

Bioclimatism through Vernacular Architecture as a Pass for New Sustainable Structure

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Abstract

Vernacular architecture typifies a majority of constraints from places where it belongs, where the use of local materials and techniques is one of the key features. In comparison to industrially-produced materials, vernacular materials have low ecological effects, being an alternate for sustainable construction. The expanding utilization of new industrially-produced and standardized materials resulted in the homogenization of the several used construction approaches, and spawned a universal architecture that oftentimes has gone out of the environment context and it is very reliant on energy and other resources. Vernacular architecture predicated on bioclimatism concepts was developed and used through the ages by many civilizations around the world. Different civilizations have produced their own architectural styles predicated on the local conditions.

This paper addresses via an analytical study to indicate the relationship between vernacular architecture, locally sourced materials and structure by relating them with bioclimatic zones. To assess the contribution of these materials for sustainability, an evaluation with industrial materials at level of environmental indicators was established. This paper highlights the advantages of using local materials and techniques as a factor of local socio-economic development. Also, indicating different solar passive features that are available in Vernacular architecture, related to temperature control and promoting natural ventilation by using locally available materials in their construction. Through this methodology, this study will introduce a new approach Bioclimatism and Vernacular architecture as a pass for new sustainable structure

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Keywords

Vernacular Architecture; Sustainability; Energy Consumption; Bioclimatic Zones; Bioclimatism

1. Introduction

Since the Stone Age, humans sought to find a shelter. Starting with a cave, they started a very long way of creating, modifying, and developing their shelters, which we later called dwellings. During the continuous seek for luxury and welfare, human started to add appliances and materials that makes his life easier ignoring the surrounding environment. Moreover, he ignored that that kind of architecture that once respected the surrounding environment and climate. (Hanan, 2009).

This kind of architecture what has once represented our historical roots, as without it we will never get future. Vernacular Architecture is the main root that presents the local culture and environment of any country, it is the result of creative interact of human and their nature with all of their aspects avoiding most of its crisis (Ahmadreza,

& Fergus, 2008). By the beginning of the sixties of the last century, it was the Egyptian Architect Hassan Fathy, who initiated the importance of such architecture, known after that by the vernacular architecture, and that he was the first to outline the need of environmental architecture in Egypt. (Soflaee & Shokouhian, 2005).

However, what is the vernacular architecture? How far could it be related to the climate and the environment around? What distinguishes it? Does it have a theme? If not, what could be similar between it in different countries? Do we have our own vernacular practices with respect to the environments? What are the critical and essential problems faced those architects who are practicing traditional vernacular architecture? What actually stopped us from incorporating the techniques of traditional practices?

Therefore, we will discuss the definitions, components, and materials of every point proving that this is not about going back to traditional systems, without satisfying current needs. It is about regarding site and climate considerations along with considerations of techniques and materials available. Achieving several objectives like clarify design roles and design techniques with respect to energy considerations, representing the basics of merging the bioclimatic concepts, integrating design concepts with natural cooling, ventilation and lighting techniques to contemporary practices, and interpreting the passive effects of natural material used on environmental solutions and its techniques.

2. Aim of research

An Approach to Integrate Vernacular Architectural practice and its structure materials and techniques to contemporary settings". Regarding to this vision, it is a systematic approach towards the integration of bio-climatic design concepts of nativity into modern practices as a solution to the current climatic issues and Energy problems; it also embraces traditional energy efficient building techniques practiced in traditional vernacular architecture of buildings in Arab countries.

3. Scope & limitation

This is not about going back to traditional systems, and it is all about acquiring traditional practices and techniques to modern buildings without satisfying current needs. Our vernacular building construction system practices are starts with site considerations, soil & physical considerations, climate considered, also considers techniques and materials available etc., it is collectively a perfect passive designing system with climatic loads and energy consideration.

Vernacular architecture has been developed and practiced by the people over generations & they are tried and tested practices which sustains over the ravages of time using locally available materials for their building erection which responds climate without disturbing the environment. The bioclimatic design a methodology that exploits advantage of the climate through the correct utilization of design components and building technology for energy saving and also to guarantee agreeable conditions into structures.

4. Research Methodology

This paper addresses via an analytical study to indicate the relationship between vernacular architecture, locally sourced materials and structure by relating them with bioclimatic zones. To evaluate the commitment of these materials for sustainability, an evaluation with industrial materials at level of ecological indicators was built up. It is not about creating a model of vernacular style to understand the energy consideration of traditional system; it is to understand the design techniques and practices of vernacular Arab architecture & its native climate. After understanding the problems of practicing vernacular systems through case studies analyzing vernacular practices with respect to bioclimatic design approach – integrating bioclimatic vernacular practices to modern contemporary design practice.

5. Research Questions & Objectives

- In Arab countries we have a wide range of traditional knowledge and practices with respect to build environments but why it's not been practiced by all the architects?
- What are all the problems faced by architects those who are practicing traditional vernacular practices?
- Advantages of the Architects who are not practicing vernacular traditional techniques and methods?
- What actually stops to incorporate the techniques of traditional practices. . . ? For example: materials, current methods of construction etc.,?

