the built scale and create the sense of belonging and individualtion to the specific users/studnets/children. The villages here are characterised by the narrow pathways that has been interpreted in this school. The entrance of the school leads to a central open yard from which emerge in opposite directions two pathways which meander to reach and serve each class cluster and functions. This pathway, along with the built form around it creates series of compression and expansion of space and allows numerious changing vistas. Sometimes the pathways end up in an open playing field with lush vegetation in the background creating a soothing experience.

Using the existing natural slope, the site is divided into several terraces, each one being roughly 2.5' higher than another. The terracing occasionally helps to define the edge of the pathways, it often demarcates the edge of a building block and sometimes works as low seat wall for the students in the landscape.

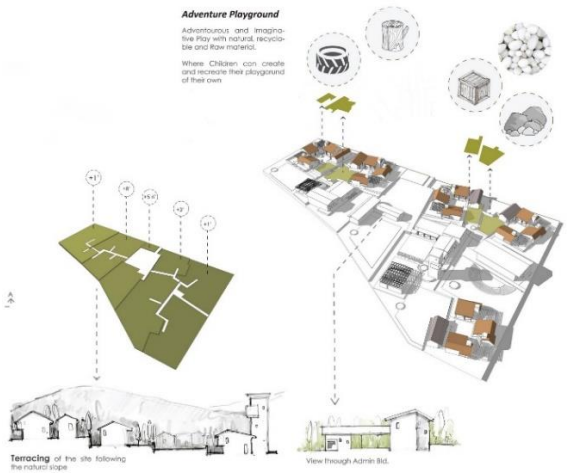


Fig 13: Diagrams showing terracing and play area

Classroom Cluster

Classrooms are formed based on specific age groups and are gatherd in clusters with centeral coutyard that is not only popular in Syria but also a familiar Greek urban form. Each cluster contains three class rooms, one anciliary function and one adventure play ground. There are outdoor (coverd by pergola) break out spaces for each class placed diagonally in each cluster.

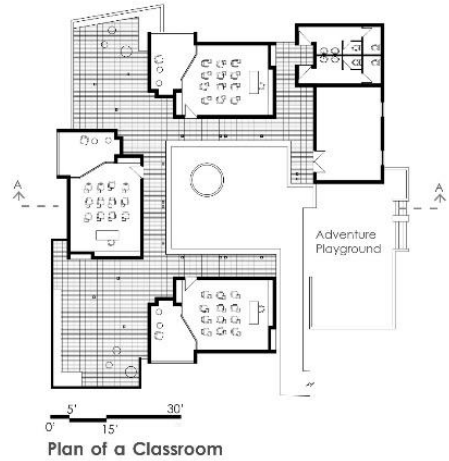


Fig 14: Plan (top), Section of a cluster (bottom)

Fig 15: Break out space in a calssroom cluster

Mediatheque

The mediatheque accomodates facilites including audio visual room, gadgets and computers zone, book collections etc. It has two levels. The ground floor houses a collection space, computer desks etc. The upper level is dedicated more for quiet reading space with cosy furniture connected with the 'stair-ramp' plaza, a space where children will spend their time freely with fun. The Stair is always a great source of activity and gathering and this stair plaza aditionally accommodates a fun-cave space underneath for children to crawl.

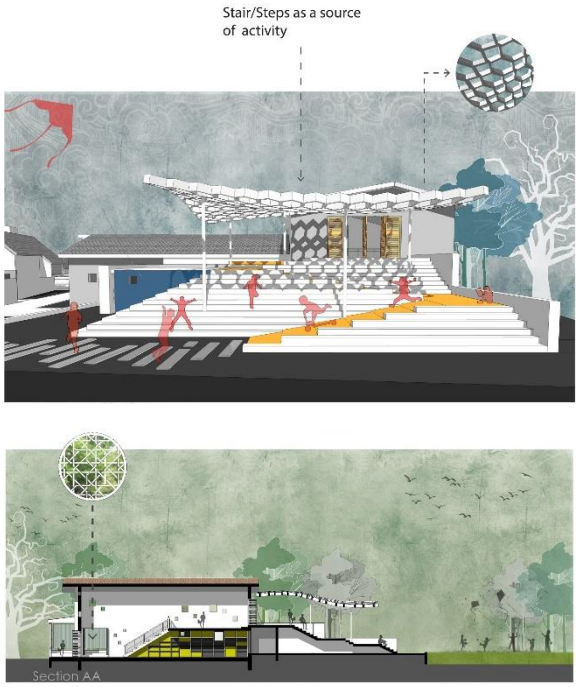


Fig 16. Perspective view of mediatheque (top). Section of mediatheque (bottom)

Café, Exhibition Pavilion , Watch tower

The zone next to the admin is comprised of cafeteria, watch tower and exhibition pavilion that altogether form a central lawn in the middle. They combined accomodate a wide range of activities. The watch tower rises beyond the average height of the surroung buildings, allowing an amazing view of the Agean sea in it's west and a hilly terrain just in the opposite. Its high walls are equiped with rock climbing facilites for the pupils.

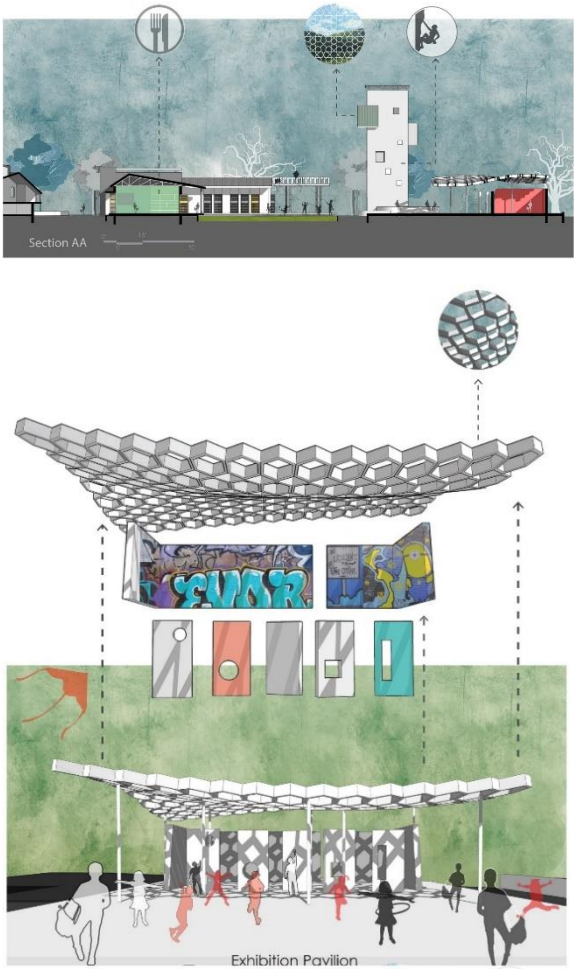


Fig 17: Section of café area (Top), pavilion (bottom)

Exhibition space is always necessary for displaying students' work and the pavilion diagonal to the watch tower is an ideal space for that. This open pavilion has free standing walls where pupils can paint, display their works visible and accessible to all. This motivational space is quite dynamic in terms of its visual experience.

Multipurpose Hall

It is located on the north edge of the site close to the soccer field with a view to allowing the Greek community to access it easily and also being connected visually. It has an adjacent open-air aphitheatre (one of the emblems of Greek architecture) for out door perfromnaces as well. During the warm dry season, the wall surface can be projected for movie show or game show and people from both communities can gather there, either sit on the amphi or on grass to enjoy the show.

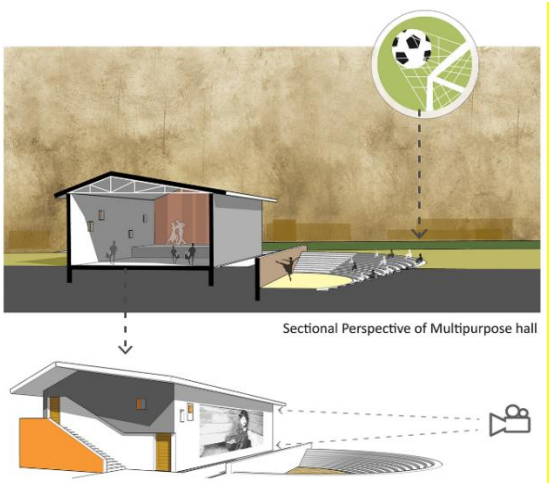


Fig17: Multipurpose hall as the cultural gathering center for the surrounding community

Conclusion:

This paper shows design and planning strategies for the integration and well being (with proper education facilities) of syrian dispalced population in a new country far away from their home. Its methodology and frame work can be a reference while dealing with other refugee population in different parts of the world with new set of cultural and contexual consideration in the frame work, which will guide to new design principles and strategies.

Reference:

1. *UNHCR Global Trends. (n.d.). [ONLINE] Available at http://www.unhcr.org/globaltrends2017/*
2. *Untold atrocities. The stories of Syrian children. (n.d.). [ONLINE] Available at https://www.scribd.com/doc/106987201/Untold-atrocities-The-stories-of-Syrian-children*
3. *ArchDaily. 2017. With the Jarahieh Refugee School, Catalytic Action Demonstrates the True Potential Of Temporary Structures. [ONLINE] Available at https://www.archdaily.com/806427/with-the-jarahieh-refugee-school-catalyticaction-demonstrates-the-true-potential-of-temporary-structures*
4. *Architecture, K. 2017. Lycee Schorge Secondary School / Kéré Architecture. [ONLINE] Available at https://www.archdaily.com/885677/lycee-schorge-secondary-school-kere-architecture*
5. *Arch Daily. 2017. Floating Pavilion / Shen Ting Tseng architects. [ONLINE] Available at https://www.archdaily.com/870009/floating-pavilion-shen-ting-tseng-architects*
6. *Koen, S. 2015. ARCHITECTURE FOR WELL-BEING AND HEALTH. [ONLINE] Available at http://thedaylightsite.com/architecture-for-well-being-and-health/*
7. *Dudek, M. (n.d.). The architecture of schools: Valuing play in the learning environment. [ONLINE] Available at http://www.markdudek.com/the-architecture-of-schools-valuing-play-in-the-learning-environment/*
8. *Barrett, P., Zhang, Y., Moffat, J., & Kobbacy, K. 2013. A holistic, multi-level analysis identifying the impact of classroom design on pupils' learning. Building and Environment, 59, 678-689. doi:10.1016/j.buildenv.2012.09.016*
9. *Bianca, S. (2000). Urban Form in the Arab World: Past and Present.*

Figure Reference:

Fig 1: Aljazeera

Fig 5,6,7 & 8: Arch Daily

Fig 9: Urban form in the Arab world (bottom) Traditional Syrian Architecture by Team CORPUS Levant (Top).

Towards Automation: An Investigation into the Applicability of Additive Manufacturing (AM) for the Design and Construction of Industrial Buildings in Bangladesh

Gourab Kundu,
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Abstract: *Additive Manufacturing (AM) is on its way to radically change the construction and design industry with many of its significant advantages such as reduced construction time, reduced wastage of material, reduced cost, and increased safety in construction. In design, rapid prototyping by AM can make an accurate model to better understand and examine the design. In construction, the making of small-scale details to large-scale building components can be automated with the aid of AM. Large-scale automated construction is still undergoing research and development to overcome its limitations. The conventional construction industry is neither safe nor sustainable in terms of site-labour-material-time management, cost-efficiency, environmental issues and dealing with state-of-the-art formal expressions. This paper has examined the necessity of application of AM in various phases of construction and design of industrial buildings in Bangladesh. There are two facets of this study: firstly, it explores the design and construction process of industrial buildings, and secondly, it examines where AM can provide better solutions. Data collection relies on literature review, field survey of under-construction industrial buildings and interviews of personnel. Through analyses and interpretations, this study makes a qualitative assessment, specifying the areas of the construction process where AM can make a significant contribution. All personnel involved in design and construction must consider AM because of the improvements it promises.*

Keywords: Additive Manufacturing, Industrial Buildings, Design and Construction, Construction Efficiency, Sustainability.

