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Urban Mobility and Territorial Attractiveness in Bir El Djir (Oran) Using the Analytic Hierarchy Process (AHP)

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ARTICLE INFO	ABSTRACT
	This research-oriented inquiry evaluates the allure of Bir El Djir (Oran) through the integration of user surveys and spatial analyses, subsequently establishing a hierarchy of interventions utilizing the AHP methodology (Analytic Hierarchy Process). A survey administered to 100 participants gathers socio-demographic information, the motivations and frequency of visits, and the perceptions regarding transportation. Statistical evaluations indicate that transportation perception (OR = 4.29) and daily trip frequency (OR = 3.08) are the primary determinants affecting user satisfaction. In light of these findings, an AHP hierarchy is formulated (objective → criteria → sub-criteria → alternatives). Odds ratios (ORs) serve as the quantitative foundation for the initial pairwise comparison matrix; the conclusive validation of the weights is conducted by a panel of experts, followed by the amalgamation of judgments and a consistency assessment (CR). The AHP framework facilitates the categorization and prioritization of alternatives (enhancing public transport, extending the tramway, developing cycling pathways, parking management, etc.), elucidating the trade-offs among service quality, frequency, accessibility, and socio-economic repercussions. The findings advocate for the prioritization of initiatives that enhance the perceived quality and frequency of service (approximate initial weights: Perception 44.2%, Frequency 31.8%, Sociodemographic Factors 24.0%), while emphasizing the necessity for expert validation and sensitivity analysis to fortify the integrity of the decisions rendered. **Keywords**: Urban mobility, territorial attractiveness, AHP, peripheral municipality, commuter flows, Bir El Djir, Oran metropolis

INTRODUCTION

Urban mobility today constitutes one of the fundamental pillars of contemporary city functioning. It structures social, economic, and spatial interactions by conditioning access to services and opportunities (Urry, 2007). In expanding metropolises, the intensification of travel flows, demographic pressure, and the growth of often diffuse urbanization render mobility challenges particularly complex (Wiel, 2006). These challenges encompass both the fluidity and performance of networks and aspects of quality of life, sustainability, and territorial equity (Banister, 2008).

The municipality of Bir El Djir, located east of Oran, exemplifies these tensions characteristic of rapidly transforming urban spaces. Its spatial development, the establishment of structuring facilities—particularly university ones—and its growing role within the metropolitan framework have generated strong attractiveness and a significant increase in daily trips. This dynamic produces recurrent issues: congestion, extended travel times, saturation of public transport, and accessibility inequalities, as highlighted by several studies on Maghrebi cities undergoing urban transition (Belguidoum & Madani, 2019).

Understanding the determinants of mobility in this context is essential for guiding planning and governance decisions. Surveys conducted among users reveal that perceived transport quality, trip frequency, employment hub

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connectivity, and sociodemographic characteristics strongly influence satisfaction and modal practices, consistent with literature analyses on mobility behavior (Ettema et al., 2011). However, these factors interact in complex ways, necessitating a method to establish an objective hierarchy of priorities.

The Analytic Hierarchy Process (AHP), developed by Saaty (1980), emerges as a robust tool for structuring multicriteria decision problems. It decomposes a complex issue into hierarchical levels, performs pairwise comparisons of criteria, and determines consistent weights validated by an internal consistency check. In the mobility domain, several studies have demonstrated AHP's relevance for evaluating transport strategies, prioritizing infrastructure alternatives, or analyzing urban service quality (Macharis & Bernardini, 2015).

Integrating AHP into the study of mobility in Bir El Djir thus represents a pertinent approach to transform empirical results into a structured decision model. This method identifies the most determinant criteria, compares various intervention scenarios, and proposes action priorities aimed at improving mobility and enhancing territorial attractiveness

Study

AREA STUDY :

The municipality of Bir El Djir covers an area of approximately 4,035 hectares. Located in the northeast of Oran province, it extends from north to south over nearly 5 km, from the coastal cornice overlooking the sea to the heights of Sidi Marouf, which overlook the depressions of Sidi Chahmi to the south. To the northwest, a coastal strip belonging to the municipality of Oran, less than one kilometer wide at Canastel, directly separates it from the sea.

