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Sustainability Features of Jeddah Traditional Housing

Maged Attia

Abstract

Sustainability is clearly represented in Jeddah old city where traditional builders have developed unique practices that promote environmental, social and economic qualities. The urban form and buildings proved efficiency towards the conservative society, the pattern of life and the prevailing hot-humid climate. The open space system, characterized by narrow walkways and wider intersections, provided shaded and ventilated places for walking and communicating. Houses were configured according to social traditions that imply the separation between private and public life. Walls were constructed of locally coral stone blocks known by its thermal insulation ability, then finished with white color which acts on reflecting sunlight and reduces the heat absorption. Large wooden latticed windows admit daylight but control heating and ventilation, while providing privacy for the family. Moreover, rainwater was collected and stored in basement reservoirs. However, attempts to record these manifestations of sustainability have always been subjective. Therefore, based on long experience of academic work in relation to historic Jeddah, the present chapter intends to reintroduce previous knowledge but supported by evidence whenever possible hoping that it can help formulating guidelines for effective and sustainable alternatives. This is of great benefit to current professionals.

Keywords: Sustainability, traditional housing, local architecture, Jeddah, Saudi Arabia

1. Introduction

Saudi Arabia occupies a location between Asia and Africa between latitude 18° south and 28° north inhabiting most of the Arabian Peninsula. The western side of the Arabian Peninsula, alongside the Red Sea, is occupied by “*Tehamah*” Plain with a width that ranges between 6 and 60 km. Jeddah city is located at 21° 30′ latitude (**Figure 1**) as the harbor for the holy city of Makkah and as a trade hub with Yemen and Egypt. It was bounded by a wall with a number of gateways that varied along time until the removing of this wall in 1947 [2]. Being a major seaport on the Red Sea, Jeddah has always been a cosmopolitan city whose culture and architecture has been influenced by others, mostly Egypt, Turkey, India, Indonesia and Yemen.

Climate in Jeddah is hot and humid almost throughout the year. The average maximum temperature is around 39°C. Minimum rates of temperature recorded at night decreases by 10°C from the maximum ones recorded at daytime [3].

A short visit to the historic core of Jeddah “*Al-balad*” can directly convey a comfortable feeling in both the architectural and urban context. This brings back to

Figure 1.
The location of Jeddah city in the Western Province [1].

mind the question of how these buildings could manage to respond to crucial concerns like the harsh climate, available building materials, construction technology as well as customs and traditions. Most of these items have become an area of research from different viewpoints, and sustainability is no exception.

Sustainability scope is not restricted to environmental practice but comprises issues related to social and economic interests. Environmental sustainability is concerned with sensitivity while interacting with the developmental location and its components. Social sustainability is concerned with maintaining identity and local socio-cultural traditions while enhancing the quality of life. From an economic viewpoint, sustainability emphasizes the optimum utilization of available resources, reducing operation and maintenance cost and commercial vitality [4].

Without knowing its meaning, sustainability was deeply inherited in the traditional built environment of Jeddah. Many passive strategies for improving thermal comfort on both the architectural and urban level were adopted utilizing local resources and technologies. Outdoor and indoor spaces are of reasonable size, flexible for more than one use and incrementally extend according to need and ability. Local culture, which is heavily influenced by Islam, was directly reflected on the city urban tissue, the house architecture down to the smallest details.

The orientation of masjids towards Makkah for prayer “*qiblah*” affected shaping the surrounding paths and buildings. The morals of privacy, hospitality and humility are essential in religious guidelines which urge the veiling “*hijab*” of women from strangers’ eyes, separation between men and women, rights of families in communities, neighbors’ rights and not hurting him, not looking upon others’ houses and turning a blind eye (turning the gaze away) [5]. In a response, paying attention to guests’ entrance and reception areas, isolating family movement, screening windows and openings as well as balustrade, simplicity, and abstraction are major design considerations in the historical house. These are argued below.

