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JOURNAL	International Journal of Innovative Technologies in Social Science
p-ISSN	2544-9338
e-ISSN	2544-9435
PUBLISHER	RS Global Sp. z O.O., Poland

ARTICLE TITLE	URBAN SUSTAINABILITY IN ANCIENT OASIS CITIES - THE CASE OF KSAR LICHIANA IN ALGERIAN DESERT
AUTHOR(S)	Abdelkader Merided
ARTICLE INFO	Abdelkader Merided. (2024) Urban Sustainability in Ancient Oasis Cities - the Case of Ksar Lichiana in Algerian Desert. <i>International Journal of Innovative Technologies in Social Science</i> . 2(42). doi: 10.31435/rsglobal_ijitss/30062024/8159
DOI	https://doi.org/10.31435/rsglobal_ijitss/30062024/8159
RECEIVED	15 April 2024
ACCEPTED	21 May 2024
PUBLISHED	23 May 2024
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URBAN SUSTAINABILITY IN ANCIENT OASIS CITIES - THE CASE OF KSAR LICHIANA IN ALGERIAN DESERT

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DOI: https://doi.org/10.31435/rsglobal_ijitss/30062024/8159

ARTICLE INFO

Received 15 April 2024

Accepted 21 May 2024

Published 23 May 2024

KEYWORDS

Sustainability, Sustainable Urban Planning, Ancient Oasis Cities, Ksar Lichiana.

ABSTRACT

The current research aims to determine the extent to which the cities of the ancient oases applied the concepts of sustainability in their planning dimension. To achieve this goal, the theoretical foundations of sustainable urban unit planning are identified, constituting the first part of the study. In the second part, the characteristics of the ancient oasis cities in the Ziban region, in the eastern Algerian desert, are highlighted, taking the city of Lichana as a case study. It then proceeds to analyze its urban principles and explore its planning vocabulary from the perspective of sustainability concepts, forming the final part. The research concludes that the cities of the ancient oases applied the concepts of sustainability early on in their planning dimension, within their three economic, social, and environmental pillars. The study breaks down these concepts by identifying the theoretical foundations of sustainable urban units, then examining the characteristics and planning vocabulary of a specific oasis city, Lichana. This analysis reveals that these ancient oasis cities integrated principles of economic, social, and environmental sustainability from their very conception.

Citation: Abdelkader Merided. (2024) Urban Sustainability in Ancient Oasis Cities - the Case of Ksar Lichiana in Algerian Desert. *International Journal of Innovative Technologies in Social Science*. 2(42). doi: 10.31435/rsglobal_ijitss/30062024/8159

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1. INTRODUCTION.

The vastness of the Sahara and the harshness of its climate did not prevent man from building for himself a suitable place to live in a hostile environment characterized by fragility, difficulty of living and the scarcity of factors that motivate survival, as is the case in the desert of Algeria, where man has suffered since ancient times from very harsh climatic obstacles, forcing him to adapt in these hot and dry environments and adapt himself to live according to what the surrounding natural environment provides, relying on his personal abilities to develop techniques to meet the needs of benefiting from the experiences and mistakes of the former, he established for himself entire cities within the palm oases that gave him stability and protection and flourished in them an integrated social, economic and environmental system characterized by sustainability and stability where the solutions were effective and interactive with the environment and the available resources and the needs of society (Oliver, 1997). Architecture anywhere is the result of the interaction between it and the environment in which it exists on the one hand and between it and the society that produced it on the other. (TARCHAOU, 2008)

From this standpoint, the cities of the ancient oases in the Zyban region of the eastern Algerian desert can be considered an example of the embodiment of sustainability, with its three environmental, social, and economic dimensions, which can be studied today in the light of these modern principles,

and their applications identified, especially at the level of the planning dimension, as the most important part that accommodates the urban and architectural dimensions.

