UNIVERSITY OF
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SUSTAINABLE CONSTRUCTION STRATEGIES AND MATERIALS AS A DRIVER FOR BUILT FORM: Proposed Skills Development Centre in KwaXimba, KZN

By

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A Dissertation Submitted in partial fulfilment of the
Requirements for the degree of Master of Architecture to
The School of Built Environment and Development Studies
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DECLARATION

I, Ncomekile Mathe declare that;

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2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons.

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Where other written sources have been quoted, then:

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The KZN Department of Public Works

Thank you for funding my studies.

DEDICATION

I dedicate this dissertation to all young people coming from rural areas and disadvantaged background of the African continent, trying very hard to break the poverty cycle within their families. WE ARE UNSTOPPABLE!

‘A diamond is a chunk of coal that did well under pressure’

Unknown.

ABSTRACT

In the past, people built their dwelling houses and surroundings with available materials from their residing regions. The materials were harvested locally, affordable and environmentally friendly, resulting in sustainable development. Indigenous communities established knowledge systems to use their local materials known as Indigenous Knowledge System (IKS). However, the industrial revolution introduced industrialised materials and rejection of indigenous & sustainable construction materials and strategies (SCSM) emerged. As a result; the knowledge of SCSM is slowly eroding and failure to transmit it to younger generation will lead to an unsustainable environment and loss of historical culture. Also, the loss of skills adversely impacts community resilience as it contributes to unemployment and poverty. Consequently, industrialised materials are utilised for construction incorrectly and place people's health in danger. The phenomenon also results in a built environment lacking cultural identity. KwaXimba, KZN experiences a high rate of unemployment caused by a lack of skills among the youths. However, indigenous SCSM is undervalued but could bring a sustainable environment in underdeveloped communities.

The purpose of the study is to inform the built form: architectural and urban design, that revitalising sustainable construction strategies and materials could promote education, transfer of indigenous knowledge to the youths, preserve historical culture and accomplish community resilience through skills development centre. The study employed the use of secondary data; current literature was reviewed, and the main findings were analysed and validated against selected precedents and case studies at both global and local contexts. Also, semi-structured interviews with professional architects were conducted. The semi-structured focus group interviews with youth and old participants in rural regions of KwaXimba, KZN were also conducted.

The conclusions are based on the research findings and principles for implementation in a suitable skill development centre in KwaXimba, KZN were developed. The approaches towards the built form that promote community resilience can be established through the creation of interactive spaces for cultural activities expressing local cultural identity. The traditional urban and architectural designs principles can resolve the issue through the symbiosis principles which interprets indigenous elements, including construction materials and strategies, in a contemporary manner. Therefore, IKS can be preserved through this principle. Furthermore, community engagement during construction guarantees the community ownership of the building or intervention. Thus, the skills development centre should leave a gap for the community to add their signature to the building through selected construction materials & strategies and created spaces or building functions. Then it will create a strong sense of belonging and cultural identity.

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- **Figure 4. 2i:** illustrating plastered adobe earth and timber interior with quality details to ensure an enclosed envelope at Seven Fountain. **Source:** https://www.designindaba.com/articles/creative-work/oprahs-touch Accessed Date: 22.01.2020

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SUSTAINABLE DEVELOPMENT THROUGH BUILT FORM: KEY PRECEDENT STUDY

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- **Figure 5.2d:** illustrates Cross-section passive ventilation through the building and symbiosis of circular and rectilinear forms, and construction timber and steel materials. **Source**: Modified by Author from (Langdon, 2015) from https://www.archdaily.com/600641/ad-classics-centre-culturel-jean-marie-tjibaou-renzo-piano/. Accessed Date: 25.05.2019
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- **Figure 5.2f:** illustrate complete Kanak hut covered with thatch grass material. **Source**: https://www.arch2o.com/jean-marie-tjibaou-cultural-center-renzo-piano-building-workshop/ Accessed Date: 25.05.2019
- **Figure 5.2g** illustrates the exterior and interior of indigenous Kanak hut constructed with timber. **Source:** (Bianchini, 2019) from https://www.inexhibit.com/mymuseum/the-jean-marie-tjibaou-cultural-center-by-renzo-piano/ Accessed Date: 11.11 2019.
- **Figure 5.2h:** illustrate the weathered iroko timber cases blending very well with trunks of indigenous trees. **Source:** (Bianchini, 2019) from https://www.inexhibit.com/mymuseum/the-jean-marie-tjibaou-cultural-center-by-renzo-piano/ Accessed Date: 11.11 2019.
- **Figure 5.2i:** illustrate a typical detail of laminated iroko timber and steel tensions to support structure. The cases are fixed unto the main timber structures. **Source**: https://www.arch2o.com/jean-marie-tjibaou-cultural-center-renzo-piano-building-workshop/ Accessed Date: 25.05.2019

5.3 DANO SECONDARY SCHOOL, BURKINA FASO

- **Figure 5.3a:** Dano Secondary school, back. View **Source**: http://www.kerearchitecture.com/projects/secondary-school-dano/ Accessed Date:13.06.2019
- **Figure 5.3b:** illustrates Burkina Faso, Africa location in world map; in the Northern hemisphere. **Source:** Modified by Author from www. mapsland.com/ Africa/Burkina-Faso Accessed Date: 13.06.2019
- **Figure 5.3c**: illustrate the Gando village in Burkina Faso. The earth material is primarily used for the walls in the area. **Source:** Modified by Author from en.wikipedia.org/Gando. Accessed Date: 13.06.2019
- **Figure 5.3d:** illustrate women participation refining the floors with stones to get a smooth polished surface. **Source:** http://kere-foundation.com/en/ Accessed date: 13.06 2019.
- **Figure 5.3e:** women carrying their handmade pottery used for the construction of roof light at Gando library project. **Source:** http://kere-foundation.com/en/ Accessed date: 13.06 2019.

- **Figure 5.3f:** illustrate children watering plants with senior lady's assistance, after fetching water. **Source:** http://kere-foundation.com/en/ Accessed date: 13.06 2019
- **Figure 5.3g:** illustrates the natural ventilation system; permeable suspending ceiling and shaded windows allowing natural airflow. **Source**: Modified by the Author from http://kere-foundation.com/en/ Accessed date: 13.06 2019
- **Figure 5.3h:** illustrates Lycée Schorge Secondary School in Burkina Faso. Kere philosophy was followed on the project, however, the timber was used as an addition to locally available materials in the area. It was used to screen the walkways and covered sitting area. (**Source**: Modified by the Author from http://kere-foundation.com/en/ Accessed date: 13.06 2019
- **Figure 5.3i:** illustrates the floor plan with covered gathering space in between to encourage unity among learners and community under shaded and unshaded area and to create a learning environment. **Source:** Modified by Author from http://kere-foundation.com/en/ Accessed date: 13.06 2019.

CHAPTER 06:

INDIGENOUS SUSTAINABLE CONSTRUCTION STRATEGIES AND MATERIALS

ITHEMBALAMAMPUMUZA ECD, KWAMPUMUZA, PMB

- **Figure 6.2a:** illustrates the exterior of IthembalamaMpumuza ECD. **Source**: by Author
- **Figure 6.2b, c**: illustrates South Africa location in world map; in the Southern hemisphere. **Source:** Modified by Author from www. mapsland.com/ Africa/south-Africa Accessed date: 13.06 2019
- **Figure 6.2d**: illustrates IthembalamaMpumuza ECD. **Source**: Modified by Author from Brian Chonco Architects
- **Figure 6.2d 1-4**: illustrates IthembalamaMpumuza ECD analysis. **Source**: by Author
- **Figure 6.2e**: illustrates IthembalamaMpumuza ECD Floor plan. **Source**: Modified by Author from Brian Chonco Architects.
- **Figure 6.2f**: illustrates IthembalamaMpumuza ECD Floor plan. **Source**: Modified by Author from Brian Chonco Architects.
- **Figure 6.2g** illustrates rammed earth composition process on-site, foundation and trenches construction on site. **Source**: By Author, 2019.
- **Figure 6.2h** illustrates the rammed earth wall construction. **Source**: By Author, 2019.
- **Figure 6.2i** illustrates the rammed earth wall with and without finish painting respectively. **Source**: By Author, 2019.
- **Figure 6.2k** illustrates IthembalamaMpumuza ECD micro context. **Source**: By Author, 2019.

CHAPTER 08:

CONCLUSION AND RECOMMENDATIONS

- **Figure 8.2a:** illustrates the analysis to be conducted in a local region to grasp the community lifestyle prior any design. The architect to design and supervise the project after the local findings. **Source**: By Author.
- **Figure 8.2b**: illustrates the floor construction technique in one of Francis Kere projects whereby women learn through repetition of the same thing. They first get it wrong; redo and it improves till when the surface is smooth. **Source**: Modified by the Author from https://www.designboom.com. Accessed date: 07.10. 2020
- **Figure 8.2c**: illustrates the hybrid architecture's intention to integrate new and old architectural elements to meet contemporary community needs and desires, and express local community signature in a universal world. **Source**: By Author.
- **Figure 8.2d:** illustrates the sustainable construction principles to be implemented to achieve an environmentally friendly built form. These are principles to be implemented in KwaXimba skills development centre. **Source**: By Author

CHAPTER 01: INTRODUCTION

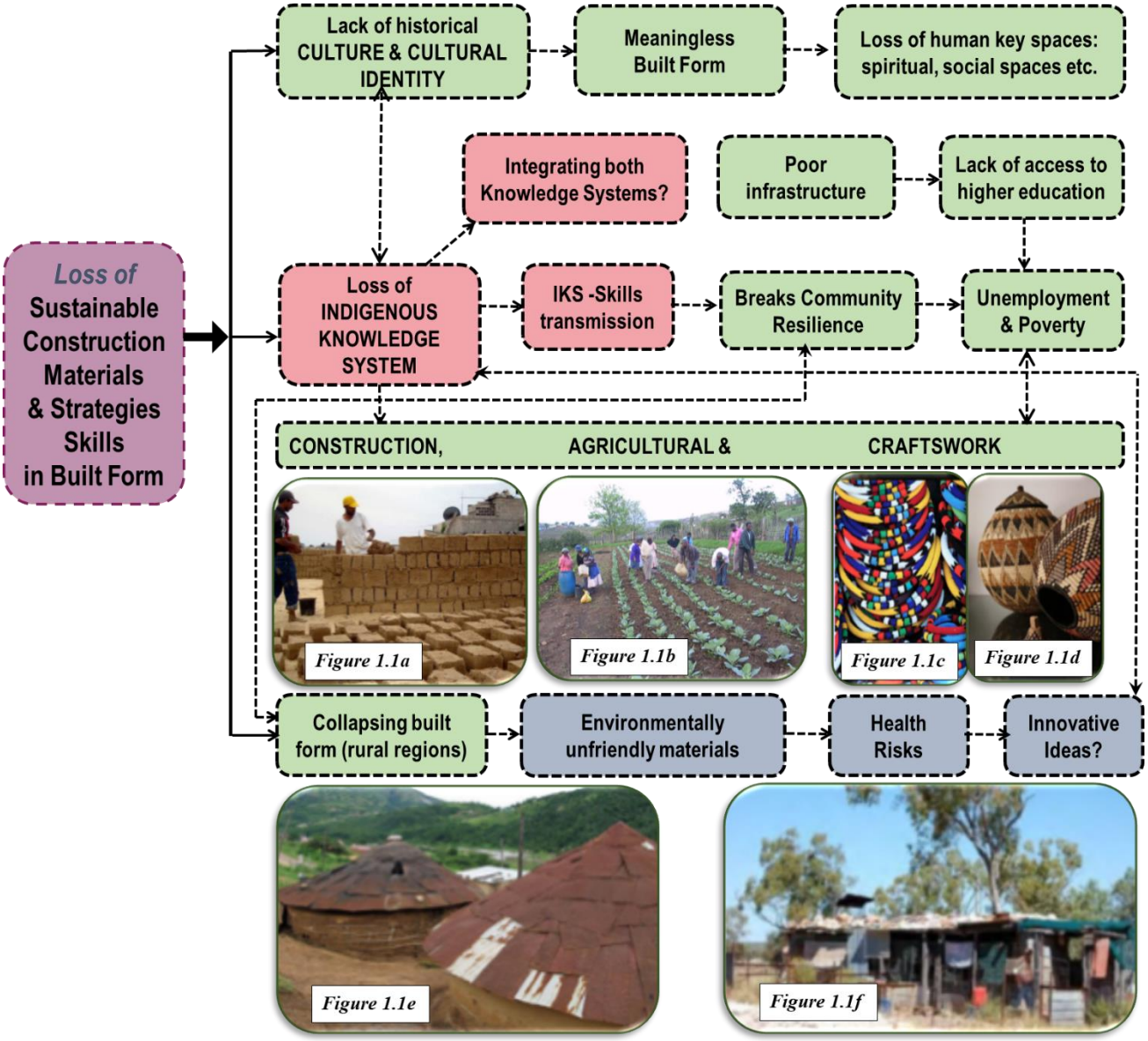


Figure 1.1: *illustrate the definition of the problem for the study or research in hand.* ***Source****: By Author*.

1.1 BACKGROUND

1.1.1 Introduction

In ancient times, most people were always on the move collecting wild plants and hunting animals for survival. As a result of this nomadic lifestyle, permanent structures were not necessary and only purely natural construction materials were used, depending on accessibility to local materials. Generally, stones were used as readily accessible materials; wood, grass and other natural materials were used depending on availability (Niroumand et al., 2013:223). When agriculture was introduced, permanent structures emerged. The seasonal structures were suddenly covered with mud or earth for impermeability, safety from wild animals and unfriendly weather conditions. The strategies and materials used were sustainable. Currently, those sustainable materials and strategies are still used mainly in developing Third World countries and rural regions in developed countries (Niroumand et al., 2013:223).

However, the modernism industrial revolution resulted in the rejection of natural and sustainable construction materials. Nevertheless, people are still struggling to adjust to those industrialised materials. In KwaXimba, an underdeveloped area in the KZN province of South Africa, the community still use sustainable and low-tech materials such as earth, stones, wood and grass as generally available and inexpensive techniques. However, it is only used by people with economic circumstances. These natural materials have a deeper meaning to communities as they are mainly used in vernacular architecture. However, once people afford manufactured materials, they destroy indigenous architecture/ buildings as it is associated with poverty (Sanya, 2007). As a result, the sustainable, traditional architecture, techniques and knowledge is slowly getting lost.

1.1.2 Motivation/ Justification of the Study

People used to live in structures built with natural and sustainable materials. Constructing buildings was not an issue as dwellings and communal structures were built and renovated by the communities as they felt those structures represented them. Lately, there have been many issues in built form caused by present industrialised construction materials and strategies which causes inconvenience in modern societies. African countries are struggling to build facilities to uplift

communities, especially rural regions. South Africa is not left out because the country has a 1.4 % population growth rate which is very high compared to the 0.9% economic growth rate (Sa, 29 July 2019). This leads to poor service delivery by the state, whereas the communities cannot afford to build those facilities as there is a high rate of unemployment and poverty. However, communities could resolve this by opting for inexpensive traditional building materials and techniques that have been abandoned over imported and expensive materials from which only manufacturers in more advanced economies benefit.

Moreover, traditional architecture has a very strong connection, identity expression and its concepts are around community interests, not individuals (Frescura, 1981). Its materials and techniques create a strong sense of community and people in the community come together during the construction period. For instance, people from underdeveloped areas like KwaXimba, KZN used to live by the proverb; *akudlulwa ngendlela umuzi wakhiwa*, with a direct translation-meaning, "one should not overlook but somehow contribute during construction". This tradition and strong community participation have been lost since sustainable materials and techniques have been abandoned.

Sustainable construction materials and techniques do not necessarily disclose only environmental form but also economic and socio-cultural aspects (Sanya, 2007), especially among underdeveloped communities. However, social and economic aspects had been disregarded for a long time within the built environment (Du Plessis, 2002). Thus, there is a need to investigate how sustainable materials and techniques can be used as a catalyst for built form in a contemporary world to establish a sustainable community in the underdeveloped region of KwaXimba.

1.2 DEFINITION OF PROBLEM, AIMS AND OBJECTIVES

1.2.1 Definition of Problem

Modernism in architecture refers to an approach that abandoned historical precedent (vernacular architecture) and rejected ornaments to create a new aesthetic based on industrialised materials

such as reinforced concrete and steel, glazing (Spasoff, 2012 -a:7). This resulted in the abomination of indigenous culture, including construction knowledge globally. The colonisation in Africa also contributed to the loss of indigenous knowledge and education in the continent (Mekoa, 2018:18). The most African indigenous architecture and culture were based on the need of people regarding location, climate, materials and context. However, it has been abandoned over manufactured, less efficient, expensive and industrialised materials.

Furthermore, industrialised materials were introduced in the mid-twentieth century, but most rural communities in Africa are still struggling to establish sustainable construction and built form with the materials. Underdeveloped communities do not have the financial wherewithal to convey materials from manufacturers in cities to their local (rural) regions. As a result, environmentally unfriendly industrialised materials such as asbestos, corrugated sheeting and plastics are incorrectly used for construction which put people's health at risk. South Africa experiences a high rate of unemployment caused by lack of skills among the youths, as a result, there are few qualified people to take up available jobs (Kraak, 2006), resulting in poverty. Thus, the reduction of poverty is one of the greatest challenges in South Africa. Poverty is directly linked to unemployment, and unemployment is closely linked to a lack of skills and access to higher education.

It is from this remark that this research seeks to revitalise sustainable and indigenous construction strategies and materials to preserve historical culture, create meaningful & environmentally friendly architecture, which is slowly becoming obsolete; alleviate poverty, attain community resilience and provide the needed skills through built form.

1.2.2 Aim

This study aims to revitalise sustainable construction strategies and materials through built form. The study also aims to promote education and sustain indigenous knowledge in a contemporary world and accomplish community resilience through skills development centre.

1.2.2.1 Objectives

KwaXimba, KZN needs an architectural approach that revolves around the idea of sustainable development to alleviate poverty and attain a resilient community. The people in the community should learn the needed skills to be employable and for daily survival. The objectives are to:

- Conceptualise culture within the developmental agenda.
- Examine indigenous knowledge systems and strategies towards its sustenance.
- Define the confines of sustainability as related to construction strategies and materials.
- Analyse indigenous sustainable construction strategies and materials of KwaXimba, KZN.
- Use the researched sustainable construction knowledge in designing a proposed skills development centre in KwaXimba, KZN. resilient communities

1.3 SETTING OUT THE SCOPE

1.3.1 Delimitation of Research Problem

There are many different sustainable materials available in the contemporary world. However, the study will focus more on indigenous organic materials used in robust regions to revitalise them. The research will not focus on urban areas, but on underdeveloped or rural areas. Furthermore, this is an architectural discipline study, hence, it will not conduct any scientific tests to prove the capability of strategies and materials such as earth and timber.

As much as the use of sustainable construction strategies and materials (SCSM) is fading away, it is still a norm in some robust regions within the African continent. Thus, the study will review precedents from those African countries to grasp the cultural motives around indigenous urban planning, materials & strategies selection and usage towards community resilience. The study will then review the issue of transmitting IKS through the built form in Africa, South Africa, KwaZulu Natal as study focus. It will then put forward an argument that SCSM are forms of indigenous knowledge system (IKS) and create a meaningful built form, hence its concepts should be correctly implemented in contemporary architecture. Developed countries are leading with representing diverse cultures through built form, thus the study will also review them with an intention to investigate strategies to integrate IKS in the contemporary world.

The research then moves to investigate environmental impacts/ sustainable construction to create a healthy internal and external environment to implement those strategies in a proposed skill development centre.

1.3.2 Definition of terms

In order to clearly understand the context of the research, the following terms have been defined to delineate their meanings in the context of this study. (Some terminologies will, however, be elaborated on, in later chapters of this study):

- **Built form**: any man-made structure or building constructed as a shelter for human beings.
- **Culture**: For this study, unless stated otherwise, is the socially transmitted behaviour patterns, beliefs, institutions and processes of a given tribe or community. (Maternowksa 2000).
- **Cultural activities**: Activities which represent a specific culture and community, contributing to the production of those goods such as craftwork, beads work, basketwork, etc.
- **Earth**: refer to soil or land at home, building soil, and graveyard soil.
- **Earth architecture:** architecture that uses natural earth/soil to build structure or shelter, including vernacular. It's used in historical and contemporary structures for people, and it is a matter closely connected to human ecology (Niroumand et al., 2013:222).
- **Indigenous architecture:** is used alternatively with traditional, vernacular, rural or primitive architecture. It is architecture known for the usage of local materials and strategies practised by indigenous people.
- **Manufactured/ Industrialised materials**: the production of something on a large scale often built and assembled through a process with aid of machinery i.e. steel, concrete and glass (Finnie, 2012).
- **Natural materials**: also called indigenous materials. It is defined by natural rawness, the true and most basic state it is captured with, which leads to the initial, unique and direct experience one encounter that stimulates a place memory or identity of where it was captured. For example; timber, stones, earth, grass etc. It is opposed to manufactured material, which is built or manufactured by a machine (Finnie, 2012).

- **Rural regions, underdeveloped regions**: Out of urban and peri-urban regions with poor or no community facilities & developments conducted by the government and usually with a high rate of poverty. Thus, the communities have their survival strategies.
- **Sustainable construction strategies and materials (SCSM):** are indigenous methods used to construct shelters, structures or buildings using natural and organic materials such as stones, wood, earth and grass etc. The eco-friendly methods were frequently used a long time ago and those skills are slowly dying nowadays. However, it also refers to strategies that are executed in a contemporary world by implementing modern or industrialised materials such as corrugated sheeting, plastics etc. in a sustainable manner, considering the travelling distance from the source to site, waste management etc.
- **Sustainable Development (**SD): is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Wced, 1987:43). It has three aspects; social, environmental and economic.
- **Strategies**: a plan to achieve an overall aim including motives behind certain construction techniques, concept, built form etc.
- **Urban planning**: a process concerned with the physical layout of human settlements, development and design of land use and the built environment, including the infrastructure. In this study, it's mainly referred to as regional planning and rural planning.

1.3.3 Stating Assumptions

- Most people in rural regions are skeptical about using indigenous SCSM because they believe they are not as strong and versatile as industrialised materials. The materials are also being associated with poverty hence, no one wants to use them.
- Skills to use SCSM can alleviate poverty and achieve community resilience in underdeveloped regions as people can save economically and develop their areas without the state's assistance.
- Moreover, the SCSM symbolise certain people's culture, thus incorporating its ideas could lead to a friendly and meaningful built environment.

1.3.4 Stating Key Questions

PRIMARY QUESTION

How can sustainable construction materials and strategies contribute to built form?

SECONDARY QUESTIONS

- What is the cultural meaning of sustainable construction materials and strategies within the developmental agenda?
- How can indigenous knowledge systems and strategies be sustained through built form?
- How do sustainable construction materials and strategies impact the environment?
- What are the indigenous sustainable construction strategies and materials of KwaXimba, KZN?
- How do we use the researched sustainable construction knowledge in designing a proposed skills development centre in KwaXimba, KZN?

1.3.5 Hypothesis

Revitalising sustainable construction strategies and materials (SCSM) could drive a meaningful contemporary built form while providing with necessary skills towards sustainable development and resilient communities in underdeveloped regions.

1.4 CONCEPTS AND THEORETICAL FRAMEWORK

1.4.1 Introduction

The issues will be analysed through the lenses of the following concepts and theories; Sustainable development concept; indigenous knowledge theory; community participation and critical regionalism theory. The concepts and theories will systematically outline the research to respond to the key question and support the hypothesis.

1.4.2 Sustainable Development Concept

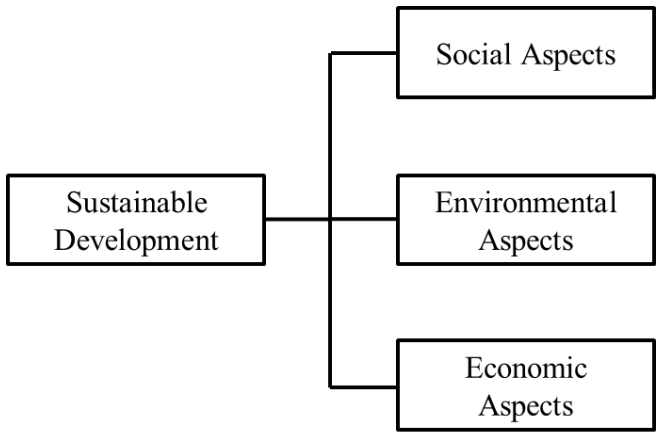


Figure 1.4: *The three Aspects of Sustainable Development.* ***Source****: (Sanya, 2007:58).*

Sustainable development (SD) is defined as '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*' (Wced, 1987:43). The key principle of the concept is to integrate environmental, social, and economic aspects throughout the decision making to accomplish truly sustainable interventions that can be used by future generations (Emas, 2015). Therefore, the SD concept provides a framework for the integration of policies and strategies that could be implemented in developed and developing countries (Wced, 1987). Sanya (2007) elaborates that SD contains two key concepts: the concept of needs; the essential needs of the world's poor and should be given priority. And the issues caused by technology conditions and social organization, that might disable the environment's ability to meet present and future needs (Wced, 1987:43).

People are at the centre of the SD concept. Social aspects are about people and their needs, including culture. Environmental aspects are about the management of resources and the basis of all production activity. Lastly, the economic aspect is viewed as the final product generated after combining environmental and cultural aspects harmoniously and satisfies people's needs (Sanya, 2007). The study is based on an underdeveloped region and intends to alleviate poverty as well as empower the community. Therefore, the SD concept will guide the study to perceive SCSM issue with social or cultural, economic and environmental aspects concerning the built form to ensure development sustainability.

1.4.3 Indigenous Knowledge Theory

Indigenous knowledge is the knowledge developed by local people and passed down over generations. The knowledge usually does not exploit resource for any development (Mundy, 1993:2). African traditional architecture is incorrectly perceived and understood by outsiders and investors from different regions who know nothing about the local culture. Mundy notes that; from an outsider's perspective, indigenous knowledge may be inconsistent, based on superstition or just plain wrong. However, a member of the local culture understands its logic, finds it useful and compatible with other beliefs (Mundy, 1993:1). This general view reveals that revitalising indigenous architecture could change how architecture is being perceived and understood (Phiri, 2011).

In Africa, there is still no institutionalised approach to formalise African Indigenous Knowledge (Phiri, 2011). This study will implement the theory to examine indigenous architecture and strategies. The theory will also guide the research to investigate means to sustain it from the older generation to the younger ones through built form, while alleviating poverty by teaching new skills, preserving the local historical culture and achieve a sustainable community in underdeveloped areas.

1.4.4 Community Participation Theory

Community participation theory in architecture was prominent in the mid-1970s when the World Bank approved and accepted to fund housing developments in developing countries (Hamdi and Goethert, 1998). The theory states that the local community should be given an active role in programs and improvements directly affecting it. According to Charles Abrama, it is only rational to give control of affairs and decisions to people most affected by them. The main aim of the theory is to increase the involvement of socially and economically marginalized people with similar needs and goals, in decision making over their own lives (Cooke and Khotari, 2001:5).

Participation does not necessarily refer to empowering and training self-help builders. The theory addresses the main issue of involving the community in decision making through the bottom-up approach when developing communities. Participatory methodologies are highly recommended by

theories such as sustainability and empowerment (ibid). The approach moves from the 'providing' paradigm towards an 'enabling' approach. The enabling approach promotes and supports the involvement of local people's opinions, knowledge, skills and priorities (Hamdi and Goethert, 1998).

The theory will guide the study towards investigating community contribution and decision-making regarding their built form and construction materials and strategies. It will promote community participation by studying local skills and its implementation in the skills development centre.

1.4.5 Critical Regionalism Theory

Critical Regionalism theory respects local culture, geography and climate. Its approach challenges the placelessness and lack of identity within a context. A philosopher, Paul Ricoeur argues that globalisation of human cultures and monotype in terms of civilisation caused the loss of variety and traditional cultures which are the main qualities for defining space and built form. Therefore, critical regionalism theory seeks to combine global and local languages of architecture to make it fit within the local context. The theory looks at identity more than in vernacular architecture as Lefaivre and Tzonis (2003) argue that climatic conditions, culture, myth and craft of a region should not be reduced to indigenous forms. Frampton agree with Lefaivre and Tzonis (2003:10) that the theory aims to resist universalisation of architecture by analysing a region’s aspects such as climate, context, and tectonics so embedded in local material traditions and culture of construction to express local identity.

The social, cultural, ecological, and social, and temporal must be dealt with simultaneously in any project. Frampton (2007) emphasize that the study of ground figures of the project brings interest in the cultural and material histories of a specific site, hence local materials and craftsmanship are very important. The results become the technical constraints and opportunities that a site can imply. Therefore, the theory does not directly adopt traditions but examines local culture and reinterprets it in contemporary terms (Frampton, 2007). Thus, Szacka & Pattecua (2019), suggest

that to implement critical regionalism theory in a contemporary world built form, one should use the methodology with three branches whereby one section studies and analyse the site in close collaboration with local craftsmen to grasp regional culture. The second section should analyse the findings with intention to produce building materials. The third section should be architectural, with architects who design and supervise the project. The critical regionalism lies in the embeddedness of the projections (ibid).

The above issues are still important today as they bring good long-term relationship of humankind and built form. Thus, the theory will focus and guide the study into architecture and built form. Therefore, the theory will guide the research to integrate the region's vernacular architecture with universal culture to meet modern world needs, while embracing and representing local identity.

1.5 RESEARCH METHODS AND MATERIALS

1.5.1 Introduction

This section intends to outline the approach and methodologies used to conduct the study, including the facilities utilised for data collection. The qualitative approach will be used to obtain data through primary and secondary data collection. The research is centred on gaining an in-depth understanding of the study topic. Qualitative methods rely on text and image data; thus, will be used.

1.5.2 Research Philosophy and Strategy

The research philosophy used for the study is the Constructionist (Interpretive paradigm) approach. Interpretive constructivists or interpretivism perceive reality as being constructed by the community, thus there are many realities. The knowledge is subjective; therefore, the reality is based on the context, experience, and background. As a result, what people value often influences how they behave, an environment they design and the way they think (Research Philosophy). The approach was chosen because the topic at hand is contextually based i.e. construction materials and strategies are determined by regions' local culture, and environmental conditions (Sanya, 2007). Also, the approach complements the thematic analysis as a qualitative research method

(Nowell et al., 2017) to be used for data collection. The approach will allow the topic to develop effectively and reach possible solutions.

1.5.3 Secondary Data Collection

Precedent Studies:

The researcher will follow chronological order starting from; reviewing the issue in the African continent and move to KwaZulu Natal, South Africa as study focus context. However, some developed countries have dealt with issues of sustainable construction materials and strategies as a driver for a built form and have resolved diverse cultures through built form. Thus, the study will also review them. Also, theories and concepts at hand will guide the selection of different precedents. This will ensure that the entire study is comprised of examining various existing buildings.

Literature Review:

The researcher will collect opinions of other researchers and experts who have written materials on the issues at hand, sustainable construction strategies and materials as a driver for built form. The researcher will collect and examine data on a global scale, the African continent, and in KwaXimba in the KwaZulu Natal province of South Africa. The key and sub-questions which are also informed by concepts and theories in the study will guide the reviewed literature. Lastly, the researcher will develop literature review from studies by various specialists and researchers from books, research reports, journal articles, articles reproduced online, academic papers, and analysis of historical events, and the World Wide Web.

1.5.4 Primary Data Collection

The purpose of collecting primary data is to examine SCSM construction techniques, do an observation, hear from experienced participants and experts, discover the current perception of SCSM in the built environment. Also, to analyse data against collected secondary data and make conclusions, and finally build principles to implement for a suitable skills development centre in KwaXimba, KZN.

Case Study:

The researcher will conduct a qualitative focus group and semi-structured interviews, with participants who have used and are familiar with selected case studies. These will be SCSM buildings occupants and skilled builders on selected case studies. The researcher will also conduct qualitative, semi-structured interviews with a professional architect and state representative expert on SCSM and related issues. Furthermore, the case studies and interviews will help to answer the key and sub-questions of the research. Therefore, the following case studies located in KwaZulu Natal underdeveloped areas will form a significant section of primary data collected and analysed in the study.

IthembalamaMpumuza ECD, KwaMpumuza (Sweetwaters), Pietermaritzburg, KwaZulu Natal.

The ECD is built of mud or earth as main materials for walls together with timber as natural, local and sustainable materials. The researcher will conduct the following semi-structured interviews on-site.

- The leader of the iThemba Projects construction team regarding construction techniques of the project, community engagement and skills transmission that took place during construction.
- 8– 10 qualitative focus group discussion, to hear from the building inhabitants and discover the outcomes the building has on their lives as a result of materials utilised for construction.

KwaXimba, Cato Ridge, KwaZulu Natal

The researcher will study KwaXimba underdeveloped area as a case study and site for the proposed skills development centre project, which will be the final product of the research. The region is very rich in indigenous culture materials: vernacular architecture, farming, music and dances, craftwork and beadwork etc. Architecturally, some people still use indigenous knowledge for their dwelling houses while others use industrialised materials. However, the cultural influences, patterns and model can still be recognised in a district. Therefore, the researcher will interview different people regarding the sub-questions of the research as follows:

- 2 indigenous skilled builders ranging from 30 – 50 years old, regarding indigenous knowledge systems and construction techniques.

- 2- 5 Participants through qualitative group discussion with participants ranging from 35 – 70 years old in one of their homes, KwaXimba.
- Lastly, 8- 10 members through qualitative group discussion with participants ranging from 18 – 34 years of age, to understand young generation perception of indigenous SCSM, the skills it offers, and opinions on its revitalisation in a contemporary world.

Therefore, the total of ±30 participants will be interviewed including two discussion groups.

1.5.5 Research Materials

To increase the understanding of the research problem and its consecutive issues, the qualitative method will be used because it allows multiple sources of data such as observations, documents, enables the use of words, opinions, views, thoughts and feelings; which this study requires, rather than relying on a single data source. It is inductive data analysis which will help to comprehend a complex and detailed understanding of the issue. Additionally, an interpretive inquiry form of research will be used whereby the researcher interprets what they see, hear, and understand. To conclude, qualitative research will provide the data needed to answer the research questions and analysis will generate answers to questions in KwaXimba context. This will be achieved through the secondary and primary collection of data.

1.5.6 Research Analysis

Precedent Studies: Will be conducted through thematic analysis/approach.
Literature Review: Will be conducted through thematic analysis/approach.
Case Study: Will be conducted using a qualitative approach through thematic analysis.
Interviews: Semi-structured interviews will be undertaken to balance both formality and informality. Open-ended questions allow for extended knowledge.
Observations: The researcher will observe construction materials and strategies used in case studies and their impact on the local community.
The researcher will then analyse collected secondary data against collected primary data and build principles to implement the proposed skills development centre in KwaXimba, KZN.

1.5.7 Summary (Matrix)

Objectives	Research Questions	Data Sources	Sample Size	Data Collection Methods	Data Analysis Method	Data Presentation: Forms and styles
Conceptualise culture within the developmental agenda.	What is the cultural meaning of sustainable construction materials and strategies within the developmental agenda?	Published books, journals, articles, web sites, government docs.	-	Literature Review, precedent studies	Documents analysis, Content analysis, thematic analysis.	Narrative text, pictures, diagrams
Examine indigenous knowledge systems and strategies.	How can indigenous knowledge systems and strategies be sustained through built form?	Published books, journals, articles, web sites, government docs.	-	Literature Review, precedent studies	Documents analysis, Content analysis, thematic analysis.	Narrative text, pictures, diagrams
Define the confines of sustainability as related to construction strategies and materials.	How does sustainable construction materials and strategies contribute to the environment?	Published books, journals, articles, web sites, government docs.	-	Literature Review, precedent studies	Documents analysis, Content analysis, thematic analysis.	Narrative text, pictures, diagrams
Analyse indigenous sustainable construction strategies and materials of KwaXimba, KZN.	What are the indigenous sustainable construction strategies and materials of KwaXimba, KZN?	Community members (seniors and old), indigenous builders, topic experts	+/_15	Case study: Qualitative Focus group, semi-structured interview, observations	thematic analysis, document analysis, observations	Narrative text, Photos, sketches and diagrams
Use the researched sustainable construction knowledge in designing a proposed skills development centre in KwaXimba, KZN	How to use the researched sustainable construction knowledge in designing a proposed skills development centre in KwaXimba, KZN?	Community members (seniors and old), indigenous builders, topic experts	+/_15	Case study: Qualitative Focus group, semi-structured interview, observations	thematic analysis, document analysis, observations	Narrative text, Photos, sketches, diagrams, and drawings

1.5.8 Conclusion

The approach used in the study will enable a detailed and complex understanding of the topic at hand; sustainable construction strategies and materials as a driver for a built form, and its consecutive issues. This will help generate the community's ideal built form; proposed skills development centre which will form part of the local cultural environment, contribute to local economic growth while providing environmental sustaining strategies.

1.6 CONCLUSION

CHAPTER 01 has built up the research foundation, research methodology and settings for the study. The techniques used to channel collected data have been documented and set out the theoretical and conceptual structure which will guide the dissertation all through. Additional chapters are in the following order:

CHAPTER 02: *Conceptualising culture within the developmental agenda*

This chapter aims to investigate the implications of the culture behind indigenous urban planning and architecture and ways that built form symbolises and embrace community. It will also discover cultural meaning in the construction strategies and materials & built form and reveal why it should be implemented in the development agenda at global & regional levels.

CHAPTER 03: *Sustaining indigenous knowledge systems through built form*

The chapter will investigate the IKS and AIKS and explore strategies to transfer the knowledge to the younger generations. The focus will be on architectural IKS which is also known as vernacular architecture, primitive architecture or traditional architecture. The study will finally investigate ways to incorporate ideas from IK and strategies to implement it into the contemporary world as a means of sustenance.

CHAPTER 04: *Environmental impacts of sustainable construction*

This chapter will investigate the environmental impact of the construction materials and strategies that have been discussed in previous chapters (mainly used in rural communities) and synthesise it with standardised sustainable construction knowledge. The chapter will explore more of KwaZulu Natal suitable strategies to be revitalised and implemented to create an environmentally friendly built form.