To achieve answers for these questions research objectives are:

- What actually stops to incorporate the techniques of traditional practices. . . ? For example, materials, current methods of construction etc.
- Understanding the bio climatic concepts of Arab region.
- Integrating design concepts of natural cooling, ventilation and lighting techniques to contemporary practices.

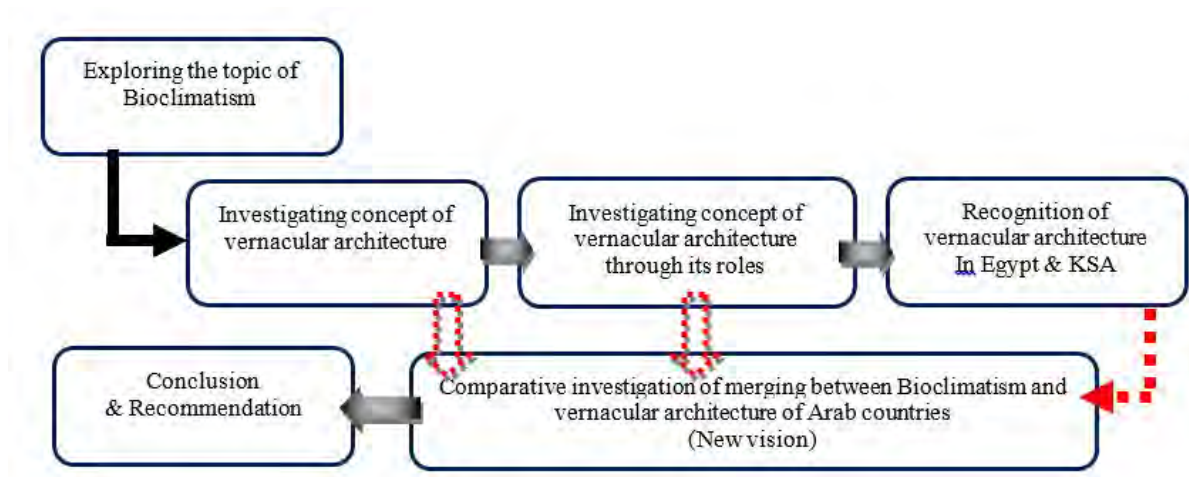


Figure 1. Process of research and analysis by authors

6. Vernacular Architecture

The word vernacular got from 'vernaculus' signifies 'native', subsequently vernacular architecture – local investigation of building. "Vernacular Architecture" is an area of architectural hypothesis that reviews the structures made by experimental manufacturers without the mediation of expert architects. There exist numerous regions of non-proficient structural practice, from crude safe house in inaccessible networks to urban adjustments of building composes that are transported in starting with one nation then onto the next", (Oliver, 1997).

Actually, vernacular architecture has as vast range of definitions as its components itself. Starting with Paul Oliver who expressed it saying, "Vernacular architecture is an area of architectural theory that studies the structures made by empirical builders without the intervention of professional architects. There exist many areas of non-professional architectural practice, from primitive shelter in distant communities to urban adaptations of building types that are imported from one country to another". As well as expressing it as the common dwellings and other native buildings of the people that are directly connected to environmental factors, traditional technologies with its available resources meeting their needs, regarding the values, economies, and the main cultures the created them, (Oliver, 1997).

Shuzo Murakami and Toshiharu Ikaga referred to it as the traditional buildings that have been designed and built to satisfy the local climate and culture, (Zhiqiang & Jonathan, 2008). Moreover, Bruce Allsopp defined it stating that it is well known outline approach that is taken from open design and can be considered as the propelled type of normal engineering of a given domain which is communicated in connection to atmosphere, culture and building materials, (Leila & Mohammad, 2016). Another definition mentioned in the same paper shows how it is related to the nature and people stating “the architecture in which harmony with nature, respect for other people and their houses, so the respect for the entire environment, whether it is man-made or natural environments are seen” (Leila & Mohammad, 2016). On the other hand, Dilan M. Rostam interpreted a nearly similar definition expressing in it the vernacular architecture as a building process created to develop a response to human’s basic necessities of life and communities as well reflecting many factors like the environmental, cultural, economic, and technical evolution (Leila & Mohammad, 2016).

Therefore, especially after knowing that the word vernacular derived from ‘vernaculus’ which means ‘native’, hence, vernacular architecture – native science of building, we can deduct a comprehensive definition that defines the vernacular architecture as “the process of creating a structure that is totally reconnected to the environment, respecting its nature as well as the climatic changes depending on locally created materials gathered from the surrounding nature”. That is approximately similar to bioclimatic architecture definition.

7. Sustainability and Sustainable Architecture:

Sustainability in architecture is known as means of conserving constructions for the future. (Soflaee & Shokouhian, 2005). As it is known, “sustainability” as a term defined by the World Commission on Environment and Development in the United Nations for the first time. It was defined then as “meeting the needs of the present generation without distorting the ability of future generations to meet their own needs.” Moreover, by comparing between different definitions in different dictionaries we will find out that its meanings vary but they all are related to lasting, durability, protection, keeping alive, permanent continue, and making life longer (Leila & Mohammad, 2016).