Administratively, Bir El Djir is bounded to the west by the municipality of Oran, to the north by the sea, to the northeast by Hassi Ben Okba, to the southeast by Hassi Bounif, and to the south by Sidi Chahmi. It serves as the headquarters of the Bir El Djir daïra, which groups the municipalities of Bir El Djir, Hassi Bounif, and Hassi Ben Okba (Figure 1).
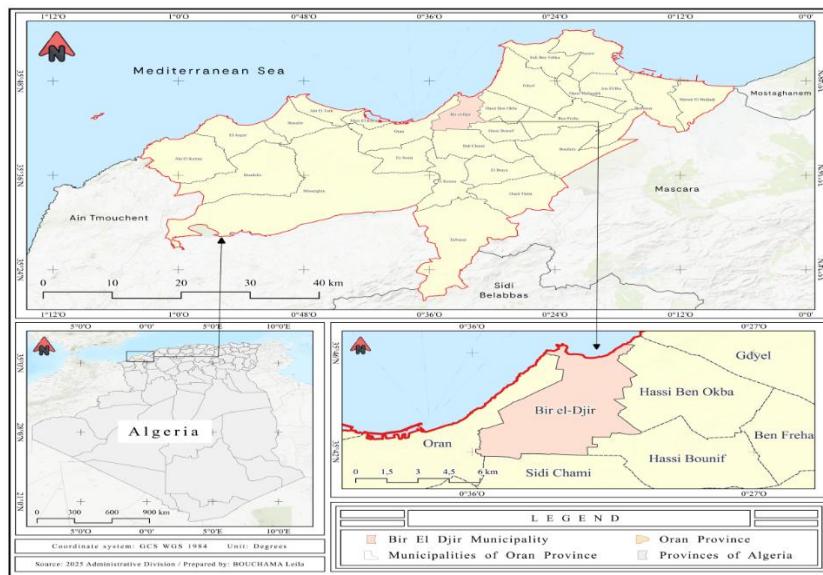
Figure 1: Location of the Bir El Djir Municipality

METHODOLOGY

This study was conducted in the municipality of Bir El Djir, located on the outskirts of Oran, to analyze territorial attractiveness through users' daily mobility practices. The methodological approach combines a quantitative survey via questionnaire and spatial analysis of urban transformations.

The survey was carried out from July 13 to 17, 2025. The target population included users from the municipalities of Bir El Djir and Oran, encompassing residents, workers, and visitors. The questionnaire, structured in two parts, aimed to collect:

- Respondents' socioeconomic characteristics (age, gender, education level, occupation, place of residence).

- Mobility-related aspects: place of residence and employment, mode of transport, frequency of visits, and trip purposes.

The questions were predominantly closed-ended, enabling rigorous statistical processing, with a few open-ended questions to gather qualitative opinions on transport satisfaction and perception.

The collected data were analyzed using SPSS 26.0 software, following a quantitative approach that integrated:

- Descriptive statistics: to characterize the sample and main mobility trends (means, frequencies, percentages).

- Chi-square tests (χ^2): to verify significant associations between qualitative variables, such as place of residence and mode of transport choice or trip frequency.

- Logistic regression: to identify significant predictors of user satisfaction and Bir El Djir's attractiveness, particularly daily trip frequency, transport perception, and sociodemographic characteristics.

Concurrently, a spatial analysis was performed to assess Bir El Djir's urban evolution. Multi-date satellite images (1995, 2005, 2015 and 2025) were processed to track the expansion of urbanized areas and identify territorial transformations influencing mobility and the municipality's attractiveness.

This integrated methodology links socioeconomic and mobility data to Bir El Djir's spatial and urban evolution, providing a comprehensive understanding of territorial dynamics and commuter flows. It establishes a rigorous framework for analyzing attractiveness and mobility practices in this peripheral municipality of the Oran metropolis.

