MAJ
MALAYSIA ARCHITECTURAL JOURNAL

Malaysia Architectural Journal

Journal homepage:
https://majournal.my/index.php/maj
e-ISSN : 2716-6139

# An Architectural Alchemy: Forging the Future by Bridging Traditional Architectural Principles with Modern Innovations in Kenya and South Africa.

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**ARTICLE INFO**

***Article history:***
Received: 30 April 2024
Received in revised form
Accepted: 15 October 2024
Available online: 23 June 2025

***Keywords:***
Architectural Heritage, Traditional Methods, Contemporary Design, Integration, Alchemy Guidelines

**ABSTRACT**

Throughout Africa, each traditional tribal state has developed its own distinct architectural morphology, iconography, and construction methodologies, each profoundly influenced and shaped by its unique socio-cultural narratives. Modern building technologies have provided advanced technical solutions to numerous challenges that traditional architectural techniques could not address. However, architecture is not merely a technological artifact; it embodies the essence of a region's people. This paper examines the rich architectural heritage of Africa, with a specific focus on traditional construction methods and styles in Kenya and South Africa. Through an in-depth analysis of the architectural principles, materials, and techniques ingrained in the region's history, this study investigates these traditional methods, emphasizing their unique characteristics and socio-cultural importance. The research extends to explore the lessons learned from these age-old practices and their potential applications in contemporary architecture. The study further delineates future guidelines and strategies for integrating traditional African architectural elements with contemporary design and technology. Such integration is essential for crafting a new architectural language that honours historical identities while fostering innovation and sustainability in future urban developments. Contemporary attempts and adaptations by architects in Kenya and South Africa are scrutinized to evaluate the efficacy of combining traditional and modern practices, thus promoting a dialogue between past and present construction methodologies. The paper

introduces "Architectural and Construction Alchemy Guidelines," which outline practical steps for bridging the gap between tradition and modernity in the architectural practices of Kenya and South Africa. These guidelines promote a synthesis of traditional forms, techniques, and principles with modern innovations, urging an architectural evolution that remains true to its roots while being adaptable to contemporary needs. This architectural alchemy is presented as a transformative approach that can generate a new, contextually relevant architectural style, providing a roadmap for future advancements in the field.

# 1.0 Introduction

## *1.1 Background*

Understanding the architectural methods and techniques of indigenous populations across different regions is essential. This insight reveals how the varied aspects of traditional African architecture—territorial organization, environmental adaptations, social contexts, political influences, cultural values, and economic conditions—shaped the development of local structures, settlements, and spatial arrangements. In African contexts, the architecture is more than a mere physical structure; it is an intricate interplay of communal relationships, spatial dimensions, functional orientation, and construction techniques, all of which evolved together over generations.

This paper examines how these traditional architectural values can be woven into modern architectural practices throughout Africa, particularly through the lens of Critical Regionalism. Focusing on case studies from Kenya (East Africa) and South Africa, the research seeks to explore how contemporary architectural designs can not only retain but also highlight and celebrate indigenous cultural identities. Additionally, the study examines the amalgamation of traditional and contemporary construction techniques, materials, and urban planning concepts, aiming to address the needs of the present and future.

In a time of swift urban expansion and cultural diversification in Africa, the relevance of integrating traditional architectural elements with modern innovations becomes increasingly prominent. This research points out the importance of such integrations, proposing that they enrich contemporary architectural discourse and practice in culturally significant and sustainable ways. According to Mitchell [1] the community can only understand its present by knowing its past.

## *1.2 Research gap*

With a rich diversity in both traditional and modern architectural practices in Kenya and South Africa, there exists a gap in studies focused on the fusion of these two architectural languages within the regions for their synergistic integration. This gap highlights the need for a focused investigation into how traditional architectural elements and principles and modern design strategies can be effectively combined to create a cohesive and culturally resonant architectural language that addresses both aesthetic and functional demands of the modern era.

### *1.3 Significance of the Study*

This research addresses the need for sustainable and culturally relevant architectural practices in the rapidly urbanizing contexts of Kenya and South Africa. By blending traditional and modern architectural methods, this study offers insights into creating more adaptive, resilient, and environmentally sensitive urban spaces that respect and reflect local histories and cultural identities. This approach not only enriches the architectural landscape but also fosters a deeper connection between communities and their built environment, promoting heritage conservation alongside modernization.

### *1.4 Objectives*

The objectives of this study are to analyse traditional architectural forms, materials, and construction techniques in Kenya and South Africa, highlighting their unique characteristics and socio-cultural relevance, to explore contemporary applications of traditional architectural methods and assess their potential to meet modern building requirements, focusing on sustainability and cultural significance, and to develop guidelines and strategies for integrating traditional and modern architectural practices, proposing a framework for what the paper terms "Architectural and Construction Alchemy."

## 2.0 Literature Review

The discourse on African architecture has evolved significantly, exploring the complex interplay between tradition, modernity, and globalization.

Aldo Rossi's "The Architecture of the City" [2] provides a foundational theoretical framework that links architecture and urban planning with historical context and collective memory. Rossi emphasizes the significance of historical continuity in urban spaces, offering a lens through which the integration of traditional architectural forms in modern design is assessed. This is particularly pertinent in African contexts, where the complex interplay between colonial legacies, post-independence nation-building, and rapid urbanization has created a unique set of challenges and opportunities for architectural innovation. Rossi's notion of the city as a palimpsest, layered with history and meaning, resonates deeply with African urban fabric. Traditional architectural forms, such as the Swahili houses of East Africa or the vernacular dwellings of Southern Africa, embody centuries of wisdom about climate, materials, and social organization. By understanding and reinterpreting these forms, contemporary architects can create buildings that are aesthetically pleasing and functionally efficient, culturally resonant, and environmentally sustainable. This approach represents an "architectural alchemy," transforming the past into a catalyst for future innovation.

Building on Rossi's historical-cultural emphasis, Liane Lefaivre and Alexander Tzonis introduce the concept of Critical Regionalism in "Critical Regionalism: Architecture and Identity in a Globalised World" [3]. This approach advocates for an architecture that resists global homogenization while preserving local traditions and promoting environmental sustainability, making it pertinent for Architects navigating the global-local dichotomy. Critical Regionalism offers a valuable framework for understanding and addressing the pressures of globalization while fostering a strong sense of place, identity, and community. By bridging traditional wisdom with

modern innovation, it provides a path to creating architecture that is both culturally resonant and sustainable.

Anoma Pieris's "Architecture and Nationalism in Sri Lanka: The Trouser Under the Cloth" [4], though focused on Sri Lanka, provides insights applicable to Africa's post-independence architectural identity formation. Similarly, Antoni Folkers in "Modern Architecture in Africa" [5] and Manuel Herz in "African Modernism: The Architecture of Independence. Ghana, Senegal, Côte d'Ivoire, Kenya, Zambia" [6] provide in-depth analyses of the introduction and adaptation of modernist architectural principles in various African countries. These scholars explore the ways in which African architects responded to the global influence of modernism while simultaneously seeking to create buildings that reflected local cultural values and environmental conditions. The integration of indigenous materials, building techniques, and aesthetic sensibilities into modernist designs represents a significant step towards an "architectural alchemy," where tradition and modernity coexist in harmony.

James W.P. Kigomo's "Sustainability, Climate Change and the Green Building Agenda in Kenya: Architectural Technology Up to Date" [7] addresses the critical need for sustainable building practices in Kenya, emphasizing the role of architectural technology in tackling environmental challenges. By examining the intersection of culture, climate, and technology, Kigomo demonstrates how sustainable architecture can be achieved without compromising aesthetic or functional requirements. His research provides valuable insights into the development of building materials, energy-efficient systems, and design strategies that are suitable for the Kenyan climate.

In "Constructing a Sense of Place: Architecture and the Zionist Discourse", Haim Yacobi [8], though focusing on Israel, offers insights into how architecture can express national identity and memory, relevant to Kenyan and South African efforts in architectural expression.

Abdou Maliq Simone and Edgar Pieterse's "New Urban Worlds: Inhabiting Dissonant Times" [9] examines the complexities of urbanization in African cities, exploring the implications for urban planning and architectural innovation amidst rapid urban growth. The authors emphasize the urgent need for innovative urban planning and architectural solutions that can address the pressing issues of inequality, informality, and environmental sustainability. By exploring the diverse experiences of African cities, Simone and Pieterse highlight the potential for architecture to play a pivotal role in shaping the future of urban life. Their work emphasises the importance of understanding the social, economic, and cultural dynamics of these rapidly changing environments to inform the development of responsive and resilient urban spaces. It is essential to engage with the complexities of urbanization as presented by Simone and Pieterse. By considering the needs and aspirations of diverse urban populations, architects can design buildings and public spaces that contribute to equitable, sustainable, and culturally rich cities.

## 3.0 Methodology

### *2.1 Research Design*

The methodology of this study employs a multi-dimensional approach, encompassing literature review, case study evaluations, field and desktop research, and the integration of both qualitative and quantitative data analyses.

### *2.2 Research Strategy*

The research strategy involves a purposive sampling of architectural projects, field research including site visits, interviews, and surveys, followed by a rigorous analysis of the collected data. See Figure 1.