2. Urban pattern configuration and sustainability

Like old Islamic Arab cities, the urban pattern of historic Jeddah, is characterized by its organic open space system (Figure 2). This urban pattern has emerged with

Figure 2.
Building forms in historic Jeddah.

Figure 3.
Map of historic Jeddah showing its organic open space system [7].

intended control over the microclimate of the area. Responding to the hot-humid climate, open space system adopted a network of narrow paths “*harat*” leading into intimate open spaces “*barhat*” [6]. While, buildings are intense, converge and adjacent (**Figure 3**). Paths vary from main or major (12–20 m), primary or local (4–10 m), and secondary (2–4 m). With a height of two to five storeys, building heights range between 8 and 20 m. Width to height aspect ratios are thus in the range of 1/2 and 1/5 or narrower in many cases (**Figure 4**).

This compact configuration of the urban tissue could adequately protect the buildings and the open spaces from the harsh weather by offering abundant areas of shade and shadows. Yet, complete shade was intentionally avoided. For outdoor spaces to be healthy, paths are exposed to sunlight for a short time, while the open spaces are receiving it for longer times along the day. The best-known benefit of sunlight is its ability to enhance providing the body with vitamin D. A half-hour in the sun can initiate enough amount for a whole day. But, most public health messages have focused on the hazards of too much sun exposure where it can contribute to sunburn or skin diseases [8].

However, open spaces will receive more intense solar radiation causing their contents to be heater than the shaded paths. Then, the hot and less dense air creates a dynamic thermal system motivated by the cooler and more dense air. Cool air masses accordingly flow from the narrow paths to replace the hot air with different velocities that help to alleviate the air temperature and the impact of humidity [9]. Narrowing paths cross-section contributes accelerating the air currents. Simulation with ANSYS R19.2 software accords with the phenomenon (**Figure 5**). Compared with modern streets, air temperature of Jeddah traditional open spaces is found to be cooler by more than 3°C, especially during peak heat hours [10]. Moreover, buildings are mostly configured with spaces in between to facilitate the movement of air around them.

Path orientation plays another role in influencing local climate. Relatively speaking, the urban tissue is configured taking the shape of stripes. Some of them are perpendicular to the coast allowing the sea breeze to smoothly penetrate through buildings, while the others are aligned with the north–south direction perpendicular to the path of sun which keeps their paths in shade most of the day and eases channeling airflow smoothly into the city’s fabric.

Figure 4.
Paths with different aspect ratios.

The effect of path orientation and its aspect ratio on reducing the impact of the local climate was investigated by ENVI-met, a computer simulations software (Figure 6). The results show that streets with higher aspect ratio (1/2.5) have better outdoor thermal comfort conditions than the ones with lower aspect ratio (1/0.5). Due to more urban shading that the buildings create, temperature can be decreased to 22°C in PET index. The preferable order of street orientations was found to be

Figure 5.
Wind velocity in the open spaces of historic Jeddah.

Figure 6.
Examined paths H/W aspect ratio.

N-S, NW-SE, E-W and NE-SW. Also, increasing the aspect ratio reduces, to varying degrees, the air temperature (up to 1.7°C), mean radiant temperature (up to 33°C), the wind velocity while increasing the relative humidity (up to 5%) [11]. However, decrease in wind velocity does deny its existence. To great extent, results are in line with the conditions in historic Jeddah.

The urban pattern of historical Jeddah did not handle with the environmental framework only. With the same efficiency, the urban pattern maintained social and

Figure 7.
Vitality of main paths and open spaces maintained by walkability.

Figure 8.
The axial map of historic Jeddah produced by integration-Rn.

economic sides of sustainability. The hierarchical and compact open spaces system provided different levels of spaces ranging from public, semi-private to private. Each level of the spaces promoted different form of social relationship among residents. Small open spaces and secondary paths were used as playing areas for children to have fun under the supervision of mothers who manage to assemble and chat around. In larger scale spaces, men settlers of adjacent houses sit in groups on raised floor. Also, in these spaces sons can safely play overseen by fathers. Moreover, allocating shops integrated with the residential use on main paths and open spaces, as well as communal services like masjids, enabled inhabitants to move easily in between. This approach, known as mixed uses, encourages walkability, ensures safety and natural surveillance and supports commercial vitality (**Figure 7**).

