Learning From the Swahili Architecture in Mombasa/Kenya.

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ABSTRACT: The Old Town of Mombasa and other towns like Lamu and Malindi found along the East African coast have a rich collection of Swahili Architecture. These towns have stood the test of time; however today they are facing a conservation challenge. It is a sad reality that Old Town Mombasa, which had various influences from different communities like the Omanis, Arabs, Portuguese and Indians, is fast losing its identity as a Swahili Town. This is mainly because of an expanding population, increased demand for land, increased land prices, and most importantly a lack of conservation awareness. Nevertheless, one has to note the significance of this town not only because of preserving its unique architectural style but also to learn from Swahili culture.
In this paper the authors present a study of examples of Swahili Architecture found in Old Town Mombasa, Kenya, covering the most significant environmental design strategies that were employed in this style of architecture in order to maintain comfort. Swahili Architecture boasts a number of environmental qualities varying from a coherent bioclimatic master planning to optimum levels of thermal comfort. The aim of the study was to draw valuable lessons from these unique vernacular buildings. The investigation was carried out first by literature review whereby various books on Swahili architecture were studied, site visits and then temperature readings over a period of two days were conducted in the streets and alleys of old town. The temperature readings observed proved that the alley ways that were well ventilated, had less heat build up and also the surface finishes around the loggers had a significant impact on heat build up around the loggers. The authors feel disappointed that the Swahili Architecture in Old Town Mombasa which had various influences from different communities like the Omanis, Arabs, Portuguese, Indians etc is perishing at a fast rate. However one has to note the significance of this town not only because of preserving its unique architectural style but also to learn from Swahili culture through its existence.

Keywords: Sustainability, Swahili architecture, Vernacular architecture

INTRODUCTION

Mombasa is an island on the Kenyan Coast and it lies in the Indian Ocean approximately 4^{o} south of the Equator, however the district of Mombasa goes beyond the island into the Mainland. In Mombasa lies the old town which is a Swahili stone town. Mombasa was built on an island more than 800 years ago and it has become the busiest port in East Africa (Moriset et al, 2009). The town came about due to local influences from tribes and trade that took place due to Mombasa's strategic location in the Indian Ocean. Mombasa has captured influences from the Arabic peninsula, Persia, Portuguese and Indians creating a unique Swahili identity which can still be found in old town Mombasa (Moriset et al, 2009, Shatry 1990). Climatic conditions often coupled with cultural and technological influences usually play a major role in forming a type of architecture. The Swahili architecture is a good example of this type of architecture that was as a result of the three factors stated above.

Kenya is a country in East Africa and it lies on the equator. The Indian Ocean is towards the south-east of Kenya and hence due to Kenya's close proximity to the Arabian Peninsula; colonisation from various groups like Arabs and Omanis occurred throughout the coast of Kenya. Eventually due to colonisation, trade and settlement from these various groups, a unique culture evolved along the coast that is the Swahili. Kenyan architecture today generally has evolved and headed towards an unsustainable direction; the skylines of towns like Mombasa and Nairobi have been transformed and cluttered with tall fully glazed and fully air-conditioned buildings. These buildings are completely alien to the region and environment.

Mombasa Old town is one of the most cosmopolitan centres along the entire coast of East Africa. Four cultural streams have converged here namely; Arab, the Indian and European, combined with the local African tradition to produce an exotic mixture of population and culture. This has also lead to the old town section of Mombasa's rich cultural heritage. The Arabs have had a strong influence in setting Islam as the prevailing religion as well as the resulting architecture. However, other communities like the Indians and Europeans plus today’s contemporary architecture have also had an influence in the Old town. The coral stone buildings of this old urban core, built on the south eastern part of the island, contrast sharply with the multi-story housing which encircles the city on its central and northern flank (Shatry.A 1990).

