



## **INTEGRATION OF BIO-CLIMATIC CONCEPTS IN A MIXED-USE DEVELOPMENT.**

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### **ABSTRACT:**

The need for vitality productive, bioclimatic and ecological, thought of engineering structures have caused, a totally different logical order called bioclimatic structure This proposition expects to exhibit procedures and investigate the benefits of adding bioclimatic ideas to arrive use plans for the Urban occupants of Lekki, Lagos contains individuals from various foundations, organizations, exercises, callings and philosophies that have a tremendous enthusiasm for living, working, relating, and general business exchanges. Bioclimatic ideas, these are ecological and financial trademark, which in contemporary world and the present dimension of progress of science and innovative comprehension go together, that we can't talk on monetary way to deal with the issue and in the meantime does not mirror the effect of the watched events on nature.

### **1.INTRODUCTION**

Mixed-use development is Blended use, advancement is a urban improvement that consolidate private, business, social, institutional, or excitement utilizes, where those designs are tangibly and practically joined, and that give walkway associations. Blended use improvement can appear as a city obstructs a solitary structure, or whole quarters. The term may likewise be utilized all the more explicitly to allude to a blended utilize land advancement venture, a structure, complex of structures, or city that is created for blended use by a private engineer, organization, (semi ) administrative or blended. The aim of this paper is to explain and discuss the idea of bioclimatic architecture as one of the most actual and important phenomena in contemporary building. This research is motivated towards the desire to create a unique and functional mixed-used

development design so as to satisfy the public need which will be achieved in a building and also stand the test of time.

## 2.1 BIOCLIMATIC DESIGN

### INTRODUCTION

Victor Olgyay utilized the term bioclimatic In1963 out of the blue. Bioclimatic graph was created by him, which relates warm solace points of confinement to climatic information, to recognize structure Schemes(Olgyay,1973). Bioclimatology tells the investigation of the atmosphere (Climatology) to the people. Design improvement through history shows numerous pertinent instances of reactions to explicit condition and climatic settings, inside the limits of the assets realistic, the innovative progression and the desires for natural quality. A portion of the key components to be considered for effective usage of bioclimatic structure are appeared in the outline beneath:



**Figure 2.1 Bioclimatic Designs.** Source: (Googleimages.com/bioclimatic design)

A portion of the ideas of Bioclimatic Designs are:

- a) Site and climatic examination,

b) Design procedures that lessen or dispense with the requirement for non-sustainable power source assets and how these methodologies explicitly influenced situation, introduction, and shading of the structure (Susie, 2011).

Sergi (2011) list 10 crucial Bioclimatic Design ideas as pursues:

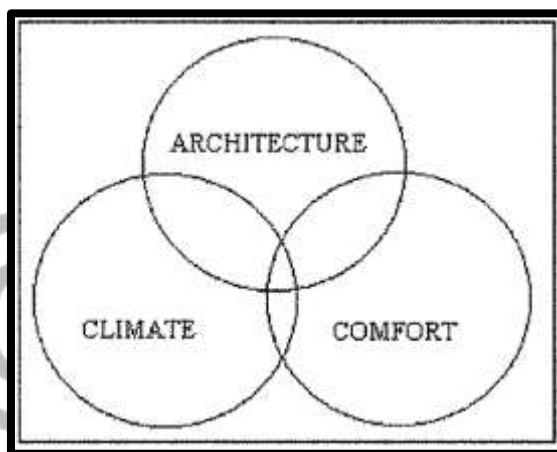
- a) Main façade face south which gives shade in the late spring and daylight amid the winter time. The situating of lower edges of rooftop are reliant upon the scope of the structure
- b) Home ought to be near deciduous (trees that shed their leaves every year)
- c) Which will give shade in the late spring?
- d) Solid dividers and materials permit more noteworthy "warm dormancy" - the capacity of material to store warmth and vitality which constructs more warmth to discharge consistently. A warmth recuperation ventilation framework can be introduced which incorporates: sun based warm boards, protection, triple-coated low-Energy windows, supply air, remove air, heat recuperation ventilation framework and ground heat exchanger.
- e) Large glass ought to be introduced in south side of house to enable sun oriented vitality to gather.
- f) A thermo-wind self-suction hood ought to be introduced in fireplaces which removes vapor and inordinate warmth. It likewise forestalls them being drawn back in to the home.
- g) Abundant utilization of bay window and deliberately setting them as indicated by sun positions for best characteristic lighting. Bay windows can illuminate lobby ways, restrooms, lofts and different rooms. Utilizing pivoted bay windows permit the window strobe balanced by season. "Since they overlay up and can be balanced, when opened in summer they dispose of the tourist and make cross-ventilation,"(Sergi, 2011).
- h) The utilization of characteristic protection and breathable, water evidence materials for the rooftop.
- i) Using nearby assets for structure materials to eliminate transportation carbon vitality.
- j) Home's power must meet a necessity of volts for each meter. Engineered and ferro attractive materials ought not be over utilized as they make electrostatic charges (Sergi, 2011).

