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PERSISTENCE AND REINTERPRETATION OF TRADITIONAL ARCHITECTURAL PRINCIPLES IN KENADSA

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ABSTRACT

This study explores the persistence and reinterpretation of traditional architectural principles in contemporary dwellings in Kenadsa, a Saharan city in southwestern Algeria. The problem studied is how traditional architectural elements, such as inner courtyards and the use of local materials, are maintained in modern buildings despite the influence of urbanization, industrialization, and social change. The objective is to understand how these principles are adapted to meet contemporary requirements, particularly in terms of thermal comfort, energy efficiency and respect for cultural identities.

To achieve this objective, a mixed methodology was adopted. It combines a thorough review of the literature with case studies on contemporary housing incorporating traditional elements. Architectural analyses, field visits, surveys and qualitative interviews with architects, planners and residents have provided rich and varied data. These data were then analyzed in a comparative manner to assess the persistence of traditional principles.

The results show that, although modernist designs are predominant, there is a significant effort to integrate traditional architectural elements into contemporary houses. For example, the move from open patios to central enclosed halls illustrates an adaptation of vernacular principles to modern needs while maintaining the energy efficiency and thermal regulation of traditional buildings. These results highlight the dynamic co-habitation between cultural heritage and innovation in Kenadsa's architecture, demonstrating that traditional principles can evolve and adapt to contemporary contexts while maintaining their relevance.

KEYWORDS

Traditional Architecture, Contemporary House, Vernacular Persistence, Domestic Courts, Energy Efficiency, Cultural Identity, Kenadsa

CITATION

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Introduction.

Traditional houses were closely linked to the local lifestyle and environment. Built with climate-friendly techniques, they were organized around indoor courtyards offering natural ventilation and communal living spaces. However, rapid industrialization and urbanization have led to significant societal changes. New architectural concepts with a focus on functionality and modern materials have been widespread. Today, while contemporary houses reflect a greater diversity of styles with the use of new technologies, some features of traditional houses seem to persist. The restoration of old architectural heritage and the adoption of more

sustainable construction practices reflect a desire to preserve certain aspects of the past, while innovation seeks to meet the new needs of residents for comfort and energy efficiency.

In this context, this study proposes to clarify how tradition and modernity are interpreted today in contemporary housing, with particular emphasis on the houses of the Saharan city of Kenadsa, located in Béchar, southwest Algeria. Kenadsa, rich in history and architectural heritage, presents a unique framework for examining the transformations of housing, especially under the influence of state policies. Today, modern housing programs tend to move away from the original typology of the Saharan house, thus moving away from the needs and daily realities of the inhabitants, and affecting the relationship between traditional architecture and local lifestyle.

The study of this subject is crucial, on the one hand, because of the wealth of Kenadsa's architectural heritage, which testifies to a spatial and social organization deeply rooted in extreme climatic conditions and local social practices. On the other hand, contemporary housing in this region faces issues related to state policy, which focuses on massive construction of housing without regard for traditional architectural principles. This approach leads to a break with cultural heritage and adaptation to the Saharan climate, exacerbating social and environmental challenges.

Thus, our objective is to trace the evolution of major architectural principles of the Saharan habitat, with a particular focus on the central role of the patio or courtyard. This element, very well known in Kenadsa, is of both socio-cultural and energetic importance. As a collective living space and natural thermal regulation, the courtyard has long played an important role in traditional Saharan constructions. Today, its use in contemporary houses, although altered, retains considerable potential to meet the comfort and energy efficiency needs of residents.



Fig. 1. Old aerial view of the ksar of Kenadsa(Barkani 2021)

This study is part of a theoretical framework, fed by work on vernacular architecture and bioclimatic design. Previous research shows that traditional techniques and principles can be reinterpreted and integrated into modern architectures to meet current requirements for sustainability and energy efficiency. Thus, the adaptation of the patio, the management of local materials and the optimization of natural ventilation are part of a process of reconciliation between tradition and modernity. Finally, the originality of this study lies in the in-depth analysis of the interaction between traditional architectural practices and new contemporary needs in Kenadsa. By exploring how modernity can reintegrate some principles of the Saharan architecture, this research aims to offer avenues for sustainable urban development in line with local cultural and climatic realities.

1. Methodology

To carry out this research on the persistence of traditional and vernacular principles in contemporary housing, we have chosen to adopt a mixed methodology that combines theoretical, qualitative and quantitative approaches. The first step is a literature review to identify concepts of traditional and vernacular principles, their evolution over time, and their current relevance. This phase involves a thorough analysis of case studies, academic articles and historical texts allowing us to build a solid theoretical framework.

Then case studies are conducted to identify and analyze concrete examples of contemporary housing that incorporate these traditional principles. This includes the selection of representative dwellings, followed by detailed architectural analyses, site visits, surveys and photographs. At the same time, qualitative interviews are conducted with various actors, such as architects, urban planners and residents, to gather perspectives on the importance and application of these principles in contemporary architecture. Finally, an analysis of the characteristics of traditional and contemporary dwellings allows to evaluate the persistence of vernacular principles by examining architectural elements, inhabited spaces and their functions in the climatic context of the city. Through this methodology, we seek to demonstrate how these principles continue to influence and manifest themselves in contemporary living.

