Impact of Urban Renewal on the Quality of Life in Informal Settlements in M'sila, Algeria

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Abstract: M'sila, like other Algerian cities, faces major difficulties that result in urban deterioration compromising the quality of life. Informal urban settlements become interconnected with the city's urban structure, requiring a strategic and effective intervention to restore these places and enhance living circumstances. Many studies have shown that informal housing is widespread and represents one of the most dominant features of urbanization in developing countries. The aim of this study is to conduct examinations of urban renewal strategies and emphasize their crucial significance in incorporating informal urban settlements into an authorized urban framework, thus supporting the advancement of sustainable urban development. GIS are utilized to conduct accurate geographical analysis in accordance with multicriteria decision analysis (MCDA) methods to methodically find and assess suggested alternatives. The methodology involved collecting and analyzing field data using advanced analytical tools to generate practical recommendations. The study concludes that urban renewal strategies integrating GIS and MCDA significantly improve the quality of life in informal settlements, particularly when prioritizing infrastructure upgrades and community participation. **DOI: 10.1061/JUPDDM.UPENG-5969**. © *2026 American Society of Civil Engineers*.

Practical Applications: This study equips urban planners, policymakers, and stakeholders with actionable strategies to enhance quality of life in informal settlements like those in M'sila, Algeria. By integrating GIS with multicriteria decision analysis, it enables precise spatial identification of service gaps (e.g., healthcare, transportation) to prioritize interventions, formulate inclusive policies that align informal housing with formal urban plans, and optimize resources using cost-calibrated benchmarks like road upgrades (120 million DZD/km). Critically, it addresses spatial inequities by targeting peripheral neighborhoods (e.g., Guerfala) where infrastructure deficits reduce the quality of life by 2–3 times compared with central areas. The participatory framework—featuring community codesign of solutions like sanitation systems—mitigates gentrification and ensures that upgrades reflect resident needs, supporting SDG 11 goals. Urban professionals in rapidly urbanizing regions (Maghreb, sub-Saharan Africa, or analogous Global South contexts) can directly implement this scalable GIS-analytic hierarchy process (AHP) methodology, tailoring AHP weightings (Table 6) to local factors (flood risk, informal economies) and cost models to transform informal settlements into hubs of equitable, sustainable development.

Author keywords: Urban deterioration; Urban renewal; Treatment strategies; Informal urban settlement; Quality of life.

Introduction

Algerian cities have seen rapid demographic increase on account of the movement of a large part of the population to the metropolis. This movement toward urban growth has produced an unparalleled phenomenon in terms of pace and scale, significantly impacting the form and substance of cities. This rapid, often unplanned, urbanization has led to the emergence and proliferation of informal settlements, characterized by precarious housing, inadequate infrastructure, and insecure tenure, significantly altering the urban landscape.

The structural composition of many Algerian cities, including M'sila, reflects this haphazard development, resulting in degraded urban fabrics. While these areas have witnessed substantial population increase, limited strategic intervention has led to deterioration affecting not only the physical environment but also the sociocultural fabric and residents' well-being (Walshe et al. 2012). This challenge is particularly acute in postcolonial contexts in which historical planning legacies complicate sustainable urban development efforts, as seen in studies like Ahmed and Boudjemaa 2023 on Djelfa, which highlight significant layout changes over time due to rapid growth and specific projects.

Urban renewal, especially in informal settlements, depends critically on addressing the several aspects of housing deprivation. These go beyond simply the physical lack of adequate housing and cover the complexity of tenure security, access to basic amenities like water and sanitation, and the general quality of the living environment. As emphasized in comparative urban studies, successful renewal often requires a multisector partnership approach and direct community involvement to align diverse needs with structured urban strategies (Hall and Hickman 2002). This aligns with broader theoretical discussions on urban informality, which stress the need for inclusive approaches rather than simple eradication (Roy 2005) and advocate for recognizing the right to the city for all inhabitants, including those in informal areas (Harvey

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2008). A mix of localized strategies and community-driven solutions, like those seen in both England's community-centered models and France's government-led initiatives, illustrates the potential of collaboration in fostering sustainable and equitable urban renewal. Understanding these linked issues is crucial, according to researchers such as Arimah (2011), Patel et al. (2022), Duque et al. (2017), and Taubenböck and Kraff (2014), in order to develop effective urban renewal strategies that improve living conditions.

In Algeria, national urban policies have aimed at balancing spatial dynamics, enriching urban spaces, and improving quality of life (QoL). However, similar to other renewal efforts globally, the economic and employment outcomes of these initiatives have often fallen short, signaling a need for cost-effective strategies that maximize socioeconomic impacts (Keane and Garvey 2006). The research gap this study addresses lies in the specific application and evaluation of integrated GIS and multicriteria decision analysis (MCDA) techniques for assessing the quality of life within M'sila's informal settlements as a basis for targeted urban renewal strategies. While urban renewal and informality are studied globally, detailed, methodologically robust assessments within the specific sociospatial context of secondary Algerian cities like M'sila remain limited. This study aims to fill this gap by providing a replicable framework for analysis and intervention. The development of spatial analysis methods and GIS has greatly changed our knowledge of informal settlements. Understanding the complex spatial patterns of informal settlements and developing more effective and focused urban renewal strategies depend on this sophisticated data analysis (Duque et al. 2017; Kuffer et al. 2016; Mboga et al. 2017; Mahabir et al. 2018).

Improving living conditions in cities depends on tracking the proportion of urban people living in slums—referred to as the urban slum population percentage. Although this indication is rather important, not much study has been done globally on mapping it (Ren et al. 2024). The absence of comprehensive data obstructs our comprehension of the magnitude and spread of urban slums, complicating the formulation of effective reform measures.

Furthermore, recognizing the need for inclusive and democratic planning processes, research highlights the importance of citizen participation to ensure that renewal plans align with residents' needs and foster trust between planners and communities. These studies underline the need for developing trust and cooperation between planners and citizens, thereby producing more sustainable and fair urban renewal plans (Arnstein 1969; Forester 1982; Baker et al. 2007; Conroy and Evans-Cowley 2006; Sarkissian et al. 2010). Such approaches contribute to more sustainable and equitable outcomes, aligning with international frameworks like UN-Habitat's (2003) principles for sustainable urbanization and the Sustainable Development Goals (SDGs 11).

Informal urban fabrics constantly adapt to evolving needs and growth. Managing these areas requires strategies to preserve and renew urban quality of life, necessitating tools to address declining conditions. Informal settlements are a common, significant component of M'sila's structural composition and not just isolated areas.

Prior interventions in M'sila include the 2010 Slum Upgrading Program, which focused on road widening and sanitation in Ishbilia. However, limited funding led to partial implementation, exacerbating spatial inequities. Despite national efforts in Algeria, including policies on land occupancy, desired outcomes in balancing spatial dynamics, enriching the built environment, and improving the quality of life have not fully materialized. The degradation of informal settlements reflects both the loss of basic urban standards and uncontrolled expansion, often ignoring the human scale in planning. M'sila, a city in northeastern Algeria, has experienced rapid urbanization since the 1990s, with informal settlements now constituting 20% of its urban fabric. Current national policies, such as the 2015 Urban Renewal Initiative, aim to regularize land tenure and improve infrastructure. Key projects include the 2010 Slum Upgrading Program in Ishbilia, which focused on road widening and sanitation but achieved only partial success because of funding gaps (Ahmed and Boudjemaa 2023). As of 2023, only 40% of informal areas had been upgraded, primarily in central neighborhoods like Koush and Larocade. The city of M'sila was selected as a case study, located 230 km southeast of the Algiers, as illustrated in Fig. 1.

Materials and Methods

This study employs an analytical approach using GIS and MCDA techniques to evaluate the quality of life in the informal urban fabrics of M'sila city. The work is divided into two main phases: The first phase involves identifying the influencing criteria and estimating their weights using the analytic hierarchy process (AHP). The second phase concentrates on creating a geographic model to examine how urban renewal might impact raising standards of living. Criteria were selected based on a review of previous studies and local expert opinions to improve the accuracy and objectivity of the expected results.

