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Traditional Environmental Treatments in Arab Architecture: As a Guide to Contemporary Architecture

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ABSTRACT

The Arab Region embraces a diverse and substantial architectural heritage, with distinctive vocabularies and treatments, that has been as a source of inspiration for architects. However, the contemporary Arab architectural production is not at the desired level. So, the study questions the reasons for the success of Traditional Architecture in providing environmental Comfort and achieving human requirements. Besides, the study explores literature reviews of contemporary trends of studies that are concerned with employing the foundations and principles of Traditional Architecture. Therefore, this study firstly, presents a theoretical background of environmental comfort then extracts the foundations and standards of Traditional Architecture in the Arab Region, with the aim of deducing a Conceptual Framework of Traditional Architecture as a guide to Contemporary Architecture and finally a literature review of recent trends in environmental architectural studies based on traditional strategies. The results of this part show that the studies are divided into three approaches: 1) Philosophical studies that attempt to analyze Traditional Architecture to reach success criteria for traditional architecture. 2) Innovative strategies dealing with modern proposals to achieve environmental comfort based on the principles of sustainable traditional architecture. 3) Studies that focus on analyzing and developing one of the elements that distinguish Traditional Architecture. As a final point, the study presents a Systematic Framework to employ all the standards of traditional architecture and exploiting all the results of contemporary studies to serve as a guide for Contemporary Architecture.

Keywords: Environmental Comfort; Thermal Comfort; Traditional Architecture; Contemporary Architecture; Arab Region.

1. INTRODUCTION

Traditional Architecture in the Arab Region, with its distinct vocabularies and treatments, has been a source of inspiration for architects throughout the ages [1, 2]. It is also characterized by controlling climatic and environmental factors taking into account the economic and social aspects [3, 4]. Traditional Architecture has also succeeded in highlighting the very special identity of the Arab region [5, 6, 7]. For instance, the distinction of traditional Islamic architecture is evident in the design of housing, markets, and mosques on Al-Muizz Street in Fatimid Cairo, which is considered as an open-air museum for the treasures of Islamic architecture. In the late 1990s, UNESCO acknowledged that Al-Muizz and its surroundings were designated a protected World Heritage Site by Islamic Cairo as having a noteworthy historical and cultural significance [8, 9]. It is worth mentioning, the architectural identity is embodied in the formation of buildings, spaces and the social life that they create [10, 11]. Christian Schulz also defined architectural identity as the integration of character and architectural form with the surrounding environment. Also, Charles Correa discussed some aspects that he considered a source of identity, including climate, which is an important determinant of identity [12, 13]. Moreover, between identity and sustainability, there is a relationship of interaction and integration. Sustainability, in its broadest sense, is an integral part of any society's physical and spiritual heritage [12]. Also, the architectural identity, and its relationships with the site, climate conditions, environment, and local material, encloses the meaning of sustainability, so we can say that identity is the main essence of sustainability [14]. Therefore, it can be said that the Arab architectural identity is the product of the integration of all cultural, social and environmental factors to create a distinctive and sustainable architectural and urban environment.

Especially, environmental treatments of Traditional Architecture represented the Arab identity in dealing with environmental and climatic conditions in the Arab Regions. The fact that is no longer true in the present time where global treatments and technologies are copied in form without relevance to the identity or the challenges in the Arab world. Consequently, the study questions the reasons of success of Traditional Architecture in providing Thermal Comfort and achieving human requirements through the use of available and affordable materials in the surrounding environment. Besides, the study explores literature reviews of contemporary trends of studies that are concerned with employing the foundations and principles of Traditional Architecture, in order to provide a methodological framework for

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architects and decision-makers. This framework provides guidelines for implementing architectural and urban treatments in Traditional Architecture, taking into consideration contemporary trends and modern technologies to reach a contemporary architectural product that achieves sustainability requirements while preserving the identity.

2. RESEARCH METHODOLOGY

This study is based on a qualitative methodology which focuses on analyzing traditional environmental treatments in the Arab region, whether at the level of urban planning and design or at the building level, with its various elements as well as literature reviews of contemporary trends of studies that are concerned with employing the foundations and principles of Traditional Architecture in order to reach the extent of success of these treatments to support Contemporary Architecture in the Arab region. The methodology of the study is organized into three parts, see figure 1. The first part introduces a theoretical background of Environmental Comfort. The second part is an analytical study of environmental treatments in Traditional Architecture. The third part deals with an extrapolation of a literature review of contemporary trends to achieve Environmental Comfort. Finally, the study proposes a Systematic Framework to employ all the standards for Traditional Architecture and exploiting all the results of contemporary studies to serve as a guide for Contemporary Architecture, while preserving the identity.

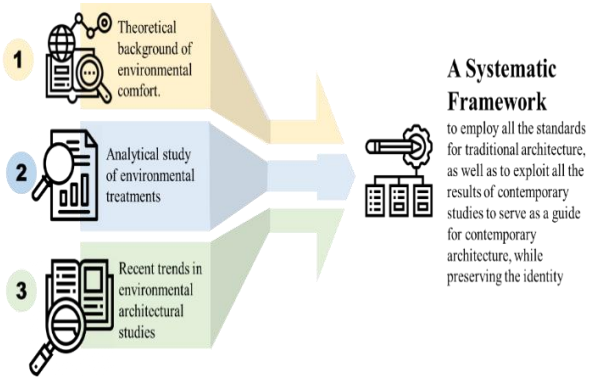

Figure 1: Research Methodology

3. ENVIRONMENTAL COMFORT

Achieving Environmental Comfort for building users helps to rationalize energy consumption for air conditioning and ventilation in addition to downsizing the consumption of non-renewable resources. Environmental Comfort is represented by thermal, acoustic, and visual comfort [15]. The strategies for achieving Environmental Comfort vary exemplified by passive design, orientation, and selection of materials appropriate to the climate of each region [16]. The following is a definition of the elements of Environmental Comfort [17].

Acoustic comfort: Although acoustic comfort is an important component of Environmental Comfort, studies have not focused on it as Thermal Comfort. Additionally, literature does not clearly define acoustic comfort yet it is referred to as “reducing noise in a specific area.’[18] Rindel [19] defines acoustic comfort as "the absence of unwanted sound and the conduct of acoustic activities without disturbing others**.** As for **visual comfort**, the European Standard EN 12665 defines visual comfort as "a subjective state of visual well-being caused by the visual environment."[20]. Moreover, visual comfort is to provide adequate lighting without glare or straining the eyes, and the Traditional Architecture has succeeded in achieving this equation, as will be shown throughout the study [21].