When dealing with the fields of urban life sustainability always have three main fields, from which it put certain criteria that ensure the continuity of the existing resources, or even lengthen the time of their existence, to guaranty the next generations’ rights. These branches are three: social, economic, and environmental sustainability. (Figure 2)

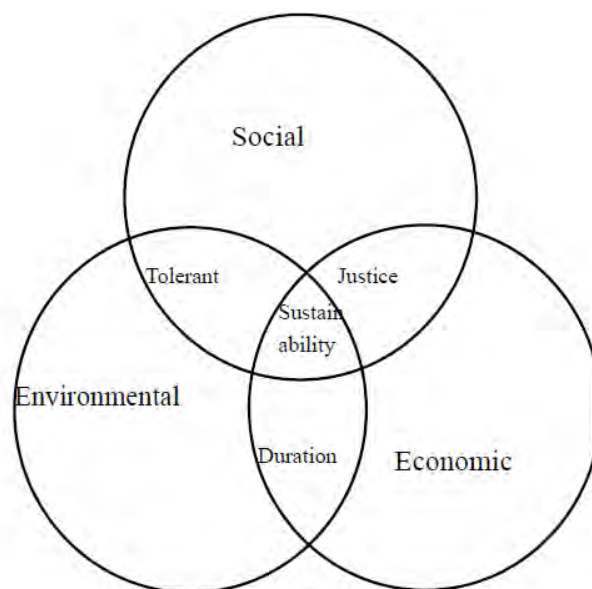


Figure 2. Graph of sustainability branches Source: The issue of “The Concept of Sustainability in Contemporary Architecture and Its Significant Relationship with Vernacular Architecture of Iran” p 134

The appearance of this term and its indicators changed the architects' points of view in the previous two decades to create techniques and standards towards it creating new techniques that are known as sustainable design, green architecture and sustainable architecture. Therefore, sustainable architecture here will be defined, as "designed structure that satisfies its users' needs from a social, environmental, and economic point of view regarding the needs of the next generations."

8. Bioclimatism (Definition & Explanation):

A movement of Climate responsive vernacular Architecture

- The term Bio climatic was first used by Victor Olgyay in 1963, Architect, Norway.
- The Architecture of vast Era's & practices of our native scholars who designed their own homes by understanding the native climate and using the locally available materials to reflect the culture and heritage of their own.
- The process of being reconnected to the environment during the design of buildings are called bioclimatic architecture.
- Climatic responsive building from the vernacular architecture is a perfect ideology of understanding climate and natural components of earth to provide a comfortable indoor environment to the users.
- It's very important to practice our vernacular techniques and systems to achieve maximum comfortable indoor environments with less energy sources.

Weather the Eco-system is proper now?

- The eco system is completely disturbed and totally unbalanced at present.
- Due to which Issues such as climatic changes, environmental issues, pollution, Resource depletion, Genetic engineering, toxic and non-degradable wastes etc.
- Due to the improper practice of earth systems

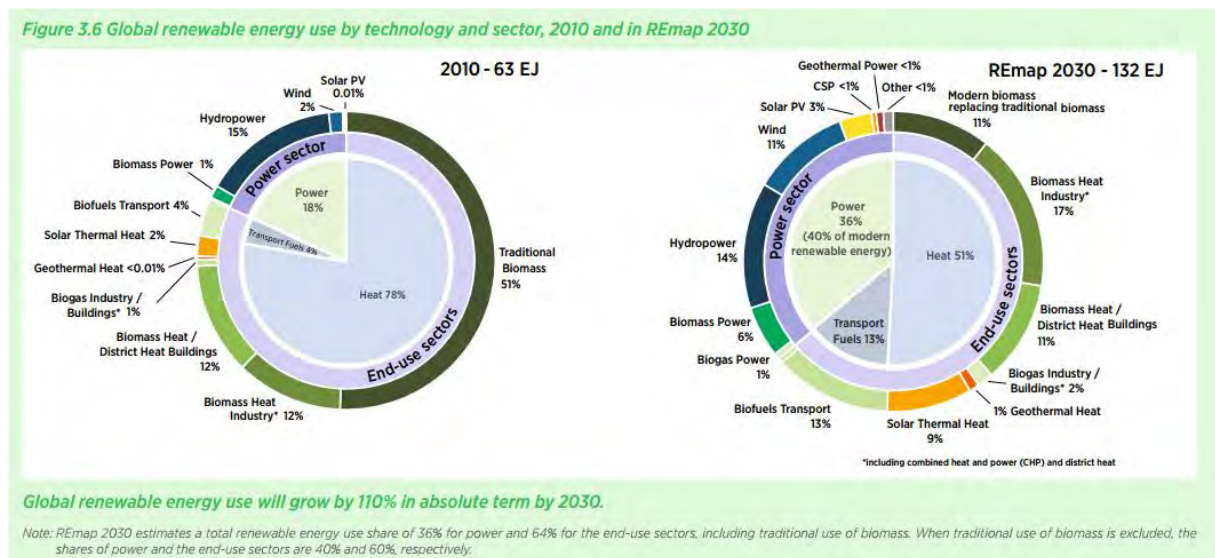


Figure 3. Global renewable energy used by technology & sector, 2010& in Remap 2030