Introduction

For decades now, Additive Manufacturing has been a very common name in industrial production that enables the creation of lighter, stronger parts and systems. To develop a prototype there are three automated processes are available in the industry: “Subtractive Manufacturing”, “Formative Manufacturing” and “Additive Manufacturing”. AM provides the third supporting pillar of the entire manufacturing technology (Gebhardt A. et al,, 2011). Additive Manufacturing is synonymous with “3D prints” - any process by which 3D objects are constructed by successively depositing material in layers such that it becomes a predesigned shape. It does not require the use of fixtures, cutting tools, coolants, and other auxiliary resources (Huang S. H. et al., 2013). American Society for Testing and Materials (ASTM) defines AM as “the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies, such as traditional machining.” Modern 3D printing has always been very useful for rapid prototype development but it is starting to make its impact on the construction world as well. The AM has been called by many as the Third Industrial Revolution (Huang S. H. et al., 2013). In construction, builders are taking a lot of technological help nowadays. We can now find numerous examples of automation such as automated bricklaying (Bonwetsch T. et. al., 2007), sprayed concrete (Shotcrete, 2019), precast techniques (Buildoffsite, 2019) as well as robotic milling to create molds for construction panels and shaping panels for facades based on techniques used in shipbuilding (Formtexx, 2014). But the construction industry has stepped on a new era with the development of Building Information Modelling (BIM) accompanied by the increasing use of digital information. Despite numerous ongoing research program on AM all over the world, no research has considered checking the applicability and expectancy of AM in building construction, and whether AM can open up the door of possibilities in the construction sector for developing countries like Bangladesh.

With the continuous economic growth of above 7% for few years, World Bank has put Bangladesh in 5th position in terms of economic growth, and the construction industry is one of the rapidly growing sectors, which posted double-digit growth (10.11%) in 2018. The construction industry contributed 7359.5 million BDT in the GDP of 2018, which is 7.53 percent of total GDP (Staff-Correspondent, 2018). Industrial buildings occupy a large share of the building construction sector. To stimulate rapid economic growth, the government is facilitating various industries through policies and initiatives. There is currently a total of 65 Export Processing Zones (EPZ) and Special Economic Zones (SEZ), and 100 more of them to be built in public and private sectors in the next 15 years (BEZA, 2019), triggering the need for construction of a large number of industrial buildings. But the construction sector of industrial buildings is facing problems in terms of labor management, labor safety, fund flow, site management, time management, cost-efficiency, environmental pollution and so on.

Clearly, the current standards of our construction industry are insufficient to achieve the construction goals. Construction delay causes significant drawbacks in the construction industry. (Islam M. et al., 2015) Construction waste (Chowdhury F. H. et al, 2016), and safety management (Roy C. et. al., 2019) are also marked as significant constraints. The purpose of the paper is to point out the particular areas of construction that can be altered, modified or improved with the help of AM to reduce construction time, construction cost and to increase construction safety in the context of Bangladesh.

Methodology

The paper has two facets. In the first one, a comprehensive view of the AM method has been stated by extensive literature review on the world

perspective and in the second, to identify problems in construction arising from technical constraints. Three under construction industrial building sites were visited: Blue Ocean Footwear, Apex (unit-i) Footwear, and Golden Sky footwear. All of them are located at Chandra of Gazipur district.

A literature review is also made to understand the worldview regarding construction problems, and how AM can contribute to resolving those particular problems. Through analyses and interpretations, this study will make a qualitative assessment – based on inductive reasoning method.

Additive Manufacturing Processes

In AM technology objects are digitally defined by computer-aided design (CAD) software that is used to create *.stl files that essentially "slice" the object into ultra-thin layers. This information guides the path of a nozzle or print head as it precisely deposits material upon the preceding layer. Or, a laser or electron beam selectively melts or partially melts in a bed of powdered material. As materials cool or are cured, they fuse together to form a three-dimensional object. (GE-Additive, 2019) AM enables architects to work with the double-curved wall, topology optimized structure, functionally graded material, fluid materials and many more advanced options that can augment sustainable development in architecture. The designers in Bangladesh, particularly Architects and Engineers, are already accustomed to CAD software and many of them are adopting BIM. This computer-dependent practice is well suited for adopting AM processes, such as creating an *.stl file.

The Increasing Potential of AM Technologies

In 2014, engineers at ARUP used 3D printing to fabricate a steel node for a lightweight structure in the very first attempts to use AM in the history of building construction. Salomé Galjaard, team leader at ARUP said, 'This has tremendous implications for reducing costs, cutting waste and enables a very sophisticated design…' (Galjaard et. al., 2015)

In the last three decades, the majority of papers published on AM focus on the processes and the technologies. Although the use of AM was, for the most part, for small scale product manufacturing, it has already started to make contributions in building construction (Labonnote N. et al., 2016). Thorough experiments and research on using AM in large scale building construction are making the technology stronger everyday. Several spectacular attempts to 3D print complete houses have been the subject of much publicity. Given the progress made over the past few years, this technology is changing the scale as well as perspective: giant printers are now printing entire houses. AM has been changing the construction industry by ensuring a low-cost, time-saving and environment-friendly construction, also helping to reduce injury. (Hager I. et al., 2016) In addition, some researchers have also started investigating system-level issues in additive manufacturing. For example, a group of researchers at Loughborough University has been exploring the use of additive manufacturing to achieve low-carbon design, manufacturing, and service for several years (Atkins, 2007). This is a promising technology, which seems to be well-equipped to face the challenges of construction in the 21st century in terms of speed, cost reduction, sustainability, strength, and durability. (ApisCor, 2019) (Ghaffara S. H. et al., 2018)

In the construction industry, 3D printing can be used to create construction components or to 'print' entire buildings. Construction is well-suited to 3D printing because the design process adopted by professionals already creates the information required: designers are getting more and more accustomed to the use of computer-aided design (e.g. software like AutoCAD and Revit Architecture). The recent emergence of BIM, in particular, may facilitate greater use of 3D printing.

Professor Behrokh Khoshnevis at the University of California used a giant transportable 3D printer and has developed a process of 'contour crafting' using concrete to produce small-scale models of the external and internal walls of houses. This technology can build the walls of a house in 24 hours. Contour Crafting can reduce the construction period by one-third of the conventional construction process (Rouhana C.M. et al., 2014)

In Spain, the first 3D printed pedestrian bridge of the (3DBRIDGE) was inaugurated on 14 December 2016 in the urban park of Castilla-La Mancha in Alcobendas, Madrid. It was 12M long and 1.7M wide. The 3DBUILD technology used was developed by ACCIONA.

AM in Building Construction

The challenges in the construction industry that have been identified decades ago, such as work in harsh environments, decrease in productivity, scarcity of skilled workforce, ensuring safety during construction, large amounts of waste and transportation of materials to the site (Camachoa D. D. et al., 2017) Construction is considered a high-risk profession, having the largest number of deaths in any occupational sector. (Sakhawat et. al., 2017) (OSHA, 2019) It affects construction quality and above all, safety in the work environment. Conventional construction is also affecting the environment by emitting greenhouse gases. In fact, the buildings are responsible for 39% of all CO_2 emissions mostly by producing building material and transportation. (Abergel, 2017) Moreover, constructions produce wastes that often include bricks, concrete, metals, glass, plastics, wood, asphalt, bricks and more which do not only pollute the environment but are also difficult to deal with.

AM can improve the construction industry of Bangladesh by reducing exposure of on-site workers to harsh environments and by automating some of the construction tasks. AM allows maximum customization without significant lead time, where each building component can be produced directly after it is designed. AM also promises a decrease in the need of a skilled workforce. Contractors generally have a hard time finding a workforce with the required skills, requiring more time and money to train them. This problem can be well dealt with by adopting AM. The use of AM in construction will require different skillsets than in current practice: computer skills and manufacturing skills - shifting from a labor-intensive work environment to a more technical environment. (Camachoa D. D. et al., 2017) However, its success depends on how the whole building industry is ready to tackle three challenges: the need for an architectural paradigm shift, the need for a holistic design process, and the need for rational designs. (Labonnote N. et al., 2016)

Problems in Construction and Probable Application of AM

The construction of the industrial buildings in Bangladesh adopts a linear workflow: Site Preparation, Foundation, Casting of Post-lintel, Casting of floor-slab, and finally the making of Non-load-bearing walls (exterior and interior). The finishing and fittings work done after this is out of the scope of this paper.

The high-level constraints facing building construction in Bangladesh are lack of experienced construction manager, inadequate construction labor and excessive workload – arranged in descending order on the basis of severity. (Islam M. et al., 2015) The most severe constraint, however, is an economic one - the shortage of funding. (Islam M. et al., 2015) Besides economic, there can be legal, environmental, technical and social constraints in building construction. (Lau E. et. al., 2006) Based on the relation to the personnel involved, the constraints can be Client-related, Contractor-related, and Interaction-related. (Ojoko E. O. et. al., 2016)

This paper focuses solely on technical constraints, irrespective of the adequacy of resources and personnel, and of the relationships among various stakeholders.

This part of the paper will discuss the summary of the site surveying which revealed the construction problems of industrial buildings. The alternative AM based solutions are also included in this portion.

Formwork

Formwork is a necessity for column, beam and roof casting. This process not only increases cost but also limits the possibilities for an optimized form of structural elements. According to the contractors involved in the construction of the above-mentioned factories, the cost for per square meter steel formwork is about 10,000 BDT which requires a huge amount of initial investment.

Figure 1: *Steel formwork and scaffolding at Blue Ocean Footwear Factory construction site. Source: Author*

The movement of heavy steel shutter and the scaffolding needed for concrete-casting are two of the most massively cost-adding factors. (Anupoju, 2016) The use of scaffolding and molds in concrete construction work accounts for about 50% of the concrete construction cost. (Bos F. et al., 2016)

From the designer's point of view, the size and shape of the structural elements also become limited and modular, which restricts the freedom of the designer. Besides, wood shuttering can result in almost 50% of it as construction waste. (Yip R. et al., 2008)

Steel shuttering can be reused but can also be affected by corrosion and their sizes are not flexible.

The use of AM can reduce the necessity of formwork in the construction industry. It will reduce the cost of formwork itself in addition to the cost of installing and dismantling the formworks. The omission of formwork will also reduce the wastage of construction industry by 23% of total wastage. To replace the formwork, the common practice is off-site fabrication which can reduce the necessity of setting gantries in the site and provide security from environmental and accidental factors; but it can add to transportation cost. On-site AM production can also reduce transportation cost. (Camachoa D. D. et al., 2017)

Concrete-casting

It has been found that the required time to dismantle the shutter of concrete is 7-10 days when admixture is used. Without admixture, the required time is around 15 days. But the total volume which can be cast at a time depends on the process of concrete mixing and carrying. On the presence of a mechanical batching plant at the site, the mixing and carrying become easy and the quality control is ensured. But without batching plants, it is more labor-intensive for both mixing, carrying and pouring the concrete and the total volume that can be cast in a day is reduced by up to 50%.

To speed up the work, even more, we just need a computer-controlled nozzle connected with the plant that will print the concrete according to the AM procedure. In addition, it will also reduce the amount of concrete by optimization. Cellular fabrication (C-fab) printing system can reduce the amount of concrete by providing a cavity between the inner and outer shell of the wall.

Figure 2: *(from left to right) Concrete shuttering, and batching plant. Site: Blueocean footwear factory and Golden Sky footwear factory. Source: Author*

Figure 3: *(left to right) Brickwork, scaffolding for brickwork at Golden sky footwear factory. Source: Author*

Wall formation

For many reasons, such as weather protection, durability, safety, and security, it is preferred for the industrial buildings in Bangladesh to have an exterior wall of brick or concrete. The interior partition wall can be heavyweight or lightweight, depending on the type of use. Brick is not sustainable, in a sense that its manufacture uses the topsoil and a huge amount of time. This makes the widespread use of brick masonry walls in Bangladesh an unsustainable practice.

In many cases, an Industrial building requires significant floor height to accommodate machinery, and as a result, the presence of huge brick walls. The Golden Sky footwear factory has a 260 running meter brick wall of 24 feet in height, which required 2 months of extensive construction without the finish, which will require another month. Gas-burnt first class bricks used in the exposed brick wall are also very expensive. While it is easy to assume that employing more labor can cut the cost, in reality, labors are generally reluctant to work in case of a minimized construction period.

Skilled labor in Bangladesh, e.g. Rajmistri with the assistance of a helper, can lay around 550-600 bricks a day that is approximately 120-125 sft per day. Thus, the technical problems associated with the construction of brick walls unnecessarily prolong the construction time.

When AM replaces manual labor, it can significantly reduce the construction time. Contour Crafting method can build a 200 m^2 area within 20 hours. (Rouhana C.M. et al., 2014) At this rate, the work done in 2 months at the Golden Sky footwear factory can be completed within 17 days with 12 hours of work per day. Moreover, an interactive session with the executives of Asia Foundation and Construction revealed that 10-15% of the construction cost can be reduced only from the reduction of days in bricklaying.