Thermal Comfort: Human Thermal Comfort can be defined as “a state of mind that expresses satisfaction with the thermal climate, so that neither warmer nor cooler environments are preferred by the person.” Comfort may also be described as “the optimum thermal state in which the thermal equilibrium of the human body needs the least extra effort to sustain it” [22, 23]. Human comfort is influenced by different environmental factors (air temperature, surrounding surface temperatures, air humidity and air velocity) and psychosocial factors (clothing, habits, age and sex) [24]. ASHRAEE [25] has adopted the Thermal Comfort index, which can be measured using the relative humidity and internal temperature values. The bioclimatic diagrams display the comfort parameter values that combine to assess Thermal Comfort and include an ambient air temperature between 18 and 26 1C, a mean radiant temperature between 18 and 26 1C on building surfaces, an air velocity between 0 and 2 m/s, and relative humidity between 40 % and 65 % [26]. Consequently, architectural techniques are applied to achieve Thermal Comfort outside the comfort zone while no thermal adjustments should be done by architecture within the comfort zone [27].

In order to achieve Thermal Comfort and energy efficiency of a building, there are various active and passive strategies. Active strategies are a group of ideas that depend on mechanical control and usually consist of heating and cooling systems, while passive strategies are a collection of ideas that are based on natural treatments, including building orientation, continuous insulation, windows and day lighting, and designing a building to take advantage of opportunities for natural ventilation [28]. Traditional Architecture has succeeded in achieving Thermal Comfort by using passive design techniques, the fact that is clearly illuminated in the study**.**

4. TRADITIONAL ARCHITECTURE

Kennedy [29] defines Traditional Architecture as a style of architecture that evolves from a specific climate and social conditions of a place. Paul Oliver confirms, in his book “Encyclopedia of Vernacular Architecture”, on the interrelation between Traditional Architecture and the society by saying that “It is particular characteristics of Traditional Architecture that each tradition is intimately related to social and economic imperatives; it has developed to meet specific needs within each cultural milieu."[30]. The Arabic architect Rasem Badran mentioned that Architecture is interested in culture, society, economics, and the surrounding environment and in order to define a place's special characteristics, the interaction of all these aspects is essential [31].

Traditional Architecture in the Arab World has great potential as a source of inspiration for Contemporary Architecture. Derek [32] states that "Traditional

Architecture offers timeless precedents from which Contemporary Architecture could well draw inspiration. It is significant that in the sphere of sustainability, Arab World countries have revisited traditional typologies to reveal identity to Contemporary Architecture ".

5. ENVIRONMENTAL COMFORT IN THE TRADITIONAL ARCHITECTURE IN THE ARAB WORLD

Traditional Architecture in the Arab World provides a wealth of environmental treatments that can be applied today to address the crucial architectural situation and the problems of lack of materials and energies facing millions in the Third World. In Traditional Architecture in the Arab, the principles of thermal control were manifested through the proper use of; 1) the compact urban fabric, narrow streets, and shaded areas, 2) the central inner courtyard, 3) thick walls and insulating materials, 4) domes, vaults, and curved roofs. Moreover, natural ventilation is considered as one of the most important distinguishing characteristics of Traditional Architecture that relies on passive design strategies. These strategies are represented, but not limited to; 5)moving air between cold and hot courtyards through Takhtabüsh, 6) directing the openings of the buildings towards favorable winds, 7) using the Mashrabiya to provide ventilation and natural lighting while maintaining privacy, 8) controlling wind movement and taking into account the direct and indirect influence of the sun via arcades, 9) attracting cold air via wind towers. Below is a review of these environmental treatments.

5.1. The Compact Urban Fabric

The severe climate that prevails in most regions of the Arab World necessitates that planning fabric and buildings forms shoud be adapted to the surrounding environment. The first step in thinking was urban planning. The basic principles for construction in hot-arid areas were minimum sun-exposure in summer through compactness and shade. Compact planning was required for groups of buildings in order to give each other shade [3]. Urban planning was distinguished in Traditional Architecture by the narrow street and small spaces in between as patio-like areas, as well as cantilevered buildings, all public spaces were designed to be shaded for the longest period of the day [33, 34, 35]. And through the analysis of the urban fabric, it appears that the buildings are connected so that it is difficult to distinguish individual homes. This helps in avoiding the sun rays, reducing temperatures and the thermal load on the buildings envelopes, see figures 2:5.

In Traditional Architecture in the Arab World, the courtyard house is essentially an urban style of dwelling. The courtyard has a major impact on the urban fabric. First, the courtyard is geometrically designed, then the spaces and rooms around the courtyard are arranged, the angles that appear and the irregular parts which are not desired are adjusted by changing the thickness of the walls that may be used as shafts, service areas, niches, cabinets, or fixed furniture. Courtyard houses, clustered together, create a dense urban fabric with a strong distinction between public and private open spaces. Thus, the compact urban fabric helps to reduce temperatures and create a natural airflow [36, 37, 38].

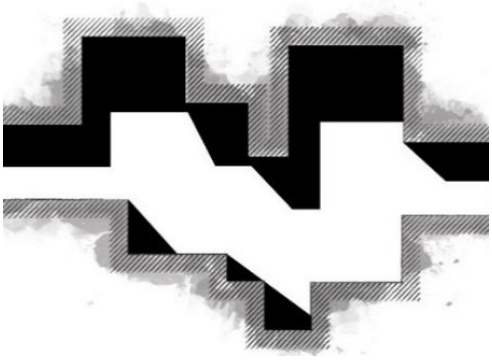

Figure 2: Clusters of buildings give each other shade

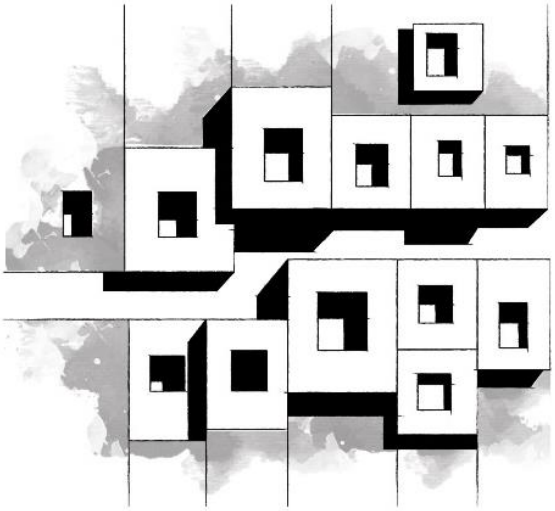

Figure 3: The compact urban fabric
The courtyard has a major impact on the urban fabric