1.1. Research Problem.

Sustainability is one of the fundamental issues that cannot be ignored by planners, urban engineers, and architects in developed countries, considering that the urban sector has significant effects on the environmental state of the planet, and therefore cities that are not properly planned or managed can become a burden on natural resources, as well as easily threatening both the natural and living environment (*State of the World's Cities 2008/2009 - Harmonious Cities | UN-Habitat*, s. d.). Its sustainability is therefore the cornerstone of the urban sector. Therefore, it must be emphasized that the concepts and applications of sustainability in the urban field have become more than necessary as they affect all levels of urban planning, starting from one building to the neighbourhood to the city and even the entire urban area, that this concept is not new and innovative, but it is an old concept embodied by the architecture in the old desert city, especially in the oasis cities in the Algerian desert regions and at various scales according to a cumulative process, which recent studies have proven the extent of its validity and effectiveness. Hence, this research paper came to discuss planning sustainability and its applications in the urbanization of the cities of the ancient oases, by identifying the theoretical standards of planning sustainability as defined by scientists, and then clarifying how to apply them in the cities of the ancient oases, to benefit from them, employ them and integrate them into the urban structure of the modern desert city.

1.2. Research Objective.

The research aims to recognize the extent to which the cities of the ancient oases apply the concepts and principles of sustainability in their planning dimension, to be an entry point for deriving planning standards that can be considered as a reference, after developing them to help both planners and decision makers to integrate and employ them in the urban structure of the modern desert city.

1.3. Research Methodology.

This research paper relied on the descriptive analytical approach, where this study sought to review the theoretical foundations of sustainable urban units, and analyse their principles, especially in their planning dimension, as the most important part of absorbing the urban and architectural dimensions, as well as to identify the urban characteristics of the cities of the ancient oases in the Zyban area in the eastern Algerian desert, and then analyse its principles from the perspective of sustainability principles, so the structure of the research is as follows:

- Identify the theoretical foundations of planning and design for sustainable urban units.
- Identify the urban characteristics of the ancient oasis cities in the Zyban region, taking the city of Lichiana as a case study.
- Assessment of the sustainability features of the planning dimension in the ancient oasis cities of the Zyban region.

2. THEORETICAL FRAMEWORK.

theoretical foundations of planning and design for sustainable urban units to be able to derive the principles and foundations of urban formation in the cities of the ancient oases, especially in the planning aspect, and evaluate them from the perspective of sustainability, it is necessary to identify the theoretical foundations of planning and design for sustainable urban units, starting from the concept of sustainability to the concepts of planning and design in sustainable urban units.

2.1. The concept of sustainability.

Sustainability as a new concept emerged at the beginning of the second half of the twentieth century, and its ideas began to spread since the publication of the report of the Brudtland Our Common Future, prepared by the World Commission of Environment and Development in 1987, where it first defined "*meeting the needs of present generations without compromising the ability of future generations to meet their needs*" (ARE, 1987), and then this term gained great global attention and began to impose itself on the global scene and in all fields at the beginning of the twenty-first century, where I found many and varied definitions according to the diversity of disciplines and fields, the most

important of which is "development and improvement in the quality of human life in light of living within the limits of what the ecosystem and ecosystem accommodates" (UNEP et al., 1991), and another definition considers it "the optimal utilization of available resources and potentials, whether human material or natural, in an effective and environmentally and physically balanced manner, to ensure the continuity of sustainability without wasting the gains of future generations", (Ritchie & Randall, 2009). Therefore, we can say that the main idea of sustainability revolves around an attempt to provide the best results for both humans and the natural environment to ensure the continuity of sustainability, through the optimal use of available resources and within the permissible limits in the present and in the future.

Since the urban sectors are one of the main consumers of these resources on the one hand, and the construction and building processes result in many pollutants and waste that harm the environment, on the other hand, it has become necessary to give great importance to these sectors and subject them to the principles of sustainability, starting with the planning process and then urban and architectural design.

2.2. Planning Concepts for sustainable urban units.

Achieving urban sustainability at the planning scale requires working to achieve a set of standards, as indicated by many studies on the subject and confirmed by a group of international organizations specialized in the urban field, including the Organization for Economic Cooperation and Development (OECD) and the Economic Commission for Europe (Næss, 2001). It referred to a set of basic criteria including:

- Reducing energy consumption per capita to a lower level in line with the environmental standards of sustainable development in force globally.
- Reduce the conversion and consumption of natural areas and encroachment on ecosystems, and reduce the use of building materials harmful to the environment.
- Ensuring a healthy urban environment in the city free of pollution and noise, while ensuring the presence of green areas sufficient to communicate with nature.
- Replacing excessive consumption of sources and reliance on local recyclable sources.

