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Community Development in Emerging Cities: A Case for Lagos,Nigeria

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COMMUNITY DEVELOPMENT IN EMERGING CITIES

A Thesis Presented

By

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DEDICATION

To my mother for her constant care and support.

To my father for his selflessness

ACKNOWLEDGEMENTS

ABSTRACT

COMMUNITY DEVELOPMENT IN EMERGING CITIES

MAY 2014

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Urban spatial expansion resulting from urbanization in Sub-Saharan Africa (SSA) is growing and will not stabilize in the near future. Sub-Saharan Africa's urban growth rate is climbing faster than developing economies. Efforts should be concentrated on accommodating this phenomenon through the promotion of sustainable urban planning and development.

Relying on secondary data, this research examines models of indigenous Sub-Saharan African urban forms and residential architecture vernacular to understand these forms and their characteristics, and how these models and associated management, design, and planning principles can be adopted in a contemporary context. Also, studies of established indigenous building materials and technology, which can be adapted to suit a low-cost and sustainable economy, are explored.

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INTRODUCTION

Intent

This thesis project aims to explore the design of communal housing within the context of growing cities in Sub-Saharan Africa. This is especially important due to the emerging phenomenon of rapid urbanization in Sub-Saharan Africa. The process of how these cities are addressing the challenges of rapid urbanization in the face of limited planning and inadequate infrastructure layout, which is necessary to accompany such urban spaces, will be examined.

In addressing this topic, the research will evaluate historical architectural vernacular, as well as prior indigenous urban forms. Examinations of historical contexts will be important to this research because lessons will be extracted that will influence a final design proposal.

The end goal will be to propose a design solution that addresses issues dealing with communal living in urban areas. Finally, central to this research will be the incorporation of sustainable and energy efficient building systems, construction methods and materials influenced by an established, but often overlooked vernacular design and construction techniques.

Design

The design phase of this project involves the incorporation of indigenous sub-Saharan

African urban forms, ideas, and concepts into the contemporary city-building process.

Architectural vernacular aspects that can be adapted to solve some design problems of

communal living, environmental strategies, seasonal flooding will be incorporated.

The design will attempt to develop a prototype to solve socio-cultural, energy, climatic,

and material issues relevant to the context.

The design phase includes:

   a. Planning at a single communal residential scale

   b. Building program /growth

   c. Energy systems

   d. Sustainable Strategies

   e. Water collection Systems

   f. Materials/building technology including adobe, terra-cotta, rammed earth, wood,

      bamboo, CMU-concrete masonry units.

CHAPTER 1

THESIS INTENT

This thesis project aims to explore the design of communal housing within the context of growing cities in Sub-Saharan Africa, and proffer a design solution that draws inspiration from established architectural vernacular while which fitting into its immediate site context.

Research Questions

1. Do indigenous Sub-Saharan African vernacular have characteristics and features that could be adapted to modern building efforts in Sub-Saharan Africa?
2. What is the prevalent architectural vernacular that could be adapted to solve some design problems?
3. Why and how could this vernacular be used to solve energy, climatic and building material issues?

This research would however be careful to ensure that historical endearment does not entail replicating past indigenous communal and urban forms, but understanding these forms and their characteristics, and then selectively borrowing qualities of these old communities and to modern community building efforts.

Research Methodology

The purpose of this study is to examine how early examples of indigenous communal living patterns and urban formations can be applied to the modern context. Therefore the study examined prior indigenous African single-family dwelling units as well as urban

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forms. This was achieved by reviews of relevant literature for contextual analysis. Case studies of relevant buildings were undertaken.

Finally an original design proposal was developed based on established paradigms and useful archetypes acquired from the contextual and case studies.

Scope And Limitations

The research was not aimed to be an exhaustive study on indigenous communal living, urban forms and vernacular architecture. The study aims to extrapolate important themes and expound on the relevance of these in articulating a more holistic and contextually responsive design.

CHAPTER 2

CONTEXT

Sub-Saharan Africa (SSA) is the geographical region of Africa south of the Sahara desert. It considered separately from the whole African continent for the purposes of this study due to its unique cultural heritage which is distinguishable from that of North Africa, which is more closely allied to the Middle Mediterranean world and the Middle East.

Figure 1: Map of Africa showing Sub-Saharan Africa. Source: Author

At a growth rate of 4% per year, urban population growth rates in Africa have been and will continue to be the highest in the world.[1] Within the next few decades, the continent's urban population will greatly increase as new cities and economic centers emerge and attract rising tide of economic migrants in search of employment opportunities, better infrastructure, educational facilities and social, cultural and economic advancement. The rapid urbanization will make huge demands for housing facilities, electricity, water, transport infrastructure and other necessary components needed to support these cities.

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[1] United Nations Environmental Programme :*Global Environment Outlook 3 (GEO-3): Past, Present and Future Perspectives(2002)*

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Therefore, as the rapid growth of these cities continues, the emerging imperative would be to accommodate this phenomenon through the promotion of sustainable living spaces in urban areas.

Urbanization In Sub-Saharan Africa

By 2030, 48 percent of all Africans will be city dwellers, and in 2040, one billion Africans will live in cities–more than the entire population of the continent today. Africa will become predominantly urban by 2050.

By 2050, Africa will become even more urban; with 60 percent of its residents living in cities a predominantly urban continent.

With cities doubling in size and megacities developing throughout the continent sub-Saharan Africa would have to deal with an increasing urban population,[2].

By 2015, Lagos, Nigeria will become the largest city on the continent, with a projected population of 12.4 million people, surpassing Cairo, Egypt currently the largest African city. Five years later, in 2020, Lagos will have more than 14 million people, and Kinshasa will have surpassed Cairo to become the continent's second largest city, with 12.7 million people.[3][4]

Smaller sized, but equally important metropolitan hubs are springing up all over the continent. Abidjan, Addis Ababa, Dar es Salaam, Kano, and Nairobi. Abuja, Bamako, Luanda, and Lubumbashi are all projected to grow by 50% by 2020 will grow by 47 to 50 percent in this decade.

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[2] UN HABITAT :The State of African Cities 2010 Report: Governance, Inequality and Urban Land Markets
[3] http://www.bbc.com/news/world-africa-11823146
[4] Jeffrey Racki: *Africa 2050: Urbanization*, Centennial, April 2013.
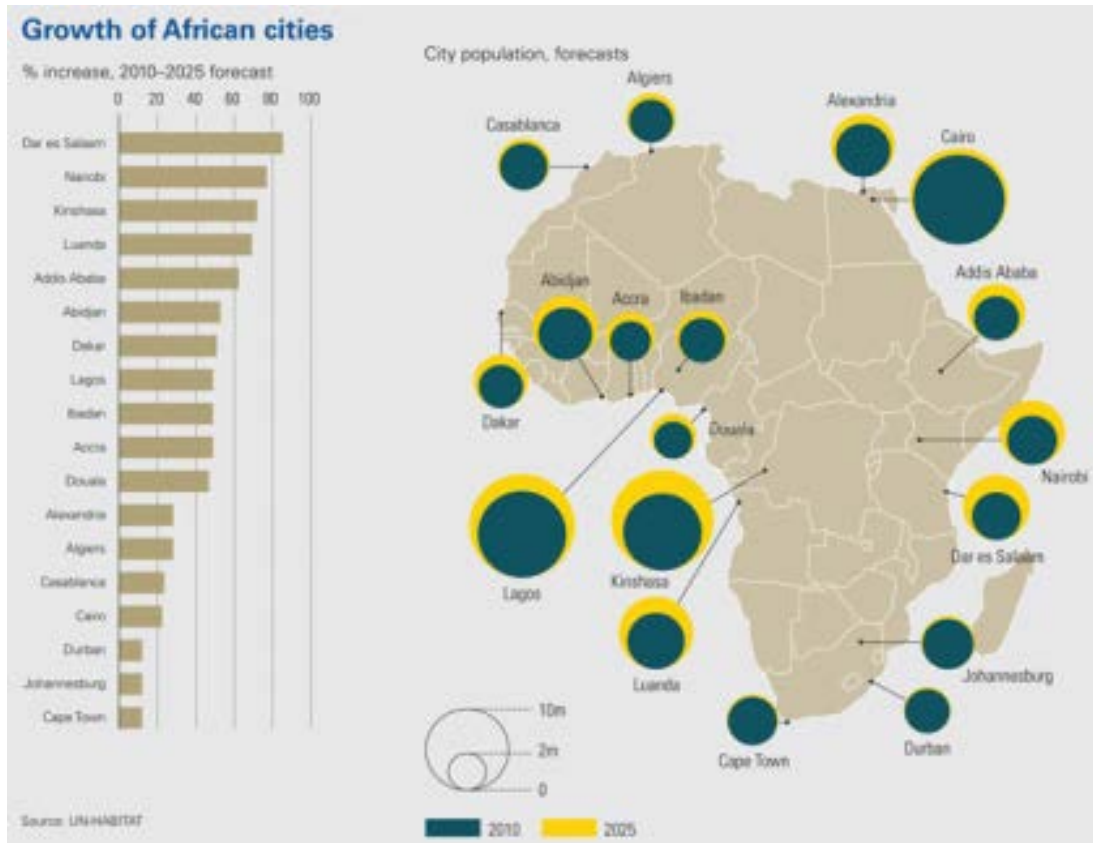
Figure 2: Growth rate of African cities. Source: KPMG INSIGHT Magazine

Context

Cities are centers of power, innovation, and central engines of growth for economies. They are centers of intense activity: production, marketing, information, finance and knowledge production. They are by their makeup shaped and driven by forces of and more recently, by forces of globalization and international competition Cities are therefore inextricably linked both to the economies of their local regions and to the wider global economy, via trade and investment. These changing forms of economic, political environments, as well as industrial and consumer economy have strong influencing effects on urban settlement systems.

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The makeup of cities both in terms of human capital and infrastructure is what enables the proper functioning of cities. Human capital inflow drives the need for infrastructure expenditure and an also provides the revenue base for such infrastructure undertaking.

Urbanization with development occurs when national economic growth and development are present at the same time including a deliberate development policy that integrates economic and spatial planning supported with by productive agricultural economy sector, growth of secondary cities and investment in suburban and rural towns to facilitate rural-urban interactions.[5] Urbanization without development occurs when national economic development and growth is insufficient to meet the needs and requirement that are needed to support a viable urban economy. This leads to an unplanned and chaotic scramble for economic capital and space. This form of urbanization is usually very spontaneous and could easily catch an otherwise unplanned semi-urban area lacking infrastructure off-guard. This leaves the area under pressure for resources to support its burgeoning population; the influx of people seeking economic rent as well as a means of living meets up with undeveloped and overburdened infrastructure.

These circumstances have not been planned for in most cases, and if anticipated, the scale underestimated. This type of urbanization is very common in sub-Saharan Africa, Asia and Central America.

The rapid growth of cities In Sub-Saharan Africa is associated with underdeveloped infrastructure, low levels of sustainable economic activity, low health and safety standards and an overarching lack of a coherent planning policy that matches

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[5] Churu,F.2005 *Globalization and uneven urbanization in Africa: the limits to effective Urban governance in the provision of basic services*,UCLA Globalization

economic growth with adequate urban planning and necessary infrastructure. Despite the odds against urbanization in sub-Saharan Africa, the region continues to experience the fastest growth rates of urban centers.

Growth / Historical Context/ Precedents Of Urbanization In Sub-Saharan Africa

Urbanization in Africa is not a new phenomenon. Its origins date back several centuries ago when Africans began founding permanent settlements which paved the way for the first urban revolution around the Nile Valley in the region of Alexandria in Egypt and Carthage,(a port city on the coast of modern-day Tunisia) these port cities were encouraged by cross-Mediterranean trade[6]

In West Africa, cities developed in Djenné-Jeno and Timbuktu, in modern day Mali, Koumbi Saleh in modern day Ghana and Kano in Northern Nigeria, all of which served as important markets for commodity traders traveling between North Africa and coastal West Africa.

Early explorers remarked on the gold and other wealth apparent in these savanna cities, but many of their inhabitants were ordinary farmers. At their peak, both Kano and Timbuktu also had sizable populations of scholars, who came from parts of North and West Africa to study Islam. [7]

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[6] Bonine, M. E. 1983. Cities of the Middle East and North Africa. In: S. D. Brunn and J. F. Williams, eds., *Cities of the World.* Harper & Row, New York, pp. 280-322.

[7] Henry Louis Gates, Kwame Anthony Appiah: *Encyclopedia of Africa: Urbanism and Urbanization in Africa*. Oxford University Press 2010

Many of these early settlements formed the basis for urban settlements in colonial era, post-independence and in the new age of globalization. Historically, urban settlements in Sub-Saharan Africa, although significant in administrative and trade terms, were generally small, few exceeding 100,000. In most of sub-Saharan Africa, towns were the seats of kings, political rulers with religious overtones. They accommodated courts and gave rise to the production of arts and crafts, but remained small because of their dependence on locally produced food.

Colonial Urbanization

The mercantilist period evolved into colonialism proper in the second half of the nineteenth century. The development of capitalism in Europe gave rise to a search for cheap raw materials and agricultural produce and for markets for manufactured exports. In Western and Central Africa, the effects of the slave trade on pre-existing social formations made it possible to shape a system of large-scale production of goods such as groundnuts, cocoa, palm oil, timber, and rubber by organizing a trade monopoly supported by local rulers, and forced labor. Colonialism introduced new administrative systems, and changed the pattern of urbanization. City centers developed not as industrial or trade centers, but to facilitate the extraction of commodities from the hinterland farmlands to Europe. The politico-administrative system on which this depended were cities. Many coastal settlements that were already engaged in international trade prior to colonial expanded. Lagos and Accra in West Africa and Tunis in North Africa are important examples of these phenomena.

However in order to fulfill the economic and administrative functions needed for trade and material exploitation, infrastructure needed to be provided. Transport infrastructure, especially railways, roads and ports were developed to connect the ports to their hinterlands. Also colonial settlements were superimposed in already existing trade hubs attached to existing towns and cities. Port cities in particular thrived during this period.