## **2.2 CLIMATIC CHANGE AND THE NEED FOR BIOCLMATIC DESIGN**

Taking advantage of climate has always been a most important consideration in architecture (Ogunsote,2002). Olotuah lectured that, the fundamental requirement of a pleasant architecture

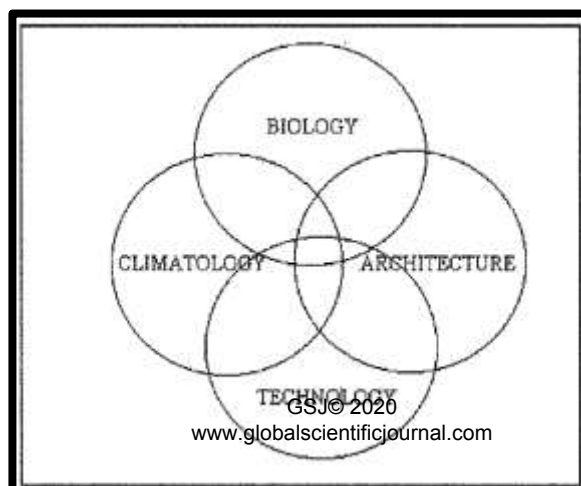
in Nigeria is established by the relationship between climate and building. Vitruvius pointed out the importance of climate in architecture in his book “Ten books of Architecture”. In establishing the relationship between climate and buildings, Olanipekun (2002), identified building as a modifier of the micro climate. Instead, it is perceived to be the physical shell that protects people from hostile climatic elements (Abigbola, 2000). This means buildings should take advantage of the climate and provide comfort conditions for the users without causing impact to the environment.

The connection between these three components is depicted by Vitruvius's tri-partite demonstration (Hawkes, 1996). This is appeared as follows.



**Figure 2.2. Vitruvian Tri-partite Model of Environment.** Source: (Davies, 1999)

This is as a result of failure of architects to keep buildings in order using traditional techniques (Reyner, 1984) there by giving technology a greater influence in building industry devoid of local climatic consideration. This has prompted Olgay in 1960 to propose a development of the Vitruvius demonstration and a technique for accomplishing ecological control by working with atmosphere at the same time considering the influence of technology (Davies, 1999). The model is shown below



### **Figure 2.3. Olgay's development of the Vitruvian Tri-partitemodel.**

Source:(Davies,1999)

#### **2.3.1 BUILDING ORIENTATION**

Introduction firmly relates a structure to the indigenous habitat the sun, the breeze, and climate introduction will have sway on the vitality execution of the structure over its life cycle. The primary destinations in settling on a given introduction in sweltering atmosphere areas are to limit the effect of the sun on the structure in summer (Hernandez, 2011).

#### **2.3.2 BUILDING FORM**

Building structure is one of the parameters of its vitality execution. Concerning detached structure plan, the vitality productivity of the structure can be improved in the beginning period of configuration utilizing suitable structure (Marija2013). This can significantly decrease the vitality interest for cooling the structure amid summer and warming amid winter.