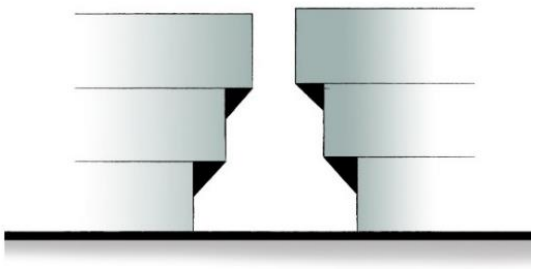

Figure 4: Shaded narrow streets

Figure 5: Cantilever buildings to increase shaded space in the street

5.2. The Central Inner Courtyard

The central inner courtyard represents the most important features of local architecture in the Arab World that achieves the most two important strategies on which this architecture is based; privacy and protection from climatic factors. The central courtyard provides a climatic and social solution as it offers shading and privacy. All rooms of the house are open to the courtyard, which preserves the privacy of the family and provides an open space for the daily activities of women and children.

Homes with a central courtyard are spread throughout the Arab World, also the courtyard has an ancient history in ancient Egyptian and Mesopotamia civilizations. For more information about the inner courtyard it could be referred to [2, 39, 40, 41, 42, 43, 44], see figure 6. Similarly, the courtyard contains water bodies with fountains that move the surface of the water, in order not to act as a reflective surface for sunlight. It also contains plantings that increase the shading of the courtyard floor and the walls overlooking it, besides purifying the air [45].

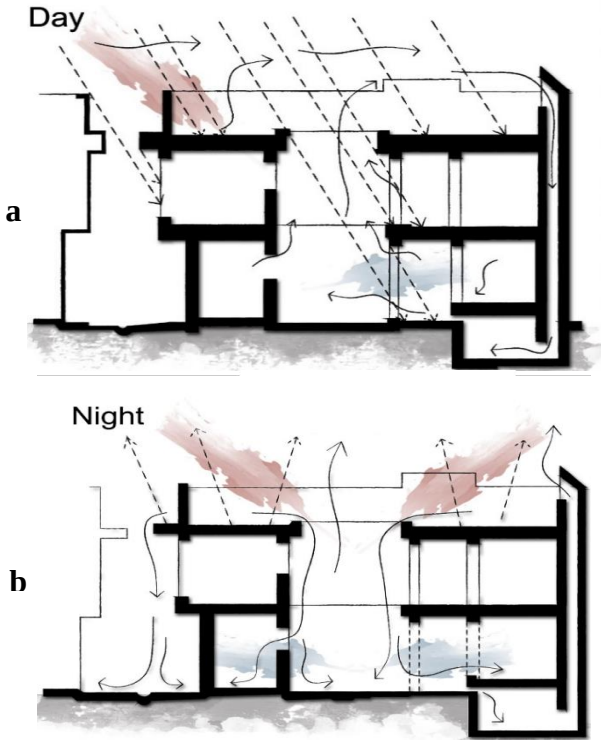

Figure 6: Thermal performance of the courtyard in a Traditional Architecture, a) day-b) night, Source: Adopted from [43]

5.3. Thick Walls

Walls are major components of heat gain because they are the largest area exposed to sunlight for a long period of the day in the hot and arid areas [46]. Therefore, Traditional Architecture implements walls made of heat-storing materials in rooms of daily activities during the day, so thick walls built with bricks that store heat throughout the day are used, and double walls were utilized to increase insulation. Light-colored finishing materials are also employed to reflect the sun rays. Besides, projections made of brick or wood are used to increase the shading of the facades, which reduces the surface temperature and reduces heat transmitted through the wall, in addition to improving aesthetic values [47,48]. Figure 7. shows the plan of the Sultan Hassan Mosque and School, which is one of the most famous Islamic mosques that is described as one of the greatest examples of Islamic architecture [49]. The plan illustrates the use of thick walls for external spaces, whether around the courtyards or the external walls, to achieve thermal and acoustic insulation.

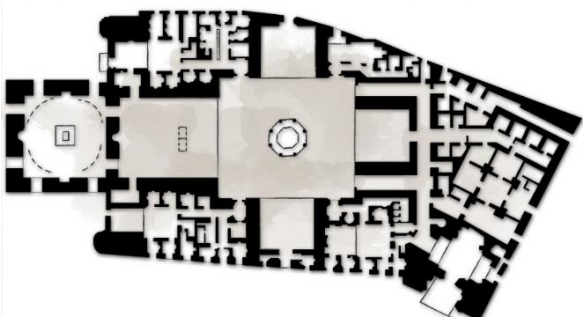

Figure 7: Sultan Hassan Mosque and School- use of thick walls for external spaces to achieve thermal and acoustic insulation, Source: Adopted from [49]

5.4. Roof Shape

The roof of the building is the most exposed element to solar radiation. It is a major source of thermal energy penetration into the building. Hence, the shape of the roof of the building affects the shading area and the intensity of solar radiation. Domes, vaults, and curved roofs are used in Traditional Architecture in hot regions, where curved roofs increase the shaded areas. Figure 8. shows the effect of orienting the vault on increasing the shaded areas for longer periods of the day [50].

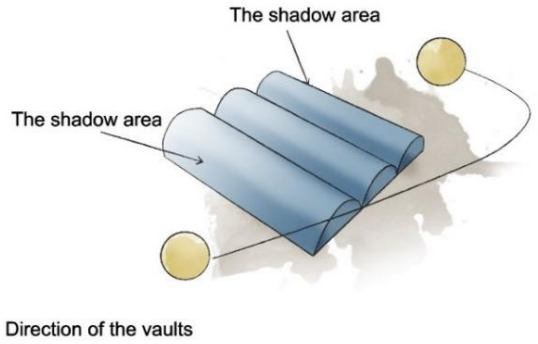

Figure 8: The effect of orienting the vault on increasing the shaded areas for longer periods of the day, Source: Adopted from [33]

5.5. Takhtabüsh

Takhtabüsh is a type of terrace or a roofed seating area at ground level located between two courtyards. These two courtyards differ in size and exposure to sunlight, see figure 9. Takhtabüsh increases the airflow due to the convection load, as the air in the courtyard exposed to the sun rays heats up, then the air rises upward and thus a cool breeze is produced, see figure 10,11, [43, 51].