Causes, Influences And Challenges

The rapid rate of urbanization in Africa can be associated with people moving into cities to seek economic opportunities. In rural areas there are limited means of living beyond basic sustenance and small-scale agro-allied industry. Cities, on the other hand, are known to be places where money, services and wealth are centralized. Cities are centers where opportunities converge with resources and where social mobility is possible. Most of the pull towards urban centers is because the key drivers of productivity which include small and medium-size enterprises, human resource and skills development, and technological innovation are lacking in rural areas. Also the infrastructure needed to support this is lacking.

Another challenge from Africa's rapid urbanization is the increasing pressure of urban populations on natural resources and the environment. The expansion of cities is generally at the expense of destruction of forests and other natural environment or ecosystems, and increasing pollution (especially air pollution) with the related diseases.

The challenge therefore requires the diversification of economic activities through the creation of new economic hubs oriented towards high sustainable and value-added production and exportation. As most of the migrants from rural areas are

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uneducated/unskilled, they end up in the informal sector, which accounts for 93% of all new jobs and 61% of urban employment in Africa. As the wages these low-skilled economic rent seekers can gain is limited, they are left in poverty in a system that is not designed for them. Therefore in poverty, and therefore poverty in Africa is becoming a predominantly urban issue which brings along all its characteristics in an urban context.

Review Of Urban Arrangements

Urban agglomeration contributes to sustained economic growth. However when it is unplanned and insufficiently anticipated, it creates a situation whereby limited resources are available to service an ever-growing and unlimited urban populace. The urban growth is attributed to both natural population growth, and rural to urban migration.

This unplanned increase in urban population puts a strain on infrastructure, social services and the environment. It is also pertinent to note that this uncontrolled expansion also puts downward pressure on the rural to urban migration magnet; higher wages. This is because growing urban areas having achieved a critical mass, often fling new entrants to the fringes of available employment, thereby creating a phenomenon known as the 'urban poor'. Urban poverty is characterized by limited access to employment opportunities and income, unhealthy and inadequate and insecure housing environment, little or no social protection mechanisms, and limited access to adequate health and education opportunities.

Therefore these new migrants are usually physically located within cities, but often remain socially, economically in some cased legally excluded from access to decent education, health services and housing facilities. The inability to access housing has

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significant consequences for fighting poverty. Housing is essential for a productive population. This is especially true in environments where residences are not only sites of social reproduction, but are key resources in economic production including small-scale industry, restaurants, shops and offices.

Poor housing facilities, overcrowding and environmental degradation make the urban poor particularly vulnerable to abuse and housing exploitation in illegal settlements. Illegal settlements are often located on land in the urban periphery, which is not suitable for residential accommodation. In very many cases, landfills and waste dumpsites have been informally annexed for housing purposes.

Structural Causes

Rapid urbanization has placed the urban poor in situations where their struggle for survival is constantly in conflict with formal laws. Informal settlements usually develop in small or large clusters dotted around the city or urban area; consequently it is very expensive to extend infrastructure to these areas. Nevertheless, many people and enterprises want to move to burgeoning cities and that is a testament to the advantages of urban agglomerations. Improving the urbanization process remains key to good economic, social and even environmental development avoid such burdens, cities and nations need to plan proactively for urban growth, making use of both markets and planning tools, and engaging with all sectors of society.

All too often, rapid urban growth occurs with little forward planning, poorly developed land markets, and with grassroots organization actively discouraged. Valuable land is controlled by enterprises or by public agencies seeking political advantages or

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speculative gain, at the cost of efficient or equitable land allocations.

Rural-urban migration in sub-Saharan Africa has especially been fueled by high concentration in cities of health, education, and other public facilities that are rarely found in rural areas. A secondary pull factor is available employment opportunities. Therefore rural-urban migration will continue to grow until such basic amenities are provided in rural areas.

Architecture Of Africa

The architecture of Africa is often regarded as being undeveloped due to the low technological advancement of the building materials and construction techniques. It is often observed as being traditionally instinctive and underdeveloped.

 However, African indigenous architecture is more than instinctive It has a well-developed sense of multifunctional meaning. It has developed from conscious effort at creating functional as well as psychological space, both coming to terms and creating an aesthetically satisfying three dimensional form.[8] Some of these spaces have spiritual or psychological meaning which have cultural origins. Others serve social purposes for gathering and settling disputes.

One of the major reasons that African architecture is often regarded as under-developed is because there is little written scientific documentation to support design decisions and

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[8] Adeyemi A.A. 2008: *Meaning and relevance in Nigerian traditional architecture:The dialectics of growth and change.* Covenant University Public Lecture Series ISSN 2006---0327, Vol. 1, No. 21, April, 2008.

choices of construction materials and technology. However the absence of documented scientific knowledge does not mean that this indigenous architecture fails to satisfy conditions of shelter, thermal comfort, natural resource management aesthetics, sustainability and being an integral part of the lives of its users and occupants.

Africa has an over 5000 year's old recorded history that shows buildings and monuments made of numerous natural materials available in abundance in its geographical landscape. Its indigenous architectural practice had been shaped by ideologies of sustainability though this was done in ignorance. Developed from naturally existing materials and cyclical possibilities of their regeneration, they impacted on the judicious use of earth's resources in the construction of its villages and hamlets, the cities and urban centers as well as the temples, tombs, monuments and religious edifices. In reality, the act of choosing a site, utilization and re-use of materials and sites in that respect have all been formed by the culture of uncomplicatedness and frugality.[9]

Although they are simple looking in perspective, issues related with industrial pollution and the effects of industrialization in a global economy have begun to paint ingenious African architecture along with the simplicity of its strategies in a more favorable light as likely technologies for the contemporary world.[10]
This is because the emphasis on sustainable building has created focus on the earth itself as a resource separate from the 'resources' if contains. The earth therefore has of late gained acknowledgement as a suitable technology for contemporary buildings.

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[9] Dayaratne, R. (2000). Learning from tradition for an environmentally responsive architecture: a formal practice, in open house international. Vol.25. No. 03 pp 10-15.

[10] Opaluwa Ejiga, Obi Paul, Osasona O. Cordelia; Sustainability in traditional African Architecture: Springboard for sustainable urban cities a paper presented.97-105 at Sustainable Futures: Architecture and Urbanism in Global South,Kampala, Uganda, 27 –30 June 2012

<center>**Construction Materials**</center>

African traditional architecture is essentially sustainable and had evolved culturally to suit the people. Usually, earth, timber, straw, stone/rock and thatch were constructed together with the simplest of tools and methods to build simple, livable dwellings. . In most instances, Africa's traditional architecture has always made judicious use of its immediate natural resources taking care not to upset the ecological balance of the environment. Also material are very often locally sourced hence a reduced carbon footprint and embodied energy in building material production.

<center>**Stones And Rocks**</center>

Stones and rocks served as the starting building material for shelter in human civilization. The basic form of the use of stones/rocks for shelter begun with the habitation of naturally occurring caves. Certainly, inhabitants of Africa constructed some form of stone architecture using both natural geological formations as well artificial solutions for shelter. This type of work required the craftsmen to be skilled in the art of stone masonry, knowledge of types, strength and properties of rocks and processes of extraction of the material from the earth to create various forms of shelter. Perhaps the most recognizable of the highest attainable feat using stone as a construction material is evident in the pyramids of Egypt.

<center>**Straw Or Thatch**</center>

Straw or thatch is a loose organic layer of dead and living shoots, stems, and roots from plants. About 25 percent of thatch is made up of a compound called lignin, which is resistant to decay by microorganisms and one of the main reasons why thatch is a viable

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building material. Thatch is also easily renewable since it is a by-product of plants. Even though, large quantities of this material could be sourced from the immediate surrounding and the wild, local communities often cultivated much of the straw as grains (wheat, oats, barley, rye, rice) in their farms which in turn provided them a building material.

The use of thatch as a building material was very widespread among various parts of the continent for roof cover, insulation, walls and sometimes woven together to form doors and windows .There are two main styles of thatch construction :wooden post and beam construction with thatch infill, and structural thatch construction.
Even today certain rural parts of Africa still use this form of construction.

Adobe

Adobe is a natural building material made from sand, clay, water and fibrous material (straw, thatch), these material are mixed and shaped into bricks using molds which are sundried to give them strength. Adobe is easy to manufacture because the raw materials are abundantly available, hence its popularity in indigenous African architecture. Adobe is eco-friendly and is part of the culture connected its cyclic and delicate eco-system that sustains the communities as a part of the environment which carefully using its resources while occupying the areas in a responsible manner.
Generally employed was wattle-and-daub earth technology; a method in some cases which uses solid wooden post frame which is first made then filled with adobe balls to create a wall. Most often, the African builders construct the walls of their building layer by layer using the mud bricks and a slurry mixture of earth as the mortar.

Figure 3: Sun dried adobe blocks: Source:http://buildinglocal.files.wordpress.com/2011/10/adobe-2.jpg
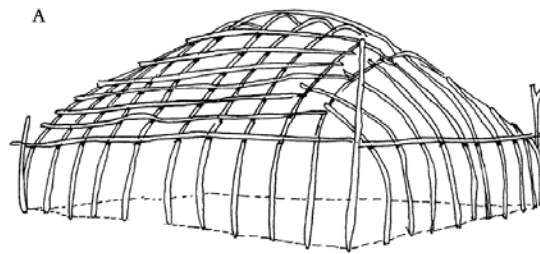

Figure 4: Songhai mat tent (after G. Brasseur, Les Etablissments humans au Mali ,Dakar, 1968)
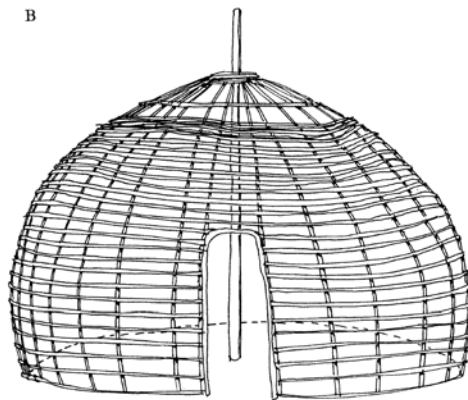

Figure 5: Figure 2 Fulani mat tent (from a photograph in the Musde de l'Homme, Paris)

Figure 6: Example of a hut built with thatch construction. Source Jon Rowley SWNS.com

Figure 7: Example of mortar application on thatch construction frame. Source Jon Rowley SWNS.com

CHAPTER 3

VERNACULAR ARCHITECTURE

Vernacular architecture is a form of architecture resulting from the traditional and established form being influenced by external forces. The influences could be of social, economic, political or cultural in nature. Vernacular influences are usually post traditional and infuse new elements into an already established style. A major characteristic of vernacular is that it is not essentially spontaneous as traditional. There is a conscious effort at infusion that employs selective borrowing of stylistic influences. Vernacular Architecture is also slowly absorbed and communally acceptable over time. It also involves an instinctive command of particular materials.[11]

It is critical to examine indigenous African architecture and its vernacular because it is influenced by the encompassing urban form and vice versa.

Traditional House/Compound Layout

Richard Hull, in his book African Cities and Towns before the European Conquest (1976), identified several forms of indigenous African building designs and categorized them into beehive or domical; bread-loaf-shaped; onion-textured; inverted cone; egg-shaped; bell-shaped; rectangular with hump roof; square box with pyramidal roof and hill-shaped; box on dome; cone on cylinder; cone on poles and clay cylinder; rectangular with gable roof; rectangular with rounded roof sloping at the ends; square, quadrangular or square with dome or flat roof; quadrangular surrounding an open courtyard; and cone

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[11] Hitchcock, H.R. (1963), *Introduction to World Architecture: An Illustrated History*, London.

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on the ground.[12]Hull's classification attests to the fact that a diversity of architectural or building forms existed in traditional African societies
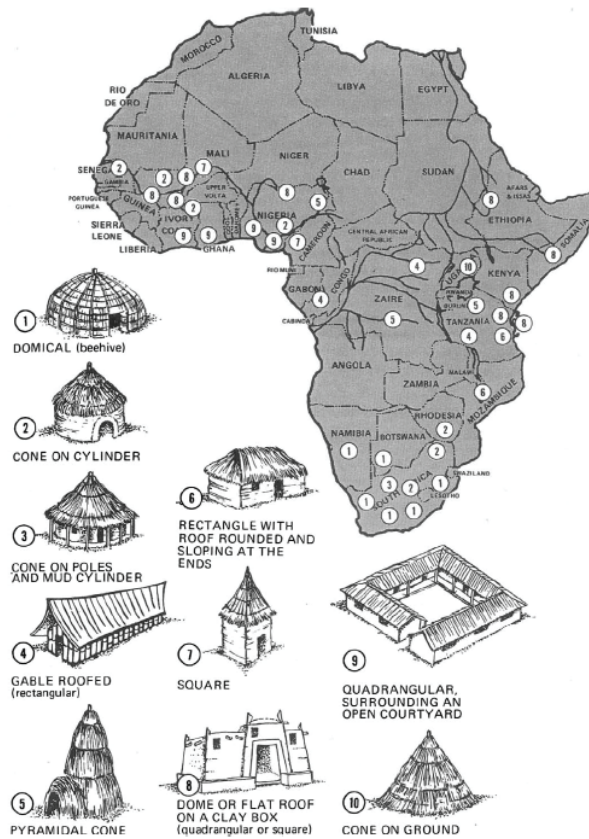
Figure 8: Major structural forms in pre-colonial African dwellings
Source Richard Hull, African Cities and Towns before the European Conquest (1976)

. While there are a variety of styles, important themes in traditional housing styles are recurrent including courtyard plans, inclined, flat or dome-shaped roofs, parapets, channel walls constructed of mud bricks set in mortar and mud roofs supported by palm frond joists. However, one of the major unique common denominators among the style of buildings is the importance and centrality of communal spaces. These communal spaces served as a central focal point of communal activity. Perhaps the most prevalent

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12 Njoh, A.J., 2006. Tradition, culture and development in Africa: historical lessons for modern development planning. Aldershot, UK: Ashgate

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and architecturally instinctive representation on the emphasis of communal spaces as socio cultural and economic anchors of these various forms of architecture is the courtyard house form.