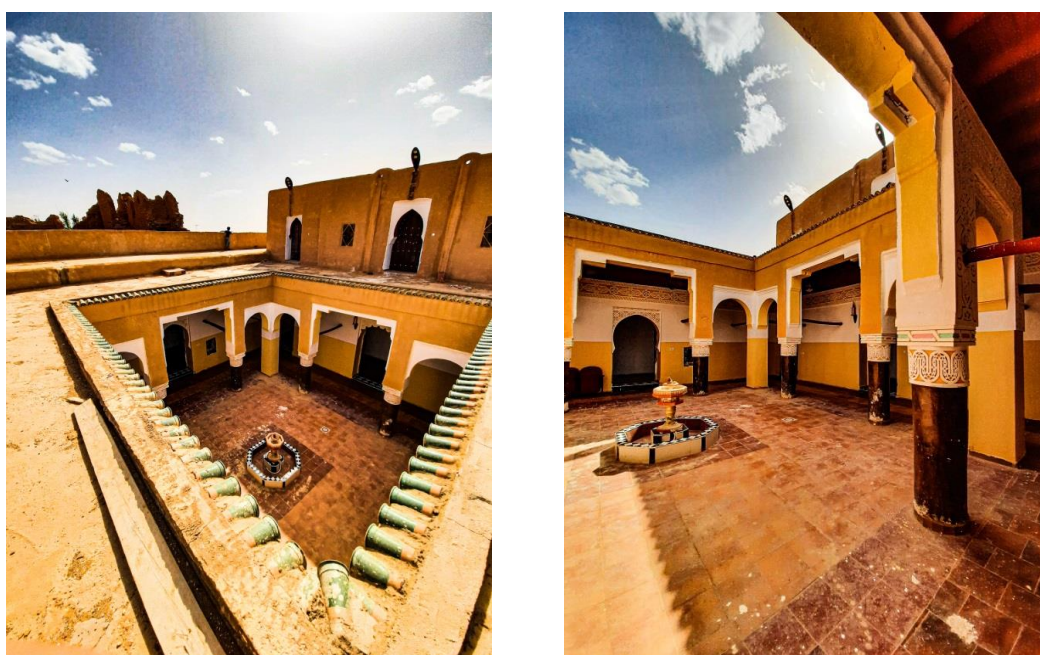


Fig. 2. Patio of a ksar Kenadsa house (Hadj Mohamed Naima and Makhloufi 2023)

2. Relevance of traditional principles: A literature review

Many researchers have explored in their scientific work the dynamics between tradition and modernity in housing, highlighting a strong interest in the richness of traditional forms and techniques of habitation. As Deffontaines pointed out in 1972, vernacular forms of construction remain relevant today (Deffontaines 1972). Other studies have shown that some of the principles of traditional houses are still present in contemporary housing, whether due to climate, energy, modernism or technological innovation.

2.1. Traditional principles and energy issues in contemporary housing

Since the second half of the 20th century, vernacular architecture has been a subject of renewed interest, thanks in particular to the work of architects, thermicians and researchers. Clément Gaillard points out that the emergence of the bioclimatic approach, integrating energy into technical and architectural choices has led to a better understanding of the thermal behaviour of old buildings and has encouraged many architects to draw inspiration from traditional architecture principles in order to face contemporary challenges, in particular those related to the energy crisis. Gaillard says that the relevance of old techniques has been rediscovered thanks to this new approach combining thermal and climate analysis (Gaillard 2020).

In this approach, contemporary architects integrate vernacular techniques and principles to design spaces that promote natural ventilation and lighting. This is done through the judicious arrangement of openings, the creation

of interior courtyards facilitating the circulation of air and light, as well as the adoption of passive ventilation techniques, thus reducing dependence on air conditioning. In addition, the vernacular principles of urban density are reinterpreted to design more sustainable spaces, optimizing natural light and enhancing social interactions.

Gilbert Simondon (Simondon 2014) argues that ancient construction techniques never completely lose their relevance and have a fundamental value that deserves to be preserved. He said that these traditional methods, although often considered obsolete, offer valuable solutions to modern challenges. For example, the construction of earth, which is efficient for thermal regulation and durability, are particularly adapted to contemporary issues of energy performance and reduction of carbon footprint. By reintegrating this know-how, we can enrich current architectural practices while meeting modern needs in terms of sustainability and energy efficiency.

2.2. Traditional principles and climate adaptation in contemporary habitat

Recent studies show a renewed interest in traditional construction techniques, particularly in the context of bioclimatic architecture. In the U.S., pioneering work such as that of Jeffrey Ellis Aronin (1953) and the Olgyay brothers (Olgyay and Olgyay 1963) laid the foundation for this approach by highlighting the importance of climate factors in architectural design, “vernacular architecture is presented as an example of legibility to understand the influence of climatic factors” (Aronin 1953).

In France, Georges and Jeanne-Marie Alexandroff conducted in 1982 (Alexandroff and Alexandroff 1982) the analysis of vernacular constructions in Europe and North Africa taking into account natural energies such as solar radiation and wind, that form the ecosystem of a construction. They highlighted the importance of inner courtyards in traditional habitats in North Africa, adapted to the way of life of the inhabitants and to climate variations. Their bioclimatic approach values these ancient practices, offering modern designers transposable examples in terms of integration at the site, choice of materials, and spatial management to meet the constraints surrounding.

The Swiss architect Michel Gerber (Gaillard 2020), a key player in the bioclimatic approach in France, has studied local vernacular constructions and demonstrates, with other architects, the continuity between vernacular architecture and bioclimatic design. Other research, such as that of Ghodsi (Ghodsi 2013) on traditional houses in Shushtar New Town, has shown that vernacular principles can be adapted for contemporary housing by using dense urban forms and local materials. Furthermore, El Sayary and Omar (Sayary and Omar 2017) highlighted the importance of interior courtyards in modern buildings for a zero natural energy house by offering ventilation and natural lighting solutions. These climate strategies are updated to improve the thermal comfort of buildings using site characteristics, local climate and available materials, through techniques such as natural insulation, thermal inertia and optimal orientation.

2.3. Modernism and Local sensitivity: evolution of traditional principles

Architects such as Maxwell Fry, Jane Drew, Tadao Ando, Nader Ardalan, Laurie Baker, Charles Correa and others explored modernist morphogenesis by drawing inspiration from local vernacular architecture to create significant architectural works (Boissésou 1968). Their work illustrates how sensitivity to local traditions can enrich architectural modernism. For example, the Gourn housing project by Hassan Fathy emphasizes the use of local materials and traditional techniques to design environmentally sustainable dwellings (Fathy 1986).