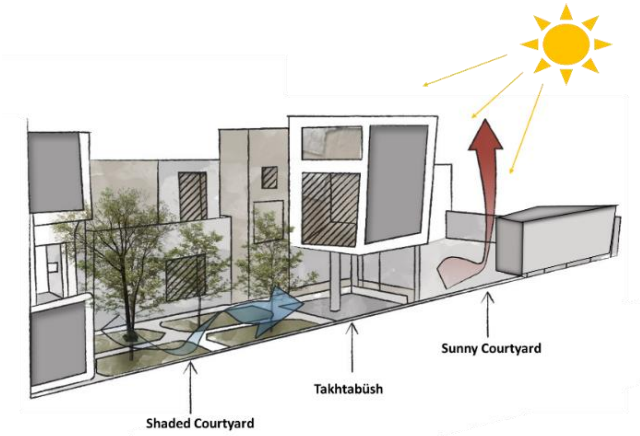

Figure 9: Takhtabüsh is a type of terrace or a roofed seating area at a ground level located between a shaded courtyard and a sunny courtyard. Source: Adopted from [51]

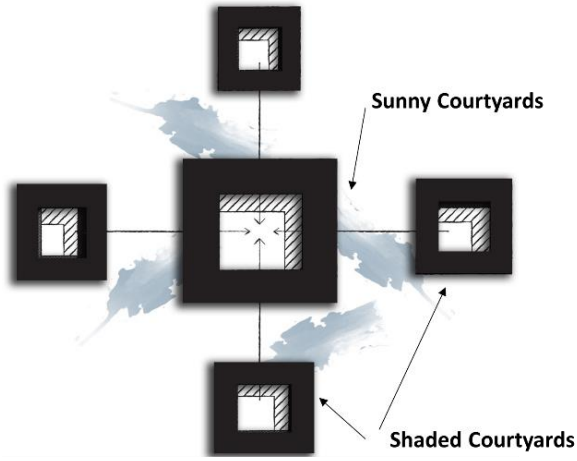

Figure 10: The transmission of cold air from shaded courtyards to sunny courtyards

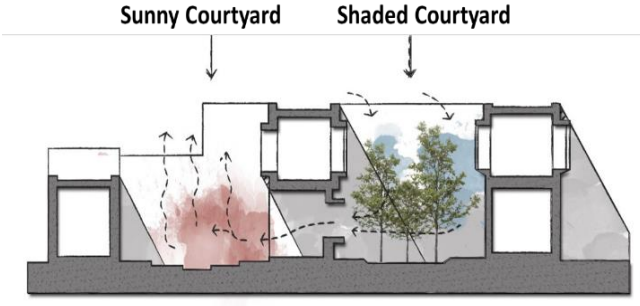

Figure 11: The transmission of air from cooler shaded courtyards to larger sunny courtyards. Source: Adopted from [51]

5.6. Openings and Windows

The importance of openings and windows is to provide natural lighting and ventilation, Traditional Architecture in the Arab region succeeded in providing natural lighting and ventilation by reducing the area of the openings and making them shaded to reduce the heat gain. Similarly, the openings were placed at the top of the walls for better protection from the reflection of sunlight produced from the ground. Many magnificent treatments are used on the windows to improve the internal environment. For example, Alqamariyat and Shamsiyat which is a name given to the openings above the windows and covered with colored glass where its function is to allow light to penetrate inside without passing the hot air into the house. Al-Omarah are small openings in the form of circles or polygons and are located in the ceilings and domes and its function is ventilation and disposal of hot air that collects at the ceiling area [52, 53]. Evaporative cooling window systems are of great importance in cooling and ventilation. Figure 12. shows a window containing a porous clay jar in which water is placed. When the air passes over the water inside the porous jar, it becomes cooler due to evaporative cooling, which improves the internal environment in the hot dry climate [43, 54, 55].

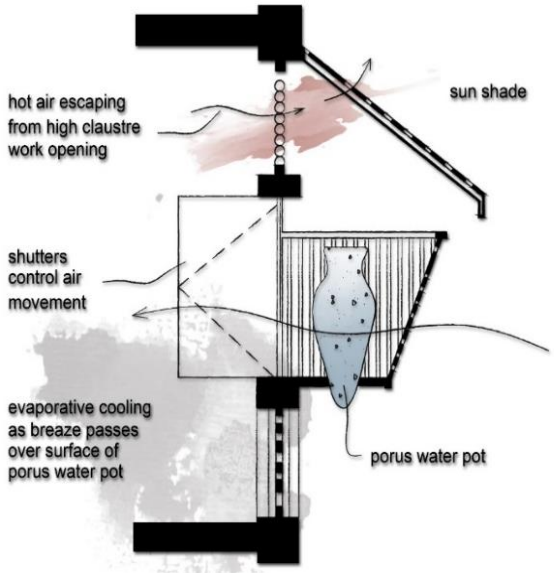

Figure 12: A window containing a porous clay jar Source: Adopted from [54]

5.7. Mashrabiya

Mashrabiya is one of the most prominent architectural treatments in Islamic architecture. Mashrabiya has five functions: 1- providing shading, 2- natural ventilation, 3- controlling the passage of light, 4- reducing the temperature of the air stream and controlling its humidity, 5- providing privacy, see figure 13. Any Mashrabiya could have achieved many of these functions or all of these jobs [1], besides its decorative role [56, 57].