A Space Syntax study attempted to understand the effect of spatial configuration on movement patterns (**Figure 8**). Outcomes of the study illustrate that the total pedestrian density and the Intensity of moving people are concentrated on the major paths (red-orange in the figure), followed by the local paths (yellow-green lines), and then by the secondary paths (blue lines). This explains the appropriateness of each segment for the intended function i.e., privacy and safety for women and children, controlled openness for men and vitality for commercial movement [12].

3. House design and sustainability

Like the urban pattern, sustainability with its integrated concept has been considered in the historic house of Jeddah too. It was shaped to meet local traditions, local climate and economic abilities. The well-established social traditions dictated the separation of private and public life which was reflected on allocating spaces in the house. There is a spacious zone at the entrance “*salamlek*”, which is donated to men settlers where strangers are received. While, the other section of the house “*haramlek*” is dedicated to women and their life to provide maximum protection from the eyes of strangers. This however produced a dual system of movement to allow using private and public spaces severally [13].

On the ground floor, the house has its bigger rooms, such as reception room “*dehleez*” and the guest room “*majlis*”, in the front section (**Figure 9**). These rooms are generally higher than others and the floors are kept wet to maintain them cool in hot days. Houses on main paths contain shops, storage rooms and warehouses, each has separate entrances from the path and not connected to the rest of the house.

Other facilities, such as the staircase “*daraj*”, the kitchen, storage areas, toilets as well as sleeping rooms share the rear part of the house. Number of rooms in the house varies according to the ability of the residents. However, the house usually has two entry points. The main entrance is placed on street preceded by a number of steps and mostly used for men. On one of the other sides, another entrance for women and family members is located. The family entrance leads to the staircase which does not have any visual contact into any room of the house to maintain privacy.

Reception room acts as a transitional zone that links the entrance door and the inner areas of the house. Men guests may use first floor in special occasions, but upper floors are only confined to family life. Upper floors contain the women guest room which is the largest and most revered space in the house. Its location on the main facade offers the preferable overlook and ventilation provided by large wooden latticed windows “*rawsheen*”.

Adjacent to this room, there is a small room known as the “*soffah*” which is used as a living room. A dual-use room, known as the rear “*moakher*”, is placed at the

Figure 9.
Plans and main elevation of selected historic house.

Figure 10.
Terraces and balustrades details.

back end of the house. It is a medium- sized room which is used as a sitting room for family women by day, and it turns into a bedroom at night. Hence, the house is inhabited by many extended families; each family has its separate suite.

Whenever the house rises, the floor area of each higher storey retracts creating terraces on the rooftops of annulled rooms. However, terraces provide outdoor spaces for women to perform domestic activities like drying clothes. These terraces are visually protected by heigh balustrades with details that provide privacy but allow air to move through (Figure 10). Likewise, the building roof provides other outdoor spaces where inhabitants can use for sitting or sleeping in summer nights. As far as possible, houses are arranged to ensure that an overview of other houses’ terraces is prevented according to Islamic sense of propriety.

Almost every house has two to five storeys in a cubical form that does not contain any protrusions, except for the “rawasheen”. The building form is not

straightly configured, but with broken masses so that adequate shade and shadows might be caught.

The direct light hitting the Nawar house and its context could be simulated at different times of the day and year. Results indicate that the direct sunlight during the morning and afternoon hours is largely blocked by the geometry of the house itself, and the neighboring buildings which largely shadow the facades in the lower area of the building (**Figure 11**) [14].

In Jeddah climate, a large amount of air is required to move through the house in order to alleviate the impact of high humidity. Stimulating air to flow requires having a positive pressure side and ensuring that the air outflows from the negative pressure sides carrying humidity and the unpleasant fumes. Therefore, most of the house had two to three facades and arranged to have at least one facade facing the preferred airflow, while others are exposed as possible.

