The ancestral urban and architectural practices, a source of inspiration towards a sustainable city:Case of M'Zab Valley Ksour

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Abstract

In the hot and arid regions of southern Algeria, and since the past there are Saharan cities, which necessarily rely on their logic of Organization and development. These are considered as an important space to adapt to the harsh climatic conditions of the Saharan environments. However, these oases recently witnessed major changes; they are characterized by its fragility and its limitations to accommodate a surplus of human settlements. These changes can lead to a risk in destroying the image of these cities. To do this, the concept of Sustainable Development is becoming an integral part of the planning practices adopted by human beings. On the other hand, despite the anarchic nature of Algerian cities, several traditional practices have been made to adapt to the spatial and environmental. The M'Zab Valley is one of the existing examples of oases cities that give us a lesson in urban planning and architecture. The Valley contains Ksour with their palm groves, which introduces its logics of adaptation to the local context through local knowledge with implication of the human-culture-climate. Thus, this study focuses on shedding light on the ancestral urban and architectural practices adopted by local people to adapt to severe social, spatial and climatic requirements. The study is based on an analytical approach that focuses on observations of urban and architectural development and planning methods in the M'Zab valley to draw lessons to be learned in order to face the major challenges of the era.

1. Introduction:

Since his appearance on earth, man has always sought to achieve optimal comfort in his living environment. Architecture, with its practices, has always helped human beings to adapt to social, spatial, and environmental conditions in its living environments regardless of climate. It is well known that southern Algeria is one of the hottest lands in the world. Climate has been the main environmental factor that has influenced the evolution of vernacular settlements and building design over time (Bouchair, 2003). For this, the developments of human settlements were made in the form of Ksour (Ahriz and al, 2017). These have been used in Algeria's hot and dry climate in response to harsh local environmental conditions. They built to make the most of the resources available locally to ensure pleasant living conditions for humans. The well-known Ksour in the Algerian desert are the Ksour of M'Zab (Ghardaïa, Melika, Béni Isguen, Bounoura and El Atteuf), Ouargla's Ksar, and the Ksour of Djanet (El Mihan, Azelouaz and Adjahil) located in the Wilaya of Illizi and the Ksar of Knadsa in the Wilaya of Béchar (Bouchair, 2013). The Ksour of the M'Zab Valley are one of the best examples of Saharan cities with these practices adopted since their construction. The Valley contains ksour with their palm groves, introduces its smart logics of adaptation through local know-how with interaction: man-culture-climate. Moreover, in the Ksour of the valley, Oases play a major role in dealing with climate conditions. These oases present a typical model to adopt to meet the local requirements of hot and dry Saharan cities. However, in the early stages and as the modernization that shook our cities with unnatural profound changes in these spaces justified by

major urban growth which endangered the survival of these oases. Knowing that the oases with these palms are considered fragile and sensitive environments with its limits and specificities where constraints to development and development are difficult and objective, because inescapable: the rigor of the climate, water scarcity, vast deserts, difficulties of displacement... etc (Bouchair, 2015). In recent decades, the sustainable development approach has become very important in the construction sector. It aims to create healthy cities, respectful of the environment and local traditions at a lower cost, while maintaining comfort conditions for the user. Numerous studies have been conducted on this subject and demonstrated the usefulness of learning from traditional practices and local know-how adopted by our ancestors as a means to ensure the survival and sustainability of these specific environments.

Thus, this work sheds light on the urban and architectural ancestral practices adopted by M'Zab people to adapt to severe social, spatial and climatic requirements. The study is based on field observations and urban and architectural analysis of the M'Zab Valley either in the Ksar space, or in the palm groves, to learn lessons to be taken to address the current major challenges of the era and how to address existing environmental variables such as hot winds, high temperatures and very low humidity, to adapt to the inhospitable conditions of the arid environment. So the object is to open a debate on how ancestral practices can be a reference to ensure the development of Saharan cities through these Oases?