Courtyard or compound house designs are prevalent in West Africa and parts of Central and Eastern Africa provide a context of valuable lessons that could be drawn from the existing vernacular. A courtyard house is a house with an open-to-sky courtyard that leads to leads to rooms either directly or through a porch or veranda.[13]

The courtyard, which represents the public space serves, a multi-functional use. It serves as playground for kids, outdoor cooking space, Laundry space, craftwork, meeting area. It could also serve as an area for ceremonies (child naming, funerals) receiving guests and settling disputes. . Examples are found among the Benin, Yoruba, Asante, and Ibo peoples of West Africa

Courtyard Houses in Benin City Nigeria were built with four buildings facing each other, thereby forming a closed space in the middle. This space allowed air and light into the house and was used as a water reservoir. The four roof surfaces sloped inwards towards the center which was called an impluvium creating a large collecting surface, driving water into the reservoir which was used for sundry domestic applications.[14]

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[13] Andersen, J.E., Andreasen, J., and Tipple, G., 2006. The demise of compound houses: consequences for the low-income population in Kumasi, Ghana. RICS Research Papers, Vol. 6, No. 8. London: Royal Institution of Chartered Surveyors.
[14] Agbontaen, K.A. (1996), The Impluvium-Courtyard (Oto-Eghodo) in Indigenous Benin
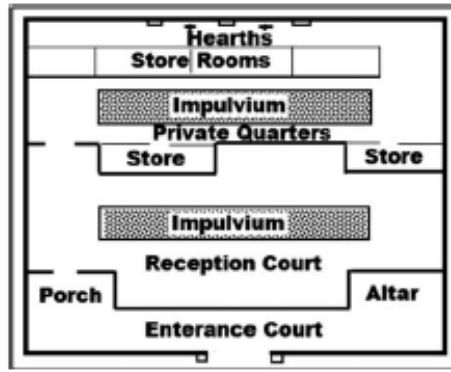
Figure 9: Benin courtyard house (ofo-eghodo)
Source: Agbontaen, K.A. (1996), The Impluvium-Courtyard (Oto-Eghodo) in Indigenous Benin

Among the Yorubas of Nigeria, huts with gabled roofs surrounded a central courtyard. The courtyard houses had spaces that were designed not only to accommodate the daily living activities of sleeping, cooking, eating, storage etc. The spaces are designed to promote family and group cohesion. The centripetal nature of the Yoruba family compound allows rooms to be organized around the courtyard. The bigger the family and more diffused the lineage, the bigger the size or number of courtyards. A visitor to the compound is instantly admitted to the center of family activities.

Most houses did not have windows because they are mainly used at night. During the day, most activities take place in the courtyard outside. There are compounds in which multiple houses are connected together, side by side. These are used when an extended family desires to all live within the same area. These compounds would then be built to surround the ward chief's home, where people would gather to discuss various matters such as political or economic problems.

Yoruba palaces for chiefs were larger versions of the impluvium style. The Yorubas had a monarchy system that considered the chief's palace as sacred. The palace consisted of

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hundreds of courtyards, with several buildings facing each other in the courtyards. Archaeological and ethnographical studies indicate that traditional Yoruba towns comprised several compounds, and each compound consisted of houses built around a series of open courtyards of different sizes, which usually contained pots to collect water from rooftop.
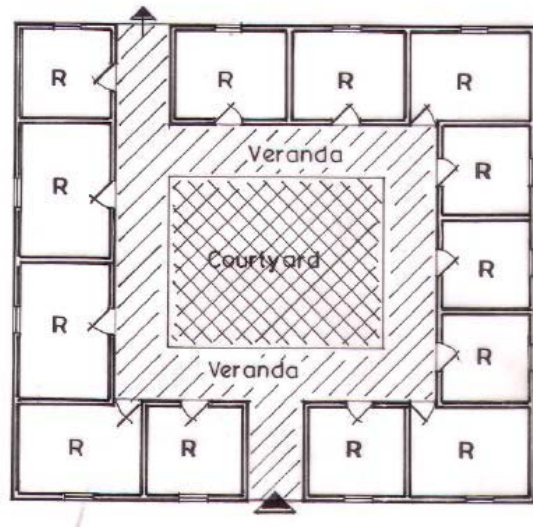
Figure 10: Schematic of typical Yoruba house layout: Source: Osasona O.O. From Traditional Residential Architecture to the Vernacular:

The Asantes, in present-day Ghana, constructed their buildings based on a courtyard system, with a central courtyard usually joining four buildings; the fourth one was usually closed off. The courtyard was used as a meeting space, children's play area, and a place for food preparation. Windows ornamented in gold, silver inlay, and applied finish demonstrated the wealth of the Asantes. The Asantes were governed by a monarchy system, and historical surveys found the King's Palace located in the center of the town overlooking a central playground for children.

Ibo architectural layout took a clustering pattern. It was not a town, city but a series of family compounds connected via wooded paths radiating to and from a central meeting

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place. A still wider path would lead to a larger area for more extended family. This central area would connect to a path leading to the marketplace.

The central communal space of the Ibos of Nigeria is called the *obi*. The *obi* of the Ibos, apart from being the personal space of the family head, could be several other socio-culturally significant things, as well. If the family head also happened to be the oldest male direct descendant of a common ancestor, he was also the clan head, and his *obi* automatically became a rallying-point for representatives of the whole clan[15]. The *obi* is both an idea and a physical structure. There are invariably several shrines within the *obi*, as well as ornamentation, consisting of open-work wood paneling (particularly if the compound head is titled). With the perforations in such decorative screens believed to represent the benevolent, all-seeing eyes of revered ancestors, and the compound head's priestly role at the various family shrines, a synergy is produced that imbues activities conducted within the *obi* (including copulation) with spiritual symbolism: the *obi* thus becomes the physical expression of an esoteric link between departed ancestors and yet-to-be-born generations.[16]

The central communal space of the Hausas of Northern Nigeria and present day Mali and Niger is called the *Zaure*

The *zaure* of the traditional Hausa homestead to all intents and purposes, is a multi-purpose space. It is the first port of call in the compound, and is the particular haunt of the *maigida* (the compound head), who receives callers, and executes whatever his home-based craft, there. With stringent Islamic injunctions forbidding casual interactions

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[15] Umeukeje, T.A. (1972), *Cultural Impact of the Igbo in History*, Local Historical Essay Series, No.1, Enugu

[16] Cole, H.M. and Aniakor, C.C. (1984), *Igbo Arts: Community and Cosmos*, Museum of Cultural History, University of California, Los Angeles.

between the sexes (particularly with married women and those in "purdah"), it has subtly become the homestead security-post, where callers are screened. With non-alignment of outer and inner doors, visual continuity is broken – further guaranteeing utmost privacy of the inhabitants within the compound. Only highly-favored males, or those who constitute family, ever get to go beyond the *zaure*. Rather than be just a space for social interactions, the *zaure* is thus a socio-religiously symbolic space, defining level of social acceptance.[17]

In general bedrooms in these forms of compound houses seemed to be the most private spaces, and rooms facing the courtyard provide an environment for mutual assistance and reciprocal duties of watchfulness and care in and around the courtyard and create an affirming, supportive, and safe environment. Sharing of services, which is customary and typical of courtyard houses, reduces the cost of services, making these services accessible to members of the community.
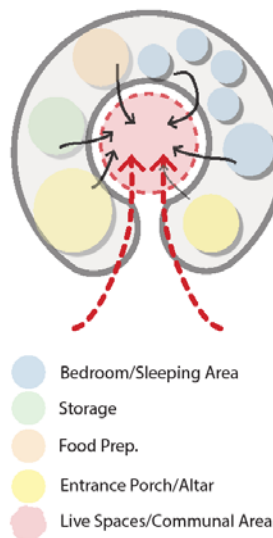

Figure 11: Schematic drawing of indigenous individual house form. Source: Author

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[17] Osasona, C.O. (2002), The Symbolic Value of Space and Material in Nigerian Traditional Houseforms, *Journal of Environmental Technology*, Vol.1, No.2, FUTA, Akure.

www.manaraa.com

Traditional Urban Layout

Contrary to popular belief, Sub-Saharan Africa has a long developed history of urbanism and communal city building effort that precede the colonial era. Many of these cities were vibrant and sophisticated in their own ways, and built on trade routes and tribal wars accelerated by the transatlantic slave trade in the 16th century. Studies by several anthropologists revealed ancient cities including Kumasi and Salaga in present-day Ghana, Great Zimbabwein Zimbabwe, Kano and Benin and Oyo in Nigeria. Loango in the Democratic Republic of the Congo, and Abomey in the Republic of Benin. These cities were seats of power, served as residences for the sovereigns holding political power, and housed religious and intellectual centers.[18]

Pre-colonial towns and cities of Africa were built on sound town planning and spatial principles. It is important to focus on analyzing the ways in which pre-colonial African towns dealt with and handled the problems associated with urban density and living in close spaces. (Not as static legacy of the past, but as modern reinterpretations)

It is important to examine how urban spaces were maximized and resources were deployed to service the population. This however by no means attempts to induce generalizations on living patterns and space arrangements of any kind on a very dynamic and heterogeneous group. Emergent themes and patterns that were observed are expanded upon to draw valuable lessons. Overall, there are certain emergent themes, among them:

The planning principles behind the form and structure of pre-colonial cities.

African urbanism that predated European colonialism involved the concepts of networks, hierarchies, and markets were inherent components of the urban development process in

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[18] Hull, R.W., 1976. African cities and towns before the European conquest. London: W.W. Norton.

pre-colonial Sub-Saharan Africa.[19] There were two main types of cities, the political city and the trade city. Both however had a basic agrarian subsistence system. The political city had power and influence over and beyond areas surrounding it, whereas the commercial city focused on trade.[20]

African Traditional cities reveal tight clustered layouts around compounds, thereby making maximum use of public and open urban spaces. Small open spaces in compounds, for example wells open kitchens and meeting spaces are often co-opted for various functions as the need arises. Larger spaces in the center of the city (plazas) tended toward public spaces such as markets, town squares for ceremonies and public events. Also large spaces on the periphery were dispersed in a city.

A great example of this centripetal city planning approach is in the form of Yoruba city planning. There is the a continual there of continuity emanating from the individual household compounds to the overall town or city planning form.. This feature of continuity is reflected in the opening lines of the poems in the Yoruba divinatory system of Ifa. One of such poem reads: *build a house around you Ifa, so you can build a house around me, so you can let children surround me, so you let money surround me*. The architectural forms of the city are interlocked within a well-defined concentric town plan. Yoruba architecture is an organization of disparate units into an interlocking whole. This belief of the circularity of nature of the Yoruba is comparable to that held by the Egyptians about the circularity of the earth and is illustrated in the Egyptian hieroglyph for city. The compound design expresses and architecture of intimacy and encourages the

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[19] Coquery-Vidrovitch, C., 1995. Towns in Black Africa: history's legacy. The Courier, No. 149 (Jan.-Feb.), 50–51

[20] Winters, C., 1983. The classification of traditional African cities. Journal of Urban History, 10, v3–31.

success of the extended family.

A major result of urban layout with center plazas is the overall annular layout pattern that eventually emerges. It is can therefore be deduced that the principles of layouts of pre-colonial African cities can best be explained by the circularity in the pattern of dwellings, roads, passages walls and the Plazas at the epicenter. It ha been severally argued that the circular house is arguably the most distinctive element in Sub-Saharan African Architecture, as is the circular spatial arrangement of dwellings of indigenous urban Planning. Circularity in African culture reveals a hierarchy. In the urban structure is a result of a centripetal living pattern that does not lead to alienation of the masses, but maintains a good sense of control of the environment.[21]
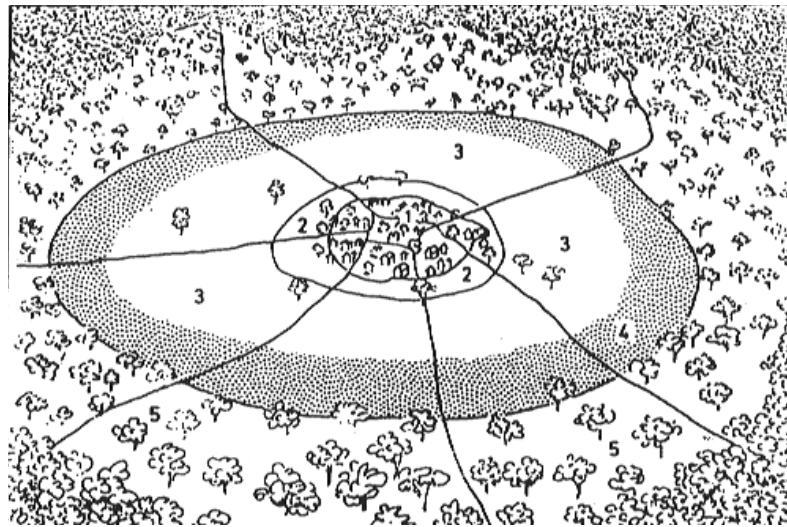

Figure 12: A generalized diagram of a Senegalese Village showing ring cultivation Source:Pelssier R.P. 1966 Les paysans du Senegal Imprimerie Fabregue,Saint Yrieix, France

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[21] Amankwah-Ayeh, K., 1995. Planning environmentally sustainable cities in Africa today. Africa Insight, 25 (1), 37–48.
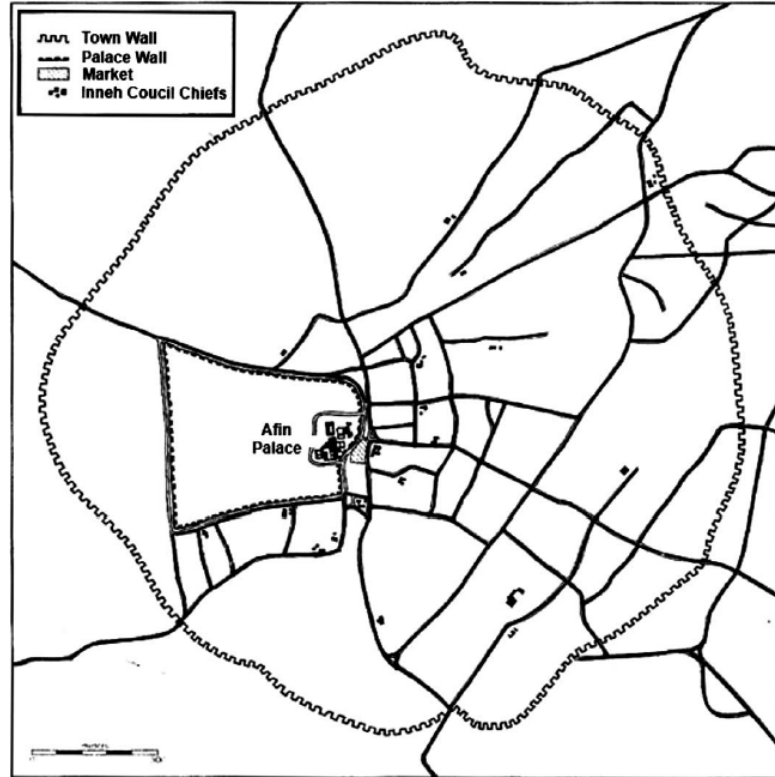
27

Figure 13: Circular plan of a Yoruba city (Ojo 1966) Source: Ojo, A.G.J., 1966. The Yoruba culture: a geographic analysis. London: London University Press.