Application of the AHP Method to Urban Mobility Analysis

The evaluation of mobility in Bir El Djir relies on a multicriteria decision-making approach based on the Analytic Hierarchy Process (AHP). Developed by Thomas Saaty (1980), AHP is widely used to analyze complex problems involving multiple qualitative and quantitative criteria. It structures the problem hierarchically, conducts pairwise comparisons of criteria based on their relative importance, and calculates consistent weights to rank alternatives (Saaty, 1980; Vargas, 1990). This approach is recognized for its ability to integrate objective data and expert judgments, making it particularly suitable for urban mobility issues where technical, social, and territorial factors interact (Macharis & Bernardini, 2015).

Construction of the Decision Hierarchy

In accordance with Saaty's methodological recommendations (2008), the first step involves structuring the problem into a three-level hierarchy:

Overall Objective

Improving mobility and territorial attractiveness of Bir El Djir.

Criteria and Sub-criteria, derived from empirical results and literature:

- Perceived transport service quality (Ettema et al., 2011)

- Trip frequency and reliability (Banister, 2008)

- Accessibility and connectivity (Geurs & van Wee, 2004)

- Infrastructure quality (Litman, 2010)

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- Socio-economic impact (Urry, 2007)

- Sustainability and modal share (Shiftan, Kaplan & Hakkert, 2003)

Intervention Alternatives, inspired by sustainable mobility policies:

- Strengthening public transport

- Creating or extending tramway lines

- Developing cycling and pedestrian infrastructure

- Improving intersections and traffic nodes

- Managing car parking

This structuring transforms a multidimensional problem into a logical and analyzable system, in line with the hierarchical decomposition principle (Saaty, 2008).

Recueil des données : Jugements experts et données empiriques

Data Collection: Expert Judgments and Empirical Data

AHP requires pairwise comparisons to assess the relative importance of criteria. Judgments are obtained from a panel of experts comprising mobility stakeholders: urban planners, transport engineers, institutional representatives, and informed users. This triangulation is recommended to reduce subjective bias and enhance result reliability (Forman & Gass, 2001).

The comparisons employ Saaty's fundamental scale, ranging from 1 to 9, where 1 indicates equal importance between two criteria and 9 indicates extreme importance (Saaty, 1980). Empirical data from surveys conducted in Bir El Djir complement and guide expert judgments, consistent with principles of integrated multicriteria decision analysis (Figueira, Greco & Ehrgott, 2005).

Construction of Pairwise Comparison Matrices

For each level of the hierarchy—encompassing criteria, sub-criteria, and alternatives—pairwise comparison matrices are constructed. Each matrix $A=(a_{ij})$ quantifies the relative importance of criterion i with respect to criterion j.

These matrices satisfy the reciprocity property defined by:

$$a_{ji} = \frac{1}{a_{ij}}$$

as well as the normalization on the diagonal:

$$a_{ii} = 1 \quad \forall i$$

This constraint ensures minimal internal consistency in accordance with the method proposed by Saaty (1980)

In the presence of multiple experts, their evaluations are combined through geometric aggregation of individual matrices, a method recommended within the Analytic Hierarchy Process (AHP) framework.

Weight Calculation (Eigenvector)

The weights are obtained by calculating the principal eigenvector associated with matrix A. The priority vector w is derived from:

$A \cdot w = \lambda_{max} w$
where λ_{max} is the largest eigenvalue of A.

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The eigenvector method is recognized as the most theoretically rigorous for extracting weights from comparison matrices (Saaty & Vargas, 2012). Column normalization followed by row normalization can be used as an operational approximation (Vargas, 1990).

Verification of Judgment Consistency

AHP requires consistency verification through the Consistency Ratio (CR) :

$$CR = \frac{CI}{RI}$$

where CICI is the consistency index:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

and RIRI is the random index provided by Saaty (1980).

A CR < 0,10 indicates acceptable consistency. If CR > 0,10, judgments must be revised (Saaty, 2008). This check is essential in transport problems where criteria may be sensitive or conflicting (Macharis et al., 2009).