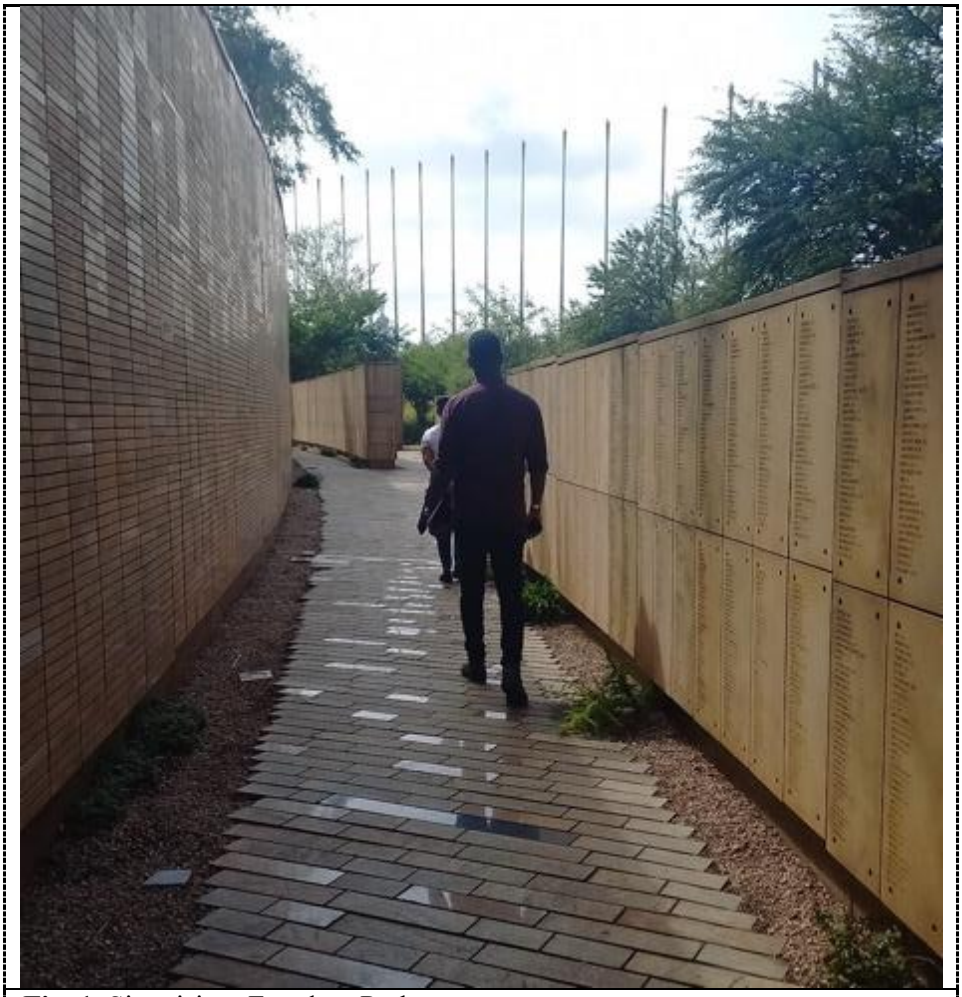

**Fig. 1.** Site visit to Freedom Park
**Source:** Author

Another research strategy selected for this study is the case study method, which is described as a form of qualitative analysis in which careful and complete observation of a selected case (an individual, situation, or structure) is done. Efforts were made to form case data generalizations and inferences. This approach has the ability to answer the 'what', 'how' and 'why' research questions. The case study approach provided the author with an opportunity to explore the traditional and emerging architectural styles. A comparative analysis of the built forms in the aforementioned cases was then done to extrapolate the cultural and architectural constants.

### *2.3 Sampling Data*

The selection criteria were based on each project's relevance to the themes of cultural heritage, architectural design and construction principles and possibility to integrate modern architectural practices.

### *2.4 Data Collection Methods*

Data was collected through a combination of site visits, semi-structured interviews, desktop research, observational studies, and surveys. According to Kothari (2004), while deciding about the method of data collection to be used, the researcher should always take into consideration two types of data i.e. primary and secondary data. Primary data is data that is collected a fresh (for the first time) and is original in character. Secondary data, on the other hand, is data which has already been collected by someone else and has already been passed through the statistical process.
For the purpose of this study, the author used both primary and secondary data. Primary data was to analyse the selected typologies. While secondary data was be used to analyse the history and transformation of the selected regions and structures. Primary Sources included Photographs (Digital recording of the environmental context, architectural elements and buildings was undertaken for analysis), sketches (a quick way to capture the layout as well as the sectional profiles of the spaces under study), interviews (the author conducted non-structured interviews on both traditional and modern built forms in terms cultural principles guiding the spatial organization, planning and choice of building materials. Secondary sources were used to analyse the history and transformation of structures.

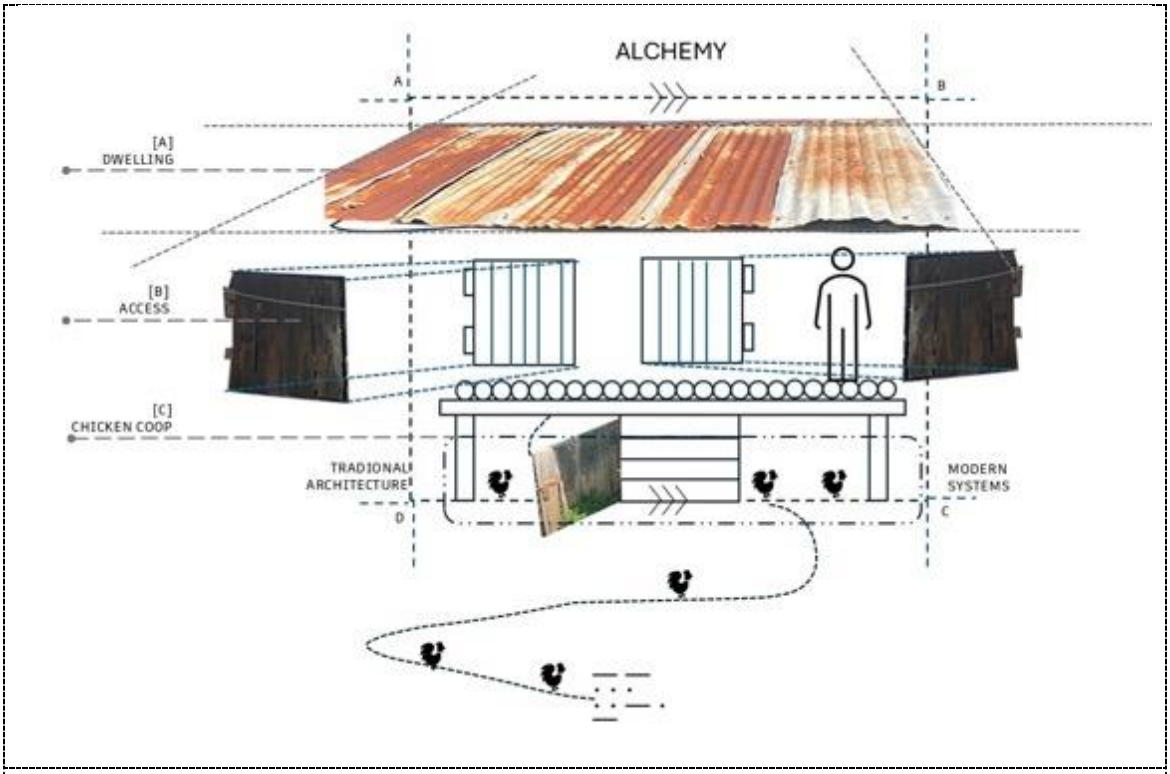


**Fig. 2.** Alchemy concept

**Source:** Lekalakala, K. (2024). Author's own interpretation

Figure 2 depicts how traditional and modern systems are fused to create smart and efficient architecture. The granary resting on top of a chicken coop.

### *2.5 Data Analysis and Presentation*

The study employed thematic analysis for qualitative data.

### *2.6 Research Results and Contributions*

The research is expected to yield significant insights into the practical and theoretical aspects of Traditional and Modern Architectural Alchemy in Africa, contributing to the broader discourse on cultural identity and fusion of modern techniques in architecture.

## 3.0 Bridging Epochs: Integrating Traditional Architectural Wisdom with Modern Practices in Kenya and South Africa

Selecting the Maasai, Swahili, Nguni, and Non-Nguni groups for this study offers a rich pool of cultural, historical, and environmental insights. These groups provide distinct perspectives on sustainable, culturally embedded construction practices diverse architectural expressions across a wider geographic area.

### *3.1 Kenya and East Africa*

In the period preceding colonization in Kenya, prior to 1901, numerous indigenous communities engaged in the construction of various architectural structures, encompassing shelters, monuments, bridges, places of worship, communal gathering spaces, and places of communal interaction (Kamau & Njoroge, 2015). Over time, each of these distinct communities evolved and refined their specific methods, employed materials, and employed techniques that facilitated the creation of these architectural edifices (Ochieng, 2012). These techniques were handed down across successive generations, maintaining a lineage of traditional craftsmanship (Mutua, 2010).

#### *3.1.1 Maasai*

The Maasai are a Nilotic ethnic community that reside across East Africa as shown in Fig. 3. Despite the pressures of colonialism, modern development, and external cultural influences, they maintain a profound connection in their cultural practices and beliefs.