9. Applications of Bioclimatism Through Vernacular Architecture (Case Studies)

Through the history of vernacular architecture till nowadays, while searching & studying Bioclimatism roles it seems that it was applicable through their designs, structure, material and even environmental solutions. The analytical study will be in Arab countries (Egypt, Saudi Arabia), where the climate region is arid zone. In these analytical study these roles will be explained as follows:

10. The Nubian Vernacular Architecture

The Nubian vernacular architecture used the site, suitable terrain, colors, patterns, materials, window placement, spatial arrangement, and sunlight very well. Starting with the site, the Nubian vernacular architecture made the best use of the place as they built their buildings within mountains.

Since concrete structures demonstrated over the time that they're vitality and warmth customers of 100%. What's more, they demonstrated their perseverance in flimsy conditions. In light of the structure massing of antiquated structures, Hassan Fathy consolidated thick block dividers and customary yard frames additionally the roof to be framed in an arch shape to deliver aloof cooling without the need of an A.C. and ensuring a most extreme space, comfort capacity:

- At a minimal cost by using local materials & innovative building techniques.
- Without using the heavy & expensive machinations of steel & concrete.

Nubians designed a unique models and building types of their own dependent on the arches ascending to help on the abuse of air streams in the easing of high temperatures without the requirement for cooling, in this way diminishing heaps of electrical surplus and lessen ozone depleting substances, as the shape, and they additionally planted numerous trees high-and medium-length side of the lake to help likewise in smooth air. They also keep construction craft through the Egyptian Nubian vault over the centuries that has become a feature of their culture. them Some architects like Hassan Fathy and Ramses Wissa Wassef inspired this technique at the beginning of the twentieth century. Nubians has been different buildings than what the architects presented in the twentieth century. By entering a home made out of neighborhood regular assets with vault molded roofs and no electrical cooling, to locate a sudden plummet of peace and quiet inside a cool environment. Conventional lights, mashrabeya screens, arches and hued glass let in silvers of light through. Components from vernacular Arab urban design, for example, the malkaf (wind get), shukshaykha (light arch) and mashrabiya (wooden grid screen), could be joined with the mud-block construction.

Table 1. Case study 1

Nubian Vernacular Architecture - Egypt		
Urban Pattern	Figure 4 Specific design and developed building technique of ancient Nubian house architecture	
Space Design	Figure 5 Keep the same old way in construction building of Nubian 's house.	Figure 6 Dom in Nubian 's style house for cooling
Environmental design elements	Figure 7	

Continued on next page

Table 1 continued

Structure systems, materials, and techniques	<p>Figure 8</p> <ul style="list-style-type: none">- "Matchbox houses" were excessively sweltering in the late spring and excessively chilly in winter.- Nubian craftsmen were aces at building domed and vaulted tops of mud block which they additionally utilized for the walls.
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Figure 4.



Figure 5.

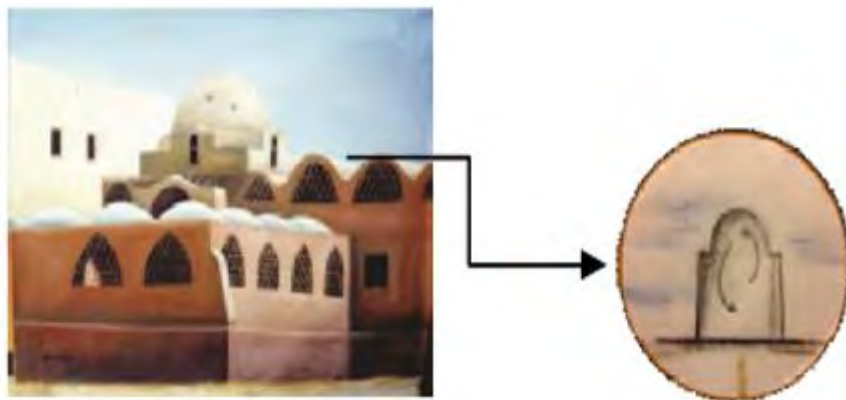


Figure 6.