Another striking example is Masdar City in the United Arab Emirates, designed by Norman Foster and Partners. This futuristic city is inspired by traditional Arab settlements, incorporating design principles such as optimal orientation, natural ventilation, and the use of materials adapted to desert climate. Masdar City represents a successful fusion of modernism and tradition, aiming to create a sustainable and innovative urban environment while respecting local cultural and environmental contexts (Algburi, Beyhan, and Algburi 2019). Similarly, in Palestine, the study by Haj Hussein (Hussein 2012) examines the transformation of traditional Palestinian courtyard dwellings into contemporary residential concepts. Although the two initiatives differ in scale, they share a common goal: to use traditional architectural principles to address climate and environmental challenges. In Palestine, the study highlights the role of traditional courtyard as a sustainability strategy, highlighting its potential to improve the quality of hygrothermal and light environments in future habitats.

Other studies on Maghreb cities show that contemporary buildings continue to integrate and preserve traditional architectural and cultural elements (Bisson 2003; Depaule 2014). Depaule's work explores contemporary housing patterns by highlighting the evolution of practices and living spaces. Through a socio-architectural analysis,

the study examines the transformations of ways of living influenced by cultural, economic and environmental dynamics highlighting the tension between tradition and modernity in residential architecture.

This tension is particularly visible in Saharan cities like Béchar, where contemporary architecture manages to maintain traditional principles despite transformations. For example, the central-space house, a substitute for the traditional courtyard, remains a central element in individual and collective dwellings. Spaces such as lounges, courtyards and terraces remain essential, strengthening social ties while adapting to local climatic requirements (Hadj Mohamed Naima and Madani 2015). Thus, although modern styles are adopted, Béchar preserves its Saharan identity by integrating innovations in a harmonious way with its local architectural and cultural characteristics.

In the same context of reassessment of the central space, the study by Fezzioui (Fezzioui et al. 2009; Khoukhi and Fezzioui 2012) demonstrates that the patio of traditional houses plays a key role in thermal regulation. This central space, with the thickness of the walls and orientation of the openings, naturally reduces heat and the need for air conditioning. The study concludes that these vernacular principles are not only sustainable but also offer effective solutions for contemporary buildings, combining thermal comfort and respect for local traditions.

3. Cross-perspectives on the application of traditional principles with actors in contemporary architecture

This chapter explores cross-perspectives on the application of traditional principles in contemporary architecture through qualitative interviews with various stakeholders and residents. By examining the views of architects, planners, residents and cultural heritage experts, we aim to understand how these historical principles continue to shape and enrich modern architectural practices while meeting today's demands, Providing an enriching perspective on the evolution of traditional architectural practices in the modern context of the city of Kenadsa.

3.1. Case study: The city of Kenadsa

The city of Kenadsa, located in the wilaya of Béchar, in southwest Algeria, is an exemplary city that offers a rich context for studying the persistence of traditional principles in contemporary architecture. The climate in kenadsa is characterized by extreme weather conditions, including large temperature variations between night and day and summer and winter. The climate in Kenadsa is desert-like, characterized by a scarcity of precipitation (average rainfall 45mm/year), and an annual average temperature of 20.5°C, with low humidity, despite the presence of palm groves that promote the creation of a microclimate(Continents 2015).

Originally a ksar, Kenadsa is marked by a traditional urban structure typical of the ancient Saharan cities, with dwellings in raw earth, narrow alleys, and community spaces such as patios and(Layachi 2016). This configuration, distinguished by compact earthy-coloured forms within palm groves, was designed to meet the harsh climatic requirements of the desert, providing natural thermal comfort and protection against sand storms.

Ksar is a sustainable architecture that combines comfort, respect for the environment and local culture. Among its features, there is a central patio (haouch) with an opening for ventilation and brightness, an entrance in chicane (skifa) to preserve privacy, and a lounge (salla) dedicated to hospitality. South-facing galleries capture the heat in winter and provide shade in summer, while the almost blind, vegetation-covered exterior facades protect privacy by opening onto the central courtyard. Finally, the light walls reflect solar heat, optimising interior comfort.

With the discovery and exploitation of coal mines, Kenadsa underwent a major transformation under colonial influence, marked by the introduction of a European city. This new city, with its brick and concrete buildings, wider streets, and distinct spatial organization, reflected an imported urban pattern in stark contrast to the traditional ksar. However, colonial architecture has not completely broken with the past; Influenced by the neo-Mauresque style, it incorporates interpretations of traditional elements of various local architectures and(Hadj Mohamed Naima et al. 2022). This neo-Mauresque style, with its semicircular arches, geometric decorations and motifs inspired by Islamic art, seeks to harmonize European modernity with the regional architectural heritage. This fusion of architectural styles illustrates not only the complex history of Kenadsa, but also the adaptation of its inhabitants to external influences while preserving essential aspects of their cultural heritage.



Fig. 3. Old colonial building (photos by Luc Desault, Archive of the Kenadsa municipality)



Fig. 4. The old city of Kenadsa in 1946 (Archive of the Kenadsa municipality)

The current extension of Kenadsa represents a new phase of development marked by a great diversity of architectural styles and an anarchic use of modern materials. This development has created a heterogeneous urban landscape, where various architectural influences coexist. However, despite this diversity, some contemporary houses in Kenadsa continue to draw on traditional principles such as the organization around a central space, the strategic orientation of buildings, and the use of local materials. This persistence of traditional principles, within a changing architectural context, highlights the cultural resilience of Kenadsa, illustrating a harmonious adaptation between tradition and modernity.

Thus, Kenadsa serves as a case study to understand how traditional architectural principles persist and evolve in the contemporary context, providing a model of sustainability and cultural preservation in Saharan architecture. The following analyses focus particularly on the traditional court principle, chosen for its importance and persistence in various forms in contemporary architecture. This exploration sheds light on how this central element continues to structure the residential space, while adapting to modern needs, demonstrating the vitality and flexibility of Kenadsa's architectural traditions.



Fig. 5. A general view of ksar Kenadsa. (Archive of the Kenadsa municipality)



Fig. 6. A general view of the city Kenadsa. (Archive of the Kenadsa municipality)

3.2. Assessment of traditional court principle by interview

- Current preferences for housing types.