2. Method:

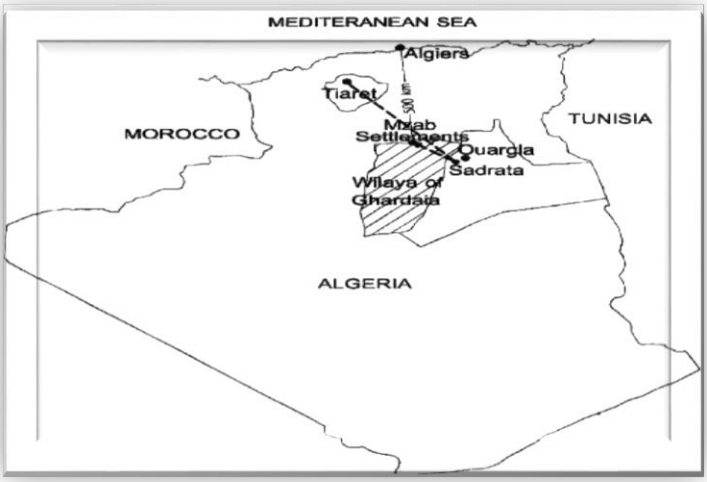
The method of investigation developed in this study corresponds to an analytical approach that is based on field observations, collecting real data with taking photos to get better understanding the practices and ideas, which addressed by M'Zab people in the development of its Ksour. Also, it was based on previous research on this subject, with data taken from the inhabitants of the Ksour of the M'Zab Valley. The objective of this analysis is to collect data on the ancestral practices by the inhabitants of the M'Zab Valley at the urban and architectural status which made to develop Ksour that ensure a comfortable way of life that adapts to the requirements imposed by local climate conditions through using available means.

2.1. The M'Zab Valley: a duality between city and oasis:

2.1.1. The Oasian space: The Ksar, the palm grove two complementary entities:

The M'Zab valley, 25 km long, is located in a desert site 600 km south of Algiers, is a limestone plateau cut into valleys and ravines in the form of a net: the Mozabite chebka (Fig.1).The geomorphological complex in which the M'Zab is located is a rocky plateau: the Hamada, whose altitude varies between 300 and 800 m (OPVM, 2018).Like the Saharan oases, the M'Zab valley, an autarcic entity, has always been an integral part of an agro-system, based on the water/habitat/palmeraie triptych. It is a geographical entity and a particular cultural fact.

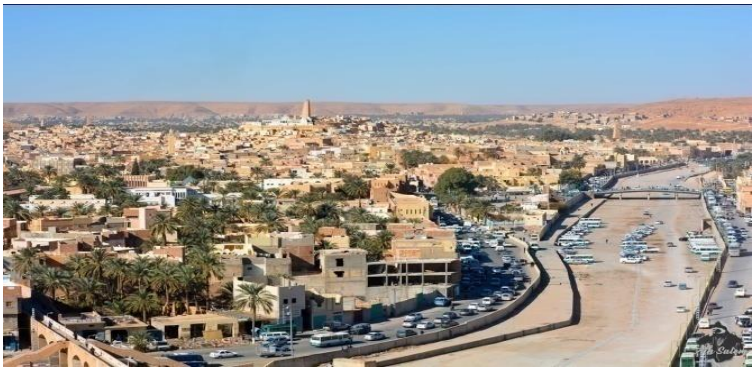
Fig.1: Geographical location of the M'Zab valley



Source: (Bouchair, 2015)

The Oasian space consists mainly of palm groves and ksar. The latter, as a symbol and physical result of the social organization typical of Saharan society, remains a secure heritage wealth of southern Algeria (Fig.2).These urban entities of great architectural and urban quality, and whose historical, artistic and cultural value is undisputed, have gone through centuries to fail today on the shore of rampant urban growth (Chaouche, 2007).

Fig.2: Photo showing the ksar and the palm grove of Ghardaia.