CHAPTER 05: *sustainable development through the built form: key precedent study*

The chapter will analyse different precedent studies from both the international level and local context. The key objective is to study how they have dealt with different concept and theories discussed in the previous chapters.

CHAPTER 06: *Conception of construction strategies and materials in modern society: Case study*

This chapter will present ethnographic research collected from the rural region of KwaZulu Natal, Pietermaritzburg, Sweetwaters (KwaMpumuza), to investigate how the community perceives sustainable construction materials and strategies-built form and the impact it has over people's lives towards the establishment of a resilient community.

CHAPTER 07*: Analysis and discussion of findings*

This chapter will consolidate all the discoveries to form one body of knowledge that offer responses to the key and sub-questions of the research.

CHAPTER 08: *Conclusion and recommendations*

The chapter will recommend strategies drawn from the research that could be implemented in urban planning and individual buildings regarding sustainable construction and strategies as a driver towards the built form that oozes community resilience, empower the community and alleviate poverty. The recommendations could be implemented in other places with similar issues and will lead to the skills development centre in KwaXimba, KZN.

CHAPTER 02:

CONCEPTUALISING CULTURE WITHIN THE DEVELOPMENTAL AGENDA

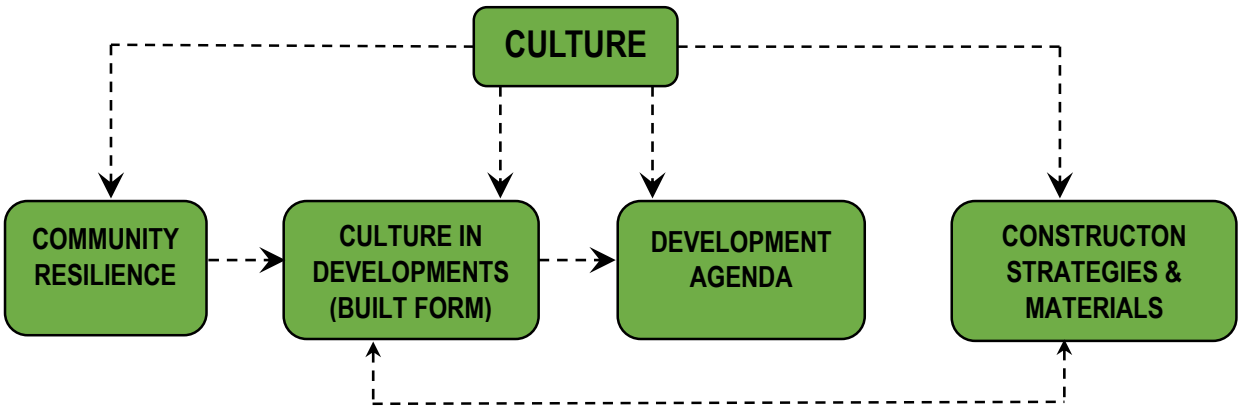


Figure 2.1: *Highlight the structure for this chapter; CHAPTER TWO.* ***Source****: By Author*.

2.1 INTRODUCTION

The studies and practices on sustainable construction and built environment have been focusing on environmental and economic aspects, meanwhile disregarding cultural aspects for a very long time (Du Plessis, 2002). On the other hand, robust regions used to thrive through cultural activities and are struggling as their community resilience, which is a determinant of community sustainability, is compromised. The cultural activities that portray the community identity are left out in developments. Thus, the built environment that lacks cultural identity has spread all over the world. Lately, most institutions policies are implementing cultural aspect in their agenda to portray the lifestyle, beliefs and values of people. The Sustainable Development Agenda 2030 has discovered the role of culture in communities. Its policies now promote cultural intervention in every development to create sustainable environments globally. Therefore, this chapter aims to investigate the implications of culture in rural areas and discover its meaning in the construction strategies and materials and built form.

2.2 UNDERSTANDING COMMUNITY RESILIENCE

2.2.1 Introduction

Change is inevitable; therefore, communities should be able to adjust and embrace all kinds of changes. Cultural activities including indigenous construction strategies, beadwork production, mats sewing, agriculture etc., that sustained rural communities long ago have collapsed for different reasons. The breakdown is not helping as robust regions are still struggling to manage and adjust to the contemporary world. Therefore, this section will explore the concept of community resilience and cultural activities' influence on developing sustainable communities.

2.2.2 Community Resilience Concept

Resilience is the capability of a system to support itself through change using adjustment and transformation. Therefore, community resilience is the advancement and engagement of community members to survive in an ever-changing and unpredictable environment, using their resources (Magis, 2010:402). Thus, the concept is a determining factor of social sustainability. Resilient community members always develop individual and collective strategies to address and

embrace the new changes to thrive as a group at present and in future. Therefore, it involves their local resources, collective actions, engagement, and strategic plans (Magis, 2010:402). However, Ahmed *et al*. (2004), emphasise that the community resilience concept is not about managing and addressing group issues, but concerning the ability of the group to adapt, conform to change and thrive. Resilience is fundamental to all communities, and failure to embrace it can destroy that community. Therefore, a community should accept and adapt to changes as they are guaranteed to occur as a result of various disturbances (Folke *et al*., 2003).

Furthermore, systems encounter changes to retain their unique original structures and activities. Therefore, disturbances can better or aggravate situations as it causes change. However, sometimes changes overpower and destroy systems or community activities completely (Magis, 2010). Nevertheless, systems should experience huge, solid and vital changes for the community to thrive on. In those cases, the disturbances force opportunities for change, which could be a maintenance, transformation, or adaptation. The resilience shift strengthens the thought of progress steadily in communities (Magis, 2010). Therefore, the change is good and bad, depending on how the community manage it. Also, local community members with traditional knowledge always play a huge role in community resilience as they understand their community better. Thus, the community should borrow and implement ideas from their social, cultural, economic resources, natural, and built resources to thrive and respond to change. Resilience is therefore elementary as it pushes community capability to thrive in dynamic environments (ibid).

Moreover, community resilience and community capacity correspond; thus, they are sometimes confused. Community capacity is community ability to use their community assets to resolve issues at hand as a collective to improve or maintain their living conditions (Magis, 2010:407). Therefore, community resilience exists as a result of progress as it acknowledges, accommodates, and build capacity for changes (Magis, 2010:408). To add more, community resilience requires certain social capital as part of the process to occur. Social capital is the capacity and ability of people in the community to willingly engage in activities coordinated by themselves as individual and or collectives (Williams, 2004) and capitals are important in community resilience.

2.2.3 Reviewing rural regions and developments matters

Infrastructure development including architecture and urban planning development is one of the cores of any community towards the growth of socio-economy. However, Dillip Kumar Das, who conducted the study in rural India where about two-third people in the country stay, reveals that in most rural areas worldwide, infrastructure development does not happen at an ideal pace as a result of different circumstances. Challenges with finances, equipment, construction materials, community engagement, and lack of skills contribute to failure to attain sustainable infrastructure developments (Das, 2018:1). Mears *et al*. (2009), consent that the failure of infrastructure development contributes to poverty in rural regions. Todaro and Smith (2006:227) add that poverty is also measured by levels of unemployment and lack of access to infrastructure. As a result of poor infrastructure, the communities in rural districts have access to poor education available, and no access to better employment opportunities as they lack the necessary skills (ibid). Consequently, they rely more on local cultural activities for survival.

Most people in rural areas participate and rely on cultural activities e.g. agriculture and contribute to the nation's economy. However, they are always sidelined when it comes to any developments. Consequently, they experience the lack of developments, poverty and over-dependence on agriculture and related matters (Das, 2018:1), yet they have the potentials and knowledge that can help them out. Poor infrastructure is observed as the source of significant obstruction for any developments in those regions. Thus, the government has to put together strategies to resolve the matter and create employment opportunities and multi infrastructure to stabilise socio-economy development (Das, 2018:2). More importantly, during infrastructure development, the aspects of economy, environment, and technical implications are always prioritised on the projects. On the other hand, the social aspect is always compromised (Das, 2016), which includes local social vulnerability, skills, perceptions, opinions, and engagement (Das, 2018:3). Furthermore, community participation and other stakeholders' engagement does not guarantee the success of the project. Thus, the socio-cultural involvement is expected to be more inclusive with the strong and effective engagement of all stakeholders (ibid).

2.2.4 Rural regions community resilience and planning

Figure 2.2a

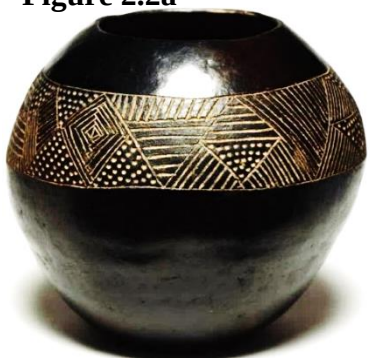


Figure 2.2b

Figure 2.2c

Figure 2.2d

According to Mears *et al*. (2009:230), who conducted a study in Eastern Cape, under Ngqushwa Municipality; poverty in robust regions is perpetuated by cultural activities' interruption of which community used to thrive through its production. Cultural activities such as agriculture, grass mats and basketry sewing, beadwork production, **(Figure 2.2a-d)** play a huge role in underdeveloped regions (ibid), including vernacular architecture construction. As Deborah Whelan states that uMsinga, KZN was known for its specific ceramics, beadwork and craftwork. People travelled to the place to buy those cultural work (Whelan, 2001). However, their production has collapsed resulting in financial struggles and somehow hinders community resilience. KZN is among the provinces with poorest rural regions that are primarily affected by declining cultural activities production (Mears *et a*l., 2009:231) in South Africa.

Mears *et al*. (2009:231) point out that the system imbalance in robust regions is caused by the enforcement of unsuitable policies that interrupt production and this contributes enormously to poverty. Additionally, the imbalance results in a high rate of unemployment and poverty in the regions (ibid). The modern built form contributes enormously to the issue as it does not accommodate local people cultures production and government policies focus more on urban areas while ignoring the rural areas' resilience.

Figure 2.2a; b; c; d: *illustrates cultural activities the rural communities used to thrive through their production.* ***Source****: (Ingold, 2000)*

The modern built form is criticised by many academics including Kisho Kurokawa, for its lack of culture and humanity. Consequently, it plays a role in destroying community resilience. Indigenous villages, towns and cities created and celebrated certain spaces to ensure the local community's resilience and preserve strong economic, cultural and social aspects in areas (Kwabena, 1995:40). Kwabena emphasises that villages layout or indigenous urban or town planning have principles that the contemporary urban planners, developers and architects can learn from to resolve current built form issues.

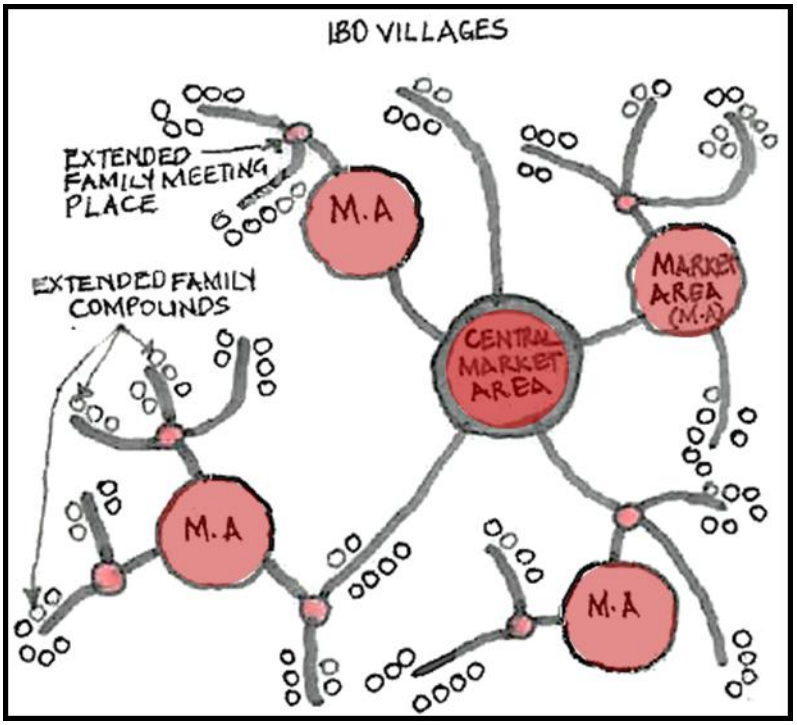


Figure 2.2e: *The Ibo Villages.* ***Source****: (Kwabena, 1995:41)*

The Ibo villages in Nigeria, West Africa have a typical planning concept that has a market area at the heart of each village, which also leads to the central market that connects all small villages as the focus of all villages (ibid), illustrated on **Figure 2.2e**. The plazas, market areas or community facilities are a platform for the trading cultural works of local people, meetings, sharing of ideas, learning and celebrations through dancing and music. They were placed at the centre of the region for easy access to all community members. On those grounds, the planning and architecture are known as cultural or socially responsive one since it expresses and embraces local people's desires. The gathering spaces are available from a bigger scale of urban planning till smaller scale of family compounds at villages (Kwabena, 1995:41). Nevertheless, the type of planning has disappeared thus, people are struggling in the villages and urban areas as a result of cultural negligence.

2.2.5 Conclusion

Communities that figure out ways to live with change and instability caused by different circumstances and manage to build capacity to thrive within that setting become resilient. Also, the new built environment and planning fail to acknowledge local regions' cultures and activities that the communities used to thrive on. As a result, rural districts encounter a breakdown of community resilience caused by the ignorance of culture within the built form. However, indigenous planning corresponded to local cultures thus, contemporary planners should learn from it.

2.3 THE ROLE OF CULTURE IN DEVELOPMENT

2.3.1 Introduction

The failure of built form planning to accommodate culture perpetuates poverty in the robust regions. Thus, it is important to understand the concept of culture before investigating its influence on built form. Culture is one of the most significant components to be incorporated when resolving social issues (Baldwin et al., 2006). In recent times, indigenous architecture as a cultural driven built form is praised for its potential to resolve contemporary world issues. Therefore, this section intends to investigate the concept of culture and related matters, before examining its impact on the built form towards achieving sustainable development.

2.3.2 Conceptualising Culture

Culture is a very complex concept with many different denotations globally (MonclúS and GuàRdia I Bassols, 2006:55), and forever changing. Long ago, culture was only understood as; the possession of a group which may be the beliefs, values and patterns of behaviour from a specific group (Baldwin et al., 2006); (Rapoport, 1969). It represents the behaviour of a group of people, their perceptions, beliefs and values. Nevertheless, recently the interpretation of culture is slowly changing (Anderson-Levitt, 2012), as its evolutionary process is affected by the continuous factor of time and advancement of technology, which results in formulation of new cultures. In the 21st century, the prominent human patterning at a global scale is the movement of people of different cultures resulting in cultural diversity (MonclúS and GuàRdia I Bassols, 2006). As a result, the

concept of culture now focuses more on patterns of human activity (Erickson, 2011) at a global level rather than small groups. Consequently, the planning policies promote the integration of culture, multiculturalism and cultural diversity (MonclúS and GuàRdia I Bassols, 2006).

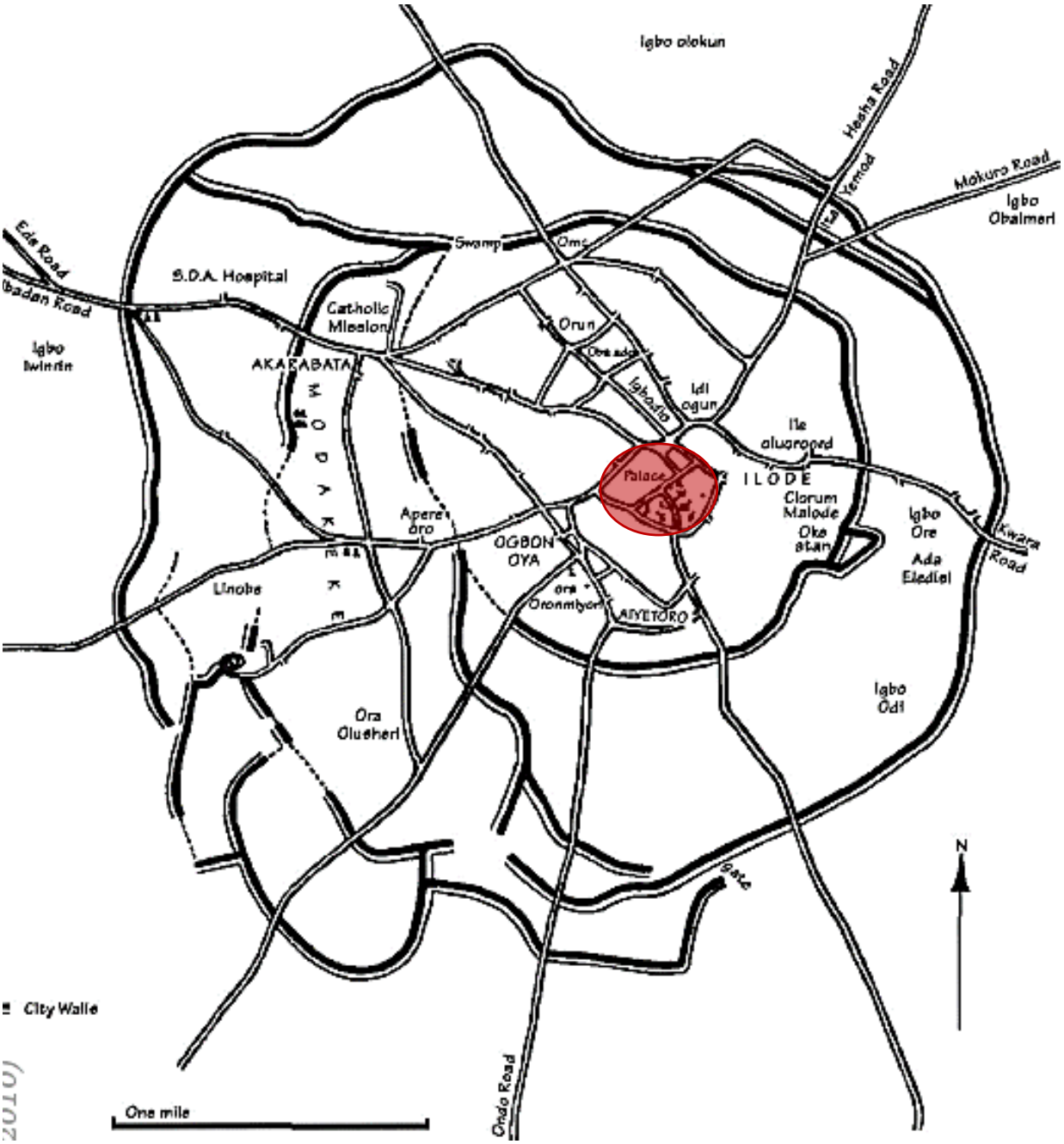


Figure 2.3a: *illustrate the indigenous Yoruba city of Ife planning with the palace in the middle.* ***Source****: (Kwabena, 1995:43).*

On the other hand, globalising culture has raised disputes as it might yield uncomfortable results to communities. Foster (1991) and Wax (1993)suggest the world should be treated as one place with common cultures which are being shared globally, to avoid conflicts of cultures and make the world a suitable place for everyone. However, people have different cultures that are not shared at global scale thus, globalising culture can create issues and meaningless context. Globalisation has resulted in the loss of many cultures while trying to accommodate multicultural societies. In most cases, the cultures that are being destroyed in the name of globalisation bring resilience among communities (Das, 2016). Nevertheless, the section will use culture as the possession of a group as it investigates indigenous architecture. The built environment including urban planning reveals people's culture.

The indigenous urban planning is evidence that in the past, urban planning could easily represent people's culture. Olufemi (1995:195), argues that tribes' traditions and culture were implemented in the indigenous towns and cities' planning and morphology. Each city morphology represents the tribe's objectives, construction materials, skills and abilities, economy and cultural statuses (ibid). Nigerian's Oyo and Yoruba tribes have indigenous cities that were built from inside/ core which becomes more traditional and the newer/latest area sprawl outward. The very compact city planning principle includes two twin institutions which are adjacent to the palace and market in the middle (**Figure 2.3a)**. The Royal palace as focal point in the middle is known as the source of culture which strongly express primitive architecture, arts and crafts of local people Olufemi (1995:196), to emphasise the hierarchy of palace and all roads pattern that leads to this point (Kwabena, 1995:69). The network pattern is very organic and reveals circular elements which represent some African cultures.

The aforementioned connotes that culture has in-depth meaning as it gives people identity, hence culture is a way people express who they are and or their identity. MonclúS and GuàRdia I Bassols (2006) emphasise that culture is…pattern and process, material and symbolic, belonging and being: identity. Lechner and Boli (2008), build on Monclús argument by stating that culture is symbolic, and ways of living shared by a community which are deep-rooted in people and objects. Therefore, there is a strong link between culture and identity thus, it is necessary to explore the identity concept.

2.3.2.1 Exploring the concept of Identity

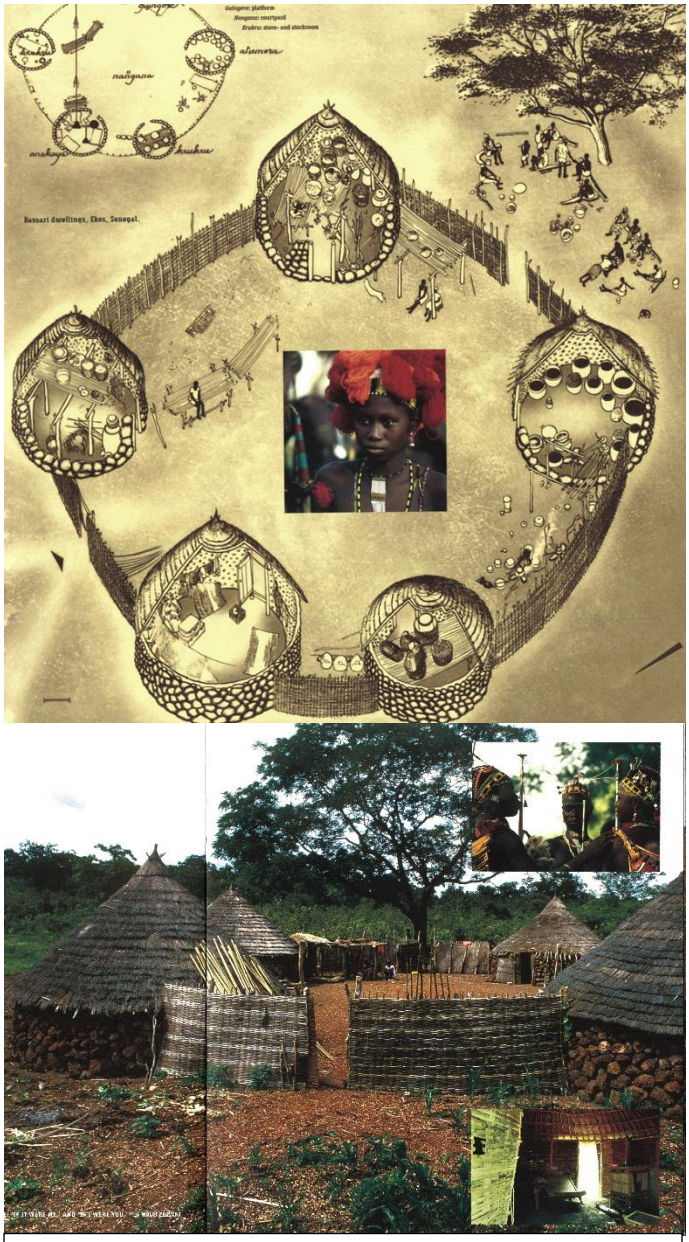


Figure 2.3b *illustrating repetition elements; circular form & materials in Bassari dwellings. Ekes,Senegal.* ***Source****: (Bourdier and Trinh, 2011:57-58).*

Identity is a unique process built by the community according to their uniqueness and understanding of cultural qualities**,** called cultural identity. Therefore, identity is always collective, fluid, and unstable process (Mahgoub, 2007), influenced by the culture which is forever on a constructive mode. Thus, the constant repetition of the same elements, objects or materials plays a role in the development of identity in a community **(Figure 2.3b)** (Hely, 2013). Lynch *et al.* (1991) describe identity as what makes an object recognisable and stand out as a distinct element from others. It could be an object's materials, commodities, shape languages, which contribute to its conditions and process that gives its character (Hely, 2013). The objects, materials or elements uniqueness has a deeper emotional or practical meaning to the user, which are stimulated by relation the user has with the specific place or the genus loci of an area or object (Lynch *et al.*, 1991). The natural stones, thatch roof and woven screens in Bassari dwellings **(Figure 2.3b)** make dwellings unique, shows the locally available materials, thus the dwelling demonstrates a specific community identity and becomes the most personal community property.

The group takes its unique architecture along wherever they go and build (Bourdier and Trinh, 2011:25). Thus, it is possible to find a group's identity on other sides of the world as people travel, especially in a global world of the 21st century.

2.3.2.2 Symbolism as a tool to express culture

Symbolism is the practical use of symbols on buildings to convey conventional meanings, through application of advanced materials, technology and construction technique. Symbols are meaningful to people who understand them and might have several connotations to different groups of people. Therefore, symbols are an expression of a certain cultural identity which unite different groups in the community (Oliver, 1975:84), (Bourdier and Trinh, 2011:25). The traditional house is one of the ethnic properties with the design signature expressed through symbolism, and the group takes it (property) along wherever they go. The indigenous construction materials and strategies also form part of symbols of a certain group as they convey a message to the group.

According to Bourdier and Trinh (2011:22), the house conveys a sentiment of nature, both functional and symbolic. The affection is caused by the involvement of dwellers in the design, conception, alterations, renovations of the house, which build a certain perception and understanding of their symbols which affect an individual life. The feeling is shared by close family and village that participated during construction (Bourdier and Trinh, 2011:25). This manifests that construction materials and strategies symbolise certain cultures to local people that outsiders never understand, thus require more focus before its selection for construction.

2.3.3 Conclusion

The signification of culture is evolving as human behaviour changes with time. Culture used to represent the common values and lifestyle of a small group of people. Lately, it represents the pattern of people on a global scale. Nevertheless, indigenous architecture symbolises the cultural identity of certain groups hence, it is relevant as it has something to offer the contemporary world to attain sustainable development and environment. Thus, it should be integrated into sustainable development policies and agenda.

2.4 INTEGRATING CULTURE INTO DEVELOPMENT AGENDA

2.4.1 Introduction

Lately, governments are encouraged to incorporate culture into their new policies, which will lead to successful developments, eradicate poverty, and achieve sustainable development. Therefore, this chapter will investigate and analyse the policies regarding the implementation of culture on the built environment from global, national and local regions.

2.4.2 The role of culture in sustainable development Agenda

Development agenda is a process led by the United Nations (UN) to frame the global development to meet current goals of that time. The development agenda aims to make the world a better place to live in, by investigating global issues and come up with strategies to resolve them. Currently, the UN development agenda formulated based on Millenium Development Goals (MDGs), a previous agenda ceased in 2015; is called 2030 Agenda for Sustainable Development (2030 ASD). According to Uclg (2018), the 2030 Agenda amended the previous development plan by implementing cultural aspects in sustainable development. The culture was implemented on 18 sustainable development goals and became the main catalyst to resolve all global issues including built form issues.

The sustainability studies in built form have been focusing on the environmental manageability while dismissing social or cultural and economic angles for a long time (Du Plessis, 2002). In previous years, the implementation of culture in global policies was less than 30% but is now mentioned in 70% of them (Unesco, 2012). Lately, culture has been implemented and emphasised in all development spheres policies; international, national and regional. The 2030 ASD, imply culture within the structure of Sustainable Development Goals to achieve peaceful inclusive communities, education, economic development, sustainable environment, sustainable cities, sustainable consumption and production patterns and food security (Unesco, c2019). The UNESCO, as depicted on their website, 2030 ASD, clearly states that '*culture is who we are and what shapes our identity.* Consequently, it is impossible to achieve sustainable development

without including culture since it initiates people orientated, equitable and inclusive development and also contributes broadly to poverty eradication (ibid).

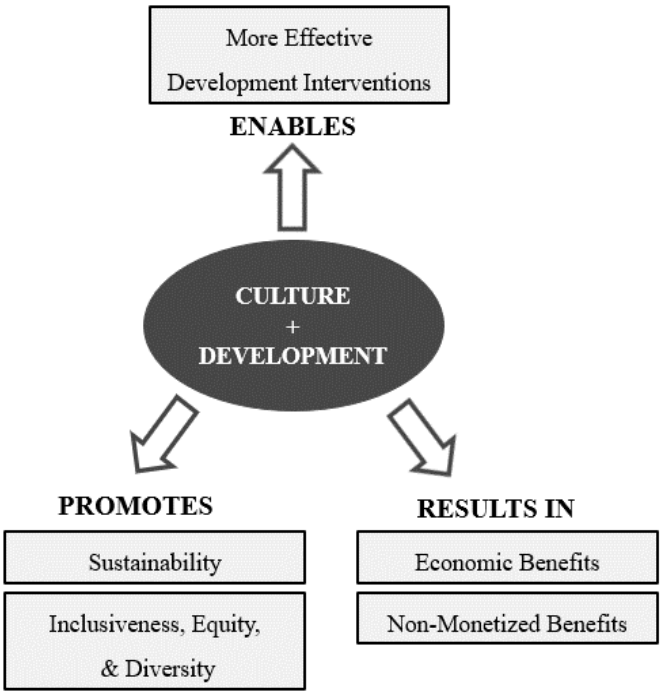


Figure 2.4a: *illustrates how culture contributes to development.* ***Source****:. (Unesco, 2012)*

In addition, the UNESCO has placed culture at the centre of policies development to achieve cultural diversity and successful globalised world (ibid). This implies that culture is a pillar for any development to be successful. **Figure 2.4a** illustrates the summary of influences and outcomes of cultural engaged developments. Culturally responsive developments benefit communities in various ways as it promotes the use of local resources innovative ideas, encourage community participation, enhances local businesses and skills. Furthermore, those interventions are always human friendly resulting in more effective and sustainable outcomes (Unesco, 2012).

Moreover, the role of culture in development requires a clear understanding of its impact on the final results. Thus, the 2030 ASD by UNESCO proposed 17 Sustainable Development Goals to govern the program, of which Goal 11 is to; make cities and human settlements inclusive, safe, resilient and sustainable Uclg (2018). The goal emphasises the need to enhance inclusive and sustainable environments, improve urban adaptability to manage any tragedies and reduce the environmental impact of cities Uclg (2018). The culture is relevant to accomplish goal 11 since most cities have a cultural heritage which contributes to local sustainable developments. Also, Uclg (2018) elaborates that indigenous construction strategies & materials and skills form part of cultural heritage, hence it should inform innovative approaches for existing buildings renovation and newly built form design.

2.4.3 Integrating culture into governance

In 2012, the UN System Task Team investigated the outcomes and relevance of culture to achieve sustainable development worldwide and the results were implemented in 2030 ASD. The task team reveal that integrating culture into governance is conception and practice towards equitable, inclusive, and sustainable development (Unesco, 2012). Also, engaging culture in developments promotes unity in community and develop businesses, especially among youths and in post-conflict situations. Consequently, the cities need to implement and amend policies and design policies to accommodate local culture to achieve sustainable local developments through built form Uclg (2018). The UNESCO suggests a cultural impact assessment within the development plan to guide on renovation and creation of more public spaces enforcing cultural interaction and participation Uclg (2018) which may be public buildings, streets, museum and arts centres and local skills development centres. Djenne Great Mosque, Mali **(Figure 2,4b-e)** is one of the UNESCO buildings made of earth material and preserve construction strategies as local people culture.

The Mosque was built about 500 years ago and has been renovated several times by local people with indigenous knowledge on construction strategies and materials. The mosque is a typical building that expresses local culture through built form; construction strategies and materials through created spaces. It has spaces for the community to gather and interact and a market area for trading cultural activities work by locals to eradicate poverty **(Figure 2.4e)** and utilised to accommodate massive community construction purposes **(Figure 2,4b)**. The main entrance is close to the market square. The skilled community members passed down the construction knowledge to the younger generation (**Figure 2,4c & d)** to achieve community resilience and ensure built form is taken care of in the future (Marchand, 2006). The building express local people culture and outsiders can also relate to it, hence UNESCO found it necessary to preserve the building and came up with policies that cities can implement to sustain culture and attain sustainable environment.

The UNESCO suggests that cities/regions can do some of the following to implement culture into policies effectively:

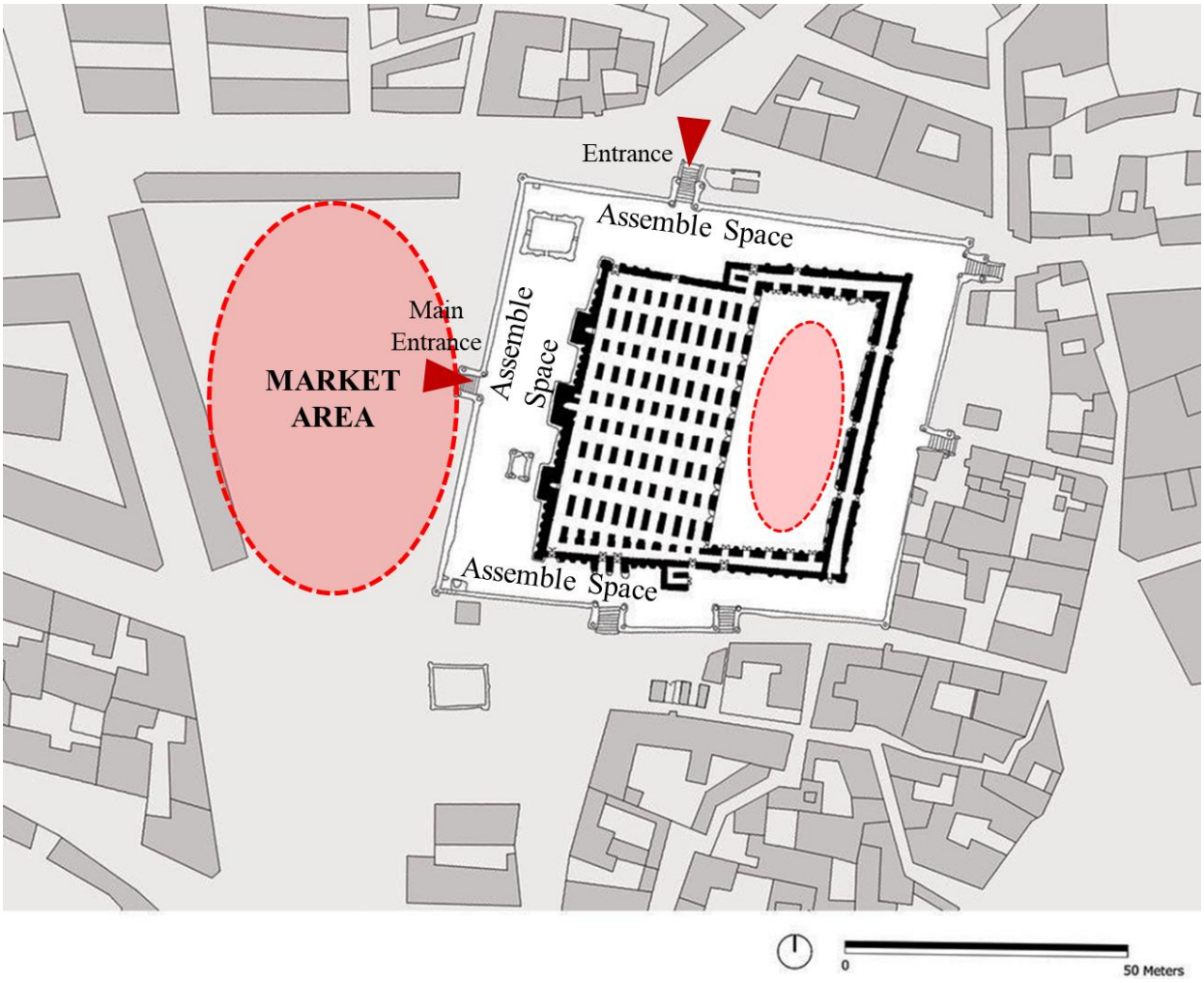


Figure 2,4b: *illustrate the site plan for Djenne Great Mosque, Mali.*

Source: *Modified by Author from https://archnet.org/sites/6395/media_contents/75605*

- *Adopt policies regarding the **protection of cultural heritage** in all its dimensions. **Promote an understanding that culture plays a role in sustainable local development**, through appropriate capacity-building, policy design, implementation and evaluation, etc.*
- *Allocate appropriate human, technical and financial resources to local cultural policies to achieve local sustainable development.*
- ***Keep an updated inventory of local natural and cultural heritage** and establish mechanisms for **its preservation and conservation according to international standards**.*
- *Foster the use of a reference guide on 'cultural impact assessment' within urban planning policies.*
- *Adopt measures to **promote the role of culture in the renovation of historic centres and the neighbourhood, district and regional development plans.***

Figure 2.4c: *illustrates seniors & youth engaging during construction of the Great Mosque.* **Figure 2.4d** *illustrate community participation, during renovations of Djenne Mosque in Mali.* **Source**: *https://archnet.org/sites/6395/media_contents/75605*

In South Africa, the national legislation embrace all cultures as Section 30 of the Constitution 1996 allows the right for everyone to "*participate in the cultural life of their choice*" and section 31 states that; "*any member of a cultural community have the right to enjoy his culture together with other members of that community".* South Africa (SA) cultural policies are highly influenced by UNESCO, African Union (AU), SADC and other organisations promoting multiculturalism context (Du Plessis and Rautenbach, 2010). SA national Department of Arts and Culture agenda and goals also comply and promote the country's cultural diversity. As a result, in Africa, SA is known for its great achievement of good cultural governance (Du Plessis and Rautenbach, 2010). This connotes that the built form should not only accommodate the local community but should also correlate to everyone including the international community.