Our survey results among the residents of Kenadsa show that a significant majority (about 70%) favour modern housing, such as buildings or villas, reflecting a marked trend towards contemporary styles, while taking into account their culture and local climate for better ownership. However, a significant percentage (about 25%) shows an attachment to traditional houses readapted, indicating a desire to preserve some elements of the architectural heritage while modernizing them. Finally, a small minority (less than 5%) prefers the original traditional houses without modification "ksar", but not fully meeting current needs.

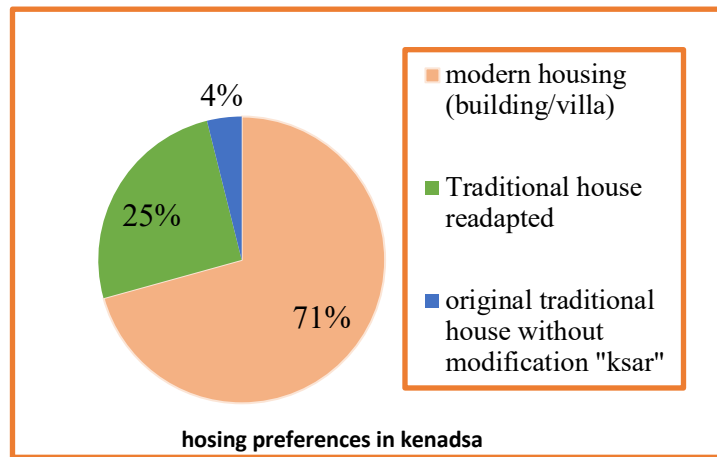


Fig. 7. Hosing preferences in Kenadsa (Source: authors)

- Motivations for joining a yard: Between traditional heritage and contemporary needs

The motivations of interviewees to integrate a yard into a future house are divided into five main categories, with the following results:

- **Environmental sustainability (30%)** : The courtyard contributes to environmental sustainability by promoting natural ventilation, reducing air conditioning requirements and managing water efficiently.
- **Functional versatility (25%)** : The courtyard is appreciated for its versatility, serving as a place of rest, garden or social space, showing the continuity of its traditional multifunctional function.
- **Culture or identity (20%)** : For many, the courtyard is a cultural or identity symbol, reflecting an attachment to traditional architectural values and practices.
- **Aesthetic qualities (15%)** : The courtyard is valued for its aesthetic qualities, contributing to the visual appeal and ambience of the house.
- **Nostalgia (10%)** : Some people are nostalgic about the past, and the court evokes memories or a connection to the past, highlighting an emotional dimension related to traditions.

These results show that the motivations for designing a courtyard in a contemporary house are largely related to traditional principles, which highlights the persistence and importance of these principles in modern architecture.

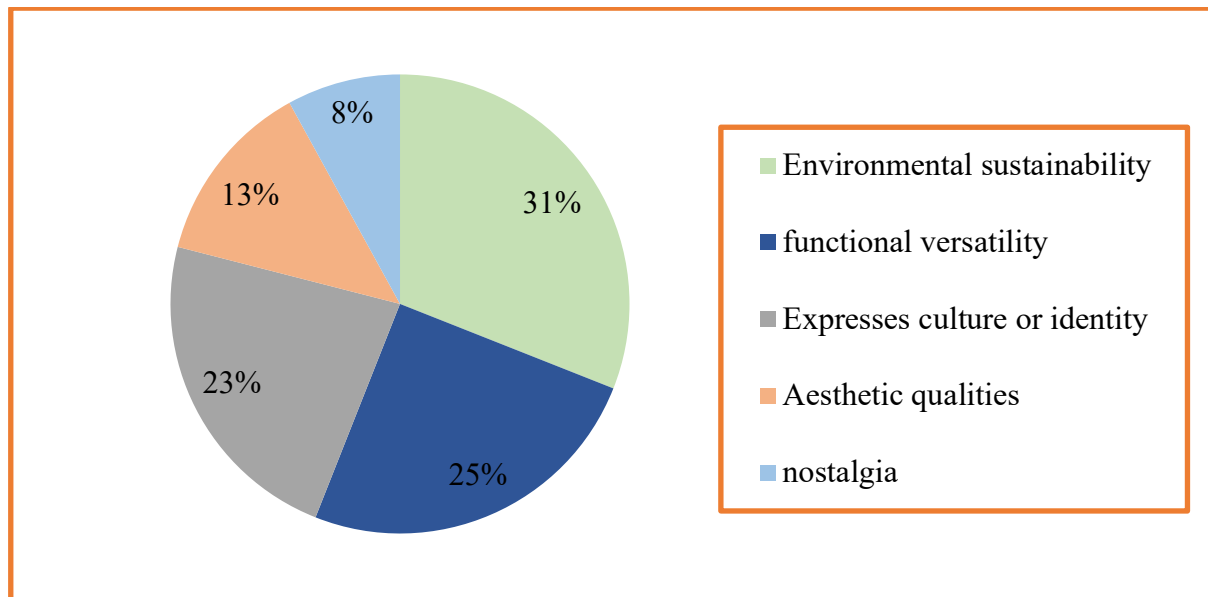


Fig. 8 .Motivation to integrate a courtyard into a future house (Source: authors)

- Appreciated qualities associated with the courtyard in a contemporary house

The most attractive qualities associated with the courtyard in a contemporary house highlight the persistence of some traditional principles. The results of the interview are as follows:

- **Social space and strengthening family ties (25%):** The courtyard is valued above all as a space that promotes family interactions, a traditional function always very prized.
- **Vegetation and connection to nature (20%):** The integration of plants reflects a link with nature and the persistence of traditional gardening practices, contributing to environmental sustainability.
- **Privacy (16%):** The courtyard offers a private space, unspoiled from outside views, inheriting the traditional concept of family intimacy.
- **Open space and sky view (10%):** A well-ventilated space with an open view is appreciated, recalling the traditional courtyard and offering a sense of freedom.
- **Natural ventilation and cooling (10%):** Although less high on the list, this quality reflects the importance of traditional climate functions adapted to contemporary needs.
- **Tranquility and relaxation (8%):** The courtyard is perceived as a place of peace, inheriting its traditional role as a haven of rest.
- **Natural light (5%):** The contribution of natural light is appreciated, linking the courtyard to traditional concepts of vernacular architecture.
- **Safety and protection (2%):** The courtyard plays a protective role by providing a barrier between house and outside, a traditional persistent function.
- **Identity and personal expression (4%):** Although minority, the expression of self through the court shows a modern dimension while remaining linked to traditions.