Waste Management

Construction waste is becoming an alarming issue all over the world. In the USA, 40 percent of their solid waste is produced by construction projects. (SustainableBrands, 2013) And the amount of waste is 30% of the total weight of construction materials delivered to

a building site. (Osmani M. et. al., 2011) Construction wastes that are produced because of errors can be nullified with the help of AM.An error may occur in the design documentation phase (Chowdhury F. H. et al, 2016) resulting in faulty construction, which can lead to total reconstruction. This error can be eliminated by the use of rapid prototyping - an application of AM. It tests the design document by simulating a scale model of the building.

Figure 4: *(right to left) rebar wastes at Blue Ocean Footwear Factory, Brick Bat leftovers at Golden Sky footwear factory. Source: Author*

Excessive procurement, another reason for wastage, (Chowdhury F. H. et al, 2016) can also be resolved by AM, which accurately predicts the amount of raw materials required. An error in the Handling of Materials, very common in the conventional system of construction, can also lead to a huge amount of wastes. (Chowdhury F. H. et al, 2016) By adopting AM, construction wastes resulting from this error can be reduced by 30 -60%. (Camachoa D. D. et al., 2017)

Conclusion and Recommendation

The construction process of the industrial buildings can be partially altered by Contour Crafting method to form the walls to reduce construction time in the first stage. It will also reduce construction waste and increase construction safety to some extent. It is a matter of further research to understand the exact extent. However, the technology is still in its early stages. There are a number of barriers that we must overcome for its wider adaptation. One of the key issues is that quality control and AM must be incorporated into local and international building standards. Since AM requires trained professionals to be executed, investments in training must be ensured. Another issue is the limited range of construction materials that can be 3D printed, although research is going on for improvements in this sector.

References

Abergel, T., 2017. *Global Status Report 2017,* s.l.: Global Alliance for Buildings and Construction (GABC).

Anupoju, S., 2016. *Different Materials Used for Formwork – Advantages and Disadvantages.* [Online]
Available at: https://theconstructor.org/building/materials-formwork-advantages-disadvantages/6188/?fbclid=IwAR3mTc1MXXAtUe1bge_yAnQT4VylpsfrrmDT0aeJ5sWKhWZ-BtZ8TJfuwS0
[Accessed 15 September 2019].

ApisCor, 2019. *Apis Cor.* [Online]
Available at: https://www.apis-cor.com/en
[Accessed 5 July 2019].

Atkins, 2007. *Manufacturing a low carbon footprint,* s.l.: Atkins.

BEZA, 2019. *Bangladesh Economic Zones Authority.* [Online]
Available at: https://www.beza.gov.bd/all-zones/
[Accessed 08 07 2019].

Bonwetsch T. et. al., 2007. *Digitally Fabricating Non-Standardised Brick.* Rotterdam, s.n.

Bos F. et al., 2016. Additive manufacturing of concrete in construction: potentials and challenges of 3D. *Virtual and Physical Prototyping,* 11(3), p. 209–225.

Buildoffsite, 2019. *Buildoffsite.* [Online]
Available at: http://buildoffsite.org
[Accessed 05 07 2019].

Camachoa D. D. et al., 2017. *Applications of Additive Manufacturing in the Construction Industry – A Prospective Review.* s.l., ISARC 2017), p. 2.

Chowdhury F. H. et al, 2016. *Construction Waste Management Practice: Bangladesh Perception.* Chittagong, ICACE 2016, p. 4.

Formtexx, 2014. *Formtexx.* [Online]
Available at: http://www.formtexx.com
[Accessed 19 7 2019].

Galjaard et. al., 2015. *Optimizing Structural Building Elements in Metal by using Additive Manufacturing.* Amsterdam, Future Visions.

GE-Additive, 2019. *Additive Manufracturing.* [Online]
Available at:
https://www.ge.com/additive/additive-manufacturing
[Accessed 05 07 2019].

Gebhardt A. et al,, 2011. *Understanding Additive Manufacturing.* Munich: Hanser Publishers.

Ghaffara S. H. et al., 2018. Additive manufacturing technology and its implementation in construction. *Automation in Construction,* Volume 93, pp. 1-11.

Hager I. et al., 2016. *3D printing of buildings and building components as the future.* s.l., Procedia Engineering, pp. 292-299.

Huang S. H. et al., 2013. Additive manufacturing and its societal impact: a literature review. *The International Journal of Advanced Manufacturing Technology,* 67(5-8), p. 1191–1203.

Islam M. et al., 2015. *Causes of Delay in Construction Projects in Bangladesh.* Busan, Korea, ICCEPM 2015), p. 85.

Labonnote N. et al., 2016. Additive construction: State-of-the-art, challenges and opportunities. *Automation in Construction,* Volume 72, pp. 347-366.

Lau E. et. al., 2006. *Identification of Constraints in Construction.* Dubai, In House Publishing, pp. 658-660.

Ojoko E. O. et. al., 2016. *Project Delay Causes and Effects in the Construction Industry.* Johor Bahru, IGCESH, pp. 222-223.

OSHA, 2019. *US Department of Labor: Occupational Safety and Health Administration.* [Online]
Available at:
https://www.osha.gov/oshstats/commonstats.html
[Accessed 05 07 2019].

Osmani M. et. al., 2011. Construction Waste. In: *Waste: A handbook of management.* https://doi.org/10.1016/B978-0-12-381475-3.10015-4: Science Direct, pp. 207-218.

Rouhana C.M. et al., 2014. *THE REDUCTION OF CONSTRUCTION.* Oslo, DOI: 10.13140/RG.2.1.1718.4646/1, p. 1040.

Roy C. et. al., 2019. Hazards and safety issues at construction sites in Bangladesh. *MOJ Civil Engineering,* 5(2), p. 52.

Sakhawat et. al., 2017. *Workplace deaths double in 2016,* Dhaka: Dhaka tribune.

Shotcrete, 2019. *Shotcrete.* [Online] Available at: http://www.shotcrete.co.uk. [Accessed 05 07 2019].

Staff-Correspondent, 2018. *Local construction firms grow from strength to strength,* Dhaka: The Daily Star.

SustainableBrands, 2013. *Sustainable Brands: The Bridge to Better Brands.* [Online] Available at: https://sustainablebrands.com/read/waste-not/planetreuse-redirecting-building-waste-from-landfill-to-leed-projects [Accessed 05 July 2019].

Yip R. et al., 2008. *Comparison of timber and metal formwork systems,* s.l.: Proceedings of the Institution of Civil Engineers-Waste and Resource Management.

'Architecture is Endless'- in the Changing Landscape of the Delta

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Abstract: *Bangladeshi people suffer and also regain triumph with its riverine domain that is also a changing landscape. From time immemorial people of this land have been laborious and have taken charges to start innovative ventures. The architectural style of Bengal has been shaped because of its riverine realm. Topography and climate have always been connected to make the architecture as one with this fragile land. In its role, architecture purposefully blends with the environment of that region and traditionally to evolve ground-breaking solutions in the face of confrontation. Sometime this confrontation is a blessing where architecture evolves into a form of art. Climate change has been largely accountable for adopting shelter in different manners in this hinterland. Vernacular architecture has undergone changes and adopted itself into the well-being of its dwellers through understanding of the environment and the human responsive systems. Chronology of architecture in this region is no exception. In the continuation of history; the change in the land form, riverine plains, flash flood and drought chiselled land and shaped grassroots architecture (marginal architecture) since the dawn of the civilization. That architectural style has been a struggle to survive for decades. This refers to any significant change in climate lasting for an extended period. It brings uniqueness in the field of vernacular architecture. Predecessors' wisdom contributed lot in all aspects to continue the architecture legacy through traditional values and vernacular insight. The focus of the research is to throw light on diversity in different vernacular styles and the current context of climate change; how it behaves with the influences of environment, climate and topography. The research would like to develop figure-ground simulation patterns in the different regions of Bangladesh starting from extreme north to the southern part. The illustrative information will be associated with critical 'architectural sections'. This research will develop a diagram-gadget to understand intelligent solution synchronizing all features. In short architectural sections will express the diverse' situations both for existing topography and latest climate change adaptation. To make the research inclusive; it is intended to bring forth the versatile situation of the local indigenous styles in the changing landscape of the country.*

Keywords: Landscape Chronology, Vernacular, Topography, Climate

Introduction

Truly saying- no dates were found to recognize the starts of delta region's civilization. Only except after the arrival of Mauryan. However, before that ancient Bengal and the people of this very hinterland quested civilization long age back. Eventually, the civilization would have a name; unfortunately, it is not recorded. Since age long- one mighty river serves spiritually, socially, economically and politically; Ganges and Ganges river valley civilizations crowned over this wet land and conquers huge manpower. Time immemorial in this marsh land density of population is commendable. People started living in big cities, which were riverine domain. Criss cross rivers shaped the cities in diverse strategies. Moreover, topography ruled vital part for the settings of the structures along with the construction technique. Having few building and construction materials; time immemorial vernacular architecture bloomed to its full extents in the diverse topography of delta. It was told that ancient people of Bengal before the Mauryan was distinct and retained with individual identity. Perhaps the trends of architecture in this region emerged with mundane by DHEEMAN and BEETPAL[11] (9th century famous sculptors), even though earliest reference is still witnessed along with Ashrafpur bronze stupa displaying in Kolkata museum.

Emergence of rooted-architecture started with Bamboo, thatch, wood and mud, were collected and mingled together in this fragile land. Rid hut structure became popular in this region and influenced other areas. An emblem of true Bengali architecture which is consists of four simple posts shaded with curved corniced roof with two/four-sided bended bamboo strips. This common structure places over a plinth which protect other natural calamities. This construction process used to diverge by region, this high plinth protested from saline, moist, diving rain gust wind, inundation and flash flood.

The then; structures wash away often during the monsoon and by the common catastrophes. However, people of this hinterland start again with new horizon by building the new homesteads. Wind, heat, rain and inundation- these four forces shaped further different components of the vernacular architecture of ancient Bengal. People started resistance against these four forces by innovative techniques of constructions. Concurrently and repetitively people of this region searched for homestead-solution through experimentation to get rid of from the hover of nature by solving with creative and intellect wisdom.

The research is focused on the illustrative sections:
-Vernacular architecture on the north-western part.
-North-eastern part
-Central part of Bangladesh
-Coastal bays
-Indigenous, Hill & highland

These areas of Bangladesh are the discussed parameters of this research, by preparing catalogic format of different region, the study would be executed with sectional pictographic information. Surveyed documentation would be the priorities of this study.

1. Father and son, established sculpture school in Bengal during the Dharmapala ruling.

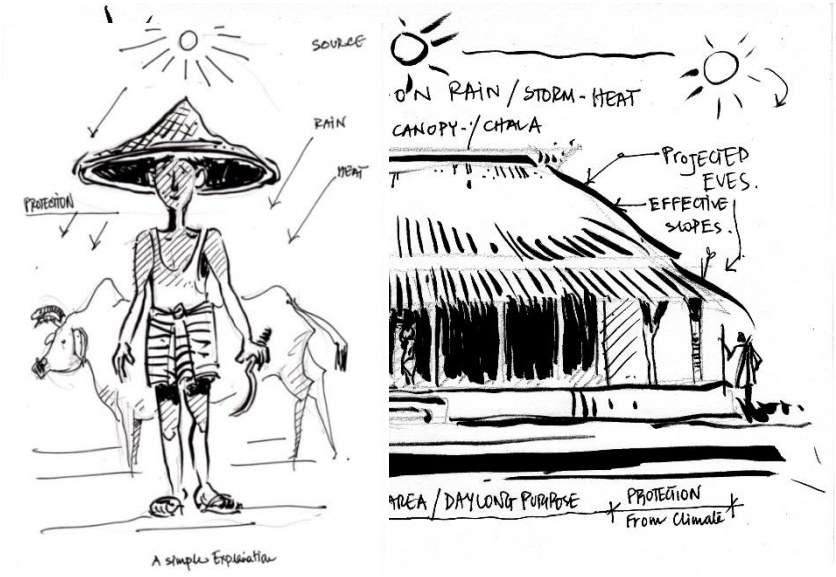

Figure 1: *Architecture in the delta region is evolved with the people, activities, habit and costumes. For instance, a farmer works in the field daylong accepting all climatic situation along with heat and rain, he use a head (hood) which has wide range of extension, eventually to provide protection from rain and heat of the summer, this hood act as the super roof for the farmer.*
Our architecture of delta specks as the same way …
Provide an extended roof that perhaps stand on stilts. Let the airflow pass through it, the shaded part would be the comfort area of the house. At the same time in-between shaded space helps to conduct day long activities of the house…