Spaces were arranged so that walls do not obstruct the continuity of air flow by providing openings between the rooms. Openings range between *rawshan* or windows on the main facade, small openings at a heigh level on the opposite walls or integrated on the top of doors. The staircase also helps ventilating the house allowing air currents to vertically flow through running from the ground floor to the roof, which is known as the chimney effect. The staircase shaft also encourages the air circulation between floors.

In the same previous study of Nawar house, the air flow through the house was visualized with the Wind Tunnel Pro simulation software. The visualization of the air flow proves that the wind penetrates through the large *rawshan* in the front facade and continues to drive the air cylinder rotating in the room due to vertical temperature differences. This situation leads to mixing the air layers and intensifies the heat and moisture exchange with the wall and floor surfaces. The small high openings in the wall opposite the *rawshan* facade increase the airflow velocity even more and is literally sucked into outdoor (**Figure 12**).

Beside the role played by the staircase to enhance air movement through the house, some houses were provided with air shafts, a treatment that developed from the traditional wind catcher "*malqaf*" (**Figure 13**). Assessing the impact of air shaft on the relative humidity, air movement, air temperature and the CO₂ level -an important indicator of air quality- have been a main interest for some studies.

Two scenarios were monitored in Nassif house "*bait Nassif*". In the first case, the window facing the air shaft was closed; the same window was left opened in the

Figure 11.
Nawar house physical model in the light laboratory.

Figure 12.
A vertical section showing the air flow through the Nawar house produced by wind tunnel pro simulation software.

Figure 13.
Air shafts in Nasif house (left: Exterior view) and Nawar house (right: Interior view).

second. Results proved the efficiency of thermal performance for the studied space in case of the opened window. Air velocity of 1.1 m/s was achieved in the first case, while it dropped to 0.0 m/s in the second. The average of CO₂ which was measured at 395 ppm in the first case opposite to 560 ppm in the second. Relative humidity reduced to 59% while it was 65% with the closed window. Air temperature also dropped from 33°C to 32°C when the window was opened. Comparable results were monitored for Noor Wali house [15].

4. Building materials and construction technology

Historic buildings of Jeddah are mostly built with the same materials, technology and principles. Structure relies on a wall bearing system that transfers loads across its section. The walls are built of coral blocks “*Al-kashur*” or “*Al-Mangabi*” stones, then covered by plaster “*nourah*” for insulation and esthetic purposes. *Al-mangabi* stones are cut from coral fossils or from the sea, *Al-arba^ceen* lake or *Al-Mangabi* lagoon, just north of Jeddah. Then, it is shaped in blocks form and used in constructing the walls. *Nourah* is a type of calcareous stone treated by fire and then dismantled, drained and mixed with water. It is used alone in the case of external polishing, while mixed with stone fragments for repairs. The silt, precipitated after rain, is utilized as mortar to cement blocks to each other. Notably, these are natural, renewable and recyclable materials.

Al-Mangabi stones proved efficiency as an insulation and resistance median. Empirical studies indicate that *Al-Mangabi* stone wall of 70 cm thickness gives high thermal mass to the building, which reduces and delays heat gain inside. A difference of 2.7°C (from 35°C to 32.3°C) between outer and inner surfaces of external wall is measured [16]. Also, the thermal properties of the stone were examined in comparison to contemporary building materials. The results confirmed that the change in the temperature of the internal surface of the stone was almost like double-brick wall section with insulation (Figure 14). Hence, it was recommended for use in contemporary buildings; the cost of insulation and the energy required for air conditioning can be lowered [17]. Results could be more enhanced with the white color of plaster which reflects the direct solar radiation and reduces the heat gained in the building’s mass.

Wood is the other major construction material which was used in structure and decoration. Structurally, Mangrove is widely used in roofing for the length of its poles which reach about 2.8 m and accordingly dictate room widths. While, Teak “*sajj*” and sandalwood “*sandal*” were used to make windows, *rawasheen*, doors and different forms of lattice work. These woods were imported from India, Java or East Africa. Local woods available in the region, such as palm trees and leaves, acacia and juniper were also used. Sustainability of wood has been heavily documented. Though, being imported is a shortage.

