

Morphological Analysis of Ksar Tadjrouna in Laghouat, Algeria

Fatiha Imane Mahcar^{1,*} 

¹ Department of Architecture, Faculty of Architecture, Bursa Uludağ University, Türkiye

*Corresponding author: mouniimy6@gmail.com

Received: 06.04.2023

Accepted: 15.01.2024

Abstract

This study focuses on the morphological analysis of Ksar Tadjrouna in Laghouat, Algeria, recognizing the significance of preserving and enhancing the heritage of the region. Emphasizing the broader definition of heritage by UNESCO, the research extends beyond monuments to encompass the cores and historic districts of cities, reflecting cultural, architectural, and historical values. The study explores the traditional architectural form known as "ksar," prevalent in North African fortified villages. In the case of Ksar Tadjrouna, the morphological analysis reveals key characteristics, such as hierarchical plot systems, orthogonal street encounters, planar built structures with central courtyards, and a clear division between public and private spaces. The study identifies pathologies in the Ksar, including the use of heterogeneous materials and degradation issues, leading to a proposed intervention strategy. The proposed plan aims to protect Ksar Tadjrouna by addressing its morphological aspects and enhancing its tourist potential, catering to both national and international tourists through cultural tourism initiatives. The research concludes by emphasizing the importance of morphological analysis for understanding urban fabric changes over time and designing place-centered interventions that contribute to heritage conservation and community continuity. The ultimate goal is to secure the classification of Ksar Tadjrouna as a safeguarded sector, ensuring its preservation as a testament to a rich and distinctive civilization.

Keywords: Morphological analysis, traditional architecture, Ksar of Tadjrouna, laghouat, Algeria

1. Introduction

Algeria is endowed with a very significant heritage, reflecting the influence of various civilizations and cultures. The conservation and enhancement of this heritage constitute one of the main challenges in the practice of architectural preservation. Currently, Algeria, like all countries worldwide, is faced with a phenomenon of demographic growth accompanied by economic development, which has caused excessive urban sprawl characterized by standardized architecture, causing neglect and abandonment of the old districts of cities. This has created the problem of abandonment, marginalization and degradation of this heritage. The Ksar of Tadjrouna in Laghouat, Algeria is one of the 5 Ksours of Laghouat (located on an archaeological site) which is characterized by its richness of urban fabric. Also, it is characterized by its seniority which allows us to take it as a conceptual landmark of traditional architecture.

According to UNESCO, established in 1997, heritage is the common heritage of a nation, or even of humanity: "The cultural and natural heritage is among the priceless and irreplaceable assets, not only of each nation, but of humanity as a whole." (UNESCO, 2019). Algeria has a very important heritage, reflecting the passage of several civilizations and interior cultures, their conservation and enhancement is one of the main issues and concerns of the practice of architectural preservation.

This study is not only interested in monuments and historic sites but also encompasses the cores and historic districts of cities which reflect cultural, architectural and historical values of society.

This heritage, in the context of various experiences, must be approached as a whole, embracing its diversity. "It is the living memory, symbol of a popular culture with strong meanings, which crosses the architectural quality of the buildings and places as well as the urban harmony of the fabric." (Hamma, 2011). Despite the climate, and the arid and challenging nature of the Algerian desert, which occupies four-fifths of the country's total surface area, populations have chosen to settle, live, and adapt in this aggressive environment. These populations have invented all their genius to create human settlements which can protect them against the annoying factors of this region, these establishments are known under the name of "ksour", they are the product of a culture and a set of moral values, they are characterized by a typical architecture. (Brik and Smaali, 2016).

A "ksar" refers to a traditional North African fortified village, predominantly found in countries like Algeria, Morocco, Tunisia, and parts of Libya, with a concentration in desert regions like the Maghreb. These settlements are marked by their unique architecture and layout, strategically designed to offer protection against harsh weather conditions and potential invasions. Ksars are tightly packed communities featuring defensive walls, including towers, constructed from locally available materials like mud bricks. The layout comprises narrow streets and alleys that enhance defense and control temperatures. Central mosques serve as focal points for religious and communal activities, and storage facilities, such as granaries, are integrated to safeguard food supplies in the challenging desert climate. Overall, ksars offer insights into the traditional life of North African communities and the adaptive strategies employed to thrive in their environments (Dłużewska and Dłużewski, 2017).