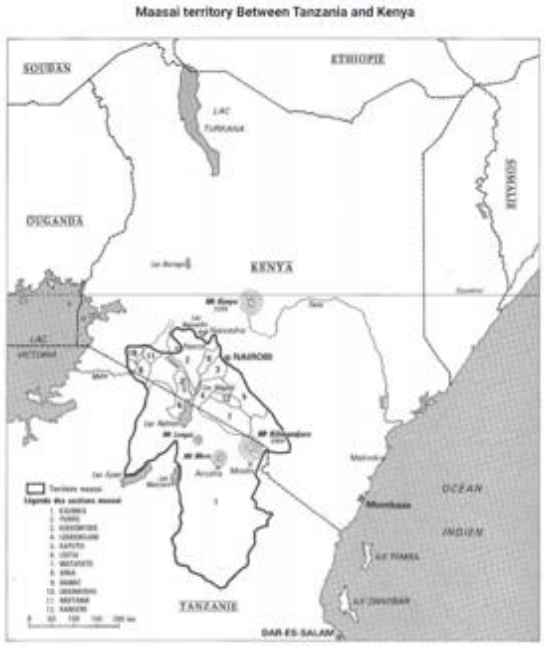


**Fig. 3.** Maasai territory Between Tanzania and Kenya
**Source:** Senses Atlas. (2020). [Picture]. https://www.sensesatlas.com/maasai-villages-an-architecture-designed-by-the-traditional-pastoral-way-of-life/

In East Africa, the Maasai's architecture is distinctive and deeply rooted in well-established cultural constants and serves as a physical manifestation of their heritage. The traditional Manyatta stand as a testament to the ingenuity and sustainability of indigenous architectural practices.

*The Maasai architectural traditional principles, materials, and construction techniques*

The construction of Manyattas is a community-centred activity that utilizes locally sourced materials that are readily available in the environment (Owino & Muthoni, 2017). The process of gathering and assembling these materials fosters a sense of community and collective responsibility, essential elements in East African cultures (Kiprotich, 2014). Whilst they seem modest, the materials are utilized in a way that shows critical thinking and deep understanding of their properties and environmental context (Njogu, 2013). The Manyattas, typically circular or oval in shape, as shown in Fig. 4 and Fig. 5, a design that facilitates air circulation, promoting natural cooling, start with constructing a framework by embedding gathered wood poles into the ground (Mutiso, 2011).

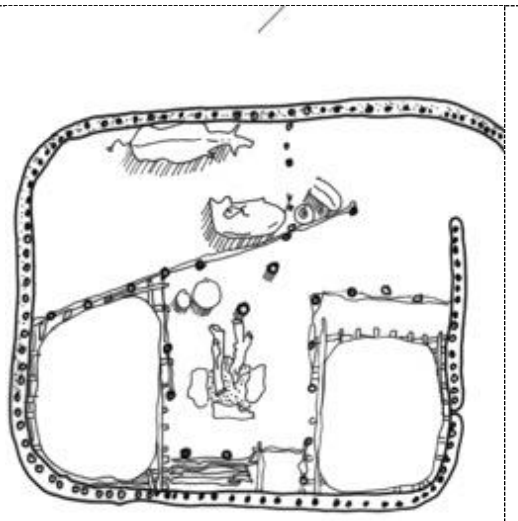

**Fig. 4.** Detailed plan of unit
**Source:** Senses Atlas. (2020). [Picture]. https://www.sensesatlas.com/maasai-villages-an-architecture-designed-by-the-traditional-pastoral-way-of-life/
Edited: Kgaugelo Lekalakala (2024)

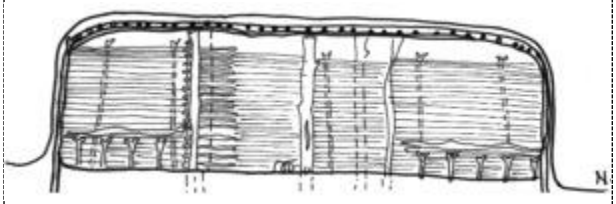

**Fig. 5.** Section of unit.
**Source:** Senses Atlas. (2020). [Picture]. https://www.sensesatlas.com/maasai-villages-an-architecture-designed-by-the-traditional-pastoral-way-of-life/
Edited: Kgaugelo Lekalakala (2024)

This frame is then intertwined with a network of smaller branches, all of which are plastered with a mixture comprising water, mud, cow dung, and occasionally, human urine. The final touches on the walls involve a plaster made from cow dung and water.

Wooden poles are chosen for their strength and durability, providing a sturdy framework for the hut's structure as shown in Fig 4. Smaller branches then serve as a lattice to fill in the gaps between the timber poles, creating a solid framework for the walls. They are flexible and easy to weave, allowing for intricate patterns that enhance the structural integrity of the hut. Mud when mixed with water, becomes a strong adhesive and is used to plaster the walls, providing insulation and protection from the elements. Mud is abundant in many environments and is cost-effective, making it an ideal choice for traditional construction methods. Cow dung is then applied and acts as a natural sealant and waterproofing agent when applied to the walls and roof as shown Fig, 5. It forms a protective layer that repels water and helps to keep the interior of the Manyatta dry. The cow dung contains natural antibacterial properties, which can help to prevent the growth of mould and fungi. Additionally, it assists in regulate humidity and temperature due to its Hygroscopic Properties that can absorb and release moisture from the surrounding environment. During periods of high humidity, the cow dung plaster absorbs excess moisture from the air, helping to reduce humidity levels inside the Manyatta. Equally, during dry periods, the cow dung releases moisture back into the air, increasing humidity levels and preventing the interior from becoming too dry. Being dense and heavy, it acts as a thermal mass within the Manyatta that stores heat energy from the surrounding environment. During the day, when temperatures are high, the cow dung absorbs heat, helping to keep the interior cool. At night, when temperatures drop, the cow dung releases stored heat, helping to maintain a comfortable temperature inside the Manyatta. Sometimes, urine is added to the mud mixture for its adhesive properties. Urine contains urea, which acts as a natural binder, helping to strengthen the mud plaster and improve its adhesion to the walls.

Thereafter, grass is used as roofing material for its insulating properties and natural waterproofing abilities. When layered densely, it forms a thick barrier that effectively sheds water and provides additional insulation to keep the interior of the Manyatta cool in hot weather and warm in cold weather. And finally, thorn fences are constructed from branches or twigs with thorns, providing a natural deterrent against predators and unwanted intruders. They are commonly used to enclose the perimeter of the boma, ensuring the safety of livestock and inhabitants alike.

**Fig. 6**: The structure of a traditional Manyatta made from sticks
**Source**: Nassrulla, T. (2016). *How are Maasai huts build? And who builds them?* [Picture]. https://www.tanzania-experience.com/de/blog/wie-maasai-huetten-errichtet-wer-baut-sie/

**Fig** 7: Manyatta finished with mud, cow dung, grass
**Source**: Barking zebra tours. (n.d.). [Picture]. https://barkingzebratours.com/wp-content/uploads/2013/10/maasai-manyatta.jpg

Together, these individual Manyattas form a boma, as shown in Fig.8 and Fig 9, typically encircled by a robust thorn fence for protection called "enkang," which encloses the community's dwellings, named "enkaji.". Within the boma, a smaller, separate thorn fence encloses a safe resting area for livestock at night. Inside the enkaji, the space is cleverly organized with slim partitions that create separate areas or "cells" with visual accesses enhanced as shown in Fig 10. The central area houses the fireplace, for cooking, light, warmth and additionally, the smoke from the fireplace acts as a natural insect repellent.

**Fig 8.** Individual Manyattas form a boma
**Source**: Kilinge adventures. (n.d.). [Picture]. https://www.kilingeadventures.com/tours/maasai-cultural-day-trip/

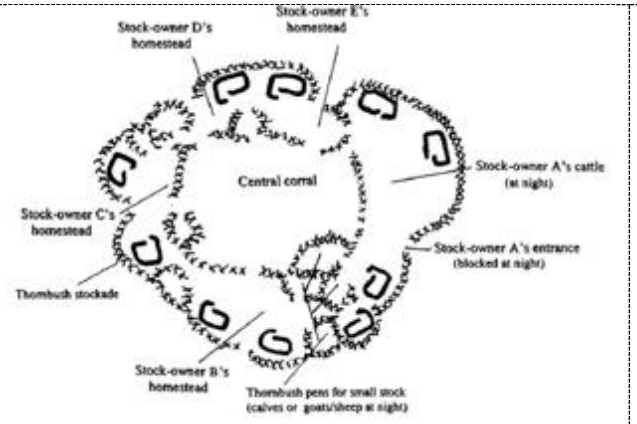


**Fig. 9.** Configuration of a typical Maasai village (boma),
**Source:** Joseph Kolowski (2006)

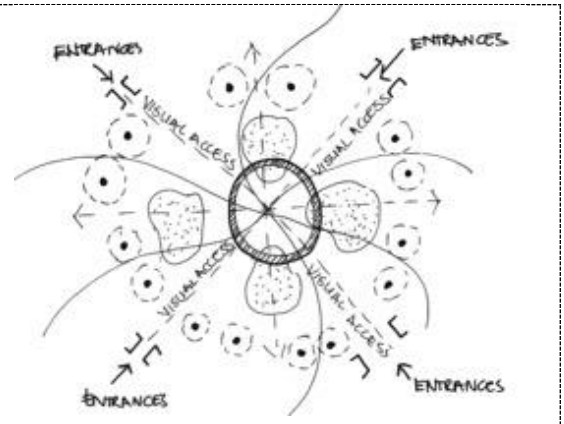


**Fig. 10.** Analysis of visual access, and entry ways.
**Source:** Kgaugelo Lekalakala (2024)

Table 1 below outlines various lessons learnt from studying the Maasai architectural and construction strategies.