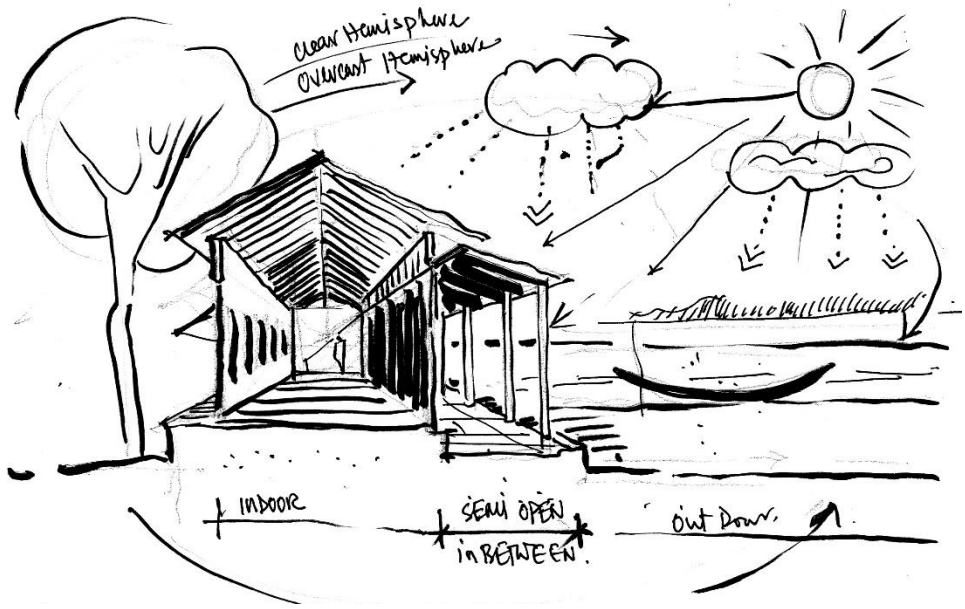

Figure 2: *Delta land is the Continuation of traditional architectural legacy …*

Flat land, flashing river, clear hemisphere and humble house form

Objective

The goal of this research firstly is to dig put with different sectional qualities of vernacular architecture in different region through pictographic information. Secondly, explanation of the diversity in settings and technique would be justifiable notion and thirdly, critical analysis to validate the endless value in primeval architecture.

Methodology

The chronology of the methods of research is as followed:

a) Mapping the different region respecting topographic and climatic diversity.
b) Identifying the existing areas of research which remain the value.
c) Survey analysis through critical documentation at the respective sites.
d) Interviews performed to understand the technique of construction.
e) Literature reviews to standardize the research in global platform.
f) Language of the research methods are elaborated through illustrative explanation.

Figure 3: *Mapping the different region respecting topographic and climatic diversity.*

Abstract

Bangladeshi people suffer and regain triumph with the riverine domain in this changing landscape. From time immemorial people of this land are laborious and take charges to start innovative ventures. It's been decades that architectural style of Bengal has been shaped due to the riverine realm. Topography and climate have always been connected to make the architecture oneness in this fragile land. In its role, architecture purposefully amends with the environment of that region and traditionally pursues to evolve ground-breaking solution next to the confrontation. Sometime this confrontation arrives with blessings by elaborating architecture in the form of art. Now Climate change is largely accountable in adopting shelter in different manners in this hinterland. Vernacular architecture ensures new changes and adopts well-being for the dwellers through understanding of the environment and the human responsive systems. Chronology of architecture in this region retains no exception. In the continuation of history; the change in the land form, riverine plane, flash flood and drought land chiselled and shaped grassroots architecture (marginal architecture) since the down of the civilization. That architectural style has been a struggle to survive for decades. This refers to any significant change in measuring climate lasting for an extended period. It brings uniqueness in the field of vernacular architecture. Predecessors' wisdom contributed lot in all aspects to continue the architecture legacy through traditional values and vernacular insight. The focus of the research is to put lights on diversity in different vernacular manners and on the latest situation of climate change; how it acts with the influences of environment, climate and topography. The research would like to develop figure-ground simulation patterns of different region of Bangladesh starting from extreme northern part to southern part, where the illustrative information will be associated with critical 'architectural sections'. This research will develop a diagram-gadget to understand intelligent solution synchronizing all features. In short architectural sections will express the divers' situations both for inherent topography and latest climate change adaptation. To make the research inclusive; it is intended to disclose most of the versatile situation of the local indigenous manners in this changing landscape of the country.

Keywords

Landscape Chronology, Vernacular, Topography, Climate

Diversity and innovativeness in primeval settings

Everyday people of this hinterland face the effect of 'changing landscape' of delta. Within the situation, they adopt the lifestyle and stat with building the shelters around the plane. Contentiously defending the condition; people of this plane used to negotiate their homestead with the topographic and climatic references.

Bangladesh is mostly plane land developed since thousands of years by the sedimentation. Fertile land is potential with deep foliage and agricultural possibilities. Though than the country is small- however, scattered with diverse vernacular means around the country. Shifting of ideas has been derived to respect the land and the climate as well.

For the authentic research-notion and to identify manifestly- the study has mentioned different terrains in the introduction writing. In this connection, firstly the study would like to focus on the north-western part and extreme northern part of Bangladesh to start the analysis.

Mud or clay built architecture in this very region is available and the land form itself is in-built with this clay. Having placed on the elevated land form 12(VARIND Track) this rooted architecture grew up with environmental and thermal comfort. As many part of this region is domain with hot dry milieu and people need to ensure the shelter with deep sheading; form of the house is varied from other region. Plinth, walls, panels, roofing pattern and construction technique have been cherished with innovative approaches.

Cavity walls, bonds of roofing system, thick walls, bottom process of mud walls, openings, ratio of semi-open space and courtyard have been advised with environmental and ecological sustainability.

Plinth of the settings was raised on high or moderate higher elevation from the ground. Perhaps, the depth of the plinth helped to control the ground heat dissemination and remains the indoor temperature comfortable.

Walls were built eventually by the local strong mud and clay. Sometimes two tires of thatch with mud covered panels were used. Special and significant technique on walls were applied used to remain retain the interior comfortable.

Water-full terracotta vases were introduced on different tires as the shelve-bracket and internal core of the walls. Carefully mud walls were placed on the both side of the vase-walls and allowed to flow air thought the filled water vases and evaporative cooling remains. (figure:5)

Main roof of this region was heighted with thatch, bamboo and straws later development were covered with corrugated tins. Moderate slopes were maintained to secure other gust wind and related phenomenon. Bonding of the bamboo truss members was joined strongly to resist the wind.

Semi-open space or front veranda of the house was observed with deep shadow area, where the projected eves were extended entirely to provide shade during the rainy and the hot dry season. It has been seen being that utmost projection roof is a sense of privacy and good in-between space in front of the courtyard.

Two storied mud construction could be seen in this region, which is elaborated with different construction process.

North-eastern part of this region is vivid with waterbody and hills, this region is also embedded with several indigenous populous. It has been

assumed that most of the vernacular houses have been derived and transformed form the indigenous setting. Specially Mymensingh and Sylhet are captivated with the nature's wonders. Climate of this region is occupied with hot humid, heavy rainfall is dominant character in the region,

There are regions which are covered by hills and swamp lands and rain forest. It is very rare to find such kind of unique diversity in such a small country like ours but yet it is present.

Plinth height of this area is shallow, having based on elevated and sloped topography water do not clogged at the plane. Being the shallow plinth permeability is frequent at the semi-open space.

Walls are treated with thatch and thick mud, tapering could be seen from base to top strata; perhaps stability of fee structures. Beautifully color reddish walls are engaged with deep ting red color mud on the bottom level, hierarchy of colors enhance the façade with treasured. Opening on the walls are limited and the courtyard environment is well proportionate, visual angle is authentic in this premises.

Considering the roof construction; unique with thatch and rigid bamboo grid, during the winter time the hinterland is empty of water and instead of aqua commerce agricultural activities generates as well. So dual lifestyle is present in the particular landscape where twice a year Mother Nature changes within the same horizontal.

The costal homestead is exposed to disaster, Mother Nature designates the community how to survive; on the contrary and same Mother Nature takes all from the people living in the edge. Since ages back the technique to uphold homestead at the coastal area, people of this region tuned with the force of the climate. Fragile land configured the architecture in a new dimension where local craftsmanship along with the additional values is blended with changing landscape. Variable landscape with variable rooted architecture complements each other; on the other hand, people are adopted with nature and continue living and lifestyle remains towards the betterment.

Coastal landscape and the indigenous means of this region is mingled down with the mother nature and natural calamities allow them to understand the strength and positive manner of their own household after the catastrophes. So trial and error process from time immemorial supported them to learn, how to build a house near the coastal area.

Indigenous community in this delta land are the primogenital population staying for decays. Innovative approaches in making of their house-hold could be seen in the particular area of Bangladesh. South-eastern, north-eastern and north-western part are covered with ethnic community. The community has different name. Mogh, Murong, Chakma, Khashia, Santal, Garo etc. different ideology maintained by the respective community to uphold their cultural values. Space has transformed according to the socio cultural norms.

Special sequence of these architecture starts from the elevated mancha (platform on stilts). Building on stilts helps people to become resilient from other hazard, down to the elevated platform multipurpose activities performs. Store for dry wood, pet shelter and other sessional storage are engaged at the place.

Considering hilly topography; course of stilts was footed together to remain stable the silting situation, contour or slope of the hills helps to support the construction of the structure with rhythm of process, where people of the region learned it from their predecessors. Splendid technique of construction with sound living ensures totem of entity about the hilly area community. Allied with the Mother Nature in the ups and downs landscape resilient shelter with aesthetic wonders defines the architecture of this region is a story telling of changing landscape. (figure: 4)

In all cases the rooted or vernacular architecture often shifted to adopt the changing landscape

phenomenon. Original mode of architecture sometimes transformed according to the force of nature, people adopted with those conditions, in the same lines' inhabitants modified their own indoor and outdoor space though the continuation of socio-cultural situation. A much defused edge always shows the possibilities of adhesive growth. The traditional organization of vernacular architecture is unsolidified, accept changes receive newness.