Synthesis of Priorities and Ranking of Alternatives

Final weights are obtained through multiplicative aggregation of relative priorities from each hierarchical level. The alternative with the highest global priority is considered the most relevant (Saaty & Vargas, 2012).

This step translates strategic objectives (mobility, accessibility, sustainability) into concrete operational choices.

Sensitivity Analysis

Sensitivity analysis evaluates the robustness of results against weight variations. This step is particularly recommended in mobility projects to test the stability of solution rankings across different scenarios (Triantaphyllou & Mann, 1995).

It assists decision-makers in anticipating the effects of changes in political, budgetary, or social priorities.

RESULTS

The analysis of data collected from 100 users in the municipality of Bir El Djir provides a precise portrait of mobility practices, territorial attractiveness, and factors influencing user satisfaction. Statistical processing was performed using SPSS (version 26.0) following standard procedures for descriptive analysis, association tests (Chi-square), and explanatory models (logistic regression). Results are presented across several axes: sample characteristics, spatial analysis, trip purposes and frequency, transport perception, satisfaction predictors, and integration into multicriteria AHP analysis.

Sociodemographic Characteristics of the Sample

The sample comprises 56% men and 44% women, with no statistically significant difference ($\chi 2=1,44\chi 2=1,44$; $p=0,230p=0,230$). Age groups are dominated by adults aged 26-45 years (55%), followed by those under 25 (25%) and over 45 (20%).

Regarding socioprofessional status, employees represent the majority (42%), followed by students (28%) and self-employed workers/traders (30%). These profiles reflect an active and mobile population, consistent with the image of a dynamic and attractive territory.

Spatial Analysis of Mobility:

User Residence and Employment

The majority of users (67%) reside outside Bir El Djir, revealing strong extralocal attractiveness. Among them, 42% come from other municipalities in the province and 25% from outside the metropolis.

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Place of employment confirms this trend: 48% of respondents work in other province municipalities, 32% in the study area, and 20% outside the metropolis ($\chi2=12,08\chi2=12,08$; $p=0,002p=0,002$). The cross-analysis Residence × Employment shows a significant association ($\chi2=23,87\chi2=23,87$; $p<0,001p<0,001$), indicating that Bir El Djir residents work more locally, while non-residents have more varied trajectories.

Urban Expansion

Diachronic analysis of satellite images (1995-2025)(see Figure 2) reveals continuous expansion of Bir El Djir toward the East, Southeast, and South. New LSP programs (USTO, Hai Yasmine) and individual constructions (Hai Emir Abdelkader, Khemisti, Douar Belgaid, Sidi El Bachir) reflect the progressive integration of the municipality into the Oran metropolitan system.
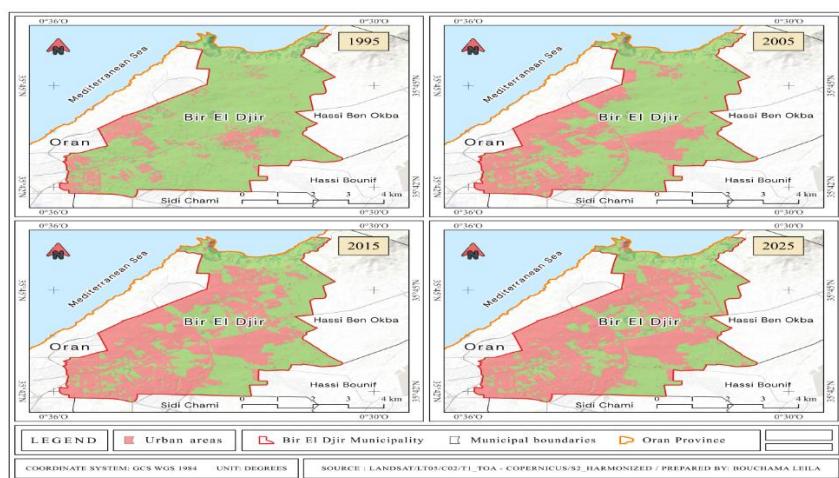

Figure 2: Urban Expansion

Trip Purposes and Frequency

Trips to Bir El Djir are primarily motivated by employment (59%), followed by shopping and leisure (16% each) and other purposes (9%). The "employment" purpose dominates significantly ($\chi2=66,62\chi2=66,62$; $p<0,001p<0,001$).