These results show that the most attractive qualities of the court in contemporary houses are deeply rooted in traditional principles, underlining their persistence in modernity.

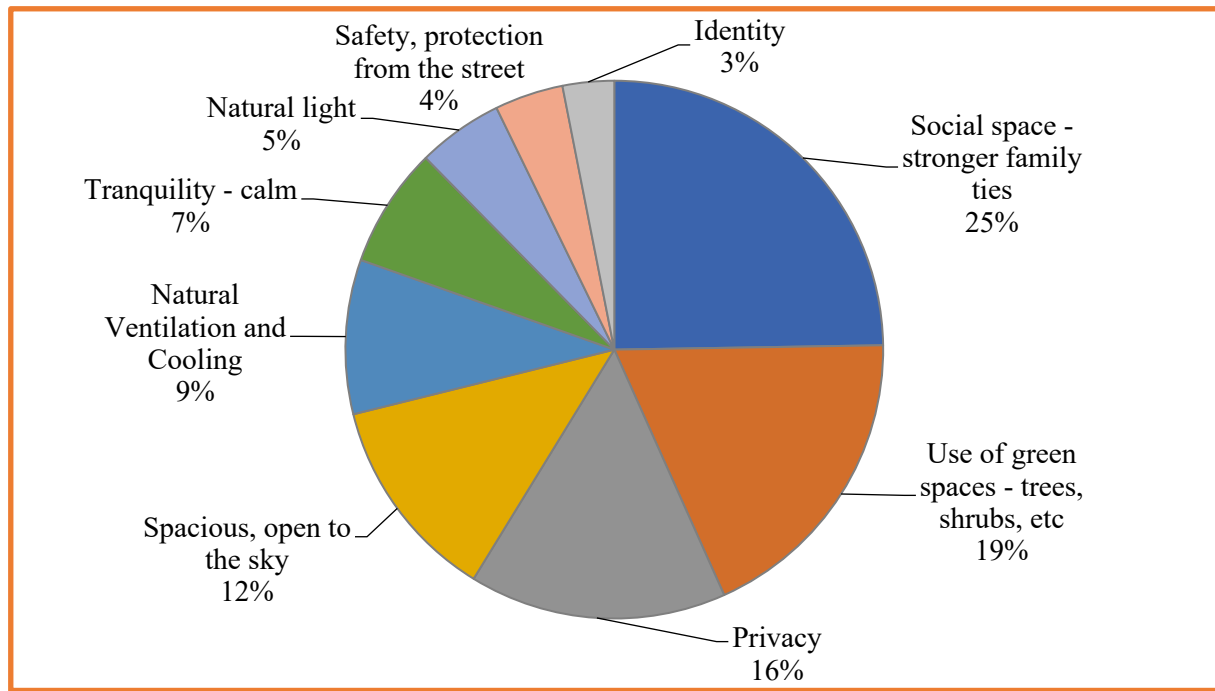


Fig. 9. Appreciated courtyard qualities in a contemporary house (Source: authors)

- Major barriers to integrating the courtyard into contemporary houses

The results reveal that the main barriers to the integration of courtyards in contemporary houses are strongly influenced by current socio-economic constraints, particularly in the context of the city of Kenadsa. A Likert scale of 1 to 5 was used to evaluate these obstacles, where 1 represents "fully agreed" and 5 "not at all agreed". The following data shows the average scores obtained during the survey:

- High real estate prices (1.5): The prohibitive costs of real estate are the main obstacle, limiting the possibility of adding yards in houses due to the need to maximize living space.
- Small land (1.7): Spatial constraints make it difficult to integrate courtyards when land is limited, illustrating the tension between traditional practices and contemporary realities of land availability.
- Housing crisis and scarcity of residential land (1.8 and 1.9): Land pressure and the housing crisis in Kenadsa make inclusion of courtyards difficult, making their implementation less viable under current conditions.
- Increased needs of residents (2): The increased space requirements for modern functions are leading to a reconsideration of the courtyard as a useful space, although the courtyard remains a symbolic space.
- Lack of government regulation (2.4): The lack of regulatory support for domestic courtyards contributes to their disappearance in new construction, underlining the need for public policies to preserve these traditional elements.
- Cultural changes related to the transformation of the Kenadsa (2.7): Cultural changes are less perceived as a major obstacle compared to economic and spatial factors, although they influence the perception of the courtyard.
- Traditional houses recall (3.1): Most participants do not see the connection to traditional houses as a significant barrier, indicating a continued attachment to traditional values despite other constraints.

These results show that, although traditional principles such as the courtyard are still valued, the current economic, spatial and social challenges in Kenadsa are major obstacles to their integration into contemporary houses.