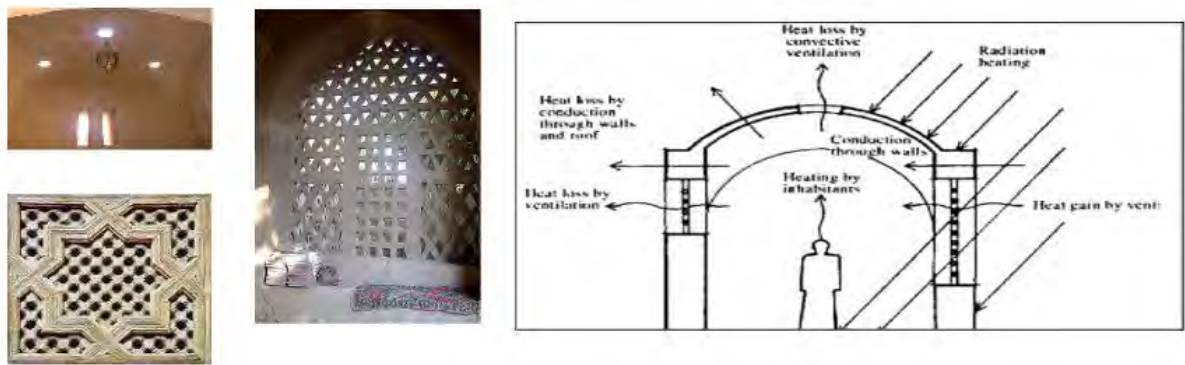


Figure 7.

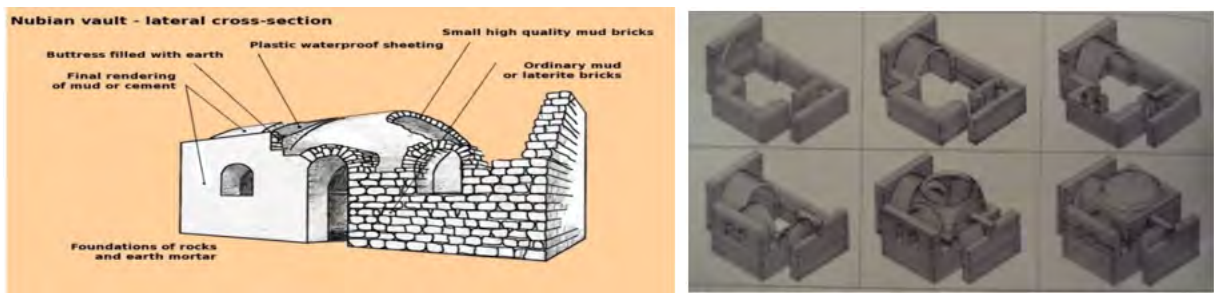


Figure 8.

11. Bait Nassif, Jeddah- Saudi Arabia

Moving on to the next case study in Saudi Arabia, Jeddah city to be more specific, the second case study differs from the first one from several points of view. It lies in the Saudi Arabian red sea city Jeddah, latitude. Moreover, this case study is not meant to study the effect of the architectural design on nature the same way as the first one. It was made to study the applied sustainable criteria, bioclimatic architectural methods, and vernacular architectural thought and their effect on both energy and water consumption. In the previous case study, results and information were noted by observations and documentation; on the other hand, she used advanced technologies to do so with this case study like simulator program called Energy Plus, which provide us with results that are more realistic if the entries were true and realistic.

The significance of the Nassif house comes predominantly from its initial hopeful and creative endeavor to restore Jeddah’s lost legacy when it was attacked by the cutting edge office squares and shopping centers which required the obliteration of huge numbers of its notable structures. The house was planned by the prestigious Egyptian engineer Hassan Fathy, who thought about the house as a chance to reinterpret the conventional design of Saudi Arabia. The proprietor, Dr Abd Al-Rahman Nassif, was among the few to start the recovery of their own Arabic-Islamic legacy in engineering in Jeddah. Nassif was brought up in the notable Beit (home) Nassif, a customary house in Jeddah, which later turned into a gallery. In any case, Nassif’s experience driven him to decide to make an Arab-style house, yet one proper to the twentieth century.

Nasseef house has 106 rooms and the work of art portion of the rooms contain is excellent. Other than chips away at wood, others on tiles can be viewed and in addition Arabic calligraphy. The plan style is said to be Ottoman Turkish. This fairly depicts increasingly the period amid which it was worked than relationship to outlines prevalent in the Umayyad and Abbasids social focuses as of now, for example, Baghdad, Cordoba and Damascus. The style is believed to be more identified with expressive components found along the Red Sea, Egypt and perhaps the Levant around then.

The material used in the construction of the gravel and limestone prospector as a basic, and the limestone prospect

is the coral limestone they answer from the shore of the Red Sea, a fragile sandstone that keeps the house from cold and heat and absorbs moisture and uses the whiteness of limestone so as to prevent the erosion of limestone Due to moisture year length.

They used the roof and the Roachin a large part of wood taken from an English ship sank in the sea bought by Omar Effendi and the rest of the wood imported from India and Indonesia, and the most important vocabulary of the wonderful architecture they worked in the house of decorations and inscriptions in the openings of windows and rugs and doorfronts.

Rawashin is the wooden part that rises above the windows and external openings, and wood is the main element in the design of Rawashin.

The house of Nassif is 900 square meters and has 40 rooms. The first floor is reserved for guests and the second is for sleeping rooms for the guests. The third floor is for the people of the house. The fourth floor is made of openings known as "air pickers" to smooth the atmosphere for the family in summer. The method of building the stairs is low, making it easy to roll out the four roles quickly and easily.