Phase 1: Key Criteria Influencing the Phenomenon and Their Importance

The evaluation of the quality of life in informal urban fabrics is influenced by multiple factors, including economic, social, environmental, and service aspects. In this study, after reviewing previous literature that addressed the phenomenon of informal urban fabrics and their treatment mechanisms in general, especially in areas with similar characteristics to the study area, and benefiting from the opinions of experts, 12 experts were selected through purposive sampling: four urban planners, three sociologists, and five residents (three from nonupgraded areas like Guerfala and two from renewed areas like Ishbilia). Inputs were validated via two Delphi rounds, achieving approximately 80% consensus on criteria weights. Most important factors influencing the study of the quality of life in informal urban fabrics in M'sila city were identified. Given its complexity and indirect link with GIS capabilities, modeling this phenomenon presents a significant challenge.

MCDA uses a collection of techniques based on which the weights of the criteria affecting the investigated phenomena are found. One of the most frequently applied decision-making techniques, the AHP, was applied in this work. Developed by mathematician Saaty (1980) in his studies, this quantitative approach ranks and evaluates alternatives depending on a stated goal (Bediar 2023). The AHP was chosen because of its effectiveness in structuring complex, hierarchical problems, its ability to incorporate both quantitative data and subjective expert judgments, and its established use in urban planning and quality-of-life assessments. While alternatives like TOPSIS or fuzzy logic exist, AHP's pairwise comparison method was deemed suitable for capturing the relative importance of diverse criteria in this specific context. Four basic stages (Taibi 2021) form the basis of the approach:

- Specifying the objective and determining the criteria.
- Creating a comparison matrix and calculating the criteria weights.
- Synthesizing the criteria by calculating the consistency ratio.
- Gathering the criteria to reach a decision.

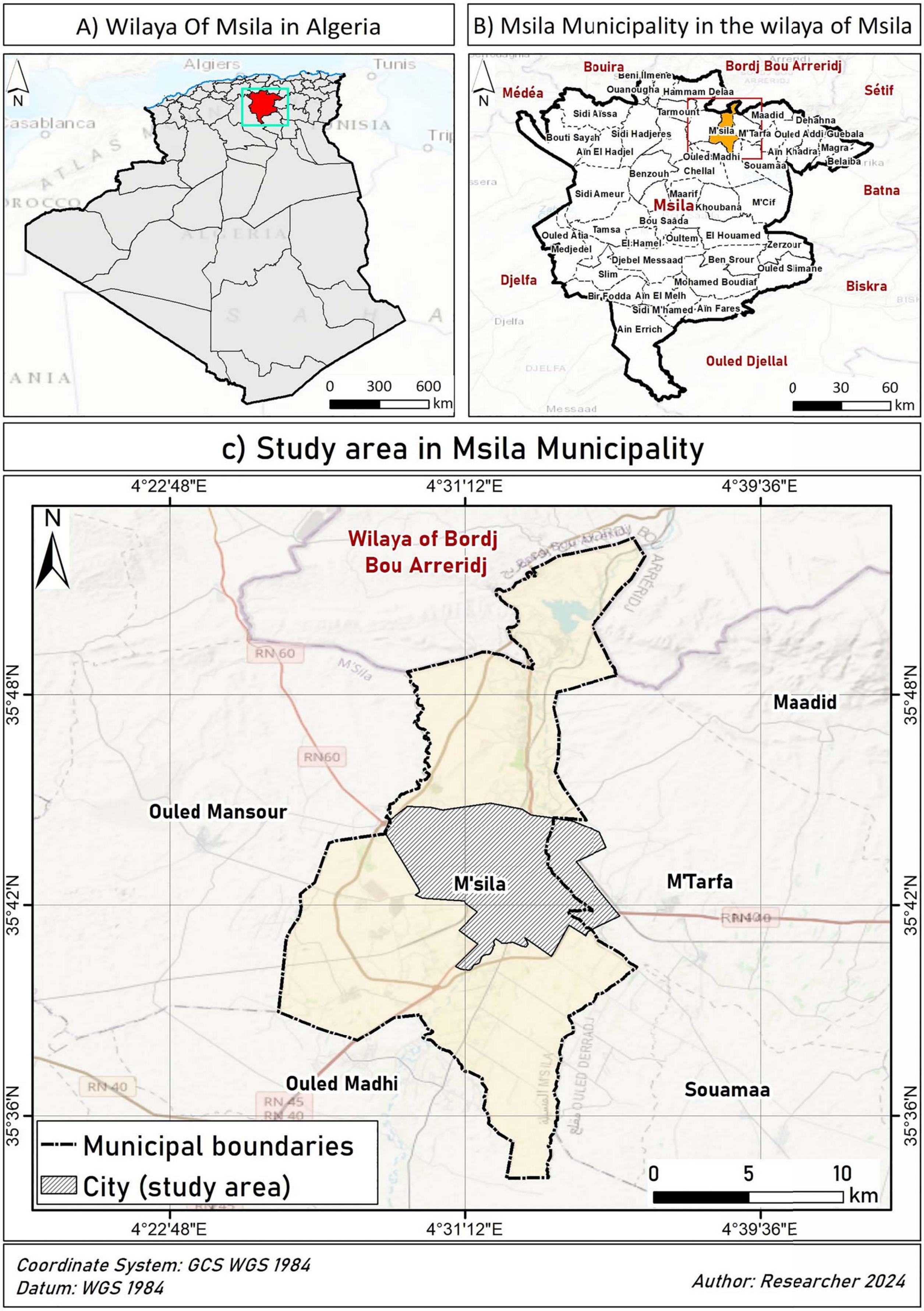

Fig. 1. Location of the study area: (a) Wilaya of Msila in Algeria; (b) Msila Municipality within the wilaya; and (c) the specific study area in Msila Municipality. (Base maps reproduced from MDUPA 2015.)

Phase 2: GIS-Based Model of the Role of Urban Renewal in Enhancing Quality of Life in Informal Urban Areas

Evaluating quality of life involves assessing potentials within the studied geographic area. To guide urban growth regulation and address problems, the evaluation must rely on assessing available resources. GIS programs play a vital role in simplifying the evaluation process through their ability to create models based on geographic data, which helps reduce the negative impacts of these fabrics in many areas and directs decisions accurately and rationally. Spatial data used (detailed in Table 8) included official data sets from municipal directorates (planning, transport), complemented by Urban and Regional Basic Administrative Services (URBAS), a government-managed geospatial repository of public infrastructure locations (e.g., schools, hospitals, security facilities) and OpenStreetMap. These data sets were refined through researchers processing, which involved digitization and attribute verification where necessary. Field validation involved global positioning system surveys and semistructured interviews with 20 residents to verify facility locations and settlement boundaries. Satellite imagery (Google Earth Pro 2023, 30 cm resolution) was cross-referenced with URBAS and OpenStreetMap data. Discrepancies, such as 12 missing waste container points in URBAS, were resolved through ground truthing. Verified data directly informed GIS outputs (Figs. 3 and 4), ensuring alignment with on-the-ground conditions.

This involves the following:

1. Collecting geographic data related to the criteria and extracting individual suitability models for each criterion.
2. Extracting the final suitability model.

Key Criteria for Evaluating Quality of Life in Informal Urban Fabrics in M'Sila City

As mentioned previously, criteria were derived from literature and expert opinion. This selection aimed to cover critical physical, social, and environmental dimensions relevant to informal settlements in the Algerian context. One of basic criteria is the environmental quality of life, which is significant both in terms of "the urban environment and the loss of fundamental standards for the appropriate formation of these areas, affecting the urban landscape" (Dheeb 2009) and in terms of the lack of health prevention due to the shortage of effective waste disposal means. This criterion depends on the distance to waste containers. The psychological and social quality of life is another crucial criterion that mostly addresses the distance to security facilities. Ben Saadi (2002) describes as the deviation of residents' behavior within these fabrics, resulting in serious social problems the residential environment in informal urban fabrics, with its narrow and dark streets, creates an unsafe environment leading to increased crime rates and deviant social behavior among residents.

Among the important criteria found in many studies (Arimah 2011; UN-Habitat 2003) is the physical quality-of-life criterion, which includes several subcriteria such as the distance to health facilities. Informal urban fabrics are considered below the standard of adequate housing because they lack many health facilities, "if not completely lacking in these facilities, and entirely missing basic health conditions" (Tchakouat 2009). The distance to these facilities plays a positive role in improving the quality of life. Another important criterion is population density, because population density (Patel et al. 2022) increases in informal urban fabrics because of overcrowding in limited spaces, even within the same dwelling. These fabrics are known for high occupancy rates, with five to six or more people sharing one room, a trend documented in Algerian informal settlements (Taubenböck and Kraff 2014).