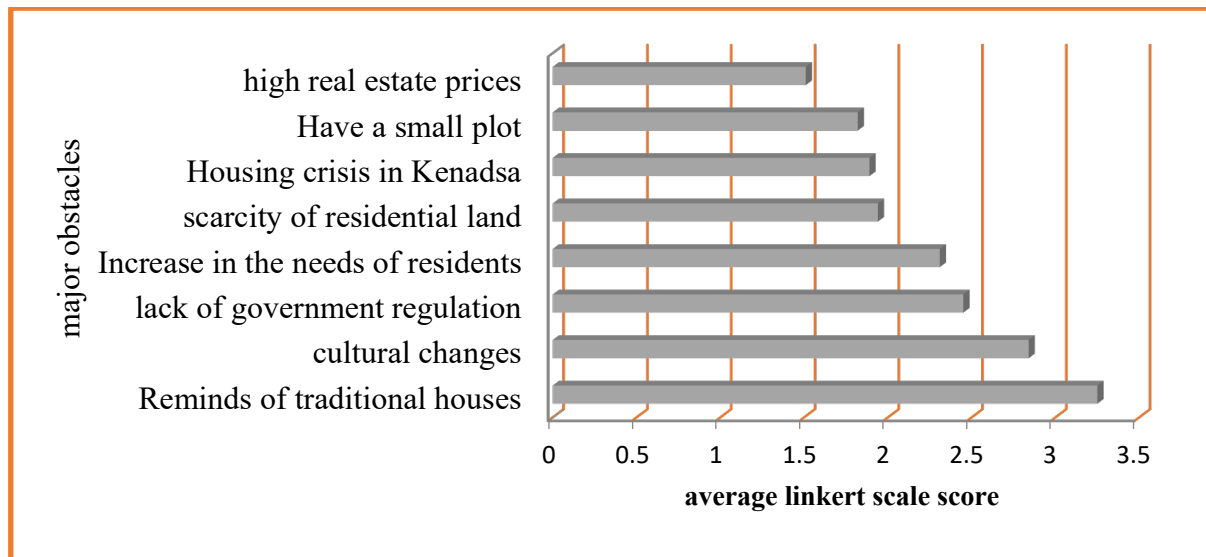


Fig. 10. Major obstacle to the integration of the courtyard in contemporary houses (Source: authors)

- Desired Court Layout

The results of our interview show the diversity of perceptions and conceptions of the court in contemporary houses, while underlining the persistence of traditional principles as follows:

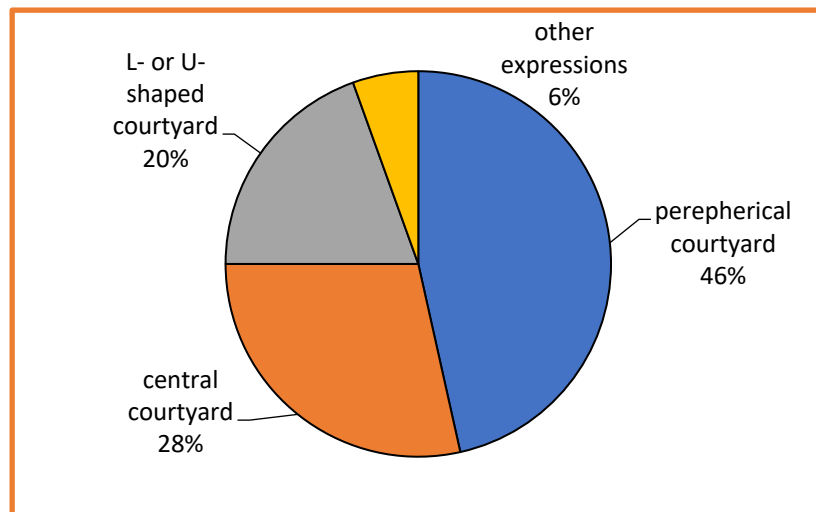


Fig. 11. Desired courtyard layout (Source: authors)

- **Peripheral courtyard (46%):** The majority of participants see the courtyard as a peripheral space around, in front of or behind the house, reflecting an adaptation of traditional concepts to modern needs. Although its position and use have changed, the court remains an important element.

- **Central courtyard (28%):** Just over a quarter of the participants maintain the courtyard in the centre of the house, faithful to the tradition of the Kenadsa houses. This layout keeps the courtyard as the heart of domestic life, providing light, ventilation and family gathering space.

- **Court "L" or "U" (20%):** This hybrid approach combines traditional and modern elements, with forms in "L" or "U". It shows flexibility in adapting traditional principles to meet contemporary needs, while retaining the essence of the courtyard as a semi-open space.

- **Other expressions (6%):** This smaller group represents varied and innovative conceptions of the court, adapting traditional principles to the specific needs or personal preferences of the inhabitants.

In short, although the court's views have evolved with modernity, traditional principles remain deeply rooted. The courtyard continues to be a central element in contemporary architecture, with varied forms and uses that show an adaptation of traditional values to modern contexts.

4. Architectural analysis of contemporary dwellings incorporating traditional principles

The central idea that emerges clearly from the previous chapter (interview with the inhabitants of Kenadsa to assess the persistence and application of traditional principles in contemporary houses) is the resilience of centrality, embodied by the reinterpretation of the court in a contemporary setting. Despite the current trends towards standardisation of new constructions, this space remains sought after and continues to be an essential principle in contemporary houses. It undergoes various transformations, allowing responding to social practices adapted to local traditions, the requirements of modernity, and the particularities of the environment. This analysis therefore proposes to examine examples of houses that have modified their architecture to integrate this space, exploring new principles related to dimensional, socio-cultural, functional and energy aspects



Fig. 12. Modified colonial house (Source: authors)



Fig. 13. Contemporary collective housing (Source: authors)

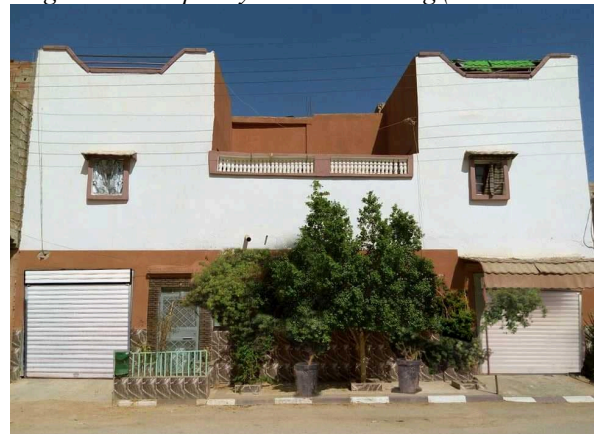


Fig. 14. Self-built contemporary house.