Currently the urban centers of Algerian cities (like: M'Zab valley in Ghardaia; south of Algeria) are in decline, faced with the difficulties of their conservation and their integration into the contemporary city. It is transformed at the pace and in the image of the populations and activities that mark the dynamism. This is the case, and even more so, with the initial core of all cities, which has a rich past and carries a future which must be able to bear witness to its history, be part of the present and integrate finally these monuments to their future. Moreover, there lies the interest and the challenge of revitalization and enhancement interventions: safeguarding the architectural and urban built heritage without slowing down development" (Hamma, 2011). This phenomenon bears the interest of the degradation of urban heritage in Algeria and the need for its safeguard by our study of the Ksar Tadjrouna in Laghouat which is an example that requires conservation and enhancement operations (Mazouz, 2015).

The "intangible cultural heritage" means the practices, representations, expressions, knowledge, skills - as well as the instruments, objects, artefacts and cultural spaces associated therewith - that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense

of identity and continuity, thus promoting respect for cultural diversity and human creativity. For the purposes of this Convention, consideration will be given solely to such intangible cultural heritage as is compatible with existing international human rights instruments, as well as with the requirements of mutual respect among communities, groups and individuals, and of sustainable development (UNESCO, 2003).

The “intangible cultural heritage”, as defined in paragraph 1 above, is manifested inter alia in the following domains:

- (a) oral traditions and expressions, including language as a vehicle of the intangible cultural heritage;
- (b) performing arts;
- (c) social practices, rituals and festive events;
- (d) knowledge and practices concerning nature and the universe;
- (e) traditional craftsmanship (UNESCO, 2003).

The UNESCO World Heritage Convention defines (tangible) cultural heritage as:

Monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;

Groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;

Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view (UNESCO, 2003).

Some definitions of interventions:

Conservation means all the processes of looking after a place so as to retain its cultural significance.

Maintenance means the continuous protective care of a place, and its setting.

Maintenance is to be distinguished from repair which involves restoration or reconstruction.

Preservation means maintaining a place in its existing state and retarding deterioration.

Restoration means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material.

Adaptation means changing a place to suit the existing use or a proposed use (The Burra Charter, 2013).

The objective of our study is to attempt for the protection of the urban heritage in Algeria from degradation and the need for its safeguard by the morphological analysis of Ksar Tadjrouna in Laghouat which is an example which requires operations of conservation and preservation.

2. Materials and Methodology

2.1. Study Area

The town of Laghouat is located in the Saharan region of Algeria and shares its limits with two towns of the highlands (Tiaret and Djelfa) and two others of the South which are (El Bayadh and Ghardaia) (Figure 1). So, the town of Laghouat constitutes an open door to the great south. It is located at: 410 km from Algiers (capital); 103 km from Djelfa 187 km from Ghardaia, 270 km from Tiaret and 230 km from El Bayadh (PPMVSA, 2018). The town experiences a desert climate with extremely hot temperatures, especially during the summer months. Laghouat has historical importance, and like many towns in the region, it has been influenced by various cultures and civilizations over the centuries. With origins dating back to at least the 11th century, Laghouat was under Ottoman Turkish rule in 1786 and later became part of the Beylik of Titteri (Médéa). The town endured the harsh Siege of Laghouat in 1852 and remained under French colonial administration until 1962. The local economy is often tied to activities related to the surrounding desert, including agriculture, trade, and tourism.



Figure 1. The location of Laghouat (Anonymous, 2020)

Laghouat has architectural and cultural elements that reflect the traditions and heritage of the Saharan region. The town attracts tourists interested in exploring the unique Saharan landscapes, as well as those interested in historical and cultural aspects of the region.

The town of Tadjrouna is located in the southwest of Laghouat province (82 km from Laghouat) (Figure 2). It has a population less than 5000. The ksar is located in the southeast of Tadjrouna city (Direction De La Culture De Laghouat., 2017).