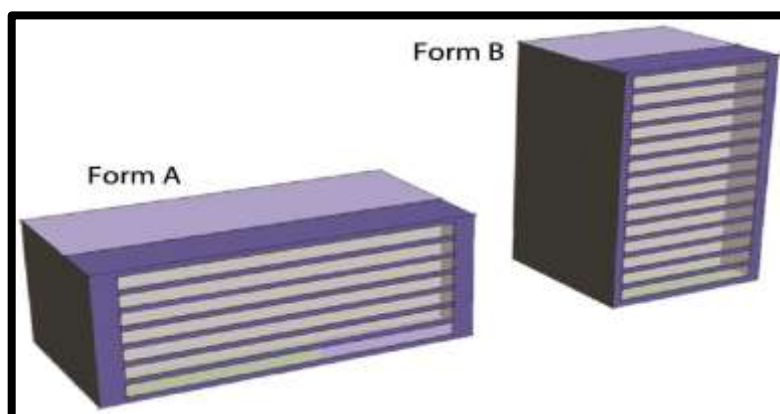
Structures with huge surface territories wanted to conservative structures. This favors ventilation and warmth mission around evening time. The principle objective is there conduction of roundabout warmth gain by radiation through opening sand of interior surface temperature. The structure ought to along these lines be planned with secured openings, yet additionally with ensured dividers. This assignment will be a lot simpler if the structure is kept low. What's more, thereof ought to stretch out a long ways past the line of dividers with expansive overhanging roof and different methods for shading atmosphere responsive structure (SKAT, 1993).

In as and led by Marija (2013) on three unique cases utilizing reenactment examination to show to which degree the structure influences the vitality proficiency of the structure and furthermore decrease of negative ecological impact.

#### **Case 1: Different positions of the same building form**

Rectangular structure with the measurements 60x30x35 mispresented in two unique positions. Structure Ah as a prevailing length ( $l=60m; w=30m; h=35m$ ) and structure Bh as a predominant stature ( $l=35m; w=30m; h=60m$ ). The two structures were seen as remain solitary, with

indistinguishable floor territories, outer coating on one façade and building envelope manufacture. The vitality execution of these structure frames was reenacted. It was discovered that, building structure An utilization less vitality for warming and cooling than B.



**Figure 2.4: Building form A and B models for simulation.**

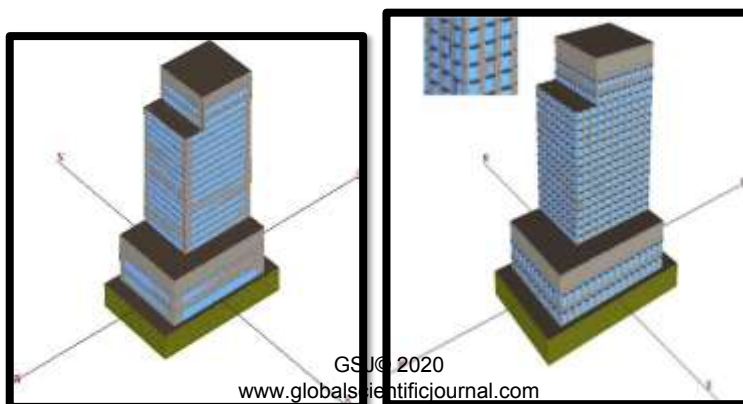
Source: (Futcheretal, 2013)

**Case2: The same building form with additional Elements Attached.**

The recreation of the inn working with rectangular structure (Fig. a) was done so as to contrast the outcomes concerning vitality execution with a similar model with joined overhangs (Fig. b). The proposed structure of the structure, other than the extra components, was improved by protection materials inside the envelope. In this way, the outcomes displayed in

**Table 2:** underneath doesn't mirrors the genuine effect of the structure on accomplishing proficient vitality use. In any case, there is an effect on the structure that can't be ignored.