Figure 1: Images of Nairobi's Skyline, Notice the Glass

Skyscrapers that dominate the skyline Source: authors records
Figure 2: Images of a building in old town Mombasa and a close up of a skyscraper in Mombasa.
Source: author's records

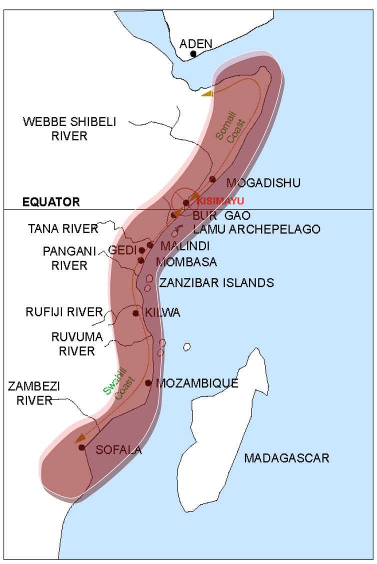


Figure 3: Map showing the extent of the East African Coast Source: Ghaidan.U 1975 Author modified

CLIMATE-RESPONSIVE SWAHILI ARCHITECTURE
Urban and Building Scale strategies

When one looks at the organic structure of the Old Town, it may appear haphazard and meaningless. But upon closer investigation into the urban history of the town, three main factors can be identified to have determined its nature, these are:
1. Fort Jesus with its strategic entrance, the former City of the Moors and the connecting path between them as shown in fig 4
2. The co-existing partnership of Government Square and the Old Port and the former trolley rail link between them as shown in fig 4.
3. The former town walls and gates.
Urban history has shown that with the growth of medieval cities, streets were formed following the outline of the former walls. The same happened in Old Town, Mombasa, where the outer circuit of the roads/streets Nkrumah, Makadara, Samburu, Wachangamwe and Kitui corresponded to the second town wall built by the Mazrui (Shatry A 1990 pg 30). Old Town is a spontaneously developed town where the buildings make the street and not vice-versa as in planned towns. The presence of different irregular buildings, orientations and positions, force the street to turn, twist, meander, expand and constrict in a different manners. Characteristically, buildings or parts of buildings juttt out into the street and others are set back, as shown in fig 5 thereby forming small pockets of space which usually become ideal popular activity nodes.
The inclined streets that branch off Mbarak Hinawy Street toward the coastline besides being circulation routes, also play a significant environmental role in channelling sea breezes and in draining accumulated surface water. They also focus views towards the ocean when walking along Mbarak Hinawy Street.

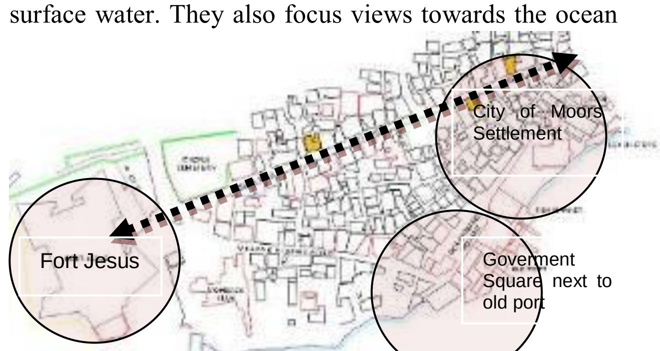


Fig 4: Map of old town Mombasa showing the factors that lead to its location, sitting and street geometry
Source: University of Nairobi (UON)- Author edited

Fig 5: Labyryntian layout of streets representation in Old town. Source: Siravo F., Pulver A. (1986

Fig 6: Views of Old town Mombasa Source: Authors records

Building Scale strategies

Mombasa's climatic patterns and other East African towns along the coast are dominated by the north-east monsoon winds which blow from November to March and the south-west monsoon winds which blow from April to October. The hot season occurs during the north-west monsoon winds with the two hottest months being February and March where temperatures range between 35^{0}c and 37^{0}c and relative humidity reaches between 70% and 80% (Ghaidan.U. 1975). However July and August, the two coolest months, are more pleasant with temperature in the range of 22^{0}c to 27^{0}c.
The rainy seasons take place with the changing monsoons. The long rains occur from April to the beginning of June and account for more than half of the entire rainfall experienced generally by the East African coastal cities. The short rains are much less reliable, but usually occur for approximately two weeks in November