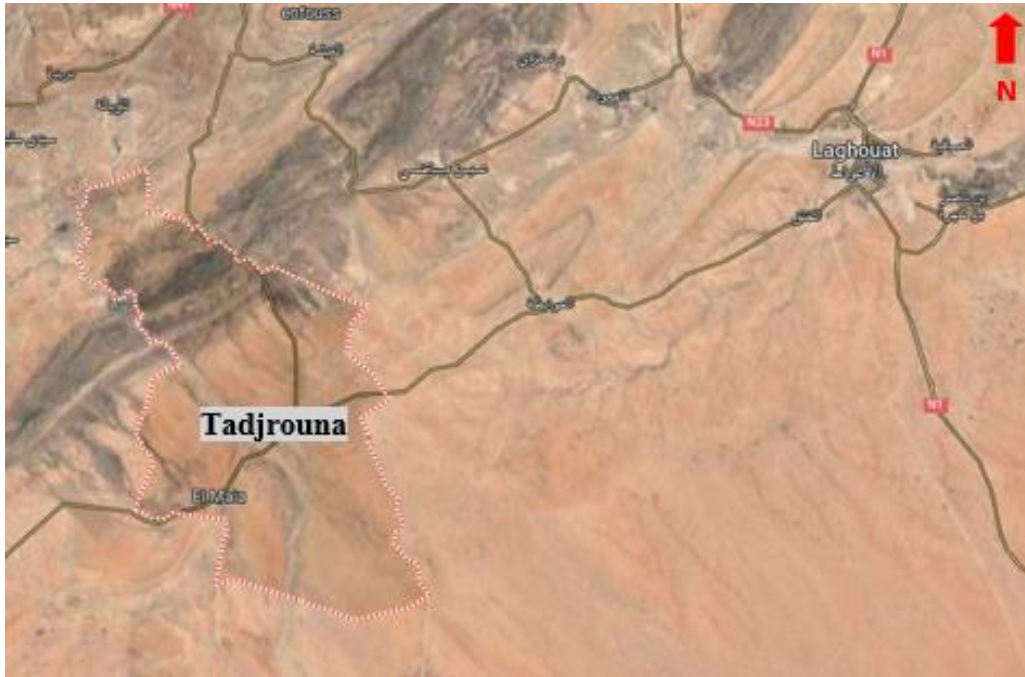


Figure 2. The location of Tadjrouna

2.2. Research Methodology

Urban morphology encompasses various disciplines and is of interest to diverse professions, including architecture, archaeology, anthropology, ethnography, geography, history, and philosophy. It is a branch of urban studies that deals with the form and structure of a settlement. It studies complex and intricate types of forms and how different factors set their mark upon the whole city. In this way urban morphology examines the configuration of the urban form as well as the relationship between the individual forms and the city as a whole, from the formative years of the city through its subsequent transformations (Kristjánsdóttir, 2019). Scheer (2017) defines urban morphology as the examination of the evolving structure of settlements and the analysis of form specifically in terms of physical elements, without delving into the multitude of relationships these elements may have with other attributes or qualities, like livability. Prokopska (2001) applied the morphological analysis technique to architectural designs. Li and Hu (2022) investigated the correlation between the architectural morphology in both 2D and 3D dimensions and the land surface temperature of urban areas, employing a boosted regression tree method, with Beijing, China as a case study. Cömert (2013) aimed to analyze and compare the urban morphological character of medieval-originated towns across diverse geographies and cultures throughout history, investigating the reasons behind the evolution of town morphology over time and understanding how it is shaped within this dynamic process. Can and Heath (2016) conducted a morphological analysis of Izmir through the application of space syntax. This study addresses the intermediate spaces between buildings and streets, exploring the significance and definition

of spatial configuration in connection with urban morphology and social relations. Topçu and Kubat (2012) examined the morphological transformation of Antakya, focusing on spatial integration and making comparisons between the traditional and modern centers of the city.

There are other studies using this methodology. Brzezicki (2021) conducted a morphological analysis of façades with adaptive shading systems, focusing on the spatial relationship between the shading system and the building's glass envelope. Their empirical evidence revealed that the location of the shading system in relation to the building's glass envelope is a crucial morphological feature determining the extent of spatial transformation in the architectural structure where such a system is installed. Wang et al. (2020) applied a framework for digitally describing and generating block forms, emphasizing the morphological complexity of urban blocks. By incorporating design factors such as the environment, transportation, and visibility, and by summarizing the objectives of blocks and buildings into corresponding functions and control indices, the initial generation plan was formulated. Recently Goodarzi et al. (2023) performed a morphological analysis of Persian historical gardens based on cultural DNA concept.