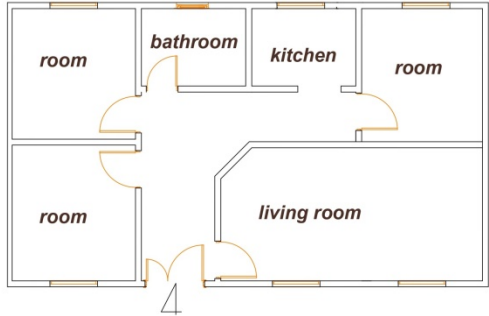
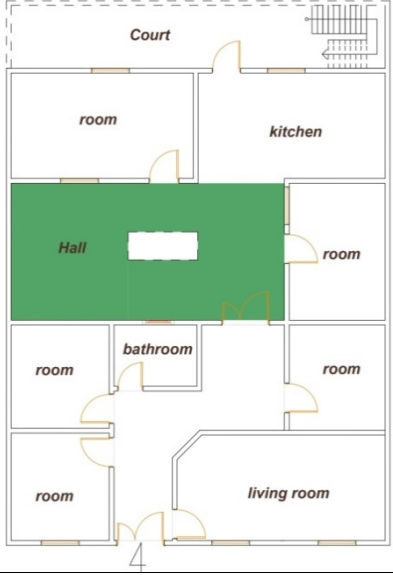
4.1. Transformation in colonial dwelling

These tables illustrate the architectural transformations of representative samples of colonial dwellings, highlighting the evolution towards more introverted and family-oriented principles. It compares the initial state of the house to its configuration after specific modifications, reflecting an adaptation of spaces to contemporary needs while respecting local architectural traditions.

Table 1. The architectural transformations of representative samples of colonial dwellings

	The initial state	The transformations
Sample 1		
<p><u>New Principles:</u></p> <ul style="list-style-type: none"> • Introversion: The veranda was removed and a central hall was created, accentuating the introversion of space, a key principle in traditional architecture. • Reorganization of spaces: Inversion of the living room and a bedroom to strengthen family intimacy, placing the reception area in front and the family space more in retreat. 		
Sample 2		
<p><u>New principles:</u></p> <ul style="list-style-type: none"> • Introversion of spaces: Reorganisation of the kitchen and living room to create a family hall/living room. • Emphasis on introversion: Removal of the veranda in favour of a new kitchen, reinforcing the intimacy of the spaces. • Strategic position of the living room: The living room is positioned directly at the entrance to the house to provide the best possible welcome. 		

Table 2. Architectural transformations of a colonial house - case of extension.

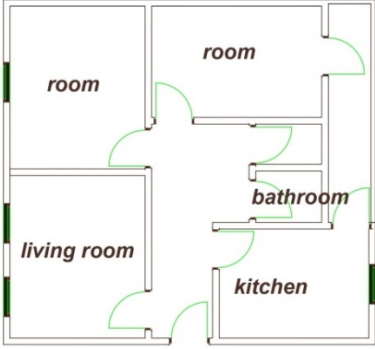
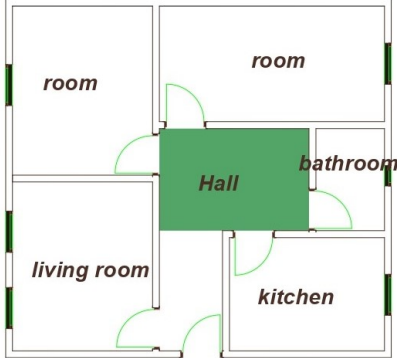
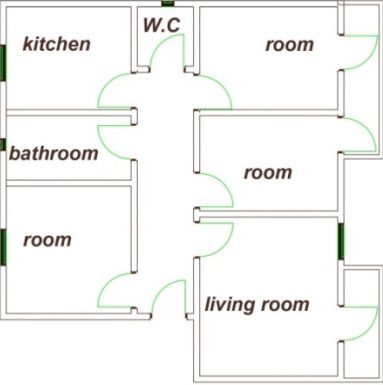
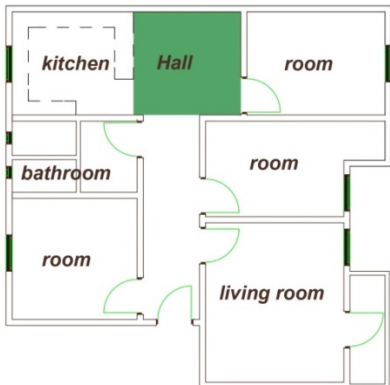
	The initial state	The transformations
Sample Case of an extension		
<p><u>New Principles:</u></p> <ul style="list-style-type: none">• New extension: The owner has completely reinterpreted the traditional space of the haouch, integrating a zenithal opening and using modern materials such as marble and earthenware, while adopting a contemporary style.• Opening of the kitchen: The kitchen is now open to the hall, promoting better circulation and interaction between spaces.• Decorative elements: Decorative touches have been added to enhance the aesthetic of the house.• Creating introversion: A central space, located in the heart of the house, reinforces the introversion, thus becoming the focal point of the interior design.		

Regarding these transformations in colonial housing, the tables present three dimensions (socio-cultural, functional and energetic) with their specific characteristics.

- **Socio-cultural:** The space promotes sociability and family cohesion, while preserving intimacy through the prioritization of spaces between guests and family.
- **Functional:** A place for family gatherings, it welcomes intimate guests, offers a space for children and allows the extension of domestic activities.
- **Energy:** Optimal east-west orientation, with effective sun protection and local materials reducing the energy footprint. Strategic openings provide natural ventilation.