As a result of the climate conditions and the Swahili culture and other influences from foreign cultures, Old Town Mombasa displays a unique set of architectural elements which are constant across its buildings. Most of them are external features and can easily be noticed as shaping the streets and building facades. The architectural elements that one can find in old town are detailed below:

(a) Doors and Doorways:
Most doorways of buildings in Old town consist of arched openings. Decorative carved doors were placed as the entrances to these buildings. Timber was used for thresholds of all doorways. The threshold is equal to the wall thickness and its raised 5cm above the floor level to take two timber members (each of about 12 x 8 cm.) built in along both edges. Old town today displays two types of carved doors namely:
The Gujarati Doors: It owes its name to the fact that it was found at the entrance to shops owned by business men coming from Gujarat in India.
The Arab Swahili Doors: These were generally found on doors of Arab and Swahili merchants and officials.
(b) Windows:
Most windows in Old town Mombasa reach to a height of about 2m from floor level and begin at about 150mm above ground level. These windows are normally split into two with the top half left open most of the daytime. Window types can be broken down according to the type/material of construction:
Wood Casement: Many windows in old town are of the wood casement type, and the panels can be made out of solid wood or glass and in some cases shutters.
Shutter windows: These can be found either alone or combined with solid wood panel. The most common type of window in old town Mombasa is the combination of the shutters above and the solid wood panel below. These are good for ventilation purposes.
Steel casement: These are found with glass panels & were introduced by the British in Old town Mombasa during their rule.
(c) Balconies:
Balconies are a dominant feature in old town Mombasa and all other Swahili towns. These balconies are elaborate, with rich carvings and motifs on them. Balconies create shade for the streets and entrances below. This is advantageous as it not only creates shade but also reduces the street to a more human scale. It also protects from the rain.
(d) Barazas:
These are basically porches that form a transition between the outside and inside. The baraza is a low stone or concrete bench/seat that is attached to the main building facade. Under the cool shade of the street, people are encouraged to sit on them for rest, interaction and enjoyment of the street scenario.

Fig 7: Views of Houses with a balcony that spans two floors in old town Mombasa.
Source: Authors records

Fig 8: Painting of a boy sitting on a stone bench and reading, right shows a different baraza, one where there are only a few raised steps
Source: Authors records

EMPIRICAL DATA COLLECTED AND ANALYSIS

Urban Scale Analysis

In order to carry out the investigation of heat build up on the streets in Old Town, two data loggers were placed in close proximity as shown on the drawing below. The investigation was undertaken in May 2010 for a period of two days. Temperature readings and Relative Humidity readings were recorded every 1.5 hours.
The authors observed the treatment of the finishes around the data loggers, and also the character of the street whether it was narrow or wide.

Data logger 1 was located between two tall buildings that receive direct breeze from the ocean along Mbarak Hinawy road and at the mouth of an alley way. The surface treatment of the building is coral, and the floor of the street is concrete. The road next to the buildings is busy with traffic and hence a lot of heat is generated.