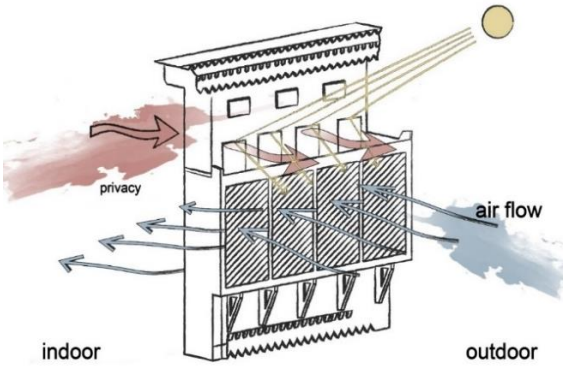

Figure 13: Mashrabiya has five functions 1- providing shading, 2- natural ventilation, 3- controlling the passage of light, 4- reducing the temperature of the air stream and controlling its humidity, 5- providing privacy

5.8. Arcades & Balconies

Arcades are semi-outdoor striped covered spaces, see figure 14. The arcade" Al-Riwaq " is spread around courtyards in mosques. The open wall overlooking the courtyard are open arches at equal intervals, thus the arcades block direct solar radiation and increase the air velocity, also, Al- Riwaq works as a barrier to the climatic conditions of the external courtyards [58].

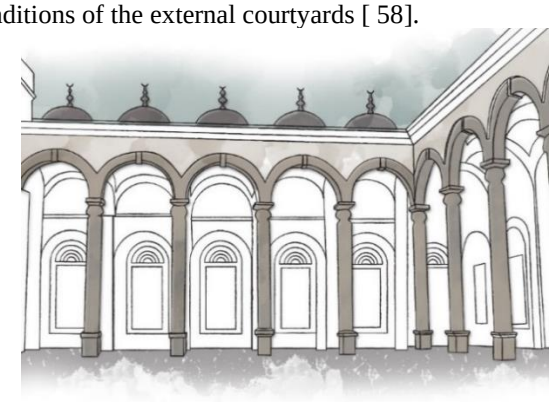

Figure 14: Arcades" Al-Riwaq " are semi-outdoor striped covered spaces

5.9. Wind Tower “Malqaf “

Al-Maqaf is one of the most important treatments in Islamic architecture to capture the cold air from the top of the building and direct it to the inside of the building. Al-Malqaf works to reduce the dust carried by the hot dry wind. Thus, it purifies, cools and humidifies the air. There are many types of wind towers including one-way, two-way and multi-directional wind towers called Badgir. There are many environmental studies that attempted to analyze and develop wind towers. For more information about Al-Maqaf it can be referred to [59, 60, 61, 62, 63, 64], see figure 15.

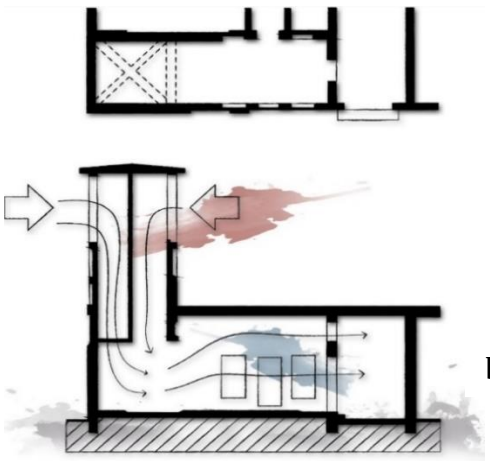

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Figure 15: Malqaf is one of the most important treatments in Islamic architecture. a) plan, b) section, c) perspective.

By analyzing the features that characterize Traditional Architecture in the Arab Region in achieving Thermal Comfort, the study provides a Conceptual Framework of Traditional Architecture as a guide to Contemporary Architecture as shown in figure 16. Arab architecture has been influenced by both religious and cultural factors, as well as customs and traditions including social organizing, family bonding, privacy, the right of the neighbor, protective jealousy, the defense, private property, and daily activities. Consequently, it succeeded in achieving Environmental Comfort by understanding the site character and taking into account climatic conditions. Also, it succeeded in achieving acoustic comfort via noise reduction, as well as achieving privacy. In addition, it achieved visual comfort by using the appropriate and sufficient amount of light and employing matte colors to improve visual comfort and reducing glare. The Conceptual Framework shows a set of elements of traditional Islamic architecture that represent the link between social and religious influences and factors and the achievement of Environmental Comfort. For instance, the Traditional Arabic Mashrabiya, which was designed to achieve privacy, has succeeded in achieving Thermal Comfort by reducing the temperature of the air entering the spaces in addition to achieving visual comfort by reducing glare and obtaining efficiency in lighting.