Overall Understanding:

- Mud brick - Low heat radiation, low cost, availability
- Thick wall - high insulation
- Small windows not facing the sun
- Wind catcher - Air circulation, a pressure gradient used to get away with the hot air
- Qanat - Used with windcatcher to cool the interior air by deep cut canal in the floor filled with water
- Screens - Restrict glare of light
- No use of R.C.C. and steel for high heat radiation
- Courtyard with partial greenery to screen dust and sand in the prevailing wind

Table 2. Case study 2

Bait Nassif, Jeddah- Saudi Arabia	
Urban Pattern	Figure 9 old Islamic city pattern with narrow not straight roads
Space Design	Figure 10
Environmental design elements	Figure 11
Structure systems, materials, and techniques	Figure 12

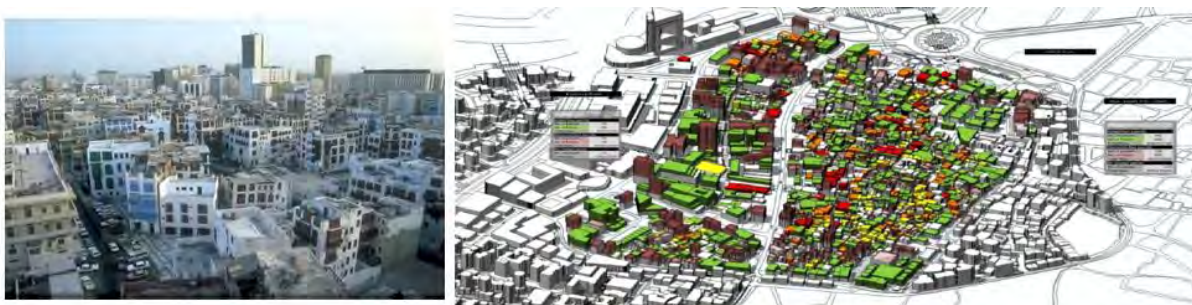


Figure 9.

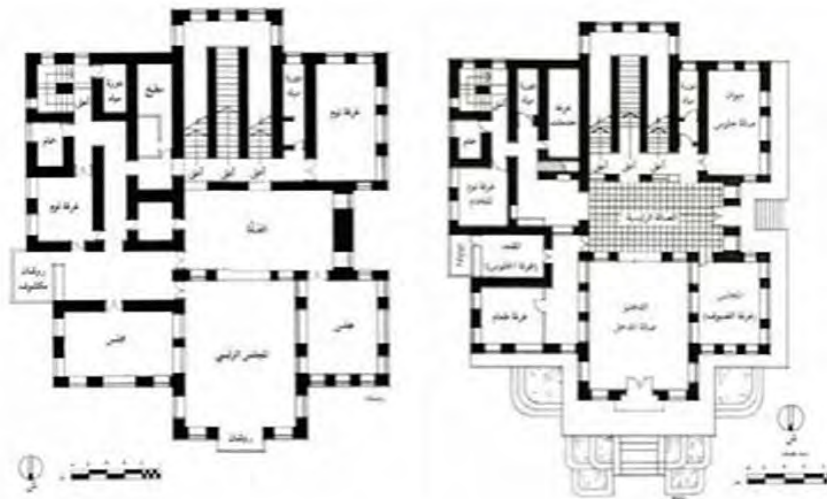


Figure 10.

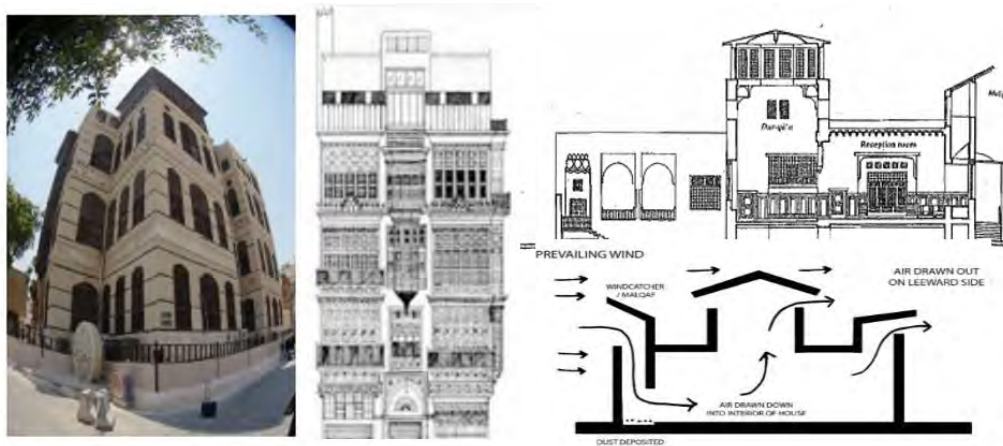


Figure 11.



Figure 12.