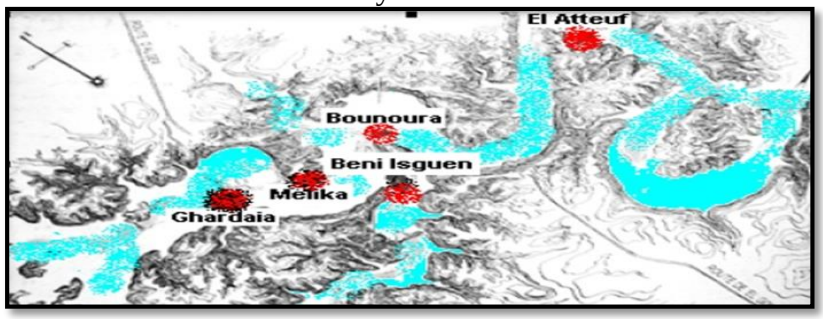


Source: (OPVM, 2018)

2.1.2. Composition of the M'Zab Valley and structure: 7 Ksour

Seven ksour form the M'Zab Valley, five are located on the banks of the Oued M'Zab and form what is commonly called the M'Zab pentapolis (Ravéreau, 1982) consisting of Béni-Isguen (1347), Bounoura (1046), El Atteuf (1012), Ghardaïa (1053) and Melika (1124). (Fig.3)

Fig.3: The position of the five Ksur of the M'Zab valley.



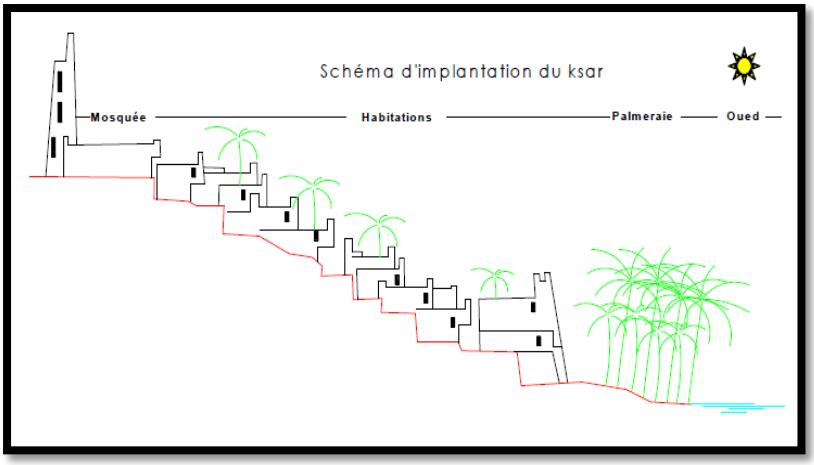
Source: (OPVM, 2018)

3. Urban practices in the M'Zab Valley:

3.1. Compacity of the urban fabric:

The principle of urbanization of the M'Zab Valley is linked to the concept of Ksar, which is the mode of settlement aggregated on a piton around a mosque (Fig.4).The perspective image that the city of M'Zab offers to the eye is that of a built mass mounted on a rocky piton, which imposes itself by its tight order composed of houses clumped harmoniously storied in terraces (Chabi, Dahli, 2013).The soils at the bottom of the valley, criss-crossed by the wadi's courtyards, are used for vegetation and the development of oases (palmeraie).

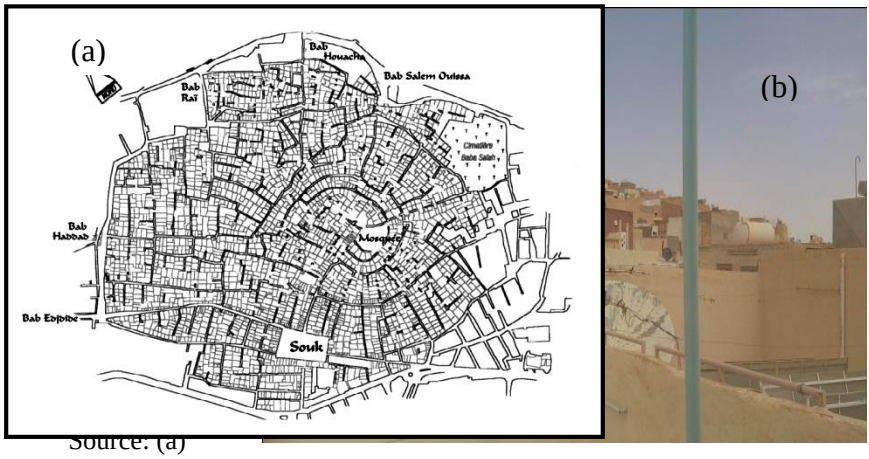
Fig.4: The layout of the Ksar



Source: (Chabi &Dahli, 2013)