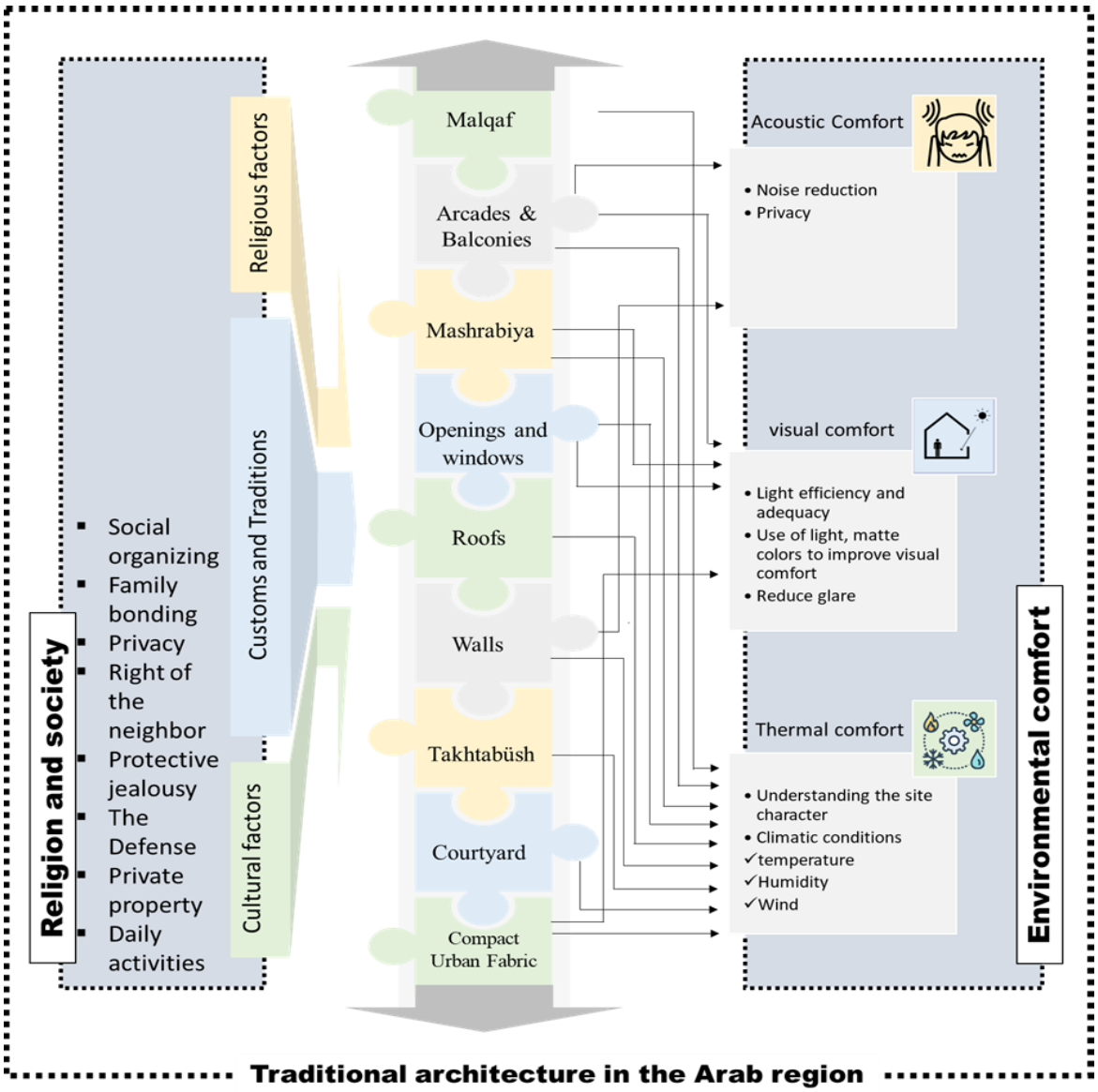

Figure 16: The Conceptual Framework of Traditional Architecture.

6. RECENT TRENDS TO IMPROVE ENVIRONMENTAL COMFORT BASED ON TRADITIONAL ARCHITECTURE STRATEGIES

During the past two decades, many studies have been carried out to implement modern technologies in developing the architectural product in the Arab world [6, 33, 71] besides the attempts to preserve the identity and take inspiration from Traditional Architecture that has proven its efficiency over time [65, 66, 67, 72]. Table 1. displays a group of literature review of Traditional Architecture as a guide to Contemporary Architecture in Arab region during the past two decades from 2000 to 2020, the table deals with the researcher's name, year of publication, location of the study, and a summary of the study.

By reviewing contemporary studies-based on Traditional Architecture strategies that deal with modern trends to achieve environmental comfort and reduce energy consumption. It shows, the tendency of some studies to focus on social and cultural aspects and their impact on architectural identity, as well as focusing on human values that have been taken into account in traditional architecture to create an urban environment in harmony with the environment [65, 66, 67, 72]. Moreover, some studies dealt with the elements of morphology and their impact on achieving environmental comfort [33, 46, 70], for example, Elseragy, in his study [50] mentioned the effect of traditional geometric shapes of domed and vaulted roofs on the intensity of solar radiation and the amount of heat gained from the roof. Also, Eltarabily, in her study [76] examines the effect of façade configuration on reducing noise pollution levels. Moreover, some studies dealt with a new architectural application based on the principles of sustainable Traditional Architecture [61, 73, 77], for example, Shahda, in her study [78] suggests a new architectural application to achieve thermal comfort in desert buildings by simulating the adaptation method of the camel's nose technique and inspiration from traditional evaporative cooling window systems.

Consequently, by analyzing contemporary studies-based on Traditional Architecture strategies. it is found that the

studies are divided into three approaches: 1) Philosophical studies that attempt to analyze vernacular or Traditional Architecture to reach the success criteria for Traditional Architecture in achieving comfort for users. 2) Innovative strategies dealing with modern proposals to achieve Environmental Comfort based on the principles of sustainable Traditional Architecture. 3) Studies that focus on one element of the distinctive elements of Traditional Architecture, such as the courtyard, Mashrabiya, or others, and try to analyze that element and present proposals for employing it, according to the requirements of each country at the present time.

Table 1. A literature review of Traditional Architecture as a guide to Contemporary Architecture in Arab region

Author/ year	Evaluated location	Focus on	Ref
Omar, (2000).	Egypt	The study focuses on the impact of the social, economic, political, and cultural aspects of the Islamic religion on Islamic architecture, also the causes of losing identity in contemporary Arab architecture.	[65]
Abusaada, (2001).	Arab world	The study provides a monitor of the reflection of human values on the urban spaces of the Arab city (traditional and contemporary). And the study is concluded with a proposal for a humanistic urban approach to design urban spaces	[66]
Al-Zubaidi, (2002).	Libya	This study provides an analysis of traditional buildings in the desert climate of Ghadames, Libya, through the efficiency of thermal performance of building materials and systems, roof and openings.	[36]
Ragette, (2003).	Arab world	The study deals with an analysis of the characteristics of Traditional Architecture in many Arab countries in terms of building materials and construction methods, important elements such as courtyards, waste and water management, and many traditional design strategies.	[6]
Elseragy, (2004).	Egypt	The study deals with the effect of geometric shapes of domed and vaulted roofs on the intensity of solar radiation and the amount of heat gained from the roof. Also, the study is concluded by guidelines for designing curved ceilings.	[50]
Balbo, (2006).	Egypt	The study presents an analysis of Traditional Architecture in the New Valley (Egypt). It shows the success of architecture in achieving environmental quality as well as preserving social and religious values.	[67]
Almusaed & Almssad, (2006).	Iraq	The study presents an analysis of the passive bioclimatic houses which are designed to face the negative effects of macroclimate in Basrah	[68]
De Filippi, (2006).	Egypt	The study focuses on traditional building materials and compatibility with the elements of environmental sustainability, which include optimization of resources and materials, integration with landscapes, careful consideration of climatic factors.	[69]
Al-Sallal & Al-Rais, (2011).	Dubai	The study investigates the extent to which the traditional urban fabric of traditional narrow streets in improving Thermal Comfort performance.	[70]
Bouchahm et al., (2011).	Algeria	The study deals with evaluating the thermal performance of wind towers. It suggests some proposals for developing wind towers to improve environmental performance.	[62]
Ahmadikia et al., (2012).	Iran	The study examines the addition of water sprinkler systems to the wind catcher to improve the environmental performance within indoor spaces.	[61]