Balance Between Mass And Space

An important overall compositional characteristic in both traditional living patterns and urban layouts is the conscious balance between mass and space at different scales. There is a deliberate effort to balance buildings and spatial forms with surrounding spaces in planning layouts. This occurs at the urban scale with plazas (official or otherwise) open spaces in the center of the city and in small living clusters and compound with open shared spaces. Settlement patterns among the Yoruba, Igbos, Hausa, Benin, and Zulu were often arranged around open spaces such as courtyards or greenery, and human interaction was important, therefore they were socio-petal in form. The fact that compounds were often made up of extended family members indicated that constant interaction was important. Thus, the design of spaces was done to promote this

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interaction, thereby, reinforcing socio-petal forms.

Fractals are swirling patterns for modeling in biology, geology, and the natural sciences. , Fractals also consist of similar shapes in different scales. Research by ethno-mathematician Ron noted "while fractal geometry can indeed take us into the far reaches of high science, its patterns are surprisingly common in traditional African designs, and some of its basic concepts are fundamental to African knowledge systems" Eglash found the self-similarity of fractals in what is characterized as 'circles of circles of circular dwellings, rectangular walls enclosing smaller rectangles' which were the basis of many Nigerian and South African ethnic groups. (Fractals are often seen in carvings, architecture, ornamentation, jewelry and hairstyles in many Sub-Saharan African cultures.[22]
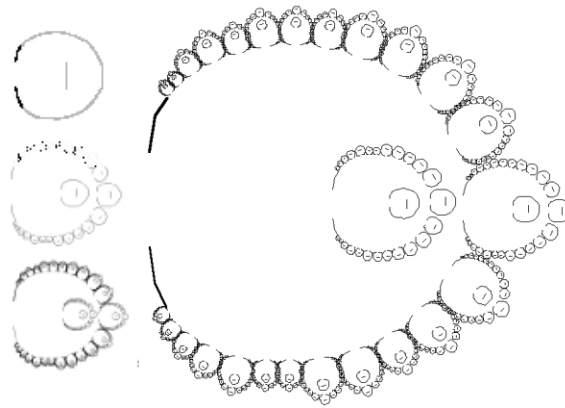

Figure 14: Ba Ila village (present day Zambia) displaying self-similarity: individual parts are the same form of the whole. Fractal traits such as these are common in African planning. Source Ron Eglash 2002:African Fractals: Modern Computing and Indigenous Design.

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[22] Ron Eglash 2002:African Fractals: Modern Computing and Indigenous Design.
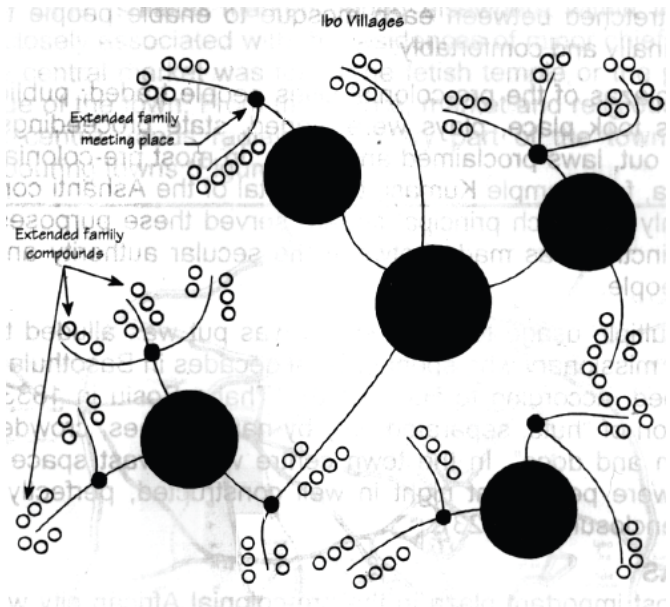
Figure 15: Conceptual Diagram of Ibo Villages. Source Hull, R.W., 1976. African cities and towns before the European conquest. London: W.W. Norton

CHAPTER 4

CASE STUDY

Case Study 1/Material/Technological Case Study

Kenya Women and Children's Wellness Center

Location Nairobi Kenya

Building type: Primary Healthcare

Size: 446,700 sq.ft.

Program Description: 170-bed inpatient hospital, outpatient clinics for women and children, Institute of learning

With Kenya having a temperate equatorial climate, the building was designed to respond to the unique daylighting and ventilation concerns that arise from heat and prolonged sunlight exposure. Therefore, the orientation of the buildings was one of the biggest design concerns. The Wellness Centre's series of individual buildings were oriented east-west to minimize the building's heat gain. Overhangs on the north and south facades shade the building from excessive sun exposure, while operable windows in these facades allowed for passive natural ventilation. The building also slopes down the rolling site opening the building to views to the north and buffering sound to the south.

 By providing this facility to the local community, they will elevate the standard of medical care in Nairobi while providing for the future of Kenyans through education and training.

Environmental/Technological Considerations

The location of the wellness center by nature in Nairobi is located one degree south of the equator, and therefore receives high amounts of solar radiation and constant levels of sunlight throughout the year providing an ideal scenario for the investment in solar power and domestic hot water. The effective solar yearly radiation in Nairobi is approximately 1900 kWh/m2 with the highest intensity from the months of January to March. These levels are comparable to the southwestern United States and provide ample opportunities for solar power, solar hot water and day lighting, but also require thoughtful design strategies to reduce excessive solar gain and glare as well as building material thermal build-up through overhangs and external shading devices. the nature of the site and its climatic environment influenced the building form by incorporating externalized spaces, single loaded corridors and smaller floor plates that take advantage of daylight.

The site position also influenced the location of sustainable day lighting strategies by making use of the constant position of the overhead sun to provide day lighting, solar power and domestic hot water.
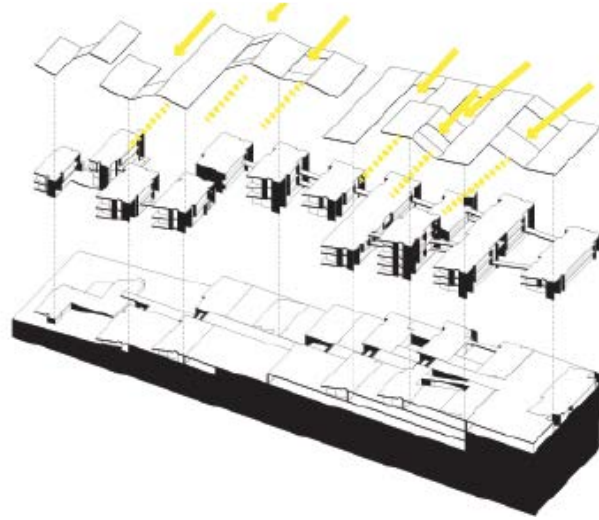
This was achieved with two complimentary design strategies. Constant throughout the entire building perimeter, a two-meter overhang provides a fixed level of control from the sunlight. In addition, the overhangs support a louvered screen system that further diffuses the sunlight that is optimized to its particular orientation. The long north and south facades are substantially protected from direct solar radiation while the short east and west facades have porches to help buffer the interior spaces against the low sunlight angles.

Environmentally, the width of the building was an important design consideration. Fixed at 14 meters wide including the overhangs, the width plays an important role in day lighting and the collection of rainwater. The building width was determined by two factors, the ability to daylight to protect against intermittent power supplies and the optimal width that would provide for a single-loaded condition, a double-loaded condition and a double-loaded condition with a centralized storage. The single loaded condition is used for classrooms corridor and patient ward-corridor. The double loaded condition is the typical patient room-corridor-support or office-corridor-office. The third condition combines the double-loaded condition with an additional layer of support or

storage that does not require daylight. This condition was implemented in the outpatient and GVRC conditions. A result of the building width, the 14 meter shed roof provides an ideal scenario to collect rainwater. The Wellness Centre will use rainwater to supplement to landscape irrigation and gray-water fixtures.

Social/Cultural Factors

Incorporates an on-site hotel, engages communities, providing resources support and motivation for women

Construction Techniques

The nature of the prevailing environment does not support the complex envelope assemblies, thermal control strategies as well as advanced ventilation and lighting strategies. Therefore many typical building systems that are commonplace in advanced building situation would have to be jettisoned for ingenious strategies driven by natural forces. Also, Understanding the local design approach helped guide in the selection of materials and their sources. The limited availability of finely engineered complex building materials limits the choice of materials to those that are locally available and are thus integrated in the local building ecosystem. These building material and techniques though unsophisticated have tried and tested applications and prove effective in solving design problems. For instance the use of Hollow pot concrete slabs to reduce floor slab weight and costs reduces thermal gain. Also effective structural spans that would support

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the medical bay modules without the need for drop ceiling was designed. This was to prevent a situation whereby the drop ceilings would interfere with effective cross ventilation on the top windows below the floor slab.
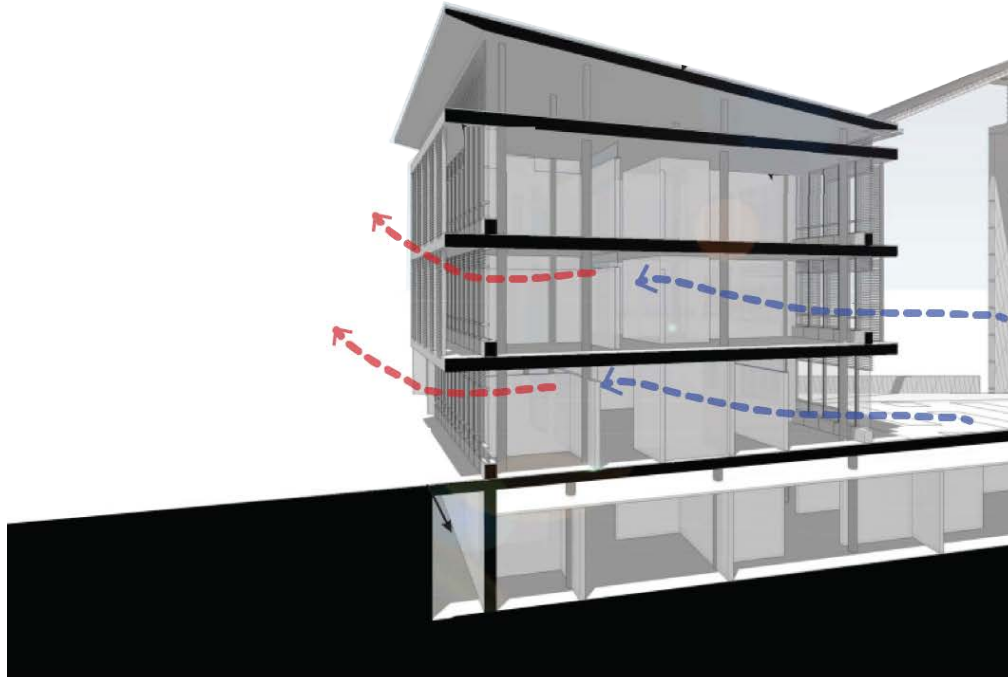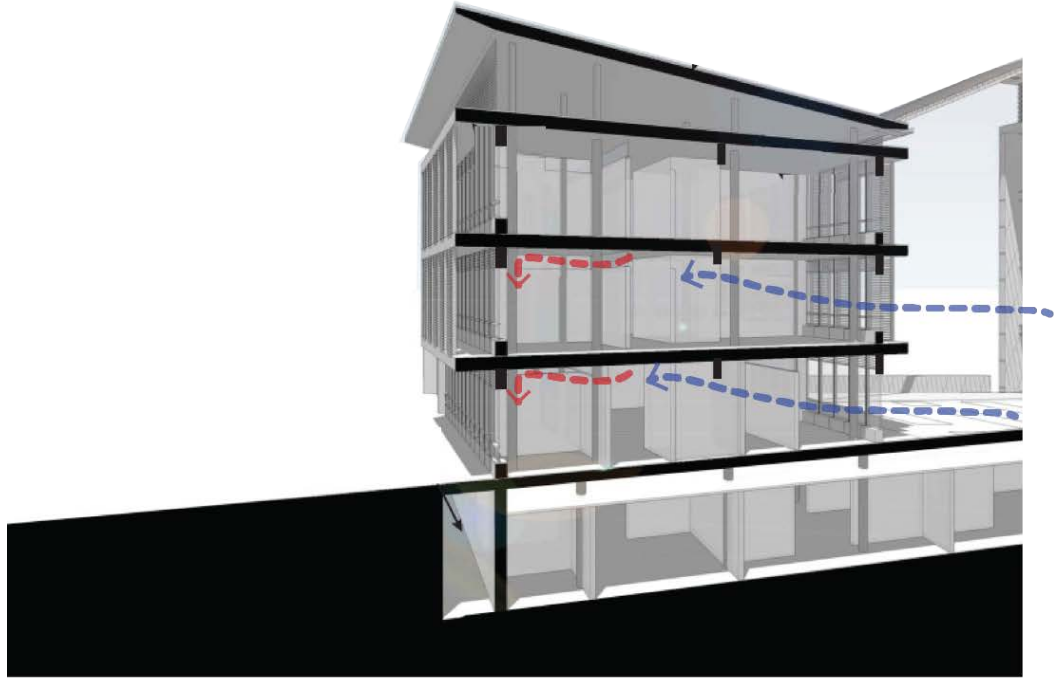
Figure 16: Illustration of natural ventilation strategies. Source: Perkins Will modified by author

CHAPTER 5

INDIGENOUS HOUSING FORM/ MODERN TRANSMUTATION

Modern transmutation of the indigenous housing form has evolved into the rectilinear pattern to fit into a traditional city plot size (usually 18m x 36m).However the spatial arrangement still maintains the central communal space with other living and work spaces surrounding the communal space.