| LESSON | DESCRIPTION | APPLICATION |
|---|---|---|
| Resource Efficiency | Utilize locally available materials to reduce environmental impact and enhance the sustainability of construction projects. | prioritize local materials, reducing transportation costs and carbon footprint, thus promoting eco-friendly building practices. |
| Community Involvement in Construction | Engage the community in the building process. | Involve local communities in the design and construction phases to ensure the resulting structures meet actual needs and respect local customs. |
| Adaptation to Environment | Design buildings that are well-adapted to local climate conditions, using appropriate materials and construction techniques. | Incorporate passive solar design, natural ventilation, and thermal mass in modern buildings to minimize reliance on mechanical heating and cooling systems. |
| Circular Design Principles | The circular or oval shape of the *Manyatta* promotes air circulation, which naturally aids in cooling the interior spaces, facilitates social interactions, storytelling, and the transmission of cultural knowledge across generations. | integrate circular or curved elements to enhance airflow and energy efficiency, especially in warm climates. |
| Natural Waterproofing and Insulation | The use of cow dung for waterproofing and insulation demonstrates an innovative way to utilize organic waste materials | Explore the use of other sustainable, biodegradable materials for insulation and waterproofing in contemporary building practices |
| Compact Design | Efficient use of space in compact designs allows for multifunctional use within a small footprint, reducing material use and site impact | implement compact and multifunctional design strategies in urban areas to maximize space efficiency and adapt to smaller urban plots. |
| Integration with the Landscape | *Manyatta*s are often built with materials that blend into the surrounding landscape, minimizing visual impact and respecting the natural setting. | Design buildings that harmonize with their environment, using colours, forms, and materials that complement the natural surroundings. |
| Sustainable Community Layouts | The organization of *Manyatta*s within a boma for strategic defence and communal living emphasizes the importance of thoughtful site planning. | Plan urban developments that foster community interaction and safe, accessible public spaces, inspired by the communal layout of the boma. |

Tab.1

Table 2 below outlines proposed strategies for integrating Maasai Manyatta Techniques with modern innovations.

| **PROPOSED STRATEGIES FOR INTEGRATING MAASAI *MANYATTA* TECHNIQUES** | |
|---|---|
| **INNOVATION** | **STRATEGY** |
| Bio-mimetic Material Innovations | Creating synthetic materials that replicate the natural insulative properties of the mud and dung used in *Manyatta*s. |
| Dynamic Modular Systems | Utilize "living" joints in building modules that adjust their form or orientation based on environmental cues like temperature or moisture, optimizing comfort without human intervention. |
| Integrated Energy Harvesting | Using photovoltaic textiles for wall coverings that not only shade but also generate electricity. This method combines traditional design elements with advanced technologies to create self-sustaining buildings. |
| Cultural and Environmental AI | Using AI to harness traditional knowledge and simulate various design scenarios optimizing buildings before they are even built. |
| Hybrid Construction Techniques | Quick assembly of modern prefabricated structures. |
| Cultural Sensitivity Layering | Design philosophy that incorporates cultural elements—such as specific colour schemes, spatial layouts, and decorative motifs. |
| Virtual Reality (VR) in Design | Using VR to engage communities in the design process. |
| Socio-Economic Models for Construction | Economic models involving local communities in the construction process. Training programs to provide skills, boosting local economies. |

Tab.2

In a modern era marked by climate change, dwindling resources, and increasing societal divisions, the sustainable principles observed in Manyatta constructions provide vital lessons for fostering resilient, integrated communities globally.

**Fig. 11.** Enashipai lodge Maasai inspired spatial layout showing solar panels for sustainable design
**Source:** Ticati. (n.d.). [Picture]. https://www.ticati.com/hotel/enashipai-resort-and-spa-585987/

The Enashipai Resort & Spa, Fig 13, is an example of this fusion, influenced by the vibrant heritage of the Maasai. The resort seamlessly integrates traditional Maasai motifs, colours, and artwork. As shown in in Fig.12, within its architectural blueprint, echoing the communal structures and material choices reminiscent of a traditional Enkang, Fig 11.


**Fig. 12.** Material choices
**Source:** Sammi Nderitu Photography

**Fig. 13**. Green practices
**Source:** Sammi Nderitu Photography

*3.1.2 Swahili*

The Swahili Coast stretches from Somalia's southern border down to Mozambique, as shown in Fig.14. This area is renowned for its distinctive Swahili architecture and has been a melting pot of cultures and civilizations for centuries.


**Fig. 14.** Swahili influence
**Source:** Bhatia Mahajan. (n.d.). [Map]. https://www.bhatiamahajan.com/eastafrica.html

Historically, this region has been a hub of maritime trade, attracting merchants from as far as India, the Eastern Mediterranean, Arabia, and the Persian Gulf (Chittick, 1974). Over time, these interactions led to a blend of architectural styles, cultures, and the emergence of Kiswahili, a language that facilitated communication among diverse groups including Africans, Arabs, Persians, and later European colonizers (Mazrui & Shariff, 1994). The settlements along the

Swahili Coast are not only noteworthy for their unique architectural heritage as seen in Fig. 15 and Fig. 16, but also for the cultural fusion that they represent (Kusimba, 1999). The intermarriages between foreign merchants and local populations created a rich tapestry of cultural and genetic legacies (Middleton, 1992). The Kiswahili language, predominantly based on Bantu but incorporating Arabic and later European influences, epitomizes this cultural synthesis (Nurse & Spear, 1985).


**Fig. 15.** Trading ports 618-1500
**Source:** K. N. Chaudhuri. (1985). *Trade and Civilisation in the Indian Ocean*. [Map].

**Fig. 16. Swahili urban landscape**
**Source:** Photograph by A. C. Gomes Panorama circa (1902). [Picture].

*Architectural traditional principles, materials, and construction techniques*

The core of Swahili architecture is deeply rooted in a socio-cultural ethos that values community, privacy, and adaptation to the environment. Swahili architecture utilizes materials that are locally available, sustainable, and suitable for the coastal environment.

The primary construction material, coral stone, is harvested from the ocean or quarried from coral rag. It was valued for its thermal properties, durability, and the ease with which it can be carved for decorative purposes. Skilled craftsmen cut coral stone into precise blocks, which are then laid in careful patterns to create strong walls and foundations. The stone is laid using lime mortar, providing robust structural support. Wooden beams from mangrove trees are interlaced to form sturdy roof frameworks, supporting heavy coral stone tiles or palm thatch, door frames, and window grilles, mangrove wood is chosen for its resistance to rot and insects, making it ideal for the humid coastal climate. Lime plaster, made by burning coral stone to create lime and then mixing it with sand and water, is used to coat the exterior and interior walls. This plaster helps to regulate indoor temperatures and humidity. In less affluent or temporary structures, roofs are thatched with palm leaves, a material that is both insulating and readily available.

By examining specific traditional Swahili building methods and their modern applications, we can appreciate how these ancient strategies inform and enhance today's architectural innovations. Table 3 below outlines various lessons learnt from studying the Swahili architectural and construction strategies.

| Lesson | Description | Application |
|---|---|---|
| Sustainable Material Use | Traditional Swahili architecture made extensive use of locally available materials for example coral stone. | Use local, sustainable materials such as bamboo, rammed earth, recycled steel, and sustainably sourced timber to minimize environmental impact. |
| Passive Cooling Strategies | Swahili homes were designed with thick walls and inner courtyards to create a passive cooling effect. The walls acted as thermal mass, absorbing heat during the day and releasing it at night, while courtyards allowed for air circulation, bringing cool breezes into the home, and providing a shaded retreat. | Design with courtyards, atriums, and open-air spaces to enhance natural ventilation and cooling, reducing the need for artificial air conditioning and improving indoor air quality. |
| Ventilation and Natural Light | Swahili builders maximized natural ventilation and lighting by placing windows and openings strategically to capture prevailing winds and diffuse sunlight, reducing reliance on artificial lighting and cooling. | Optimize airflow and natural light through advanced ventilation systems and strategically placed windows, employing techniques such as stack ventilation and solar tubes. |
| Solar Shading and Reflective Surfaces | Often featured verandas, overhanging roofs, and light-coloured or reflective surfaces to provide shade and reflect heat away from buildings, essential for maintaining cool interior temperatures in a hot climate. | Incorporate solar shading devices like adjustable louvers, brise-soleil, and reflective glass to control heat gain and glare, dynamically adjusting to the sun’s position. |
| The Integration of Nature | Incorporating elements of the landscape into the design | Use cool roofing materials to reflect sunlight and absorb less heat, helping reduce cooling needs and mitigate urban heat island effects. |