Additionally, the ease of access to transportation is part of the physical quality-of-life criterion and is among the fundamental criteria because of its importance, "as informal urban fabrics are areas that were either never planned or poorly planned" (Afifi 1989). These areas are known for their noncompliance with building and urban planning regulations, leading to narrow or sometimes nonexistent streets, making access difficult, especially during disasters and accidents. On the other hand, the road network contributes to linking these fabrics with the boundaries of the current area, which, in turn, helps reduce economic costs by extending infrastructure services and integrating them with the urban area to achieve urban cohesion.

Finally, among the criteria comprising the physical quality of life is the distance to educational facilities, which is also important. It is well known that in informal urban fabrics, there is always a noticeable decline in the educational level of residents (Khalifa 2011; UN-Habitat 2003) because education is directly influenced by income levels. Given the distance of these fabrics from educational facilities, the deteriorating conditions, and the difficulty of various life demands, residents often prefer work for their children to contribute to the family income rather than pursuing education.

Using the AHP

Defining Objectives and Criteria

The analysis process in this method begins by organizing the complex problem into a hierarchical structure of interrelated elements. The objective of the analysis is placed at the top of the hierarchical structure, followed by the criteria influencing the determination of the optimal alternative at the next level, and finally, the alternatives that define the objective at the lowest level, as shown in Fig. 2. Fig. 2 visually represents this structure, outlining the main QoL dimensions and the specific criteria nested within them.

Creating the Comparison Matrix and Calculating Criterion Weights

In this stage, a binary comparison matrix is created based on expert judgments. Experts conduct binary comparisons between all factors (factor against another factor) according to their relative importance (Al-Ghorayeb et al. 2023). The quantitative importance scale developed by Saaty (1980) (as shown in Table 1) is used to convert evaluations into numerical values that can be used to compare all criteria. In this study, a comparison matrix was created, and criterion weights were calculated at two levels: the first level included the physical quality of life, psychological and social quality of life, and environmental quality of life; the second level focused on the physical quality of life, considering the influential criteria within it, as illustrated in Table 2. Table 2 presents pairwise comparisons for the main Level 1 criteria.

Following the binary comparisons, the sum of each column was calculated. Then, each value in the binary comparison table was divided by the sum of its respective columns. The average of the row values was then calculated to obtain the weights of the criteria, as illustrated in Table 3. Table 3 explicitly shows the calculated weights for each Level 1 criterion derived from the comparison matrix.

To ensure consistency within the binary comparison matrix and validate the calculated weights, the consistency ratio (CR) was determined. This ratio should not exceed (0.1). Before calculating the CR, the consistency index (CI) and the random index (RI) were calculated (RI represents a random consistency index, which are fixed

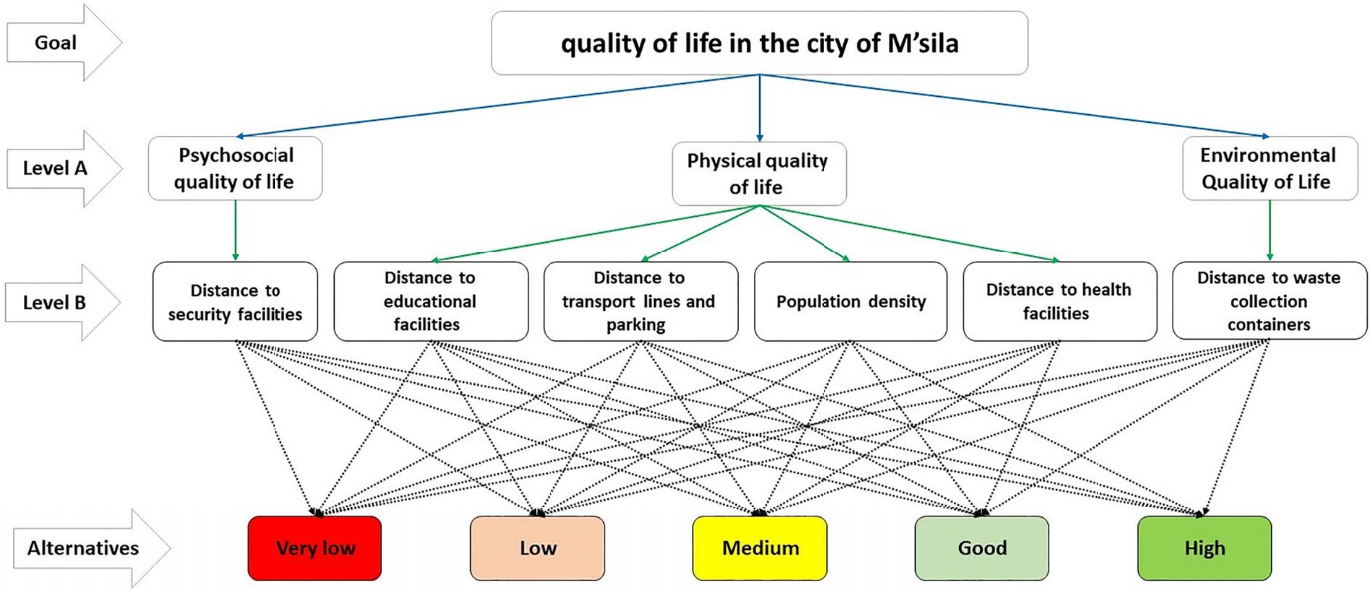

Fig. 2. Hierarchical structure for assessing quality of life in informal urban settlements.

Table 1. Quantitative scale for determining weights by degree of importance

Degree of importance	Value
Equal importance	1
Preference for one criterion over another	3
Strong preference for one criterion over another	5
Very strong preference for one criterion over another	7
Absolute preference for one criterion over another	9
Intermediate values between the aforementioned weights	2, 4, 6, 8

Source: Data from Saaty (1980).

Table 2. Binary comparison matrix (Level 1)

Criteria	Environmental quality of life	Physical quality of life	Psychosocial quality of life
Environmental quality of life	1	2/1	2/1
Physical quality of life	2	1	1
Psychosocial quality of life	2	1	1
Total	5	2.5	2.5

values established by Saaty 1980). The CI is given by the following equation:

$$\mathrm{CI} = \frac{\lambda\_\max - n}{n-1} \tag{1}$$

The values of previous indicators for Level 1 are indicated in Table 4, where (**λ**_max) is the largest eigenvalue and (n) is the number of criteria. Values for Level 1 are given in Table 4.

Table 4. Values of previous indicators in the study for Level 1

AHP consistency indicators	Values
λ_max	3
CI	0
RI (5)	0.58
CR	0

The CR was calculated by dividing the CI by the RI using the following equation (Saaty 1980):

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \tag{2}$$

Table 5 shows a binary comparison matrix of Level 2 as follows:

Using the same approach at Level 1, the criterion weights were obtained, as shown in Table 6. Table 6 details these weights for the subcriteria within physical quality of life.

By applying the same method, we calculated the values for CR, RI, and CI, yielding the following results, as given in Table 7. Table 7 presents the consistency check values for the Level 2 AHP analysis.

The CR value in our study for the first level is CR = 0, and for the second level, it is CR = 0.011, which is <0.1. Both values are <0.1, confirming the consistency and reliability of the pairwise comparisons and the derived weights. Therefore, the previously calculated weights are considered reliable.

Using GIS

Geographic Data Collection Phase

This phase is summarized in Table 8. Table 8 lists the specific data types used for each criterion and their sources, including governmental bodies and open data platforms.