Figure 14.
Thermal performance of Al-Mangabi stone compared with some contemporary materials.

However, the construction process starts with a shallow foundation trench to the depth of one or two courses of *Al-Mangabi* blocks. At every six rows (120 cm), a bonding course of round wood beams “*takaleel*” is inserted and locked with short pieces at the ends to ensure homogenous load distribution. They support the building to resist the settlement stresses (**Figure 15**). Also, they enable maintaining the wall by supporting the wooden beams from the external and internal side and changing damaged stones underneath (**Figure 16**).

At ground level, the walls thickness is about 80 cm. The higher the building go, the thickness would be reduced by about 15 cm with each floor. This reduction is taken from the internal side of the wall to create a ledge with sufficient space to place the ceiling beams side by side. Spaces assigned for *rawasheen*, windows and doors would be left according to width. Wooden lintels or arches as well as wooden fixtures of *rawasheen* are then utilized in position. The internal walls are provided with niches “*taqat*” which are used as cupboards. Both openings area and niches served to alleviate the weight of the structure, not ignoring reduction of the walls thickness and areas taken out in balustrades. In many cases, voids covered by *rawasheen* are found to reach around 50% of the wall surfaces [18] (**Figure 17**).

For the roofing of each floor, wooden beams are placed resting on ledges of two parallel walls and firmly impeded inside the wall. Several layers are then implemented above the wooden beams including palm leaves or light weight wood planks, sackcloth, wet soil, crushed gravel, lime and finally clay mortar, which are natural materials are used too (**Figure 18**).

Figure 15.
External views of Al-Mangabi blocks and wood beams.

Figure 16.
Supporting traditional wall for maintenance.

Figure 17.
Solid and void percentage of selected facades.

Figure 18.
Roofing system in the historic house.

From structure view, staircase, is the backbone of the building. Being rectangular stone walls with central column “*fahl el-daraj*” running vertically across the building height, it is considered as a main pillar. Whereas walls of staircase and external walls mutually support each other through the wooden beams.

5. Rawshan

One of the most noticeable elements in historical Jeddah architecture is the *rawshan* which covers large areas of the building's facade. As mentioned earlier, it is a large wooden structure with a recognizable latticed component. Some buildings are characterized by vertical *rawshan* that extends to 3–4 storeys (**Figure 19**), while others contain horizontal ones. *Rawasheen* are normally found projected about 60 cm and are fixed with the aid of wooden cantilever.

Rawshan has many functional and aesthetical roles in the building. Beside protection from the harsh climate and solar radiation, it provides a resting place for two persons lying full-length with the ability to watch outside without being noticed. This is consistent with the privacy values. The lower and upper stripes of the

Figure 19.
View of historical rawshan, Noor Wali house.

Rawshan are fixed wooden panels, while the middle contains shutters that can be lifted outwards and upwards to control the air to pass through creating gentle and continuous cross ventilation. The air passing through is employed to cool water contained in pottery grouped in identified place “*shurbah*”. Around the top of the *rawshan* there is an ornate projected unit called a *rafraf*; Its projection promotes casting shade on the higher section. Another latticed component, known as the “*ghula*”, is often hanging over the lower half of *rawshan* or windows to cover the interior spaces while the shutters are open providing additional privacy [19].

Rawshan provides natural gentle daylight with interesting patterns projected on internal walls and floors. Being finished with moderate soft colors that have a reasonable level of reflectance, *Rawshan* reduces glare in outdoor spaces caused by the building’s white walls. Colors reflection determines the amount of light that will be directed inside. Its projection helps to shade the building’s facade and the narrow surrounding paths.