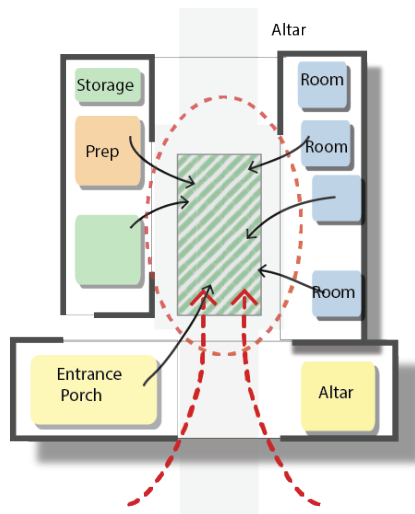Figure 17: Typical plot size with spatial configuration Source: Author

Figure 18: Spatial organization in sub-urban setting Source: Author

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Program Analysis

The existing paradigm involves public spaces which include retail spaces and commercial use spaces on the ground level facing the street and residential spaces on upper floors and towards the rear of the building.

Figure 19: Existing program analysis Source: Author

However the proposed project would incorporate an additional program use. This new program use would be communal spaces to serve as a buffer between residential This new program use would involve 10% communal spaces between the public spaces and the private residential spaces.
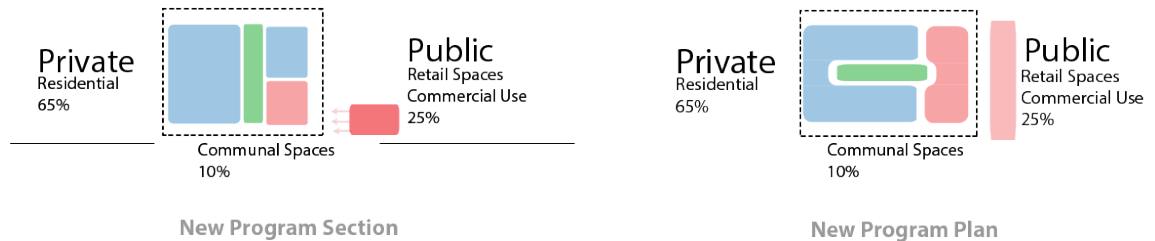

Figure 20: New program involving communal space Source: Author

Program Breakdown

Residential Spaces

- o Dwelling Units
- o Living Space

38

Commercial Spaces

- o Indoor/Outdoor Retail Space

- o Live-Work Spaces

Communal Spaces

- o Food Preparation Area

- o Common Laundry Area

- o Storage

- o Common Space

Infrastructure/Alternative Technology

- o Independent Water Collection Systems

- o Onsite Composting and Waste

- o Alternative Energy and Electric Systems

- o Indigenous Building Material Technology

Independent
Water Collection   Composting and   Energy /Electricity
Sysyems   waste

39
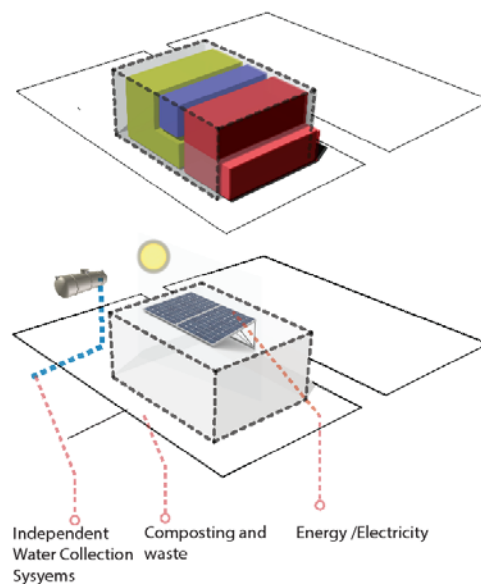
Residential Spaces Program

- Living Room

- Dining Room

- Kitchen/Kitchenette

- Bedroom

- Bathroom

CHAPTER 6

SITE SELECTION AND ANALYSIS

Lagos is a coastal city and the most populous city in Nigeria.it is 385.9 sq. miles in size with a population of about 17.5million[23]. Lagos makes up 1% of the landmass of Nigeria (356,667 sq. miles), but constitutes about 10% of the total national population (174.5 million)[24].

It was the capital city of Nigeria from the amalgamation of two British protectorates which formed the country Nigeria in 1914 to 1991. It however remains the center of commerce, industry and entertainment of the country. As the capital city it served as the main base of British colonial government from 1914 national independence in 1960. During this period, the city experienced lots of investment in infrastructure such as coastal ports, railways, roads, Government Reservation Residential Areas (GRA), and Industrial zones. Post-independence the city also experienced some infrastructure development especially the Third Mainland Bridge which is the longest bridge in Africa (7.3miles).The Third Mainland Bridge connects Mainland Lagos to Lagos Island.

The city consists of two main parts: Mainland Lagos and Lagos Island. They are connected by three bridges: Carter Bridge (completed 1901) Eko Bridge (completed 1973) and Third Mainland Bridge (completed 1990).

The Mainland is the major residential area of the city. There are several residential districts such as Yaba, Ebute-Meta, Mushin, Surulere and the state capital Ikeja.It also houses several industries, higher education institutions and commercial centers.

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23 Lagos State Bureau of Statistics **2005.** http://www.lagosstate.gov.ng/pagelinks.php?p=6

24 "Nigeria". *The World Factbook.* Central Intelligence Agency

41

The Island is composed of 3 main of business districts of Lagos Island, Ikoyi and Victoria Island.

Figure 21: Map of Africa showing Nigeria. Source: Author

Figure 22: Map of Nigeria Showing Lagos. Source: Author

Demographics

Lagos has an annual population growth rate of 3.2%. Men make up 52% of the population, while women make up 48% of the population.[25] Youths (0-24yrs) make up 52.5% of the population.[26]

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[25] Lagos State Bureau of Statistics 2005. **http://www.lagosstate.gov.ng/pagelinks.php?p=6**
[26] "Nigeria". *The World Factbook*. Central Intelligence Agency.

42

Lagos is ethnically diverse .It is often referred to as "no man's land" because most of the major 200 ethnic groups in Nigeria are represented in Lagos.

Climate

Lagos has a tropical wet and dry climate that borders on a tropical monsoon climate.

Rain: Typically two rainy seasons between April to July and October to November

Harmattan: Dry dusty spell caused by southern winds from the Sahara Desert from December to January.

Temperature: avg. 24-30°C

Solar Orientation: Direct Overhead Sun all year round.

Humidity Range: 60%-90%

Annual Rainfall Distribution
Jan.-Jun.
Jul.-Dec.
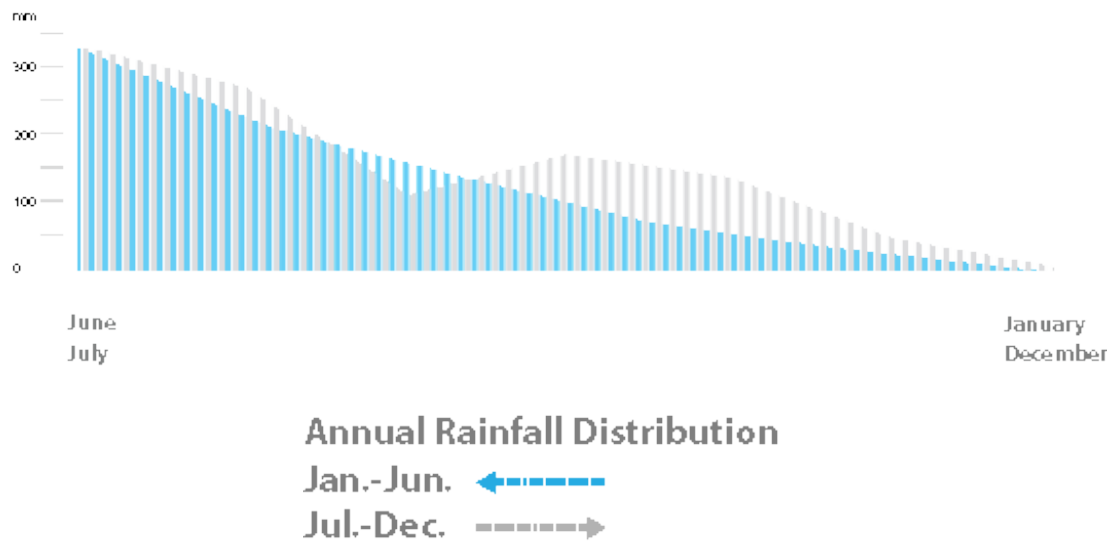
Figure 23:Annual Rainfall Distribution Lagos. Source: Author

Ebute-Meta

Ebute-Meta is located in Lagos mainland. It is an old part of the city that has historically served as a residential area. It also serves as a main access route that links mainland
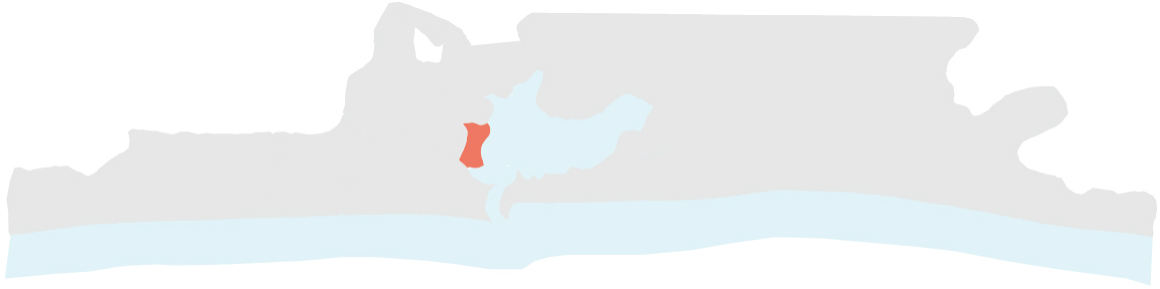
43

Lagos to the Island

Figure 24: Map of Lagos Showing Ebute-Meta. Source Author

Figure 25: Close-up Map of Lagos showing Ebute-Meta's connection to Lagos Island

Site Location

Location: Jebba Street, Ebute-Meta, South-West Lagos Nigeria.

The site currently has no building structure. However the land is being used for small

scale economic activities such as local food preparation and a makeshift auto repair

workshop.

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Figure 26: Close up map of the site area Ebute-Meta. Source: Author

Local Interest Points

- Nigerian Railway Corporation Terminal

- Oyingbo market which also serves as a major bus terminal

- Evans Square: a local recreation area

- Murtala Muhammad Way and Herbert Macaulay Road (main Transportation routes in Mainland Lagos)

- Makoko waterfront area (a local community that resides on makeshift houses built on the Lagos Lagoon)

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Figure 27: Typical Lagos street scene. Source: Nairaland.com

Figure 28: Mass transit station near Ebute-meta. Source: Nairaland.com

Figure 29: Timber logs floating on the Lagos Lagoon. Source: Flickr, Sunday Alamba

Figure 30: Aerial view of Makoko community in Ebute-meta. Source: Nairaland.com

Advantages

- Close proximity to railway station, bus terminal and Mainland- Island link bridges

- Close proximity to the market which serves as the economic backbone of the community

- Uniform, square-grid street network which would enable replication.

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Disadvantages

- The site is located a low lying area prone to flooding during the rainy season

- Poor condition of the surrounding urban infrastructure

- Environmental conditions in the area are subpar.

Cultural Transplant

Important questions that would need to be addressed for the inhabitants of this design project would be:

Who are the new kinds of people and how do they translate to the new congested urban situation. What activities do they engage in and how can architecture foster those hierarchical or non-hierarchical relationship.

Moving to such areas in search of work opportunities is urbanization. When people abandon their culture and their socio-economic transactions, they lose their community structures and spatial patterns, things fall apart. Coping with the new Urbaneness is the transient mannerism of urban areas. When this takes place the people crowd themselves into tenement-style living and lose their humble way of life, with closeness to their environment, the soil. They lose the free air space between individual dwellings. Without open garden and courtyards to separate them, the partition between neighbors becomes a single wall.

Seasonal Flooding

Due to the neighborhoods proximity to the Lagos Lagoon, the neighborhood frequently gets flooded during the peak of the rainy season from May to July.