Table 3. Calculation of the weights of criteria used in the analysis (Level 1)

Criteria	Environmental quality of life	Physical quality of life	Psychosocial quality of life	Weight	Rank
Environmental quality of life	0.2	0.2	0.2	0.2	2
Physical quality of life	0.4	0.4	0.4	0.4	1
Psychosocial quality of life	0.4	0.4	0.4	0.4	1

Table 5. Binary comparison matrix for Level 2 (physical quality of life)

Criteria	Sanitary facilities	Population density	Easy access to transportation	Distance to educational facilities
Sanitary facilities	1	2	1/2	1/3
Population density	1/2	1	1/3	1/4
Easy access to transportation	2	3	1	1/2
Distance to educational facilities	3	4	2	1
Total	6.5	10	3.833	2.083

Table 6. Calculation of the weights of criteria used in the analysis for Level 2 (physical quality of life)

Criteria	Sanitary facilities	Population density	Easy access to transportation	Distance to educational facilities	Weight	Rank
Sanitary facilities	0.153	0.2	0.130	0.16	0.161	3
Population density	0.076	0.1	0.086	0.12	0.095	4
Easy access to transportation	0.307	0.3	0.260	0.24	0.277	2
Distance to educational facilities	0.461	0.4	0.521	0.48	0.465	1

Table 7. Values of previous indicators in the study for Level 2

AHP consistency indicators	Values
$L_{\max}$	4.031
CI	0.010
RI (5)	0.9
CR	0.011

Extracting Individual Quality-of-Life Models

In this phase, a set of cells must be created, particularly concerning distances, to directly extract individual quality-of-life models. For example, if the criterion relates to the distance to waste containers, the data must be obtained in vector form (vector data) (Daoud 2018), and then the distances from waste containers are extracted. Subsequently, each category is ranked to weigh it against the criteria (Taibi 2021). In this study, a scale from 0 to 5 was used according to the degree of impact (with a value of 0 representing very low-quality life, 1 representing low-quality life, 3 representing medium quality of life, 4 representing good quality, and 5 representing high quality), as shown in Table 9. Table 9 specifies the distance ranges corresponding to each QoL rank for every criterion.

The data from this table are utilized within GIS software environments to create visual models representing individual quality-of-life levels, as illustrated in Fig. 3.

It is observed that the environmental quality of life is good in the neighborhoods under study that are within the urban perimeter, such as the old Ishbilia neighborhood, part of the southern Mouilha, and part of the northern Mouilha. We also find it to be good to high in the neighborhoods of Larocade and Koush. However, for other neighborhoods outside the urban perimeter (such as southern Sidi Ammara, Zeqaqra, Guerfala, Sbaa El Gharbi, and El-Mashtala), the environmental quality of life is generally very low, as shown in Fig. 4.

Table 8. Geographic data collection

Data	Source
Population density	Directorate of Planning + Open Building v3 + Personal Processing
Public facilities (educational, healthcare, security)	URBAS + OpenStreetMap + Personal Processing
Transportation stops and routes	Directorate of Transport + OpenStreetMap + Personal Processing
Waste containers	Technical Landfill Center (TLC) of M'sila + Personal Processing

According to Fig. 4, the psychological and social quality of life in the studied neighborhoods within the urban perimeter ranges from good to high. However, for neighborhoods outside the urban perimeter, the quality of life is good to moderate near the urban boundary but becomes low at the peripheries.

We relied on several criteria to assess the physical quality of life, which are shown in Fig. 5.

Among the criteria used to assess the physical quality of life is the population density criterion (as shown in Fig. 6), which was studied based on the number of residents per hectare. We find that this criterion falls within the range of good to high in all the studied neighborhoods, except for one, which is the Ishbilia neighborhood, where the population density criterion is average. Fig. 6 indicates widespread high density, a common trait of informal settlements.

The distance to educational facilities (Fig. 7) is considered a component of the physical quality-of-life criterion. In the neighborhoods studied, the quality of life for this criterion falls within the range of good to high for neighborhoods within the urban surroundings. In contrast, for neighborhoods outside the urban surroundings, the quality of life for this criterion ranges from medium to low. Fig. 7 illustrates disparities in educational access between inner and outer areas.

With regard to the distance criterion for healthcare facilities, which is considered an influential factor in the physical quality of life, in our study and through Fig. 8, we find that neighborhoods outside the urban perimeter fall within a range of average to low quality of life, while other neighborhoods range from good to high quality of life. Fig. 8 clearly shows better healthcare access for residents in more central, formally developed areas.

As previously mentioned, the criterion of ease of access to transportation is considered part of the physical quality-of-life standard. Additionally, the road network helps connect these areas with adjacent regions. From Fig. 9, we observe that the ease of access to transportation for neighborhoods within the urban perimeter falls within a quality of life range from good to average. In contrast, for neighborhoods located outside the urban perimeter, the quality of life ranges from average to very low. Fig. 9

Table 9. Quality-of-life ranking criteria with color mapping

Quality of life	Color in maps	Range or category	Criterion	Distance (m)
High	Green	0–100	Distance to waste containers (m)	0–3,540
Good	Light green	100–500		
Medium	Yellow	500–800		
Low	Orange	800–1,000		
Very low	Red	1,000–3,540		
High	Green	0–500	Distance to health facilities (m)	0–3,840
Good	Light green	500–1,000		
Medium	Yellow	1,000–1,500		
Low	Orange	1,500–2,500		
Very low	Red	2,500–3,840		
High	Green	0–50	Population density (persons/ha)	Persons/ha
Good	Light green	50–100		
Medium	Yellow	100–200		
Low	Orange	200–300		
Very low	Red	>300		
High	Green	0–200	Distance to transportation (m)	0–3,340
Good	Light green	200–500		
Medium	Yellow	500–800		
Low	Orange	800–1,500		
Very low	Red	1,500–3,340		
High	Green	0–300	Distance to educational facilities (m)	0–3,370
Good	Light green	300–800		
Medium	Yellow	800–1,000		
Low	Orange	1,000–1,500		
Very low	Red	1,500–3,370		
High	Green	0–500	Distance to security facilities (m)	0–3,640
Good	Light green	500–1,000		
Medium	Yellow	1,000–2,000		
Low	Orange	2,000–3,000		
Very low	Red	3,000–3,640		

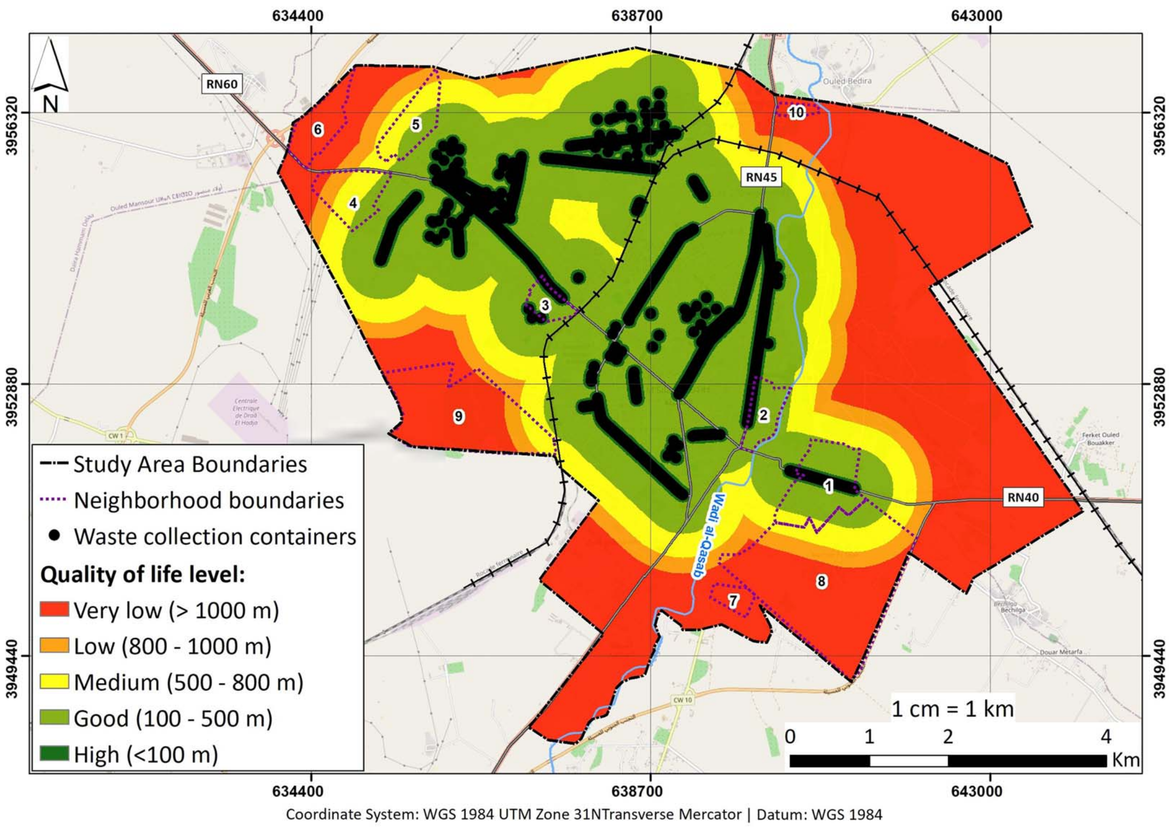

Fig. 3. Environmental quality of life. (Base map generated using ArcMap 10.8.)