The overhangs on the proposed model have the job of keeping the immediate sun. It is vital to shade the structure so as to bring down cooling load and improve the indoor warm conditions.



**Figure 2.5(a) Original building form. Figure 2.5(b) Building form with attached balconies-Proposed model.** Source: (Sozer, 2010). Table 2.1: Energy consumption for Original and proposed building design. Source: (Snoozer, 2010)

	Space heating MBTU (Natural gas)	Space cooling MBTU (Electricity)	Total site energy MBTU	Reduction on space heating (%)	Reduction on space cooling (%)	Reduction on total site energy (%)
Original building	8493.8	6881.2	39102.1			
Proposed building	1167.6	2773.6	23430.8	36.25	60	40.1

**Table 2.1 The real impact of the building form.** Source: (Snoozer, 2010)

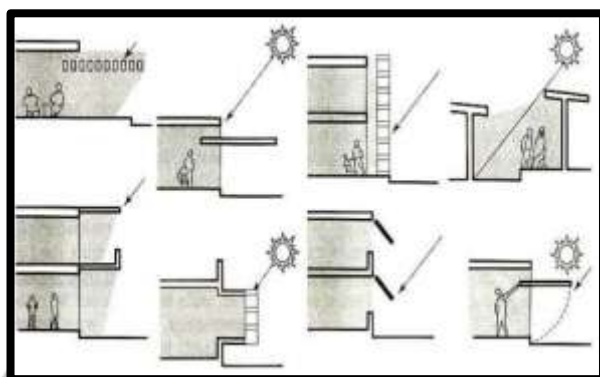
At last, it was understood that the proposed structure lessens vitality utilization by 40% For both warming and cooling as can be found in the table above.

### 2.3.3 OPTIMAL SHADING

Daylight falling on a structure brings up in entryway temperature in various ways running from immediate and backhanded radiation (Ajigbool, 2011). Umoh (2000), features that the sun oriented radiation level in Nigeria is between 110kg-Calin South and 190kg-calin the North. This is caused inside temperature stories above solace go, in this manner including inhabitant's inconvenience. Along these lines, shading of the structure is fundamental. It is the most savvy approach to decrease sun based radiation and cut cooling cost (DOE, 1995). This is accomplished utilizing different techniques. The following are a portion of the standards to be connected in prohibition of sun based radiation in structures:

- Shading.
- Thermal properties of materials.
- Ventilation.
- Forms and introduction (Ajigboola, 2011).

Very much structured sun control and shading gadgets, either as parts of a structure or independently put from a structure veneer, can drastically diminish building top warmth increase and cooling necessities and improve then a lighting nature of structure insides. The structure of successful shading gadgets will rely upon the sun based introduction of a specific structure exterior. For instance, straightforward fixed over hangs are viable at shading south-bound window sin the late spring when sun edges are high(Mohammad,2012).Some of the distinctive shading gadgets are appeared as follows.

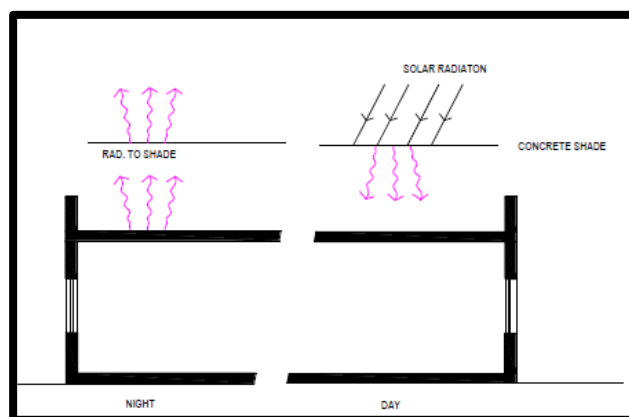


**Figure2.8: Different types of shading devices.** Source: (Mohammad,2012)

Different building elements need to be shaded for efficient protection from solar radiation.