Daily trip frequency (59%) confirms Bir El Djir as a structuring economic hub. Spearman's correlation shows a strong link between employment purpose and daily frequency ($\rho=0,721\rho=0,721$; $p<0,001p<0,001$), while shopping and tourism purposes are associated with occasional trips.

Perception of Transport and Infrastructure

The dominant mode of transport is private car (61%), followed by public transport (28%) and walking (11%). Evaluation of public transport is generally positive: 59% rate it as good ($\chi2=27,26\chi2=27,26$; $p<0,001p<0,001$).

In contrast, road quality appears more mixed: 55% consider them inadequate. Despite these limitations, 68% of users report overall satisfaction ($p<0,001p<0,001$), indicating that public transport quality partially compensates for infrastructure deficiencie

Multivariate Analyses: Satisfaction Predictors

Table 1: Regression coefficients and statistical significance (p-values) of factors predicting perceived urban transport quality

Variable	Odds Ratio (OR)	p-value	Significance
Perceived transport quality	4.29	0.001	***
Daily trip frequency	3.08	0.004	**
Age 26−65 years	2.33	0.040	*

Note: * $p<0,05$, ** $p<0,01$, *** $p<0,001$

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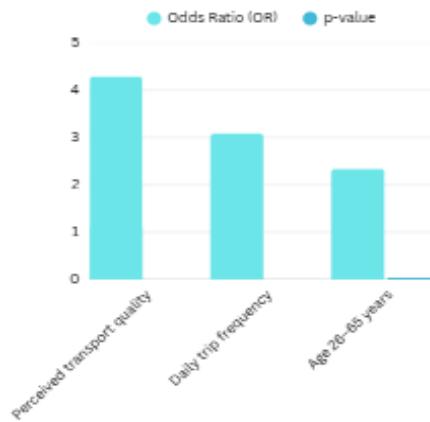
Figure n° 3 : Regression coefficients and statistical significance (p-values) of factors predicting perceived urban transport quality

Table 1 and figure 3 displays the multivariable logistic regression results examining predictors of perceived urban transport quality. Perceived transport quality emerged as the most robust predictor (OR = 4,29, p = 0,001), demonstrating a strong positive association. Both daily trip frequency (OR = 3,08, p = 0,004) and age 26-65 years (OR = 2,33, p = 0,040) exhibited significant, albeit weaker, associations, underscoring the importance of mobility habits and working-age demographics in service assessment.

Relative Weights of Evaluation Criteria

The relative importance weights derived from the AHP analysis are presented in Table 2. The results indicate that perceived transport quality emerged as the most critical criterion, accounting for 41% of the total weight. This was followed by service frequency and reliability (27%), and accessibility and connectivity (17%). Infrastructure-related factors, socio-economic impacts, and sustainability considerations received substantially lower weights, collectively representing only 15% of the decision framework.

Table 2: Hierarchical ranking of urban transport quality criteria based on AHP-derived weights

Evaluation Criterion	Normalized Weight	Priority Ranking
Perceived transport quality	0,41	1
Frequency and reliability	0,27	2
Accessibility and connectivity	0,17	3
Road/pedestrian infrastructure	0,09	4
Socio-economic impact	0,04	5
Sustainability and modal share	0,02	6

Note: CR (Consistency Ratio) < 0.10 for all matrices. Weights calculated using geometric mean aggregation of expert pairwise comparisons.