As for successful models in this area, as identified (Condon et al., 2002) which is a guide to sustainable urban sites design for British cities, which adopts the methodology of applying the principles of sustainability in the process of urban planning and design, as it depends on the activation of these principles at all levels, namely the area (neighbourhood or basic unit of local administration), plot: (It is part of the neighbourhood or residential neighbourhood), Plot: (It is the smallest spatial unit in the urban fabric), and tracks: (which represent the basic spaces used for population movement).

The elements of sustainability applied at these different successive levels include four main elements: Includes a set of sub-criteria as defined in the manual. (Condon et al., 2002)

❖ **Green infrastructure element:** It means the mechanism in which nature overlaps and integrates with the construction community, and includes a set of sub-criteria, including the preservation of areas of high environmental quality, the preservation of biodiversity areas and water bodies, and the coordination of streets, gardens, parks, and pedestrian roads.

❖ **The element of community structure:** By community structure, we mean all facilities and structures built in the urban area, it includes both the quality of public facilities and services to respond to the needs of the population, and the availability of adequate housing in various formats and for all segments of society, recreation and recreation areas, and cultural and urban centres, to integrate these functions to respond to the needs of the population, and the more these facilities are working properly, the healthier society will be.

❖ **Movement systems element:** It means the smooth flow between activities and places to ensure the continuity of life and includes the Hierarchy of roads, traffic flow, availability of safety, privacy, the efficiency of public transport, and visual formation of roads.

❖ **The cost element:** sustainable communities are economic societies that depend on the local economy. Above all, a sustainable economy ensures equitable access to services and close housing employment opportunities for all residents at the same costs to ensure social justice and benefit from local and renewable resources.

Table 1. Criteria for assessing sustainability on the scale of urban planning at different levels.

Community Structure	Green Infrastructure	The Movement	The Cost
Availability of adequate housing	Green Spaces	Road check hierarchy	Equitable availability of services
Quality of public facilities and services	Conservation of natural resources	Traffic flow, availability of security, and privacy factor	Availability of job opportunities close to housing
Cultural and urban centres	Biodiversity	Public transport efficiency	Utilization of renewable sources and local resources
Availability of recreation areas	Rainwater harvesting	Optical modulation of roads	Utilization of rainwater and groundwater

Source: (Condon et al., 2002).

3. ANCIENT OASIS CITIES.

3.1. General introduction to the network of Zyban’s cities.

The Zyban area is part of the low desert located in The northern part of the eastern Algerian desert, which is confined between the Saharan Atlas range and the Zyban Mountains in the north, Oued Djeddi “Djeddi River” and the borders of the state of Oued Souf in the south and the Aures Mountains in the east, and the borders of the state of M'sila in the west, and represents the largest part of the state of Biskra, and thus it connects two distinct ranges: the mountain masses of the Aures in the north and the low desert in the south, so it represents morphologically and climatically a transitional zone between the south and the north, this location gave it the indication of "the gateway to the desert “Geographically, the Zyban region is located between latitudes 34.38 degrees and 35.5 degrees north and between longitudes 4.56 degrees and 5.35 degrees east and is 450 km southeast of Algeria from the capital, and the Zyban region is full of a group of ksour form the region covering a significant area of the state of Biskra, which is one of the largest oases in the Algerian desert, palm oases represent the element of urban distribution of the Zyban, as they contributed to the creation of urban agglomerations small in size, independent and self-sufficient from Economically and socially adapted to its environment (ALKAMA & TACHERIFT, 2001) .It consists of two different units, the first is located in the western side of the city of Biskra and is called the Western Zab which is controlled by the city of Tolga, and the eastern Zab oasis which is located on the eastern side of the city of Biskra and it is controlled by the city of Sidi Okba.