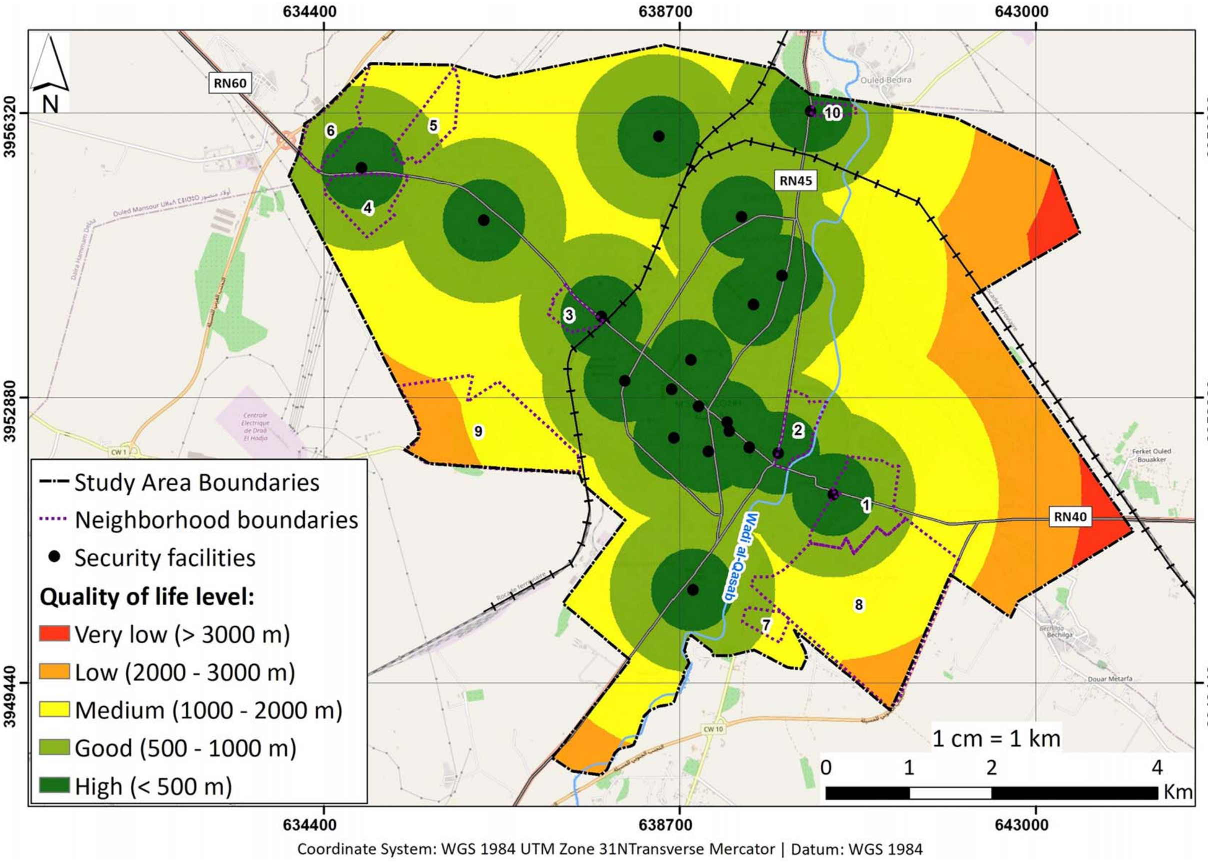

Fig. 4. Psychological and social quality of life. (Base map generated using ArcMap 10.8.)

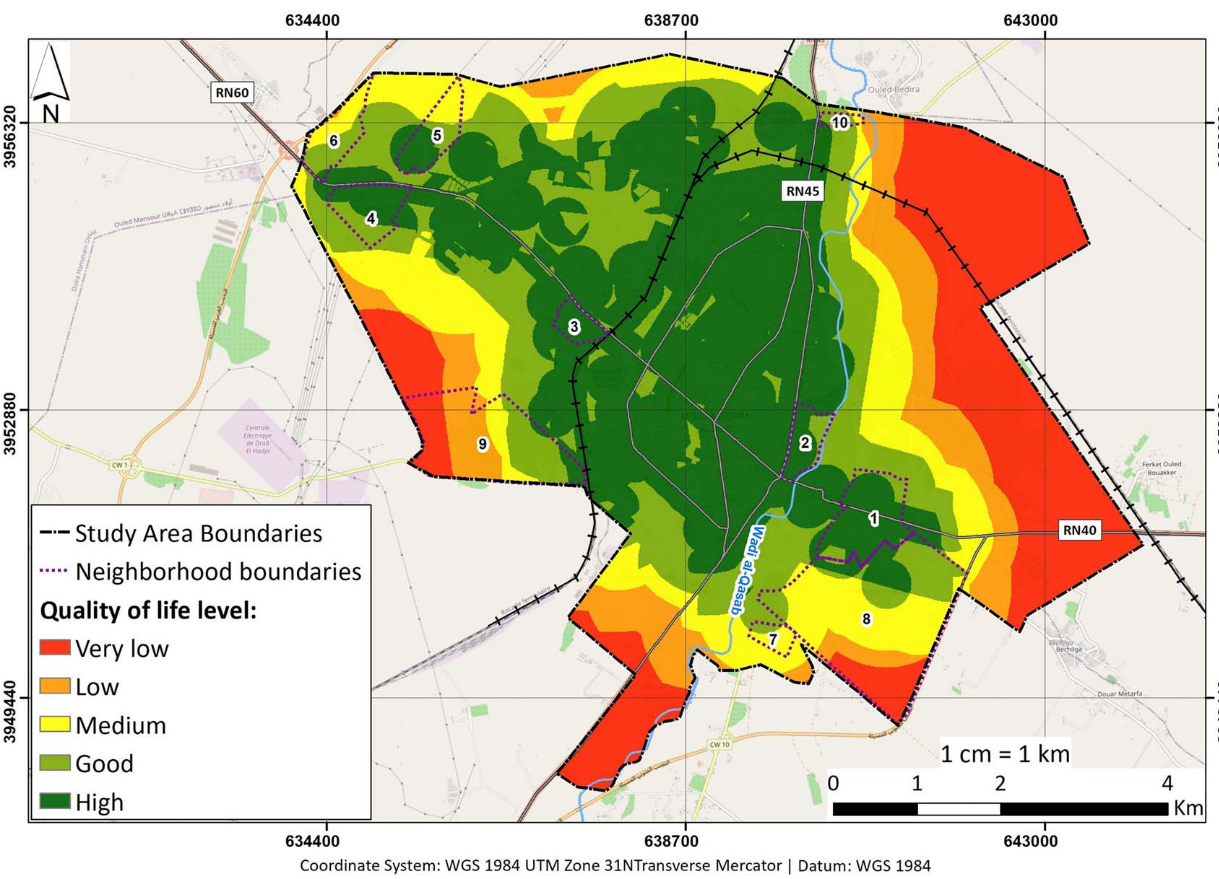

Fig. 5. Physical quality of life. (Base map generated using ArcMap 10.8.)