Table 3. Vernacular as solution to contemporary Architecture through Bioclimatism

Bioclimatism Through Vernacular Architectural A Pass to Sustainable Structure			
Vernacular as solution to contemporary Architecture			
No.	New suggested Ideas	Samples	
1	The Idea of Passive Design	Figure 13	
2	The Idea of Materials & Techniques Effect	Local and Regional Materials Only Local Materials Were Used in Construction Depending on The Location	Figure 14
		Recycled Materials -Most Traditional Rural ARCHITECTURE - Was Made Entirely Out OF Recycled Materials,	Figure 15
3	The Idea OF Root Zone & Carbon Minimization	Figure 16	
4	The Idea of Daylight 100%	Figure 17	
5	The Idea of Conservation of Buildings and Recycling of Materials	Figure 18	
6	The Idea OF Zero Waste	Figure 19	

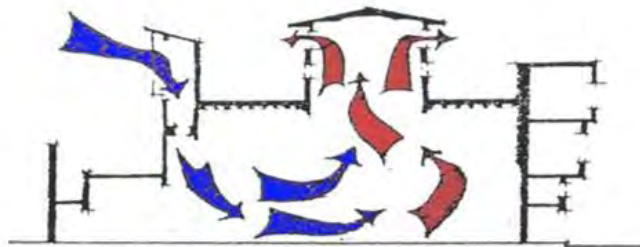
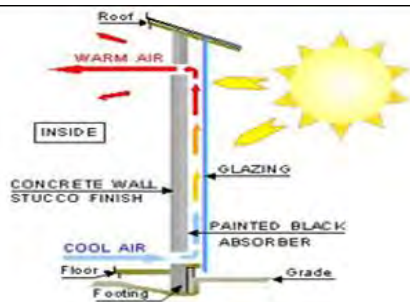


Figure 13.



Figure 14.



Figure 15.



Figure 16.



Figure 17.

Masdar Initiative Description		Masdar City Master Plan
<p>Masdar City will pioneer the sustainable green building practices with the aim of achieving zero-carbon emissions, zero waste and being powered entirely by renewable energy sources</p>		
<p>Renewable Energy</p>	<ul style="list-style-type: none"> 100% Renewable energy – balance between demand and supply only 240 mw 	
<p>Building Design</p>	<ul style="list-style-type: none"> Building design will ensure the latest use of energy efficient technologies and smart design 	
<p>Innovative Transportation System</p>	<ul style="list-style-type: none"> The City will contain pioneering public transportation systems with no fossil fuel usage 	
<p>Recycling / Waste to Energy</p>	<ul style="list-style-type: none"> The City will strive towards a zero waste objective 	
<p>Cleantech Cluster</p>	<ul style="list-style-type: none"> Masdar City is focused around R & D and attracting cleantech companies to build, operate and live in Masdar City 	<p>Masdar City Profile</p> <ul style="list-style-type: none"> Location: Abu Dhabi Built Area: 6 million m² Population: 90,000 residents, 50,000 commuters, 40,000 Density: 135 people / ha

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Figure 18.



Figure 19.

12. Results

From the previously mentioned, vernacular architecture is not old or separate type of architecture that has gone. On the contrary, it is one of the kinds of architecture that are flexible and can be modified to fit in any time's style and criteria as well as being the closest design method to the sustainable design method.

Shuzo MURAKAMI and Toshiharu IKAGA stated that “vernacular housing to be either equal to or superior to modern housing in terms of environmental efficiency when both environmental load and environmental quality are taken into account” according to results that he had using CASBEE tool. Hence, he put three steps that help to change the building from vernacular towards sustainable housing with an even higher environmental efficiency which are, the use of energy for machines, the deployment of appliances and fixtures featuring high-energy efficiency, and the creation of a sustainable society. The environmental design elements incorporated into all of the examples of the vernacular housing shown here provide valuable hints for achieving this end (Shuzo, M.I. & Toshiharu, Y.I., 2008).

Therefore, vernacular architecture with its way dealing with the climate whether it is hot or cold makes it the bioclimatic architecture.

Here are some other lessons from the vernacular architecture need to be considered when we design a sustainable bioclimatic architecture:

- Participatory paradigm
- Density and sense of place
- Local materials and regional flare
- Energy conservation and ecology

Eventually, the three points classifications interpreting the vernacular architecture:

Architectural and urban properties of the building:

- Urban scale
- Structure of neighborhood spaces
- Spatial urban and local relationships
- Orientation of buildings
- Building form

Applying passive systems by using architectural elements:

- Natural ventilation and physical solutions through creating natural ventilation
- Natural ventilation elements used in building a shell
- Combination of two components incorporating louver and cross section in the building inside and wind circulation
- Green surfaces
- Courtyard
- Openings
- Building shading

Materials and structures:

- Specifications
- Thickness of walls
- Using local materials
- The permeability of underground water Structure Techniques
- Benefits of Alternate Building Materials:
- The interest for building materials has been ceaselessly ascending with the expanding requirement for lodging both in provincial and urban territories.
- The assets used to produce development materials influence the environment by draining common assets, utilizing vitality, and discharging pollutants to the land, water.
- Commercial misuse of customary building materials by different industries have irritated the circumstance. It has, along these lines, end up fundamental to thoroughly consider this issue truly and to give some reasonable solution to make the elective materials accessible to illuminate the lodging problem.
- Advantages of Conventional Materials:
(Better practical productivity - Cost viability - Better sturdiness - Ease of development - Better complete - Minimum waste - Less support cost - Minimum imperfections - Less vitality concentrated)