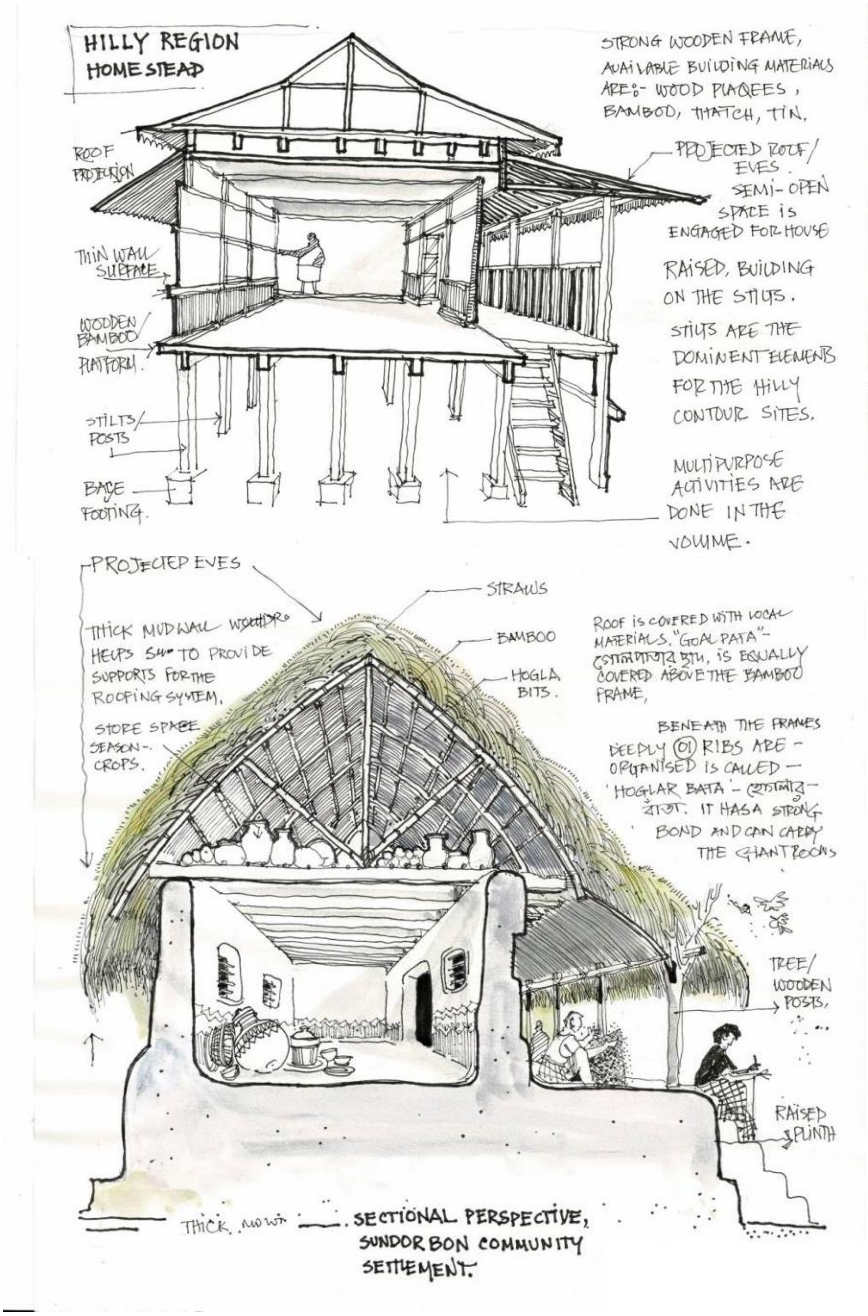

Figure 4: *Hilly region & Sundorbon homestead*

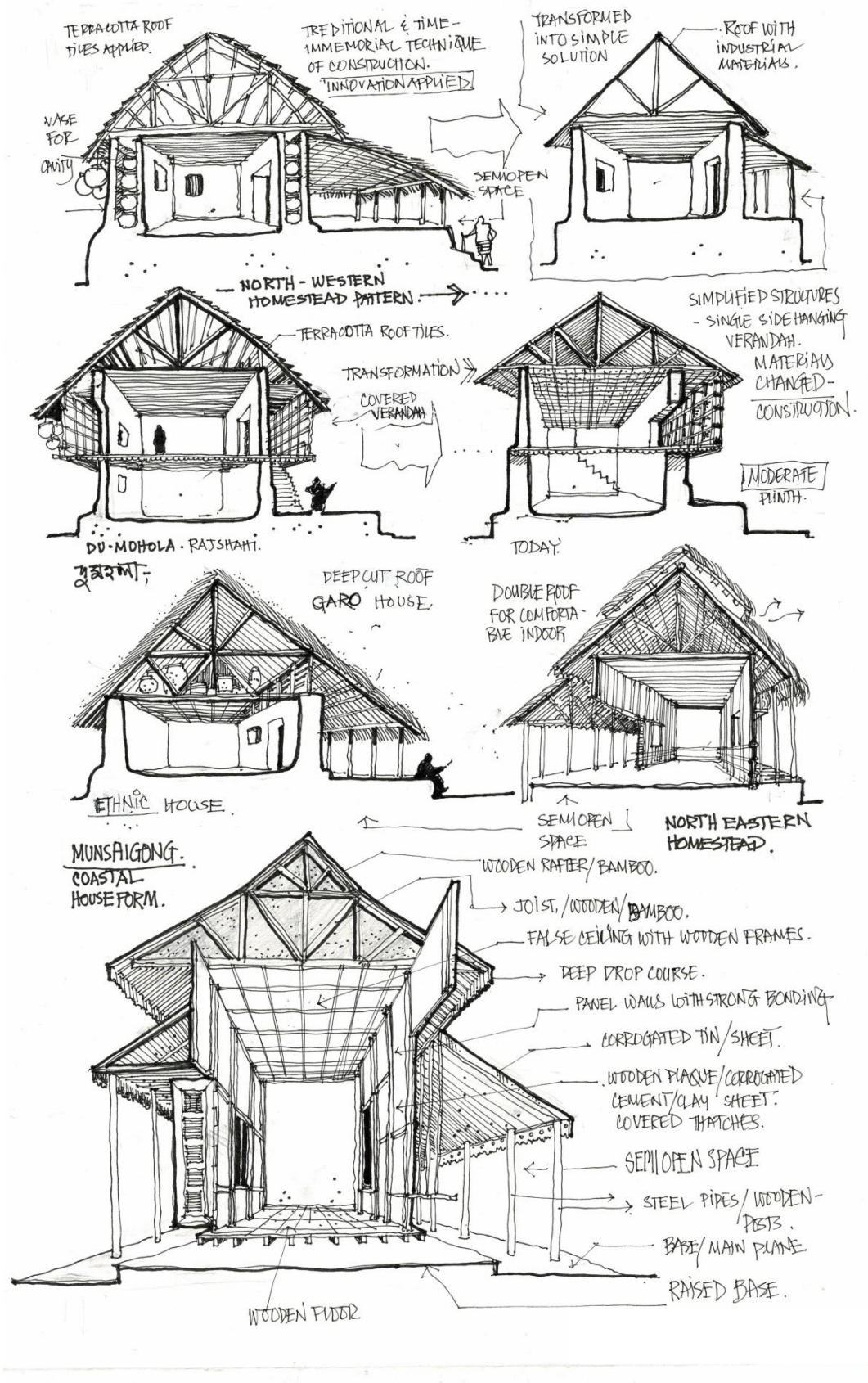

Figure 5: *Diversity & Transformation of endless vernacular architecture in changing landscape of delta.*

How architecture becomes endless in the changing landscape, a diagram.

Zone	Climate & topography	System/ components	Innovative approach	Reason of approach	Transformation/due to changing landscape	Status /endless
North western	Hot dry	Mud walls with cavity	Water filled terracotta vase	Evaporative cooling	Instead of cavity walls thick walls added.	Exists
		Plinth	High plinth	To control ground heat dissemination	Remain same	Exists
		Semi open space/ external verandah	Deep slope with projected eves	To protect form hot air and diving rain	Remain same	Exist with minor modification
		Roof	Dochla/chouchala Deep roofline	Hot air becomes cool passing through shades	Remain same with few modification	Exists
Zone	**Climate & topography**	**System/ components**	**Innovative approach**	**Reason of approach**	**Transformation/due to changing landscape**	**Status /endless**
North eastern	Hot humid Local rain, haor area	Mud walls with different thatch panels	Thatch wall panels coated with mud covering, sometimes only thatch panel walls remains	To pass air through the walls during high humid	Materials and technique is advanced with industrial supply	Evident in the middle of huge lake of Sunamgonj,
		Plinth	Household ground height is like a mound, plinth is moderate	Resists inundation and water clogging	Stilts have been incorporated instar of huge mound	Evident
		Semi open space/ external verandah	Loft roof is present	Sufficient airflow	In-between space became larger	Exists
		Roof	Two tires of roof	Hot air passes vertically through clearstory	Remain same with modification	Exists
Zone	**Climate & topography**	**System/ components**	**Innovative approach**	**Reason of approach**	**Transformation/due to changing landscape**	**Status /endless**
Costal plane	Hot humid ocean rain,	Corrugated tin walls with different wooden panels and sometimes only thatch panel	Deep footing and bracing on the ground. Panel works help to remain strong during cyclone and storm	To resist form gusts wind, tidal surge, heavy rainfall, inundation	Material transformation, spatial relation remain same	Survives
		Plinth	Deep high plinth/ stilt with raised platform	High surge and tide with gusts wind, cyclone	Wooden on concrete plinth with posts	Exists

		Semi open space/ external verandah	Larger than the other region	Gathering and congregation	Transferred in to small scale, like portico	Exists
		Roof	Strong rafter and joists for the roof	Resists during high wind pressure	Steel materials adopted	Exists
Zone	**Climate & topography**	**System/ components**	**Innovative approach**	**Reason of approach**	**Transformation/due to changing landscape**	**Status /endless**
Indigenous, hill and highland	Hot humid ocean rain,	Thatch, mud walls	Opening small on walls	Comfort in indoor	Minor transformation	Exists
		Plinth	High plinth, plinth on stilts	To get rid of from natural hazard	Materials changed	Exists
		Semi open space/ external verandah	Elevated mancha	Frontal area	Remain same	Exists
		Roof	Strong bonded deep chala	Comfort in in-between space	Same	Survives

Conclusion & Summery

In the remarks; it has been contentiously cherished since time age-old that - the hinterland of this region has shattered edge; seasons drive the landform to be special with crops and plaque with contextual connotation (lifestyle, riverine mode); where landscape acts like the versatile ties. Vernacular architecture- in this porous plane digs up with continuation of socio-cultural tactic; where spaces have been generated for the purposeful activities. Cultural background and roots are embedded to shape and to chisel the environ of spatial qualities. Moreover articulation with changing landscape takes the entire situation towards varied entity. As the form of landscape changes in all over Bangladesh, uttering from the extreme northern to southern part of delta land- traditional process of building vernacular settings did not undermine, ancient process of having comfort is obvious, however further simplified with planning organization, materials and technique which is at times do adapt and last with the latest situation. Sometime miss apart from originalities. Coping the changing landscape in the hinterland of delta, origin of architecture actually, adopt with the changing phenomenon (climate change, flood, inundation and deforestation). Truly speaking, the transformation of vernacular architecture in the marsh land is a need, a must to accept the ever changing-newness and modification by the people, because people of this plane faces the truth of nature, so the architecture of this region must have the versatile approach. Here in the delta plane Architecture floats, fluids, act like the music, sings like the riverine people, shapes of living changes with the season, it moves from one place to another. This process will continue even in the extreme situation (impact 2100) at this very delta land. This is the story of an endless architecture at the changing landscape.

Sometime it is on the ground while sometimes floats. Need and necessity staple people's lives in the highland where stilts acts like the rhythm of nature, merge in deep hilly slopes. Hierarchy in one canvas shows the poems of endless. Here in the delta people depict their architecture is away from horizon, architecture of this marshland is an Endless STORY.

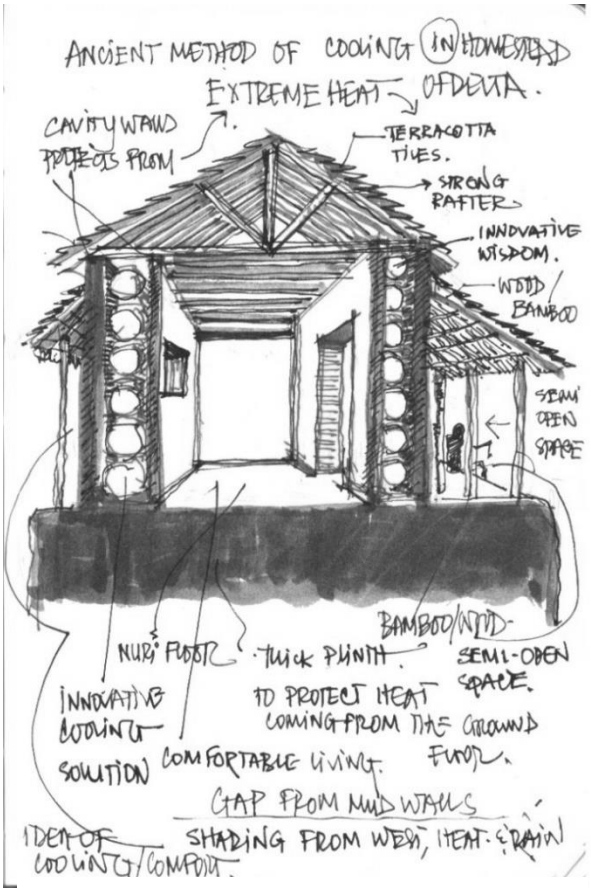

Figure 6: *Ancient method of cooling, homestead of northern part.*

**Sketches done by Sajid Bin Doza, PhD

References

Adams, McC Rober. The Natural History of Urbanism, Ancient Cities of the Indus. (ed) ed. Delhi: Greogory L. Possehl, 1950. Print.

Āḷī, E. Ke. Ema. Iẏākuba. Aspects of Society and Culture of the Varendra, 1200-1576 A.D. Rajshahi: M. Sajjadur Rahim, 1998. Print.

Bernier, Ronald M. Himalayan Architecture. London: Associated UPes, 1997. Print.

Brammer, Hugh. The Geography of the Soils of Bangladesh. Dhaka: UP Limited (UPL), 1996. Print.

Brown, Percy. Indian Architecture (Buddhist and Hindu Period). Vol. 1. Bombay: Taraporevala, 1965-1968. Print.

Chakrabarti, Dilip. "Ancient Bangladesh : A Study of the Archaeological Sources with an Update on Bangladesh Archaeology, 1990-2000." (Book, 2001) [WorldCat.org]. Oxford University Press, Delhi, 1992. Web. 06 Nov. 2015.

CHATTERJEE, VASKOR. GOUR-BONGER ITTIHASH O SANSKRITI (The History & Culture of GAUR BENGAL). Vol. 2. Kolkata, WB, India: GRONTHOMITRO, 2005. Print.