Figure 2.4e: *illustrate the Market area/square with community trading their various stocks. The built form support or contribute to community resilience and development through cultural activities.*
Source: *https://archnet.org/sites/6395/media_contents/75605*

2.4.4 Conclusion

UNESCO has discovered the importance of culture and its great influence on successful developments. As a result, it recently developed the new agenda with culture as a driver for most policies that guide developments and encourage local regions government to implement it to attain sustainable developments. The indigenous buildings are of cultural driven development and they attain community resilience and sustainable development and we should learn from them. South African polices acknowledge culture & aim to incorporate it in developments.

2.5 CULTURE ON CONSTRUCTION STRATEGIES & MATERIALS

2.5.1 Introduction

According to (Rapoport, 1969); (UNESCO, 2012); any building form which may be in town, village, or house, patterns/layout are the results of different socio-cultural factors from the local area which effectuate the building. Therefore, cultural forces are the main or primary factors that shape the building form. Sanya (2007) adds that sustainable construction strategies and materials are specific to the culture and each culture has historically common building materials. The indigenous African architecture has tons of hidden cultural connotations behind construction materials and strategies used, compound layout, building process and spatial planning. The underlying connotations are only understood by locals and guide how, where, and why they do things the way they do. Therefore, this section will investigate underlying cultural principles and beliefs and how they influence the built form and create meaningful environment.

2.5.2 Construction strategies and materials component on built form

Construction materials and technology go hand in hand. Materials and technology or strategy together with climate, site, social issues, economics, religion are all principals or theories that affect the building form. However, they are considered secondary or modifying factors as they do not justify decisions on what needs to be built and never determines the building form on its own (Rapoport, 1969). Generally, the very same materials can result in absolute different forms

determined by socio-cultural forces. Therefore, the role of construction strategies and materials is to engineer and respond to the ideal environment, and climatic conditions as physical environment component, and enclose the designed space and transform the space organisation (Rapoport, 1969).

Nevertheless, they affect how the space function and can hinder some procedures from taking place and make people feel in a certain way. Therefore, they affect the form predominantly even though the form is not completely dependent on them. Thus, their importance cannot be undervalued in the built environment. As Rapoport (1969) state that space should be confined to create a place, and materials and techniques are used to enclose those areas. Moreover, people discover new knowledge of construction materials and strategy every day. Consequently, building form also advances and becomes more complex as new knowledge on construction materials and strategies is acquired at time Rapoport (1969). However, the materials and structures techniques improvement are not guaranteed, and people might not implement it to their buildings.

Therefore, construction materials selection is a complex issue. However, the architectural history including indigenous architecture contribute in determining the acceptable materials in a region, to create a sense of place, unique signature, and to blend well with the neighbourhood (Halliday, 2008, Steyn, 2014). Most regions keep certain skills and crafts based on the construction materials they use; thus, it contributes to local culture/ heritage of the area and local participants. Also, locally harvested materials result in the building that blends very well with its context (**Figure: 2.5a, b,c**). Seamon (1991) considers such blend a phenomenology of the landscape which investigates on how users experience the landscape, as a result, it enforces architectural design and materials that respond to the landscape that influences the character and sense of place Seamon (1991).

2.5.2.1 Phenomenology and Tectonic Concept

Phenomenology is understood as a critical, meaningful knowledge of how people directly experience and become conscious of objects or space through all human senses (Stewart and Mikunas, 1974); (Seamon, 1991). The concept focuses on hidden patterns that display the complete human experience because of the object or space without being critical (Seamon, 1991).

Its foundation is not about using different materials in construction, but the way people understand the materiality world which may be oblivious or not. Thus, it questions the moods, emotional states and attainments of people in different contexts as a result of materiality surroundings and environment (Souto, 2013). Consequently, construction materials and strategies used for construction contribute to how people experience the space and built form as a whole.

Figure: 2.5a, b, c: *indigenous Himba tribe hut, clothes & craftwork respectively blend well with the site.* ***Source****: (Steyn, 2018).*

Accordingly, the indigenous environments provide with daily basis living, less complex and honest to the local community and those are essentials core and foundation of humanness & experiences through available materials and strategies, without bling (Seamon,1991). Hely (2013), complements Seamon's thought when stating that architecture develops a visible identity through the creation of space by carefully selecting construction materials and technology, focusing on final design appearance, and by creating analogous experiences along spatiality, materiality and tectonic experience that represent or have a meaning to interplay placemaking. Seamon (1991) make an example that as much as an outsider might find the place underdeveloped or unsophisticated, the users always strive to be home because of underlying experiences the users have with a place. Leslie (1998), adds that whenever people crafted objects, it provides with an honest experience and offers memory, which creates a special bond between the two, thus people enjoy vernacular environments.

2.5.3 The cultural principles on the selection of construction materials & strategies

Africans have myths and profound understanding of construction materials used for indigenous buildings. Those beliefs are still relevant in indigenous communities. As a result, their architecture acknowledges and respects relations with nature, people and God/Spirit (Chabal and Daloz, 1999,

Senanayake, 2006). They believe spirits are everywhere in courtyards, in the village, fields as they speak to them in case of need and inform them of the community events. They are called whenever a new house is built since houses are only protected and recognised once reported to them, and they guarantee the continuity of the family lineage (Bourdier and Trinh, 2011:40). The ancestors' altars are usually pillars or conical mounds located next to specific dwelling entrance (Bourdier and Trinh, 2011:39). Consequently, West African countries such as Mali, Burkina Faso, Niger and Ghana, respect the soil and perform rituals before they touch it, before any construction events (Bourdier and Trinh, 2011:11).

2.5.3.1 The importance of the circle in most traditional African culture

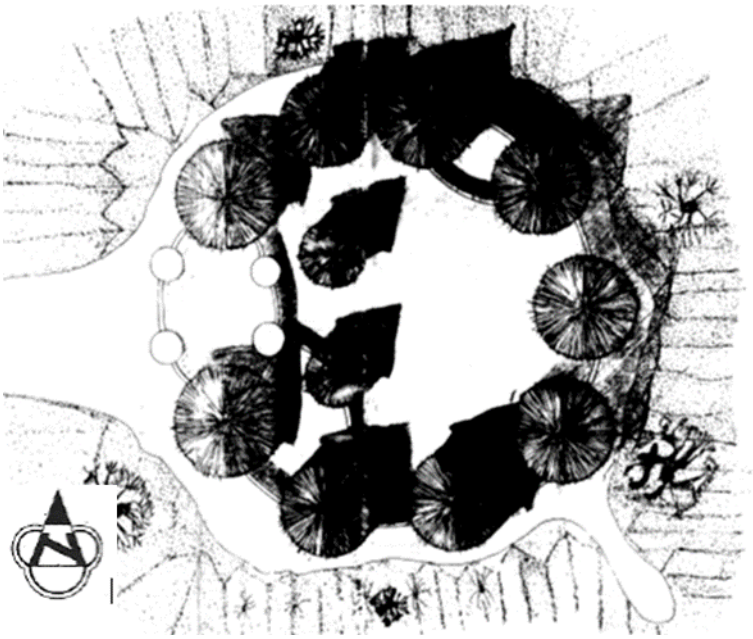


Figure 2.5d: *Site Plan for a Typical Batammaliba compound.* ***Source****:* (*Yavo: 2013: 116).*

Yavo Phillipe carried out a study in West Africa, emphasise that circle symbolises completeness, harmony, holiness, considered as the source of wisdom and represent ancestors/God or Spirit in traditional African cultures (Yavo, 2013:49). The circular form of the rondavel is intended to align the homestead with the Creator and the completeness of life. The traditional architecture in Western Africa countries reveal the importance of circle within their cultures hence their traditional dances, utensils are circular as well. Nevertheless, Southern Africa traditional architecture layout also use the circular form. Kwabena (1995:63) states that circularity reveals a hierarchy in the urban structure or compound layout while providing with a sense of control of the

environment. It allows everyone to occupy a front-seat, enhancing unity as everyone is interconnected (Yavo, 2013:47). Therefore, these African cultures and circularity are inseparable. Their traditional settlements have an organic circle and cones forms and were surrounded with organic or circular walls or screens to give it a sense of place and separate the public from semi-private (Kwabena, 1995:64).

2.5.3.2 Exploring Earth Architecture

Earth could be soil or land at home, building soil, and graveyard soil. Food grows from the soil, soil makes a man; (according to some African myth, a man was formed from clay), and everything man makes is linked back to the earth. Consequently, they believe the earth's power is infinite and continuously generated. Thus, it is respected and touched carefully as a mother of all fertility, life, and including architectural creation (Bourdier and Trinh, 2011:11). Nevertheless, constructing a building on earth distract the harmony of the earth spirit. The process involves digging and removing vegetation and ploughing of the land which interrupts natural order. Thus, it requires an appeasement and reconciliation ceremony since the earth is more than just a place to dwell and ill-treat its nature, but a complex source of life and the end or destination of which life returns at the time of death (Bourdier and Trinh, 2011:53). Therefore, the construction materials are selected with the purpose to connect the family/community with ancestors/spirits. Man as the head of the family and leader of the compound dwellers is the one who communicates with the ancestors with the help of the family mediator. The most indigenous African urban planning reveals the importance of structure, which is influenced by the Spirit/God/ Ancestors, as the headman's space is usually at the top or in the middle and surrounded by village members dwellings.

The earth is the most used construction material especially in most hot-arid and temperate climate zones. It has been used as a natural and abundant construction material for more than 9000 years (Minke, 2006). Halliday (2008); Keeler *et al*. (2016), revealed that more than 3 billion people live in houses made of unfired earth as the construction material. Earthen architecture is found in many African countries (Bourdier and Trinh, 2011:86). The soil of most African regions is well mixed with variable proportions of sand, clay, and water and ready for construction purposes. It saves energy and keeps the good temperature and flexible for artistic ornaments, provides excellent

insulation and good heat storage. Local resources create structures that are easy to extend at low cost as need requires (Bourdier and Trinh, 2011:86). However, earth construction material is still associated with poverty (Minke, 2006) and doubted by many people. Contrarily, the material was/is used for big-scale building such as religious buildings and cities e.g. the mud town/ great Mosque of Djenee in Mali **Figure 2.4e**, etc. There are many ancient structures built of the material and are still existing (Minke, 2006), to prove its strength and durability as local community maintain those structures.

Lately, the earth as a construction material is getting more attention because of the dominance of sustainability construction concept (Halliday, 2008). The affordable and economical material consumes very less to nothing energy during the process of construction. Consequently, less pollution and carbon are emitted during the process since it is dug from the site or close by. It is easy to use earth; however, builders must have a certain skill to attain earth's proper finish (Minke, 2006). It requires a suitable soil since too much clay cause 'cracked when the air is dry. Also, too much sand makes earth week and erodes easily in the rains.

a) **Rammed Earth architecture:** The Batammaliba dwelling in Togo

Figure 2.5d*: illustrates an aerial view of Batammaliba dwelling in Togo.* ***Source:*** *(Yavo. 2006:106).*

Furthermore, Batammaliba architecture (**Figure 2.5d)** is known for embracing and denoting elements of nature/materials & strategies to connect with spirits through anthropomorphism inspired approach (Bourdier and Trinh, 2011:76);(Yavo, 2013). The Batammalibaland dwellings in Togo, regard the newborn child's body as earth or clay and gives strength; water represents the blood, stones as the bones, and for breath (air) the holes symbolise it and let the air in (Blier, 1981:238), and could be windows and doors. This mythology is respected in indigenous communities, stimulate the strong honour of nature at large and thrust the usage of natural construction materials and environmentally friendly strategies in Africa. The indigenous built form in Africa reveals cultural connotations.

In addition, the Batammaliba community believe ancestors are omnipresent and represented with different elements of the dwelling in a yard (Yavo, 2013). Thus, they use a snake devouring its tail symbolising an infinity principle. This symbolises the continuity of village people and stability. Consequently, Batammaliba traditional architecture concept is inspired by circular form generated from infinity principle (ibid) illustrated in **Figure 2.5e**. The circle is a very important element in African cultures.

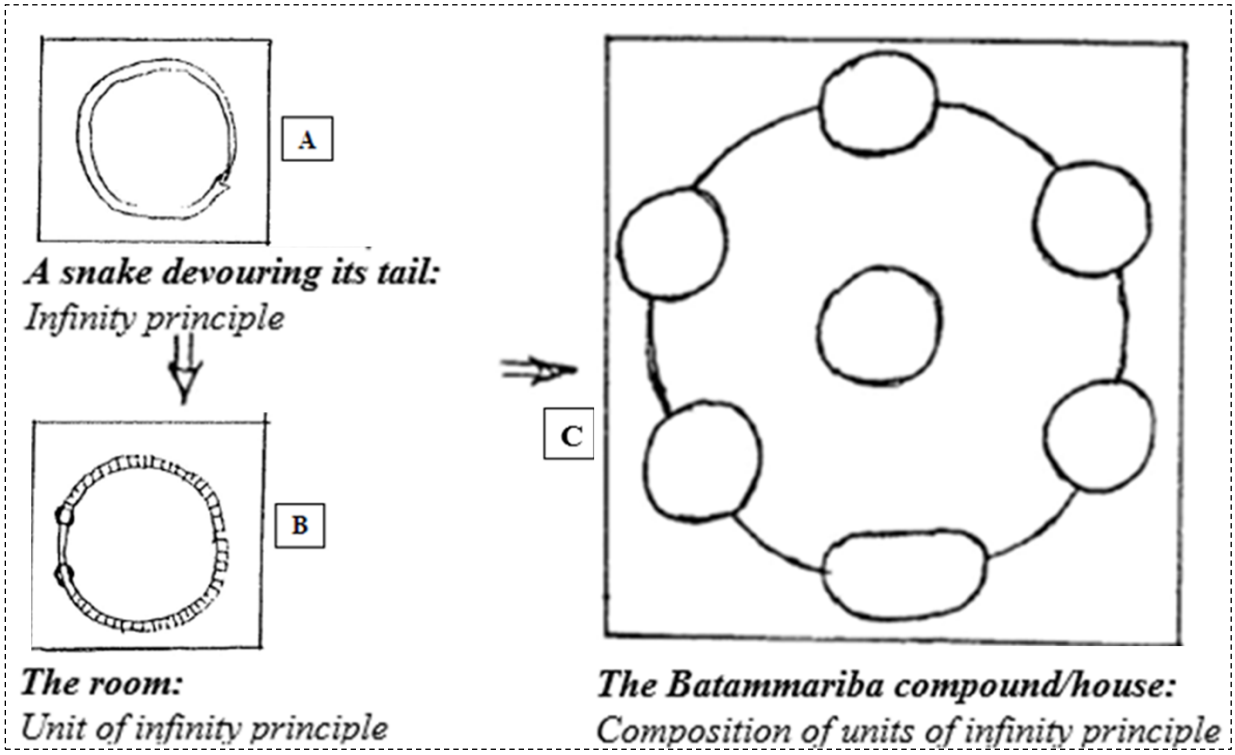


Figure 2.5e *illustrating snake gobbling its tail symbolising infinity principle as a concept of Batammaliba dwelling and compound.* ***Source****: (Yavo: 2013:50)*

- Physical orientation of Batammariba compound

The layout/ physical orientation, openings of the Batammaliba compound stems from the belief of two worlds which are; natural physical world concern the winds movement, rainfall direction; and supernatural world concerns the evil spirits movement direction as illustrated in **figure 2.5f**. The North is regarded as an evil direction thus most dwelling entrances don't face it. The East receives very harsh climatic conditions including heavy rainfall direction. Thus, West is the most preferred entrance to a Batammaliba house; as they believe it is supernaturally neutral. Also, it has climatic advantages than other directions; no harsh and dusty winds, and harsh rainfalls (Yavo, 2013).

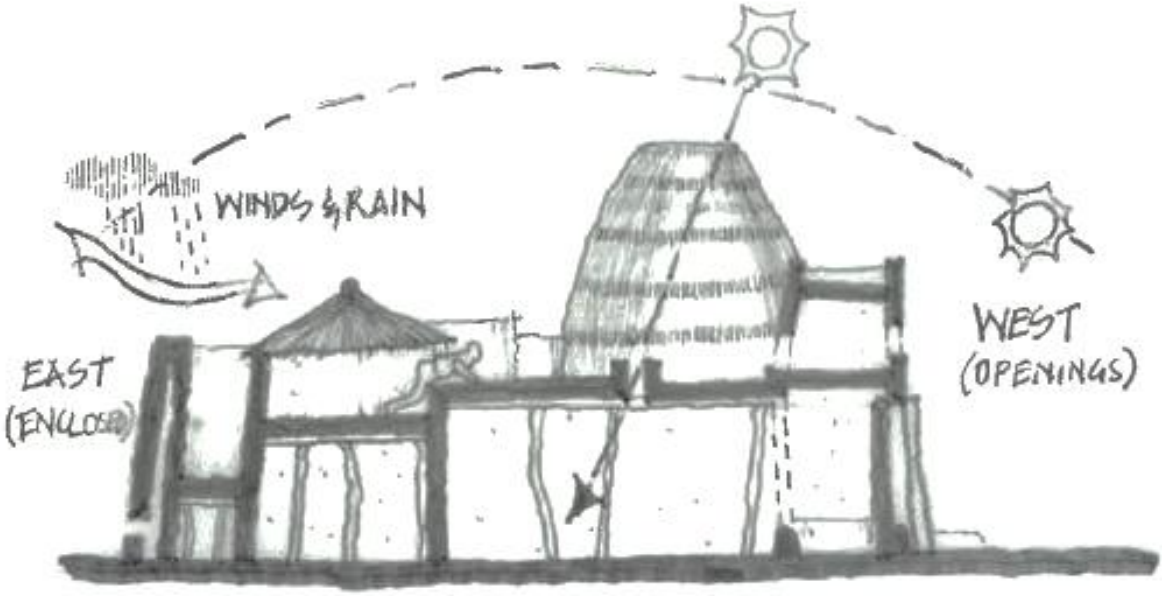


Figure 2.5f: *illustrate a typical section of Batammaliba compound corresponding to world principles such as climate and landscape.* ***Source****: Modified by Author from Bourdier and Trinh (2011:79)*

- Batammariba Construction techniques and materials

The Batammaliba cluster is usually two-storey with tall towers, granaries, and pointy conical roofs which form multiple and monumental pieces of sculpture facing the sky. The layout forms a circular shape surrounded with a vertical wall which is usually three to four metres high and covers a big open terrace (Yavo, 2013). Every building construction is a way of establishing relationships (Bourdier and Trinh, 2011:69). Thus, the men dig foundations, raise walls framework and roofing while, women plaster the walls, decorate walls, and add all the fittings to furnish rooms. In that way, a house construction becomes a platform for male and female constant interaction principles.

The house is coated in powdered red laterite to give the reddish colour to walls. The red colour of the soil blends with walls colour, and colour of sun (rising and setting), of blood relating to new-born. (Bourdier and Trinh, 2011:62).

The Batammaliba builders are known for their intelligent architectural ability to use the rammed earth. According to Minke (2006), earth mixture is poured inside the two thin timber walls or boards of formwork separated with the spacers and can achieve any form/ shape. However developed countries sometimes use industrialised machines to speed up the construction process, which is not as environmentally friendly as the original strategy. Also, the technique requires no plaster and less labour but does not provide adequate thermal insulation in very cold climates (Minke, 2006).

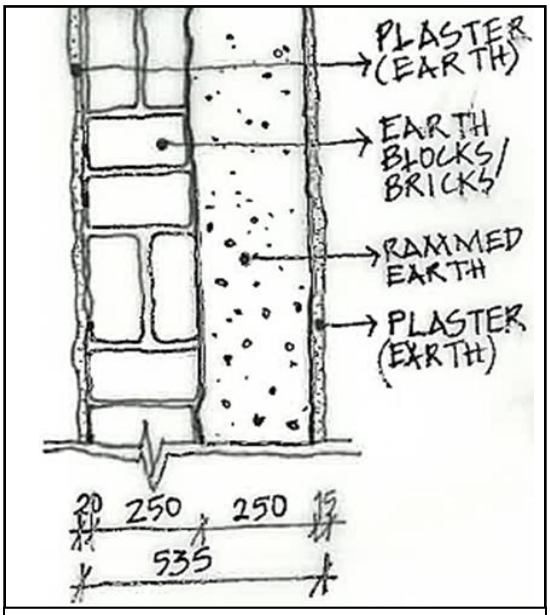


Figure 2.5g: *Rammed earth detail covered with earth blocks & plaster.* ***Source****: (Modified by Author from Minke, 2006)*

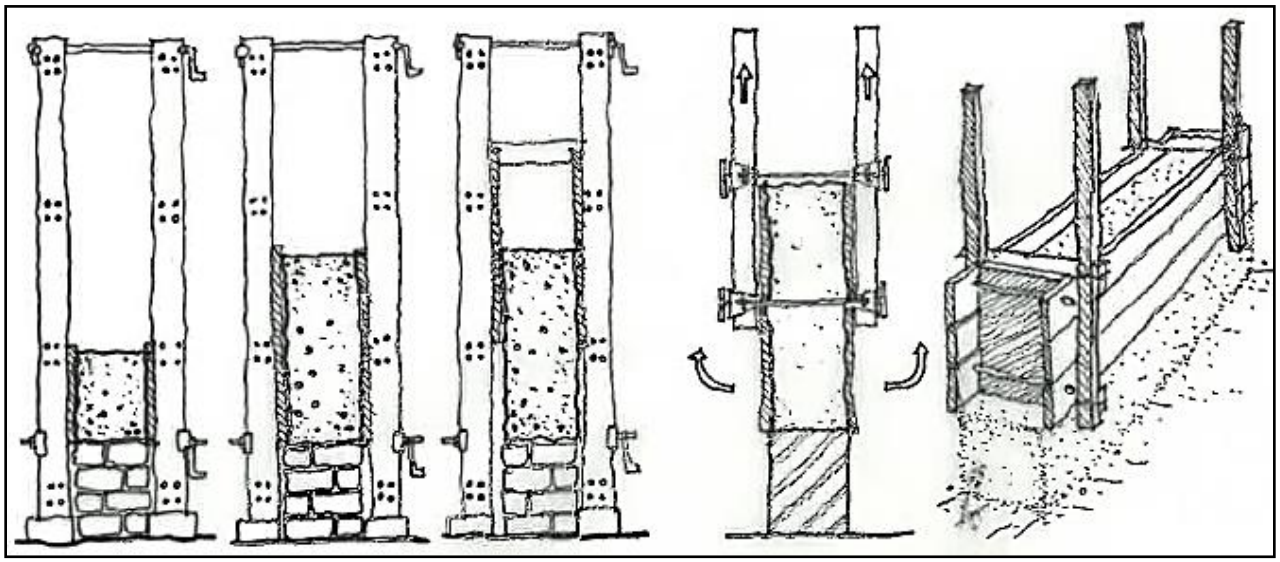


Figure 2.5h *illustrate techniques (in section and 3-dimensional view sketches) to construct* Rammed earth using parallel panels. ***Source****: (Modified by Author from Minke, 2006).*

b) **Adobe earth architecture**: The Seerer dwelling in Senegal

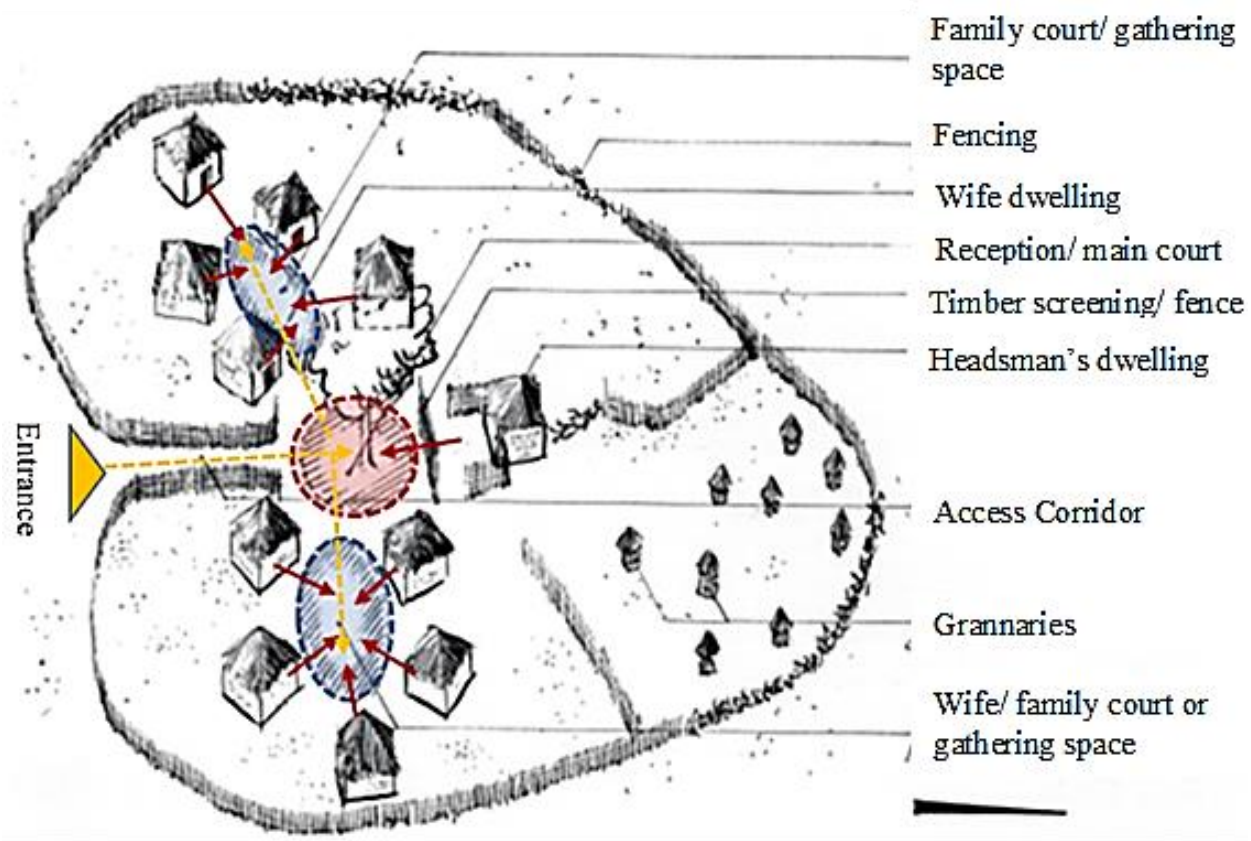


Figure 2.5i *illustrating Seerer compound layout in Senegal*. ***Source****: (Modified by Author from Bourdier and Trinh, 1997:195)*

The Seerer dwelling in Senegal compound illustrated in **Figure 2.5i** emphasize the importance and role of a man as a headsman of the compound. The headsman's dwelling is in the middle of the compound, after the corridor access that leads straight to his space. It reveals man's duty of communicating with ancestors and outsiders as a family representative. The reception court is in front of his dwelling and used for public meetings, interaction space, space for learning, knowledge sharing, administration and more (Bourdier and Trinh, 1997); (Bourdier and Trinh, 2011). The courtyard is very important in West African culture because they use orals communication. The compound also has family courts in front of each wife's dwellings, which become private courtyard yet still have visual access to the public or main courtyard (Bourdier and Trinh, 1997:202). The tree gives a sense of place within the courtyard (**Figure 2.5i)** and also has cultural motives as together with the earth, connect dwellers with their ancestors (Bourdier and Trinh, 1997:186). The compound layout is derived from a tree concept (**Figure 2.5j)** which is also sacred.

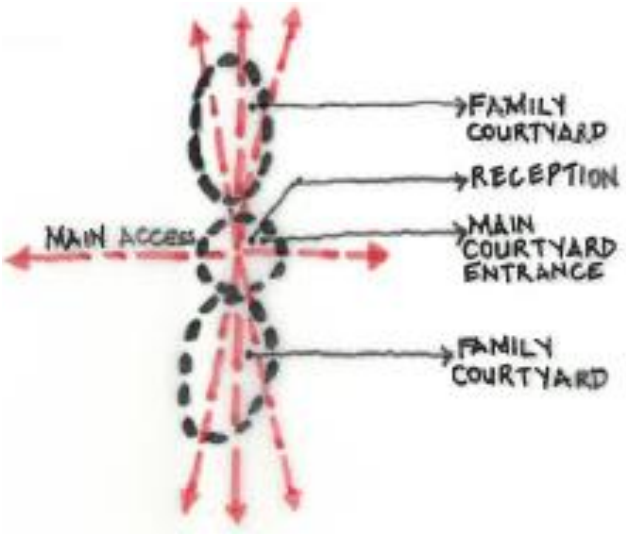


Figure 2.5j *illustrates the axis principle of expansion in Seerer compound dwellings. The strong entrance axis allows the interaction between outside and inside world, symbolising the tree trunks from which the roots originate and spread along the main segment.* ***Source****:(Modified by Author from Bourdier and Trinh, 1997:202).*

Seerer dwellings are made of adobe, also called sun-baked dried blocks or mud bricks or earth which were discovered about 8000 to 6000BC years in Turkestan. Most ancient vaults and domes illustrated in **Figure 2.5k** were made of earth blocks, including the ones in Africa, whereby the structure was not supported during the construction process (Minke, 2006). The blocks are made by filling timber moulds, which comes in different sizes illustrated in **Figure 2.5l**, with earth mixture, and smoothen it by hand or timber, and leave it to dry out. It is assumed that each person can make about 300 earth blocks per day. Nevertheless, industrial techniques are also used to speed up the process, which is economically positive, but not as environmentally friendly as the original strategy. However, the disadvantage of adobe blocks is that they sometimes require about 4 – 8% cement to give it more strength (Minke, 2006).

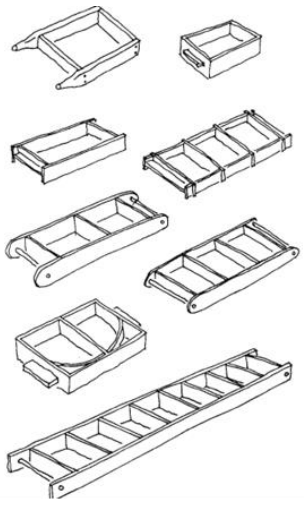


Figure 2.5k *illustrate wooden moulds to make adobe blocks, and* **Figure 2.5l**: *Nubian vault made of adobe blocks under construction. The adobe can be plastered with earth plaster to achieve a smooth and attractive surface.* ***Source:*** *(Minke, 2006)*

2.5.4 Conclusion

Culture influence the selection of construction materials and strategies used in traditional architecture. However, those predominant underpinning region's principles in Africa are never revealed and result in environmentally friendly and familiar built environments to local people. Community relate to those environments as they define their identity.

2.6 CONCLUSION

Culture is a variation of diverse material, spiritual, stir emotions of a community or group, and incorporates ways of life, value frameworks, traditions and beliefs. It is everything. However, it's been ignored in many built forms, and communities are struggling as developments are beyond their region's capacity, which results in poverty and breakdown of community resilience. However, indigenous planning corresponds to local cultures thus, the contemporary world should learn from it to attain a sustainable community. UNESCO has discovered that culture is a catalyst of successful developments, hence it has implemented culture in global sustainable development policies and agenda; 2030 ASD. The regions' culture should be studied thoroughly before any development take place, as UNESCO emphasize the importance of localising the developments to ensure it's in harmony with local community. The local construction strategies and materials used in communities also form part of culture thus, it could be discovered during analysis of local areas prior developments and be reinterpreted in contemporary world. This approach is sustainable as it addresses cultural, environmental and economic aspects.

CHAPTER 03:

SUSTAINING INDIGENOUS KNOWLEDGE SYSTEMS THROUGH BUILT FORM

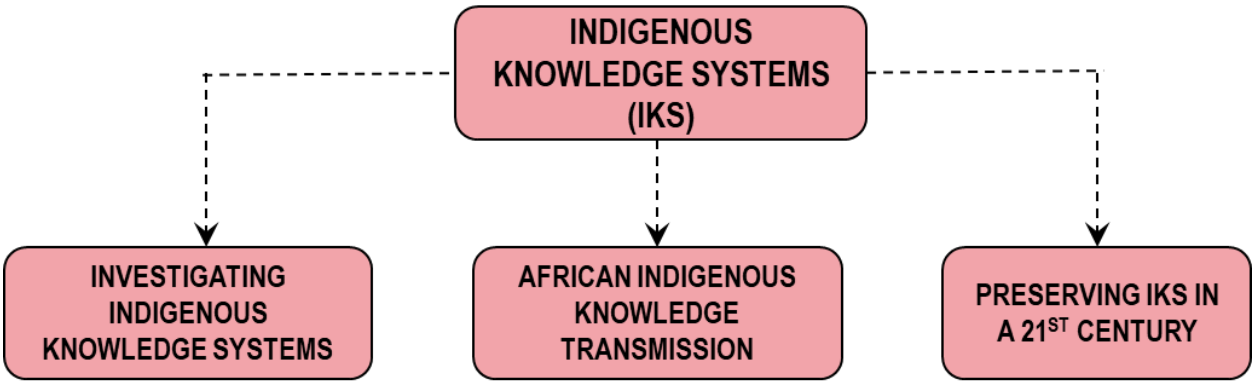


Figure 3.1: *Highlight the structure and content for CHAPTER THREE.* ***Source****: By Author*.

3.1 INTRODUCTION

In 1990, Rapoport revealed that only 2% of buildings in the world are designed by architects while 98% is of vernacular architecture (Rapoport, 1990), hence indigenous architecture cannot be ignored. (Oliver, 2003) adds that 90% of the world's buildings are of vernacular architecture. Thus, Norberg-Schulz (1971) accentuates that disregarding indigenous structures from the architectural world is of imperfect judgement, as most people live in them and they provide with unsurpassed methods and different cultural responses towards, technologies, site, climates etc. (Rapoport, 1990). Besides, indigenous people have been surviving through IKS for many years and have survived severe climate conditions, strengthen community resilience, and obtained sustainable environments (Magni, 2017).

Therefore, this chapter will investigate the IKS and AIKS first and explore strategies to transfer the knowledge to younger generations. This is an architectural study or research; thus, the focus will be on architectural IKS which is also known as vernacular architecture, primitive architecture or traditional architecture. The study will finally investigate ways to incorporate ideas from IK and strategies to implement it into the contemporary world as sustenance means.

3.2 INVESTIGATING INDIGENOUS KNOWLEDGE SYSTEMS

3.2.1 Introduction

The past disasters in the world and the fact that there are about 370 million indigenous people in this world who still live in a sustainable and indigenous manner, has resulted in the growing interest in IKS at a global level (Magni, 2017). The IKS are now considered as possible solutions to these past year's tragedies and with possibilities to advance many people's lives differently. Therefore, this section will investigate the IKS initial perception and current status as it evolves with time.

3.2.2 Defining Indigenous Knowledge Systems (IKS)

Indigenous Knowledge can be any skill or knowledge built up by indigenous people and passed from one generation to the next through oral transmission, repetitive or everyday life engagement,

people's science and practical learning (Breidlid, 2009);(Mekoa, 2018);(Senanayake, 2006). It is also understood as knowledge collected by local people over a long time of surviving very close with nature (Mekoa, 2018); (Kassa and Temesgen, 2012). The knowledge is characterised by practice and beliefs, know-how skills, technologies and strategies, including sustainable construction materials, that allows a group of people to attain a stable living in their specific environment (ibid). Also, IK reveals diverse cultures and geographical location as it is also influenced by social, political, and economic context (Senanayake, 2006);(Jauhiainen and Hooli, 2017). Thus, SCSM is a form of IK and imply a specific group culture (Sanya, 2007).

Furthermore, for a long time, IKS has been understood as a rigid knowledge and substitute knowledge for poor rural people's development initiatives (Mekoa, 2018); (Sanya, 2007). Thus, rural communities in developing countries (Jauhiainen and Hooli, 2017), destroy indigenous structures when they can afford to buy industrialised materials. As a result, the architectural IK is slowly getting lost, yet it is valuable as a complex approach towards a sustainable built environment. However, the IKS theory now dwells on how indigenous & non-indigenous people from specific areas interact with the environment with the purpose to fuse and implement useful knowledge into contemporary interventions (Kassa and Temesgen, 2012).

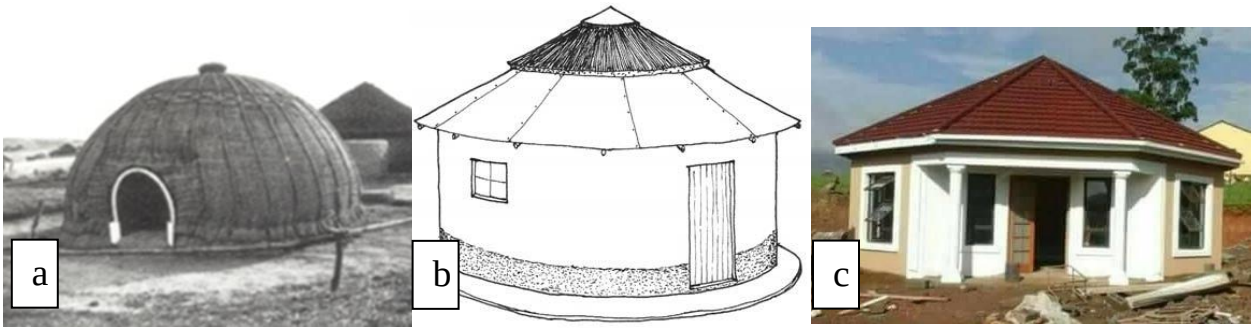


Figure 3.2a-d: *Indigenous Zulu hut evolution from organic to modern world materials to satisfy modern society needs.* ***Source****: (Frescura, 1981).*

The Zulu hut evolution implies the resilience which consists of different knowledge integration, though Mercer *et al*. (2009), warns that the process might destroy communities when implemented improperly. The Zulu hut has evolved from pure organic grass thatch materials (**Figure 3.2a)** to earth/mud materials, to glazing on windows and door, & roof tiles being implemented as available materials in a contemporary world (**Figure 3.2d)**. Also, the planning has evolved into a house with

corner to fit in modern furniture. Nevertheless, the anchor of a circular and embracing form is still there. Lately, IKS received more attention because of their holistic and organic, environmentally friendly, and people-centred characteristics (Senanayake, 2006); (Jauhiainen and Hooli, 2017);(Breidlid, 2009).