The morphological approach is defined as a tool for understanding traditional fabrics in a clear and explicit way the complexity of the morphological relationships that reign in old neighborhoods through two modes. These are the mode of distribution (parcel and street system) and the mode of occupation (built and open spaces system) (Borie and Denieul, 1984). The processes of this approach are presented (Figure 3).

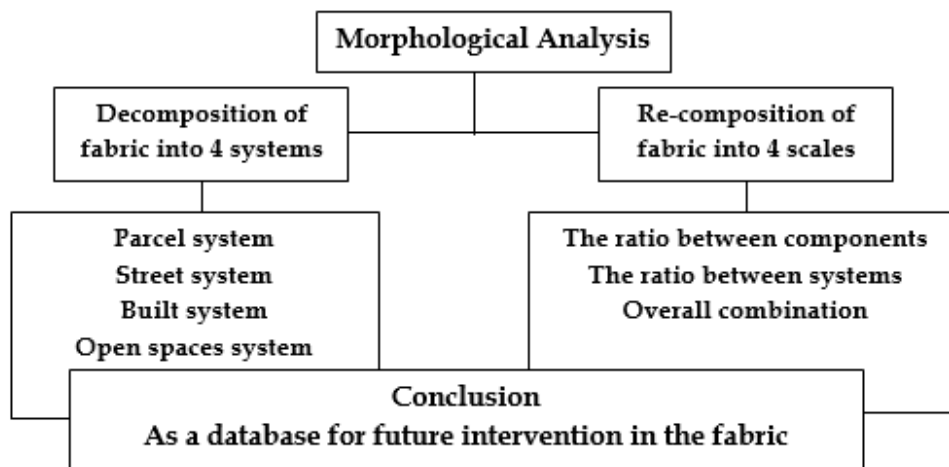


Figure 3. The processes of morphological analysis

The morphological analysis of Ksar Tadjrouna relies to understand how the Ksar has changed in the past and how it may change in the future even without a formal plan. Just as importantly, morphological analysis provides a basis for design that is unique and place-centered. It can protect valuable vernacular resources (e.g. buildings, alleys, street patterns) by recognizing their active contribution to the physical character of the place.

3. Results and Discussion

3.1. Morphological Analysis of Ksar Tadjrouna

Among the traditional fabrics we have our case study; it is the Ksar Tadjrouna which is characterized by its seniority which allows us to take it as a conceptual landmark of traditional architecture. The morphological analysis of Ksar Tadjrouna is shown in Table 1 and Table 2.

Table 1. The decomposition of Ksar Tadjrouna

Decomposition			
Parcel System	Street System	Built System	Open Spaces System
<ul style="list-style-type: none"> ▪ Directions of parcels are hierarchical; this means that a preferential direction ▪ Directions of the plots: The fundamental directions of the plot are mainly linked to a natural limit (valley). ▪ A variant of plots of different dimensions. 	<ul style="list-style-type: none"> ▪ Orthogonal Encounter: the hierarchy of the streets does not modify the frontal continuity of the space prevails on the lateral side. ▪ Inclusion of linear system with loop system (hierarchical). 	<ul style="list-style-type: none"> ▪ Planar built: the buildings are attached to each other on all sides to form a continuous mass. ▪ No ramified planar built. ▪ The type of volumes: building with a central courtyard. 	<ul style="list-style-type: none"> ▪ Planar Building: The differentiation between private free space and public free space tends to be done automatically. ▪ A certain balance between the full and the empty.

Table 2. The re-composition of Ksar Tadjrouna

Re-composition		
Topological ratio between systems	The ratio between the 4 systems	The ratio between systems
<ul style="list-style-type: none"> ▪ Hierarchical plot: is characterized by a hierarchy between the main road and secondary streets. ▪ The plot has a rectangular proportion. 	<ul style="list-style-type: none"> ▪ The free space is very clearly subdivided into a public zone (P) and a private zone (p), in this case the private space is isolated from all sides. 	<ul style="list-style-type: none"> ▪ After the combination between the built system and the street system, we obtain the tissues of: <ul style="list-style-type: none"> * Planar built system - linear street with hierarchized plot. * We have the case of building aligned on the street.