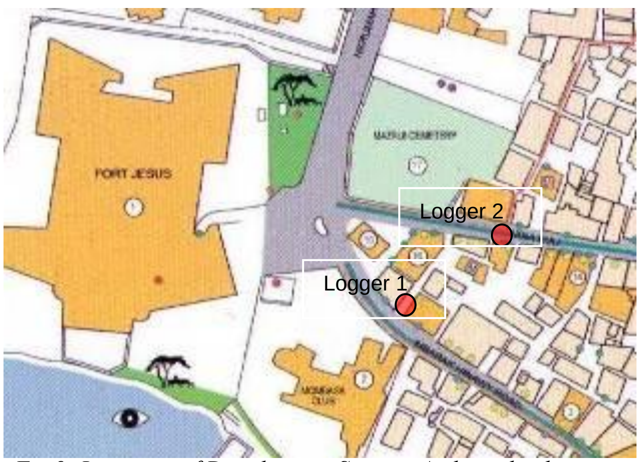


Fig 9: Locations of Data loggers Source: Author edited

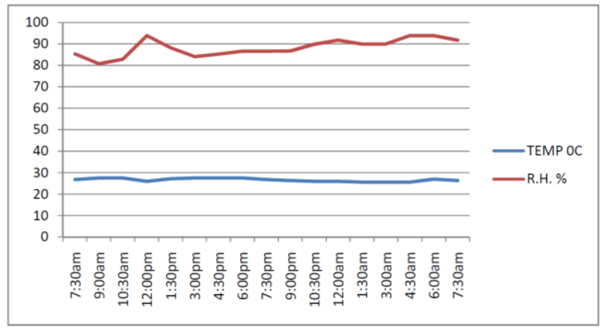
The results of this data collection and analysis can be seen in tables 1& 2 and in graphs 1 &2. Although the data logger shows a relatively high temperature, the buildings along Mbarak Hinaway Street create a microclimate whereby the temperature is relatively low.

Data logger 2 was located in a relatively shaded area along the wall of building 69 on Ndia Kuu street. The street normally has high vehicular traffic, which results in generation of some heat and carbon dioxide. The buildings surrounding the logger are made of lime and are painted cream. The road has a cabbro paving and this reflects heat back hence increasing the temperature of Ndia kuu. The results of this data collection and analysis can be seen in tables 3&4 and graphs 3&4.

DAY 1

TIME	7:30am	9:00am	10:30am	12:00pm	1:30pm	3:00pm	4:30pm	6:00pm	7:30pm	9:00pm	10:30pm	12:00am	1:30am	3:00am	4:30am	6:00am	7:30am
TEMP ^{0}C	26.73	27.52	27.52	25.95	27.12	27.52	27.52	27.52	26.73	26.34	25.95	25.95	25.56	25.56	25.56	26.95	26.34
R.H. %	85.3	80.7	82.8	93.8	88.1	84	85.2	86.6	86.6	86.7	89.8	91.7	89.9	89.9	93.8	93.8	91.7

Table 1: Logger1 day 1

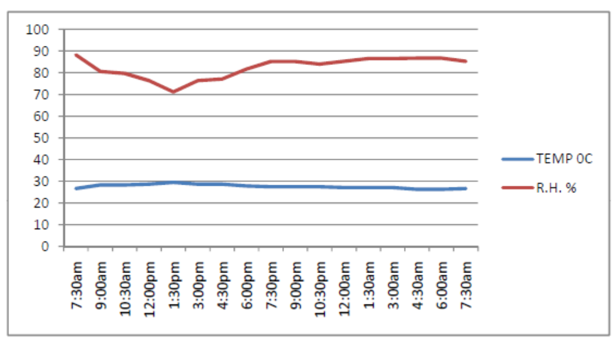


Graph 1: Logger 1 day 1

DAY 2

TIME	7:30am	9:00am	10:30am	12:00pm	1:30pm	3:00pm	4:30pm	6:00pm	7:30pm	9:00pm	10:30pm	12:00am	1:30am	3:00am	4:30am	6:00am	7:30am
TEMP ^{0}C	26.73	28.31	28.31	28.7	29.5	28.7	28.7	27.91	27.52	27.52	27.52	27.12	27.12	27.12	26.34	26.34	26.73
R.H. %	88.2	80.6	79.7	76.4	71.2	76.4	77.1	81.7	85.2	85.2	84	85.3	86.6	86.6	86.7	86.7	85.3