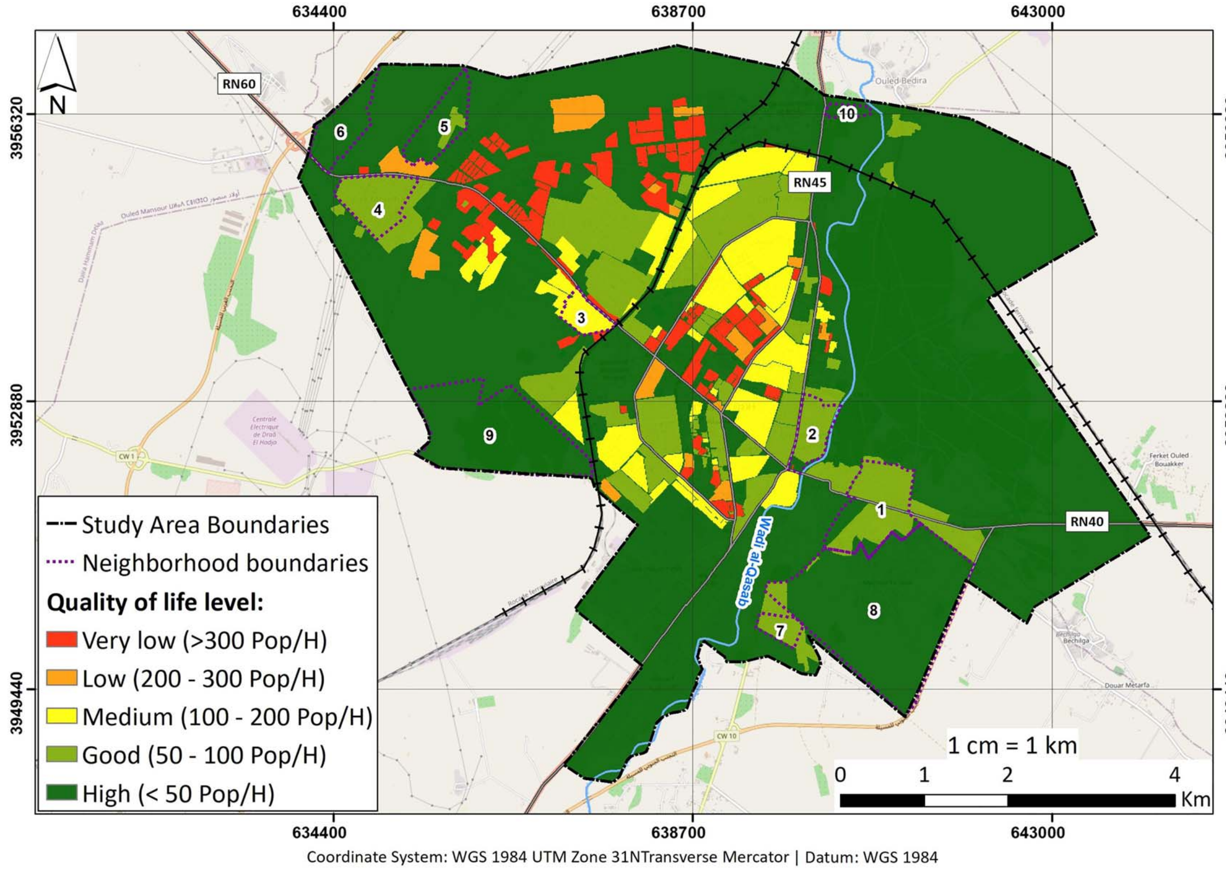

Fig. 6. Population density. (Base map generated using ArcMap 10.8.)

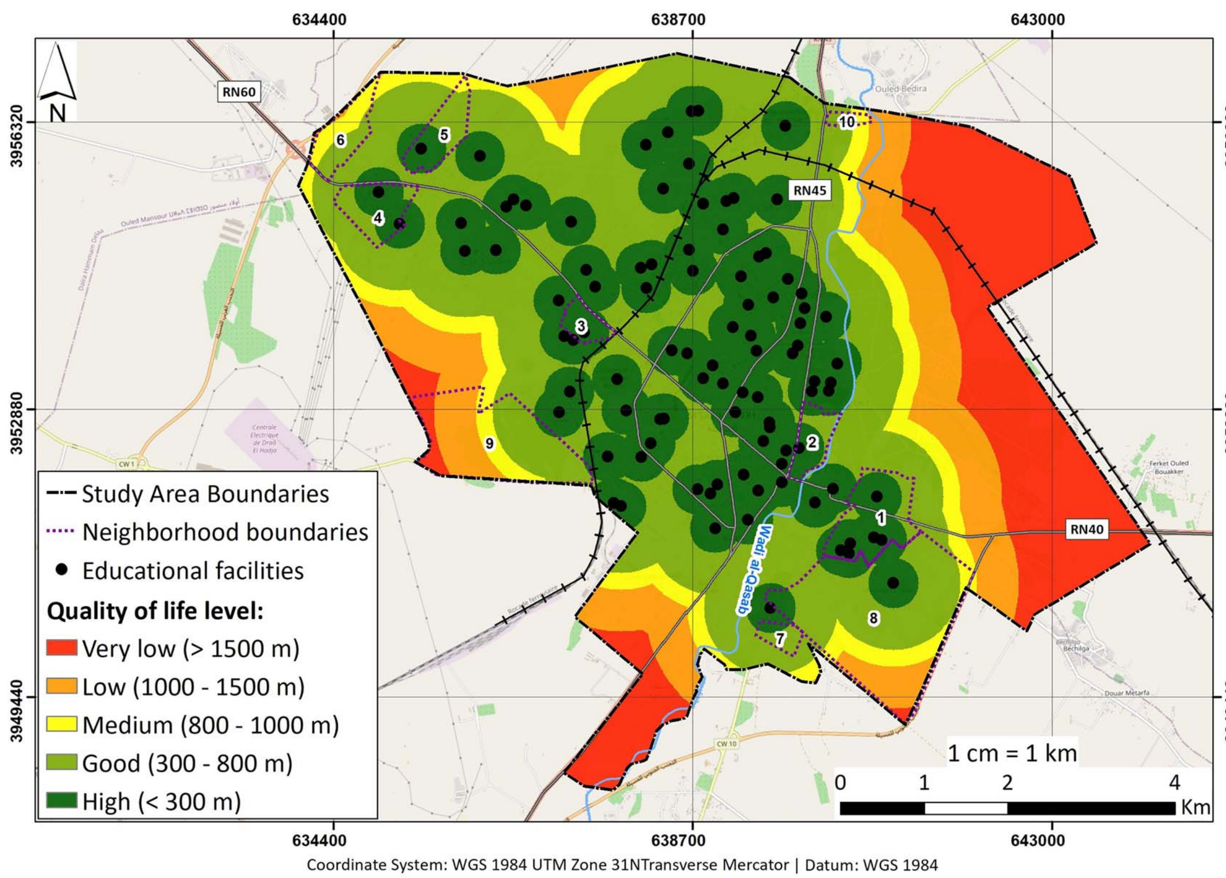

Fig. 7. Distance of educational facilities. (Base map generated using ArcMap 10.8.)