Majumder, Ramashchandra. Bangladesh Ittihash, Prachin Joog (Ancient Period). Kolkata: n.p., 1974. Print.

Shahnewaz, A.K.M. BANGLADESHER SHANSKRETIK OITHIRJHO (The Cultural Heritage of Bangladesh). 1st ed. Dhaka: Novel House, 2009. Print.

Doza, Sajid Bin, Razzaque, Zakaria Ibne, "DO MAHELA" An 'Enlightenment' about Two Storied Mud Architecture, January 2008, vol 12 no-1, Protibesh-Journal of Department of Architecture, BUET

Doza, Sajid Bin, AKH1LA Jami Mosque-Understanding 'vernacular-religious' architecture and mosques of the Muslim Bengal: a case study analysis. IBS, RU, Vol. XXXII, 2009, ISSN 0256-503X

Doza, Sajid Bin, The Story of Mud and Thatch from Time Immemorial': Publication of Booklet of The Exhibition, Alliance Francaise de Dkaka, 2009, ISBN: 978 989 33 0788 0

Green Networking: An Approach to Apply Landscape Ecology Model in Reviving the Ecological Networks of Dhaka Metropolitan City

Manjima Shabnam,
Ahmed Abdullah-Al Tawheed [1]

Abstract: *Dhaka, the capital of Bangladesh and the 11th most populous city of the world, home to 18 million people has been named the 2nd least liveable city in the world. Its ever-increasing population and hunger for buildable land has created an acute shortage of green reserves and open spaces in the city and have caused a severe disturbance in the precious ecological systems. This imbalance is posing serious environmental threats as well as creating ground for further disappearances of green lands. This study aims to propose the application of landscape ecology in planning urban networks in the densely built-up city of Dhaka in order to conserve the remaining few natural reserves and maximize their effects if possible. The landscape ecology model discussed here is the 'Patch-Matrix-Corridor' model which has been applied in Dhaka's urban network. The ecological and man-made networks of the city are studied based on a conceptual framework. Available data and resources regarding the city's natural and urban context have been analysed and categorized based on the model to produce an ecological structure of the city. This is followed by suggestions for structural improvements and methods of prescriptive interventions in order to design the functional ecological network, namely 'Green Network' for the city.*

Keywords: Landscape ecology, Ecological models, Urban ecological networks, Patch-matrix corridor model, Landscape fragmentation

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INTRODUCTION

Landscape ecology is the science of studying and improving the relationship between spatial patterns and ecological processes in a landscape on multiple scales (Wu, 2013).On the other hand, ecology of the city regards the city to be an ecosystem built by human activities and supported by natural and man-made functions and processes over time (Pickett et al.,2001). Landscape ecology focuses on structures, functions and transformations of the environment, attempting to find patterns and interrelations between landscape elements; patches, corridors and the matrix. (Forman, Godron, 1986).

The natural or ecological networks in the city play a major role in achieving a sustainable landscape within the urban environment. This is a suitable basis for integrating urban ecology to the city fabric. Additionally, multi-functional urban ecological networks not only achieve environmental sustainability, but also can contribute to recreation, reduction of storm water flooding and enhancement of water quality. Within this view of urban ecological network, this paper attempts to analyze some of the opportunities and challenges of it in the prospect of megacity Dhaka where rapid cleaning up of green space is leading to adverse climatic and ecological effects. The average surface temperature is increasing rapidly (Sabbir, Md and Shahid, 2015), and causing environmental pollution in all possible ways making the urban dwellers suffer from the adverse effects of excessive micro climatic heating. Not only more spaces need to be reclaimed as open spaces and urban forests to sustain the city, new planning methods have to be invented for sustainable land use and to preserve a well-balanced ecology.

Importance of urban ecological networks

Ecological networks in the urban environment are divided into two categories: natural and built. To create balance and sustainability among the natural and built networks, various ideas have been developed, such as: urban open space network (Cranz and Boland 2004), park systems, and greenway networks (Ahern, 1995), and the Patch-Matrix-Corridor model by Forman and Godron (1986).

Patch-matrix-corridor model

Forman and Godron (1986) use three fundamental landscape elements to define landscape structure: patches, corridor and the matrix. A patch is a relatively homogenous non-linear area that differs from its surroundings, e.g. agricultural fields, patches of forest lands, villages, etc. A corridor is defined as a linear area of a particular land cover type that is different in content and physical structure from its context e.g. riparian or river corridors are natural corridors whereas canals, highway systems, or greenway across the road etc. are manmade corridors. The matrix is the dominant land cover type in terms of area, degree of connectivity and continuity, and control that is exerted over the dynamics of the landscape. The size and shape of the patches determine to a large degree their ecological and functional characteristics. Spatial distribution, the relative locations of patches and corridors within the matrix matters as well, hence the term ‘connectivity’ emerges. Physical connections between patches via corridors affect connectivity of habitats as well as protect the patches from further fragmentation or degeneration.

The structure of urban ecological network is defined by the spatial relationships among distinctive elements forming the landscape. Urban ecological networks should facilitate and strengthen connections between patches through ecological corridors and the symbiosis between the urban and natural context.

Objectives

The main objectives of this study are:

-To adopt a landscape ecology model, namely the 'Patch-Matrix-Corridor' model in urban network planning

-To analyze the current natural and built elements of the ecological networks in Dhaka city.

-To suggest methods of interventions for strategically improvement of urban ecological networks in Dhaka

Methodology

The ecological networks of Dhaka metropolitan area are studied based on a conceptual framework. The data required for the research including maps, Detail Area Plans (DAP), structure plans, reports, satellite images and aerial images have been gathered from Dhaka's planning organizations. The obtained data have been analyzed based on the Patch-Matrix-Corridor model to produce an ecological structure of the city comparing to the ideal structure. The layers that have been analyzed to obtain the base map are:

-Natural green spaces, agricultural lands, reserved forests/gardens and manmade parks working as patches

-River corridors working as main ecological corridor. This also includes the manmade canal system

-Highways and road network working as corridors in the densely built-up urban fabric

-Lowland and water retention area working as natural matrices

-Build-up lands working as manmade matrices

This is followed by the merging of the layers of natural and manmade ecological patches and corridors into one single map that present the overall ecological structure of the city and shows the probable points of intervention.

The study area

In this article, the term "Dhaka City" stands for "Dhaka Metropolitan Area (DMA)", which is located almost at the geographical center of Bangladesh at 23°43′0″ North latitude and 90°24′0″ East longitude (Figure 1). DMA covers a total area of about 1528 sq.km. which is the total of RAJUK's jurisdiction area for the DAP (Detail Area Plan). This is also the central area or Zone C under the RAJUK Regional Development Plan (RDP) .The central part of DMA is demarcated as Dhaka City Corporation (DCC), which is approximately 360 sq.km. in area. According to World Urbanization Prospects 2014 published by the United Nations, in respect to population of Dhaka is now the 11th largest megacity. Within a span of 14 years from 1993 to 2007, 24% increase of buildup area was observed.(Ahmed, F. & Akhter) (Figure 2).The gradual changes in built-up area have not occurred in a regular or linear pattern rather the growth pattern is sporadic in nature. The city structure has taken its shape due to development of several transportation networks encouraging urban growth. Intensive urban development has led to decline of wetland, water bodies, agricultural lands, vegetation areas over the years.

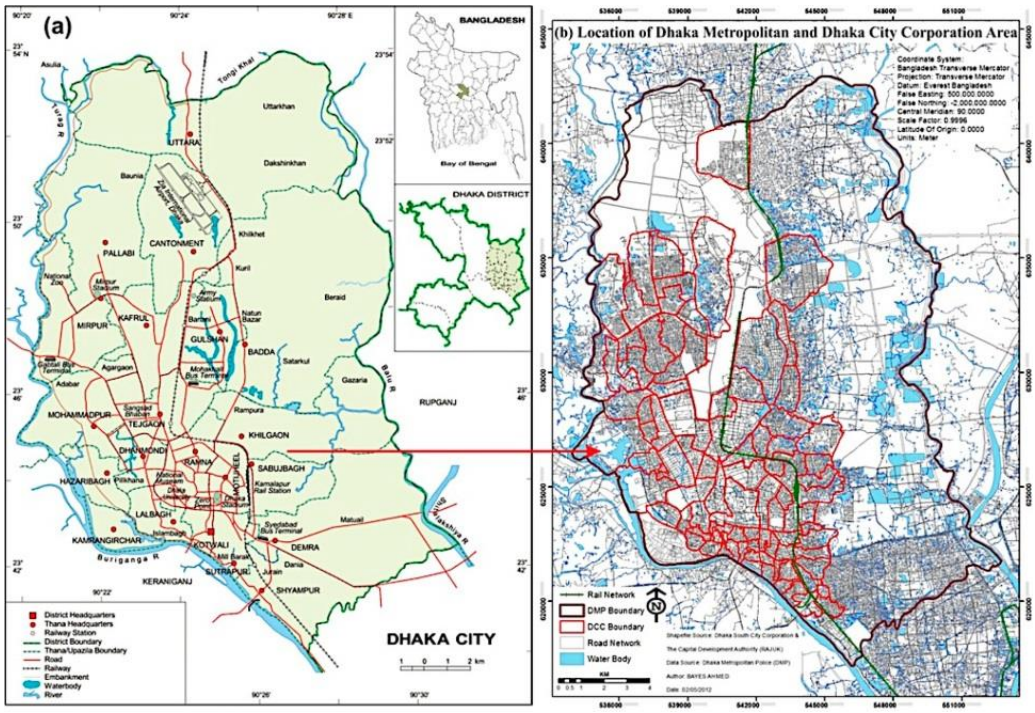

Figure 28 Location of (a) Dhaka Metropolitan Area and (b) Dhaka City Corporation (DCC). Source: (a) Banglapedia, National Encyclopedia of Bangladesh, 2014, and (b) RAJUK, Dhaka, Bangladesh, 2014

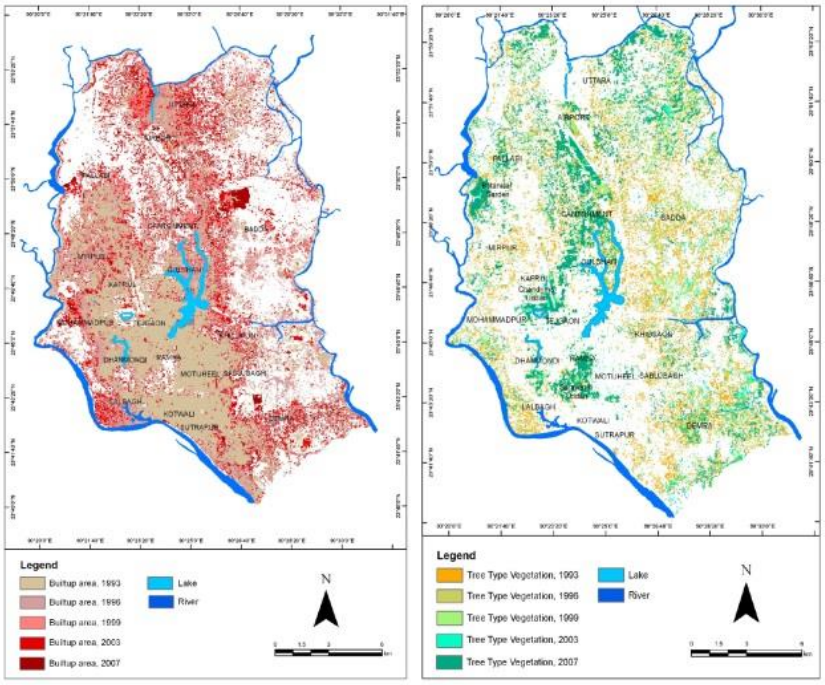

Figure 29 changes in built-up area and vegetation (tree) covered area in Dhaka from 1993-2007 source: Farhana Ahmed Mohammad Shakil Akhter, The Changing face of Dhaka City Seen through the Eyes of Satellite

Description of Dhaka's ecological network

Natural Patches

Agricultural lands and forestlands are hardly seen in the heavily built-up present Dhaka though it was not the case three or four decades ago. There has been a significant reduction in natural patches or green spaces in Dhaka in the last 20 years with an 88.78% increase of built-up space (Nagakoshi, N., & Dewan, A. 2012) (Figure 3). In the 1990s only 36% of the core Dhaka city area was under urban use and the rest 64% was non-urban or semi-rural, and agricultural use. Survey of Regional Development Project (RDP, 2013) for Dhaka Structure Plan (2016-2035) reveals that 48% of the entire RAJUK area is under urban use and rest is under non-urban use (Nilufar 2015). Experts suggested that an ideal city needs to keep its 40%-50% of land open or free, whereas old Dhaka has only 5% and new Dhaka (planned neighbourhood) has about 12% open space (Mowla 2005). At present day, the only agricultural lands still exist are in the less condensed eastern edge of the city but are not usually related to the built-up areas.