Tab.3

**Table 4** below outlines proposed strategies for integrating Swahili Techniques with modern innovations.

| **Proposed Strategies for Integrating Swahili Techniques** | | |
|---|---|---|
| | | |
| Sustainability and Resilience | Ensure that all new buildings are energy-positive and resilient to climate changes. | •Energy: Integrate renewable energy sources such as solar panels, wind turbines, and geothermal energy systems.<br>•Materials: Utilize sustainable, recycled, or bio-based materials that reduce environmental impact.<br>•Design: opt for designs that naturally reduce energy consumption, like passive solar heating, natural ventilation, and optimized insulation.<br>•Resilience: Design structures to withstand local environmental risks, such as earthquakes, hurricanes, or floods. |
| Digital Integration and Smart Technology | Embed intelligence into building infrastructures to enhance efficiency, comfort, and adaptability. | •IoT: Equip buildings with IoT sensors for real-time monitoring and control of environmental conditions, energy use, and security systems.<br>•Data Analytics: Use data collected from IoT and other sources for predictive maintenance, energy management, and user behaviour analytics.<br>•Automation: Integrate automation systems for lighting, HVAC, and security to optimize performance and comfort. |
| Modular and Flexible Design | Allow buildings to adapt to changing use cases over time, supporting longevity and flexibility. | •Modular Construction: easily added, removed, or reconfigured.<br>•Flexible Spaces: Create multipurpose spaces that can be transformed according to need through movable walls, adjustable floors, and modular furniture.<br>•Lifecycle Adaptability: Design for easy upgrades and retrofits as modern technologies emerge. |
| Community and Wellness | Design buildings that promote health, well-being, and community interaction. | •Biophilic Design: Incorporate natural elements into building design to enhance mental and physical well-being.<br>•Community Spaces: Include communal areas that encourage interactions and build community ties.<br>•Health-Centric Features: Ensure ample natural light, superior air quality, and acoustic comfort. |
| Cultural Integration e.g. Intricate carved wooden doors and lattice work that not only serve decorative purposes but also ventilate and light interiors. | Respect and reflect the cultural context and heritage in which the building is situated. | •Cultural Research: Engage with local communities and historians to understand the area's cultural dynamics.<br>•Design Reflectance: Incorporate local arts, crafts, and design motifs to keep the cultural identity intact.<br>•Community Engagement: Involve local communities in the planning process to ensure the design meets their needs and respects cultural sensitivities. |
| Regenerative Design | Positive impact on their environments. | •Zero Waste: Design for zero waste during construction and operation through efficient material use and recycling. |

| | | |
|---|---|---|
| | | •Ecological Enhancement: Integrate features that enhance the local ecology, such as green roofs, permeable surfaces, and wildlife corridors.<br>•Carbon Negative Technologies: Implement construction practices and technologies that sequester more carbon than they emit. |
| Advanced Material and Construction Technologies | Leverage innovative materials and construction methods to push the boundaries of what buildings can do. | •New Material Utilization: Experiment with advanced composites, self-healing materials, and programmable materials that adapt over time.<br>•Construction Innovation: Employ robotic construction, 3D printing, and AI-driven design processes to increase precision, reduce waste, and cut costs. |

Tab.4

By drawing upon the wisdom in traditional methods, modern architects can create buildings that are environmentally sustainable, culturally, and historically resonant (Amory, 2012). In Lamu, a UNESCO World Heritage site, the design of the Lamu apartments shown in Fig. 17 reflects a conscientious approach that both preserves and celebrates the area's architectural legacy (Ghaidan, 1976). The development is designed to blend with the existing landscape, respecting the natural contours and vegetation, which helps minimize its environmental footprint (Ahrens, 2013).

**Fig. 17.** Lamu apartments designed to blend with the existing landscape
**Source:** Photograph by Callejas, J. (n.d.). [Picture]. www.archdaily.com

**Fig. 18** Interior image showing Swahili design features.
**Source:** Photograph by Callejas, J. (n.d.). [Picture]. www.archdaily.com

The architectural strategy involves incorporating Swahili design features, notable for their high ceilings and large windows, which facilitate natural ventilation and cooling. This traditional method is a sustainable choice that diminishes the dependency on mechanical air conditioning in Lamu's warm climate. While the building honours traditional methods and materials, it does not

shy away from modern enhancements as seen in Fig 18. The apartments has a contemporary architectural layout and use glass extensively to optimize natural lighting, making the interiors both functional and appealing for today's living standards as shown in Fig 19. It extends into modern sustainable practices such as rainwater harvesting and, potentially, solar energy solutions.

**Fig 19**: Elevations of Lamu Apartments
**Source:** Drawings by Urko Sanchez Architects. (n.d.). [Drawings]. www.archdaily.com

*3.2 South Africa and Southern Africa Region*

South Africa's traditional architecture tells a story of resilience, adaptation, and progress.

*3.2.1 Nguni Architecture: Zulu*

The Zulu community, predominantly residing in South Africa's KwaZulu-Natal province, structures their homesteads in a configuration known as "umuzi" or kraal. In this arrangement, beehive-shaped huts encircle a central cattle kraal, emphasizing the community's valuation of cattle as symbols of wealth, status, and power, as well as their role in social practices like polygamy. The spatial arrangement within the umuzi is purposeful, with huts positioned on higher slopes to aid in drainage. The most significant hut, known as the indluNkulu, houses the man's mother and serves as the spiritual center for the family's ancestors. Upon her passing, this hut is traditionally inherited by the man's first wife (Dlamini, 2003; Atkinson, 1987).

*Architectural traditional principles, materials, and construction techniques*

Zulu architecture is characterized by its distinctive beehive-shaped huts, crafted from a framework of inward-bending poles that converge at the top. Women traditionally apply thatch to

this framework, effectively insulating the structure against the extremes of summer heat and winter cold. The floors of these huts are crafted from termite nest clay, a material chosen for its waterproof properties that keep the interior dry during the rainy seasons. Security considerations are important to the design of these huts, most notably seen in the low entrances that require one to stoop when entering— a feature that provides a tactical advantage by limiting easy access as shown in Fig 20. These structures are not just homes but serve as spiritual and communal hubs, evidenced by areas like the "uMsamo," a sacred space dedicated to ancestral communication through offerings.

**Fig 20:** Zulu hut, South Africa iQukwane homes, or "beehive houses
**Source:** Photograph by Rye, G. (n.d.). www.archdaily.com

Historically, the semi-nomadic Zulu people constructed their dwellings using locally sourced materials like sticks, reed grass, and mud, to easily dismantle and reassemble their huts in alignment with their nomadic lifestyle. This architectural style is deeply intertwined with their spiritual practices, reflecting an ongoing engagement with their ancestors and connectivity with uMvelinqangi (God). Traditional Zulu dwellings, known as rondavels, continue to embody a strong commitment to cultural heritage. Originally built from thatch, many rondavels now integrate concrete and are equipped with windows, enhancing light and ventilation while preserving their traditional form. Modern architectural endeavours, such as the dome-shaped Mpumalanga Legislature building (see Fig. 21), demonstrate a fusion of traditional and contemporary elements, utilizing modern materials while respecting ancestral architectural styles. As rondavels have transitioned from temporary to more permanent structures, materials like concrete blocks have replaced mud walls, facilitating larger windows and better ventilation. Initially maintaining thatched roofs, many have now shifted to tiles or metal sheets. This evolution from organic to more durable materials illustrates the Zulu community's adaptability, maintaining respect for their heritage while embracing necessary modernizations for contemporary living. This blend of tradition and innovation ensures that Zulu architecture remains vibrant and relevant, continually enhanced by advancements in material technology to meet modern needs.

**Fig 21**: Mpumalanga Legislature building
**Source:** Co-Arc International Architects. (n.d.). [Picture]. *https://www.co-arc.com/mpumalanga-government-complex/*

**Table 5** below outlines various lessons learnt from studying the Zulu architectural and construction strategies.

| Lesson | Description | Application |
|---|---|---|
| Use of local low materials | Zulu traditionally used what was locally available e.g. cow dung, thatch, and termite clay in their construction | Instead of just riding on the 'modern' era, consideration to the use of local materials is key. |
| Use of native construction methods | Like the Zulu, almost every native community has a skillset of construction methods and techniques that have been used successfully over centuries or decades | Adopting Native construction techniques and working on developing them instead of overlooking them completely. |
| The Integration of a people's spirituality into the design | If spirituality is at the core of the values of a community, incorporating it to the design | Allowing the facility provisions in a design project be inspired by belief systems of the community so that they can feel a sense of ownership.. |
| Sustainable Material Use | The materials used by the Zulu were all sustainable. Due to the durability of the poles, they were also considered sustainable | Modern sustainable design practices embrace the principle of using local, sustainable materials that minimize environmental impact |
| Passive Cooling Strategies | The Zulu hut was able to regulate the indoor temperatures over the different seasons | Instead of modern buildings using high-performance insulation, adopting passive means makes the life costs of the constructions low |

Tab.5

*Contemporary attempts and adaptations : Freedom Park*

A great example of architecture that fuses traditional concepts and modern concepts is Freedom Park in Pretoria, South Africa shown in Fig 22. Mufamadi [10] describes how Freedom Park uses indigenous knowledge systems and rural and traditional homestead concepts to design the building. Figure 23 shows the Zulu traditional spatial configuration that was used as inspiration to sculpt the landscape. The project uses materials such as stone, water, fire, indigenous trees, and plants were used throughout the process of the design and shows the sensitivity it has to the landscape.