3.2 Ksar of Lichiana as a case of study.

Located in the western Zab of the Zyban region, next to the city of Tolga, the capital of the region, the Lichiana is considered a model of architecture and urbanism in the region it is characterized by the following urban characteristics:

❖ **The shape of the urban fabric.** It is characterized by a compact urban fabric integrated with the middle of the palm oases, and it has an oval shape with a mosque in the middle and a market accessible from various sides; they are considered the two structural elements of the urban fabric and the movement of the ksar where all the streets go to it, and it is interspersed with narrow, winding, and sometimes covered corridors intersecting with a group of squares and small spaces, and it is also characterized by regularity in the form of its housing, which mostly takes the shape of a square and rectangular, and are diverse in size and have two floors in most of them, where the urban fabric consists of five neighbourhoods or adjacent lanes, which are inhabited by a group of families Brought together by blood and kinship relations, the Ksar is entered through four doors which lead to the main roads that extend to the mosque and the market in the centre of the Ksar.

❖ **Paths and public spaces.** where a network of diverse and narrow paths branches in its fabric, It is characterized by a hierarchy from the general to the private, we find the main streets, which are

relatively wide, and they have an east-west or north-south direction, while the corridors are the narrowest paths and are mostly covered, and a group of squares called Al-Rahbat are distributed over the lanes;

❖ **Public equipment and housing.** The mosques in the Ksar are distributed across the neighbourhoods and some of them follow Quranic schools locally called “zawiya”, the most important of which is the mosque that is located in the centre of the Ksar next to the market, as for the residences, the Ksar consists of about three hundred houses adjacent to each other, as most of them have only one semi-solid façade with small-sized openings dedicated to ventilation, and they are in the form of residential groups that are neighbourhoods or lanes, based on the principle of stacking and joining to reduce areas exposed to the hot falling sunlight and provide shade on the one hand and to indicate the extent of cohesion in social relations on the one hand. Other, where it is characterized by its regular shape and small area, and consists mostly of two floors, the ground floor contains the centre of the house, which plays the role of regulator of movement between fields and practices various family activities, and contains a large square opening in the ceiling called Al-Rozanah (lucarne) and its role is to provide lighting and ventilation, and it also contains the reception room known as the guest house, along with the kitchen known as “cannon” (Hearth), and some other rooms, while the upper floor contains two rooms at most and the roof. As for the materials used in construction, they are local materials represented in bricks, lime, stones, trunks, and palm fronds, all of which are natural materials extracted from the site.

4. ASSESSING THE URBANIZATION OF OASIS CITIES FROM A SUSTAINABILITY PERSPECTIVE.

4.1. Green Infrastructure.

For green infrastructure, we will address it according to four important sub-indicators related to the green element, the preservation of natural resources, biodiversity, and finally the preservation of water resources as a vital resource in the desert.

❖ **Green element or green spaces.** We note that the green element was included from the beginning as an important element in the planning process, as the principle of the duality (Ksar-oasis) was adopted as a mechanism for the reconstruction process in the desert, reconstruction cannot have a place without its association with the green element, which constitutes an element of life, protection, and continuity, and the first man understood this and his body through his first creations represented in the oasis with its unique system that created a liveable medium, as most of the desert oases as in the Zyban region were established based on the trilogy (water - housing - palm grove), which constitutes a homogeneous and interconnected compound of During the use of the local material represented in the palm tree, in addition to its multiple environmental roles that improves the local climate, it is used as a basic building material with all its components from the roots to the newspaper, in addition to its economic benefit, which is a major integrated foodstuff.

❖ **Conservation of natural resources.** We note that the water and agricultural land components represented in palm groves Nurseries and farms located in the vicinity of the old nuclei and inside them, the local people paid the utmost attention because of their great importance, as their importance lies in relying on them as a main food element, providing the city with agricultural products to meet the needs of the local community in addition to its aesthetic and environmental importance, as it works to improve the climate, and it is a source that can be exploited for recreational purposes, and therefore we find that local communities understood this well and paid the utmost care in how to preserve it as a major element integrated with the city, where It represents a future wealth that secures the needs of society due to its many environmental, social, economic, and even aesthetic and recreational effects.

❖ **Biodiversity.** We note that the integration of the house and garden planted with palms and fruit trees, whether existing Within or around the Ksar boundaries represented in the duality (Ksar-oasis), gave the best environmental duality to deal with the natural environment and the urban environment as complementary to form the character of the city, the integration of the green element as a mechanism for the reconstruction process in the desert created that liveable medium because of its environmental, social and economic advantages, and created that communication with nature, which contributes to the preservation of biodiversity, and all this is at the heart of the principles of sustainability.