3.2.3 Conclusion

In the late 21st century, the IKS perception has changed from old styled, poor people lifestyle and rigid knowledge, into a model to learn from sustainable ways to develop communities successfully. IKS differ with their context thus, AIKS is different from WKS. Therefore, to gather more knowledge on the study area, AIKS will be examined in the next section.

3.3 AFRICAN INDIGENOUS KNOWLEDGE TRANSMISSION THROUGH BUILT FORM

3.3.1 Introduction

AIKS is the science which indigenous African people developed before colonisation or introduction of WKS in their regions (Mekoa, 2018). Therefore, the purpose of this section is to examine AIKS, investigate its transmission and influence on community participation and solidarity. The section will focus on KwaZulu architecture and region to narrow down the scope.

3.3.2 Reviewing African Indigenous Knowledge

Africa still needs to bring back the dignity of all kinds of AIKS that was tarnished during colonisers reign (Jauhiainen and Hooli, 2017). Colonisers disabled the continuation of AIKS development and its technical growth deliberately to promote WKS (Mekoa, 2018). Their legal system discredited AIKS. As an illustration, in the Republic of South Africa, the Witchcraft Suppression Act of 1970 prohibited the practice of AIK traditional medicines. AIKS work in its entirety, hence indigenous architecture was also paralysed in SA and neighbouring countries. Till today, people believe architectural development can only be successful through WK, as a source of intelligence, whilst AIKS is perceived as primitive, limited, traditional and for low-class people (Mekoa, 2018).

Some African countries have tried to fuse AIKS with other knowledge systems, universalise and implement it into other similar underdeveloped districts so as to revitalise AIKS as the root of new innovative and socioeconomic strategy (Jauhiainen and Hooli, 2017). However, the challenge is that AIKS are strictly based on the local context. As a result, the innovation system always requires to be adjusted into a specific local context with few people. The Zulus in Southern Africa, used about seven different types of grasses based on their availability to build the traditional beehive. This forced the tribe to be creative and adaptive based on available materials and limitations. Consequently, their hut form is rich and diverse yet from one tribe and province (**Figure 3.3b)** (Frescura, 1981:44). Therefore, most countries are aware of AIKS potential and the importance of including it in their development agenda.

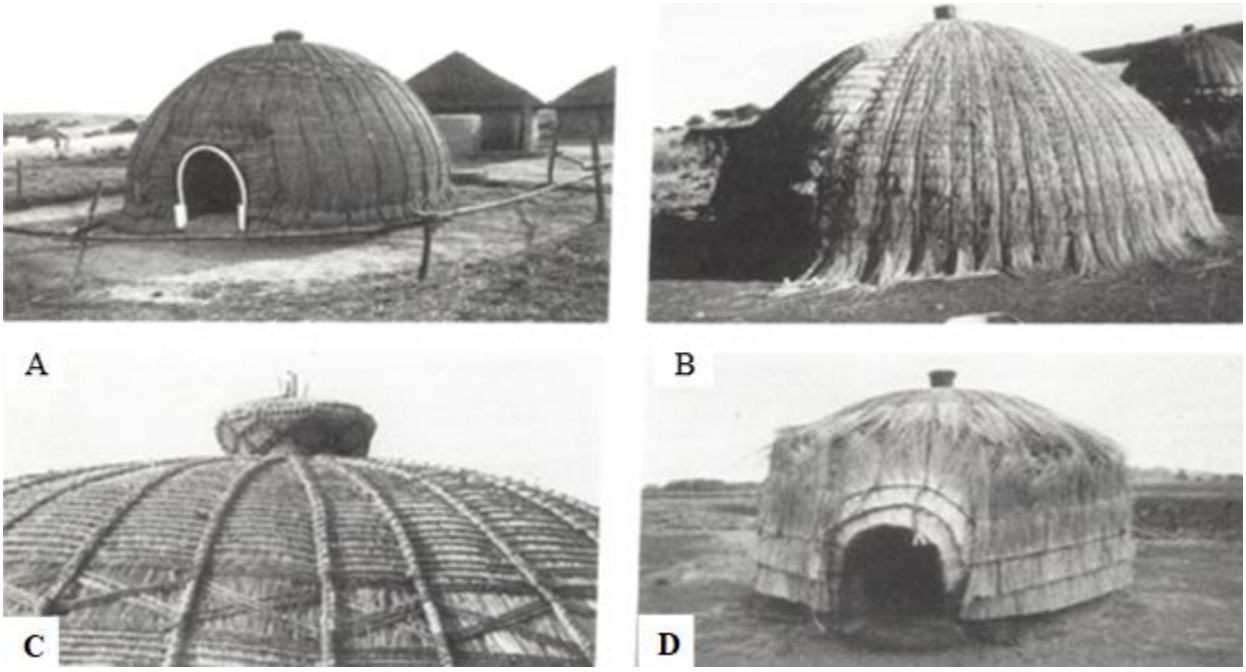


Figure 3.3b: *illustrate different characters of Zulu beehive as a result of materials available in different locations within KwaZulu.* ***A*** *&* ***C*** *- Ndalini,* ***B*** *– Tugela Ferry,* ***D*** *- Bergville. This shows the adaptability of indigenous architecture and it's strongly rooted in materials availability.* ***Source****: (Frescura, 1981:44).*

Nevertheless, Africa has various small tribes with various great traditional architectural conceptions and construction practices (Pearson, 1994) that offer a good lesson on the built environment. AIKS use well-thought strategies and techniques to manage locally accessible materials to fabricate regions without any import from outside sources (Kwabena, 1995:72). Therefore, there is still a gap on how to create a common AIKS innovated approach to suit different

regions & cultures (Mahgoub, 2007). The question that needs answers is; what should be grasped from original AIKS? The continent may have the knowledge to teach the world regarding environmentally friendly construction systems to achieve sustainable development (Breidlid, 2009), and improve developing countries socioeconomic conditions (Jauhiainen and Hooli, 2017).

3.3.3 Knowledge Transmission Strategies

Knowing that the future is secured by teaching generation strategies to take care and use materials sustainably make people feel secured. Knowledge transmission is important since the relationship between human beings and the built environment is of continuing involvement than a once-off matter (Bourdier and Trinh, 2011:54). The transfer of strategies makes AIKS more different as it is more participatory on-site (Marchand, 2006). The transmission takes place during the construction process, prior to building construction when collecting and putting together construction materials (Magni, 2017). The traditional house is both constructed habitable space and a platform of learning (Bourdier and Trinh, 2011:15). Thus, discarding indigenous architecture results in unstable community and family solidarity (Sanya, 2007, Mekoa, 2018).

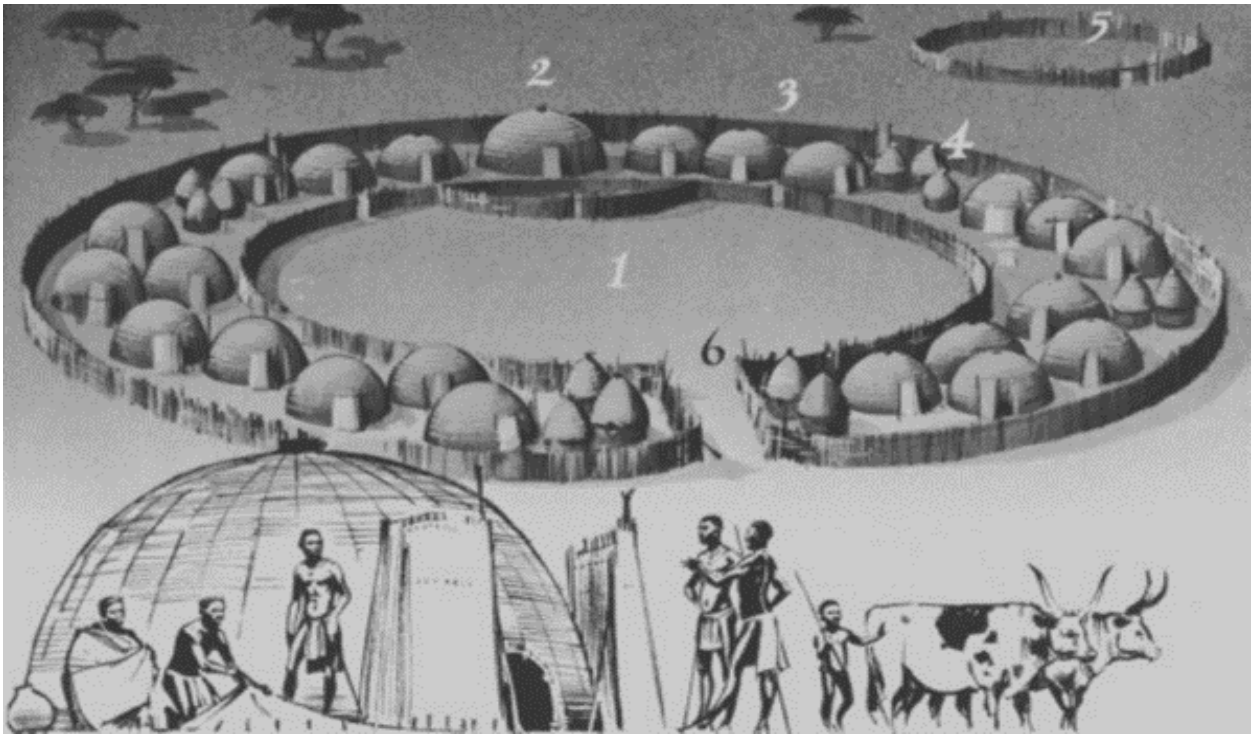


Figure 3.3c*: illustrate the circular Zulu homestead layout with **1**. – cattle enclosure. **2**. – Chief's/ Head man hut. **3**. – Chief's first wife quarters. **4**. – Storage. **5**. Goat kraal. **6**. Main entrance. (**Source**: https://thelastdiadoch.tumblr.com/post/119520451920/mthethwa-zulu-military-reforms-and-the-buffalo)*

The bottom-up approach process is a platform of passing knowledge to the next generation, presenting a certain community vision to the world and a unique response to problems of dwellers resolved collectively (Bourdier and Trinh, 2011:25). It strengthens socio-cultural matters through community participation, including young and old members (Frescura, 1981); (Steyn, 2018). Therefore, house construction operates as a social regulator that reinforces the spirit of cooperation, stimulates creativity, and learning or skills transmission moment (Bourdier and Trinh, 2011:25). The knowledge belongs to the community and not individuals (ibid). The dwelling size, placement, relation to the site, aesthetic quality, technique, and order of construction are based on community protocols. Nevertheless, the practice is not rigid and allows for creativity (Bourdier and Trinh, 2011:22).

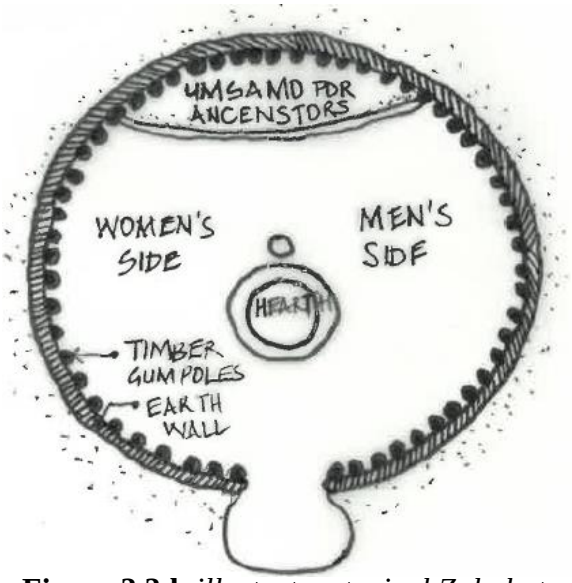


Figure 3.3d: *illustrate a typical Zulu hut floor plan with hearth in the middle.* ***Source****: (Modified by Author fromWhelan, 2006:74).*

Thus, indigenous architecture always has a community gathering space to foster knowledge transmission. The Zulu homestead (**Figure 3.3c)** has a CCP for cultural activities work, local gatherings and men to discuss community issues, judicial, administrative, and agricultural matters. It's normally constructed on sloping ground to give recognition to the main house at the top and access at the lowest point that leads directly to the central space (Kwabena, 1995:65). Some other African gathering spaces are inside the hut and become symbolically sacred structure called great shelter (Bourdier and Trinh, 2011:72).

All huts have a physical relationship with the main gathering space and have secondary assembly spaces used by individuals to teach their children. Internally, the beehive floor plan also has a central space/ hearth for cooking and the family gather around it for children storytelling by seniors (**Figure 3.3d)**. This demonstrates that the indigenous architecture was designed to accommodate learning processes from urban planning to the hut design. Thus, circular gathering symbolises growth and eternity of the tribe (Frescura, 1981:41).

3.3.4 Community participation in indigenous architecture

Marchand (2006) emphasise that the collection of practical learning also contributes to the appreciation of social position and build young individuals' identity and sense of belonging. It guarantees that the community will look after the building. Therefore, the indigenous architectural practices have deeper meanings to local users which is more than physical but also psychological, since identity comes from within. Thus, some traditional earth architecture and community structures have been in place for more than 500 years as the community takes care of structures, which forms part of the community (Marchand, 2006). It allows for every community member including children and women to participate during construction **(Figure 3.3e)**. Consequently, it strengthens the community solidarity as they are all involved during construction (Sanya, 2007).

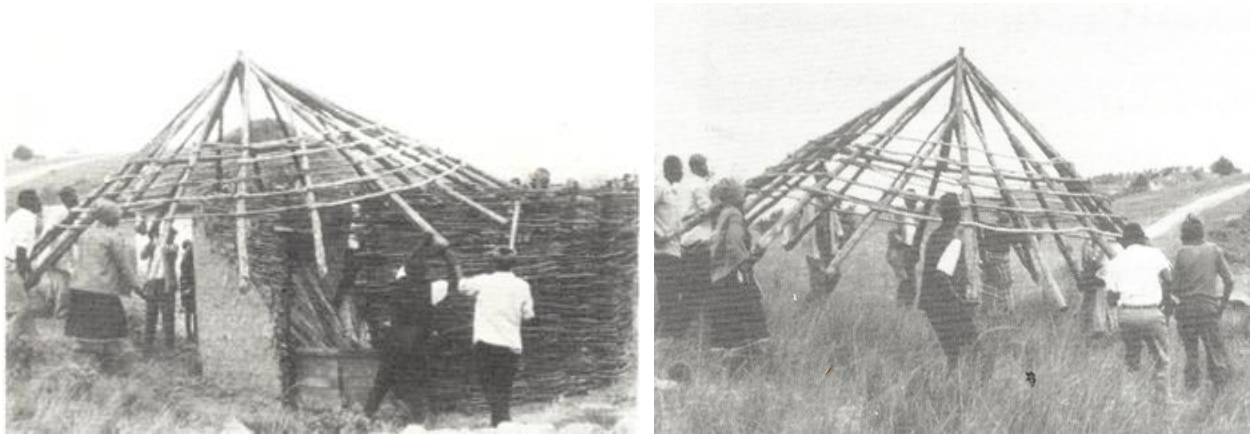


Figure 3.3e: *illustrate the community engagement during the construction of a Zulu hut roof structure fitting it on the timber and earth constructed walls.* ***Source****: (Frescura, 1981:135)*

Children are groomed within this tradition (Frescura, 1981) to ensure it passes to the next generation and also prepare members as both individual and collectively (Blier, 2006, Fathy, 1973). The practical learning takes place in family or community structures' construction through observations, interactions with community elders and environment, and actions (Frescura, 1981). Thus, vernacular architecture buildings possess symbolic values understood well by individuals of that specific culture (Rapoport, 1969). However, as a principle, IK belongs to no specific individual, but to the community as participants and creators. Bertelsen & Muller (2003) points out that this also contributes to difficulties towards IK storage, transfer methods and development

into the contemporary world since it is no individual intellectual properties (cited by Jauhiainen and Hooli, 2017).

Gender and roles are inseparable with vernacular architecture and its construction. Usually, experienced senior males on construction site teach the boys while girls learn from their experienced mothers. This ensures that everyone participates and have a role in house construction. The male head facilitates the construction program such as materials for roof and directs the allocation of new dwellings for collective, construction of additional units or demolition of buildings (Bourdier and Trinh, 2011:17). The architecture reflects the importance of roles through the hierarchy as the homestead leader's hut sit at the top and is more dominant, with the senior wife's next to it **(Figure 3.3c)**. The first wife is seen as the guardian or custodian of traditions; hence women are known as the main guardian for IKS. An African says; "*I suckled it at my mother's breast"*, which reflects senior females' role in the knowledge transmission (Bourdier and Trinh, 2011:22).

Furthermore, Magni (2017) and Foundation (2009) adds that women and elders play a huge role and are considered as authentic sources of IK transmission (Dweba and Mearns, 2011, Mekoa, 2018). Nevertheless, the age gap between elders, women and youths make the learning process difficult. Consequently, younger people are not grasping all the knowledge as they should, which may cause more problems in future as they might not be able to use AIK to deal with social, economic and ecological issues at that time (Ford *et al*., 2010). Thus, it is pertinent that the knowledge is collected and preserved while still available. Besides, indigenous languages are important as experiential learning, oral approaches & practical demonstrations are conducted through them (Frescura, 1981). Thus, it is difficult to collect AIK under WK strategies, which only use specific languages.

- Zulu Construction Materials and Strategies

The Zulu hut has saplings harvested and constructed by men, planted in a circle into the ground and bent into arches spanning from one side to the other. Another set of saplings is closely spaced and arched over the first layer at 90° angles (**Figure 3.3f)**. The layers are fixed together with woven

grass ropes at every junction. The structure is then covered with grass mats layers woven by women, placed over the hut and tied onto a framework. All the grass is sewn onto the frame to make it more intact; the extra loose rope is cut off and leaves the fine mesh aesthetic (**Figure 3.3f (a))**. Senior women and children prepare the grass at night while teaching them *amahubo*, traditional songs at the same time before bed (Frescura, 1981:39). The layered grass ropes are placed over a crown externally as a waterproofing strategy called '*ingqongwana*' (**Figure 3.3g(b)**) (Frescura, 1981:39).

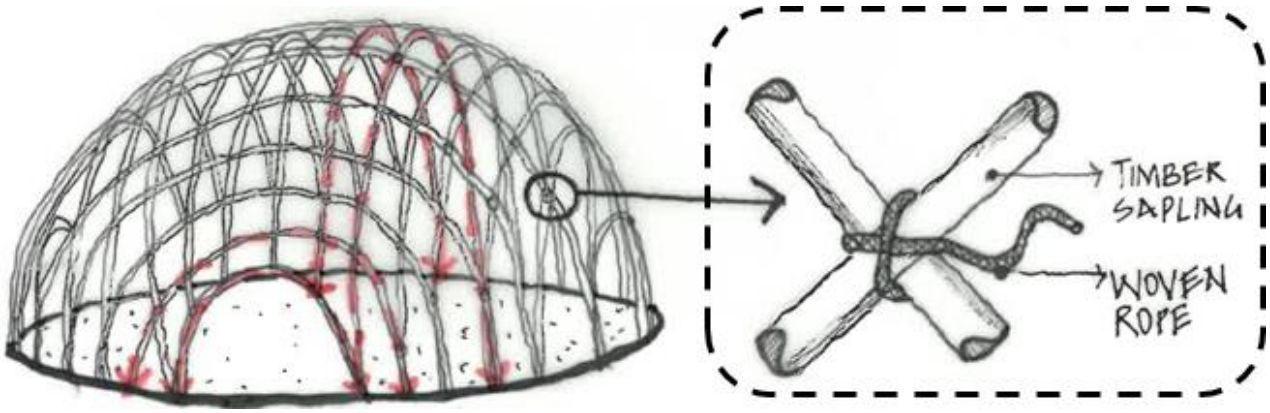


Figure 3.3f *illustrates the Nguni hut structure and form which has widespread in KwaZulu Natal, by Zulu original from KwaZulu/Swazi,* ***Source****: (Modified by Author fromFrescura, 1981:39)*

Old women train young girls to master roof thatching, rope weaving, traditional mats and other material culture objects. During those times, they sing traditional songs and tell their historical culture. In that way, various IKS is transmitted through construction materials (Frescura, 1981:167).

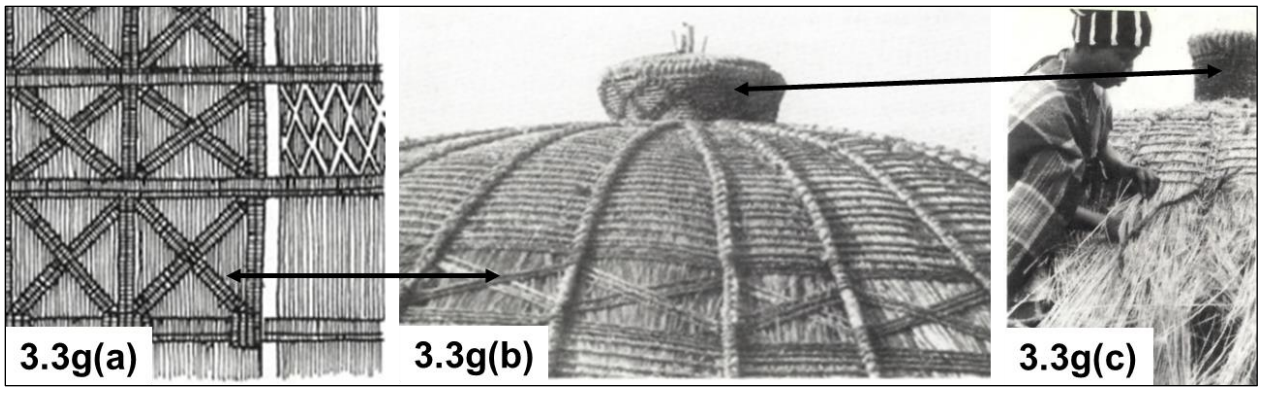


Figure 3.3g(a)*:* *illustrate a grass woven decoration with ropes that are used to tie the timber hut structure.* **Figure 3.3g(b)*:*** *The externally crown as a waterproofing strategy called 'ingqongwana'.* **Figure 3.3g(c)*:*** *illustrate a Zulu woman thatching the roof.* ***Source****: (Modified by Author fromFrescura, 1981).*

The hut is finished off by forming a low earth kerb which is visibly internally, the thatching only reach the ground outside (Frescura, 1981:47). The kerb also protects the building from floods since the thatch easily gets destroyed by surface rainwater runoff. However, its height varies, sometimes forms a part of the hut's structural stability (**Figure 3.3h)** and it finally becomes a wall. The evolution was caused by an increase of population density which resulted in a shortage of construction grass where else, the earth is always available (ibid). In addition, introducing a wall led to a high level of roof & internal headroom, enough space for windows for natural light as well as ventilation and a comfortable entrance that the initial grass hut did not have **(Figure 3.2b)** (Frescura, 1981:45).

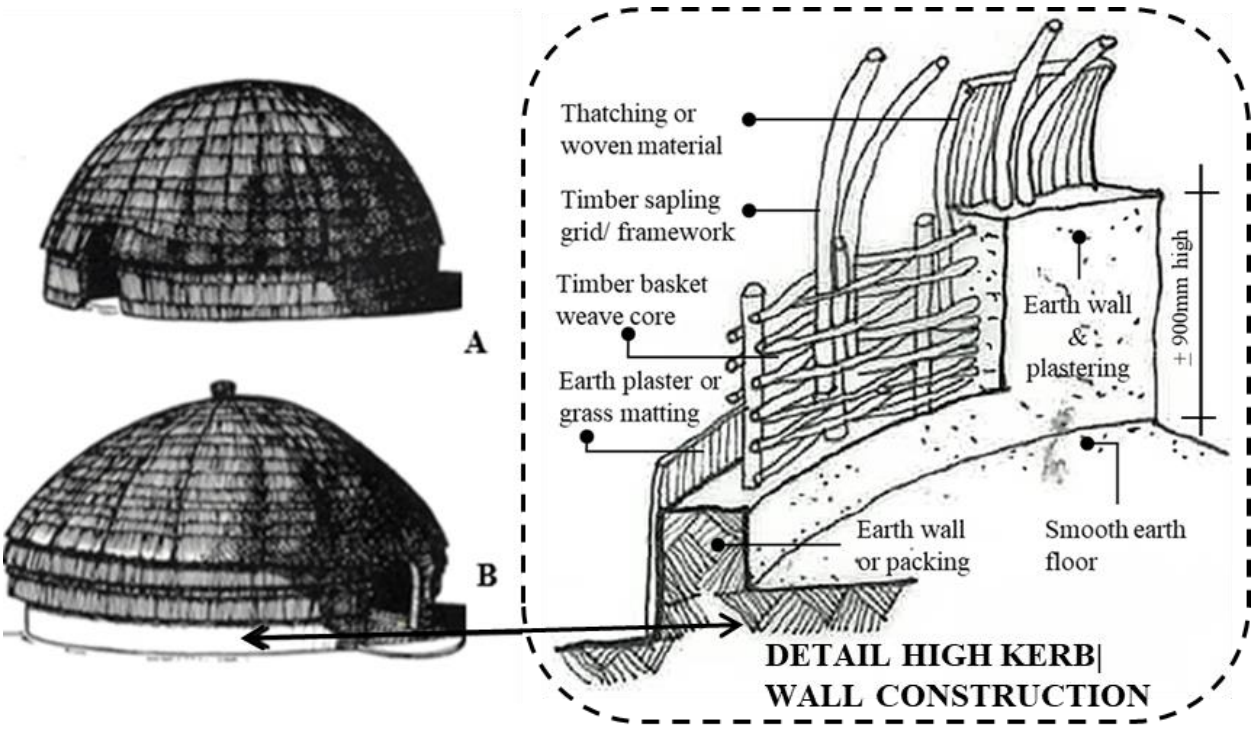


Figure 3.3h: *A- display thatch wall which was also used in Zulu Hut before kerb invention. B - illustrate construction detail for earth/daga kerb as shown in Detail.* ***Source****: (Modified by Author from Frescura, 1981:46)*

Additionally, the hut also evolved by replacing thatch with saplings externally and a high-level earth kerb/wall internally. The timber allows for natural ventilation flow **(Figure 3.3j)**. The earth kerb is made of 900m high timber posts, inserted into the ground and woven saplings are placed in between to form a basket core **(Figure 3.3i)**. Then the earth mixture is inserted and plastered to both sides to create a more water-resisting solid earth wall (Frescura, 1981:46). **)**. Frescura

discusses more details, including ones with grid sapling framework, reed core with parallel sapling and horizontal sapling framework with earth mixture inserted in-between.

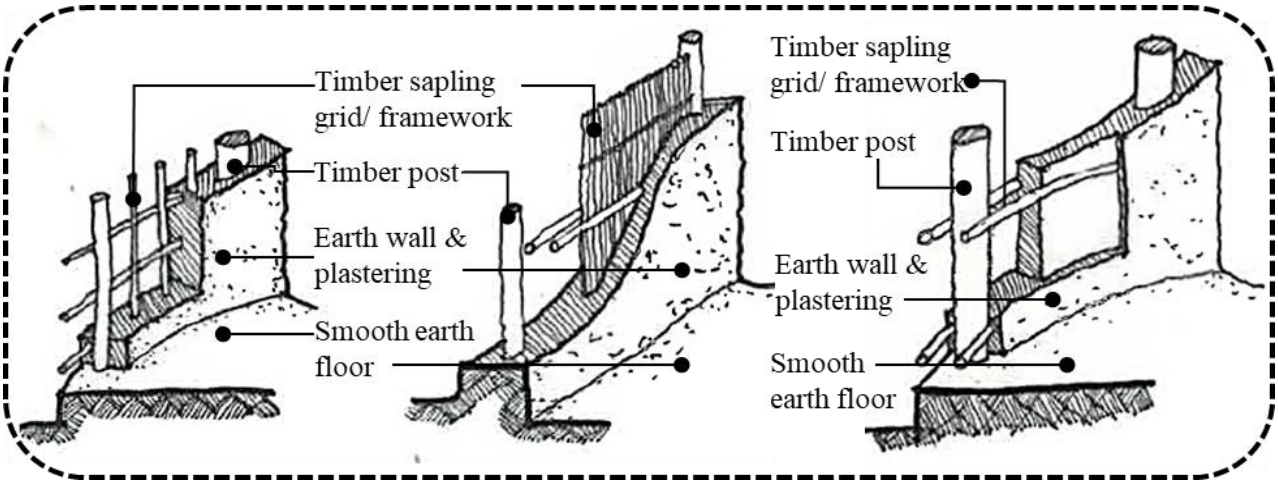


Figure 3.3i*: illustrate different earth construction techniques details.* ***Source****:(Modified by Author from Frescura, 1981).*

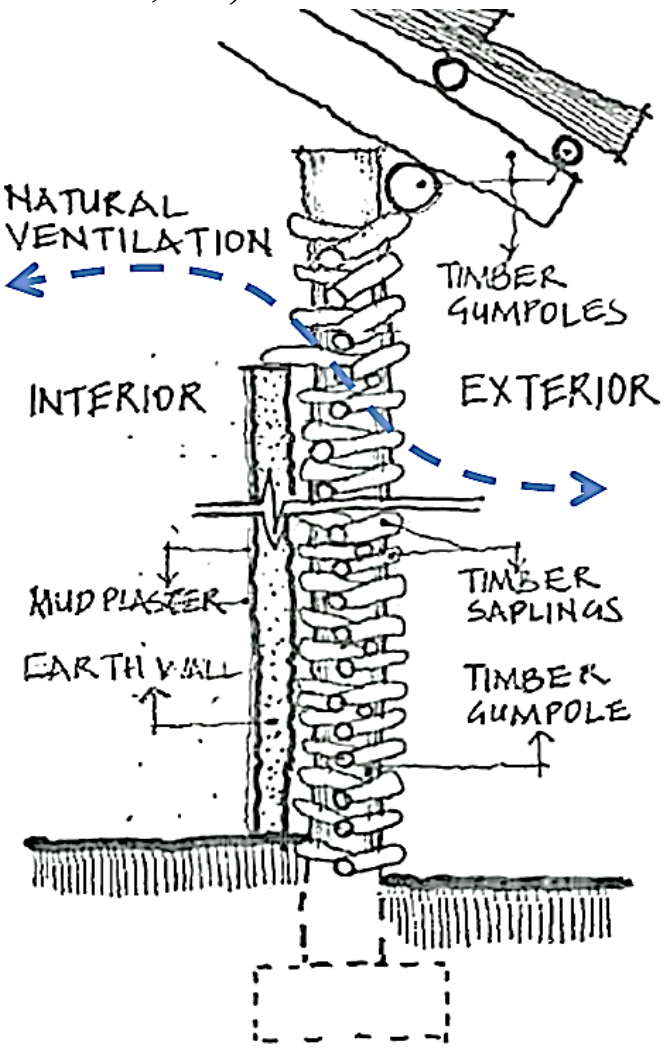


Figure 3.3j*: illustrate a different construction technique that allows natural ventilation without openings/ windows.* ***Source****:(Mhlaba, 2009).*

3.3.5 Conclusion

Millions of people still survive through IKS. The knowledge is resilience and evolves when the community resolve issues at hand. Africa has many IK with the potential to resolve contemporary world issues. AIKS design & construction strategies foster interaction & learning among all community members. However, the knowledge is vanishing because of transmission issues and needs to be preserved through built form.

3.4 CONCEPTUALISING VERNACULAR ARCHITECTURE

3.4.1 Introduction

Vernacular architecture has been studied for many years, but architects still fail to incorporate its concept correctly. However, contemporary architects should learn from indigenous architecture to establish a sustainable built environment. Therefore, this section will investigate vernacular architecture as a learning tool to enhance the contemporary architecture and sustain IKS.

3.4.2 What is vernacular architecture?

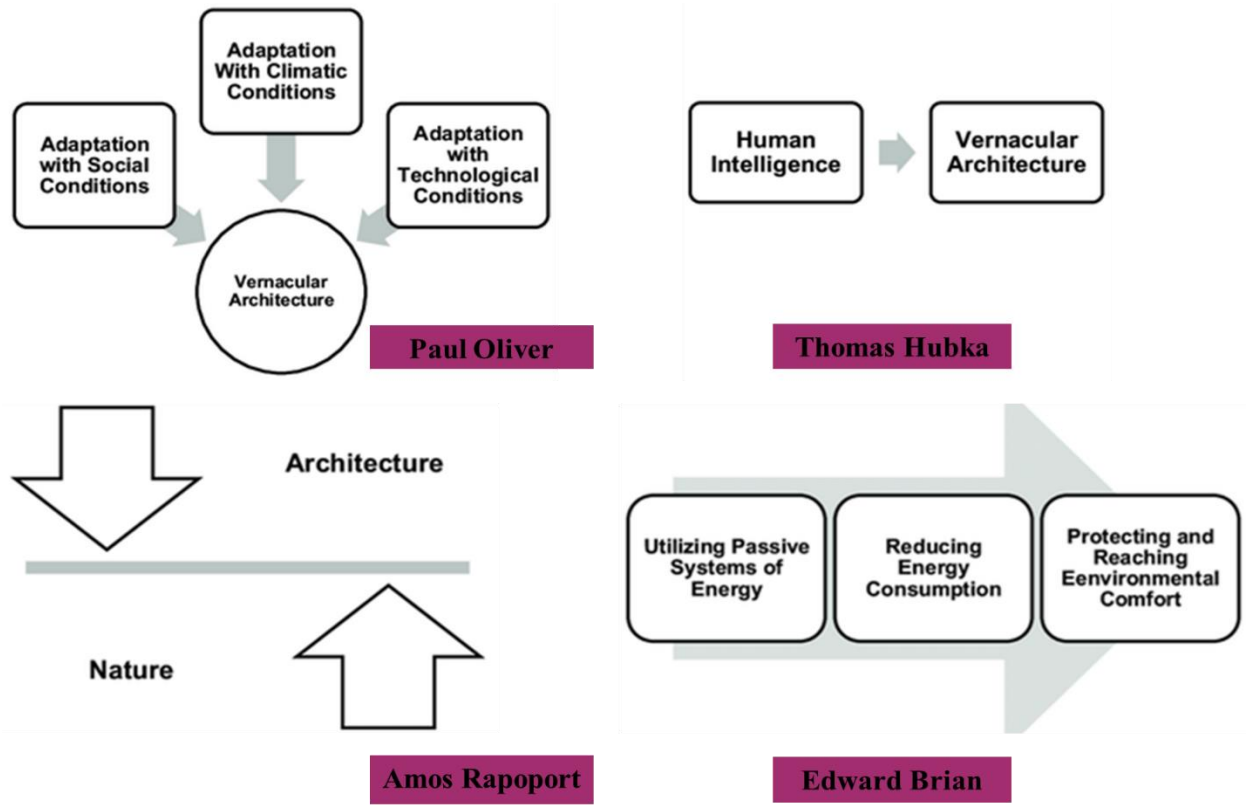


Figure 3.4a*: illustrates that different researchers define vernacular architecture as the built form that is social/cultural, economic and environmental responsive thus it is known as sustainable architecture.* ***Source****:(Motealleh (2017:4)*

Vernacular architecture is designed based on local needs, availability of construction materials and strategies (Asquith and Vellinga, 2006). It grasps customary structures, primitive structures and all world's structures which acknowledges geographical location, local history and culturally

entrenched, economy status (**Figure 3.4a)** (Blier, 2006). Fathy (1973), Steyn (2014) clarifies that every community created primitive architecture with their preferred forms. Consequently, it suits people's character and they can easily relate to its construction materials and strategies. Therefore, it gives a place its unique signature (Fathy, 1973). It is an ever-changing form of human expression, always purposeful (Blier, 2006), symbolically and functionally.

3.4.3 Learning from vernacular architecture

In a contemporary world, nobody still wants to reside in an indigenous hut. Jencks and Kropf (2006) quote an architect, Robert Maguire in 1976 RIBA conference, who grounds that, '*vernacular architecture is not a style…it can't be copied, its significance is as a learning tool'*. Therefore, it can be used to learn to resolve various issues within contemporary architecture, including the elimination of culture in the built form (Rapoport, 1969). Modern architecture foundation was on the discovery of new construction materials & strategies, form and function, omitting culture and sustainability (Spasoff, 2012 -b). Consequently, SCSM was deserted over these new materials resulting in a loss of humanity, lack climatic applicability and cultural identity (Özkan, 2006).

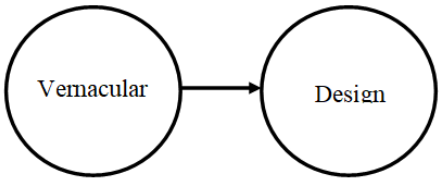


Figure 3.4b*: Illustrating learning by coping approach.* ***Source****: (Amos Rapoport, 2006: 182)*

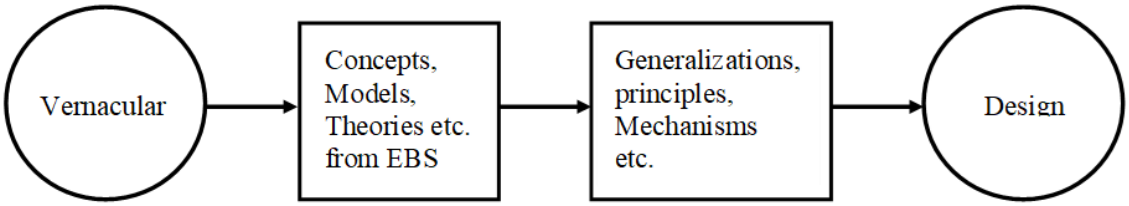


Figure 3.4c*: Illustrating Learning through environment-behaviour relations analysis.* ***Source****: (Amos Rapoport, 2006: 182)*

Learning from vernacular architecture is not a new concept, as Rapoport (1969) states, people always claim structural and construction concepts as new yet in principle, are of primitive architecture. Over the years, learning from primitive architecture has been incorrectly performed

by copying certain formal qualities such as shapes, massing, details and more, while omitting its core (**Figure 3.4b)**. This approach only romanticized vernacular architecture (Steyn, 2014) and never works. Rapoport introduced the appropriate method to learn from vernacular architecture by analysing context, understand its concepts & models, and then derive lessons and principles to apply into the proposed design (**Figure 3.4c)** (Rapoport, 2006:182). The process requires a more problem-oriented conceptual thinking rather than targeting physical aspects of the problem and copying them. Rapoport's argument instils that vernacular architecture always has hidden knowledge understood by locals, yet modern society disregards it. However, contemporary architects always prioritise the aesthetics of individual building they are designing, while neglecting its context, roots and drivers that make it what it is, which result in meaningless built form.