After this morphological analysis, we can emerge the characteristics that present the identity of Ksar Tadjrouna (Figure 4) which must be taken into account in each intervention:

- The fabric characterized by a no ramified planar built.
- Introverted architecture with the courtyard in the house as the basic unit.
- Hierarchical street system from public to private (street, alley and blind alley).
- The blind alley is 3m and 7m for the commercial street.
- The template is limited in between (ground floor to the first floor).

The notion of privacy presented by:

- The use of a public to private crossing space provided by the places.
- The arrangement of the entrance doors in relation to each other.

- Simple facades characterized by treatment of the doors or windows.

This study has allowed us to understand the elements that help the success of the interventions and to put certain parameters considered as reference elements and basic principles for the operations on the Ksar. It also highlights that the revaluation of the Ksar is a very large operation and proposes interventions that allow the preservation of the Ksar.

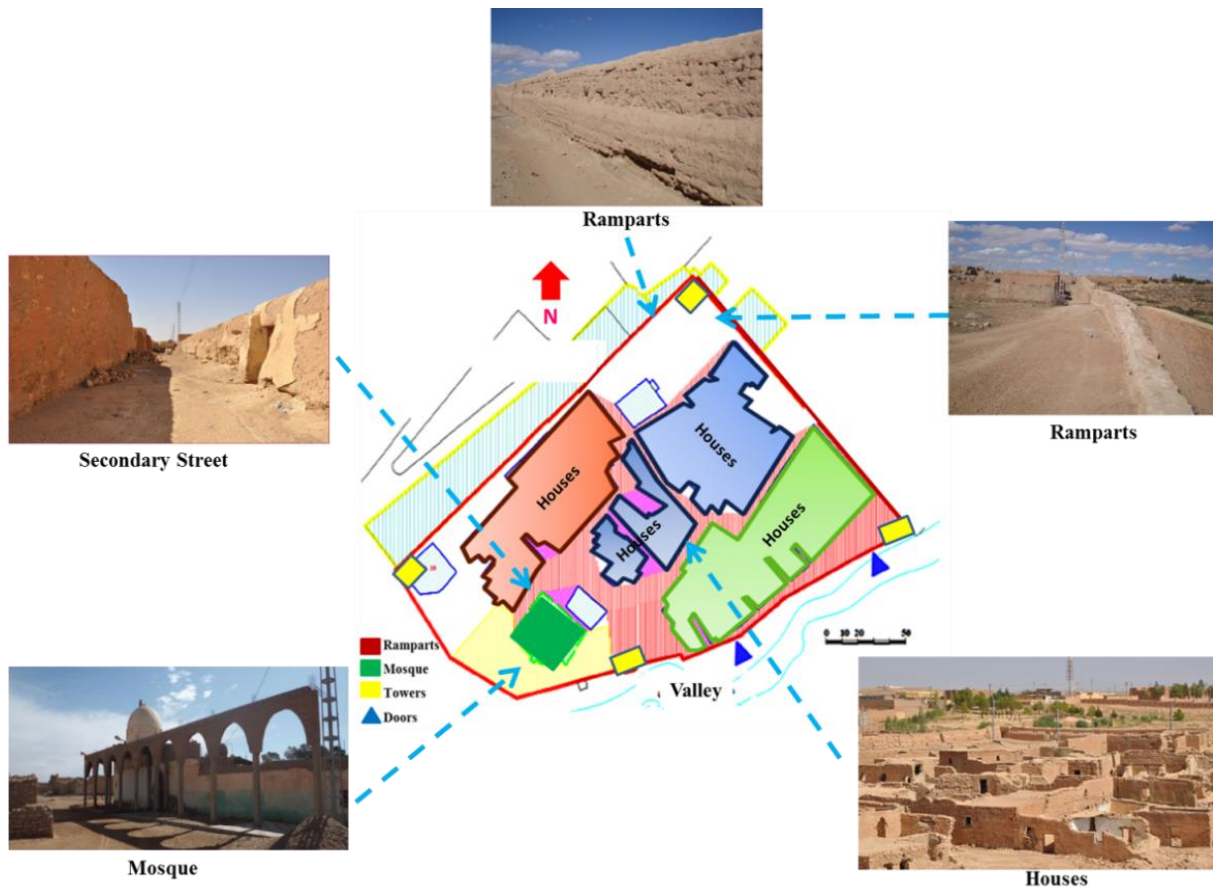


Figure 4. The current state of Ksar Tadjrouna

3.2. Diagnosis

According to several visits to the Ksar, the pathologies noticed in the Ksar Tadjrouna are as follows:

- The use of heterogeneous materials (cement)
- Superficial cracks
- The degradation of the plaster
- Degradation of the base of walls
- The capillary rise
- Degradation of doors.
- Collapse of walls.

Most of the causes of these pathologies are:

- Water stratification
- Absence of maintenance
- Rainwater infiltration.

3.3. The Proposed Strategy (Intervention)

The main objective of our study is the protection of Ksar Tadjrouna through its morphological analysis and the valuation of its tourist potential and the attraction of its inhabitants who have deserted it.

Experience has shown that a comprehensive approach to architectural heritage conservation is imperative for its success. Merely addressing surface-level issues such as filling cracks, renewing plasters, and constructing new buildings may not suffice. A holistic strategy should not only encompass physical restoration but also prioritize community engagement and socio-cultural considerations. Preserving architectural heritage extends beyond the structural aspects; it involves fostering a sense of belonging and identity among the local population.

In instances where conservation efforts are limited to superficial repairs, the result can be a struggle in retaining the current inhabitants. A more nuanced approach that integrates the community into the preservation process is essential. This approach not only ensures the sustainability of the architectural heritage but also enhances the quality of life for the residents.