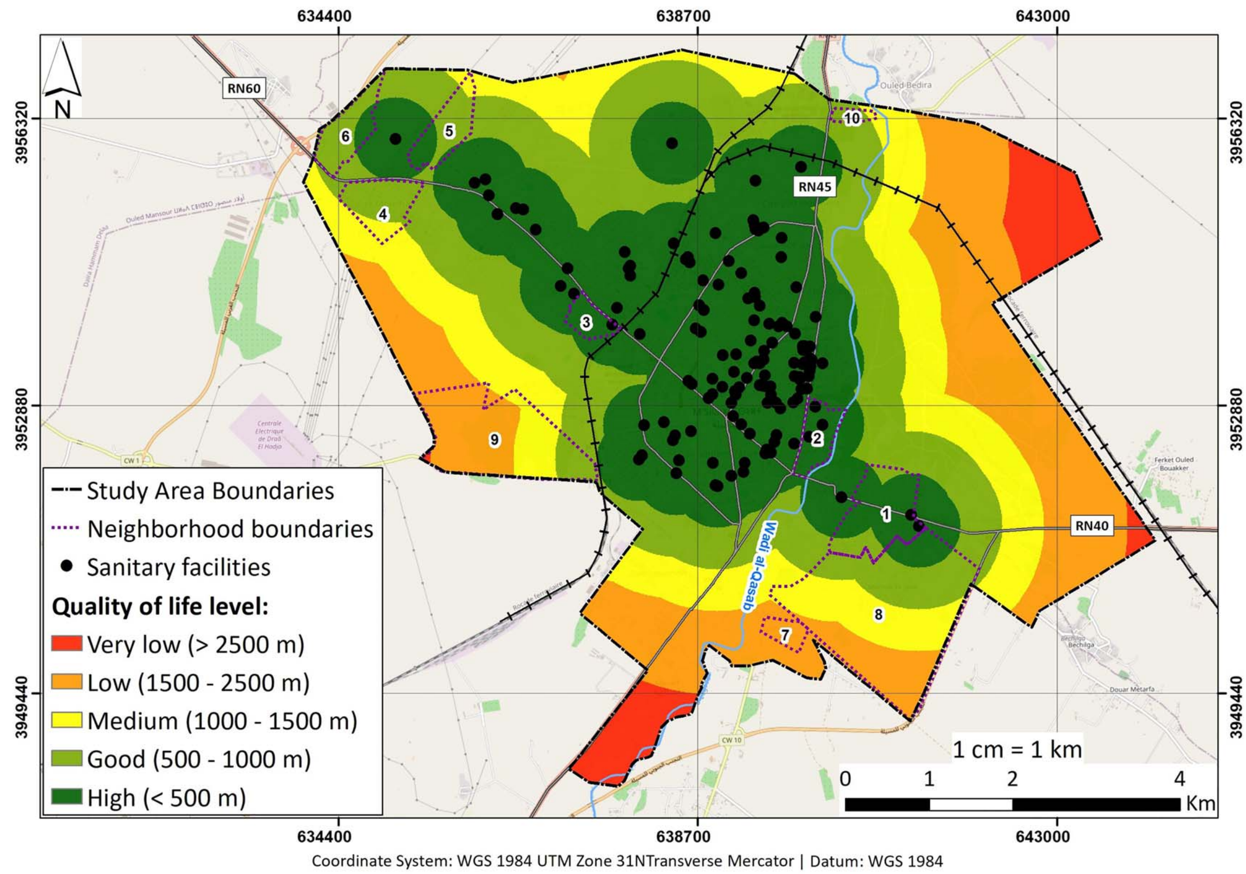

Fig. 8. Distance of healthcare facilities. (Base map generated using ArcMap 10.8.)

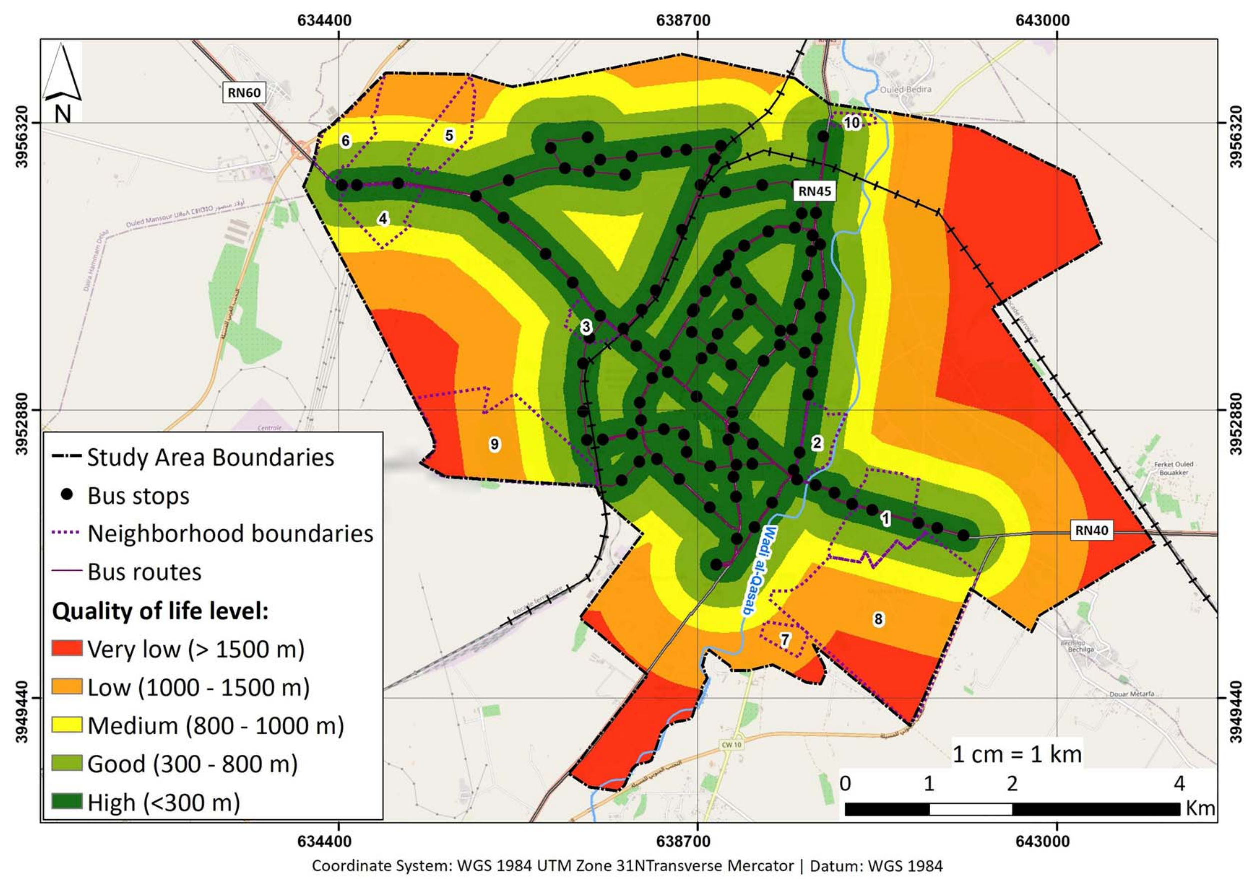

Fig. 9. Accessibility standard for transportation. (Base map generated using ArcMap 10.8.)

highlights the transport connectivity challenges faced by peripheral neighborhoods.

Extracting the Final Suitability Model

After obtaining the individual quality models, the data are continuously used within GIS software to create a final quality-of-life model. This is achieved by aggregating the previous criteria in GIS using weighted overlay based on AHP weights. The final objective can be expressed with the following equation:

Final Objective = (Environmental Quality of Life × Weight of Environmental Quality of Life) + (Psychosocial Quality of Life × Weight of Psychosocial Quality of Life) + (Physical Quality of Life × Weight of Physical Quality of Life).

- Environmental Quality of Life is represented by the distance between waste containers.
- Psychosocial Quality of Life is determined by the proximity to security facilities.
- Physical Quality of Life = (distance to healthcare facilities × weight of distance to healthcare facilities) + (ease of access × weight of ease of access) + (population density × weight of population density) + (educational facilities × weight of educational facilities).

The final quality of life is represented in Fig. 10. Fig. 10 synthesizes all criteria to provide an overall spatial assessment of Quality of Life across the studied neighborhoods.

Similarly, the area and percentage of quality of life of the neighborhoods under study are given in Table 10.

Discussion and Analysis

Fig. 10 illustrates the spatial analysis results using GIS, showing the final evaluation grades for the quality-of-life model, which utilizes the AHP. The study reveals that the urban fabrics of the studied areas—Koush, Larocade, Ishbilia, and southern Mouilha—have a quality of life ranging from good to high. In areas near the city edge, including Zgarir, northern Mouilha, and southern Sidi Amara, quality falls to a good-to-medium level, nonetheless. This study's principal technical contributions comprise the following: (1) a scalable GIS-AHP framework for evaluating the