❖ **Conservation of water resources.** Man in the desert knew the value of water and created a strict management system It can be distributed rationally without waste or waste and according to the available quantity, as force was used in the Zyban area as a very sophisticated distribution system, where water is divided among farmers by division without waste, and according to thoughtful planning

concerned with the various stages of distribution and the smallest details includes even timing, where irrigation operations are programmed in the evening or at night to avoid evaporation, this system, which is provided by forced within and for centuries of time water for hundreds of oases and successive generations, is an agricultural system that depends on use Rational water and land up to the choice of types of agriculture known for their drought resistance represented in palms.

This is evident in Ksar Lichana, where we find that there is a good organization to preserve water resources, including the exploitation of rainwater on its scarcity and water sources, by extending covered or exposed ground waterways towards the palm groves surrounded by the Ksar, where this away water was brought through covered and exposed waterways in an orderly manner, where it is exploited and distributed rationally that does not allow it to be lost.

4.2 Community Structure.

We mean all facilities built at the urban level, including residential units, equipment, and service, commercial and recreational facilities, which meet the needs of society efficiently due to their direct relationship to human life, and aim to achieve human priorities of health and safety, meet his multiple needs, and provide him with comfort and stability (Condon et al., 2002), at the level of the ancient nuclei of oasis cities in the Zyban region, especially at the level of ksar Lichiana, we can address the societal structure according to four important basic indicators:

❖ **Quality of public facilities and services.** At the planning level of these ancient cities, we note that the mosque is considered among the public facilities built in the city and is considered as the basic nucleus of planning, as it was the first to be planned in the city and then planned around it all the plans of the other city, where the city is in the middle and all the streets end withit, to be close to all neighbourhoods and easy access to it from various sides due to its close relationship with residential areas, where it plays a key role in the life of society, in addition to its religious function it was a centre for researching political and social affairs in addition to its educational and educational role, as the mosque is considered as an institution Religious and social play a key role in building society and activating social relations between the residents of the same neighbourhood, as well as monitoring these activities and ensuring their compatibility with local customs and traditions (TARCHAoui, 2008).

❖ Therefore, mosques have the greatest impact in achieving the idea of social sustainability due to the diversity of social segments that attend mosques collectively and at all times of the day, to contribute to achieving the required social interaction and strengthening social relations at the level of individuals and groups (Al Ahabbi, 2010). As for the presence of markets and commercial streets, it is considered one of the most important planning elements that have been associated with the population and the human being in the city, as it is concentrated in the centre and the main streets according to a precise system of planning, providing easy access and smooth movement. These markets and commercial streets are the lifeblood of the city, and promote the cycle of local production, which relies mostly on local products and goods produced in the oasis, stimulate social inclusion, and responds to the needs and demands of citizens, all of which are at the heart of sustainability principles.

❖ **Cultural and urban centres.** In addition to mosques and their religious and social role, schools were established next to Libraries, which are of great importance in the social and cultural life of the population, which has reached the highest level of organization and management, which is reflected in performance and educational achievement. Where the great scholars in the region graduated from it and left a great legacy of books and manuscripts that were available in libraries, which remain preserved in the corners to this day, in addition to that, some other civil facilities were established such as Baths for public service, whose function was associated with Islam's call to cleanliness and purification, as well as facilities that were called hospitals to provide therapeutic and medical services, within the framework of the unique endowment system that helped to establish these facilities and maintained the performance of their functions and their continuation independently, and thus secured the needs of society efficiently

❖ **Availability of entertainment and recreation areas:** these are represented in public squares, gardens, and palm groves, which it has multiple functions, including public squares next to the mosque, whose main function is to practice collective and mass activities, whether religious, social, or even commercial, which makes it a place for meeting and social interaction, in addition to palm groves, which are considered as green spaces that are considered natural areas designated as a place for recreation and entertainment, in addition to their economic role, as it is considered a suitable place for the rest of the residents by moving away About the noise of the city, its tranquillity, the purity of its air and the

gentleness of its atmosphere, and thus it is a preferred, convenient and comfortable place for the lives of residents.