By its scheduling, the valley has a principle of urban organization with a compact plan with narrow alleys (Donnadier &Didillon, 1986).The compactness of the urban fabric presents a good solution to reduce excessive heat in hot and arid climates as it reduces the exposure of outdoor surfaces to intense solar rays (fig. 5).

Fig.5: (a) Spatial organization of the old ksar of Gharda ïa, (b) View of B éni Isguen's Ksar from the terrace of the house.



Source: (a) (Adad&Mazouz, 2013); (b) (Author, 2018)

3.2. Streets as a way to control excessive outdoor heat:

The buildings are grouped with narrow, winding streets to reduce the effect of stormy winds and establish a shady space throughout the day (Fig.6).In a hot and dry climate, this model offers a cool and comfortable microclimate that would remain relatively warm during cold nights. The main objective of street development is to provide maximum shade in the summer for pedestrians and minimal solar exposure of buildings along the streets, (Bouchair, 2013).

Fig.6: The deep shading canyon in different Ksour

Source: (Author, 2018)

Source : (Author, 2018)

3.3. The palm grove as a major environmental component of urban design:

The palm groves are located close to the cities (Fig.7), and equipped with the basic means of defense that constitute the control towers that allow warning the city. All include numerous hydraulic structures, dams, foggara, wells and seguia. These oases tend to become real cities of second homes (OPVM, 2018). From an analytical point of view, the former inhabitants did not depend on the palm grove as an economic resource, but

also as an important element of urban design, as a significant percentage of Ksour built on the end and edges of the palm grove. In these oases, there are summerhouses from which the inhabitants of Ksar own a winter house inside the Ksar and a summer house in the oases. When these spaces are characterized by their fragility, our ancestors made a specific layout in these spaces with the existence of water, vegetation.

Fig.7: overview of oasis in the M'Zab valley, Algeria

Source: (Author, 2018)

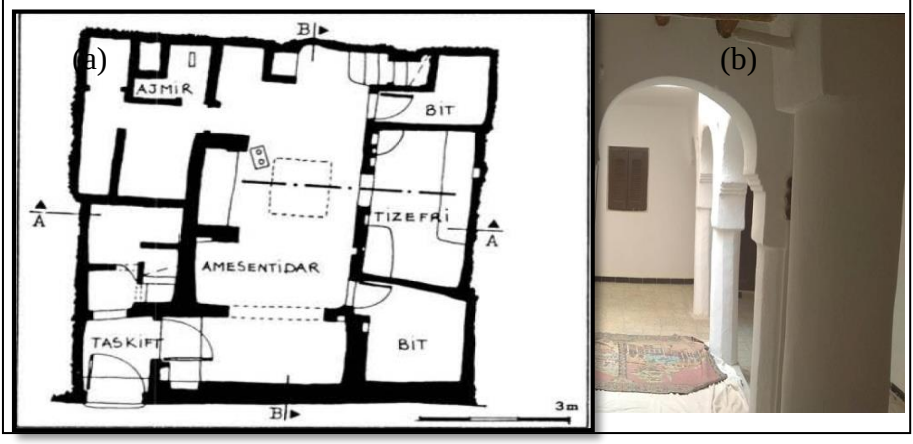
4. Ancestral practices to manage the interior space:

The Mozabite House is characterized by its simplicity and functionality devoid of any superficial decoration; it must not include any external sign of wealth as a principle of equality and social solidarity. The house of the M'Zab corresponds to the type "patio house".