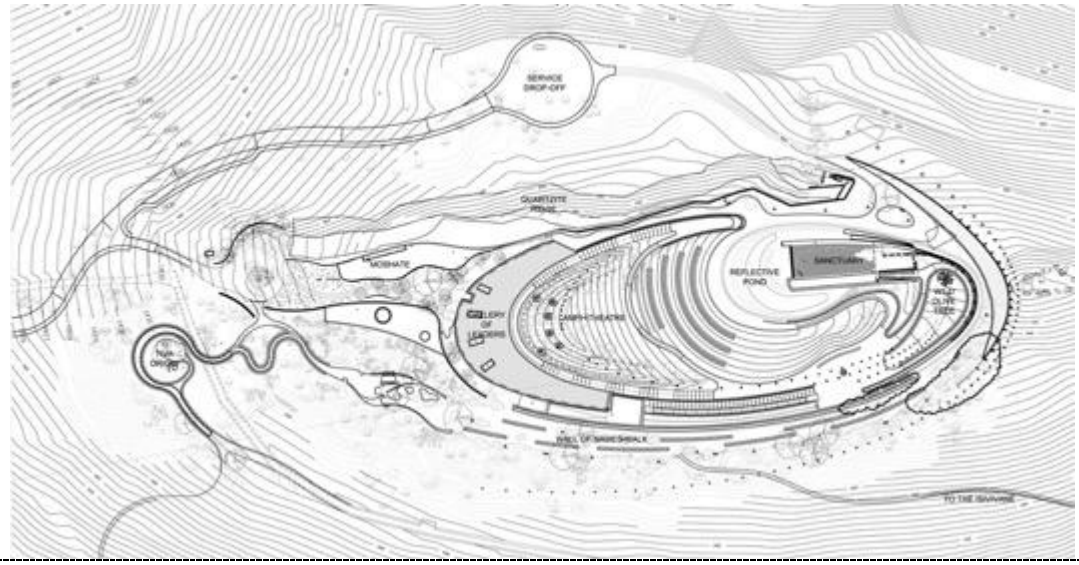

**Fig 22**: Freedom Park- South Africa
**Source:** Design by GAPP + Mashabane Rose Architects + MMA (2012). [Drawing]. https://www.archdaily.com/

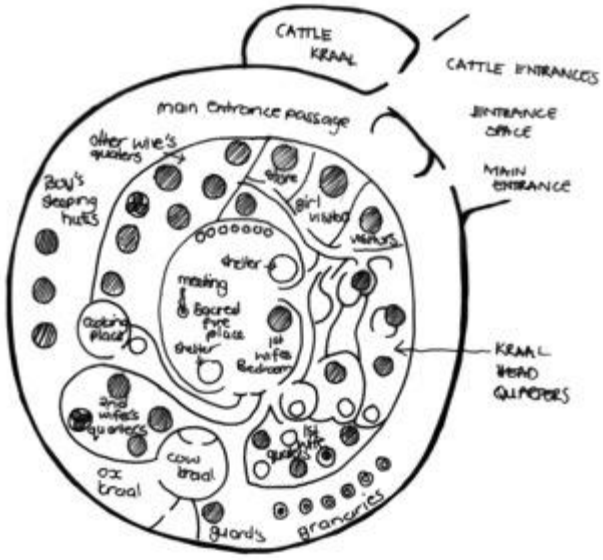


**Fig 23**: Freedom Park-Zulu Kraal- South Africa
**Source:** Peart, C.L. (2002). [Drawing].
Edited: Kgaugelo Lekalakala (2024)

Figure 24 express Mufamadi [10] description of how natural reeds were used as a source to channel life and were also used to frame S'khumbuto (the grass amphitheatre).

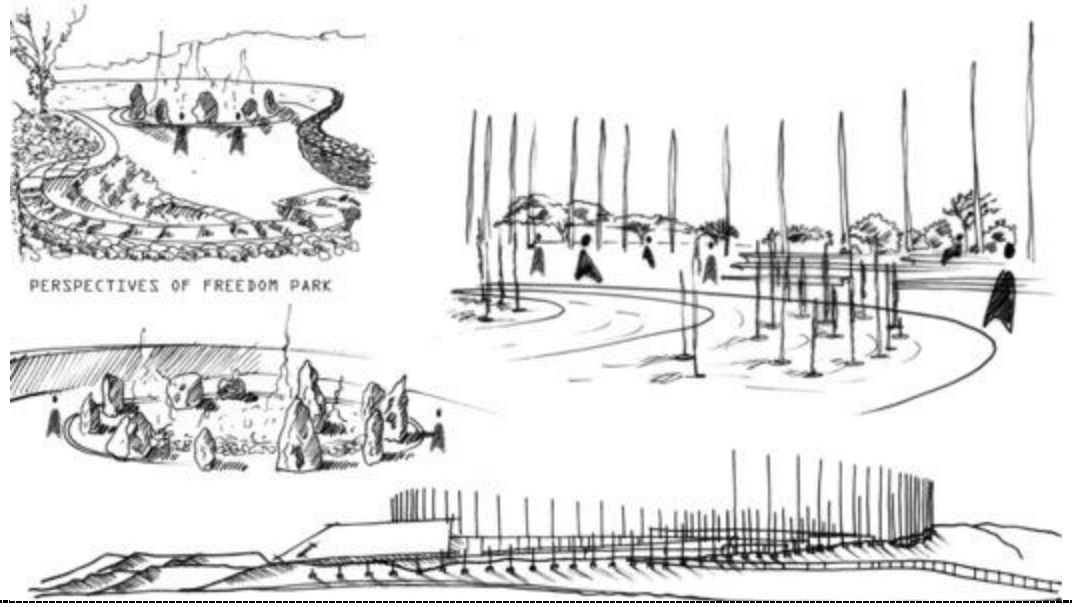


**Fig 24**: Freedom Park- South Africa
**Source:** Design by GAPP + Mashabane Rose Architects + MMA (2012). [Drawings]. https://www.archdaily.com/
Edited: Sketches by Kgaugelo Lekalakala (2024)

### *3.2.2 Non-Nguni Architecture: Setswana*

The traditional Setswana ntlo (house) combines rituals, environments conditions, habitat geography as mentioned by Steyn, [11]. Figure 25 shows the iconic African village layout is comprised of roughly elliptical or circular huts. Despite the variations in design and approach, settlements have retained the bilabial pattern as a feature of permanence with a fringe around the central group regarded as 'verandas'. They were used to provide a sense of openness and protection of outdoor living spaces by abiding by the rules of genius loci.

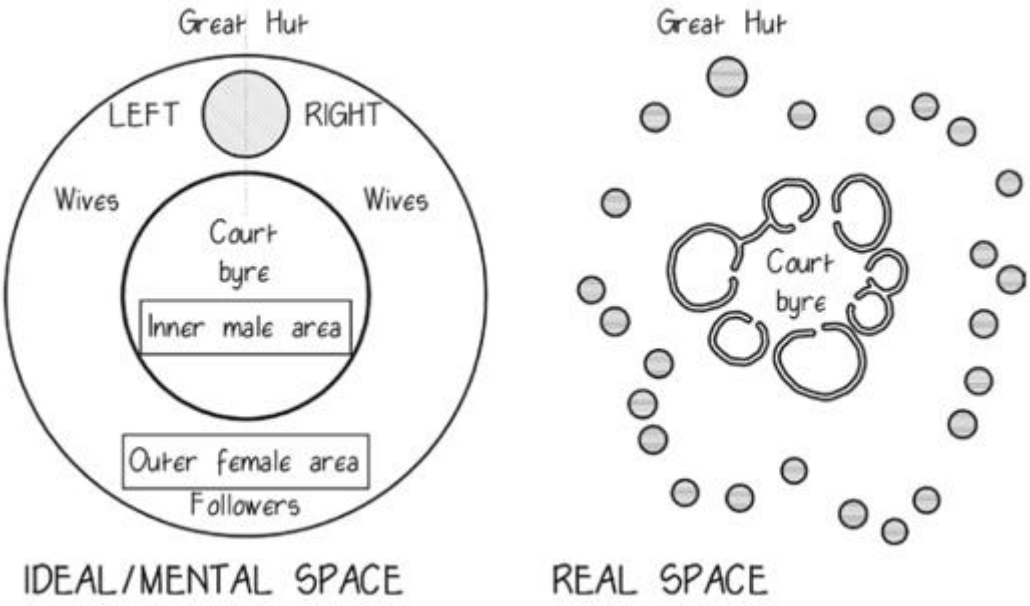


**Fig 25**: The central cattle pattern.
**Source:** Steyn, G. (2011).

*Architectural traditional principles, materials, and construction techniques*

Traditional Setswana buildings utilized locally sourced materials. Despite changes, certain architectural elements, such as wooden door and window frames and conical thatched roofs supported by posts, have withstood the test of time as seen in Figure 26. These structures traditionally employed the wattle and daub technique, using a mixture of clay, sand, and organic materials like cow dung or grass, applied over a framework of wooden branches and stakes. This method provided robust, monolithic earth walls renowned for their durability and insulation properties.