3.4.4 Conclusion

Vernacular architecture is not to be copied, but modern architects should learn its underlying, hidden knowledge and principles and also implement it in contemporary architecture to resolve the lack of humanity in built form. Nevertheless, its hidden elements should be integrated into contemporary architecture to meet contemporary society needs and preserve/sustain it somehow.

3.5 PRESERVING IKS IN A 21st CENTURY

3.5.1 Introduction

The current traditional AIK transmission system is not good enough as indigenous architecture life is under continuous threat of vanishing (Steyn, 2014). Yet, the indigenous architecture stands a chance to fill in the existing gap caused by disregarding the cultural aspect on built form in a globalised world. Thus, this section will investigate strategies to sustain IK in a modern world, as Hendrix (2013) suggests that 21st-century architecture should combine a local culture or knowledge with globally understood structure, to nourish and create meaningful context everyone can relate to.

3.5.2 The concept of symbiosis and hybrid architecture

The integration of different cultures is getting more attention in the contemporary world. Kisho Kurokawa introduced the symbiosis concept as a strategy to integrate different cultures. Symbiosis is a common element among different animals and plants, that makes them live in harmony, peace or co-existence (Kurokawa, 1991:9). Therefore, there is a need for a symbiosis between construction technology introduced by modernism and the cultural element of indigenous architecture to achieve multicultural built environment, rather than universalising cultures (Kurokawa, 1991:32). Lately, the symbiosis is about mix & match instead of creation from scratch (Kurokawa, 1991:6). Nevertheless, indigenous people have been successfully combining AIK and WK to cope for years, therefore, it is not a new concept (Jauhiainen and Hooli, 2017). Researchers support Kisho by pointing out that knowledge must be integrated to achieve sustainable communities (Mekoa, 2018). Communities should acknowledge their uniqueness and different communities should learn each other's culture and co-operate to achieve symbiosis. Thus, each community must have its unique signature to express their culture (Kurokawa, 1991:12), within a multicultural world.

3.5.2.1 Hybrid architecture as a response to multicultural identity

The concept of symbiosis is very similar to hybrid architecture which fuses historical and contemporary style to express popular culture in a region (Kurokawa, 1991:135). The concept brings back (historical) culture in the built form which was lost in modernism. However, during the colonialist times, foreign-built forms were incorrectly introduced in African cities. As a result, the hybrid architecture in African built form (Alsayyad, 2013) destroyed the indigenous cultural identity visibility of cities. Thus, it is important to uncover and preserve remaining local culture to resist placelessness and lack of identity in contemporary architecture (Mahgoub, 2007, Montiel, 2013, Hely, 2013, Steyn, 2014). Hely (2013) add that architecture is a vital component to grasp reality as it is human-made and people know how to carry themselves very well around the environment that reflects their identity, rather than raw nature surroundings (Mahgoub, 2007). Therefore, it ought to express and embrace the multicultural context in a contemporary world and the hybridity theory aims to accomplish such.

3.5.3 Sustaining AIKS in contemporary architecture

Identity is striving to pull out of traditional historical restrictions but not less concerned about its disappearance possibilities at large (Hely, 2013). Integrating traditional elements into architecture might restrict creativity in architecture rather than contributing to building identity. Thus, futurist architects discard historical culture elements on built form claiming it 'resist' the 'new', & prohibit evolvement (Mahgoub, 2007). On the contrary, traditionalist architects consider vernacular architecture as the only precedent to be studied to shape contemporary architecture and give it an identity. However, both parties agree that technology is a requisite (Mahgoub, 2007). Therefore, globalisation in the 21st resulted in the creation of universally shared ideas & identities that represent multicultural architecture (Hendrix, 2013). Furthermore, some architects in Kuwait, Asia state that, architecture that reflects local identity is like a property that has a soul of the local context that should never be rejected (Mahgoub, 2007). This connotes that local identity is more than physical but also spiritual and psychological to indigenous people. Thus, communities should be taught about integrated knowledge values and contributions by implementing it in institutions and formalise its structure and regulations (Mekoa, 2018).

Figure 3.5a: *illustrate V& A Food market interior with different food stalls revealing various cultures.* **Figure 3.5b:** *V& A Food market craft shop. (**Source**: https://capemarkets.co.za/markets/waterfront-food-market/).*

On those grounds, AIKS should be revived to resolve contemporary African issues and be developed to meet modern society needs in harmony (Mekoa, 2018). The cultural identity elements could be expressed through conceptual design, form making, materials used for external and interior, including functionality. The interior of V& A Food Market in Cape Town shows diverse

cultures, both local & international through various food stalls function (**Figure 3.5a)**. Also, the interior of a craft shop reveals the local people's cultural heritage through artworks. Local timber materials used for suspended ceilings in a universal style gives both local and international identity while preserving IKS (**Figure 3.5b)**.

3.5.3.1 Preserving IKS through the built form: Spatial organisation

Senanayake (2006) declares that all IKS disappearance is caused by the intrusion of foreigners' systems. However, Heath (2009) proclaims that in a contemporary world, indigenous architecture elements can be implemented in a different non-native environment to resolve social circumstances as long as they are symbioses with local elements understood by local people. The Garona **(Figure 3.5c)** harmoniously integrate indigenous Tswana architecture with modern architecture to meet people's lifestyle, create international recognised symbolism and identity while also preserving the historical culture of the Tswana tribe.

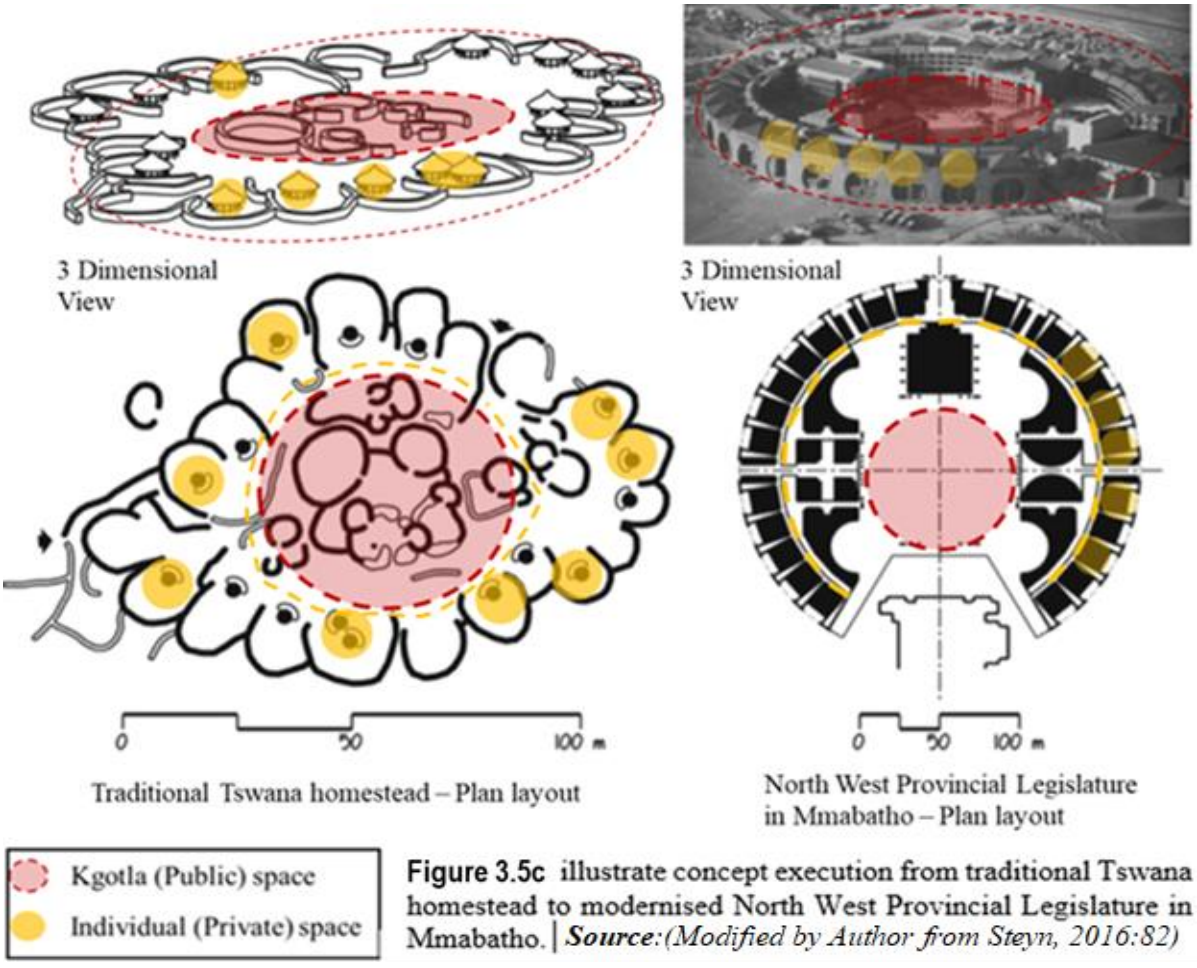


Figure 3.5c illustrate concept execution from traditional Tswana homestead to modernised North West Provincial Legislature in Mmabatho. | ***Source:****(Modified by Author from Steyn, 2016:82)*

Mmabatho provincial legislature (*Garona* meaning Our Place)**,** by Britz and Scholes architects, was built in the 1970s. The building reflects an outstanding morphological feature of traditional Tswana indigenous architecture with the circular space *kgotla*; CCP (**Figure 3.5c)** (Steyn, 2016:78). The building is modernised to fit in a modern universal context. However, the Tswana architecture essential elements which are: (1) a clear hierarchy of spaces, (2) successive layering of space, and (3) a clearly expressed circulation system are clearly articulated with a very strong sense of enclosure (Maré 1981: 40). Therefore, the vernacular underpinnings; the spatial organization and the form are well expressed in a building erected with universal structure and materials: concrete, face brick, steel windows and corrugated sheeting. The very subtle symbiosis of different knowledge contributes to regionalism and a passive climate control design **(Figure 3.5d)**, are all aspects that justify a Critical Regionalism classification (Steyn, 2016:83).

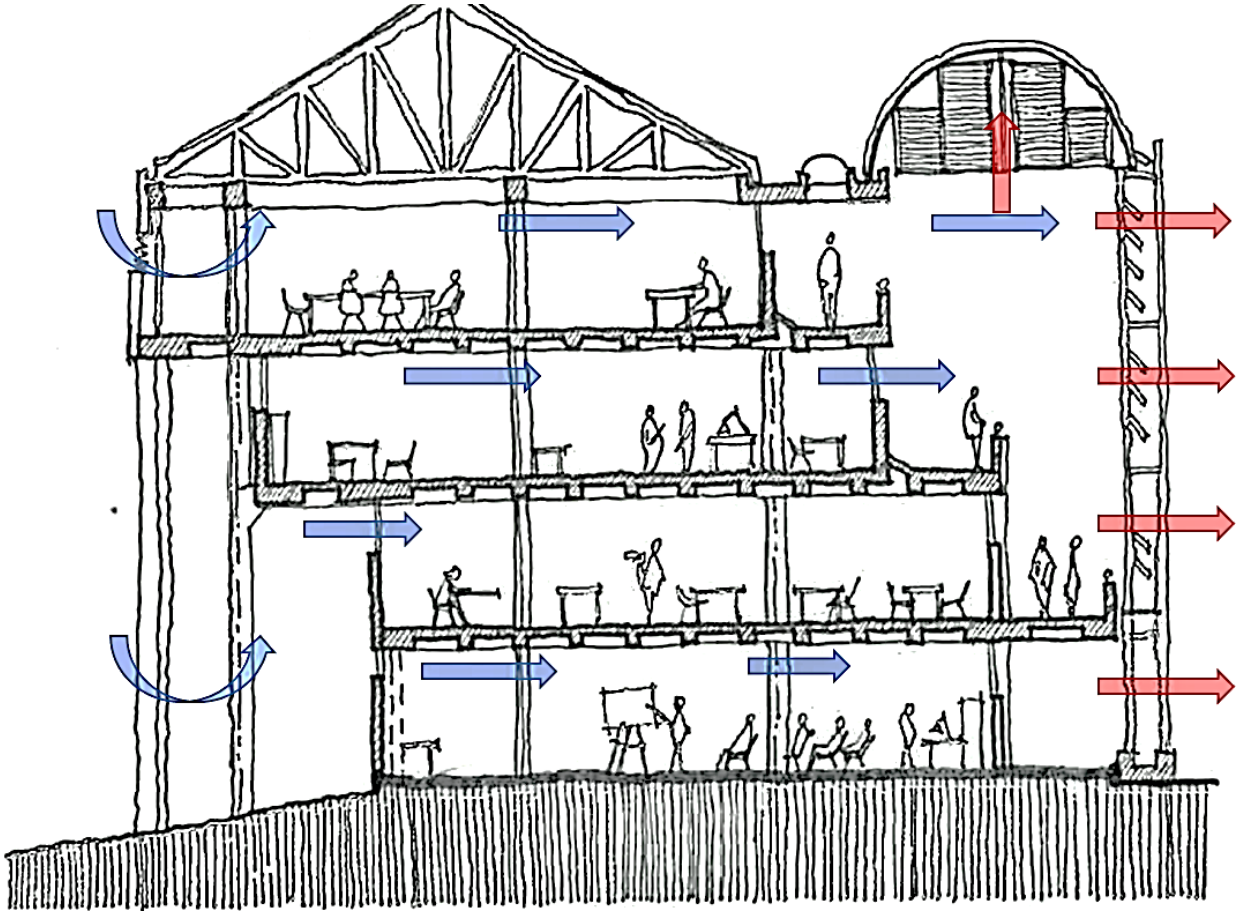


Figure 3.5d*: Typical section through a building of Mmabatho provincial legislature.*
Source*: (drawing provided by Michael Scholes & Modified by Author from Steyn, 2016:84).*

In addition, the urban context of the Garona is also centralised within the provincial government precinct **Figure 3.5e**. The concept of symbiosis is considered from urban planning to individual buildings. It is placed in the middle of the axis and between two towers on both sides. The parliament is a building for people; thus, it has a gathering space in front, to facilitate knowledge transmission through space. These principles are derived from indigenous urban planning patterns, which always have the king's homestead in the middle of the village, hence local and international individuals find the building meaningful. Therefore, it is wrong to assume IKS value can be utilised to only resolve issues in indigenous and rural communities (Mekoa, 2018).

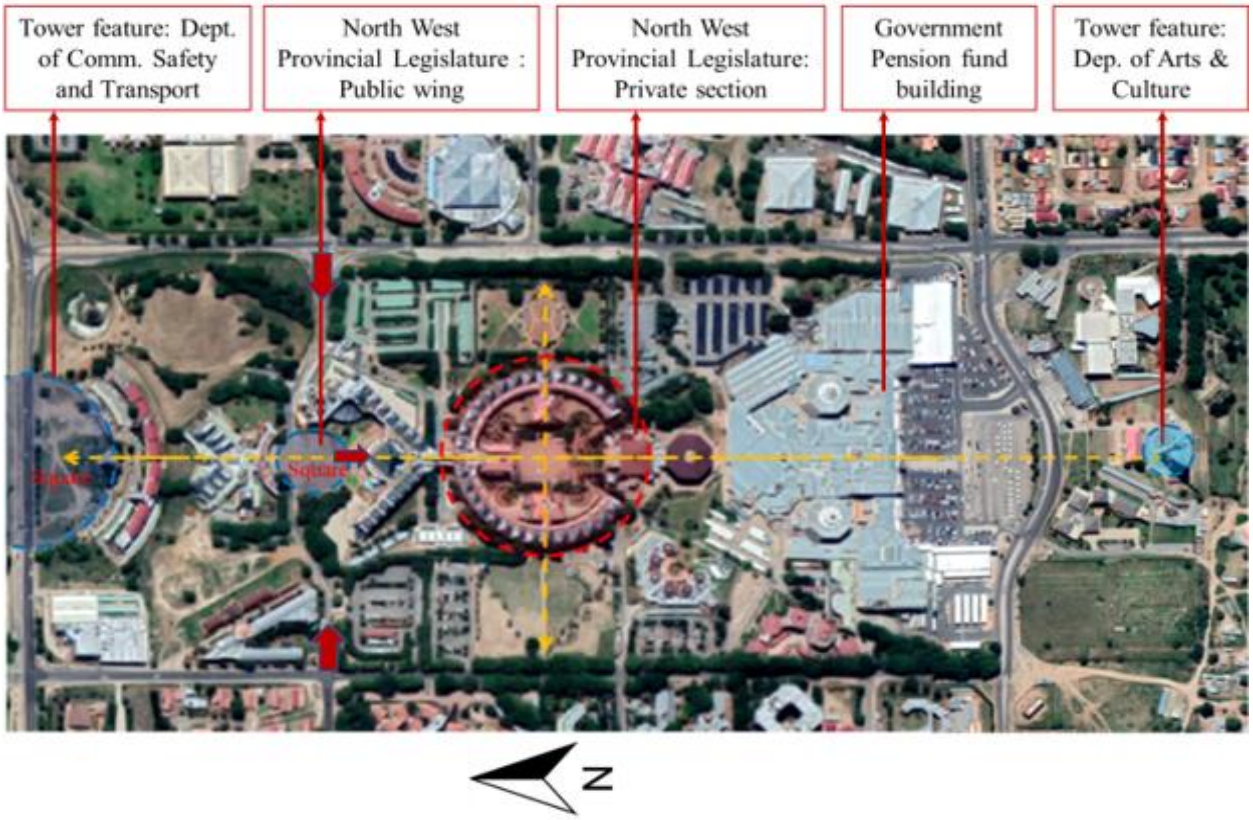


Figure 3.5e: *illustrate the precinct of the North West Provincial Legislature in Mmabatho. The parliament gathering place is the central or focal point of the governmental precinct. (**Source**: Modified by Author from https://www.google.com/maps/search/mmabatho+legislature/).*

3.5.3.2 Preserving IKS through the built form: Symbiosis of Forms

Developing countries are still struggling to represent multicultural identity through the built form (MonclúS and GuàRdia I Bassols, 2006). However, developed countries are used to the strategy

as Szacka & Pattecua (2019), state that lately in Europe the critical regionalism theory contributes to the exploration of the close relationships between the building, its construction and meaning. Therefore, it is necessary to study how they integrate cultural identity into their built form. The Dine College Library in Shiprock, USA (**Figure 3.5f-h)** context respects the connection between mankind, world view and local culture, which are represented in curves (*Dine College Library*). The building executes the underpinning principles of Navajo vernacular architecture called Hogan into a contemporary building. It acknowledges and embraces the sacred and natural world through a vertical opening that symbolises an ascending spirit of prayer through the roof. Thus, the library has a circular element to acknowledge sacredness and opening on the roof **(Figure 3.3f)**.

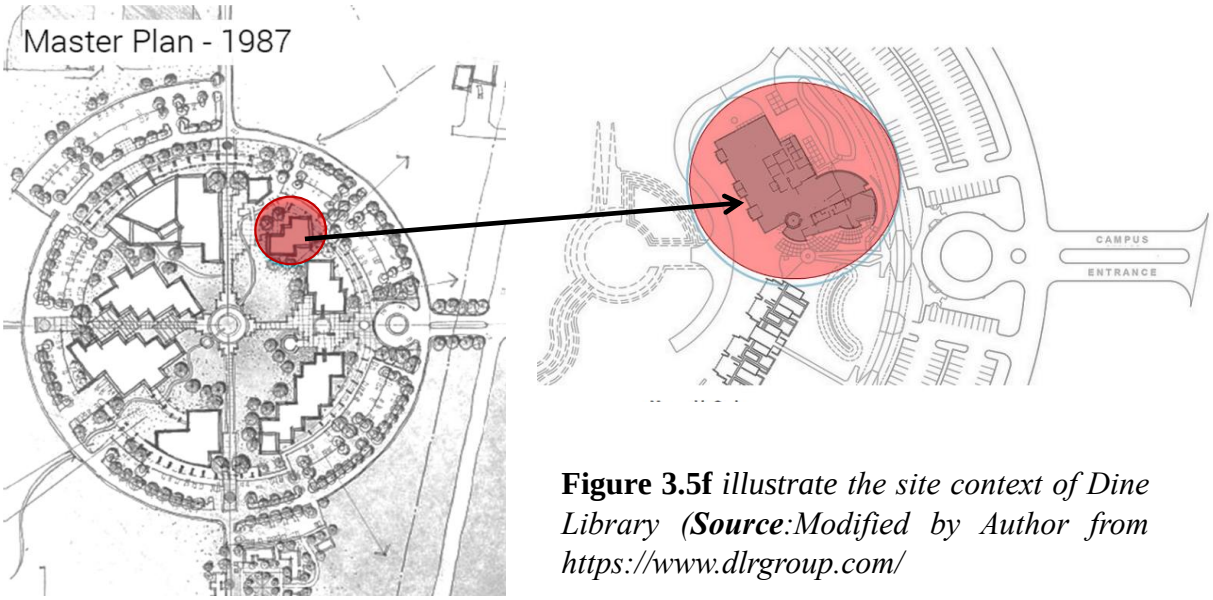


Figure 3.5f *illustrate the site context of Dine Library (**Source**:Modified by Author from https://www.dlrgroup.com/*

Nevertheless, it honestly integrates different forms; rectilinear and curves which also create different volumes and spaces resulting in a complex building that meets contemporary library requirements i.e. computers & furniture fit well in linear walls. The circular form has a long-slit cut in the east wall of the library to fill the interior with natural light through blue translucent opening. Internally, it becomes a Navajo's central life, as it is placed in the middle of the building and accommodates the storytelling room. In that way, cultural elements are explored both symbolically and functionally (*Dine College Library*). Lastly, the library appeals to the entire community as it boasts of local cultural identity and internationally recognised structure and materials. Thereby, the IK is preserved and transmitted to future generations through building form in a contemporary manner.

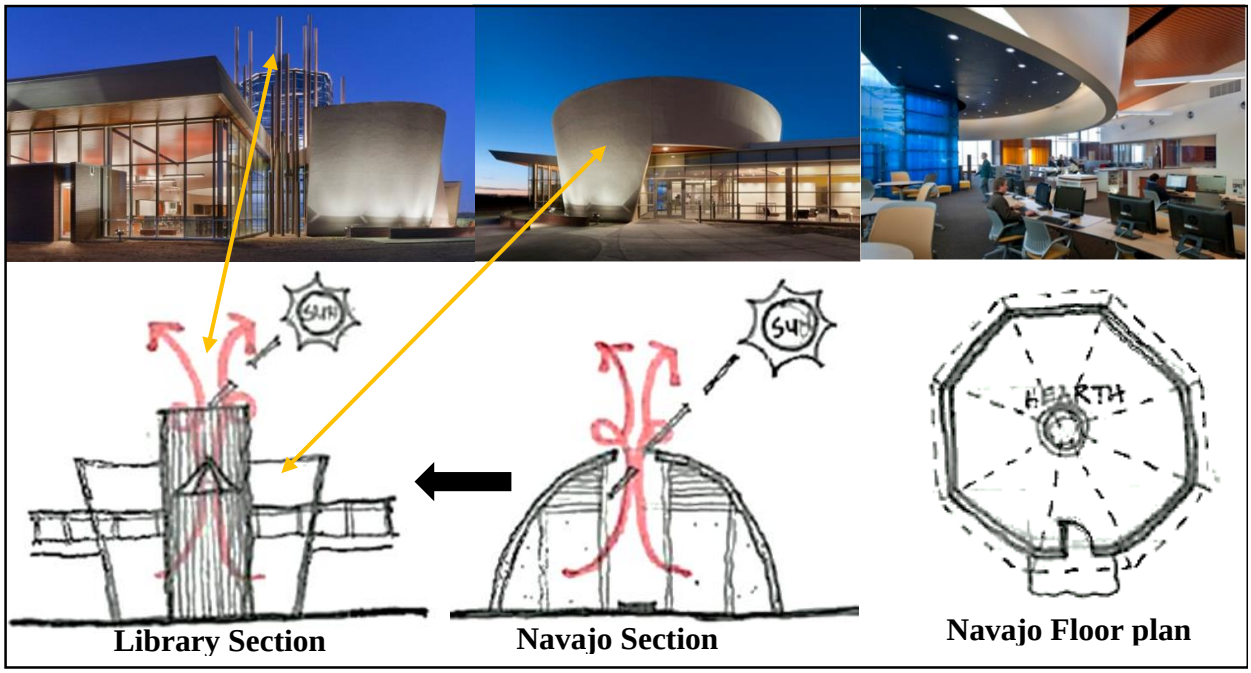


Figure 3.5g. *illustrates the implementation of Navajo vernacular architecture in a contemporary world through integrated knowledge principles.* ***Source****: (Modified by Author from https://www.dlrgroup.com/)*

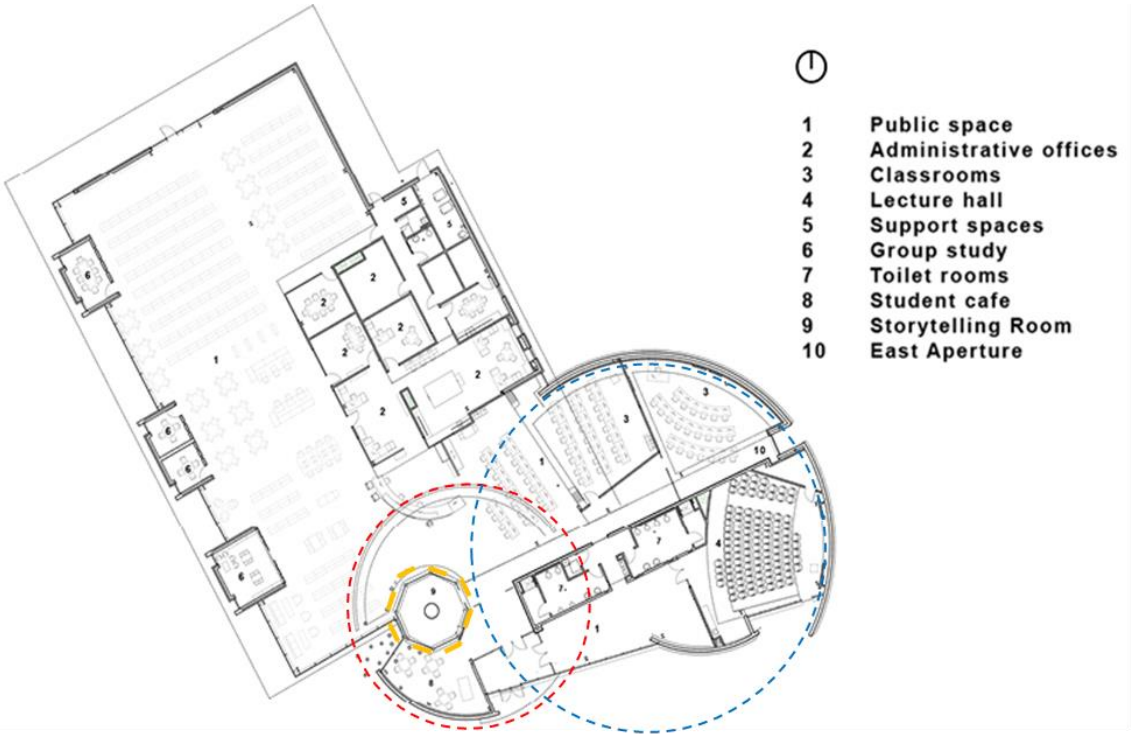


Figure 3.5i *illustrate Dine library floor plan which represents and preserve indigenous architecture in a contemporary manner. The building's openness and transparency encourage a learning environment.* ***Source****: (Modified by Author from https://www.dlrgroup.com/)*

3.5.3.3 Preserving IKS through the built form: Symbiosis of Construction Materials

Figure 3.5j, k,l*: Spanish Pavilion, Shanghai, China 2010.* ***Source****: Architypereview.Com, 2019*

There are many ways to attain different cultures' symbiosis through construction materials, techniques and built form. The Spanish Pavilion, 2010 in China reflects Shanghai's climate, local materials and weaving culture. The building fuses different construction materials to express and preserve local culture in a contemporary manner. The modern steel structure is covered with glass, which is a globally recognised material, then the layer of traditional woven mats made of natural fibres are added to create a sense of place. Nevertheless, the (basket) weaving is a global and common traditional handcraft culture, although they differ slightly. Therefore, the materiality concept is used to bring together different cultures and revitalise the unique weaving craft **(Figure 3.5j)** with a local signature **(Figure 3.5k)**.

The woven materials allow natural light to penetrate and fill the room while controlling the glare **(Figure 3.5j)**. Also, the identity was enforced by requesting local people to weave and sell the mats for construction purposes (Architypereview.Com, 2019). In that way, the development is considered sustainable as the community benefited economically though it was a once-off project. Culturally; the building is meaningful to the community as it incorporates their IKS, and the materials are locally harvested and environmentally friendly. Therefore, the building expresses the symbiosis of international and local styles successfully as well as multicultural identity.

3.5.4 Conclusion

Diverse cultures in the world have created a new multicultural identity which is achieved through integrating different knowledge systems in harmony, through form-making, construction materials and spatial planning. Nevertheless, indigenous architecture carries cultural identity and represents a community's signature, thus it is combined with the universal structure to create multicultural identity. Thereby IK is preserved and sustained through innovative contemporary built form.

3.6 CONCLUSION

IKS expresses group culture, environmentally sensitive and economical hence most, communities in rural regions thrive through it. However, the younger generations are failing to grasp it from the seniors and women as IK safeguards. This put lives at risk as it will disrupt community resilience in the future. Africa is too rich in culture, as a result, it is difficult to teach, develop and collect all AIK. Indigenous architecture carries cultural identity and meaningful to its users. However, architects struggle to learn from it as they intend to ignore its underpinning cultural knowledge and copy its aesthetics which creates placelessness in built form. Nevertheless, vernacular architecture is the key learning tool towards creating a meaningful built form which requires symbiotic local and international cultures to embrace all users through built form. Nevertheless, it is not enough as it cannot encounter contemporary society needs. Hybrid architecture integrate IK with universal structures to create multicultural identity, preserve IK and meet modern community desires and needs. The hybrid architecture can be used as a form of a tool to preserve indigenous knowledge through built form; including architecture, materials and strategies.

CHAPTER 04

ENVIRONMENTAL IMPACTS OF SUSTAINABLE CONSTRUCTION

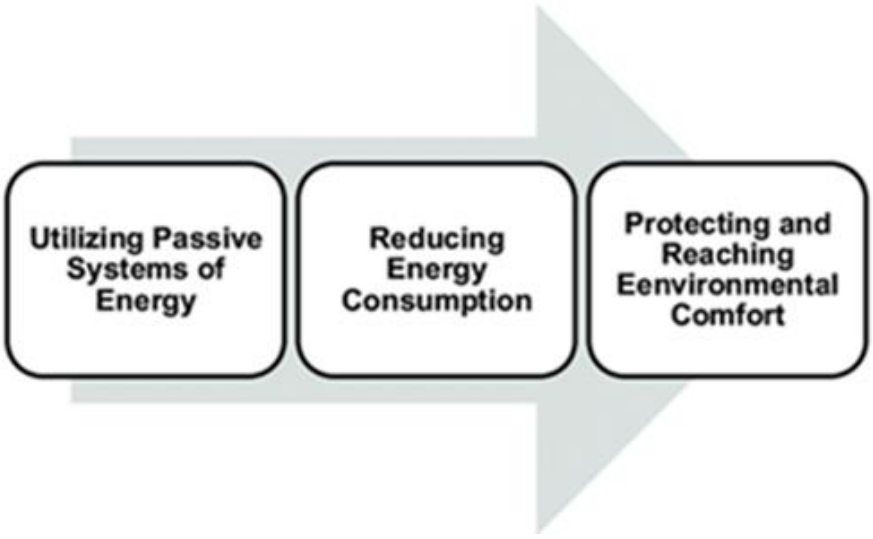


Figure 4.1: *illustrates Edward Brian understanding of vernacular architecture which precisely explains the concept of sustainable construction discussed in this chapter. (**Source**: Motealleh (2017:4)*

4.1 INTRODUCTION

Sustainable construction is a tactic to meet sustainable development within the built environment field. Thus, it is implemented to achieve sustainable development which integrates three aspects; socio-cultural, economic and environmental **(Figure 4.1a)** (Sanya, 2007, Keeler et al., 2016). Sustainable development/ sustainability is a very old concept, however, the built industry including architecture has been focusing on the environmental aspect only, while ignoring social or cultural aspect for a very long time. Consequently, there is more standardised knowledge on the sustainable environment which lacks regionalism. Kurokawa (1991:135) blames modernism for introducing material and technology civilisation that eliminates humanity or cultural aspect in the process. In addition, built environment including materials and strategies used during construction contribute enormously to environmental pollution globally. Therefore, this chapter aims to investigate environmental impact **(Figure 4.1a)** caused by construction materials and strategies that have been discussed in previous chapters (mainly used in rural communities) and synthesise it with standardised sustainable construction rules. Also, the chapter will explore KwaZulu Natal's implemented strategies to revitalise construction materials in a contemporary world, to create an environmentally friendly built form.

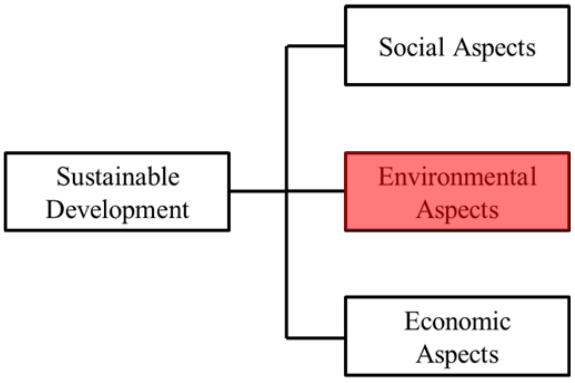


Figure 4.1a*: illustrating the three Aspects of Sustainable Development, with Environmental aspects highlighted as the primary focus of the chapter.* ***Source****: Author edited from (Sanya, 2007, Keeler et al., 2016).*

4.2 INVESTIGATING SUSTAINABLE CONSTRUCTION

4.2.1 Introduction

The world is rich with raw materials such as water, forests, minerals and more. However, it requires an effective management system to ensure resources are prudently used and enjoyed by the present

inhabitants while sustaining them for future generations. Thus, the concept of sustainable construction has been implemented at global and most local management spheres since built form depletes natural resources. This section will explore the concept of sustainable construction principal elements and strategies to implement it in built form.

4.2.2 Concept of sustainable construction

Sustainable construction concept has developed globally ever since sustainability took off in the 20th century. (Abolore, 2012) agrees that sustainable construction is the actual process to accomplish sustainable development through built form. The concept also facilitates the building and planning that corresponds to the environment emotionally, spiritually and psychologically, while fostering community engagement, local skills, values and healthy neighbourhoods (ibid). Thereby, it assures that the correlation of human dignity, ecological aspects and economic equity are all not compromised in the built environment; starting from planning, design, construction and operations and management of buildings (Abolore, 2012, Plessis, 2005). Therefore, the concept is to improve built form performance, decrease the environmental issues caused, reduce waste and be more ecologically amicable to achieve a healthy environment. Thus, construction materials and strategies form part of the concept as they contribute to building a healthy environment.

However, the approach towards sustainable construction varies depending on climatic conditions, natural resources and construction issues thereof. Bourdeau (1999) contends that sustainable construction strategies depend on the country's understanding and interpretation of the sustainable construction concept and issues accordingly. Developed countries focus more on the environmental aspect while developing countries prioritise social issues first than other aspects (ibid). Du Plessis (2002), (Frampton, 2007), develop Bourdeau's argument by stating that the main construction issue in developing countries is; imitation of construction systems shaped in developed countries which use high technological solutions, instead of developing their own that responds to the local environment, social identity and economy. Therefore, the concept of sustainable construction is universal, but the approaches must be different, and issues based.

4.2.2.1 Low impacts construction

Figure 4. 2a *illustrating adobe earth as abundant and renewable materials used in multipurpose building, Seven Fountain School in Kokstad. (**Source:** https://www.designindaba.com/)*

(Ugochukwu *et al*., 2016) emphasise that sustainable construction requires learning from both vernacular and contemporary practices, raw materials sources, and execute strategies into new sustainable built environment developments. A typical indigenous building of earth, timber or any other natural materials emits less pollution, consume less energy during construction and afterwards, balances ecosystem, achieves a good thermal comfort naturally, without external controlling solar devices (Ugochukwu *et al*., 2016, Halliday, 2008, Abolore, 2012). It reduces energy costs and decreases required building maintenance services (Passive Design Handbook, 2016) if built properly. However, it is always on a small scale and in rural regions yet carries greater knowledge about environmentally friendly construction. The lack of knowledge to use the materials and strategies correctly contribute to the poor impression (Halliday, 2008). Consequently, the low impact architecture is perceived as useless in bigger scale developments and as architecture for the poor (Rapoport, 1990).

Contrarily, those sustainable construction strategies and materials were previously implemented in bigger developments such as ancient religious buildings or temples, some of which are still

existing today as local community maintain them i.e. Great Mosque of Djenné (Halliday, 2008, Minke, 2006). Derek van Heerden, an architect who designed the Seven Fountains School in Kokstad, KZN add that people including professionals discredit the capability of natural materials because of lack of knowledge, yet it is strong enough on its own when used correctly (**Appendices Interview III).** The school design concept was sustainable construction which allowed inclusive, transparent design processes. Therefore, there is a knowledge gap on natural materials which is still expanding as industrialised construction materials get advanced daily (Halliday, 2008), resulting in more focus on new materials and negligence of the existing indigenous ones. Thus, the principal elements for sustainable construction will be analysed through a contemporary building: Seven Fountain school (**Figure 4.2a-e**) which was designed in line with the concept.