Abdelsalam & Rihan, (2013).	Arab world	The study reviews the principles of sustainable architecture and green cities inspired by Traditional Architecture.	[71]
Ajaj & Pugnaloni, (2014).	Arab world	The study deals with an analysis of the vocabularies and characteristics of traditional Arab architecture as a basis for developing Contemporary Architecture, taking into account the social, economic, and environmental conditions.	[72]
Ramzy, (2015).	Arab world	The study provides an approach to integrate Biomimicry techniques and the historical architecture to reach applications that enhance sustainability	[73]
Gelil & Badawy, (2015)	Egypt	The study presents a development of the idea of the traditional Mashrabiyya and comparing it to the prevailing windows in Egypt, known as Sheesh.	[74]
Abdulkareem, (2016)	Iraq	This study provides an investigation into the determinants of the courtyard in Traditional Architecture, with the aim of employing it in contemporary architecture	[51]
El-Ahwal et al., (2016)	Egypt	The study presents a proposal to apply green roofs on residential buildings in Egypt to reduce energy consumption and increase thermal insulation	[75]
Eltarabily et al., (2016).	Egypt	The study examines the effect of façade configuration on reducing noise pollution levels	[76]
Waseef & EL-Mowafy (2017).	Arab world	The study focuses on kinetic facades as a new concept for sustainable design and increasing the efficiency of the indoor environmental quality	[77]
Shahda et al., (2018).	Egypt	The study suggests a new architectural application to achieve Thermal Comfort in desert buildings by simulating the adaptation method of the camel's nose technique	[78]
Shahda, (2018).	Arab world	The study focuses on the effect of the architectural composition (mass -cover - site) on supporting sustainable architecture, by dealing with some traditional Arab formations.	[33]
Elnokaly et al., (2019).	Egypt	The study provides a simulation of traditional vaulted roofs in terms of energy consumption and solar radiation. Also, it provides a set of suggestions to improve the design of the traditional vaulted roof.	[79]
Abo EL Einen et al., (2019).	Arab world	The study focuses on the effect of building shape on improving thermal performance and reducing energy consumption in buildings	[44]
Shahda, (2020).	Egypt	The study proposes an idea to achieve self-shading of the walls at a low cost and available materials where reduction in the external surface temperature is reached.	[46]

7. ADAPTING THE STRATEGIES OF TRADITIONAL ARCHITECTURE TO ENHANCE CONTEMPORARY ARCHITECTURE

In addition to the contemporary studies that are concerned with exploiting the foundations and criteria of traditional architecture, there are some architectural attempts to employ environmental treatments inspired by traditional architecture with the integration of some modern techniques to achieve contemporary architecture with Arab identity. For example, 1) Jean Nouvel Institute of Arab d' Paris: The Arab cultural identity appeared in the architecture of the Arab World Institute in Paris as a necessity for it to be an exhibition for the Arab world in Paris [80]. The architect used the 'Mashrabiya' element to create a specific architectural effect. The idea was embodied in the giant Mashrabiya, which acts as a light filter depending on the weather, and the operation of the Mashrabiya is controlled by a light-sensitive electronic system. Thus, the project combined the Arab identity, represented in one of the elements of traditional treatments, with contemporary high-tech [81], see figure 17.

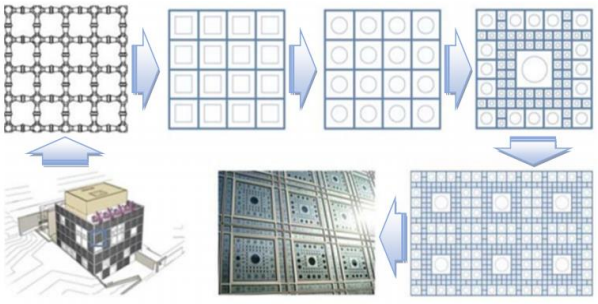

Figure 17: The relationship between technique and culture [81]

2) Masdar City in Abu Dhabi is home to one of the world's largest clusters of low-carbon buildings [82]. Buildings are designed to meet stringent environmental requirements. Five main axes to support sustainability in the city: planning and design, power, water, transport, and supply chain. One of the techniques invented by Norman Foster and inspired by traditional architecture is solar umbrellas in the public plaza [83]. During the day the solar umbrellas open to shade and keep the cold air that has been collected during the closure of solar umbrellas at night. Also, Fosters and Partners have intelligently designed the city to maximize natural lighting and cross ventilation which reduces the need for artificial lighting and air conditioning [84], see figure 18.

Figure 18: Masdar city plaza during day [83]

Moreover, as mentioned in the previous section by reviewing contemporary literature on Traditional Architecture Strategies, it was found that the studies are categorized into three approaches, yet how to employ them to promote Contemporary Architecture in the Arab Region is still a demand. Therefore, the study provides a Systematic Framework for using Traditional Architecture as a guide for Contemporary Architecture. Figure 19. shows the three approaches of contemporary studies. The first approach deals with the mutual influence of lifestyle, surrounding environment, architecture and urbanism in creating a distinctive mixture of foundations and standards that produced the Traditional Architecture which can be a guide to Contemporary Architecture to achieve Environmental Comfort and sustainability, without neglecting the identity aspect. Through this analysis, it appears that the first axis “lifestyle" includes a set of factors such as, customs, traditions, cultural, social and religious factors. The combination of these factors produced many important social foundations that affected Traditional Architecture in the Arab region such as, social organizing, family bonding, privacy, the right of the neighbor, protective jealousy, the defense, private property and daily household activities.

All these foundations crystallized Traditional Architecture as distinctive and inspiring aspect. The second axis, "surrounding environment", includes the community - with all its elements: residents, workers and builders of the site and climatic factors, taking into account environmental factors, in addition to using the available materials on the site .The third axis deals with the distinct architectural and urban elements and treatments, as the analysis shows the success of Traditional Architecture in providing materials and energies. By studying the mutual impact of all these standards and foundations trying to apply them to the architectural and urban reality in Arab cities, the study suggests issuing a set of requirements and laws to preserve the environment as Traditional Architecture did while preserving the identity.

The second approach in contemporary studies on Traditional Architecture shows the focus of many studies on one element of Traditional Architecture. For example, the use of a courtyard and trying to reach recommendations for employing it, with the ideal dimensions and ratios that are appropriate for each region or climate. Another example is to present proposals for the best proportions and dimensions for employing vaulted ceilings in order to reduce energy consumption and improve the environment. Hence, the study suggests using the latest technologies and simulation software to set standards for each element of Traditional Architecture, to make it easier for architects and designers to employ these elements in their designs for the purpose of preserving the environment and the identity as well.