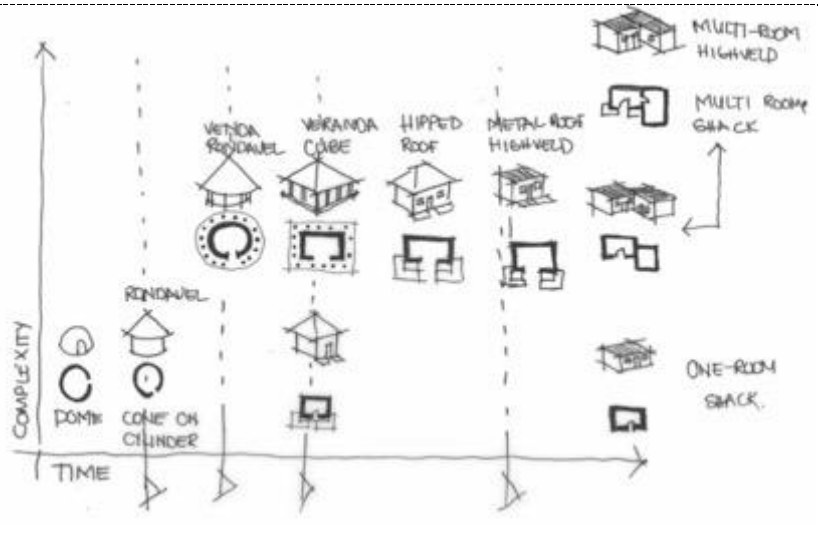


**Fig. 26.** A simplified evolution matrix for indigenous South African dwellings.
**Source:** Steyn, G. (2006),
Edited: Sketches by Kgaugelo Lekalakala (2024)

The rondavels (thatched rounded huts) at Dithakong were constructed using monolithic earth walls of thickness between 150mm and 100mm, formed by wooden branches and stakes almost perfectly plastered over with a solution of clay, sand and fresh cow-dung or freshly cut grass as shown on Figure 27. This technique was referred to as a 'wattle-daub-technique' by Burchell [12].

Rapoport [13] elaborates on the fact that circular or elliptical dwellings are easier to roof compared to other shapes. The choice of shape was symbolic to nature of forms inherently drawn from their day-to-day environments as their traditions did not necessarily have orthogonality. Harmony between earth and sky in the lens of texture, scale and colours and abstraction into built form to achieve genius loci was key.

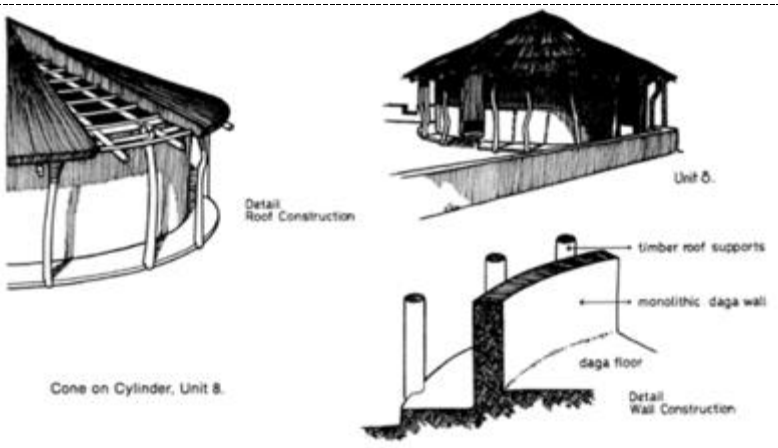


**Fig. 27.** Tswana construction
**Source:** Frescura (1981)

**Table 6** below outlines various lessons learnt from studying the Setswana architectural and construction strategies.

| Lesson | Description | Application |
|---|---|---|
| Use of local low materials | The architecture uses locally available material e.g. clay, wooden frames and thatched roofs or stone. | The use of thick clay walls was modified and compressed earth blocks were used. The use of stone to mimic the landscape architecture, so that the materials do not contradict the landscapes textures. |
| Use of native construction methods | The use of thick walls to create thermal mass. The circular spaces and dome like element were used n the architecture. | The concept of circular was carried through to create volume in spaces such as domes and creating gathering spaces bringing in the essence of community and togetherness. |
| Sustainable construction and materiality used | The materials used such as mud were sustainable at the time. | Sustainable practice and was used to create innovative engineered designs by making compressed earth blocks. |

Tab. 6

*Contemporary attempts and adaptations : Mapungubwe National Park*

Mapungubwe National Park, located where South Africa, Zimbabwe, and Botswana meet, is a UNESCO World Heritage site that features a diverse natural landscape of riverine forests, mopane woodlands, and dramatic rocky terrains shaped by tectonic forces, forming the Limpopo River (see Figure 28). The park's interpretive centre, designed by Peter Rich, creatively uses local materials and labour. Its roof is constructed with soil-cement tiles forming structural tile-vaults, a technique detailed by Ramage et al. [14] in Figure 28, integrating the building aesthetically and functionally into its surroundings.

The design has been choreographed to develop interior spaces that are sacred and influence psychological nuances of safety and security during user experience. Figure 30 shows how the arched edges of their thin shells are exposed, three number vaults rest on the undulating landscape spanning fifteen metres by eight metres on four corner supports, a shallow barrel and domed vault. From a bird’s eye view, the chameleon-like vaults form robustly buttress onto the land, contrasting the horizontality of the structured contours of delicate arches and domes as explained by (Ramage, et al.,) [14]. Fig. 29. illustrates the timelessness for the rubble stones and curvature of the arches using earth tiles, that is, less energy intensive while Figure 31 depicts the construction of compressed earth blocks. The stabilized earth has long history of sustainable practice and was used to create innovative engineered designs by making compressed earth blocks (CEB) using a hand-press and hence, create a state-of-the-art solution.

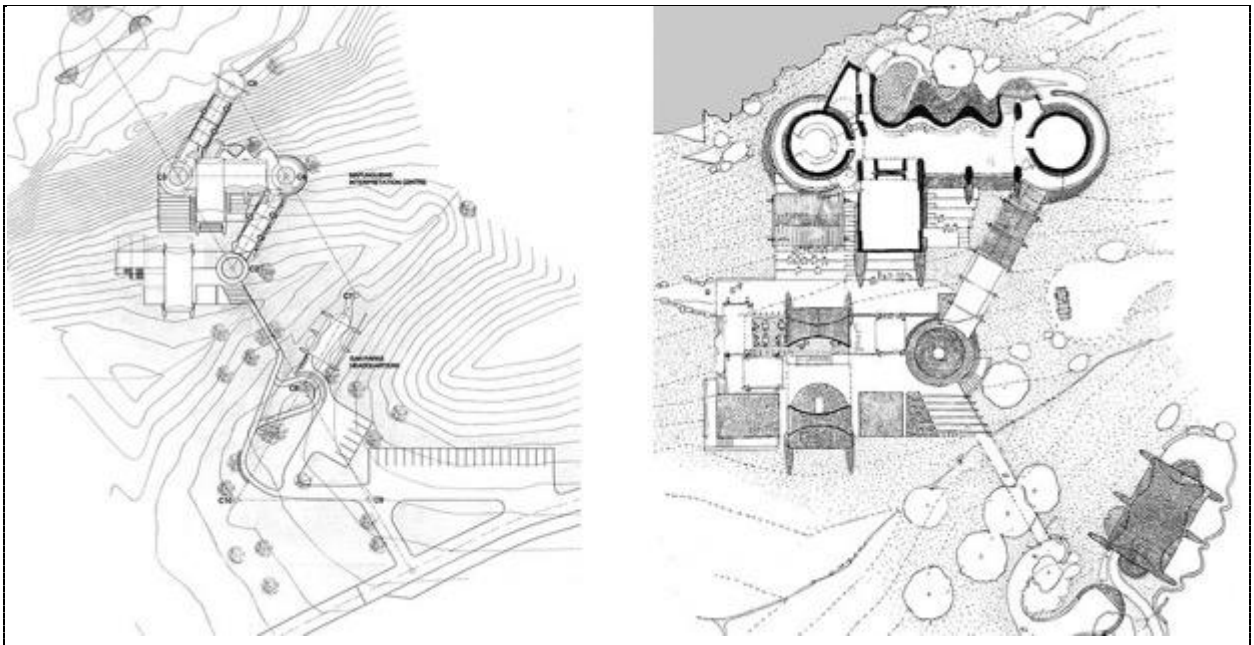

**Fig.28.** Site Plan: Freedom Park, Phase 1 / GAPP + Mashabane Rose Architects + MMA
**Source:** Design by GAPP + Mashabane Rose Architects + MMA (2012). [Drawings]. https://www.archdaily.com/

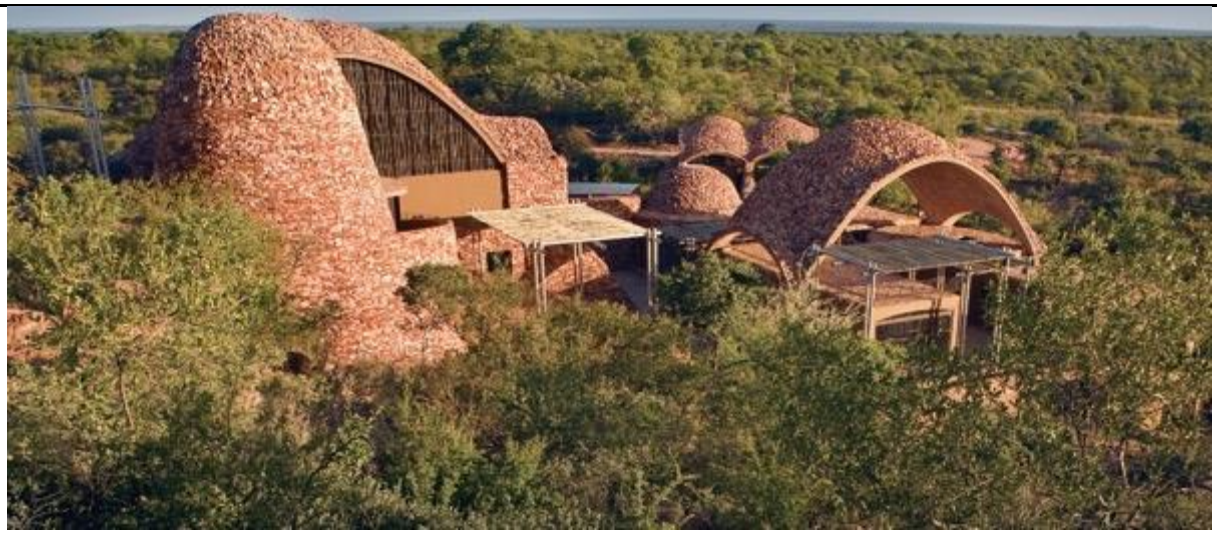

**Fig. 29.** Overall perspective of Mapungubwe Interpretation Centre
**Source:** Fagan, G. (2010). Mapungubwe Interpretation Centre by Peter Rich Architects, Mapungubwe National Park, South Africa [Picture]. The Architectural Review. https://www.architectural-review.com/today/mapungubwe-interpretation-centre-by-peter-rich-architects-mapungubwe-national-park-south-africa