4.2.3 Principal elements of sustainable construction

The prime aim of sustainable construction is to use natural, recyclable or full lifecycle material resources which will eliminate waste from the environment to attain a healthy environment and community. As a result**,** the global principal elements were designed to only guide construction developments as they vary and are issue-based. Nevertheless, the following principles are interconnected and should be integrated to fulfil the sustainable construction as an integral of sustainable development (Halliday, 2008, Kibert, 1994).

4.2.3.1 Minimize resource consumption/ Resource Base

Figure 4.2b *illustrating reused bricks and timber gum poles used for foundations and earth bricks used for walls as natural with good insulation materials in Seven Fountain School multipurpose building. (**Source**: https://www.designindaba.com/)*

The built environment is considered the 2nd industry that overconsumes sources of raw materials (Halliday, 2008). Thus, the principle intends to conserve sources of raw materials, as the main problem in the contemporary world (Kibert, 1994). It requires one to consider the scarcity of the material when deciding on materials to use. Kibert divides this principle into three; Reuse, renew and recycle are principles on their own.

Strategies & Materials: It implies that scarce construction materials should be replaced with abundant and renewable or recyclable materials (**Figure 4.2a**). Halliday (2008) adds that the principle requires the efficient usage of materials and promotes reuse or recovery, although natural materials are economic and environmentally responsive than recyclable ones when used correctly. Kibert (1994) adds that the passive design, high level of insulation materials and long lifespan materials are also a strategy to reduce resource consumption including; reusing materials and architectural elements that have been used before such as bricks (**Figure 4.2b**), windows and doors in new construction and renovations. Reusing elements also reclaim a historical culture within newly designed spaces. It also includes building in the same land previously used for other buildings, greywater recycle and reuse of energy through solar & wind power etc. (ibid).

4.2.3.2 Protecting the natural environment/ Non-toxic environment

Figure 4.2c *illustrating rainwater tanks to collect all rainwater from impermeable surfaces and used to flush toilets and water vegetables which is in line with protecting the natural environment principal. (**Source**: http://www.angelabucklandphotography.com/)*

The built environment pollution will always have an impact on the natural environment and ecological systems but could be monitored. Thus, the natural environment requires preservation/sustainability and improvements where possible Kibert (1994). More pollution is embodied through materials' manufacturing, extraction, distribution and packaging processes as industrialised materials involve mechanicals and contain chemicals to process which affects occupant's health. (Halliday, 2008, Kibert, 1994).

Strategies and Materials: The principal aim is to eliminate toxins indoors and outdoors as much as possible. One of the major objectives is to achieve good indoor air quality by selecting environmentally-friendly materials (Halliday, 2008). In relation to the exterior environment, landscape design should prioritise indigenous plants or vegetation that are hardy, drought-tolerant, insect resistant and could rectify and return the land to its original state. Lastly, the waterbody and deforestation need an intervention in creating a sustainable built environment (Kibert, 1994). The Seven Fountain is not located close to a forest or waterbody but has rainwater tanks to collect all rainwater from impermeable surfaces, stored in an underground reservoir and then used to flush toilets and water vegetables **Figure 4.2c**. Thereby, the natural environment is protected by controlling water usage.

4.2.3.3 Pursue quality in erecting the built environment

The quality component of sustainable construction is crucial (Kibert, 1994) because the implementation of sustainable materials and strategies into design does not automatically create a suitable environment or indoor comfort unless attention is paid to details and understanding of the quality it has. Also, the durability of construction materials is important as it affects economic aspects, hence most people are skeptic about using natural materials as they require more maintenance. However, Halliday (2008), (Heerden, 2019a) emphasize that natural materials are good enough to achieve suitable durability similar to one achieved through industrialised materials, and indoor comfort on their own and proper detailing of appropriate materials obviates the need for polluting treatments (Halliday, 2008).

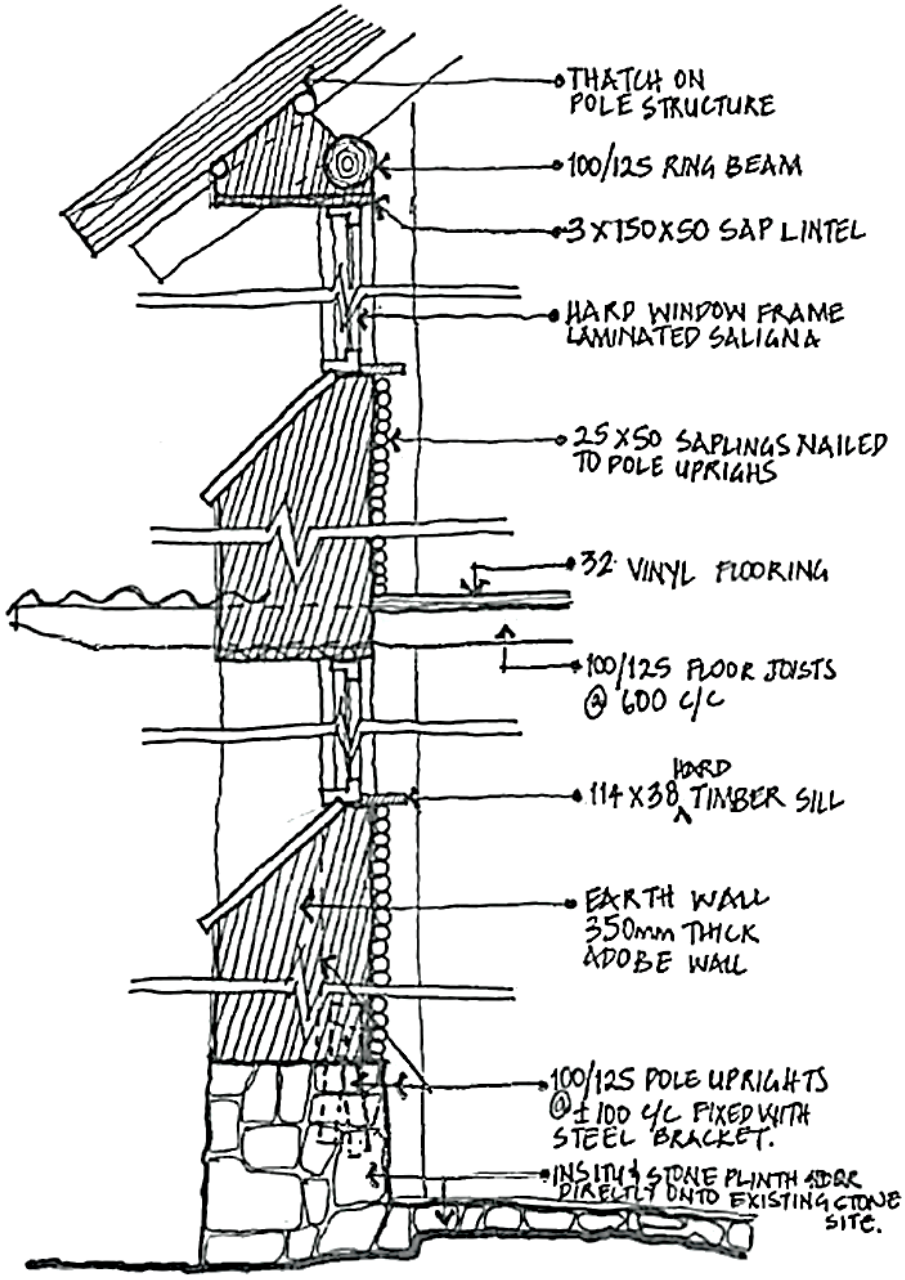


Figure 4.2d: *Seven Fountain School Earth structure detail drawing.* ***Source****: https://www.eastcoastarchitects.co.za/projects/ Accessed Date: 22.06.2019*

Strategies & Materials: (Halliday, 2008) emphasize that the main issue in environmentally friendly construction are sourcing, performance, durability and construction skills. For example, timber-framed windows are good insulators than the steel ones, however, if not used properly, it does not make any difference to indoor quality. The incorrect detailing results in the incorporation of toxins materials such as plastic paints etc. (ibid). Furthermore, understanding the qualities and impact of selected materials in a specific region is also important. For example, heavy materials such as earth take long to catch the heat and take longer to release, thus, it can be good in passive solar design. On the other hand, lightweight materials such as timber catch the heat and release it easily. Hybrid structure **(Figure 4.2d)**, heavy and light can be combined to achieve a certain indoor comfort. For example, the ground can be of heavy materials while the walls are light (Halliday, 2008). (Heerden, 2019a)

detailed the Seven Fountain **(Figure 4.2d)** and ensure materials; stones, adobe bricks, timber and thatch, corresponds with a temperate interior climate which is not extreme and results in a warm interior in winter and cool in summer.

4.2.4 Sustainable passive systems design

Sustainable construction leads to sustainable buildings and environment which is achieved through an integrated design that involves suitable and sustainable materials, passive ventilation, and heating (Halliday, 2008).

4.2.4.1 Indoor Environment Quality (IEQ)

Figure 4.2e: *illustrating children playing in a gathering & performance space facing North orientation and classrooms with covered walkways as solar devices to ensure space gets natural light and warm in winter. (**Source**: https://www.eastcoastarchitects.co.za/)*

Construction materials and strategies have a direct contribution to indoor environmental quality, occupants' health and comfort. Therefore, indoor air quality (IAQ), thermal comfort, moisture management, ventilation, lighting, noise, and orientation are strategies that have an impact on the building IEQ (Keeler and Vaidya, 2016, Alliance, 2016). The good IEQ contributes to occupants' comfort, health and productivity level. Thus, it is crucial and must be considered and never

compromised at all design phases, as most people spend about 90% indoors (Keeler and Vaidya, 2016, Alliance, 2016). Seven Fountain School layout took advantage of solar orientation of the main learning spaces as good natural light improves the quality of the visual environment to ensure that classrooms are cool in summer and warm throughout the icy winters (**Figure 4.2e&f)**. All occupied areas are well insulated to improve thermal comfort. Glare and heat gain are reduced through suitable solar shading and light devices (**Figure 4.2f)**.

Figure 4.2f: *illustrating Solar devices to achieve a suitable IEQ at Seven Fountain. (**Source**: www.eastcoastarchitects.co.za/)*

4.2.4.2 Passive design

Passive design involves studying and understanding the site requirements and local climate conditions to reduce the building's energy usage and increase indoor comfort to the inhabitants (Alliance, 2016, Sanya, 2007). Nowadays, most buildings use mechanical systems to achieve suitable indoor comfort caused by poorly designed buildings. However, the implementation of passive design can reduce the building's energy consumption and improve IEQ naturally. Thus, the passive design requires architects to consider the local climate while designing and deciding on the type of structure, strategies and materials to implement in a building (Alliance, 2016, Sanya, 2007, Keeler and Vaidya, 2016). Passive design elements include passive cooling and passive heating.

- Passive cooling - Ventilation and cooling

The primitive architecture builders developed passive design (passive cooling) strategies based on microclimatic conditions and can be integrated within contemporary architecture to achieve more environmentally friendly buildings (Kamal *et al*., 2004). Seven fountains school implemented a

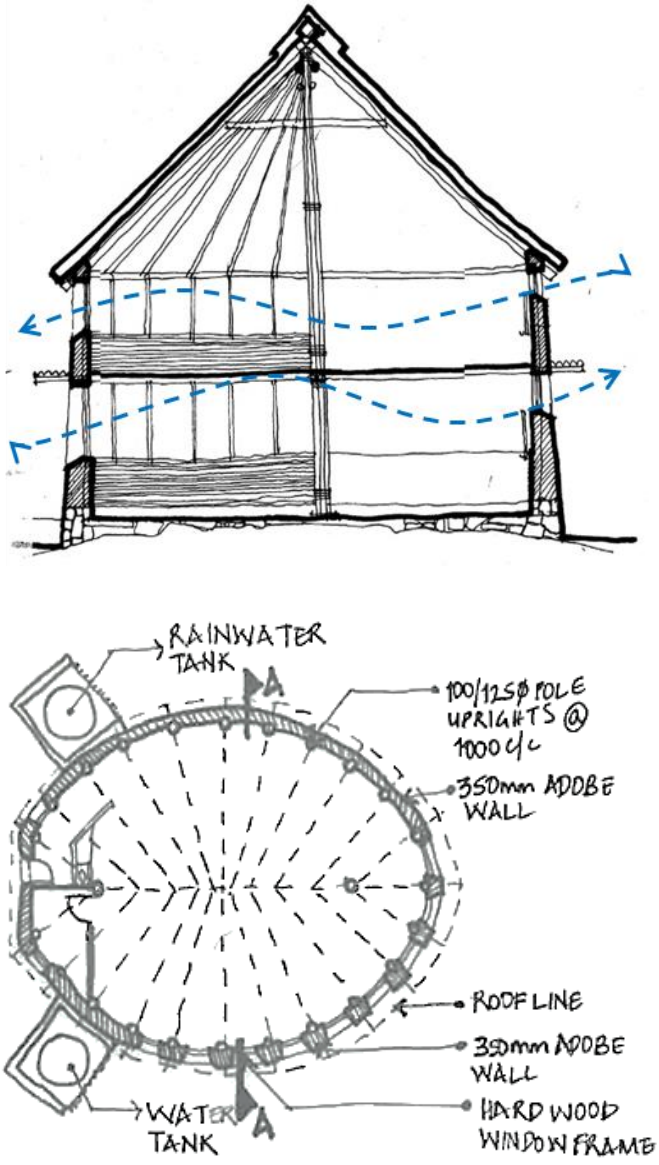


Figure 4.2g: *illustrating Solar devices to achieve a suitable IEQ at Seven Fountain School. (**Source**: Modified by Author from https://www.eastcoastarchitects.co.za/projects/seven-fountains-primary-school)*

passive design strategy for ventilation and cooling (**Figure 4.2g)**. The main aim of ventilation and cooling systems is to get rid of heat from indoor equipment, remove moisture and pollutants' emissions from materials and achieve a healthy indoor environment (Halliday, 2008). In addition, it also affects lighting and daylighting which are very important as it contributes to how people experience the building's internal spaces. Natural ventilation can be achieved through different natural windows or openings, stack/ passive, or atria (ibid).

Keeler and Vaidya (2016) add that passive cooling approaches depend on climatic conditions, as natural ventilation is more suitable for humid with reliable wind and dry, daytime temperature swing climates. The climates allow earth material to absorb heat and cool the interior naturally as it has amazing thermal mass (ibid). In summer, the earth building is cool and warm in winter (Heerden, 2019b). The climate also affects the construction process, i.e. Kokstad has a temperate interior climate which forced the community to make adobe bricks in winter **(Figure 4.2h)** as the climate receives less rain and bricks to dry fast in winter.

(Figure 4.2h): *illustrating women making adobe bricks/blocks in Seven Fountain School in winter. (**Source**: https://www.eastcoastarchitects.co.za/)*

- Passive Heating

Passive heating is attained through orientation, window positions and sizes, massing and use of thermal insulation in walls, floors and roofs (Keeler and Vaidya, 2016). The orientation is the most important principle to achieve passive heating design and a very cost-effective strategy. It is achieved when most windows/openings are facing the North/East orientation (in the southern hemisphere) since the west and south sides release more unwanted heat in summer and too little heat when needed in winter. Earth materials have high thermal mass and control and also absorbs heat during the day and releases it at night in winter. However, the good skill to use materials matters as the strategy requires a well-enclosed envelope (Keeler and Vaidya, 2016) as illustrated in **(Figure 4.2i)**.

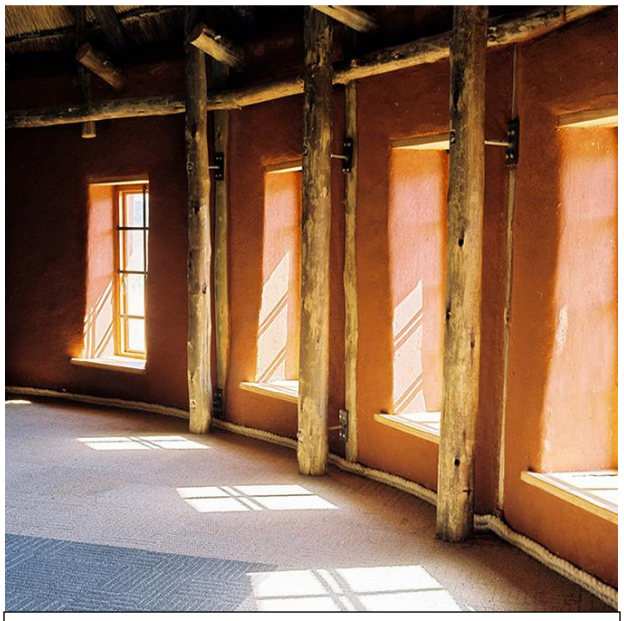


***Figure 4.2i**: illustrating plastered adobe earth and timber interior with quality details to ensure enclosed envelope at Seven Fountain Sckool.*
***(Source:** https://www.designindaba.com/articles/creative-work/oprahs-touch)*

4.2.4.3 Water and sewage management

Halliday (2008) emphasise that environmental sustainability includes construction materials and strategies to use water and energy. The role of sustainable water management is to minimise water pollution, promote effectual use of water and recycle. However, most projects disregard the importance of water management principle that includes water conservation, rainwater drainage (ibid). **Figure 4.2c** illustrates rainwater tanks to collect all the rainwater used to flush toilets and water vegetables.

4.2.5 Conclusion

The environmental aspect has been investigated for many years, yet the built form still contributes extremely in world pollution. Indigenous architecture is known for its sincerity to nature's conservation and environmental protection at a very low cost. Therefore, there is a need to absorb the knowledge and implement it into contemporary architecture to create a sustainable environment.

4.3 CONCLUSION

Sustainability has been investigated at a great extent. However, its knowledge is standardised and based on a specific region, which makes it infeasible in other regions. Sustainable construction requires responding to the environment's criticism of a region's natural resources including materials, climate and culture. Therefore, the standardised sustainable construction knowledge should be considered as guidelines that need to be criticised before implementation on projects. Nevertheless, indigenous architecture offers useful knowledge that could assist in the localisation of sustainable construction strategies including passive design, water conservation, recycling, use of materials etc. The use of materials requires good skills as it leads to an enclosed envelope that facilitates environmental health indoor, as most people spent time indoor. Moreover, architects should implement sustainable construction strategies in contemporary architecture design to reduce the entire pollution generated by built form and achieve a healthy, friendly and sustainable environment.

CHAPTER 05

SUSTAINABLE DEVELOPMENT THROUGH BUILT FORM: KEY PRECEDENT STUDY

5.1 INTRODUCTION

The following precedent studies were chosen across the globe as excellent exemplars that have successfully dealt with the theories and concepts that are core to the study. The two key precedent studies have responded to their local context, learned from local culture including vernacular architecture, climate, available materials and express it through the built form in a contemporary manner. The construction materials played a huge role to attain community resilience and sustainable environments within their regions. Hence, the chapter will analyse precedent studies and how they have dealt with context and underlying issues concerning construction strategies and materials.

5.2 JEAN-MARIE TJIBAOU CULTURAL CENTRE, 1993-1998

Architect: Renzo Piano

Place: Nouméa, New Caledonia

Concept: To preserve and celebrate historical culture and create a formal contemporary architectural identity.

Figure 5.2: *illustrates New Caledonia location on the macro map. (**Source:** www. mapsland.com)*

5.2.1 Introduction and Justification

According to Array (2019), the country was populated by Melanesians; Kanaks's ancestors when discovered in 1774 by the British. On 24 September 1853, France took over and removed the

British from power. During the colonisation era between 1864 and 1897, the place was turned into slave prison, given its island location and surrounded by water for shipment and Kanak people were enslaved there. Nevertheless, they fought back, and many uprisings took place especially the one led by Great Chief Ataï in 1878. New Caledonia has been French since then (Array, 2019). The Noumea, founded in 1854, is the capital city of New Caledonia. In 1946, the country was made a French Overseas Territory. Till to date, New Caledonia is a Melanesian country with a dynamic multicultural heritage forged by people who contributed to the country's history: the native Kanak people make 41% and other communities from Europe, Asia, Polynesia and Reunion Island, making it a home of diverse cultures (Array, 2019).

Consequently, the Melanesian: Kanak people's historical culture was disappearing when Tjibaou who was a priest and doctoral student, and an independence movement leader in the area, wished for his people to be aware of their historical culture and embrace it as much as they develop and participate in the modern world. Thus, he sought for the harmonious integration between the cultural and modern worlds. As Du Plessis (2002) states, the culture can be understood by local people and be meaningless to outsiders. The late Tjibaou shared the same opinion as he stated that it would be easy to talk about his culture, but the next person from a different culture cannot completely understand it, thus, global culture would not work if directly implemented into his culture (Lefaivre and Tzonis, 2003). The competition for the architectural design of a new cultural centre for the Kanak people was held in Noumea. The project's purpose was to get the design that reveals the Melanesian, Kanak's historical culture and create a formal contemporary architectural identity for all the Melanesian people (Lefaivre and Tzonis, 2003) through construction materials and strategies in built form.

5.2.2 Location and Historical background

The Jean-Marie Tjibaou cultural centre is located on the land donated by the municipality of Nouméa, within the small island of a lake that extends south-east into the Pacific Ocean, Southern Hemisphere. Thus, the building is in green land on the edge of the lake, but the location enables visual accessibility or connection with the CBD, airport and suburbs. Also, in 1975, the cultural struggle and political recognition by France were hosted in the very same site by Tjibaou.

Figure 5.2a: *illustrates New Caledonia location in world map; in the Southern hemisphere.* (***Source:*** *Modified by Author from www. mapsland.com)*

Figure 5.2b: *illustrates New Caledonia location on the macro map. (**Source:** Modified by Author from www. mapsland.com)*

5.2.3 The Building Design

The objective of the project is to preserve and celebrate the Melanesian, Kanak historical culture and create their identity in a formal contemporary world (Lefaivre and Tzonis, 2003). The intention was achieved through form, materiality and programme of the cultural centre as it epitomises the Kanak tribe in different perspectives. The centre has an administration section, research section, and music & dance performances, special events, and lectures section. The spaces created to display the spatial qualities of how the indigenous Kanak huts were laid out, the green spaces in

between filled with indigenous plants found in the island, and with the rooms displaying the tribe's rich culture through artworks and artefacts. In that way, the centre becomes the heart of the tribe as their memory palace (Pzarch14, 2012).

5.2.3.1 Architectural Design Concept

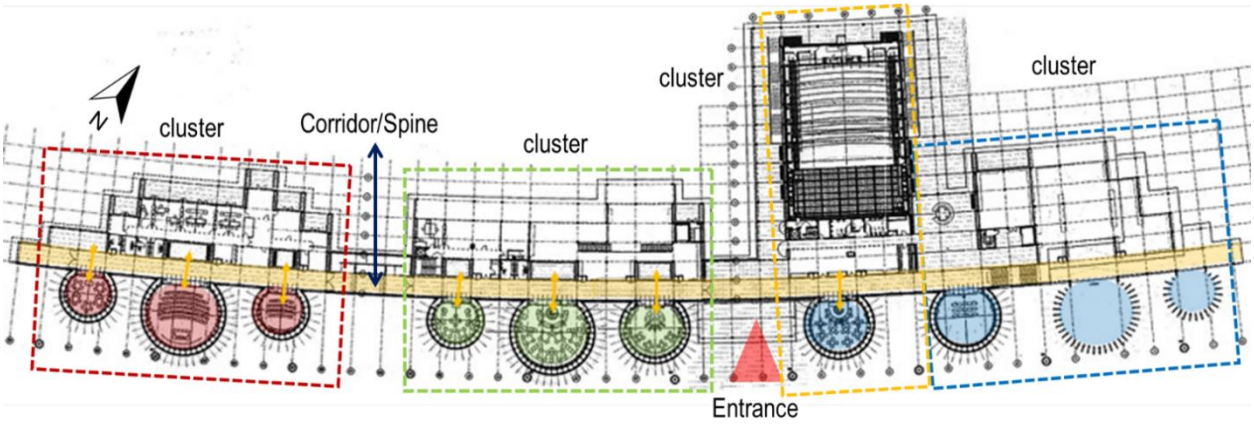


Figure 5.2c: *illustrate the floor plan of Jean-Marie Tjibaou Cultural Centre with circular form grouped into different 'villages group'.* ***Source****: (Modified by Author from Langdon, 2015).*

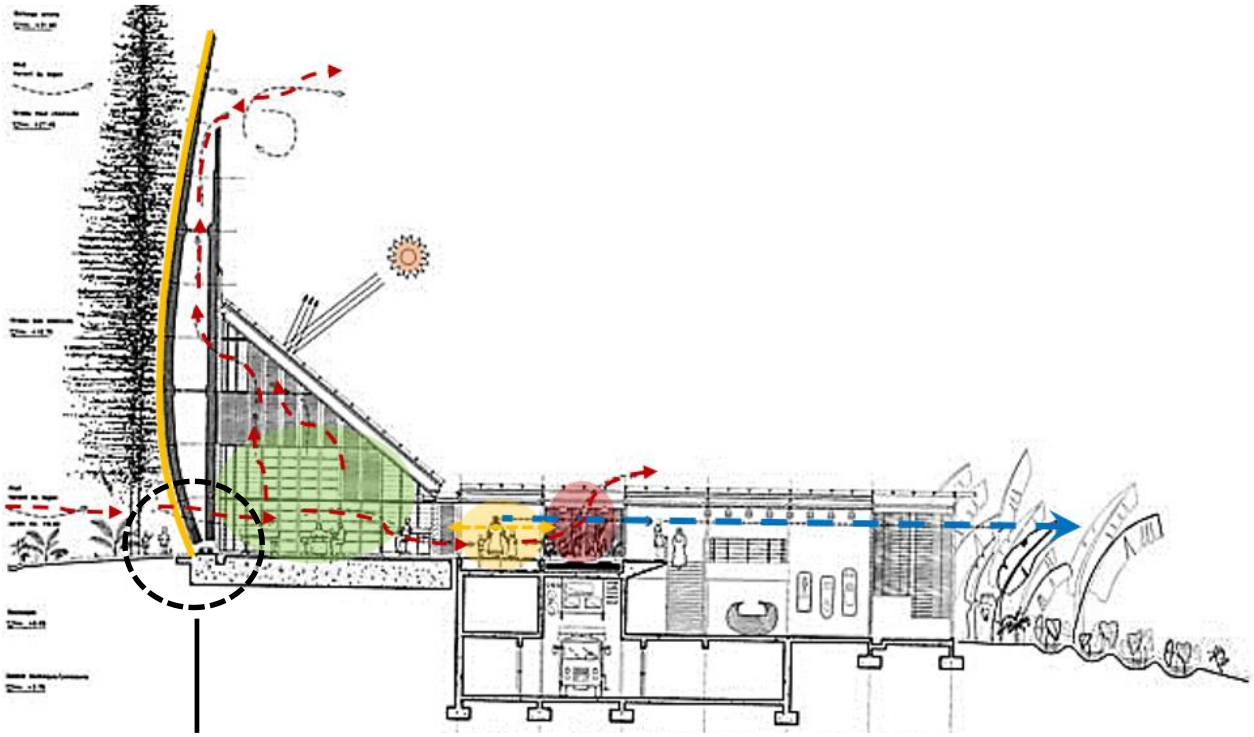
The architect, Renzo Piano first studied local culture, Kanak vernacular architecture, and available raw materials. However, he was concerned about not designing another Kanak hut, but a universal architecture that acknowledges sustenance and celebrates the Melanesian, Kanak culture. Therefore, the Kanak village's vernacular architecture principles are incorporated into the design. The building consists of 10 huts as memory boxes which are grouped into three village clusters **(Figure 5.2c)**. Each cluster has the main hut with cases which is 28m high in the middle. The huts symbolise the great hut of the Kanak Chiefs (Piano and Brignolo, 1997). Therefore, the form generator is from indigenous Kanak huts. However, it was interpreted in a universal language, thus this is an exemplar of critical regionalism in the contemporary world.

The centre has the main axis as a spine that contains main circulation spaces and opens to one side to allow for cross ventilation within the building. The spine circulation follows the lake's axis and connects the 'three villages cluster' of which each connects with an opposite rectangular courtyard space which also opens to the corridor (**Figure 5.2c)**. The well-planned circulation allows people to experience indigenous plants with mythic meanings and very powerful in Kanak culture (Piano and Brignolo, 1997).

5.2.3.2 Response to the local context and environmental conditions

The building is in the green land, thus, in prior construction, the cut plants were replaced with some indigenous plants; Norfolk Island pines (Langdon, 2015). The cases - curved structural elements, represent the surrounding tall trees, as the design fits into context fully. Also, they block off the harsh prevailing winds from the Baie de Murari lake on the south and associated with the climate since the temperature ranges from 18 degrees in winter to 34 degrees in summer (Pzarch14, 2012). In addition, the cases serve as sun shading devices, especially in summer. Thus, the passive cooling strategies (**Figure 5.2d**) through natural ventilation and shading devices ensure the building gets enough cool air flowing through to attain indoor air quality for its occupants (ibid). The flat stainless steel and glass roofs are supported on laminated Iroko columns, volumes are largely defined by timber and glass louvres, which form part of the passive cooling system. Internally, the adjustable louvres are implemented on the walls at a lower level of the complex.

The 10 circular huts which are memory boxes stand out as the spine is at a lower level together with the rectilinear forms dropped to underground to allow more views and visibility of timber huts as illustrated in **Figure 5.2d.** The trees also hide the rectilinear forms from a distance, which are human scale in relation to tall -28m high memory boxes.



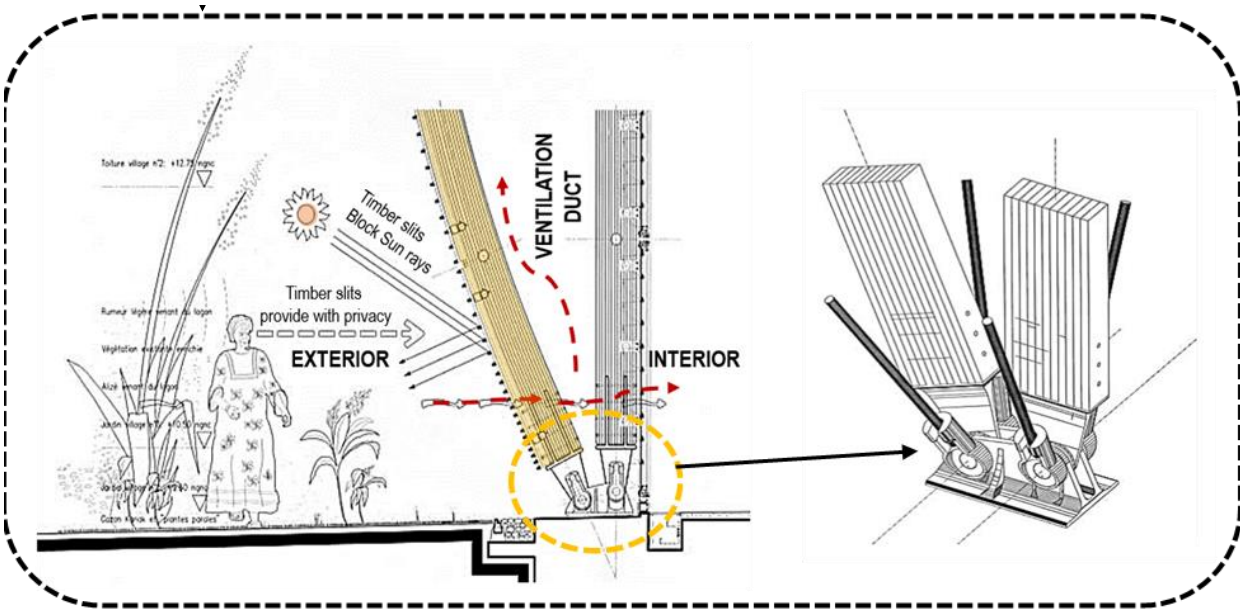


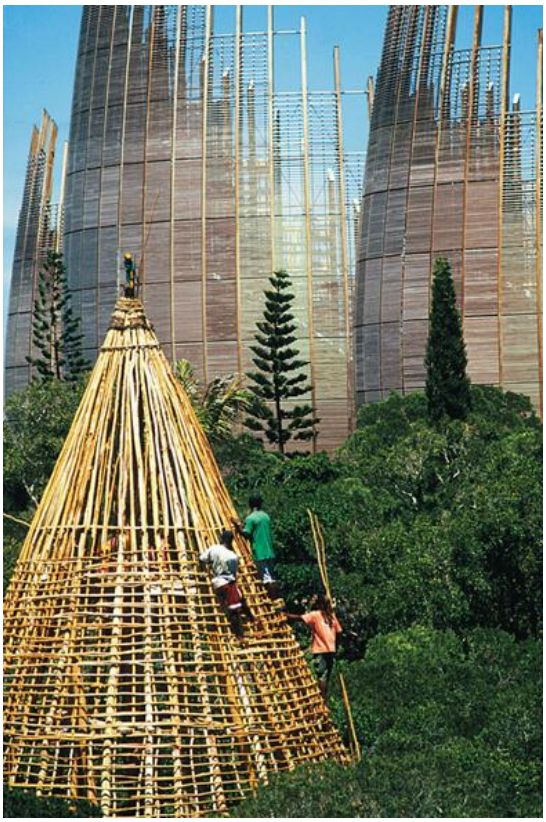
Figure 5.2d: *cross-section illustrating passive ventilation through the building (on pg. 89) and symbiosis of circular and rectilinear forms, and construction timber and steel materials (above).* ***Source****: (Modified by Author from Langdon, 2015).*

5.2.4 Integration of indigenous and modern construction strategies and materials

The architect drew inspiration from the Kanak vernacular architecture which uses a large amount of timber, which is seen in Jean Marie centre design. Renzo Piano is an architect who claims not to follow any theory but his design relies on local construction strategies (Thompson). He declares that the life around the Pacific Ocean is only temporary as the indigenous buildings are made of local perishable materials. Thus, the continuity of the reliance on the preservation of a specific construction strategy rather than the actual building (Piano and Brignolo, 1997). Thus, the Kanak construction strategy was implemented as the principle that guided the design of the centre and to preserve the strategy. The indigenous tall hut structure made up of palm saplings and has a thin curved roof which is cladded with more palm timber members on top **(Figure 5.2d, e & f).**

However, the symbiosis theory was implemented on the centre building to interpret traditional architecture tectonic with modern construction materials such as steel to cover a bigger span and which is equivalent to about 8 storey building, glass, and local materials such as wood and stones. Furthermore, the project involved local people such as leaders and women (Thompson), to ensure the community look after the building. Therefore, implementing local construction strategies contributed to community participation in the project. Consequently, the community perceives the

architecture as relevant to their historical culture as a result of engagement, programmes and the architecture itself.



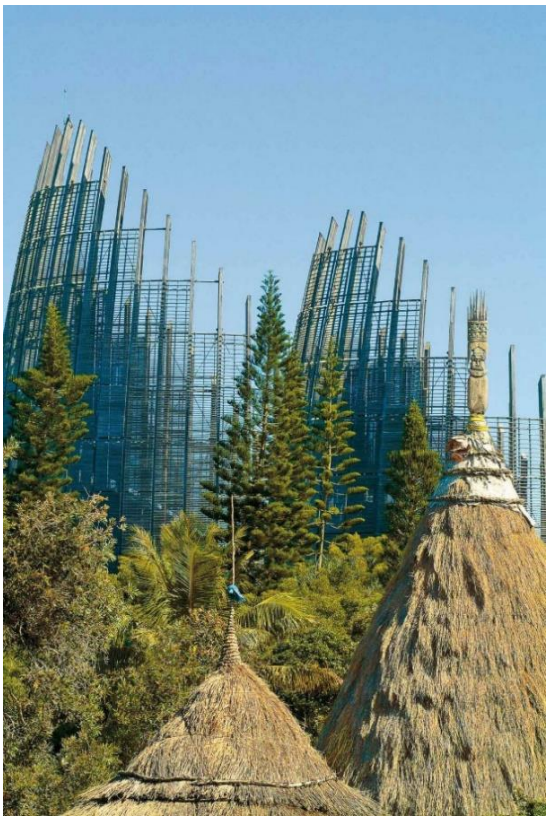


Figure 5.2e: *illustrate the construction of Kanak indigenous architecture, timber and reed were used which is in common with the Jean-Marie Tjibaou Cultural Centre at the back.* **Figure 5.2f*:*** *illustrate complete Kanak hut covered with thatch grass material. (**Source**: https://www.arch2o.com).*

Figure 5.2g & h: *illustrate that laminated iroko timber blend well with nature & its typical detail with steel tensions to support structure. The cases are fixed unto the main timber structures. (**Source:** www.inexhibit.com/mymuseum/the-jean-marie-tjibaou)*

The timber elements on cases are carefully spaced unevenly to create a light and shade aesthetic **(Figure 5.2d)**. The timber was locally harvested, however, the Iroko timber was imported from the West coast of tropical Africa, because of its properties to withstand harsh weather conditions as its finish, gets better as it weathers, and laminated in France before transporting to Nouméa, New Caledonia (Pzarch14, 2012), (Thompson:255). Also, the timber cases allow for natural light to pass through and fill the interior. Piano cautiously chose wood or timber to evoke the qualities of natural surroundings; trees. The rot proof Iroko ribs become pale silvery grey and resemble the trunks of indigenous palm trees. In that way, it emerges organically from its land and context (Thompson:255) **(Figure 5.2f).**

Figure 5.2i: *illustrate the exterior and interior of indigenous Kanak hut constructed with timber sourced locally.* ***(Source:*** *www.inexhibit.com/mymuseum/the-jean-marie-tjibaou)*

5.2.5 Conclusion

Materials do not determine the form but culture does (Rapoport, 1969). Tjibaou Cultural Centre supports this philosophy as it captured the indigenous spirit through modern materials, but the culture dictated the building's form. However, the materials and strategies had a role in fulfilling the objectives of the centre's design; preserving Kanak historical culture through modern world

lenses. This connotes that each community has its traditional architecture systems which can be expressed through construction materials and strategies as it forms a part of their culture.