Table 4. Conventional Materials

Conventional Materials			
Material	Shape	Description	Advantages
Hollow Concrete Block (as brick)	Figure 20	a concrete masonry unit (CMU).	-Low Maintenance -Load Bearing -Fire Resistant -Provide therma , sound insulation Economical. -Environment Friendly
Fly Ash Bricks	Figure 21	made of fly ash, lime, gypsum and sand	-Saves Construction Cost -Less Water Seepage and Dampness in wall -Less Energy Consumption -Reduction in Air Pollution -:

Continued on next page

Table 4 continued

Rice Husk Ash	Figure 22	containing reactive silica and/or alumina	<ul style="list-style-type: none"> -Increased compressive and flexural strengths. -Reduced permeability. -Increased resistance to chemical attack. -Increased durability. -Reduced effects of alkali-silica reactivity. -Reduced shrinkage -Enhanced workability of concrete. -Reduced heat gain through the walls -Reduced amount of super plasticizer -Reduced potential for efflorescence
Ferrocement	Figure 23	a mixture of Portland Cement and sand reinforced with layers of woven or expanded steel mesh and closely spaced small-diameter steel rods rebar.	<ul style="list-style-type: none"> -Low construction material cost -: -Ease of fairing during construction -Low ongoing maintenance -Intrinsically safer in the event of grounding -Long operational life
Tire Veneer (as flooring material)	Figure 24	Rubber tires play an essential role in modern life.	<ul style="list-style-type: none"> -environmentally responsive ground surface material flexible both inside and outside. -used in territories, for example, sports and entertainment, creature lodging and high movement regions outside. -variety of buyer items

Continued on next page

Table 4 continued

Plastic Wood	Figure 25	high-density polyethylene (HDPE),	<ul style="list-style-type: none"> -100% resistant to rot. -Impervious to breaking and part -environmentally amicable -requires less upkeep. -Waste plastic and wood is utilized for assembling. -all woods may check, split, container, criminal, contort, and twist, and climate after some time to a grayish shading
Synthetic Fiber	Figure 26	Fiber-reinforced concrete (FRC)	<ul style="list-style-type: none"> -Improve blend union -Improve solidify defrost obstruction. -Improve protection from touchy palling in the event of a serious fire. -Improve affect obstruction. -Increase protection from plastic shrinkage amid restoring. -Improve auxiliary quality and diminish split widths. -Reduce steel fortification necessities. -Improve malleability. Improve ductility

Continued on next page

Table 4 continued

<p>Fly Ash</p>	<p>Figure 27</p>	<p>a byproduct from burning pulverized coal in electric power generating plants</p>	<ul style="list-style-type: none"> -saves Construction Cost. -reduction in Air Pollution. -good Compaction. -high scope of OMC. -high inward edge of grinding. -free depleting (less interference because of rain). -no huge knots to be broken (simple to spread). -light in weight (can be utilized on frail sub-grades).
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Figure 20.



Figure 21.



Figure 22.



Figure 23.

13. Recommendations

After what has been presented, it is now known the importance of the vernacular architecture as a wide step into the climatic sustainable criteria path, but the path is yet to finish. We, as architects, should work harder in the field of research in order to cover the gap the existed between the modern architecture and the sustainable vernacular architecture.

More researches should be done to help spreading the awareness among people, architects, investors, and stockholders to confirm the importance of the vernacular architecture, its dimensions, methods, solutions to the problems it faced during the time, and the most important thing of all, the simplicity of having it integrated with the new architectural designs.



Figure 24.



Figure 25.



Figure 26.



Figure 27.

Moreover, the climatic architecture criteria, it should have its own papers studying in detail its components, methodologies, propositions, and thoughts. Along with the methodology of integrating it with the advanced technologies like simulation programs to have the best results and the best design methodologies.

14. Conclusion

Having major crisis happening in nowadays like greenhouse gas substance outflows that add to global warming and acid rain (Zhiqiang, Jonathan ,2008) demanded alternative solutions. Architects sights directly pointed towards sustainability. In studying its rapid expansion since the first release of the term till nowadays, they realized its importance. During the digging into its principles, they found that most of its principles achieved in the vernacular architecture.

On realizing the importance of the principles, vernacular architecture kept proven its importance as a sustainable climatic architecture. It took care of the smallest details. It knew the essentiality of materials for construction and its significant environmental impacts, (Fernandes, Mateus, & Bragança, 2014).

Through it, the urban morphology in hot arid regions dealt with very well. Therefore, researches have been done to study these methods and techniques in dealing with nature and the surrounding environment. After comparing between some of these researches and papers, it became clear that the vernacular architecture is the clearest way to have climatic sustainable architecture achieving the greatest fit through nowadays-modern design techniques.

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Table 5.

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Table 6.

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