4.1. Patio house:

This method of building is very common in this type of climate since the patio has several climatic roles, from which it lets the house ventilate at night (Fig.8). After sunset, temperatures drop dramatically and create convection currents that replace warm air with fresh air (Bouchair, 2013).

Fig.8: (a) Plan of a Mozabite house with patio; (b): overview of the patio



Source: (a) (OPVM, 2018); (b) (Author, 2018)

4.1.1. Chebek:

It is a large opening overlooking the outside. It is a hole in the ceiling that plays the role of an element of lighting and ventilation and sunshine. It can be opened or covered with a canvas as needed (Fig.9). It has a rectangular shape and it is usually located above the central position.

Fig.9: (a) overview of the "Chebek" from the terrace, (b) overview of covered Chebek "patio" at house in Béni Isguen.

Source: (Author, 2018)

4.2. The roof terrace:

In the accommodation, the family uses the roof of the house to sleep outdoors during the summer nights. The roof is used to sleep because the rooms stay warm at night because of the small ventilation (Bouchair, 2013). Or there are two kinds of terrace, one that communicates directly with the nearby terraces, and the other marked by a slight survey of masonry, and doors that allow communication with the other houses. It is a women's space (OPVM, 2018).

4.3. Building materials:

The dwellings are built with thick walls of high thermal capacity, from locally available materials, such as stones, mud and lime (Fig.10).

Fig.10: (a) adobe wall; (b) Stone vault with Timchent and trunks of palm in B ńi Isguen

Source: (Author, 2018)

5. Synthesis: The M'Zab Valley: Association of Human-Culture-Climate:

Indeed, the establishment of the M'Zab valley assumes the challenge of making such an environment livable, a management of space and a specific architecture that can materially translate the complex structures of Mozabite society, its way of life and its thought. Some principles can be cited:

1/The founding group chose a site according to the availability of water resources, a condition that ensures the creation of essential palm groves for human installation and the starting point of the oasis.
2/The size of the ksar and the importance of its built space depend on the nourishing capacities of the soil. When it is able to develop to receive the population growth, the ksar multiplies; some writings also tell that once the population growth exceeds the capacities of the mosque, it is necessary to build another one at the top of a hill and to start building a new city around it.

6. Conclusion:

The urban and architectural practices identified in the ancient Ksour of the M'Zab valley present alternatives to meet the social and cultural requirements of the Mozabite society, but also, obstacles of hot and dry climate. Indeed, the ksour development approach presents a promising approach that can be adopted to address the problems of sustainable urban development. The inspiration of the ancient Ksour practices is considered as the best example to manage and develop the Saharan territory without taking risks to the sensitive and fragile spaces of the desert, namely the oases. Also, The Ksour of M'Zab Valley gives us good lessons on how to treat a territory to better manage the space in terms of construction, benefit from natural ventilation, design with local means and materials by introducing the local solutions, to assist a quality living space; economically efficient, socially equitable and ecologically tolerable. These practices can be summarized in the following points:

- Compactness of the urban fabric is the best way to manage the harsh conditions of a hot arid climate.

-Reducing the streets' size with sinuous shape and proper orientation to the dominant winds play a big role to improve urban thermal comfort.

- Oases affect our climate, and therefore our weather, in three major ways: they lower temperatures, reduce energy usage and reduce or remove air pollutants, and the principles: water, palm trees are a very prominent solution in summer homes.

- The palms present a viable solution to cool the hot air. They control the prevailing winds, high temperatures, plus it is considered a food source.

- The patio plays a major role in shading the surfaces and decreasing their surface temperature and heat gain compared with the exposed surfaces.

-The use of local materials in the construction is an effective way to achieve optimal indoor thermal comfort.

Through this study, we can conclude that ancestral practices and local knowledge can be a viable and effective source of inspiration for ensuring the sustainability of Saharan cities. In these conditions, the tree and patios owe its survival to its suitability to the climate which in turn reduces fuel use and makes pollution control easier because it reduces energy consumption. Future research might investigate the old building with reference to new buildings which can help the architects and urban designers to learn from the past to develop our future building design.

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