Table 2: Logger1 day 2

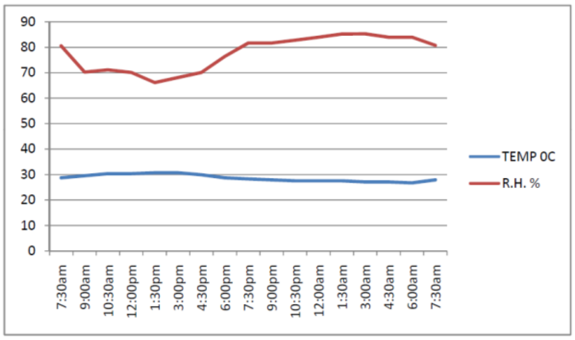


Graph 2: Logger 1 day 2

DAY 1

TIME	7:30am	9:00am	10:30am	12:00pm	1:30pm	3:00pm	4:30pm	6:00pm	7:30pm	9:00pm	10:30pm	12:00am	1:30am	3:00am	4:30am	6:00am	7:30am
TEMP ^{0}C	28.7	29.5	30.31	30.31	30.71	30.71	29.9	28.7	28.31	27.91	27.52	27.52	27.52	27.12	27.12	26.73	27.91
R.H. %	80.6	70.2	71.1	70.1	66.1	68.1	70.1	76.4	81.7	81.7	82.8	84	85.2	85.3	84	84	80.7

Table 3: Logger2 day 1

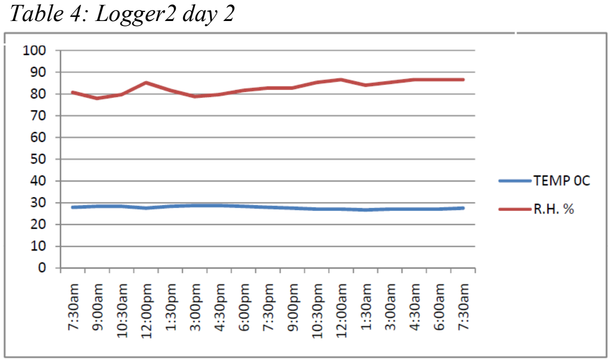


Graph 3: Logger 2 day 1

DAY 2

TIME	7:30am	9:00am	10:30am	12:00pm	1:30pm	3:00pm	4:30pm	6:00pm	7:30pm	9:00pm	10:30pm	12:00am	1:30am	3:00am	4:30am	6:00am	7:30am
TEMP ^{0}C	27.91	28.31	28.31	27.52	28.31	28.7	28.7	28.31	27.91	27.52	27.12	27.12	26.73	27.12	27.12	27.12	27.52
R.H. %	80.7	78	79.7	85.2	81.7	78.8	79.7	81.7	82.8	82.8	85.3	86.6	84	85.3	86.6	86.6	86.6

Table 4: Logger2 day 2



Graph 4: Logger 2 day 2

From the Results, one can see that the temperature readings of Data logger 1 and 2 differ slightly. Day one of readings of data logger 1 show readings that are close to the upper comfort limit (27 degrees), and day two the temperature goes above the limit. However the temperature readings of data logger 2 show that temperatures go way above the upper comfort limit. This may be due to the locations of these loggers. Logger 1 gets breezes direct from the sea hence this reduces the heat build up. However logger 2 does not get direct sea breeze due to its location. Also another attribution may be due to the busy human and vehicular activities that take place around logger 2. As mentioned earlier logger 2 has cabbro paving around it, and this increases heat build up as well.

Building Scale Analysis

The climate is very hot and humid; hence there was scope for the use of Courtyards. Cool air descends through the courtyard and hot air rises. The streets are narrow and lie along the North-east and South east directions of Monsoon winds (Shatry A 1990). Hence wind is funnelled through these streets, thereby cooling the pedestrians (Shatry A 1990). Windows and openings in the facades are placed in strategic positions to face the prevailing wind directions allowing for its penetration. All the external walls of the Buildings were about 300-600mm thick; this was done so as to reduce the transmission of heat into the interior by radiation (Shatry A 1990). All the Internal walls are white washed increasing illumination of the interior by reflection. The high exterior walls provide shade for the courtyards keeping it cool (Shatry A 1990).