Furthermore, a one-dimensional focus on physical restoration may not encourage the return of those who have left the area. A successful conservation policy should strive to create an environment that attracts and welcomes back individuals who may have migrated for various reasons. This might involve initiatives that blend modern amenities with historical significance, thereby striking a balance between preservation and contemporary needs.

In essence, a holistic architectural heritage conservation policy should intertwine physical restoration with community involvement, creating a sustainable and vibrant environment that not only preserves the past but also enriches the present and future.

In light of these challenges, we propose a renovation plan which includes various planning operations (rehabilitation and restoration operations), in the objective (i) to provide the Ksar with a basic infrastructure for the inhabitants who still reside there; (ii) and also, to make it find its cultural and spiritual role through the creation of:

- A tourist route inside the ksar which initially passes through the place of the mosque, the typical house (the house of EL-kaid), the place of El-Sahli, the tower.
- Guest houses near the place of EL-Sahli and the restaurant.

These are intended to receive national tourists who come to visit it and attracting international tourists by encouraging cultural tourism. These additions not only cater to national tourists seeking to explore the Ksar but also aim to attract international tourists by promoting cultural tourism, fostering a renewed appreciation for the historical and architectural richness of Ksar Tadjrouna.

4. Conclusions

The Ksar of Tadjrouna has a cultural, historical and tourist importance, it has a particular identity. The nature of urban morphology has been explored as a quantifiable interpretation of the physical form of the Ksar, along with its own theories to explain changes in multiple urban situations.

At the analytical level, we endeavored to conduct a morphological analysis of Ksar Tadjrouna by examining the relationship between space and the successive events that have shaped this Ksar. Additionally, we observed the significance of rehabilitating and

requelifying various systems and components of the Ksar that had undergone degradation and distortion.

This led us to propose recommendations related to specific aspects of urban life and to integrate various dimensions such as social, environmental, and architectural considerations.

- The reassignment of certain heritage buildings to accommodate certain cultural and commercial activities: library, open-air museum restaurant, etc.
- The requalification of public places that have been marginalized.
- Improving the urban landscape through the urban renovation of facades.

All these proposals and solutions were derived from a desirable theoretical framework intended for real-world application. Our ultimate goal is to advocate for the classification of Ksar Tadjrouna as a safeguarded sector, ensuring its conservation as a testament to a rich and characterizing civilization.