In addition to that, the third approach includes the integration of modern technologies and materials and the foundations of Traditional Architecture to create innovative ideas. For example, integrating smart materials [85, 86, 87] such as smart glass in the Arab Mashrabiya, or developing the method of its opening and closing the openings by using kinetic architecture techniques [88, 89]. Another example, using green walls and roofs [90, 91] to achieve the Traditional Architecture strategy that focuses on exploiting the botanical component to improve the environment. And a third example, utilizing the principle of evaporative cooling used in many environmental treatments in traditional Arab Architecture, such as the Malqaf, and combining it with modern technologies to improve the internal environment. There are many attempts to provide innovative ideas for the development of Traditional Architecture. Therefore, the study suggests focusing on the available modern technologies and trying to integrate and employ them with the foundations and standards that characterize Traditional Architecture in the Arab region.

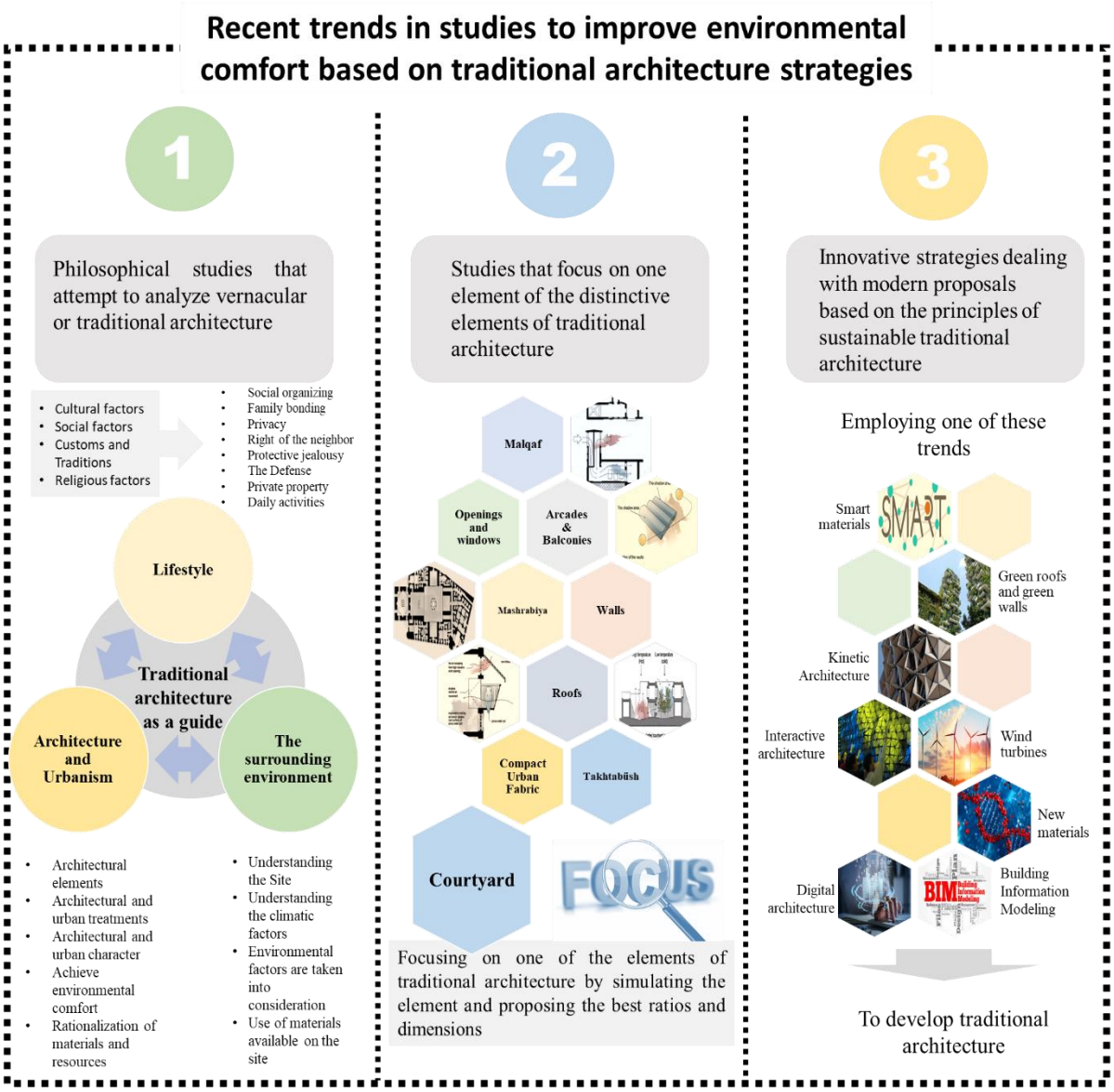

Figure 19: A Systematic Framework for using Traditional Architecture as a guide for Contemporary Architecture.

8. DISCUSSION AND CONCLUSIONS

By investigating architectural and urban authenticity in the Arab region, it is clear that there is a link between traditional and Contemporary Architecture through updating and integrating the vocabularies of traditional environmental treatments. Some designers resort to use traditional vocabulary in their buildings with slight modifications, others resort to use it with changes in proportions, shape or construction materials, while some resort to understand environmental requirements and translate them into innovative modern designs. This study focuses on three axes; the first is extracting the foundations and standards of Traditional Architecture in the Arab region by analyzing the distinctive elements of this architecture with the aim of deducing a Conceptual Framework of Traditional Architecture as a guide to Contemporary Architecture. The second is a literature review of recent trends in environmental architectural studies based on Traditional Architecture strategies, and the results of this axis have shown that the studies are divided into three parts; 1) Philosophical studies that attempt to analyze vernacular or Traditional Architecture to reach success criteria for Traditional Architecture. 2) Innovative strategies dealing with modern proposals to achieve Environmental Comfort based on the principles of sustainable Traditional Architecture. 3) Studies that focus on one element of the distinctive elements of Traditional Architecture, and try to analyze this element and present proposals for employing and developing it. The third is submitting Systematic Framework for employing all the foundations and standards for Traditional Architecture, as well as exploiting all the results of contemporary studies on the development of Traditional Architecture to serve as a guide for Contemporary Architecture.

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