As Du Plessis (2002) states, culture can be understood by local people and be meaningless to outsiders. The late Tjibaou shared the same opinion as he stated that it would be easy to talk about his culture, but the next person from a different culture cannot completely understand it, thus, global culture would not work if directly implemented into his culture. Therefore, when people do not understand the culture or symbol or cannot relate to construction materials used in a building, it means nothing to them. Renzo Piano incorporated the local culture to create a universal identity and sense of place by capturing vernacular spirit successfully through universal construction strategies & materials and forms that connect closely to local people while still communicating easily with outsiders. The forms, traditional architecture tectonics stand out, evoke emotions and create a memorable place. Also, the building fits into the context naturally and respond to its context, thus it is known as a sustainable building.

5.3 DANO SECONDARY SCHOOL, BURKINA FASO, 2007

Architect: Francis Kere

Place: Gando Village, Boulgou Province, Burkina Faso.

Concept: To combine global architectural knowledge with indigenous building strategies to facilitate infrastructure and provide the community with access to education.

Figure 5.3a: *illustrating women passing by the completed Dano Secondary school at the back. (**Source**: http://www.kerearchitecture.com/projects/secondary-school-dano/)*

5.3.1 Introduction and Justification

The 510 m² school project consists of three classrooms, a computer room and office space. There is also a covered outdoor "conversation pit", where students can sit during break times. The precedent study was selected because it blends well with rural context through the revitalisation of sustainable construction materials and strategies implemented and promotes indigenous knowledge transmission, education, and train people with construction skills. The project's main aim was to come up with a suitable design that meets the climatic conditions and all other sustainability aspects such as economic, social and environmental. As a result, the integrated design was implemented successfully. The project perfectly combines sustainable development concept and community participation theory.

5.3.2 Location and Historical background

Figure 5.3b: *illustrates Burkina Faso, Africa location in world map; in the Northern hemisphere.*
*(**Source:** Modified by Author from www. mapsland.com/ Africa/Burkina-Faso)*

Gando is a small village in the province of Boulgou, Burkina Faso. The area experiences very high temperatures in hot seasons which ranges between 44 and 55 degrees while receiving less rainfall in yearly (Tomfreed, 2012) as it lies in the tropical savanna climate in the Northern hemisphere. Consequently, the area has limited resources for construction materials. Earth material is mainly used for construction because of its availability and affordability in the village (**Figure 5.3c)**. Thus, the community struggles with building facilities' developments, for instance, children in the community walk long distances to get to their schools. In addition, the existing built form is not of good condition as it has ventilation and natural lighting issues. On the other hand, the country is

among the poorest globally with over 80% rate of illiteracy (Tomfreed, 2012) and the government can do little to nothing to uplift the schools-built facilities. Dano Secondary School is one of the projects built, applying Francis Kéré's sustainable philosophy.

Figure 5.3c: *illustrate the Gando village in Burkina Faso. The earth material is primarily used for the walls in the area. (**Source:** Modified by Author from en.wikipedia.org/Gando).*

5.3.3 Francis Kere sustainable philosophy

Francis Kéré, the architect who grew up in the Gando community developed the philosophy of implementing sustainable construction strategies and materials to uplift the community and bring the social change (Tomfreed, 2012) which is harmonised with the sustainable development concept. Sustainable development concept emphasises the importance of comprising social, environmental and economic aspects (Wced, 1987). Kéré analysed the surroundings of Burkina Faso especially the indigenous architecture construction strategies and materials as a social matter and draw inspiration from it to ensure the community will engage frankly. Also, the topographical quality and its impact on the built form such as ventilation and natural lighting issues were analysed

and tackled as an environmental point. Furthermore, the economic perspective is the major driver of the philosophy since the main objective is to uplift the poor rural communities-built environment. Thus, this precedence focuses on Dano Secondary School but will also include other projects by Francis Kere philosophy.

5.3.3.1 Community engagement and knowledge transmission

The Gando community has a culture of supporting each other when constructing traditional village houses and believes in giving back to uplift the community (Kere-Foundation). This encouraged Francis Kere to conceptualise and revitalise indigenous knowledge for construction to embrace community engagement and achieve community resilience. Consequently, during construction, all community members participated as children collected stones for the foundation and lower walls and fetched water with the senior lady's assistance, for the construction of mud bricks (**Figure 5.3e & f**). Women smoothen or polish the earth floor with stones (**Figure 5.3d)** while men worked on the walls and roofs etc. The participation allowed the transmission of Indigenous Knowledge from seniors to the younger generation as they were all working together and the IKS theory works well through practical scenarios.

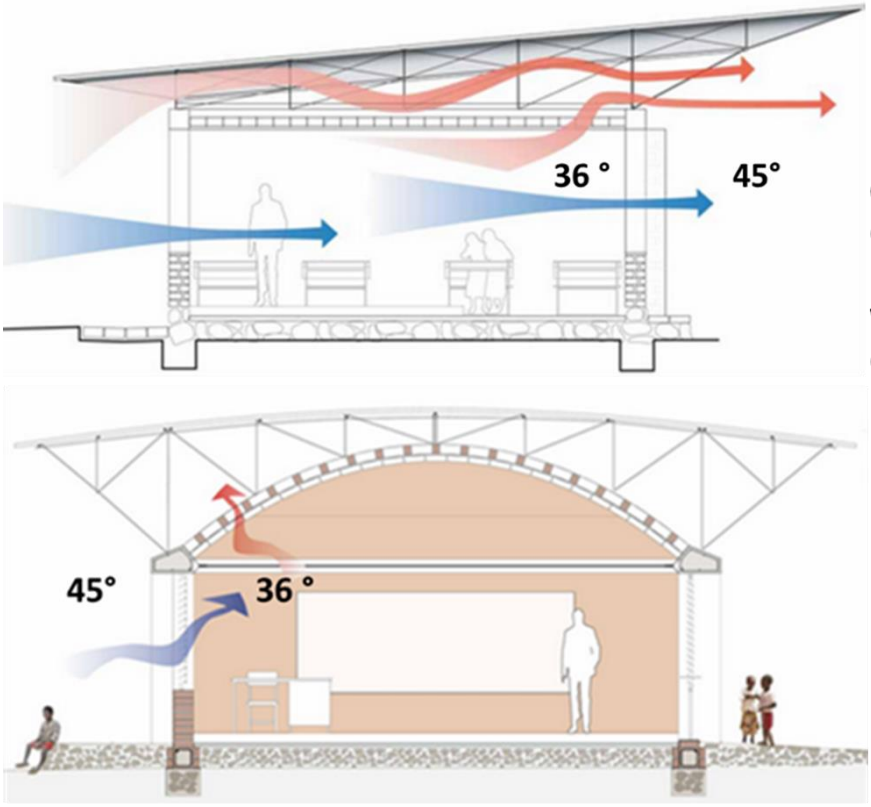
In addition, the ethos of community participation implies that the community played a role, participated and had a say in the project which will directly affect their lives (Cooke and Khotari, 2001) and empower them (Hamdi, Goethert,1997). Dano project affirms the theory as Kere states, '*Only those who are involved in the development process can appreciate the results achieved, develop them further and protect them*'(Kere-Foundation). Therefore, community participation creates a sense of belonging and identity to participants, which leads to project acceptance, preserved, valued and taken care of by the community (Kéré, 2013). Community participation creates acceptance. Thus, the project has received awards for the best community pride project and sustainable architecture (Kere-Foundation).

Figure 5.3d: *illustrate women participation refining the floors with stones to get a smooth polished surface.*
Figure 5.3e: *women carrying their handmade pottery used for the construction of roof light at Gando library project.* ***(Source****: (Kere-Foundation)).*
Figure 5.3f: *illustrate children watering plants with senior lady's assistance, after fetching water.* ***(Source:*** http://kere-foundation.com/en/*).*

5.3.3.2 Response to the local context and environmental conditions.

Climate is one of the secondary factors that affect the built form (Rapoport, 1969). Kere focuses on the climatic response to deal with the very hot climate, ranges up to 45 degrees, in Gando naturally. The natural ventilation was one vital principle of design to achieve thermal comfort or good IEQ in the room; permeable suspending ceiling and shaded windows which allows natural airflow (**Figure 5.3g)**. Thereby, artificial air-conditioning was eliminated to cut cost and energy,

yet it drops the heat by +/-9 degrees. The country is on the list of countries that require imported energy to meet local demands, therefore, energy-saving is critical (Tomfreed, 2012). In addition, the walls are protected from heavy rains and attain more shaded areas with large overhangs of corrugated sheeting to correspond to harsh weather conditions. The corrugated roof sheeting is mainly used in the area; however, it absorbs too much heat from the sun and makes the interior unbearably hot. Thus, the perforated clay ceiling with ventilation was introduced as an innovative idea. The clay brick joint with mortar suspended ceiling allows air circulation from the interior and exterior of the building (**Figure 5.3g)**. The same design principles have been implemented on different projects by Francis Kere in Burkina Faso.



Roof: Corrugated sheeting & steel tube trusses.

Ceiling: suspended adobe ceiling.

Walls: 8% cement and earth traditional Clay-brick load bearing.

Foundations/Floor base: clay and natural stone filling.

Floor finish: compressed clay, clay traditionally pounded.

Figure 5.3g: *illustrates the natural ventilation system; permeable suspending ceiling and shaded windows allowing natural airflow. (**Source**: Modified by Author from http://kere-foundation.com/en/).*

5.3.4 Integration of indigenous and modern construction strategies and materials

The success of the project relied on both embracing and responding to the local constraints such as very hot climate, scarce construction materials, and poverty issues (Tomfreed, 2012). It is

important to combine indigenous and modern techniques for great longevity; however, the indigenous strategies must be sustained on the project to keep the community independence of construction. In order to maximise results with the minimal resources available, earth/clay is abundantly available in the region and is traditionally used in the construction of local housing. The critical regionalism was crucial for Kere material selection as he articulated that if the project is in England as an advanced country in modern technology and industrialisation, the industrialised materials and strategies would be used as readily available materials. However, in Gando, they use clay as the most readily available materials (Kéré, 2013). Nevertheless, some traditional clay-building techniques were modified by mixing with 8% industrial cement to create a more structurally robust construction material and protect against erosion during short rainfall seasons (Tomfreed, 2012).

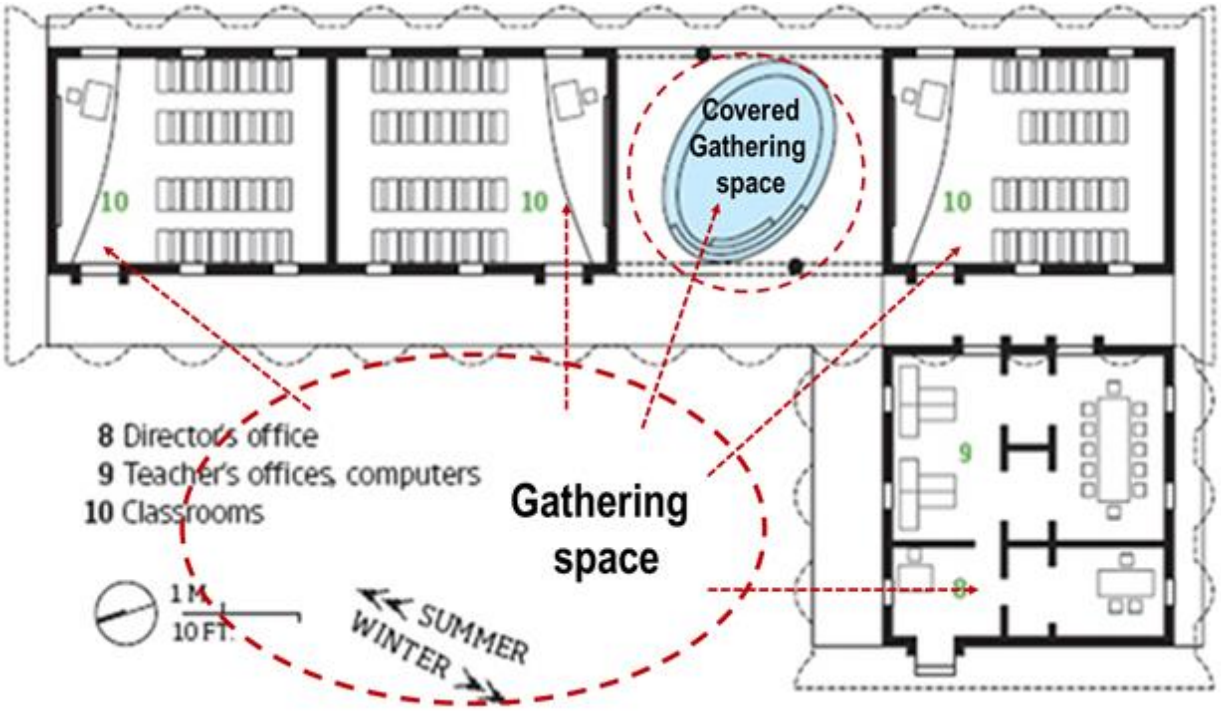


Figure 5.3i: *illustrates the floor plan with covered gathering space in between to encourage unity among learners and community under shaded and unshaded area and to create a learning environment.* ***Source****: (Modified by Author from http://kere-foundation.com/en/).*

Earth was used for the walls. The use of cement was one of the innovative ideas in the region. Cement was also used for concrete components such as lintels for the windows and doors while stones with mortar were used for foundations. Besides, the clay bricks have the added advantage

of being cheap, easy to produce and provide thermal protection against the hot climate. Moreover, the corrugated sheeting is mainly used for traditional houses roofing in the region and was also used in the project. The cheap steel roof trusses were implemented in the project. The continuous non-reinforced foundations are made of a mixture of compressed clay and natural, locally harvested stones (**Figure 5.3g)**.

5.3.5 Conclusion

Francis Kere has designed several projects in Burkina Faso based on his sustainable philosophy. The approach embraces the critical regionalism from incorporating indigenous form, climatic responsive, to local construction materials and strategies. The indigenous materials and strategies were mixed with modernised ones to invent innovative ideas while still embracing community capacity and resilience achieved through community participation as discussed in the literature. The community can then implement the innovative ideas in their homesteads and community facilities and improve local built form on their own. Therefore, the aim was to learn from this rural region's critical approach and implement it in other places though it will vary depending on social, economic and environmental issues.

CHAPTER 06

CONCEPTION OF CONSTRUCTION STRATEGIES AND MATERIALS IN MODERN SOCIETY: CASE STUDY

6.1 INTRODUCTION

This chapter intends to conduct ethnographic research from the rural region of KwaZulu Natal, Pietermaritzburg, Sweetwaters (KwaMpumuza), to find out how sustainable construction materials and strategies impact people's lives. The ECD is constructed with rammed earth with the community assistance and runs different programs to uplift the rural community. This includes both indigenous combined with modern construction strategies in a sustainable manner. Therefore, the impact of people's engagement, the materials and strategies will be explored. Critical analysis will be synthesised against the concept, theories and literature reviewed earlier in the study.

6.2 ITHEMBALAMAMPUMUZA ECD, KWAMPUMUZA, PMB

Architect: Chonco Bryan Architects
Place: KwaMpumuza, Pietermaritzburg, KZN (3,800 m²)
Motivation: Empowering local community members through the construction of community building

Figure 6.2a*:* *illustrates the exterior of IthembalamaMpumuza ECD.* ***Source****: (by Author,2019)*

6.2.1 Introduction and Justification of case study

The IThembalamaMpumuza ECD is in the rural region of KwaMpumuza, Pietermaritzburg. The community is energetic and culturally rich. Nevertheless, the region is also characterised by poor

housing and restricted important services and facilities. Poverty is overflowing and there is a shortage of education/skills required for employment. Thus, the unemployment rate is high and numerous families depend on social grants for survival (Projects, 2017). Employment opportunities are scarce, caused by the low level of education, which leads to a high rate of unemployment amongst the people. In 2001, the unemployment rate was over 70% but has improved to some extent. There are primary and high schools in the area, but most are under-resourced and understaffed. Consequently, learners perform poorly when they enter the formal education system at higher levels and quit (Projects, 2017). Thus, the Ithemba project implemented low-cost construction strategies and materials in the area. The ECD/ Community Centre project started with a preschool and the second phase is the community centre.

6.2.2 Location

Figure 6.2b: *illustrates South Africa location in world map; in the Southern hemisphere.* ***Source****: (Modified by Author from www. mapsland.com/ Africa/south-Africa)*

Mpumuza (Sweetwaters) is a poor, semi-rural community located 5km outside the town of Hilton, Pietermaritzburg in Kwa-Zulu Natal. It has between 50 000 and 60 000 population, comprising mainly of youths and children. The region is surrounded by hills covered with green vegetation during the summer months.

6.2.3 Empirical data

The information presented in this chapter is based on firsthand observation and analysis. The aim is to experience the spaces and environment first hand, embrace the spaces, feel the warmth triggered by construction materials and strategies used in the building. Also, to find out the impact construction materials and strategies have on the local community of KwaMpumuza. Therefore, eventually confirming secondary data and vision stated early in the section, and finally analyse against the architectural principles reviewed in previous chapters.

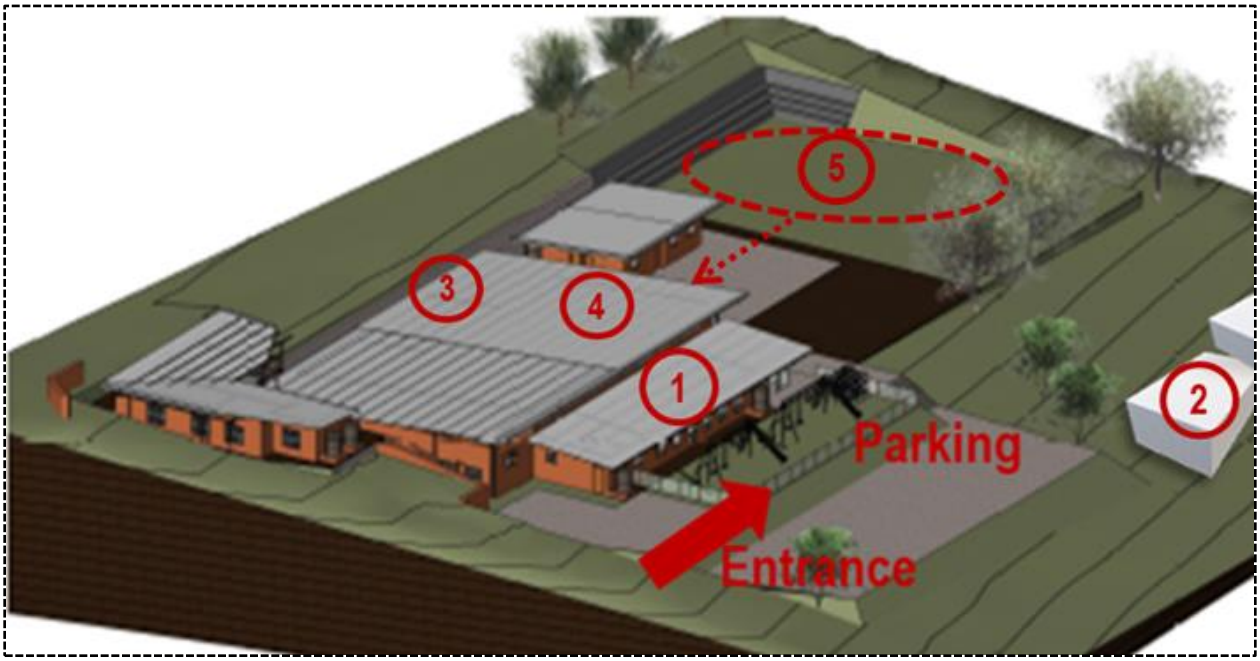


Figure 6.2c: *illustrates IthembalamaMpumuza ECD.* ***Source****: (Modified by Author from Brian Chonco Architects).*

Figure 6.2d 1-2: *illustrates IthembalamaMpumuza ECD.* ***Source****: (by Author,2019)*

Figure 6.2d 3-4: *illustrates IthembalamaMpumuza ECD.* ***Source****: (by Author,2019)*

6.2.3.1 Sustainable Development design Approach

The IThemba programme enables the community of Sweetwater to create job opportunities and eliminate poverty through indigenous knowledge including agriculture **Figure 6.2d(2)** and construction skills (**Figure 6.2c**). They started by analysing the local context issues and figured the source of poverty, accelerated by the lack of skills. Most people do not have formal education and do not have requirements for most employment opportunities. Thus, the organization came up with the following programme for the centre; A GAP year for Community School leavers; After school homework support; Teachers training and resource centre; Base for the Early Childhood Household stimulation programme; Children and teens holiday programmes; Sports clinics; Community discussion groups, Community functions. Currently, Early Childhood Household stimulation is the only programme operating on site (**Figure 6.2e**), thus the community centre is sometimes called ECD (Projects, 2017).

6.2.3.2 Community Participation

The community's participation is crucial to accomplish community resilience. Thus, the architect designs the building and ensures the community will be involved from the start until the end of the project. In that way, the community takes ownership of the building. As some participants stated as per **Appendices interview: I**, '*if anyone wants to destroy this building, they will have to go through us. We built it with our own hands, and it forms part of our lives'*. They spent long hours on-site learning and exploring the new techniques and then building the preschool, and worked

closely with the engineers, architects, technicians, donors and volunteers. Some members such as local businesses were not physically available on site but donated construction materials (Projects, 2017).

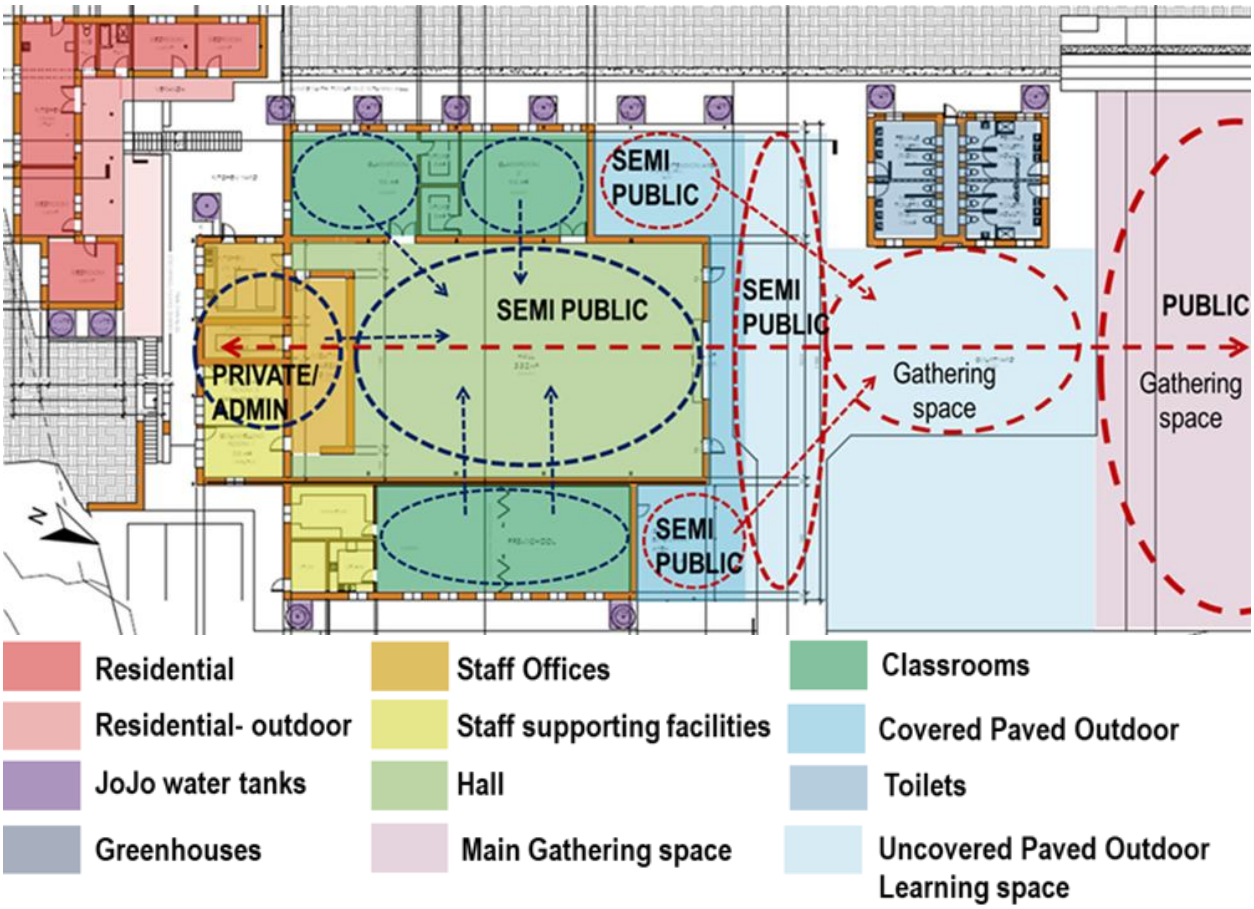


Figure 6.2e: *illustrates IthembalamaMpumuza ECD Floor plan.* ***Source****: (Modified by Author from Brian Chonco Architects).*

They improved and integrated indigenous skills with contemporary technologies to achieve a global acknowledged identity. The rammed earth is known in some places within the KZN province. However, in KwaMpumuza, most people did not know it, thus experienced people, not from the area taught local people. Therefore, the knowledge was transmitted during construction and the site became a learning platform. The completed section is ECD and the second phase is the community centre to house the beginning of the children and teens support centre programmes. They aimed to employ and train unemployed community members and ensure they gain marketable skills. In the end, they had both the technique and the team that produces quality, low-

cost buildings for the community centre, and the community as a whole (Projects, 2017). Thus, the development was divided into different phases to ensure the community consume knowledge and also fully engage and apply it on the other phases during construction.

The earth material is used as the construction material for housing in the area. However, the community normally use adobe bricks and not the rammed earth. Therefore, earth culture is not completely new in the region and easily creates local cultural identity and the familiar environment through construction materials. Nevertheless, the indigenous material was integrated with other industrialised materials such as concrete column, corrugated roof sheeting and steel columns for longevity purposes. Also, the earth is affordable and suit the humid subtropical climate location.

6.2.3.3 Construction strategies

- **Foundation construction**

Rammed earth technology involves mixing soil excavated from the building site (Step 01), refine and filter (Step 02) and mixed with lime stabilizers to make it strong (Step 03). The composite soil mixture is then rammed into 500mm thick trenches (Step 04) between wooden moulds/shuttering until it is cured. The method is cost-effective, eco-friendly, and a better insulator than cement blocks the community normally use (Projects, 2017). Nevertheless, the foundations were constructed with in-situ concrete with some stones as stabilisers to make it durable and strong enough as a proven strategy.

Figure 6.2f *illustrates rammed earth composition process on-site, foundation and trenches construction on site. (**Source**: By Author, 2019).*

- **Wall construction**

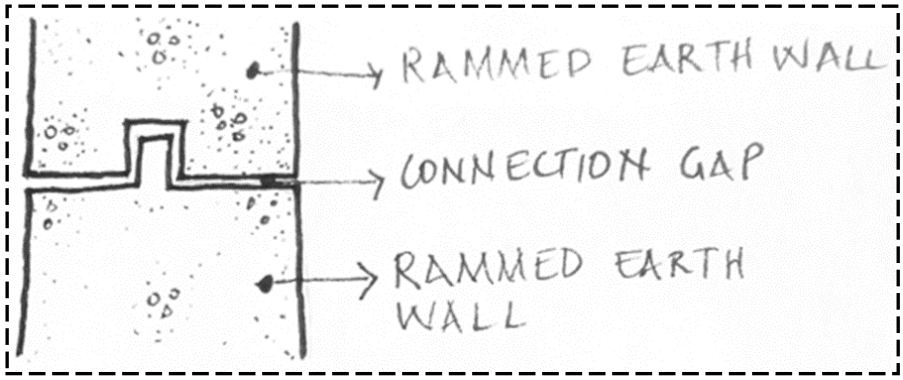
Figure 6.2g: *illustrates rammed earth wall construction. (**Source**: By Author, 2019).*

However, every site has different soil type, thus, it took time to get the suitable soil and correct stabilizers to get the strong composition for walls. In the case of KwaMpumuza, the professional engineers discovered that the lime is the best stabiliser and also affordable. The site has different soil types; red and black soils; the black soil failed to give the required results while the red soil succeeded. Therefore, the formula of soil composition was formed containing red site soil, lime and water (Projects, 2017). The earth mixture is poured on the foundation, inside the 500mm wide two thin wooden shuttering separated with the movable reinforcement (**figure 6.2g**). The workers then prepare the composition and only remove the shutters when it has set. The walls are not plastered but finished with bonding liquid painting to protect from rain and get the polished finish **(figure 6.2h)** as it gives a dull and dusty aesthetic without the finish **(figure 6.2i)**. The process is affordable, especially when using machines instead of human labours but not environmentally friendly. It took 12 days for four men to build 5m wide x 7m high wall. In addition, the walls are 500mm wide, thus the concrete win blocks

that cover the entire wall thickness are used instead of the normal window frame which is too thin for the walls (**figure 6.2h)**.

Figure 6.2h & i *illustrates rammed earth wall with and without finish painting respectively. (**Source**: By Author, 2019).*

- **Walls connection detail**



The connection detail requires a good skill as it might result in leaking and an unenclosed building envelope which might jeopardise the IEQ (**Figure 6.2j)**. It is very important in ECD construction as it is built at different phases. Therefore, workers had to be careful when connecting old and new structures.

Figure 6.2j: *illustrates the rammed earth wall connection detail. (**Source**: By Author, 2019).*

- **Roof and overall innovative construction strategies and materials**

Corrugated sheeting is mainly used for roofing in the area as the cheapest available material, manufactured within the local perimeters and lasts longer. The treated gum poles were locally harvested and used instead of manufactured trusses in shorter spans. The disadvantage of gum poles is that they easily loosen up within a few years. Thus, the steel tensions were inserted on them to support the roof and can be pulled and tightened when the roof starts sagging and sinking in the future (**Figure 6.2k**) as discussed on **Appendices interview: I**. However, the Steel portal frame was used for the bigger span section i.e. hall section, to create a big gathering space and eliminate distractions/ columns in the middle. The steel is not an organic material but was ordered locally, around Pietermaritzburg to avoid pollution produced during delivering logistics.

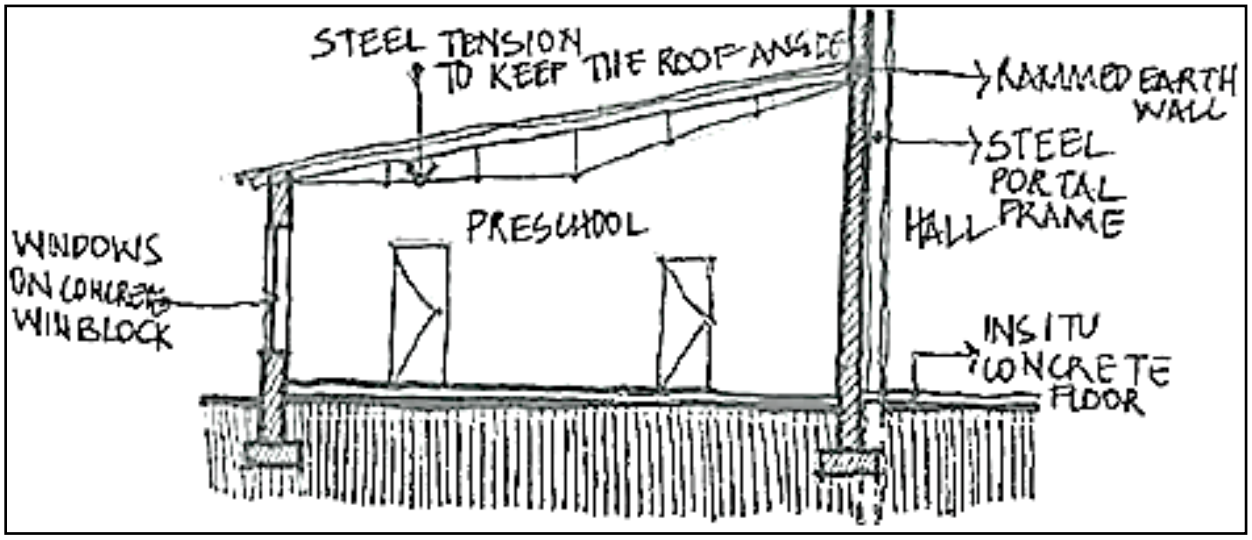


Figure 6.2k: *illustrates timber gum poles & steel tension to keep the roof angle the same in future.*
Figure 6.2a: *concrete plaster on edges for aesthetic purposes. (**Source**: By Author, 2019).*

Concrete plaster is used to cover some wall sections that were not done correctly as the community was learning by doing/ practical learning. It was difficult to correct some sections, yet they were structurally correct, hence they were scraped to get a flat surface and plastered instead of demolished. In other sections, it was used for aesthetic purposes to break down the massive walls that give negative spaces (**Figure 6.2a)**. The community members designed the plaster for aesthetics and the internal is painted white while the exterior is unpainted to avoid costly maintenance and for longevity.

Different volumes and polycarbonate sheeting were used on clerestory windows and allowed natural light to fill the indoor spaces to achieve good IEQ that contribute to occupants' comfort, health and productivity level (**Figure 6.2m**).

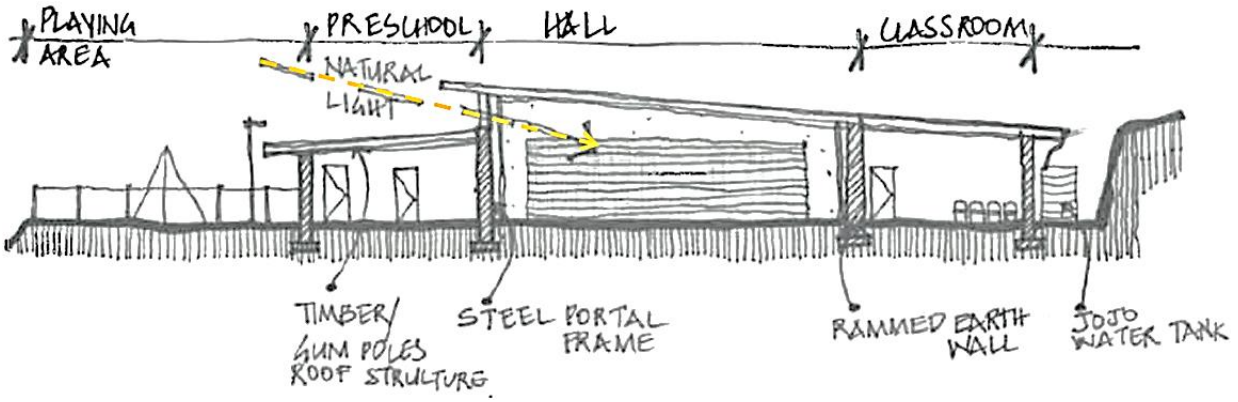


Figure 6.2m: *illustrates section high window to fill indoor space with natural light. (**Source**: by Author).*

The site has several JoJo tanks to collect rainwater (**Figure 6.2n**) for construction, watering of plants and to flush toilets. This is very important since IThemba has a holistic sustainable approach which is harmonised with the sustainable development concept by tackling social, economic and environmental aspects. Also, there is a global issue of misusing natural resources as South Africa is currently facing water shortage issues. The surrounding community is evidence of the impacts the IThemba programme has as they now have a small vegetable garden per house for self-sufficiency as trained in the centre.

Figure 6.2n *illustrates JoJo tanks collecting rainwater from the buildings and supply the entire site. (**Source**: By Author)*

6.2.4 Conclusion

Sustainable construction and materials could bring change and help a community eradicate poverty by offering them some skills to be employable based on their context. Community involvement gives the community a sense of ownership and will look after the building, as they have the necessary skills. Also, the community takes pride in the project as they were involved from its conception stage and during construction.

CHAPTER 07

ANALYSIS AND DISCUSSION OF FINDINGS

7.1 INTRODUCTION

The research hypothesis acknowledged that sustainable construction strategies and materials carries unrevealed knowledge that is only understood by individuals of a specific community and its implementation could rebuild a sense of belonging and community. Thus, it should be revived and integrated into contemporary designs to fulfil the wishes of the 21st-century people. The hypothesis was backed up by the fieldwork conducted in the rural region of KwaXimba, KZN. The interviewed seniors affirmed that indigenous construction strategies and materials unite people as they help and learn from each other and every community member participates during construction. The community is familiar with the created environment and feels at home even in a neighbour's yard or within the village. The youths agree with elders but raised the issue of the indigenous living style as backwards, implying integrating with modern systems to accommodate current needs. Therefore, planning and architecture have an opportunity to preserve historical cultures while closing the gap between indigenous and contemporary construction materials and strategies harmoniously through built form.

7.2 CONCEPTUALISING CULTURE WITHIN THE DEVELOPMENTAL AGENDA

In the first chapter, the research looked at culture with an intention to implement it within the developmental agenda. Culture is everything and regionally based in most cases. However, it's been sidelined in developments resulting in community decay. Rural regions thrive through cultural activities such as craftwork, medicine, agriculture and vernacular architecture. The indigenous planning embraced those cultural activities to ensure community resilience within regions capacity (Olufemi, 1995:196). Nevertheless, contemporary planning is failing to acknowledge the local skills that could be used to eradicate poverty. Many governments exclude robust regions concerning infrastructural developments, yet they carry the rich cultural knowledge and skills that could reduce the high rate of unemployment and poverty and provide the community members with skills to sustain themselves.

Lately, the importance of culture in developments has been discovered. Involvement of culture results in inclusive, successful projects and sustainable development (Unesco, c2019). Thus, the

UNESCO has developed new policies to promote the implementation of culture in global, national and regional levels to resolve social issues. Consequently, there is a global urge to preserve cultural built form as models that allow communities to interact, express local cultural identity and attain community resilience. South Africa has adopted some cultural policies and implementing it in developments such as public squares etc.