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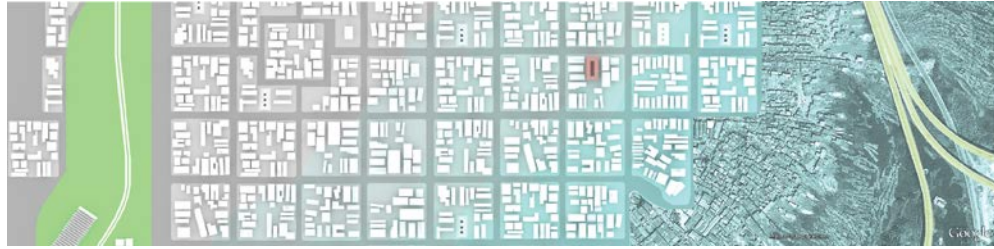Figure 31: Site neighborhood without flooding. Source: Author

Figure 32: Site neighborhood with flooding situation. Source: Author

Figure 33: Composite images showing the situation of the area during a flood. Source: Nairaland.com
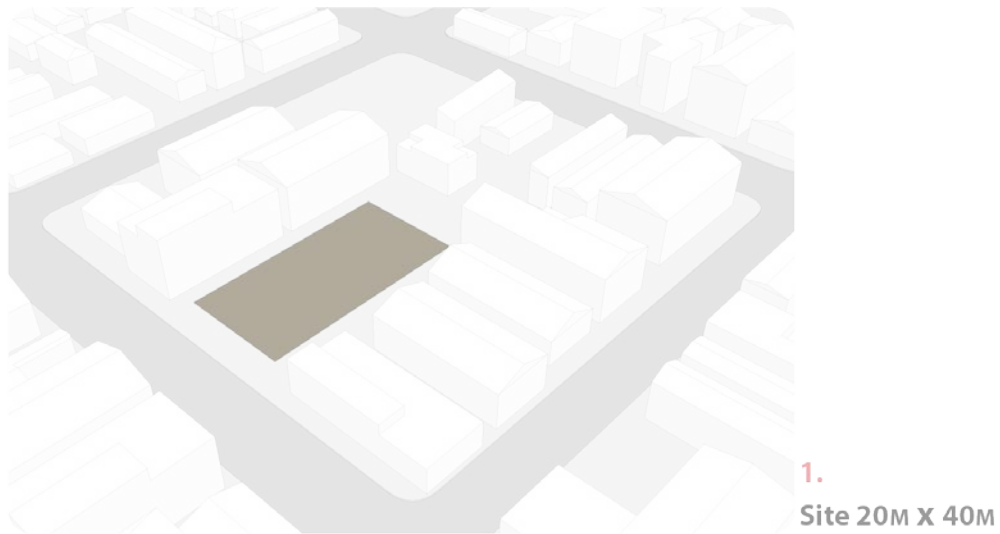
CHAPTER 7

DESIGN

1.
Site 20m x 40m

Figure 34: Proposed Site. Source: Author

The site is 20m wide by 40m long, nestled between adjacent buildings. The street scene is
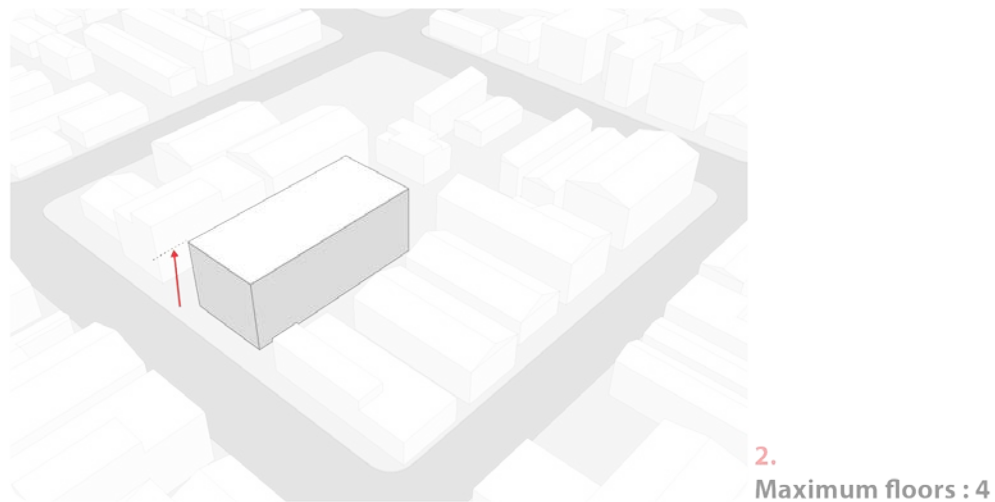
the active space.

2.
Maximum floors : 4

Figure 35: Building massing with maximum floors. Source: Author

Vertical circulation by means of powered elevators is not a viable option in this

environment due to irregular electric power supply. Although it would be appropriate to

promote urban density, the limitations of the environment prevent the building from exceeding 4 floors. The proposed building will therefore be constrained to 4 floors.


Figure 36: Typical street scene. Source: Author

The adjacent streets in the neighborhood are active streets. Commercial activities take place on the ground floor and then sometimes spill over into the street. This is a major cause of the urban chaos that the city of Lagos is known for. The commercial activities are an integral part of the neighborhood and are crucial to the economy of the community.

Therefore the design proposal would integrate these commercial activities on the ground floor. As an alternative to commercial activities spilling into the street, a central communal space at the center of the building would serve the purpose of the expansionist tendencies of these commercial activities. This central space will serve as both a commercial center, but also as part of the socio-cultural central communal space that is vital to effective community living.
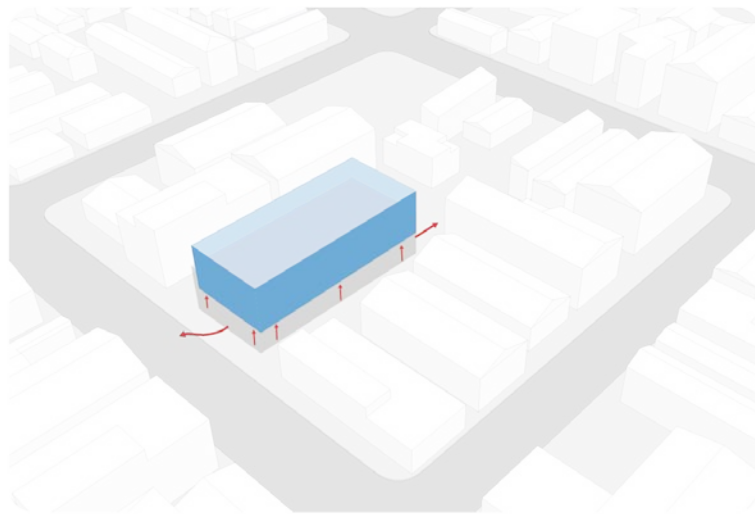
3.
-Lifted due to flooding
-Creates Retail and
Communal Spaces

Figure 37: Residential spaces lifted above ground floor to create commercial and communal spaces.
Source: Author
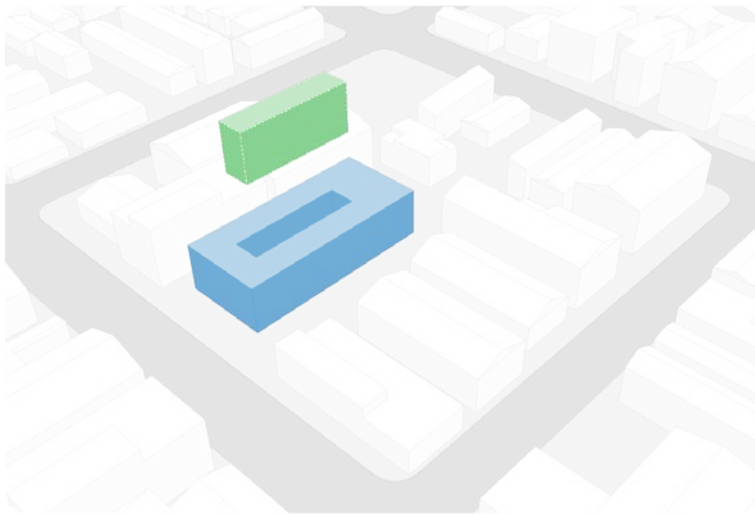
4.
Extraction for lighting,
ventilation and to create
an open air space

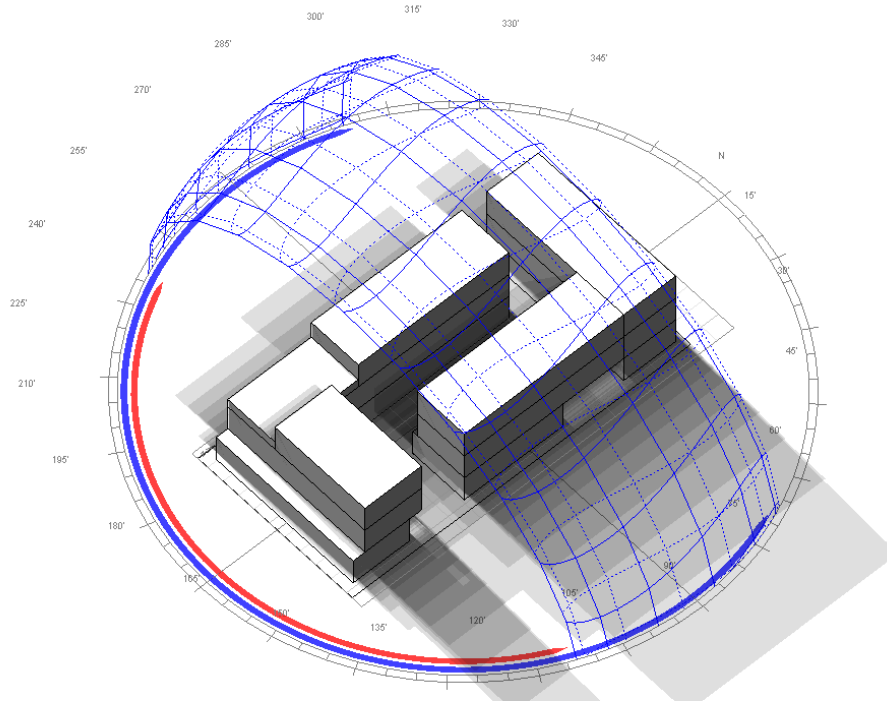Figure 38: Central space extraction for communal space and ventilation. Source: Author

Figure 39: Illustration showing solar shading analysis 1. Source: Author
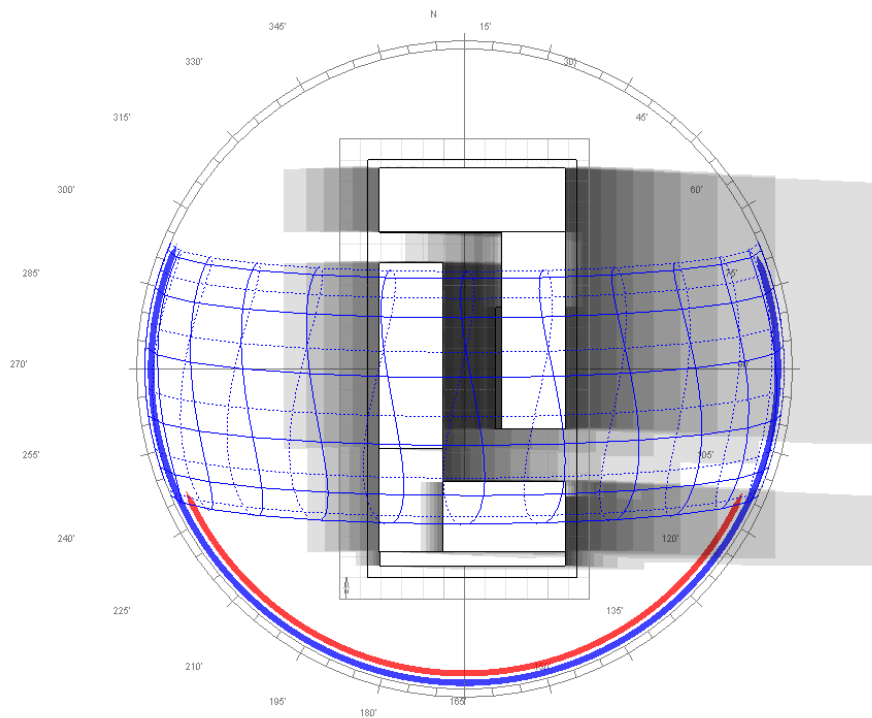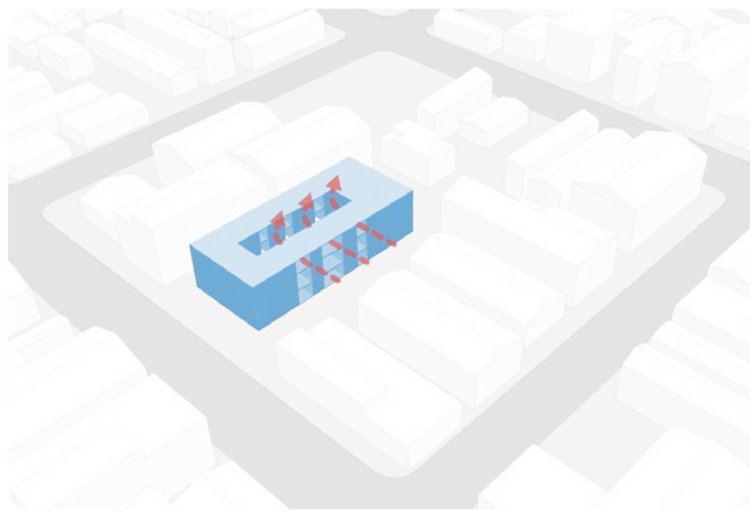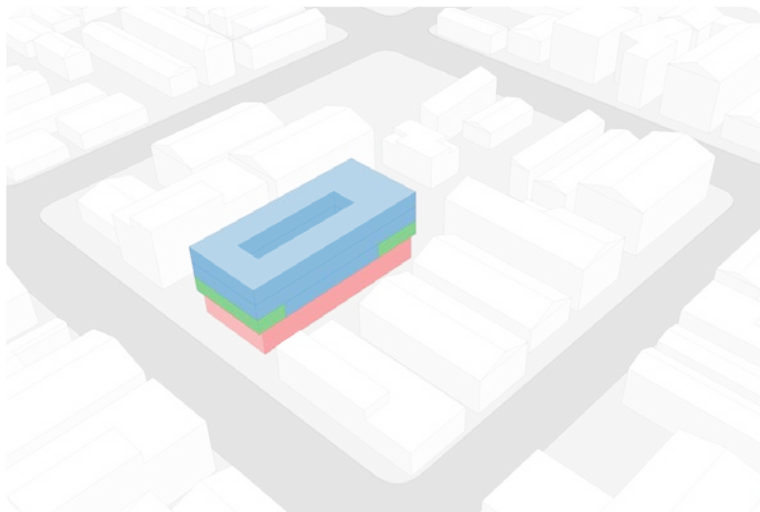

Figure 40: Illustration showing solar shading analysis 2. Source: Author

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5.
Facilitate cross-ventilation
in apartments