4.2. Transformation in contemporary collective housing

Table 3. Architectural transformations of contemporary collective housing

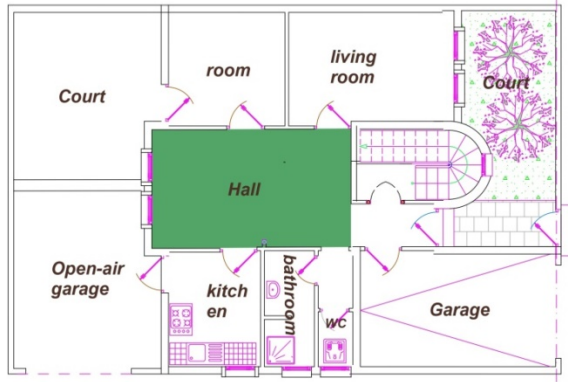
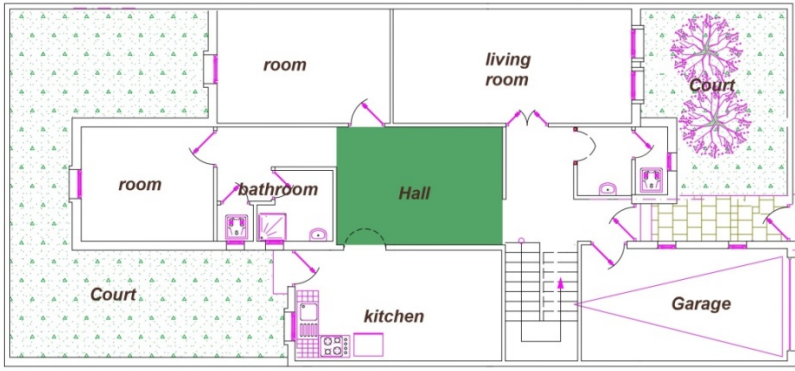
	The initial state	The transformations
Sample 1		
Sample 2		
<p><u>New Principles:</u></p> <ul style="list-style-type: none"> • Reorganization: The apartment is divided into two areas (family and guest) with a central hall/living room, created by extending an existing corridor. • Layout : Balconies are removed and a central space is created to enhance privacy, with reduced exterior openings and curtains to distinguish spaces. • Modernization: Use of contemporary materials such as paint, false ceilings, and modern decorative elements. 		

Characteristics of the table:

- **Socio-cultural:** The space is hierarchical to distinguish family areas and those for guests, reinforcing the uniqueness and stability of housing.
- **Functional:** The space extends the activities of the rooms and kitchen, while serving as a place for meals, rest, and reception of intimate guests.
- **Energetic:** Designed to withstand summer conditions with no direct openings, the central space is optimized for comfort and protection.

4.3. Transformation into self-built contemporary house

Table 4. Architectural transformations of self-built contemporary house

State of self-built dwellings	
Sample 1	
Sample 2	
<p><u>New Principles:</u></p> <ul style="list-style-type: none"> • Centrality and Tradition: The spaces are central and organized in a traditional way, with introversion, versatility, and interconnectedness. • Closure and Modernization: The hall is without exterior openings, and the spaces incorporate modern elements in terms of form, aesthetics, and materials. 	

Characteristics of the table:

- **Socio-cultural:** Private spaces away from the entrance to preserve privacy and distinguish areas for guests and family, while seeking uniqueness and stability.
- **Functional:** Versatile, connected and flexible spaces that are suitable for a variety of activities.
- **Energy:** No external openings to better manage the summer heat, with a central protected space as main living place.

5. Conclusion and discussions

These results suggest that, although modernism is widely preferred, there is a persistent desire to preserve certain aspects of traditional architecture, notably through contemporary adaptations.

The literature review reveals that traditional building principles remain relevant to modern challenges, such as energy crisis and environmental sustainability. The bioclimatic approach has rediscovered the effectiveness of old techniques, such as the use of local materials and natural ventilation methods, to improve the energy performance of contemporary buildings. The fusion of modernism and local traditions, illustrated by projects such as Masdar City and the constructions in Béchar, shows how vernacular practices can enrich modern designs while respecting cultural and climatic contexts. By reintegrating traditional elements such as patios for thermal regulation, modern architecture offers sustainable solutions adapted to current climate needs.

The analysis of cross-perspectives on the application of traditional principles in contemporary architecture at Kenadsa reveals a dynamic interaction between cultural heritage and modernity. Kenadsa, with its traditional clay ksar, narrow alleys and community spaces such as patios, continues to influence contemporary architecture despite the major transformation of the city under colonial influence and recent expansion. The results show that traditional architectural principles, such as the central courtyard, remain influential in the face of social and economic developments. The majority of Kenadsa residents prefer modern houses with traditional elements, while a minority value redeveloped traditional houses. The motivations for including a courtyard in contemporary houses are mainly related to environmental sustainability, functional versatility and maintaining a cultural identity.

However, the integration of prices into new construction faces significant obstacles such as high real estate costs, land constraints and housing crisis. Despite these challenges, the preferences of the inhabitants show an adaptation of traditional principles to contemporary needs, with a predilection for varied configurations such as peripheral or "L" courses. The example of Kenadsa illustrates how traditional architectural principles can evolve and persist in a modern context, while underlining the importance of striking a balance between cultural heritage and contemporary demands.

Analysis of the transformations of house types in Kenadsa-colonial, collective and self-built-houses-reveals a significant adaptation of traditional principles to a contemporary context. In colonial dwellings, there is a trend towards increased introversion with the removal of verandas and the reorganization of spaces to strengthen family intimacy. The changes highlight traditional principles such as centrality with halls transformed into central family spaces, while integrating modern materials and strategic openings to optimize ventilation and energy efficiency.

Contemporary collective dwellings also present a reinterpretation of traditional principles. Spaces are redefined with the creation of separate areas for family and guests, and the removal of balconies to introduce a central space that enhances privacy. This transformation shows an adaptation of spaces to modern functional needs while preserving a social and energy hierarchy adapted to local climatic conditions.

In self-built houses, the traditional principles of centrality and introversion are maintained, but with a greater closure and modernization. The spaces are organized in a way that reflects tradition while incorporating modern elements in materials and aesthetics. The results indicate a desire to combine functional versatility and energy comfort with an effective management of summer heat, illustrating a persistence of traditional values while meeting contemporary requirements.

The evolution of the vertically open patio in traditional houses to a central hall closed vertically but opened laterally in contemporary houses illustrates a successful adaptation to modern needs while preserving traditional climatic principles. This transition responds to the need for improved thermal comfort and efficient space management, while limiting extreme climatic disturbances. The central closed hall allows to maintain a more stable indoor temperature, while optimizing the use of vertical space and providing a visual connection between the different levels of the house.

Despite its vertical closure, the central hall retains some natural ventilation through its lateral openings, inspired by the operation of traditional courtyards, which promotes horizontal air circulation. This design also allows for more controlled management of natural light, diffusing a softer light and minimizing glare. By reinterpreting the traditional patio, this contemporary approach preserves the essential elements of climate regulation while integrating modern aspects of comfort, privacy and energy efficiency, Thus preserving a link with cultural and architectural roots.

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