The sustainable construction strategies and materials represent local and historical, underpinning culture that local people understand. They do not determine the form, but engineers form to become real, communicate certain feelings and respond to climatic issues. In most African countries, most sustainable construction materials have a deeper meaning that guides their construction strategies which is to represent God/ Spirits (Bourdier and Trinh, 2011:40). The circle as a predominant shape in most cultures, represents the completeness and allows them to connect with God hence, the spaces created are always circular. The earth material is believed to be holy hence, they appease to God before working on it through agriculture/ construction. Thus, these cultural connotations shouldn't be ignored as they fully reflect locals and forms part of the community. The government should implement policies to revitalise cultural knowledge as it informs cultural identity through built form.

7.3 SUSTAINING INDIGENOUS KNOWLEDGE SYSTEMS THROUGH BUILT FORM

The second chapter investigates indigenous knowledge (IKS) to discover strategies to pass it to younger people and sustain it through contemporary built form. IKS is a resilience, know-how knowledge including construction strategies & materials, each community develop based on geographic location available materials, climate and culture. Millions of people still survive through indigenous knowledge, yet it is compromised and slowly getting lost. Nevertheless, lately, it is getting the attention as researchers presume many disasters could have been avoided through it (Jauhiainen and Hooli, 2017). AIKS was once oppressed during the colonization era, hence it is disappearing as its safeguards (seniors) get old and die (Mekoa, 2018). Thus, it must be collected and stored while it's still available.

However, it is taught through practical experience, regional and culturally based, and Africa has many different tribes in small groups (Pearson, 1994), making it more difficult to collect and preserve. Thus, it is questioned, what/which knowledge to be grasped from AIKS to create a common innovative knowledge? The knowledge transfer is complicated as it requires a house construction which becomes a creation of living space and platform of learning. Indigenous architecture gathering spaces foster learning and community interaction as a form of knowledge transmission, from urban planning until the individual shelter. It involves all community members during construction; hence its rejection has resulted in the collapsing of community building and unity (Mekoa, 2018). Therefore, the architecture resolved most of the issues the contemporary built form is struggling with. That has led to questioning how to learn from this holistic, humanity and bottom-up approach architecture.

Rapoport (2006:182) discussed that the architecture is not to be copied but requires critical thinking that questions the problem and formulates a concept to apply in contemporary built form. The contemporary architect focuses on the aesthetics of indigenous architecture while neglecting context, discarding culture and the underpinning principles and this results in meaningless built form. Therefore, integrating indigenous architecture into contemporary architecture could resolve the issues in built form. Kurokawa (1991:9) introduced the concept of symbiosis to guide and ensure different cultures are integrated harmoniously. In that way, indigenous or vernacular architecture construction strategies and materials are combined with contemporary ones to create meaningful built forms that accommodate the multicultural world and meet modern community desires. There are various ways to unite indigenous and contemporary architecture. It could be through a spatial organisation which emphasise a clear hierarchy, layering circulation system of spaces. It could be through form making whereby the focus is on integrating different forms representing different cultures. It could also focus on combining construction materials that connote different cultural identity. Consequently, the IKS will be preserved and sustained through contemporary built form.

7.4 SUSTAINABLE CONSTRUCTION IMPACTS ON ENVIRONMENT

The environmental aspect of indigenous/ vernacular architecture has been investigated for many years hence, there is more knowledge on it globally (Halliday, 2008). However, the built form is still rated second as the fields that contribute to environmental pollution. Therefore, Chapter three focused on investigating the standardised environmental standardised knowledge on construction material and strategies and synthesise it against region mainly KZN.

The purpose of the sustainable construction concept is to secure sustainable development through the built form from planning, design, construction and management of buildings (Abolore, 2012). Therefore, the concept is to improve the usage of natural resources such as water body, forests, and more to achieve a healthy environment. A typical natural material or earth indigenous building emits less pollution during and after construction and achieves good thermal comfort and fewer maintenance costs when built properly. Halliday (2008) state that the lack of skills to use the materials has contributed to the poor perception of indigenous architecture. Halliday's statement was confirmed by the KwaXimba community who stated that indigenous architecture is only temporary as it cannot achieve properly sealed building envelop, bigger scale buildings, easily get destroyed by rainfall although it provides with the comfortable indoor environment. Thus, they prefer industrial manufactured materials over indigenous strategies.

Heerden (2019b), an architect, verified that the lack of development of indigenous knowledge contributes to unhealthy environmental developments. The community discredits their indigenous architecture because they are not aware of its best part. Therefore, the sustainable construction responsive elements from primitive architecture should be harmoniously integrated with contemporary strategies and materials to allow the community to learn and embrace it. The standardised sustainable construction principal elements include minimising natural resource consumption, protecting the natural environment and advance quality in erecting the built environment. Those principles are found in indigenous architecture, hence contextual social issues should be investigated prior to architectural design and developments. Sustainable construction also promotes the passive design cooling; ventilation and heating and water conservation, which are all the anchors of indigenous architecture used to achieve indoor air quality. Therefore, indigenous knowledge should be implemented to achieve a sustainable environment.

7.5 CONCLUSION

Sustainable construction strategies and materials contribute to built form socially/cultural, economic and environmental. SCSM represents and acknowledges the community, hence, provides with required spaces towards community resilience. They symbolise cultural identity and create a sense of place which is lacking in the contemporary built form. The importance of culture in built form has been discovered. Thus, indigenous architecture must be investigated as it has most answers the contemporary world wants regarding the topic at hand. However, it is discarded, and the community lack its knowledge (IKS) which is at risk of disappearing. Therefore, the knowledge needs to be preserved and revitalised through contemporary built form. Indigenous knowledge (architecture) is not to be copied but to learn its underpinning concepts and combine with modern systems. The community need to be taught about IK construction strategies and materials especially in rural regions, so they could use it to sustain their communities, create a healthy environment, sustainable developments and meaningful built form.

CHAPTER 08

8.1 INTRODUCTION

The chapters above investigated various theories and concepts based on secondary and primary data. The findings were helpful in viewing the research topic at hand and related matters from various perspectives. Therefore, this chapter aims to put together all the findings and create one proposition that answers the primary and secondary questions.

The research came about the abomination of indigenous knowledge on construction materials and strategies, beadwork, craftwork in rural regions which results in an unskilled community and poverty, as the community survive through the knowledge. The regions are struggling to adapt to environmentally unfriendly manufactured materials, use it incorrectly and put their lives at risk. The issue starts with urban planning that is universalised and does not embrace local cultural activities and lacks identity. As a result, it amounts to placelessness. The architectural buildings also do not belong to the regions as they do not embrace local context. On the other hand, IKS, indigenous architecture tackled most of those issues, yet it is discarded. The research sought to revitalise indigenous construction and strategies through the built form to restore cultural identity within the contemporary world. Moreover, to alleviate poverty, by teaching cultural activities in robust regions and attain community resilience through skills development centre-built form.

To answer the key question, the main objectives formulated aimed to understand the underlying meaning of culture in the development agenda, to examine indigenous knowledge to preserve it and investigate the sustainability of construction strategies and materials, with intention to implement the findings to the proposed Skills Development Centre.

8.2 GENERAL DESIGN PRINCIPLES

Several basic design principles need to be considered at a conceptual design stage towards sustainable construction and strategies of the built form. These include the overall design approach, from urban to individual building layout, spatial planning, and construction materials and strategies selection.

8.2.1 Local Community driven urban framework

The research reveals that sustainable built environment should respond to its context by acknowledging, culture or local community, climate/environment and economy towards community resilience. In Southern Africa, including KwaXimba, KZN the Nguni indigenous planning has a clear visible circularity morphology with pathways that lead to the central space. The aim is to create an urban framework that supports cultural activities such as crafts work, beadwork, dancing, etc. and allows the communities to express themselves and occupy the created spaces. It is to design for and with local people. In that way, they interact, share ideas and learn from each other and build cultural identity. Also, common central spaces allow Indigenous Knowledge transmission to take place. The common space with public buildings is usually the focal point and easily accessible and visible to the public. Consequently, knowledge sharing becomes part of the lifestyle, enforce togetherness and express the local people's identity. Therefore, the analysis should be conducted in a local site with local craftsmen to grasp the culture, climate, vernacular architecture, craftwork and skills, and materials to find a suitable architecture for a specific region from urban context to individual building as illustrated in (**Figure 8.2a).**

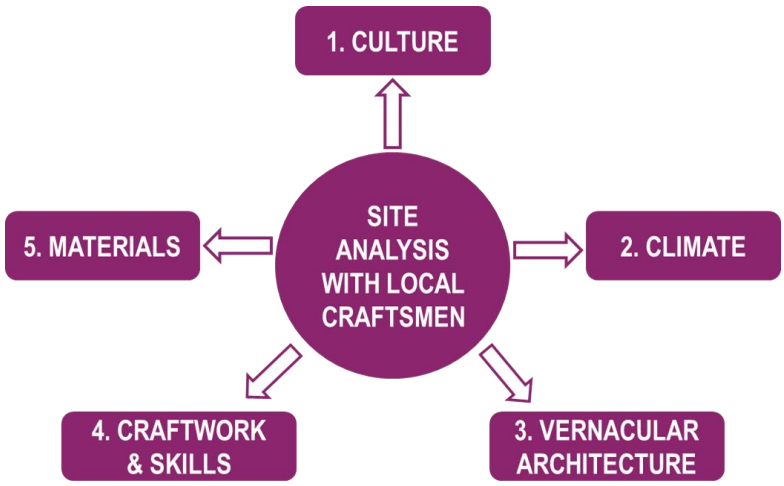


Figure 8.2a: *illustrates the analysis to be conducted in a local region to grasp the community lifestyle prior any design. The architect to design and supervise the project after the local findings.* ***Source****: By Author.*

8.2.2 Repetition design principle

IKS are practical learning that requires several repetitions for a person to learn and understand what is being taught. IK driven form contains repetitive elements for the community to learn by

making mistakes until when they have mastered the skill. The community learn to use locally harvested materials several times and come up with innovative ideas and understand what works for regional climate. Then they could easily decide if they want to destroy the initial structure or to fix it and keep it (**Figure 8.2b)**. Also, it forces the community to consider future development layout rather than focusing on an individual building at a time. Consequently, they always have a holistic approach that will develop itself. The contemporary architects are being blamed for only designing individual buildings and ignore the context of neighbouring buildings. Besides, repetition of the individual block allows the building to respond to the context very well which might lead to less cut and fill. Therefore, this should be implemented towards a responsive architectural design that is complete as an individual and collective form and allows people to learn practically.

Figure 8.2b: *illustrates the floor construction technique in one of Francis Kere projects whereby women learn through repetition of the same thing. They first get it wrong; redo and it improves till when the surface is smooth.* ***Source****: Modified by the Author from https://www.designboom.com.*

8.2.3 Hybrid architecture

Learning from indigenous architecture is limiting when it is executed incorrectly. In a contemporary world, it is tricky to express cultural identity in built form because of multiculturalism in the global world. Thus, it is important to combine/ symbiosis different architectural elements to embrace everyone in the community. The symbiosis ensures all living organisms exist harmoniously, hence; architecture should integrate different elements while ensuring no culture is oppressed by others. This could be done through integrating different forms,

concept development, and through materials and strategies of different cultures. It allows the community to express its signature into a universal and contemporary built form. Indigenous or vernacular architecture offers the signature that the local community can use to represent itself among others, through built form. In that way, it resolves placelessness issues and represents a multicultural identity and everyone, both local and international can relate to the built form.

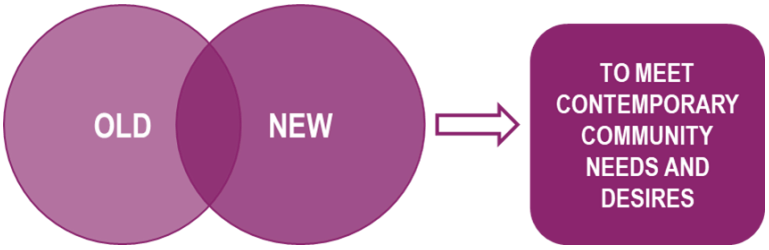
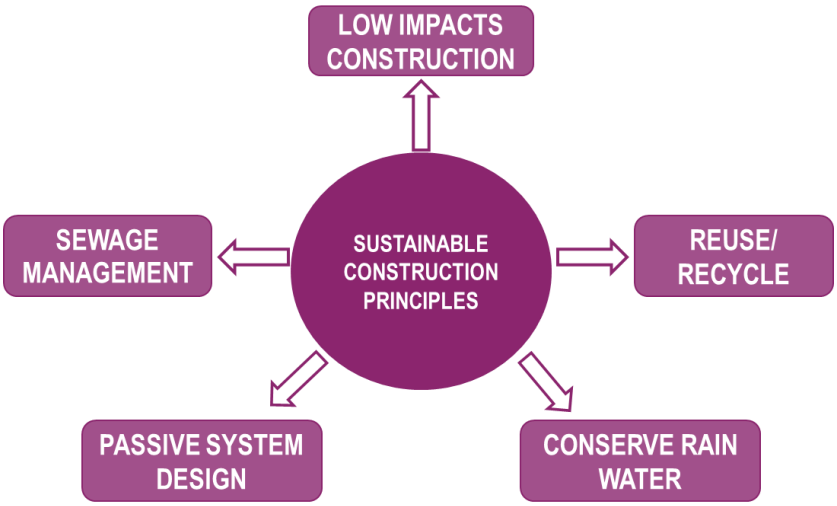


Figure 8.2c: *illustrates the hybrid architecture's intention to integrate new and old architectural elements to meet contemporary community needs and desires, and express local community signature in a universal world.* ***Source****: By Author.*

8.2.4 Sustainable construction principles

Figure 8.2d: *illustrates the sustainable construction principles to be implemented to achieve an environmentally friendly built form. These are principles to be implemented in KwaXimba skills development centre.* ***Source****: By Author.*



In a contemporary built environment, the concept could help to achieve a healthy built environment from planning, design, construction and operations and management of buildings illustrated in **Figure 8.2d**. Sustainable construction concept intends to manage the usage of resources. It focuses more on the sustainable usage of the local context available and closed by natural and manufactured materials and strategies towards a sustainable built environment. It ensures that the

selected materials and strategies would suit the climate of the region. Consequently, it encounters materials' durability, embraces local knowledge and skills and also achieves a healthy environment, both indoors and outdoors. Materials from the local context have a deeper meaning to the local community as it builds a sense of place. Therefore, any building should implement sustainable construction principles to reduce the global pollution the built environment produces daily through unnecessary materials' transportation, waste management, incorrect usage of materials.

8.3 SUGGESTED FUTURE DIRECTION: Towards built form framework driven by sustainable construction strategies and materials

The government should develop a curriculum and framework that guides the developers and communities regarding construction strategies and materials in regions. It should stipulate the following:

- Study local context indigenous constructions strategies and materials, available (construction) skills, culture, climate and historical background, before any developments.
- Discuss the findings with the regional community and hear the opinions and changes they want concerning social & economic statuses, building form, created spaces, in relation to the local context.
- Discuss the new construction materials with the community, its advantages and disadvantages and teach strategies to use it correctly.
- Share innovative ideas that involve local culture, skills, construction materials and strategies to enforce participation.
- Allow them to use their cultural activities skills on some building sections that symbolise their cultural identity.
- In that way, rural communities will have an opinion regarding their areas' developments and can relate to their built form. They will also learn to build their own houses, use construction materials and strategies correctly.

8.4 CONCLUSION

Based on the literature review, precedent studies, case study and conducted interviews, it is clear that sustainable construction materials and strategies can be a driver for a built form. The research investigated the impact SCSM have on built form hence, it should be revitalised. Starting from the urban framework to the individual building, construction materials and strategies used to communicate with people, represent them as it connotes cultural identity and requires critical thinking at the conception stage as it drives the built form.

Therefore, the recommendations discussed above are meant to assist architects and developers to create the built forms that are culturally informed, environmentally responsive and preserve indigenous skills in an innovative manner in a contemporary world. Therefore, the findings will also be used to develop a design brief towards a Proposed Skills Development Centre in KwaXimba, KZN discussed in PART II.

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APPENDICES

APPENDICES INTERVIEW I: ITHEMBALAMAMPUMUZA ECD

Interviewer: Ncomekile Mathe (210506775)

Date: 26 /08/2019

SECTION 1: ITHEMBALAMAMPUMUZA ECD CASE STUDY, KWAMPUMUZA (SWEETWATERS), PIETERMARITZBURG, KWAZULU NATAL.

Mr Londani Nkabinde who is a leader of iThemba Projects construction team will participate on a face to face interview, in Pietermaritzburg, KwaZulu Natal.

SECTION 1.1**:** SUSTAINABLE CONSTRUCTION MATERIALS AND STRATEGIES TECHNIQUES

- **Where and when did you learn to use mud as a sustainable construction strategy and material in built form?**

All the people who work or participate in the centre are uneducated. They did not have any earth building skills. However, iThemba Project introduced the rammed earth strategies to them, including myself.

- **Who decided on mud or earth materials for construction? Why?**

Leaders of IThemba Project NGO came with the idea of using rammed earth for the built form to address the current community issues.

- **Where did you get earth or mud from?**

We dig the earth from the site. Though the lime was bought from the shops around the area.

- **Which techniques (indigenous or modern), were used to construct mud or earth walls? Elaborate on the process.**

Mainly, the rammed earth strategy.

- **How did earth material and strategy influence the building design and form? Elaborate**.

Any form can be achieved with the rammed earth strategy as they use wooden shuttering and pour the earth composition. Therefore, the shuttering can be placed in a way that gives any ideal form.

- **How did you ensure the building durability since it is made of mud or earth, as main construction materials?**

The building is strong enough and it gets tougher with time since the earth cures with time. It behaves like concrete.

- **What were technical issues in combining indigenous and modern construction materials and strategies? Elaborate.**

Walls are 500mm wide to accommodate a person who is pouring and levelling during construction. The thin internal walls could be 250mm wide. The main issue was the cracking of walls when removing shuttering. It was resolved by applying the releasing oil with water on the wooden shuttering to ensure earth composition does not stick on. Also, the required results were not achieved, until they found out that shuttering should only be removed after 48 days. Lastly, the shuttering used to move a lot during construction and resulted in skewed walls, hence they had to demolish them. It is very important to get the joints correct to avoid leaking and structural issues in the future. The progress was very slow as it took 12 days to complete 5 x 7m wall with 5 men working on it.

- **Where did you get the rest materials from? Was the strategy sustainable?**

It was delivered and mixed on-site, Manufactured Precast concrete for win blocks, steelworks for the portal frame were also delivered on-site. They were all bought from within perimeters of Pietermaritzburg to reduce pollution released during transportation and support local businesses as a sustainable strategy. Also, all the waste is stored in a specific area on site and dumped in the nearest dumping sites.

- **Was community satisfied with the establishment of an ECD centre constructed with sustainable construction materials and strategies? Elaborate.**

Community suggested the programs to be incorporated in the building and the architect designed it. During construction, they participated also. Consequently, young and old people are happy with the final product and are willing to use the materials and strategy on their dwelling buildings because it is affordable. Also, the inside gets warm when it's cold in winter and cool when it is hot in summer or outside as the results of the material thermal capacity.

- **Do you think there is a need for skills development centre to teach to use sustainable strategies did you use on industrialised construction materials?**

There is a need for a community to learn construction strategies because it is affordable, and anyone can afford it hence there is poverty in the area. It is locally harvested and unburnable as it does not have timber elements like the ordinary indigenous Zulu hut strategy. It only needs renovations after 100 years.

- **Any idea how should it work and other skills to be taught there as well?**

It should relate to the local community e.g. an abstract of local culture. Also, the wooden shuttering's, lime and other materials need space for storage. And security is very important.

SECTION 1.2: THE PHENOMENOLOGY IMPACTS OF EARTH ECD BUILDING
Interviewer: Ncomekile Mathe (210506775)
Date:26 /08/2019

Participants: IthembalamaMpumuza, earth ECD building users or occupants.
Section 1.2 deals with the community members or building users, to discover the impact the building has on them as a result of sustainable construction strategies and materials used for construction. A 5 – 10 focus group discussion will take place at IthembalamaMpumuza ECD premises.

- **Did you participate during the construction of the building? What's were your duties?**

Yes. During the construction of walls, by collecting the soil and its filtration.
5 full wheelbarrows of soil; 25 kg lime; and water (depending on the desired composition)
Putting up the wooden shuttering
Making 500mm wide rammed earth walls and wait 48 days before roofing.
Build the timber roof and fitted iso board ceilings.
Adding bonding liquid for walls finish and painting on plastered sections.
Building concrete surface bed and getting the finish floor levels correct.

- **Did you know or have any knowledge about the earth as a construction material before the project?**

We had some knowledge, but we learned more during construction.

- **What was your perception of earth construction material before and after ECD construction?**

We did not know that earth can build structures that can last for 100 years and can achieve more with fine details.

- **Would you use the material for your own dwelling houses in future? Why?**

We would build our dwelling houses with the material and strategies because it is climate-friendly, free of charge and soundproof.

- **What is the experience of living in a rammed earth constructed building? Is it any different from industrialised materials building?**

There is no difference. We all grow up wanting to have a typical house made up of concrete blocks, plastered & painted, and roof tiles because you are perceived as a successful individual in the community if you own one. However, this building has changed that perception as everyone in the area want to know how to use rammed earth and want to build with it in the future, although no one has built with it yet.
In winter, it is very warm inside. In summer it becomes cool inside. This is the reason most people want to build with rammed earth strategy and it's beautiful aesthetic effect as well.

- **What does the building represent or symbolise to the local community?**

The building shows that our community is united and can build big things in the future.

- **Do you think there is a need for skills development centre to teach to use sustainable strategies?**

Yes. It creates job opportunities and eliminates poverty; very affordable and natural materials are mainly used.

- **Any idea of how should it work and its design?**

The community should have a say as it was done here; at Ithemba lamaMpumuza Centre. Consequently, the building belongs to the community and will always protect it. The community must also engage during construction and benefit from it. In terms of the shape, the rondavels remind us of where we are coming from as Zulu people. We love our identity.

- **What other skills to be taught there as well?**

Nothing, except the emphasis on making 470mm wide minimum for external walls for stability since there would not be steel and concrete structures on dwelling houses. Releasing oil on shuttering to ensure the earth does not stick when the framework is removed. The wooden shuttering or framework must be drilled with a drill tool instead of fixing with nails, as it might leak when nails move slightly. Also, the electricity must be fitted before building the rammed earth walls. The project has taught the community many simple and sustainable strategies including to save power by introducing clerestory for natural light and saving water by collecting rainwater with JoJo tanks and having a vegetable garden at homes.

APPENDICES INTERVIEW II: KWAXIMBA, CATO RIDGE, KWAZULU NATAL

SECTION 2: KWAXIMBA, KZN CASE STUDY AND INTERVIEWS WITH THE GENERAL PUBLIC
SECTION 2.1: THE EXPERIENCED SENIORS IN KWAXIMBA, KZN

Interviewer: Ncomekile Mathe (210506775)
Date:07 /10 /2019

2.1 INDIGENOUS SUSTAINABLE CONSTRUCTION STRATEGIES AND MATERIALS

Participants of 35 – 70 years old will be interviewed in KwaXimba, KZN as a focus group, open-ended interview.
Section 2.1 deals with the people with experience to use indigenous sustainable construction strategies and materials and have lived in buildings constructed with it. Also, the section deals with how the local culture and sense of community are affected by the desertion of indigenous SCSM over industrialised ones in architecture.

- **Please describe the construction materials and strategies of your house?**

Most houses have nothing from indigenous strategies of building, but some consist of earth wall which is then covered with concrete plaster. Kraals and cultural activities are still made using indigenous strategies.

- **How long did it take to construct your house since you had to deliver materials from the city and materials are costly?**

Very long as we bought concrete and soil from manufactures in peri-urban areas. We then make blocks on our own on-site. It is cheaper if one has economic freedom as they just buy the blocks and all the materials.

- **Is it comfortable in every season?**

These houses are very cold in winter**.** The one with thatch roof and earth walls are more comfortable, warm in winter and cool in summer.

What gives you a sense of belonging in your house?
The rondavel are ancestral house, without them, it feels like one is staying in a rented house. Also, the kraal makes one realise that s/he is home. Sitting under the central tree, listening to traditional music and being able to do chores in the premise or garden makes one feel at home.

- **Does construction materials and strategies contribute to that?**

The indigenous hut materials influence how we feel about our houses as they used to engage by weaving grass for walls and roofs. However, these new houses do not affect people that much.

- **Do you have any skills to use indigenous construction materials and strategies?**

We know how to use those indigenous skills as we used to watch and participate during construction on site when we were young.

- **Do you still use it in your house or homestead?**

No, we do not. Termite was the main issue with those materials and strategies. The buildings were not lasting long, and it was better if there was a wall or kerb at a lower level. The huts (grass) used to catch fire as well. Hence no one still wants to live in those huts. Nevertheless, the houses were very cool in summer and warm in winter. Also, some still use those strategies (earth wall) in their houses although it is hidden behind concrete plaster.

- **Why should sustainable construction strategies and materials be used nowadays?**

That will not be a good idea because durability is still an issue. Also, people assume one is poor when living in those huts. However, everyone wants to live in it if it's built-in a modern style. Therefore, the answer is yes and no.

- **Do you think there is a need for skills development centre to teach how to use sustainable strategies did you use on industrialised construction materials?**

It can teach the youths how to work because very few have construction skills and builders are expensive. It can teach them about local construction history.

- **Any idea of how should it work and its design?**

It can be a huge rondavel to remind the youths of where we are coming from. Like iSithumba tourist and game reserve design. It must be beautiful as the ones we normally see on televisions. We do not want old-style buildings that no one wants to use.

- **What other skills to be taught there as well?**

Any as long as it will teach young people some skills and they will be employable.

SECTION 2.2: YOUTHS OF KWAXIMBA, KZN

Interviewer: Ncomekile Mathe (210506775)
Date:07 /10/2019

2.2 INTERVIEW WITH THE YOUNG PEOPLE IN KWAXIMBA, KZN
(Focus group and face to face interview in KwaXimba Area)

Youths or participants ranging from 18 – 34 years of age, will be interviewed in 8- 12 members group discussion interview, which will also take place in KwaXimba, KZN.

Section 2.2 deals with the perception of the youth on sustainable construction strategies and materials in built form, local culture, and sustainable community issues in contemporary architecture and world.

- **Have you ever stayed in a house made of indigenous SCSM?**

Yes, in the ones by game reserve and tourist centre around the area. Some of our homes used the indigenous SCSM but fused with concrete plaster.

- **Do you know how to use them and who taught you?**

We only know how to build with earth material but have never participated during construction. It is too much work and buildings do not look legit. Also, some participated in the construction of the game reserve but used timber not earth.

- **Do you still use it in your house or homestead?**

No. Except for rondavel ancestral houses which fused them with concrete plaster**.**

- **What is your perception of existing buildings with indigenous SCSM?**

It reveals the family economy status as it is only used by poor people on their houses. Thus no one still wants to apply them in their buildings.

- **Does is it make any difference to you?**

Yes, a bad feeling though as houses made of the materials and strategies are always collapsing. However, the game reserves in the area are well built, maintained and make one feel at home. It gives a sense of healthy and lively rural areas that everyone would like to be part of. It makes one want to explore more of the traditional culture e.g dress up traditionally, eat traditional food and listen to traditional music and dance.

- **Would you like to learn the skills to build using indigenous sustainable construction strategies and materials?**

Yes, most people love traditional architecture if it is built correctly. Therefore, if one can master the skill, they can easily get jobs from the community. People are always trying to build use indigenous materials and strategies in their homesteads but fail, hence those houses are not strong enough, always cracking and falling apart, leaking during rainfalls and screams poverty.

- **Would you, as young people, use that skill to get the job or employment for survival and eradicate poverty?**

Most definitely. There are very slim job opportunities these days. Thus, one would take any job as long as it is legal.

- **Do you think participating during the construction of a project can rebuild a sense of community in KwaXimba?How would you feel if you had to participate during the construction of a public building?**

Yes, it can. There is a project in the neighbouring area whereby they are building a game reserve or tourist centre. The community is working on the project which has the traditional huts design concept. The youths are participating, and they love it already. They call it their village new home. Therefore, we believe it would be the same with us as well.

- **Do you think there is a need for skills development centre to teach how to use sustainable strategies did you use on industrialised construction materials?**

There is no FET college in the area. Therefore, there is a need for post-high school learning facilities as the youths had to relocate to the big cities to get education or skills after high schools. Many people struggle to get there because it is expensive, and most parents cannot afford it. The youths can benefit from intervention as such. They can start their businesses.

- **Any idea of how should it work, and its design?**

The design could be something like the existing game reserves in the area with big hut, contain both traditional and contemporary elements. We all love it, seniors and youths.

- **What other skills to be taught there as well?**

There should have traditional dance and music practise areas, competitions space. It should teach how to prepare traditional food and alcohol (umqombothi) because very few know about it. Computer centre area because being in rural areas does not mean one should not learn to use new technologies. Library, there is no proper library in the area. It should teach different traditional ways of living because most youths do not know them and can learn from them.

SECTION 2.3: THE BUILDERS OF KWAXIMBA, KZN

Interviewer: Ncomekile Mathe (210506775)
Date:07 /10/2019

INTERVIEW WITH TRADITIONAL BUILDERS IN KWAXIMBA, KZN
(face to face interview in KwaXimba Area)

Interview with Local builders ranging from 30 – 50 years old will take place in KwaXimba, KZN. This will be a face to face interview regarding indigenous knowledge systems and vernacular architecture.
Section 2.3 deals with the local (traditional and modern) builders and their daily experience and perception of sustainable construction strategies and materials and indigenous knowledge transmission in contemporary architecture.

- **When did you learn the skill to build with sustainable materials and strategies?**

We learned from home as a kid whereby parents used to apply strategies and materials for our houses. We used to participate during construction as everyone was participating. My role as a boy was to collect materials and started to build as I get older and being taught by dad or grandfather. Lately, we use cement blocks and other manufactured materials as per client requests.

- **What do people think about indigenous SCSM buildings?**

We prefer those materials as it is less harmful when building with it but it is too much work. However, people do not want to use those materials anymore and prefer manufactured ones.

- **Would you like to teach other people, especial youth, the skill to use SCSM?**

The youths do not show any interest in learning construction strategies. Thus, we are always busy and do not get time to rest. They should learn to use the skills as we will not be around forever.

- **What do you think about combining indigenous and modern SCSM in built form, in a contemporary world?**

Most people prefer that since no one wants a pure traditional house. When we have built a house by combining indigenous and manufactured materials strategies, we get more clients and most people enquire about our services. People from urban areas love thatch houses and rondavels and always want our services when they see the houses we have built. The tourists always take pictures of those houses as well.

- **Do you think there is a need for skills development centre to teach how to use sustainable construction strategies and materials?**

Most definitely. People lack the construction skills hence they stay in collapsing houses and can not afford to pay us as builders because of unemployment. As a result, they always build falling and unsafe houses and put their lives at risk. Some end up waiting for the government to build them houses and deliver all kinds of facilities which they could do if they had skills.

- **Any idea of how should it work, and its design?**

Most people love integrated indigenous and manufactured strategies and materials design. Therefore, it should integrate the strategies so that both can be taught and be passed to the younger generations during construction. The dome-like hut or circular buildings symbolise the Zulu nation hence it should be incorporated into the design. Local materials such as stones from the river, timber from the local forests must be used on the building.

- **What other skills to be taught there as well?**

Youths lack many different traditional skills which can be taught in the centre such as shield craftwork, beadwork making, and traditional lifestyle. The youths need guidance and mentorship from seniors. Therefore, that could be part of the centre as well.

APPENDICES INTERVIEW III: PROFESSIONAL ARCHITECTS

SECTION 3.1: MR. DEREK VAN HEERDEN FROM EAST COAST ARCHITECTS.

Interviewer: Ncomekile Mathe (210506775)
Date: 29/ 09/2019

3.1 INTERVIEW WITH MR. DEREK VAN HEERDEN FROM EAST COAST ARCHITECTS. (face to face interview)

Section 3.1 deals with sustainable construction strategies and materials and social issues mainly in rural or underdeveloped areas.

Therefore, the expert on social and green architecture mainly in rural or underdeveloped areas throughout southern Africa, Mr Derek Van Heerden will be interviewed. His work or design always represent local people lifestyle or culture. The use of local sustainable construction strategies and materials results, culture and identity, and community participation of local people will be discussed. The interview will take place in his office, 56 Glade Road, Morningside, Durban, KwaZulu-Natal.

- **Why do you have more interest in working and developing rural areas communities?**

There are more opportunities to be innovative in rural areas as certain things cannot be done in urban areas yet can be explored in rural regions. Also, the robust regions are the most forgotten places in the country, and they require more innovative ideas from what they have.

- **What is the recipe for successful and sustainable rural areas architectural projects?**

Participation and communication are the key factors in successful projects in rural regions. The outcome of participation is ownership. Consequently, the community willingly maintain the buildings. Also, participation requires a bottom-up approach which results in a more sustainable project that strengthens the moral community.

- **What exactly do you study in the underdeveloped areas before the project resume?**

Each community is unique; therefore, one must study its culture and must never use one size fit all approach.

- **Most people in rural areas have indigenous construction knowledge, how do you combine it with modern materials and strategies and ensure they still use their indigenous knowledge?**

One can ensure that by studying the area's construction strategies thoroughly before the conception of the project. Also, by employing senior local people and allow them to teach others during construction. In that way, skills are transferred to others especially young generations.

- **What are the challenges in using SCSM in built form?**

The main issue is that architects design buildings for themselves and forget to engage the community or ordinary people. As a result, people do not relate to their built environment caused by the use of unfamiliar materials and strategies.

- **Why most architects do not implement SCSM in their work or design?**

Architects are not paid for conducting thorough research from communities before any project. As a result, architects do not respect context, communities or people who'll use the building as they get eliminated from projects which lead to violation of buildings and the unfamiliar built environment.

- **Do you use vernacular architecture for your innovative strategies?**

Yes, it is very important to me. I draw the most inspiration from it for the projects that I design.

- **How do people feel when the built form expresses their culture and identity?**

It enhances the ownership level as rural areas people understand vernacular architecture very well.

- **Do you think there is a need for skills development centre to teach how to use sustainable strategies did you use on industrialised construction materials?**

Most definitely, that could enable communities to develop their communities with or without the help of the state. It could also resolve the housing issues in South Africa as people could be able to build on their own. Also, more than 50% of waste comes from construction and demolition of buildings and could be reduced through a selection of materials and strategies that are environmentally friendly and has health benefits. For instance, we did Seven Fountain School in Kokstad which has a section made of adobe blocks. Some grannies who suffered from osteoporosis disease were making adobe blocks. The grannies hands were working perfectly by the end of the project because earth heals naturally unlike cement which is poisonous when inhaled excessively.

- **Any idea of how should it work, and its design?**

Any building design should be inspired by the local culture. It should represent local people and integrated into contemporary design. Also, durability should be a priority when it comes to construction materials. If the materials won't last long, it should at least be able to go back to earth harmoniously.

- **What other skills to be taught there as well?**

To add on the topic, the secret of materials is in the detail. Some timber or eath buildings have stood for more than 500 years because they were detailed correctly. That should be the focus when teaching people how to use any material. The earth is very strong on its own, however, it becomes weak when concrete plaster is added on it. There is no such thing as sustainability but there are buildings that are less damaging and the ones that are more damaging Industrialised materials are not good for our health as they release toxins all the times e.g paints contain the volatile organic compound. Therefore, communities should sustainably use all materials.

SECTION 3.2: THE DEPARTMENT OF KZN PUBLIC WORKS

Interviewer: Ncomekile Mathe (210506775)
Date:03/09 /2019
3.2 INTERVIEW WITH THE DEPARTMENT OF KZN PUBLIC WORKS PROFESSIONAL ARCHITECT (Face to face interview)

Section 3.1 deals with the public official from KZN Public works, to find out how far is the department with developing agenda (if there is any) to use the sustainable materials and strategies within the province, especially public buildings in underdeveloped areas like KwaXimba, KZN to create meaningful context and sustainable communities.

- **What kind of work the department of Public Works is currently doing in KwaXimba surroundings or Durban?**

The department is currently busy with schools in KwaXimba Area, on behalf of the department of education.

- **How does KZN Public Works develop underdeveloped areas and ensure the local culture is being conserved through built form?**

KZN Public works do not have its projects but an agent that works various project for other departments. Therefore, the department takes instructions from those departments accordingly.

- **What do you think about sustainable construction materials and strategies in general?**

It is a good idea especially for rural areas because they are not limited by any regulations and have more natural resources such as forests, rivers etc. that they can use to develop their regions.

- **What do you think of indigenous architecture, materials, indigenous knowledge and construction skills? How the department select the materials to use in a project?**

The department does not select materials as the decision is made by specific departments. However, the main concern is the durability of buildings. The state cannot afford to renovate and maintain buildings more often, hence the materials are selected based on financial affordability and durability.

- **Do you think indigenous architecture can be developed into contemporary architecture to achieve a sustainable environment or community? Elaborate.**

Yes, it can. The materials are environmentally friendly and can be symbioses with contemporary strategies towards a contemporary architecture that meet modern society needs.

- **Are there any projects the department has built to promote using local sustainable construction strategies and materials within the province of KwaZulu - Natal?**

No. However, the department supports project such as IThemba lamaMpumuza in Pietermaritzburg, which promote earth building construction strategies and integrate it with other materials such as steel, concrete etc. to ensure its longevity. Other rural areas should learn from that project and start implementing it in their areas. In that way, they can sustain themselves.

- **Were they successful? Elaborate**

The project was a big success in the area as it has trained and taught people new construction skills which can be used in their households.

- **Was the community involved during construction?**

The project was community-driven hence it was a success**.**

- **Do you think there is a need for skills development centre to teach how to use sustainable strategies did you use on industrialised construction materials?**

Yes, especially in rural areas. This would not be a new concept, indigenous communities used to do it in the villages. Therefore, it needs to be reinverted into a contemporary world towards sustainable and healthy communities.

- **Any idea of how should it work, and its design?**

It should be functional, symbolise community culture and celebrate existing construction skills.

- **What other skills to be taught there as well?**

Rural area communities are usually good with their hands. They make beads work, sculptures, traditional clothes and more craftworks. Those local skills need to be developed to empower communities and could be featured in skills development centre.