### Shading of roof

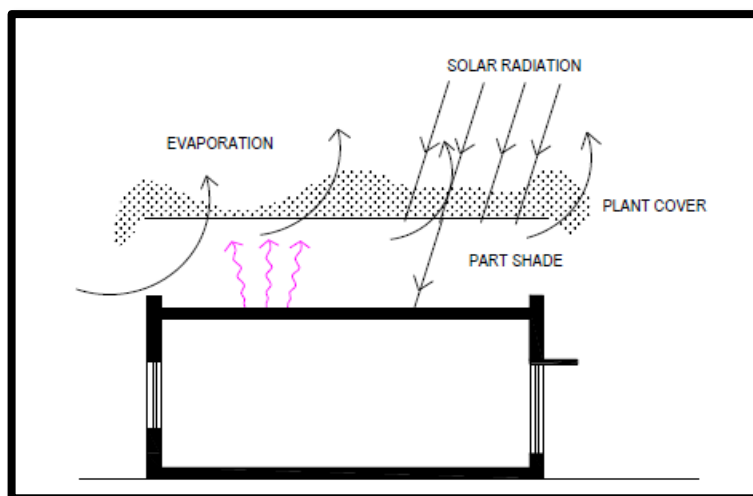
Shading the rooftop is an imperative technique for lessening heat gain. Rooftops can be shaded by giving rooftop front of cement or plants or canvas or earth enpotsetc. Shading given by outer methods ought not meddle with evening time cooling. A spread over the rooftop, made of cement or stirred iron sheets, gives assurance from direct radiation. Burden of this framework is that it doesn't allow getting away of warmth to the sky around evening time





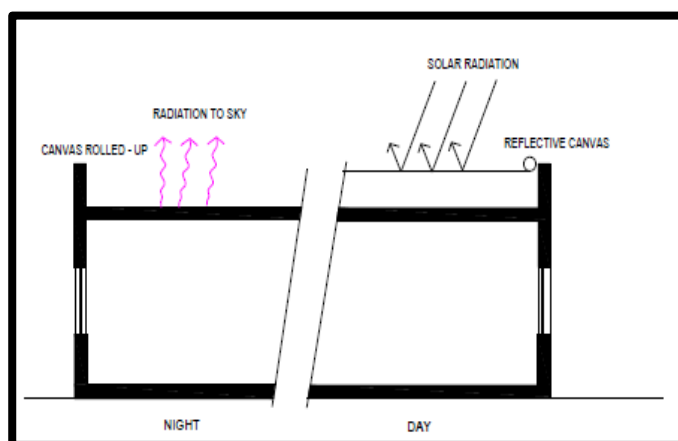
**Figure2.9. Roof shading by solid cover.** Source: (Mohammad,2012)

A front of deciduous plants and creepers is a superior option. Vanishing from the leaf surfaces cuts down the temperature of the rooftop to a dimension than that of the day time air temperature. During the evening, it is even lower than the sky temperature.



**Figure 2.10: Roof shading by plant cover.** Source :( Mohammad, 2012).

Another in costly and powerful gadget is a removable canvas spread mounted near the rooftop. Amid day time it forestalls passage of warmth and its evacuation during the evening, radiative cooling. Fig.2.14 shows the working principle of removable roof shades. Painting of the canvas white limits the radiative and conductive warmth gain (Gupta, 1984).



**Figure 2.11: Removable roof shades.** Source: (Mohammad, 2012)

## 2.4 CONCLUSION

The vertical blended use advancement in this way turns into a crucial piece of urban living space and go about as one of the suitable answers for 'Urban Environmental Management' in Nigeria. Twentieth to sixty stories tall is an ideal stature for structuring a high rise biologically. Modelers like 'Ken Yeang' have inquired about that at these statures, a structure can be intended to be vitality proficient and monetarily practical. The road areas should be reclassified along these lines, as to be appropriate for the urban Indian conditions with more extensive walkways, isolated bike paths, tree ranch, precise stopping, space for merchants and committed paths for open transport like transports and metro. New type of elevated structures is being worked in Nigeria however they should be blended utilize and economical.

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