Rowshan is also a flexible space that can be added to adjacent rooms. When necessary, it is flexible enough to perform the function of any type of rooms in the house. Too, activities taking place in a room can simply extend in *rawshan* as additional space (**Figure 20**). However, each *rawshan* is unique enough so that it is almost difficult to find two identical pieces in the whole area. There are endless varieties of sizes, shapes, treatments and organizations.

The indoor air temperature of two rooms with *rawshan* were examined from 5 to 31 August 2018. Rooms are typical, but one with opened *rawshan* and the other was closed. *Rawshan* could essentially regulate the indoor temperature during the high fluctuations. Median temperature in the rooms ranged between 32.3–38.4°C when the outdoor temperatures ranged between 30.9–48.7°C (**Figure 21**). Closed *rawshan* caused to delay heat transmission about three hours a day. But, when the *rawshan* was opened, the time regressed to one hour. The open *rawshan* allowed more airflow which mostly alleviated the rise of temperature. Similarly, night ventilation decreased the indoor air temperature assisted to decrease and postpone reaching peak time of temperatures in the space. Notably, these results are with the contribution of building’s total thermal mass [20].

Results confirm that the relative humidity declines as air the temperature escalates and vice versa. Due to airflow into the room with opened *rawshan*, it lowered more heat acquisition and permitted relative humidity more than the room with

Figure 20.
Different functions of rawshan in the inside space.

closed *rawshan*. Air velocity was measured at 0–8.1 m/s in the outdoor, 0 to 6.9 m/s in room with opened *rawshan*, and 0 to 1.1 m/s in room with closed *rawshan*. The highest frequency of air velocity values measured were found to be (2 m/s - 18.27%)

Figure 21.
A comparison between ndoor and outdoor air temperature during the investigated period.

Figure 22.
Air movement through rawshan, opened (above) and closed (down).

Figure 23.
Daylight factor and daylight level of examined single glaze, closed venetians and rawshan.

in the room with open *rawshan*, (0.5 m/s - 28.9%) in the outdoor and (0 m/s - 90.44%) in the room with closed *rawshsan*. Simulation by ANSYS R19.2 software proved comparable results (**Figure 22**).

The effects of *rawshan* on the performance of daylighting was examined with a computer model (Autodesk ECOTECT) to demonstrate its ability in reducing the glow of solar lighting in interior spaces. It was compared with closed venetians and single glazed windows of the same dimensions. *Rawshan* scenario proved efficiency on both daylight factor and daylight level (**Figure 23**) [21].

Rawshan is thus a passive mean that efficiently reduces buildings dependency on air-conditioning and artificial lighting and accordingly reduces energy consumption.

6. Gateways and ornamentation

Details used to reflect the social and economic strata of the residents. Beside richness of *rawshan*, this was also presented in gateways and ornamentation. Better houses usually have gateways with the finest elaborated woodwork. The principal external doors have two leaves. They are decorated with engraved panels; the right fold contains a smaller one “*khokhah*”. The gateway is topped by pointed or semi-circular arches decorated with different motifs (**Figure 24**). The gateway has two purposes; first, it identifies the social status of the owner, and second, it reaches to the *dehleez* leading to the reception hall while controlling field view to protect privacy.

External plaster, added to protect *Al-Mangabi* stone, was developed by adding decorative carving especially on the lower level of the building facades framing the main gateways and windows. Plaster was employed to the stone and instantly

Figure 24.
Main gateways with different levels of details.

Figure 25.
Level of details that reflect the economic strata.

carved while it is still wet. The plaster was profoundly engraved with ornamental geometric or floral designs which were cut so that the upper surfaces sloped downwards to ease water to run off the plaster. The technique was more laborious and more permanent. Again, richness of decoration (**Figure 25**) satisfies a basic human need of self-expression, being noticed, demonstrating the social and economic excellency which is a key ingredient of sustainability.