Figure 41: Cross Ventilation between dwelling units. Source: Author

6.
Program arrangement
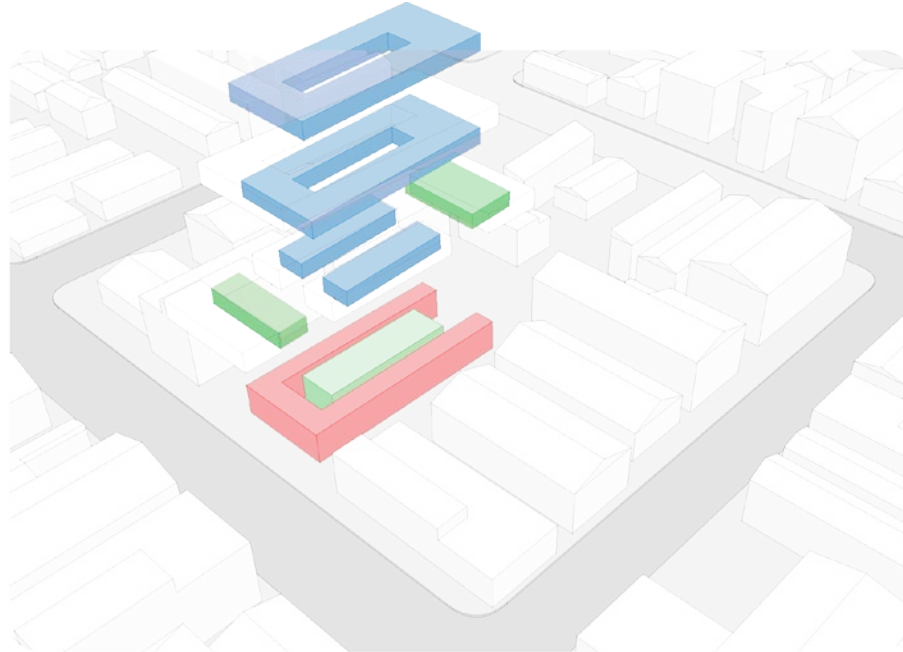
Figure 42: Complete program arrangement. Source: Author

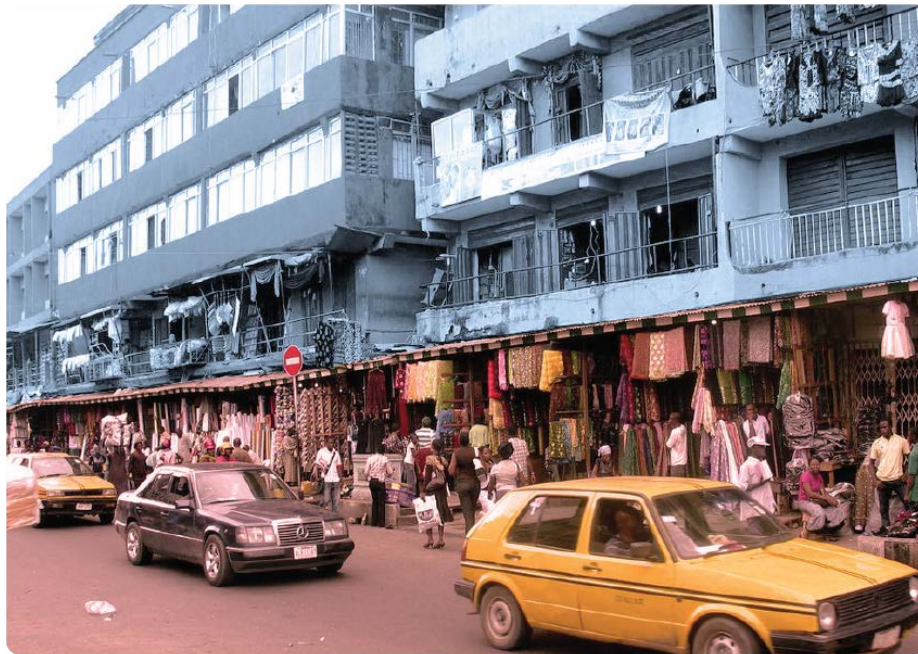Figure 43: Program arrangement exploded. Source: Author

Ground Floor

Figure 44: Typical street scene showing commercial spaces and residential spaces. Source: Author
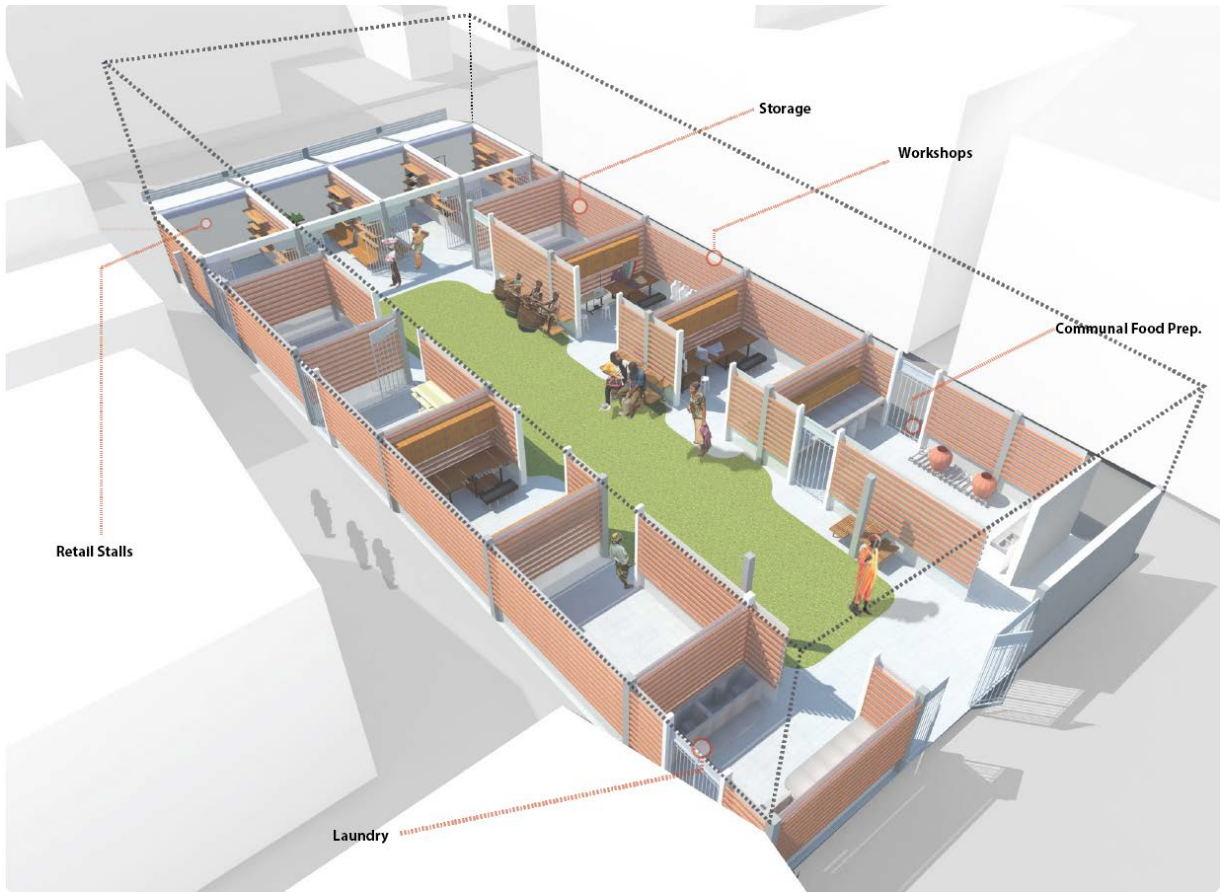
www.manaraa.com

Figure 45: Illustration of the ground floor spaces and their uses. Source: Author

The ground floor is the most active part of the building. The ground floor is adjacent to the street and is the focal point of commercial activities. However the occurrence of seasonal flooding makes the ground floor a uniquely dynamic space that is occupied by floodwater, retail activities, workshops, and communal meeting spaces at different points in time. A major design decision is to avoid having enclosed rooms on the ground floor:there are no walls. Spaces are separated by means of metal wire mesh and long teracotta slats. This allows for easy flow of floodwater through the building. since there are no solid obstacles to prevent water from moving through and out of the building.

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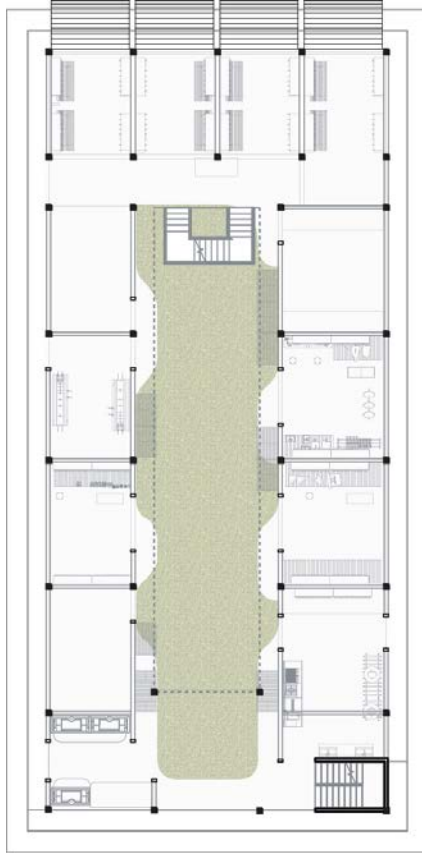
Ground Floor
Retail Stalls
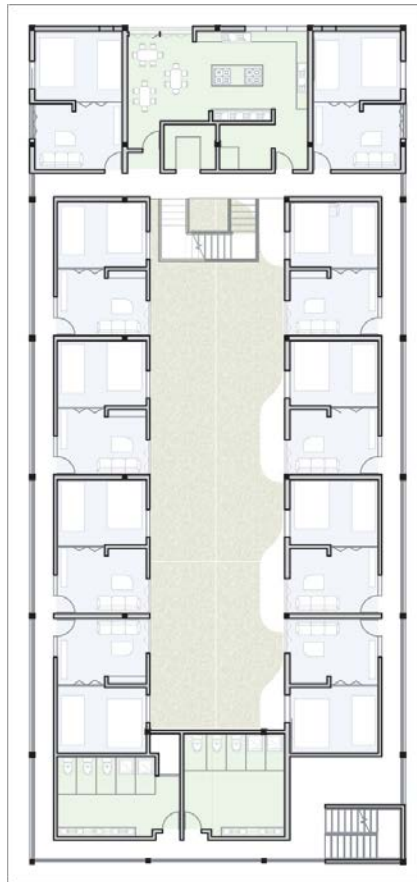Communal Area
Laundry
Communal Food Prep.
Craft Workshops

Figure 46: Ground floor plan. Source: Author

Figure 47: Illustration of typical craft space. Source: Author

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Figure 48: Illustration of communal food preparation area. Source: Author

1st Floor
Room and Parlour
Communal Kitchen
Communal Bathroom

Figure 49: 1st floor plan. Source: Author

المنارة للاستشارات

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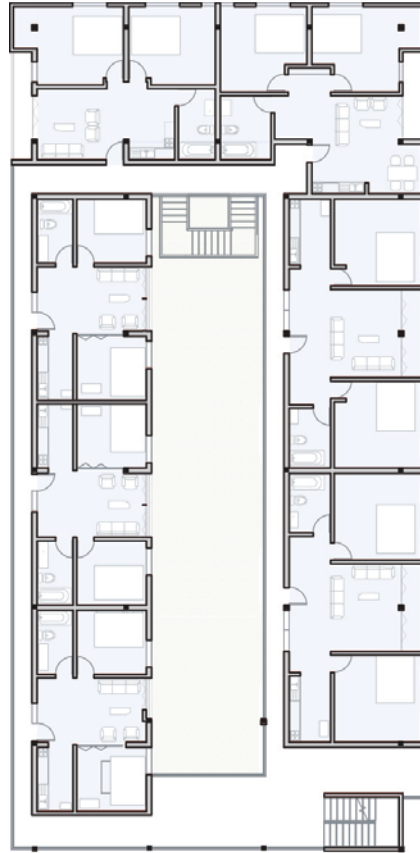
Floor Plans And Dwelling Units

The general layout of the second, third and fourth floors is arranged around the central courtyard. The corridors are alternatively arranged around the inside and outside of the central courtyard. This provides alternate views of both the interior courtyard and the exterior of the building. On the first and third floors balconies in living rooms also give vantage views into the courtyard. A communal space for learning is also provided on the second floor.

The variety of dwelling units. Simple dwelling unit with flexible '*room and parlor*' a popular local form of living units that consists of a generally open family reception space that can be rearranged into a makeshift bedroom and a single room .This is a common unit of dwelling common in urban areas in Nigeria.
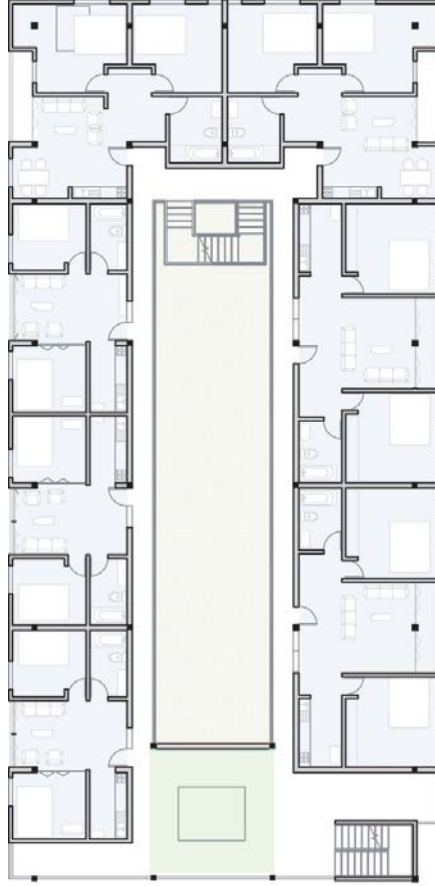
2nd Floor
Two-Bedroom Units

Figure 50: 2nd floor plan. Source: Author

3rd Floor
Two-Bedroom Units
Figure 51: 3rd floor plan. Source: Author

Materials And Ventilation

Lagos has a tropical wet and dry climate which allows for natural ventilation in the

dwelling units. However conventional construction techniques prevalent do not allow for

building permeability. Therefore the design proposal incorporates operable building

elements such as doors and windows to facilitate effective cross-ventilation in the

dwelling units.

The exterior walls are constructed of locally fabricated adobe blocks. The blocks serve as

a thermal mass which absorb the solar heat during the day, and emits some of the heat

when the air temperature gets cooler at night.