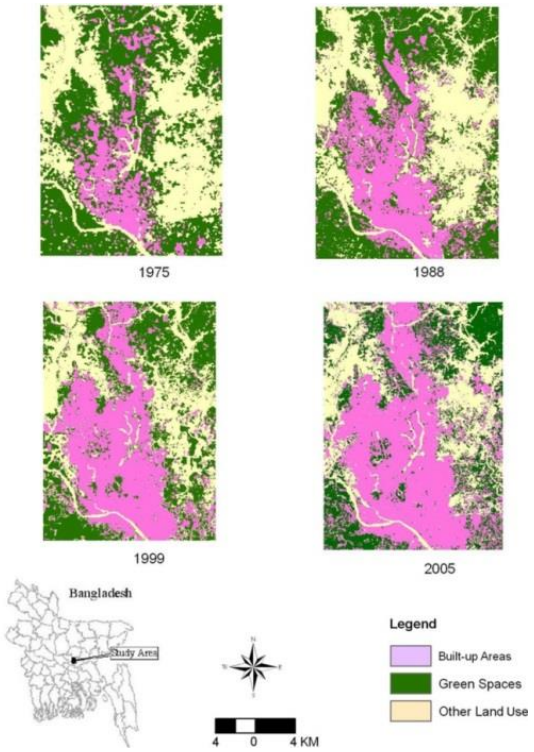

Figure 30 Spatiometral changes in green spaces in Dhaka (Nakagoshi, N., & Dewan, A. 2012)

Built Patches

Built patches are reserved urban forests, parks, gardens and other built green areas of all shapes and sizes. The national zoo and the national botanical garden at Mirpur are the only remaining urban forests in the city consisting of 200 and 210 acres of land respectively. The other built patches are parks and playgrounds. Dhaka Metropolitan City is currently home to 148 playgrounds and 27 parks occupying 1266 acres of land comprising 2.9 % of the total area of the DMA. (Ahmed, K. and Sohail M., 2008). Large scale public open spaces and parks, which are under the supervision of PWD include the Ramna park working as the green lung for the city with 58 acres, Sohrawardy Udyan comprising of 55 acres and Chandrima Udyan of 77 acres and Osmani Uddan comprising of 25 acres. Small built patches of urban parks are scattered in the urban fabric, usually without any hierarchical order and connectivity.(Figure 4a)

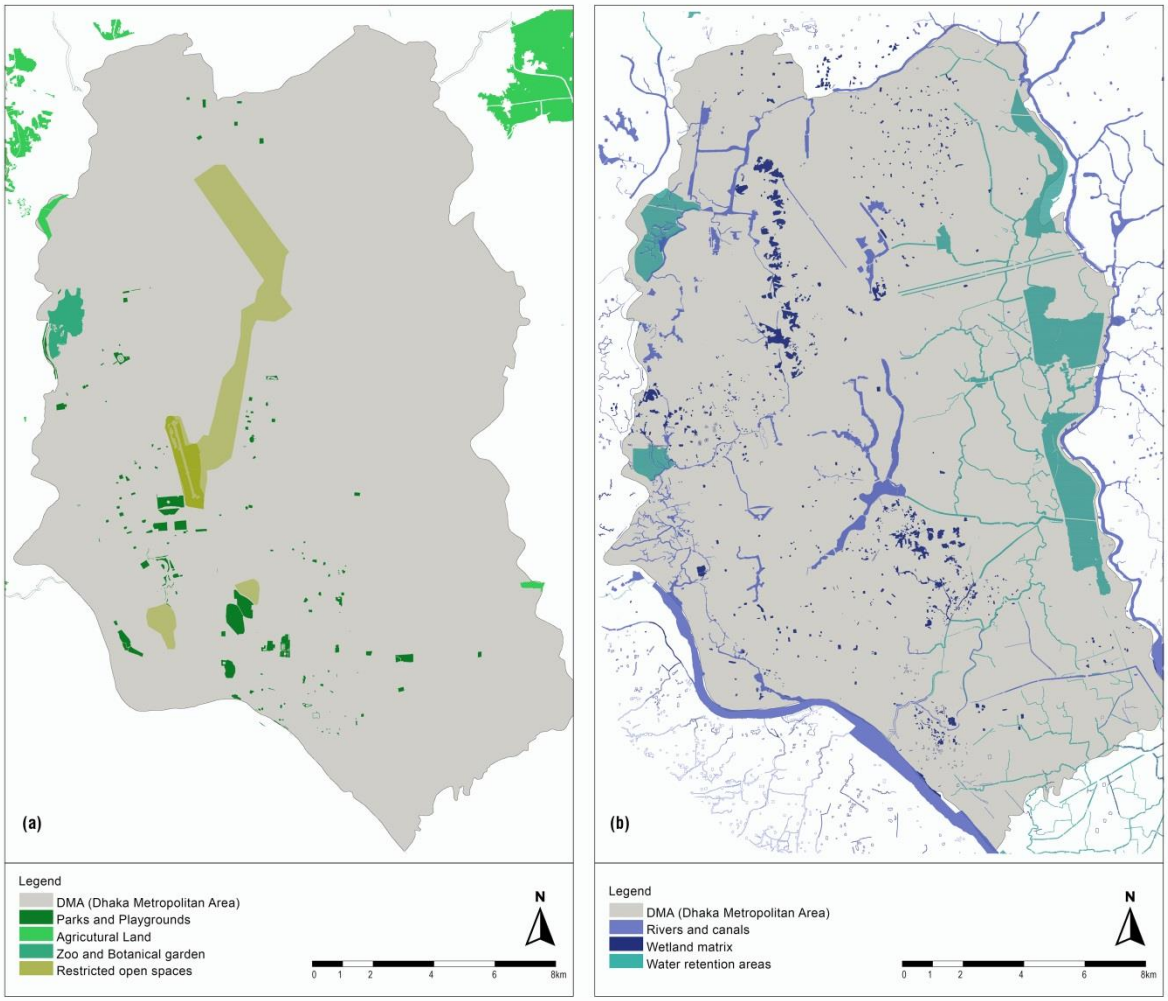

Figure 31 (a) Existing natural and built patches and (b) Existing natural corridors and wetlands in Dhaka metropolitan area (Source: Redrawn from Detail Area Plan (DAP) map prepared by RAJUK)

Natural corridors

Historically Dhaka's urban life and living was interwoven with the system of rivers, canals, lakes and ponds scattered and crisscrossing the city (Mowla, 2008). Dhaka is surrounded by four major river systems: the Buriganga to the south, the Turag to the west, the Tongi to the north and the Balu to the east side of the city. Apart from the rivers , water channels like the Dholai Khal, the Segunbagicha Khal or the Begun Bari Khal played an important role in the city life. Most of these Khals (canals) lie east-west, that used to serve an important purpose of intracity communication. However, roads have been constructed in place of these khals creating obstruction in their natural flow. Existing natural corridors are the river valleys in the perimeter of the city (Figure 4b). But these water bodies have fallen victim to indiscriminate land filling over the years. It is found that water-bodies and lowland areas decreased 32.57% and 52.58% that means more than 49% of the wetland areas decreased over the period 1960 to 2008 (Islam, 2014).The low-lying areas in the north-western part of the city extending towards Mirpur, Mohammadpur and Pallabi-Cantonment areas are filled for the urban development. The parts of Gulshan and Dhanmondi lakes have also been reduced and some of the channels of Motijheel areas are not identifiable at present.

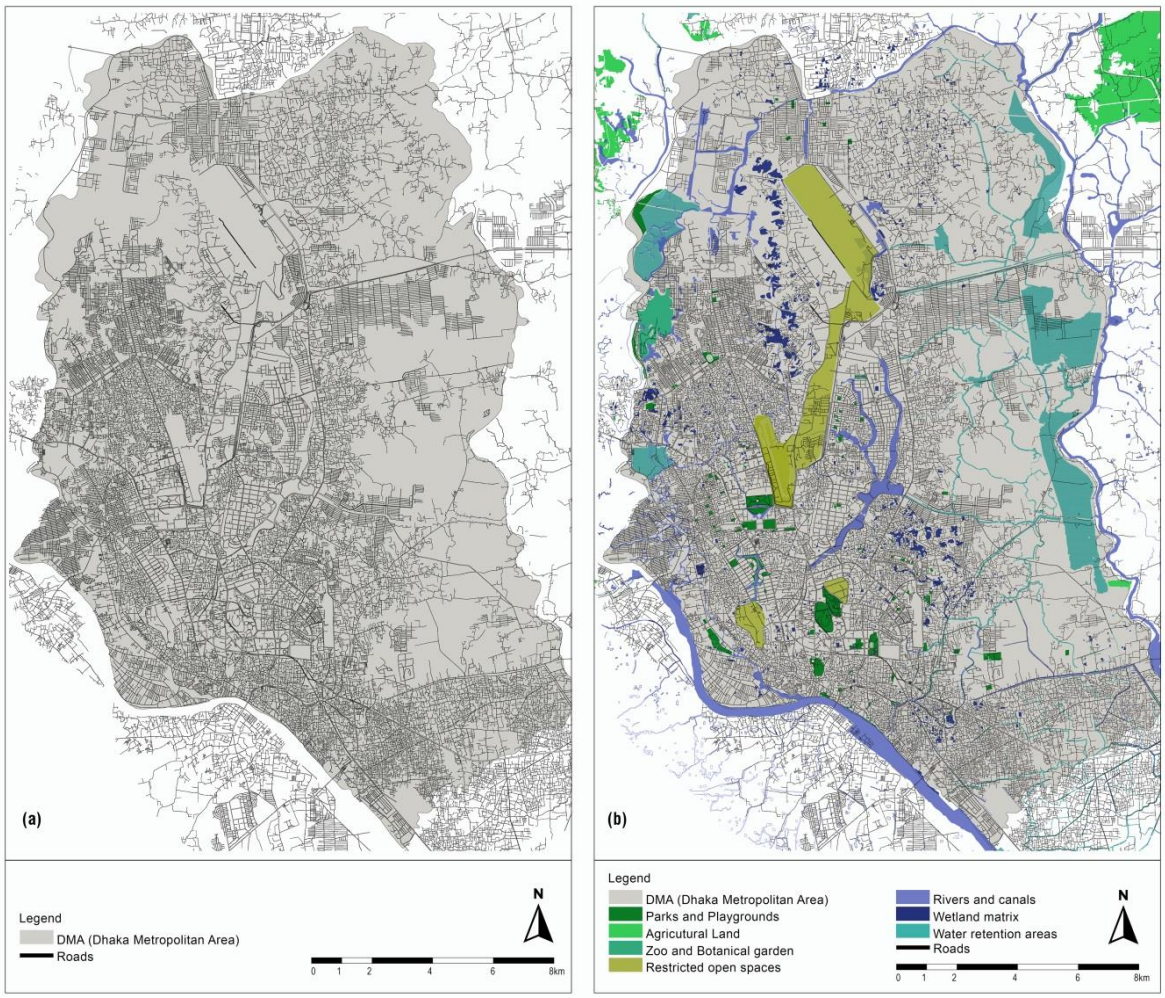

Figure 32(a) Existing road network and (b) All ecological layers of Dhaka metropolitan area (Source: Redrawn from Detail Area Plan (DAP) map prepared by RAJUK)

Built corridors

The road network is the manmade corridor system inside the city. Roadways and pavements occupy 9% and 6% of the city area. Some major roads in Dhaka were developed by filling the natural water bodies or 'Khals' by making box culverts, thus disrupting the natural corridor network by reducing the water carrying capacity as well as reducing ground water replenishment (e.g. Dholai Khal and Panthapath). The hierarchy of the built network follows the North-South directions which result in disruption of the East-West flow of ecological corridors (Figura 5a).

Natural-built matrices

The relationships between natural and built matrices in the morphology of Dhaka city have changed throughout the history. At present the core Dhaka is almost completely covered by built settlement matrices with very few patches of green or open spaces. There are some

matrices of wetlands still existing in the low-lying areas of the city which are highly defragmented by built corridors. The rivers and canals being the only natural corridors are also being obstructed in their ways resulting in gradual separation of urban fabric.