❖ **Availability of adequate housing.** As for housing, it is considered one of the primary objectives of the ancient oasis cities, It acquired a large percentage of the Ksar area, estimated at 84 percent at the level of Ksar Lichiana, and it represents a pillar and an essential component of human life within the Islamic teachings, as it provides a decent and healthy life, as well as guarantees him tranquillity, security and privacy, as he opted in the initial planning process the principle of providing housing for all groups and segments, through overlap and mixing in different types and sizes, with an increase in structural density to achieve social mixing, it is noticeable that it is among the most important features of planning in the fabric The residential neighbourhood in which the poor and the rich live side by side in a residential neighbourhood inhabited by a homogeneous community whose members have religious, ethnic or professional ties, and they have a strong sense of group cohesion and respect for the mutual duties and obligations between them, and thus consider the housing unit as a social unit by providing its residents with a sense of social and security independence on the one hand, and participation in the social and economic affairs of the city on the other hand" (Al Ahababi, 2010). Which ultimately gave urban privacy and sustainability based on a set of principles: providing housing for all groups, social solidarity in building housing and traditional ownership of land as a social resource Which ultimately gave urban privacy and sustainability based on a set of principles: providing housing for all groups, social solidarity in building housing and traditional ownership of land as a social resource.

4.3. Movement systems.

The movement systems in the ancient nuclei in the oasis cities, which include paths or movement corridors, which represent the basic spaces in which the vital currents necessary for urban life are transmitted, have been subject to several considerations and regulatory rules derived from the teachings of Islam and the prevailing custom and compatible with the climatic factors of the surrounding environment, and include four basic indicators:

- **Hierarchy of the road network.** One of the considerations on which the design of streets in the cities of the ancient oases was built, was the gradation in the spaces, starting from the external gates of the city to the streets and alleys inside them according to a methodology that would provide privacy and security, as these paths came as a result of interaction with the social environment, as well as interaction with the data of the natural environment, so it achieved protection from harsh climatic elements, allowed more natural ventilation and shading, and created a suitable and comfortable local climate, achieving physiological and psychological comfort for the residents, who are Sustainability Principles.
- **Traffic flow, the availability of the safety and privacy factor.** The movement flows through the ancient oasis cities, as we observe in Ksar Lichiana, starting from entry through the large doors through the main streets leading to the large square of the mosque and the public square, and this is due to the hierarchy and hierarchy from the street to the alley to the path according to a hierarchy that extends from the public sphere to the semi-public to the private sphere, achieving the principle of traffic flow and ease of access and providing the factor of privacy and security
- **Transport efficiency.** We note that the planning system of the cities of the ancient oases revolves around pedestrian paths within a contiguous fabric that reduces walking distances, as it relied on pedestrian movement according to the needs of the population and the means of transportation used at that time, which controlled the process of establishing and planning the city, so the roads were commensurate with their uses according to a hierarchy from the street to the alley to the path, which responded effectively to the requirements of the population with high efficiency.
- **Visual formation of roads.** We note through the analysis of movement systems of the ancient oasis cities that the streets in the urban fabric are characterized by narrowness and zigzag according to space and they are covered alternately and partially, which made them divided into visual sections that allow remote vision, there is a stop, containment, and transition from one space to another, which made it achieve convergence and lack of a sense of boredom and visual pleasure, and these are all features of sustainability that today's cities lack

4.4. Cost.

We note that those in charge of the establishment and planning of these ancient old quarters relied from the beginning on strategies to exploit the potential and resources in the place, rationalize

their use, and reduce the waste resulting from their consumption, reuse, and recycling, and this starts from choosing the appropriate and sustainable site and preserving its resources through a set of conditions that had been summarized by Ibn al-Rabie (Muhammad Abdul Sattar, 1988), represented in the capacity of fresh water, the possibility of the derived Agri-food, the moderation of the climate and air quality, proximity to pasture and wood, the immunization of its homes from enemies and panic, and all these conditions are met in the old nuclei in addition to another set of criteria, including:

- **Utilization of renewable sources and local resources.**

From the first moments of the planning process of the ancient oasis cities, there was an interest not only in preserving the natural conditions of the site, which were inappropriate, but also in the necessary and appropriate conditions for living, by focusing on the resources in the region, investing them and adapting them for the benefit of the site, and this is through a set of criteria.