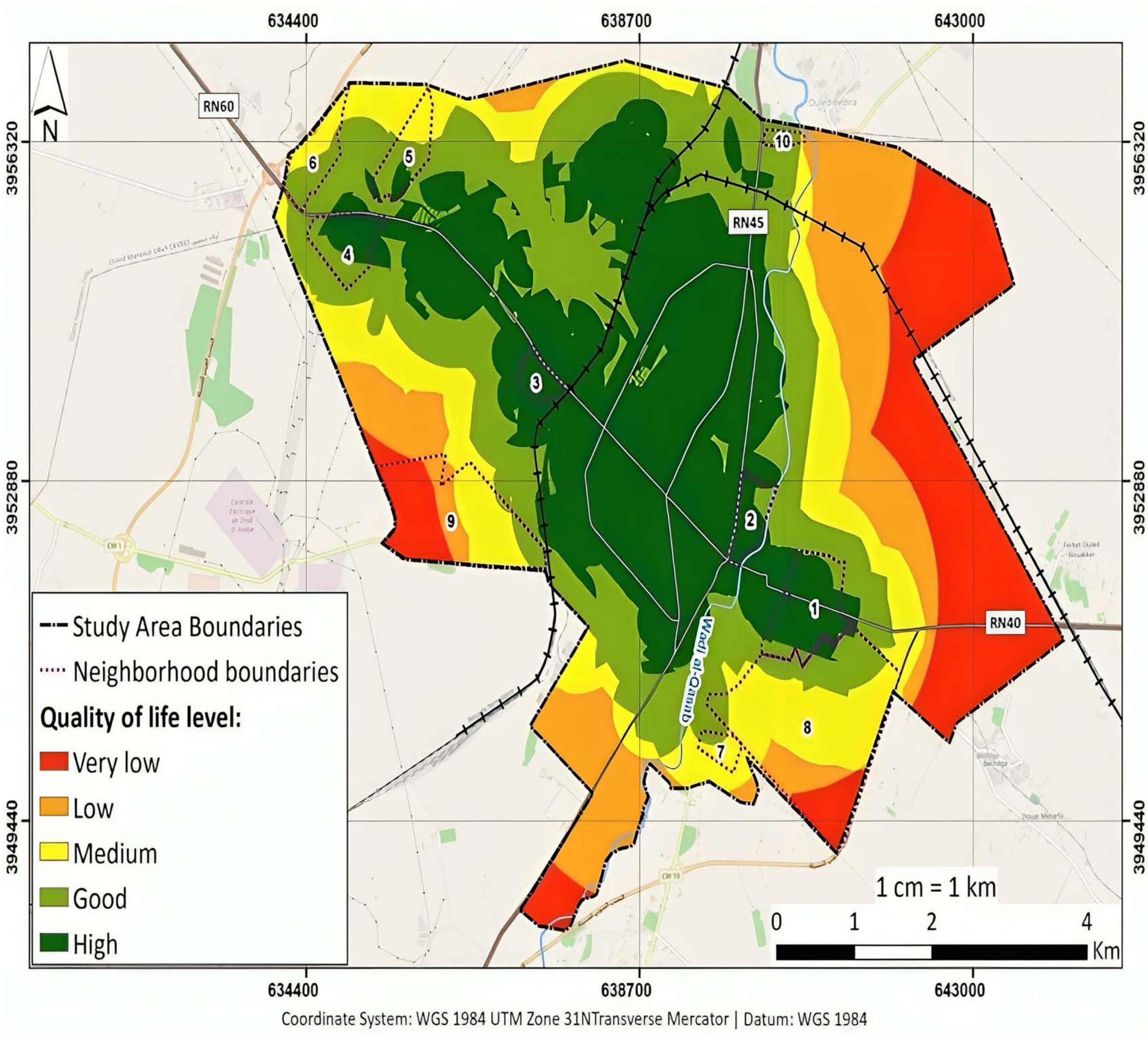

Fig. 10. Final quality of life. (Base map generated using ArcMap 10.8.)

Table 10. Area and percentage of quality-of-life categories of the studied neighborhoods

Neighborhood	Very low (ha)	Low (ha)	Medium (ha)	Good (ha)	High (ha)
1	0	0	0	13.78	67.1
2	0	0	0	5.84	25.19
3	0	0	0	0	19.39
4	0	0	0	18.86	27.61
5	0	0	13.76	20.23	8.26
6	0	0.98	19.39	22	0
7	0	0	10.59	3.71	0
8	36.8	32.77	154.3	60.36	5.98
9	63.38	27.54	57.93	13.96	0
10	0	0.15	0.26	6.96	0

geographic gradients of the quality of life in informal settlements, validated in M'sila (Fig. 10); (2) empirical research indicates that peripheral localities (e.g., Guerfala) have 2–3 times poorer quality-of-life scores than central areas because of infrastructure deficiencies (Table 10); (3) cost-calibrated renewal strategies (e.g., road enhancements at 120 M DZD/km) associated with SDG 11; and (4) a participatory methodology guaranteeing 80% expert consensus (via Delphi) and community codesign (Recommendation 7), augmenting policy legitimacy.

As one approaches the outside of the city, quality further decreases from medium to low and very low as seen in areas like Guerfala, Sbaa El Gharbi, and El-Mashtala (nursery). This spatial gradient clearly correlates quality of life with proximity to the urban core and integration with formal structures.

This decline in quality necessitates strategies to integrate these urban fabrics into the urban environment and adapt them to new life demands. Enhancing urban furniture, improving facilities, and increasing their number are crucial steps. In other words, urban renewal is required to enable these urban fabrics to meet these demands under the fast-paced social and technological changes, ultimately improving quality of life. The challenge lies in addressing the issue of informality of these fabrics and examining the role of urban renewal in improving them to achieve an acceptable quality of life. Critically, the findings of this study underscore the spatial dimension of inequality in M'sila, where peripheral informal settlements bear the brunt of inadequate services and infrastructure, impacting residents' daily lives and opportunities. While the GIS-AHP model provides a valuable diagnostic tool, implementation of effective renewal strategies is beset with significant hurdles and challenges in the form of potential financial constraints for infrastructure upgrades, complex governance structures involving multiple municipal and regional actors, sociopolitical factors related to land tenure regularization, and the need for ensuring genuine community participation to avoid displacement or gentrification. Addressing these implementation challenges requires tailored approaches sensitive to the local context, significant political will, and coordinated multilevel governance. Furthermore, these efforts align with the broader goals of achieving sustainable and inclusive cities as outlined in SDG 11.

Implementing renewal strategies involves facing significant financial and governance challenges. For instance, road upgrades in Guerfala (Recommendation 6) could cost approximately 120 million DZD (USD 900,000) per kilometer, based on Algeria's 2023 Municipal Development Program standards. Funding may require national ministries funding (e.g., Ministry of Housing). However, bureaucratic delays and competing priorities in Algeria's centralized planning system could hinder progress. A decentralized governance model, as piloted in Oran's 2020 slum upgrade, may offer lessons for coordination. These efforts align with SDG 11.1 (upgrading slums) and 11.3 (inclusive urban planning), emphasizing the need for equitable resource allocation.

Conclusion

To comprehensively address the various problems plaguing the irregular and informal urban fabrics under study in the city of M'sila, Algeria, GIS and AHP were employed to map the quality of life in these fabrics. This study provided an in-depth analysis of the factors affecting the quality of life in the urban areas and identified the various issues these areas face. Finding effective and practical solutions requires choosing physical interventions that do not necessarily alter the function of an area but rely on modernization and coherence with the existing urban fabric, thus enhancing the quality of life. Given that our study encompasses marginalized, old, and new irregular urban fabrics within or on the outskirts of M'sila, urban renewal is seen as a successful urban intervention to revitalize these deteriorated fabrics by integrating them into a new framework that presents a suitable and harmonious image of the city.

Study Limitations and Future Research

This study has three key limitations. First, the AHP weights rely on expert judgments, hence introducing the element of subjectivity despite Delphi validation. Second, GIS outputs (e.g., distance to facilities) require ground truthing through household surveys to account for informal footpaths or seasonal accessibility changes. Third, the model does not taken into account economic factors like unemployment rates, which shape quality of life. Future research should test this framework in other Algerian cities (e.g., Oran, Constantine) and integrate socioeconomic surveys with GIS data to refine criteria weights. Comparative studies could also explore how Algeria's informal settlement challenges align with Maghreb or sub-Saharan African contexts.

The following recommendations are directly informed by the study's findings. For example, the GIS analysis (Fig. 10) shows that neighborhoods like Guerfala and El-Mashtala exhibit very low quality of life because of inadequate infrastructure, justifying the need for targeted upgrades in these areas.

Recommendations

1. Implement interventions to regularize planning conditions, potentially developing specific protocols within the existing Algerian planning framework, creating urban environments aligned with basic standards.
2. Assess existing buildings; improve those suitable for development, while removing unsafe structures.
3. Initiate projects aligning with the unique characteristics of the targeted areas, using appropriate urban planning tools that foster local identity.
4. Foster processes integrating irregular fabrics and enhancing planning, viewing urban renewal as vital.
5. Address poor living conditions (unsafe, poorly lit streets contributing to crime) in irregular areas.
6. Prioritize road upgrades in peripheral neighborhoods (e.g., Guerfala, El-Mashtala) where GIS analysis (Fig. 9) shows very low transportation accessibility.
7. Involve residents in codesigning sanitation and waste management systems, reflecting community priorities.
8. Expand healthcare facilities, particularly in areas identified as having low access or quality, such as southern Sidi Amara (Fig. 8).

9. Approach informal area challenges within an urban renewal framework, conducting thorough assessments (social, economic, cultural, health, environmental) and adapting recommendations considering financial feasibility and local governance capacity.

Data Availability Statement

All data, models, and code generated or used during the study appear in the published article.

Author Contributions

Seidi Bouaouira: Software, Validation, Writing—original draft; Boudjemaa Khalfallah: Supervision; Malika Ouzir: Writing—review and editing; Abderrahim Cheikh: Methodology, Writing—review and editing.

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