Findings and Results

According to the overlaid map of all ecological layers (Figure 5b), the many weak points in the network are evident. The current situation of built and natural patches show that their proximity do not have connectivity and that large patches are located too far away from each other without direct connections. The circuit pattern of the hydrological network is being obstructed or damaged in places by land filling and human acquisition. Lowland and wetland areas which served as catchment areas for flash flooding are now being turned into housing societies overnight. As a result, less and less connectivity is found among the different layers of the ecological network day by day. The main constraints on Dhaka's ecological context are:

-Increased population demand on very limited amount of land

-Invasion of urban development in remaining patches of nature

-No preservation codes for urban forests and greeneries.

-Disruption of natural canal system of the city

-Illegal acquisition and fill-up of wetlands and water retention areas

-Absence of proper land use planning in keeping the ecological balance in mind

Strategies and solutions for the network

Following the principles of patch-matrix – corridor connectivity, the existing and patches, matrices and corridors can be connected into a functioning green network via means of greenways, greenbelts and protecting the water bodies through buffer area. The greenways and greenbelts will work as the major corridors to connect the existing scattered patches and the lowland/wetland buffers will work as additional matrices connected to the system.

Greenways along streets

Since the road network is the most connected and accessible network in the city, this infrastructure should be used to add to the ecological network. Strategic roads in the existing network can be converted into greenways by adding a layer of plantation along the pavements. The tree lanes can also be accompanied with bio-swales which will increase absorption of surface run-off water. Moreover, small park lets can be created on vacant plots or acquired lands which will be connected to the greenway for creating opportunities for recreation for the pedestrians. (Figure 6)

Figure 33 Proposed greenway section

Developing greenbelt along water bodies

Greenbelts have to be created as buffer zones around the water bodies and hydrological network of Dhaka city. Landscaped greenbelts can work for wetland preservation as well as serve as recreation spaces for the people. Bangladesh Inland Water Transport Authority (BIWTA) has decided on a 50m wide continuous green zone to be preserved along the circular waterway connecting Buriganga, Turag and the Balu river in order to protect the rivers as well as prevent river erosion (Dhaka structure plan 2016-2035). Ideally at least 2-4 meters of buffer green zone is required around small sized wetlands and at least 5-15 meters buffer for connecting scattered pockets of wetlands. This concept can also work as wetland park for local people. For a built example in this regard, the Hairjheel-Begunbari khal development project can be considered. A green belt of 15-20 m has been developed all along the bank of the lake to protect the lowlands of the area as well as to enhance the storm water retention capacity of the lake in order to minimize the risks of flooding in the adjoining areas. This ecological intervention has made Hatirjheel the largest storm water detention basin in the city which is hydraulically linked with the Gulshan and Banani lakes (Afrin, S. et al, 2015). (Figure: 7)

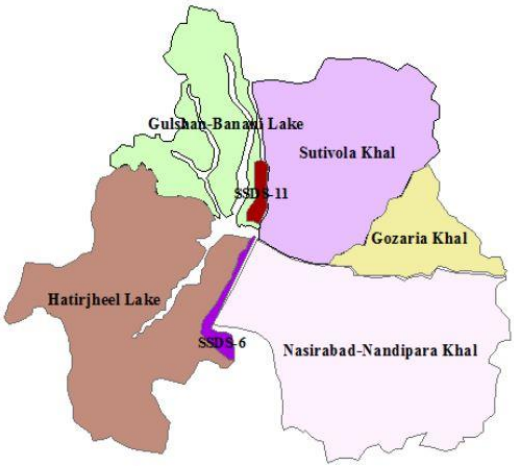

Figure 34 : Catchment area of Hatirjheel-Begunbari Lake. Source: Afrin, S. et al, 2015

A development of a wetland park is shown for example (Figure 8a) in the lowlands of the western side of the airport connecting the wetlands of Bhashantek, Manikdi, Matikata, and Kafrul. A 20-meter buffer area has been designated around the scattered wetlands and this wetland matrix has been connected via

retention channels to Uttara lake to the North and Shewrapara to the South. These wetland parks can add up to the matrices of the ecological network.

Strategic connections in the green network

The least cost method can be implied to find the shortest and best path to connect the patches and networks through built greenways or green corridors. The network can be developed centering the Old Airport site turning it into the central open and green space of the city. The reclaimed site of the abandoned airport will add to the existing patches of the city and it can be connected to other existing large green patches, the Ramna Park and Sohrawardy Uddan to the South and to the existing water corridor, Dhanmondi Lake to the South-west via greenways. This can further be connected to the North-East to the Hatirjheel Lake and to the North-west to the Mirpur Zoo and Botanical garden. This will make the main North-South axis of the network. This axis can further be connected in East-West directions at several points through greenways and retention canals. The lowlands will be protected by green buffer and these matrices will be connected to the main network via retention channels. Thus, an interconnected network of connecting the existing and new patches, matrices and corridors can be created. (Figure 8b). Large chunks of forest areas outside the core city area can also be connected to this network by enabling the green reserves to penetrate the city.

Limitations and Potentials analysis of the network

Limitations	Potentials
Existing 'Khas' lands (government owned fallow lands) in the core built-up space of the city inaccessible to the public use and disconnected with the whole ecological network, e.g. the Old Airport at Tejgaon, the Central Jail area	The Old airport at Tejgaon can be reclaimed as central public park and can work as the potential core for the green network. The old central jail has already been relocated and a plan has been proposed there for a public museum complex.
Khals and water retention areas are under constant pressure of encroachment.	The lowlands and retention ponds can be integrated with public recreation facilities by converting them into ecological parks which will prevent further encroachment as well as add recreational value.
Erosion and encroachment of main river banks	River valleys can be developed with green belts and recreational waterfront development.

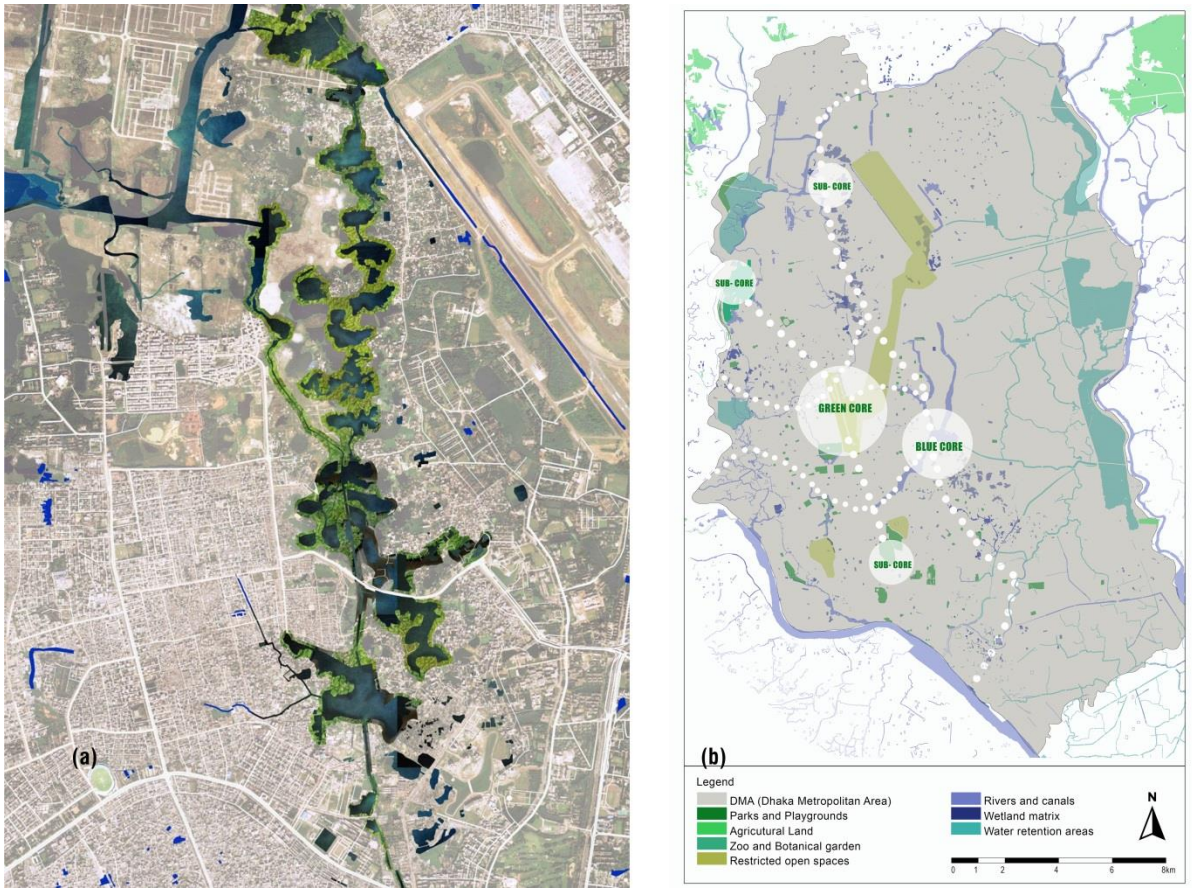

Figure 35 (a) proposal of Wetland Park with buffer area (b) Proposed green network

Conclusion

This research has argued that establishing a multifunctional green ecological network is a serious challenge in a built-up city like Dhaka, so it must be carefully planned. The attention is drawn on three evolving principles: mapping the layers of the existing ecological network, identifying the areas needing attention and planning strategies to increase connectivity and sustainability of the network. Following the principles of patch-matrix –corridor connectivity, existing and new potential patches, matrices and corridors have been identified, which can be connected in a green network via means of greenways, greenbelts and protecting the waterbodiesand lowlands.

At present the land allocation planning in the city does not reflect the ecological needs of the city, it is hoped that this research can help to identify the areas needing attention to improve decision making. The research is based on the ecological networks in Dhaka metropolitan area as a case study to provide a model in other densely built-up areas where urban intervention threatens the natural environment.

References

Afrin, Sadia & Islam, Mohammad Maksimul & Rahman, Md. (2015). Assessment of Future Flow of Hatirjheel-Begunbari Drainage System due to Climate Change. Journal of Modern Science and Technology. 3. 102-116.

Ahern J (1995) Greenways as a planning strategy. Landsc Urban Plan 33:131–155. doi:10.1016/0169-2046(95)02039-V.

AHMED, K. and SOHAIL (KHAN), M., 2008. Child's play and recreation in Dhaka City, Bangladesh. Municipal Engineer: Proceedings of the Institute of Civil Engineers, 161 (4), pp. 263 – 270

Ahmed, F. and Akhter, The Changing face of Dhaka City Seen through the Eyes of Satellite.Available at: http://www.bip.org.bd/SharingFiles/journal_book/20140427150419.pdf

Cook, EA & Van Lier, HN 1994, Landscape planning and ecological networks. in Landscape planning and ecological networks. Elsevier; Developments in Landscape Management & Urban Planning, 6F.

Byomkesh, Talukder & Nakagoshi, Nobukazu & M. Dewan, Ashraf. (2012). Urbanization and green space dynamics in Greater Dhaka, Bangladesh. Landscape and Ecological Engineering. 25. 45-58. 10.1007/s11355-010-0147-7.

Cranz G, Boland M (2005) Defining the sustainable park: a fifth model for urban parks. Landsc J 23(2–04):102–120.

Forman RTT, Godron M (1986) Landscape ecology. Wiley, New York

Forman RTT (1995) Land mosaics: The ecology of landscapes and regions. Cambridge University Press,Cambridge, UK

Islam, Md & Shahabuddin, AKM & Mostafa Kamal, M & Ahmed, Raquib. (2014). Wetlands of Dhaka City: Its Past and Present Scenario. Journal of Life and Earth Science. 7. 10.3329/jles.v7i0.20126.

Mowla, Q. A. 2006. 'Memory Association in Place Making – Understanding an Urban Space', Protibesh ,BUET, 10(1), pg. 23-32.

Nilufar, Farida (2015, October 5) Preserving open space for livability of Dhaka. Public Space for all, World Habitat Day 2015, Seminar organized by Housing and Public Works Ministry, GoB, Dhaka

Pickett STA, Cadenasso ML, Grove JM, Nilon CH, Pouyat RV, Zipperer WC, Costanza R (2001) Urban ecological systems: linking terrestrial ecological, physical, and socioeconomic components of metropolitan areas. Annu Rev Ecol Syst 32:127–157

Sabbir, Md & Shourav, Ahmed & Shahid, Shamsuddin. (2015). Impact and Adaptation to Climate Change in Dhaka City of Bangladesh.

Tawhid KG. 2004. "Causes and effects of water logging in Dhaka city, Bangladesh," TRITA-LWR Master thesis, Department of Land and Water Resource Engineering, Royal Institute of Technology (KTH). 75p.

Wu, Jianguo. (2013). Landscape Ecology. 10.1007/978-1-4614-5755-8_11.

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