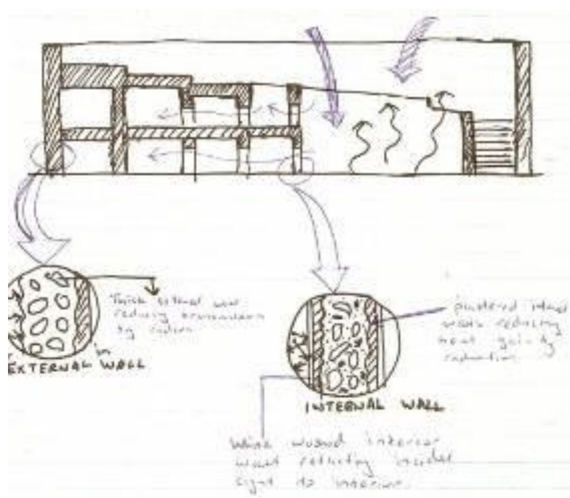


Fig 10: A section through a Courtyard in a traditional stone Swahili house

Source: Authors Sketches University of Nairobi (UON)

Wall Thermal mass: White washed facades ensure that excessive heat is reflected. Old town traditional building's walls are generally constructed of coral rag bonded with coral lime or soil.

External wall thicknesses vary from 500 to1200 mm, giving a conductance of 1.56 W/sq.m deg.C compared to say a hollow block (250 mm) concrete wall with a conductance of 1.08 W/sq.m deg.C) (Shatry A 1990). The time lag for the coral sandstone will be over 12 hours, and this is better than the concrete block wall.

Window Design: The design of the windows also contributes to the air flow patterns within the rooms. They are constructed of very good hardwoods. Double louver shutters perform a dual purpose, the top shutters can be opened for increased ventilation and air movement, while the lower ones can be shut, thus allowing some air flow, but shading the inhabitants from direct glare (Shatry A 1990).

Ceiling Height: Ceiling heights are generally high especially on ground floor, mostly more than 3.5m, and are essential in increasing the volume of air indoors that is necessary for the increased respiration by the inhabitants and to reduce condensation problems due to the high water content of the air (Shatry A 1990).

Choice of Materials: The Swahili used wood extensively, but they also used Coral stone, which is readily available along the coast, and is a renewable material. Thus when designing a building is important to choose materials that are renewable and locally available as the Swahili did. These materials all have a low embodied energy (Shatry A 1990).

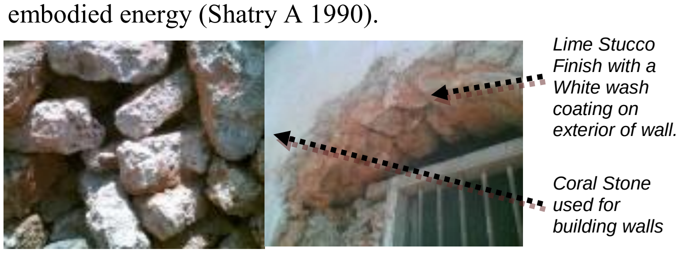


Fig 11: Images of Coral stone and its application in Old town

Source: Authors records

CONCLUSIONS

In conclusion, one can see that the Swahili architecture in Mombasa, Kenya has elaborate environmental strategies and features we can learn from. From the building design, to the streets design and configuration; one can appreciate the environmentally conscious solutions these people adapted from their understanding of climate, materials and their behaviour. It is sad that this town is under a considerable threat from a lack of conservation. However the authorities are trying to tackle this and this paper is aimed to help in documenting the unique architecture. Modern designers in the Mombasa context should consider some Swahili characteristics such as courtyards and windows with shutters for ventilation purposes, use of similar materials which have good time lag and the application of light colours to reflect solar radiation. These considerations should expand to the urban scale with the design of narrow streets to channel sea breezes to cool pedestrians and also channel wind into spaces. As seen in the analysis of the results from the two loggers, the logger that had direct breeze from the sea recorded fairly lower temperatures than the logger that did not have direct breeze. Therefore it is important to design in a way that the breeze is funnelled to benefit both inhabitants indoors and pedestrians outdoors. Also what was interesting in the findings was that the surface treatments also influence the heat build up. Hard surfaces increase heat build up, therefore materials that reflect heat or soft-scape can be beneficial in reducing heat build up. On a whole Swahili architecture as described by Shatry maybe timeless, in the sense that the towns have still lasted till today and we can learn alot from the way the Swahili culture adapted to the environment and context they were found in. Therefore this investigation draws to a conclusion that the Swahili architecture in old town Mombasa has allot to teach us from the environmental strategies employed in the buildings to the urban scape of the streets and alley ways.

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