7. Underground water cistern

Although Jeddah does not get too much rain, but it is subject to serious seasonal precipitation. In the historical houses, rainwater was harvested and collected in

Figure 26.
Rooftop and underground cistern of Nasif house.

underground massive cisterns “*saharij*” with vaulted ceilings for domestic use along the following months. This system works only on gravity without pumps, only pipes from exposed roofs to a tank below. The rate of rain may be as little as 0.5 cm in some seasons, yet it was very necessary. However, family members used to clean up the roof at times when rain is expected in communal gathering known as favor “*faz^{ca}*”. The rainwater will be directed to the drainpipes that carry it to the lower tank (**Figure 26**). This water harvesting system does not then require pipes throughout the city. These underground cisterns were also found in non-residential buildings like the masjid.

Nowadays, the only reliable source of water for Jeddah is desalination which provides 972,400 m³/day for 3.4 million residents. Desalination processes cost the Saudi authority about 1.87 US\$/m³, at a total daily cost of 1,818,388 US\$. Only 2% of desalination cost is paid by the residents at a rate of 0.04 US\$/m³, while the rest is heavily subsidized by the government [22].

A recent study proves that rainwater harvesting is still feasible, and it can significantly decrease desalination cost if applied in each house. Relying on energy, and corresponding environmental impact, can thus be limited. The study illustrates that rainwater harvesting from rooftops can help reducing the effect of urban flooding and accordingly the amount of water emitted in the sea threatening the marine life. It can also reduce the possibility of raising water table which threatens the durability of buildings [23]. It is argued however that the water cisterns on the ground floor may have helped to cool the lower part of the houses [24].

8. Conclusion

The current work raises the efficient sustainability of historical houses that can alleviate relying on fossil fuel and corresponding negative impacts. Keeping in mind the inclusiveness of the concept of sustainability, it can enhance the performance of Jeddah's contemporary housing by considering the following:

Environmental issues: Shading in outdoor spaces and paths is a considerable objective; it can be provided by compact development which accordingly alleviate the impact of hot climate. Building configuration can also protect its envelop from overheating. Shading in open spaces and on buildings can be enhanced by projected masses. Likewise, enhancing air movement through the urban tissue is an effective way for creating comfortable outdoor spaces. Also, the natural ventilation for inner spaces of the houses can reduce air temperature and humidity. Passive tactics for

promoting shade and natural ventilation, like “*rawshan*” and air shafts, can be examined, simulated and efficiently developed. Too, paths width to height aspect ratio and orientation is a vital tool to control both shading and natural ventilation in outdoor spaces. Research identifies the direction of N-S, NW-SE, E-W as the most appropriate, in association with aspect ratio of 1/2.5.

With the abundance of contemporary building materials, some traditional materials, like “*Al-Mangabi*” stone, continue to prove their efficiency in meeting the harsh environmental conditions. Making use of the properties of such materials, especially the thermal resistance, can inevitably open the scope for more sustainable products and applications.

Rainwater harvesting from rooftops is a feasible approach that can alleviate relying on desalination and reduce the effect of urban flooding; both have serious environmental impacts.

Social issues: Local culture, customs and traditions and religious teachings are inherited in Arab communities and mostly reflected in historic houses. Privacy suggested hierarchical open space system with tiny areas for women and children, private entrance and separate section for women in the house, and special treatments for windows, openings as well as balustrade to protect the family from strangers’ eyes. Hospitality advocated fancy gates and spacious reception room for guests. Humility promoted simplicity and abstraction.

Economic issues: Feasibility and economic vitality are a main driver for society. In the historic house, spaces were rationally tailored, flexibly used and incrementally extended to meet family needs. On the urban level, mixed use, and corresponding active trade movement, brought vitality and safety for outdoor spaces. Not contrasting with humility, ornamentation demonstrated the distinction of economic classes.

The discussion herein does not mean to replicate the historical houses but to benefit from sustainability values inherited in. Historical houses were formulated affected by several environmental, social and economic forces. It is important to understand which of these forces are still acting and which are vanishing. In contemporary housing, the reflection of continues forces can be developed in the light of present knowledge.

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Author details

Maged Attia
Faculty of Architecture and Planning, King Abdulaziz University, Jeddah,
Saudi Arabia

*Address all correspondence to: mattia@kau.edu.sa

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