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Foldable doors and screens are used in the living rooms to facilitate cross-ventilation. There are terra-cotta screens on the interior and operable bamboo screen doors which open to exterior balconies which allow for cross ventilation. The foldable doors are made up of locally available bamboo.

Operable screens are also installed in the under the above and below the windows to allow for natural ventilation in the rooms.
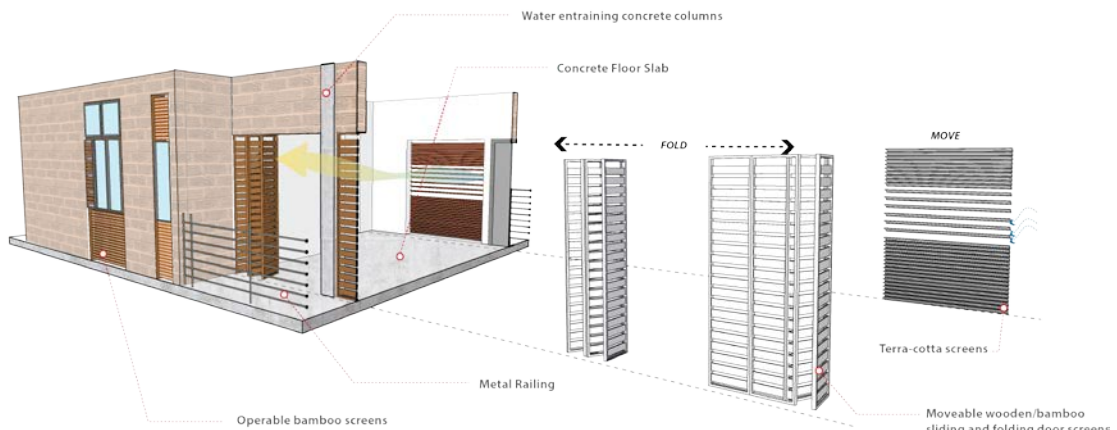
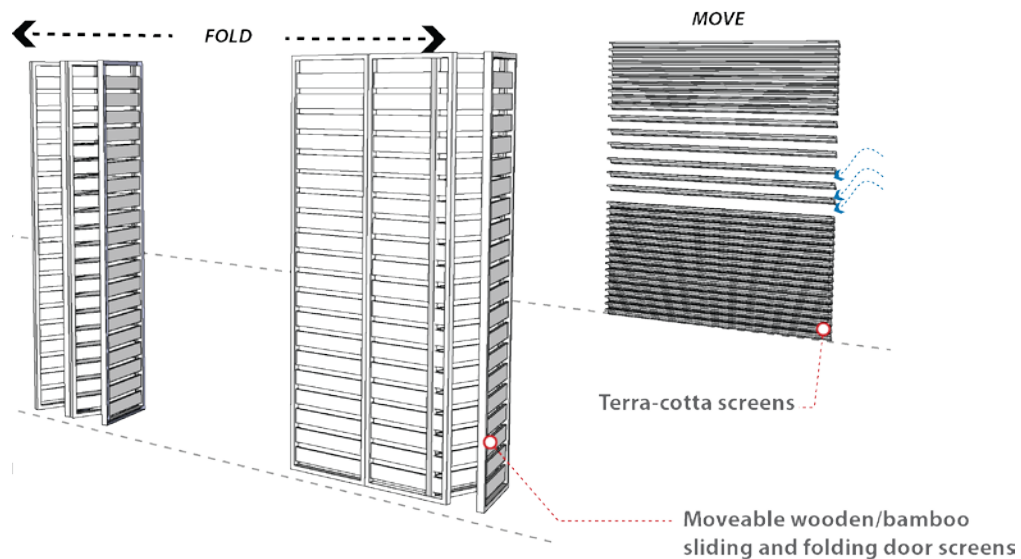Figure 52: Illustration of materials used. Source: Author

Figure 53: Illustration showing foldable doors and moveable screens. Source: Author
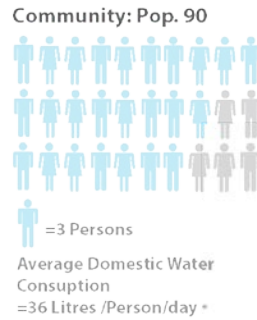
Water Collection And Storage

Figure 54: Illustration showing water use from overhead storage for a day's use. Source: Author

Water collection employs a variety of strategies including rainwater collection on the roof, ground water collection and overhead water storage. A 3000 liter underground rain water storage tank and 2000 liter fresh water storage tank are used for water storage. Water storage is important due to irregular electric power supply in the area. The 2000 liter fresh water tank would be located on the roof. Freshwater from the groundwater borehole would be pumped up to the tank which supplies the building via gravity.

Rainwater Collection

The metal roof serves as a rainwater collection surface. Rainwater collection leaders follow the building columns to an underground water tank. This rainwater collected would be used to flush the water closets. The roof is made of 7mm thick aluminum metal sheet. The total metal roof surface area is the water collection surface area. The total water collection area is 550m^2. Based on metrological rainfall estimates, a sample month of rainwater collection calculation is as follows:

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Sample month: April

Rainfall harvest = (RA x AF x 0.9)

Rainfall harvest = (550m x 0.14m x 0.9)

=70,000 liters/month

=2300 liters/day

Where RA=Roof Area, AF=Total monthly rainfall, 0.9= rainwater collection potential for metal roof.
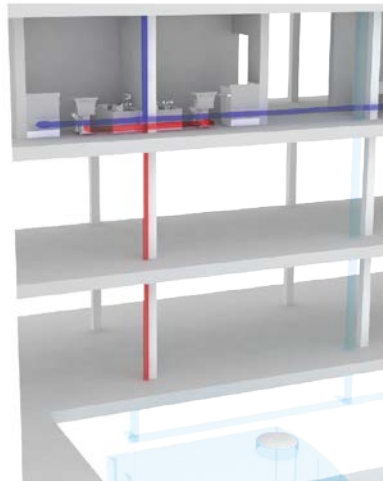

Figure 55: Toilet fixtures are flushed using rainwater collection. Source: Author

Fresh Water Collection

A 35m deep water borehole is the primary source of freshwater. The water from the borehole is pumped up to a 2000 liter overhead water storage tank. The overhead water storage tank can accommodate 75 of 90 potential building occupants when full.
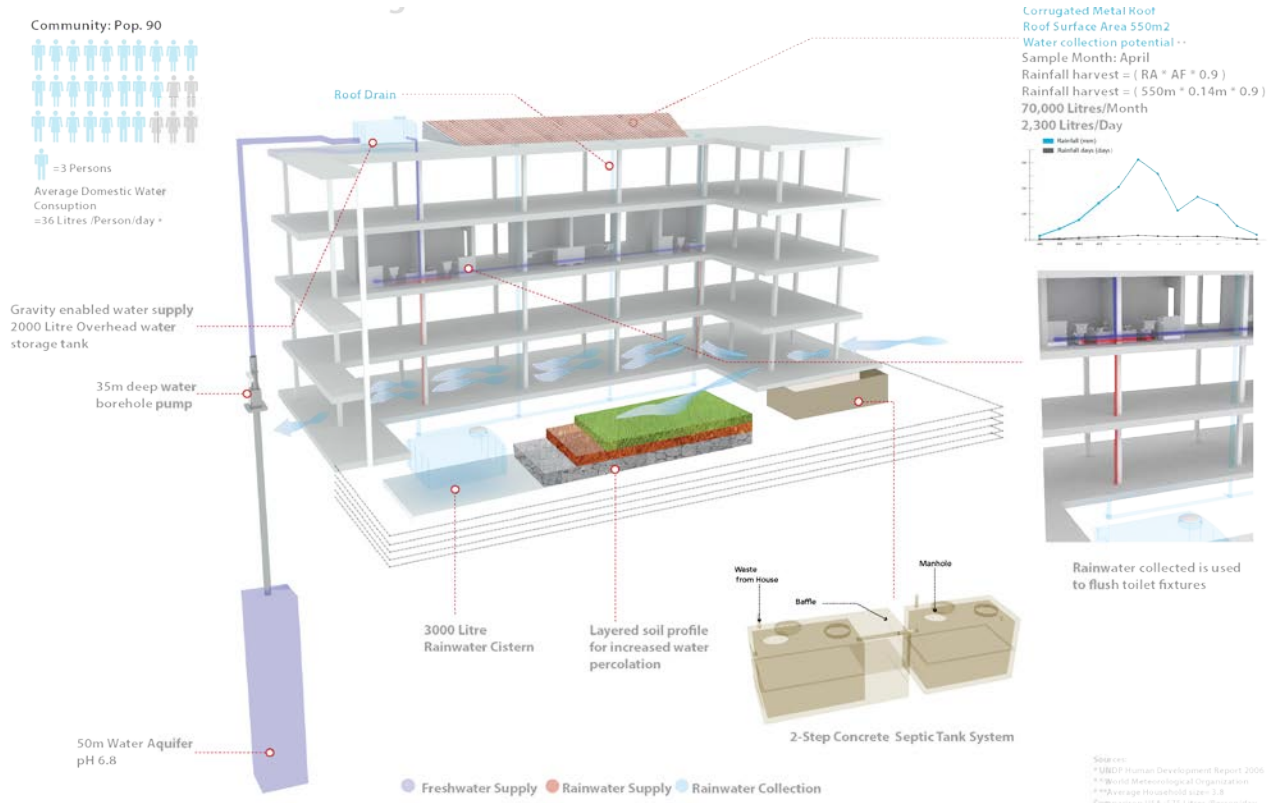
Figure 56: Illustration showing complete water and waste systems. Source: Author

Seasonal Flooding

The decision to elevate the residential units above the ground floor and is to allow water flow through the building during the seasonal flooding. Also the soil profile is engineered to allow quick water percolation.
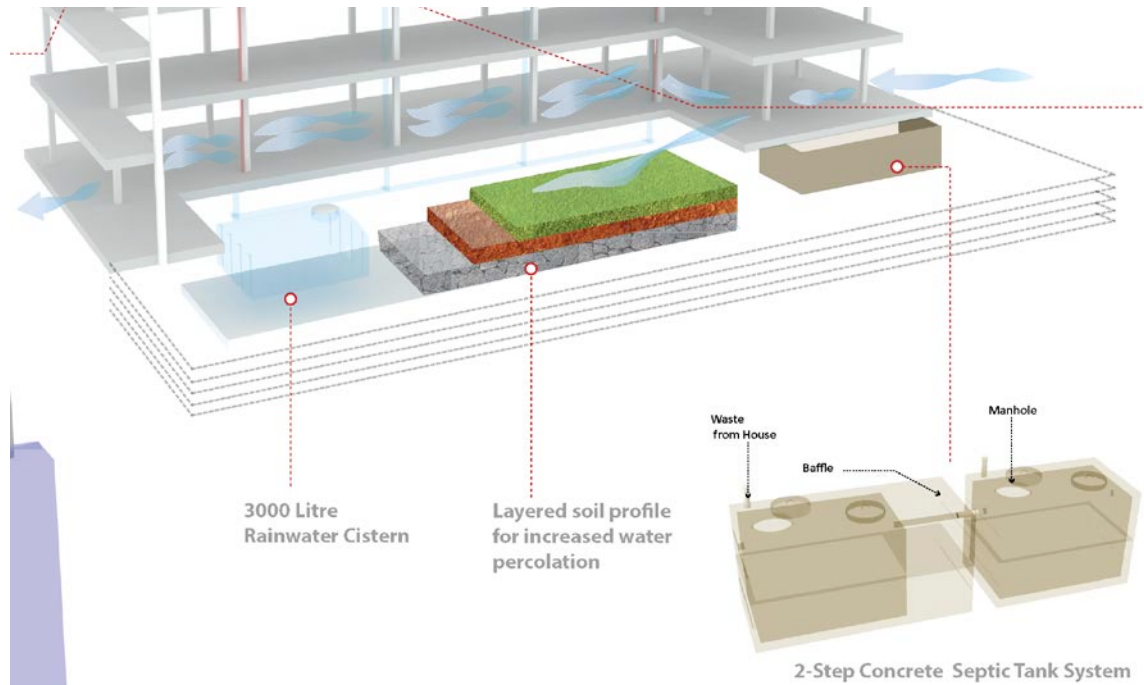
Figure 57: Illustration showing water flow through building and soil percolation. Source: Author

Figure 58: Illustration showing the ground floor flooded. Source: Author

Figure 59: Building elevations. Source: Author

Overall Urban Strategy

The immediate focus of the project is a single building. However, possibilities abound for replication on the scale of a city block. This would incorporate the individual communal space merging with communal spaces on a city block scale.

Figure 60: Illustration showing building during the peak of the rainy season. Source: Author

Figure 61: An illustration merging the individual communal space with the larger urban communal space. Source: Author

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CHAPTER 8

CONCLUSION

This project explored the historical origins of urbanization in Sub-Saharan Africa predating the pre-colonial era to the expansion of traditional urban centers into administrative urban areas during the era of colonization. Culturally significant architectural vernacular was explored. The most important feature of this exploration was the central communal spaces which always served as the focal cultural space in many communities in rural and sub-urban settlements. However this design vernacular was lost in the urban transmutation.

The design proposal therefore incorporates a central communal space at the center of the building to accommodate socio-cultural needs of the building occupants .Also the central communal space serves as an economic nerve center for local crafts and workshops for the building occupants. This economic paradigm did not exist in prior rural and sub-urban contexts, but the economic factors associated with urban living necessitate vibrant economic activity coexisting with private residential dwelling.

The site posed a variety of challenges. However, most notable was the occurrence of seasonal flooding in the neighborhood due to poor storm water drainage systems and the proximity of the site to the Lagos Lagoon. The solution involved raising the dwelling units above the ground floor and creating a ground floor space for economic and communal activity. This ground floor space can be flooded with minimal impact to residential life and this allows flood waters to flow through the ground floor of the building and out of the site. Tropical climatic consideration influenced various strategies including cross ventilation and rainwater collection.

This single building is then presented as a prototype that can be implemented on a larger urban scale, which begins to affect the complete urban fabric of the city. This creates small pockets of communal spaces in dwelling cluster which themselves open up to larger communal spaces in the urban scale.

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