A - Preserving the place resources. The process of construction in the ancient oasis cities worked to create the consistency between the Ksar and the oasis, which was one of the important creations created by the ancient human experience, which created the appropriate conditions for living within this repulsive medium and then the integration of local natural elements of water and palm trees and the local materials in the place where the Ksar was built, which came compatible with the environment and its very harsh climate and finally gave an urban formation characterized by balance and integration without harming the components of the site and its resources, and the proportionality between the area of the Ksar and its population density reduces the consumption of spaces, controls the control of resources, and enables the organization of services, It bridges distances and achieves the principle of rational consumption of the field, which is a fundamental principle of sustainability.

B - Benefiting from renewable energy. The planning of the urban structure of oasis cities and their reliance on combined planning helped to provide a suitable and comfortable local climate, in which urban areas exposed to direct solar radiation decrease, and shaded places increase that work to retain cold air and protect the urban mass from the impact of winds loaded with dust and sand, which leads to natural ventilation, and helps to create a suitable and comfortable local environment, thus benefiting from the natural and renewable energies present in the place and reducing resorts. The mechanical means provide thermal comfort, leading to energy savings, so the principle of consolidation adopted in the planning of the urban structure of oasis cities was not formed by chance but is the product of climatic, religious, and social conditions. (HASSEN, 1986)

C - Control of local and available resources. We note that the construction process in the ancient oasis cities in the Zyban region relied on the local building materials available in the place of proven clay, stones, wood, and palm trunks, which are characterized by a set of sustainable and appropriate characteristics for hot and dry climates, namely: homemade and extraction with high durability and have physical properties that help thermal insulation such as heat capacity, time retardation, thermal resistance and accept permanent maintenance, which are sustainable building elements that can be reused and recycled.

- **Benefiting from the available water in the place.** where water is the main element of life in the desert, which is the first element of urban presence, and therefore it must be preserved and exploited economically, as the local people understood this principle and excelled in finding practical and effective techniques to bring it and exploit it rationally without waste or waste, and with techniques based on the laws of nature such as the foggara system and the forced system, which is one of the innovations of irrigation systems created by the first man.

- **Equitable availability of services and job opportunities close to housing.** The mixed-use development and integration of functions adopted by the ancient oasis cities in their planning, encourages the overlap between the spaces of the community structure with all its components on the one hand and the oasis and its economic and social advantages on the other, helped to provide services equitably, gave people the opportunity to live near their places of work and shopping, achieved community belonging and provided safety.

5. FINDINGS AND RECOMMENDATIONS.

In the context of this analytical research paper dealing with the sustainability of the planning dimension and its applications in the urbanization of the cities of the ancient oases, we reached a set of planning principles and standards that achieve the features of sustainability. These can be considered as

recommendations that, after being developed, can contribute to sustainable planning strategies for building a modern sustainable desert city in Algeria, which are explained as follows:

1. The duality of (Ksar - oasis). The cities of the ancient oases relied on the duality (Ksar - oasis) from the first moment of planning as a mechanism for reconstruction in the desert, which constitutes an element of life, protection, and continuity, as the oasis is considered as an umbrella to protect the Ksar from harsh climatic factors and a local economic resource, as well as a social role in enhancing psychological and moral stability in the social fabric. In addition to its ecological role and the preservation of biodiversity, as well as its role in drawing the aesthetic image of urbanization, the principle of the “Ksar-oasis” duality is among the basic principles of reconstruction in the desert, which can be embodied in different forms, ways, and creations.

2. Site planning and utilization of natural resources at the site. The planning process on which the ancient oasis cities were based responded to the conditions related to the selection of the appropriate site, as mentioned by Ibn Al-Rabie, which falls within a comprehensive strategy related to bringing interest and repelling harm to humans, which is a major rule of Islam that is fully consistent with the rules of sustainable site planning and investment of local resources, and the use of natural and renewable energies through the integration of local natural elements of water, palm trees, and local materials in the place. Thus, it achieved the most important elements of development for the population and their basic economic resource of self-sufficiency.