Author Statement

The author confirms sole responsibility for the study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Conflicts of Interest

The author declares that there is no conflict of interest.

References

- Anonymous. (2020). On The World Map, <https://ontheworldmap.com/algeria/>. (Date of access: 03.05.2023)
- Borie, A., & Denieul, F. (1984). Etude et Document sur le Patrimoine Culturel, Méthode d'analyse Morphologique des Tissus Urbains Traditionnels, UNESCO. Paris, France.
- Brik, B., & Smaali, A. (2016). La Réhabilitation Des Ksour De La Veille Ville De Nigrine, Cas D'études: (Types de Maisons Ksouriennes). *Master Thesis*. Larbi Tébéssi-Tébessa University.
- Can, I., & Heath, T. (2016). In-Between Spaces and Social Interaction: A Morphological Analysis of İzmir Using Space Syntax. *Journal of Housing and the Built Environment*, 31, 31-49.
- Cömert, N. Z. (2013). Testing an Integrated Methodology for Urban Typo-morphological Analysis on Famagusta and Ludlow (Publication No. 11129/656). *Doctoral Dissertation, Eastern Mediterranean University*. Eastern Mediterranean University Institutional Repository.
- Direction De La Culture De Laghouat. (2017). «Etude Des 5 Ksours De Laghouat ».
- Dłużewska, A., & Dłużewski, M. (2017). Tourism Versus The Transformation of Ksours-Southern Morocco Case Study. *Bulletin of Geography. Socio-economic Series*, (36), 77-86.
- Goodarzi, P., Ansari, M., Mahdavinejad, M., Russo, A., Haghghatbin, M., & Rahimian, F. P. (2023). Morphological Analysis of Historical Landscapes Based on Cultural DNA Approach. *Digital Applications in Archaeology and Cultural Heritage*, 30, e00277.

- Hamma W. (2011). Intervention Sur LePatrimoine Urbain, Acteurs Et Outils, Le Cas De La Ville Historique De Tlemcen (Publication No. 112/10733). *Master Thesis*. Abou Bekr Belkaid Tlemcen University.
- Kristjánisdóttir, S. (2019). Roots of Urban Morphology. *ICONARP International Journal of Architecture and Planning*, 7, 15-36.
- Li, Z., & Hu, D. (2022). Exploring The Relationship Between The 2D/3D Architectural Morphology and Urban Land Surface Temperature Based on a Boosted Regression Tree: A Case Study of Beijing, China. *Sustainable Cities and Society*, 78, 103392.
- Mazouz. F. (2015). Le Renouveau Du Patrimoine Bâti Vétuste -Le Cas Du Centre-Ville d'Oran. *Doctoral Dissertation, University of Science and Technology of Oran Mohamed-Boudiaf*.
- PPMVSA. (2018). Plan Permanent de Mise en Valeur et de Sauvegarde des Sites Archéologiques, la direction de la culture de la wilaya de Laghouat. "Permanent Plan for the Development and Protection of Archaeological Sites, cultural department of Laghouat". Project leader: Chettih Azzedine, Studies Office: Sahli Faisal.
- Prokopska, A. (2001). Application of Morphological Analysis Methodology in Architectural Design. *Acta Polytechnica*, 41(1), 46-54.
- Scheer, B. C. (2017). Urban Morphology as a Research Method. *Planning Knowledge and Research*, 167-181.
- The Burra Charter. (2013). The Australia ICOMOS Charter for Places of Cultural Significance.
- Topçu, M., & Kubat, A. S. (2012). Old and New City: Morphological Analysis of Antakya. In *8th International Space Syntax Symposium* (pp. 1-16).
- UNESCO. (2003). UNESCO Convention for the "Safeguarding of the Intangible Cultural Heritage".
- UNESCO. (2019). Operational Guidelines for the Implementation of the World Heritage Convention. United Nations Educational, Scientific and Cultural Organization, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage.
- Wang, X., Song, Y., & Tang, P. (2020). Generative Urban Design Using Shape Grammar and Block Morphological Analysis. *Frontiers of Architectural Research*, 9(4), 914-924.