**Fig. 30.** Timelines quality of the rubble stones and arches of the interior

**Source:** Ramage, et al. (2010). Design and Construction of the Mapungubwe National Park Interpretive Centre, South Africa. [Picture]. ATD Forum. https://www.atdforum.org/

**Fig. 31.** Construction of compressed earth blocks (CED) using a hand press

**Source:** Source: Ramage, et al. (2010). Design and Construction of the Mapungubwe National Park Interpretive Centre, South Africa. [Picture]. ATD Forum. https://www.atdforum.org/journal/pdf/Architecture_Michael_Ramage_Ochsendorf_Rich_Bellamy_Philippe%20Block.pdf

### *3.3 African Cultural Evolution*

The evolution of African music and fashion epitomizes the continent's successful harmonization of traditional elements with modern influences, illustrating a rich cultural heritage dynamically merging with contemporary trends.

African Music has profoundly influenced global genres like blues, jazz, and hip-hop through its rhythmic complexity, percussion, and communal participation. Modern genres such as Afrobeat, Amapiano, Afro-pop, and Kwaito emerge from artists like Fela Kuti, Angelique Kidjo, and Burna Boy blending traditional and contemporary elements, showcasing Africa's innovative spirit while preserving its musical heritage.

African Fashion has transformed traditional textiles and patterns into modern design pieces, Fig 32, with fabrics like Kente, Shweshwe, and Ankara prints gaining international recognition. Designers like Maki Oh and Thebe Magugu have reinterpreted traditional attire for a global audience, revitalizing local industries and challenging global fashion stereotypes.

This parallel evolution in music and fashion demonstrates Africa's ingenuity in maintaining cultural identity while adopting modern expressions, making significant contributions to global culture. This synthesis not only underscores the resilience and adaptability of African cultural expressions but also highlights their role in shaping global music and fashion landscapes, setting an example for preserving cultural heritage amidst modernization.

**Fig 32**: Embracing fusion of modern materials and culture with African fashion
**Source**: https://mbbaglobal.com/

## 4.0 Recommendations and Conclusions

*4.1 Summary of Findings*
*Architecture and Construction Techniques*

Table 7 shows the comparative analysis of the Maasai, Swahili and Zulu Architectural techniques and strategies.

| Techniques | Maasai | Swahili | Zulu |
|---|---|---|---|
| **Use of Locally Sourced Materials** | Utilize locally available materials like wood, mud, and cow dung, which are sustainable and biodegradable. | Employ coral stone and other locally sourced materials that offer high thermal mass and sustainability. | Traditional huts are constructed from local materials such as thatch, clay, and cow dung, emphasizing low environmental impact and availability. |
| **Community Involvement** | Building processes involve the community, fostering a sense of ownership and cultural continuity. | Although not explicitly mentioned for Swahili, traditional African communal practices likely influence construction, similar to Zulu methods where communal efforts in building reflect social cohesion and practical cooperation. | |
| **Adaptation to Local Environments** | Structures are designed to be climate-appropriate, utilizing shapes and materials that enhance natural cooling. | Thick walls and strategic courtyards optimize for cooling, reflecting an adaptation to the hot, coastal environment. | Thatch roofs and strategic layout of homesteads cater to temperature control, addressing both summer heat and winter cold efficiently. |
| **Circular and Compact Design** | *Manyatta*s are circular, promoting efficient air circulation and space utilization within a communal setting. | Although more rectangular or square with inner courtyards, the principle of using design to facilitate natural ventilation is evident. | Rondavels (circular huts) also utilize a circular shape, which is effective for both structural integrity and thermal efficiency. |
| **Integration with the Landscape** | Huts are built with materials that blend into the surrounding environment, minimizing visual and environmental impact. | Architecture traditionally harmonizes with the coastal landscape, using colours and materials that reflect the natural surroundings. | The layout of homesteads respects and integrates into the natural landscape, with minimal disruption to the environment. |
| **Spiritual and Cultural Integration:** | Although not detailed for Maasai and Swahili in the text, traditional African communities often incorporate spiritual and cultural elements into their building practices, suggesting a possible similarity. | | Building orientation and layout are influenced by spiritual beliefs and social structures, reflecting the integration of cultural values into architectural practices. |

Tab.7

### *4.2 Architectural and Construction Alchemy Guidelines for Bridging Tradition and Modernity in Kenyan and South African Architecture*

The adoption of sustainable building practices is significantly advanced by prioritizing the use of indigenous materials, which are both environmentally friendly and effective in reducing the ecological footprint. One key strategy is the incorporation of design elements such as thick walls. These traditional features naturally maintain comfortable indoor temperatures, thereby lowering energy consumption and supporting overall environmental sustainability. Additionally, integrating Swahili passive cooling techniques—such as thick walls, courtyards, sun-shading elements, and

cross ventilation—further reduces reliance on artificial cooling systems. Orienting building façades from North to South also enhances passive cooling, optimizing energy efficiency.

Preserving cultural heritage through architectural symbolism is essential for maintaining cultural identity and reinforcing community bonds. Structures that embody cultural symbols and traditional layouts, such as the Maasai's circular *enkang*, play a crucial role in this regard. Community-inclusive design practices ensure that new constructions resonate culturally and support communal life. This approach not only bolsters social cohesion but also strengthens cultural heritage, contributing to a richer, more connected community fabric.

Combining modern technology with traditional techniques offers valuable opportunities for enhancing sustainability. For example, integrating bio-enhanced weatherproofing and insulation benefits of traditional materials with modern technologies like solar panels promotes sustainable energy use. Buildings designed to adapt to climatic shifts through elevated structures or flexible materials, inspired by traditional dwellings, exemplify how contemporary methods can complement historical approaches. The development of prefabricated buildings reflecting traditional aesthetics provides a practical solution for urgent housing needs. Modular homes inspired by Manyattas can expand or contract based on environmental cues like temperature or moisture, utilizing "living" joints and 3D printing with sustainable materials to recreate intricate designs while minimizing waste.

Public spaces and community centres that reflect the social and spiritual dimensions of traditional life are essential for fostering social interactions and cultural ceremonies. Establishing centres dedicated to the conservation and education of local traditions, styled in traditional architectural designs, ensures these spaces serve as cultural beacons and support heritage preservation. Incorporating green spaces into urban designs, using native flora and water features, enhances biodiversity and provides communal gathering places. Community-driven waste management strategies that blend traditional resource reuse with modern recycling techniques further support environmental sustainability.

For essential facilities such as schools, hospitals, and government buildings, integrating elements from traditional architecture with modern technological solutions merges functionality with cultural aesthetics. Intelligent building solutions within these traditionally inspired designs ensure operational efficiency and comfort. Designing urban spaces to mimic or rehabilitate natural wetlands helps manage urban runoff and promotes biodiversity. Additionally, using high thermal mass materials in construction stabilizes indoor temperatures, akin to traditional thick mud walls. Combining earthquake-resistant traditional methods with modern structural engineering enhances safety and structural integrity, while utilizing local plant species in landscaping ensures ecological compatibility and promotes biodiversity.

Upgrading and repurposing old buildings preserves their historical value while adapting them for modern uses. Incorporating spaces within contemporary buildings for dynamic exhibits on local history and cultural practices bridges past and present. Promoting building techniques that reduce carbon emissions supports green building standards. Organizing workshops where community input shapes the planning process ensures that projects are culturally relevant and widely accepted. Engaging young people in architectural design through targeted programs nurtures a legacy of cultural continuity and innovation, empowering future generations to contribute to sustainable and culturally aligned architecture.

This paper contributes to the broader discourse on sustainable and culturally sensitive architecture. It calls for a continued exploration of innovative architectural approaches that can navigate the complexities of modernization while preserving and celebrating cultural identities-

where the global and the local, the contemporary and the traditional, harmoniously coexist. Future research should focus on expanding the study of material alternatives to address limitations related to availability and cost. This research should aim to develop and test new, sustainable materials that either replicate the benefits of traditional materials or offer innovative, locally sourced, and cost-effective solutions. Additionally, advancing technology integration studies is crucial for enhancing the synergy between traditional building techniques and modern technologies. This research should involve pilot programs and collaborative efforts to explore effective combinations of traditional methods with contemporary innovations, such as bio-enhanced weatherproofing and renewable energy solutions. These studies will provide valuable insights into how these approaches can be seamlessly integrated, leading to more efficient, sustainable, and culturally meaningful building practices.

**Acknowledgement**

This research was not funded by any grant.

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