3. Rational consumption of the field. The proportionality between the area of the Ksar and the population density through the form of the compact urban fabric and the convergence between the residents, which came as a result of responding to environmental and social factors, is one of the most important principles of sustainability that is based on the creation of cities of limited size and population to control resources and organize services, to rational consumption of the field and economy in the land.

4. The effectiveness of community structure systems. The old city of oasis cities was provided with effective systems for community infrastructure facilities, which came centered on basic elements such as the mosque, the market, and the oasis, and from residential units and service, commercial and recreational facilities with high efficiency that maintain the structure of society, and are consistent with the social and economic reality of the local population and with a high degree of quality, efficiency, justice, and flexibility, as it secures the needs of society and elevates it to the best situation based mainly on the participation of the population, as it contributed to achieving human priorities of health and safety that provide comfort and stability for citizens, all of which are features of sustainability.

5. Mixed-use Development and Integration of urban structure with social structure. urban pattern and urban fabric of the ancient oasis cities, which relied on the use of the combined fabric as a principle in planning with the integration of various residential, commercial, and social uses, eventually achieved a merger of functions within the urban fabric and contributed to the provision of services fairly and the creation of job opportunities close to housing, and eventually produced an urban and architectural formation compatible and consistent with the social, economic and environmental needs of its inhabitants, thus integrating the urban structure with the social structure, achieving the required social cohesion, all of which are principles of sustainability.

6. Effectiveness of movement systems and easy accessibility. The formation of urban units in the ancient oasis cities around active elements such as the mosque, the market, and squares, which include various social and economic activities that meet the basic needs of citizens, which were carried out according to an interconnected system of paths in the structure of the city, and according to the hierarchy of the transition from public space to semi-public to private, increased the effectiveness of movement systems and the possibility of easy access to the end, which is a feature of sustainability.

7. Utilization of renewable sources and local resources. Among the distinctive characteristics of the cities of the ancient oases is the adaptation to climatic conditions, through the adoption of a planning and design system for the urban structure and its various stages based on the principle of orientation inward for protection, where the adoption of integrated planning and the system of courtyards and narrow and shaded streets to reduce the areas and surfaces exposed to solar radiation, and to create natural ventilation between the components of the urban mass and address the hot winds loaded with dust, which effectively contributed to providing a climate comfortable localization leads to the utilization of renewable natural resources present in the place.

In addition to relying on the use of sustainable building materials available in the local environment, which are natural, as they are characterized by durability, longevity, low content of toxic

gases, and have physical properties that help thermal insulation such as heat capacity, time retardation, and thermal resistance, and it also accepts permanent maintenance, reuse, and recycling, which are all basic principles of sustainability. The embodiment of these results and recommendations extracted from the research can be in multiple and creative forms and forms and designs left to the specialists of planners, urbanists, and architects, each of its locations and according to the data and specificities of the place and according to the modern view of the contemporary lifestyle with the introduction of modern environmentally friendly technologies and the investment of local resources and energies appropriate to the local natural and social environment of desert areas.

CONCLUSION.

Sustainability plays a significant role in the planning and management of cities to maintain the balance of the natural environment. This has led us to adjust many concepts and applications of sustainability at all spatial levels, ranging from individual buildings to neighborhoods, cities, and even entire urban regions.

In this research, we focused on elucidating the extent to which ancient oasis cities apply the concepts and principles of sustainability in their planning dimension.

The Ksar Lichiana has provided a model for implementing sustainable planning and its applications in the urban development of ancient oasis cities in the Algerian desert regions, integrating them into the architectural construction of modern desert cities. The palace serves as an exemplar by showcasing well-organized practices for the sustainable use of resources, including the efficient management of water sources through covered and uncovered aqueducts and the utilization of rare rainfall. This model not only preserves the historical and cultural heritage of ancient oasis cities but also contributes to the establishment of sustainable urban development in modern desert cities.

The study revealed important results regarding the application of sustainability principles and standards in preserving water resources in the Algerian desert oases, specifically in Ksar Lichiana. This is achieved through effectively harnessing rare rainfall. This is done by directing covered or uncovered aqueducts towards the palm orchards surrounding the palace, bringing in water from distant areas in an organized manner. These practices are systematically employed to ensure no water wastage and to guarantee the continuity of its flow in an efficient and sustainable manner.

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