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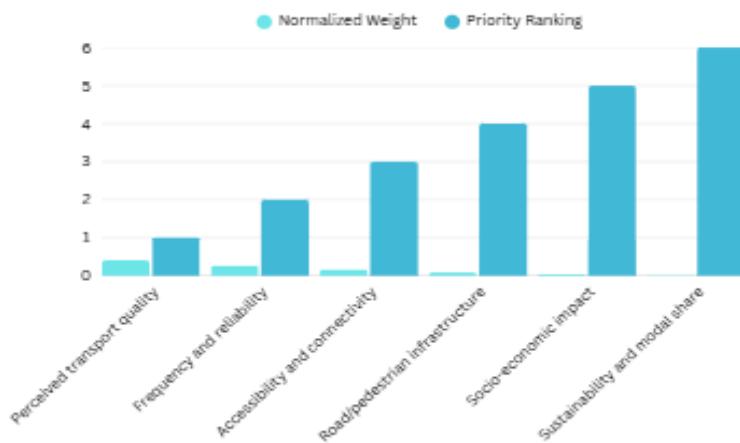
Figure 4: Urban Transport Quality Criteria by Weight

Table 2 and Figure 4 illustrate a multicriteria analysis (AHP method or similar) where perceived transport quality dominates with a weight of 0,41 (rank 1), reflecting its primacy in the overall urban service evaluation. Frequency and reliability (0,27, rank 2) and accessibility (0,17, rank 3) follow, while socio-economic and sustainability aspects carry less weight (0,04 and 0,02), indicating operational priorities over long-term impacts. These findings guide public transport investments toward enhancing user perception and reliability to maximize sustainable mode usage.

Results for Sub-criteria

Within perceived quality (C1), the following weights were obtained:

Table 3: Hierarchical decomposition of perceived transport quality (C1): local and global priority weights of constituent sub-criteria

Sub-criterion	Local Weight (within C1)	Global Weight (overall hierarchy)
Punctuality and schedule reliability	0,51	0,209
Comfort and travel conditions	0,33	0,135
Physical accessibility and ease of boarding	0,16	0,066

Table 3 reveals a clear hierarchy of priorities expressed by Bir El Djir users regarding perceived transport quality (C1). Punctuality and schedule reliability dominate significantly with a local weight of 0.51, reflecting residents' priority expectations for service predictability. This predominance suggests that Bir El Djir users prioritize temporal reliability above comfort aspects (0.33) or physical accessibility (0.16). The global weight of 20.9% attributed to punctuality makes it the most influential sub-criterion in the entire evaluation model, implying that any improvement in service regularity would have a significant impact on Bir El Djir's territorial attractiveness. These findings guide local decision-makers' intervention priorities toward optimizing frequencies and schedule adherence rather than toward massive investments in vehicle comfort.

Alternative Prioritization

Table 4: Priority ranking of urban transport improvement alternatives based on composite AHP weights

Alternative	Global Weight	Priority Rank
Public transport system enhancement (A1)	0,34	1

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Active mobility infrastructure development (A3)	0,23	2
Tramway network extension (A2)	0,18	3
Intersection reconfiguration (A4)	0,15	4
Parking management measures (A5)	0,10	5

Table 4 synthesizes the final outcomes of the multi-criteria decision analysis (employing AHP methodology) for strategic alternative evaluation. Public transport system enhancement (A1) emerges as the highest-priority intervention with a composite weight of 0,34, thereby confirming its primacy in urban mobility optimization strategies. Notably, active mobility development (A3, weight 0,23) ranks second, surpassing tramway extension (A2, weight 0,18), while infrastructure-focused interventions—intersection redesign (A4, 0,15) and parking management (A5, 0,10)—occupy lower positions in the hierarchy. This ranking distribution reflects a strategic equilibrium between collective transport capacity enhancement and long-term sustainability objectives. These prioritization results provide evidence-based guidance for public investment allocation, directing resources toward interventions with maximum impact on perceived service quality and daily travel patterns.

Application of the AHP framework to the spatial dimension reveals distinct attractiveness gradients across Bir El Djir sub-zones. The USTO/Industrial zone achieves the highest composite score (0,38), attributable to its employment density, substantial commuting flows (59% of daily trips), and superior perceived quality of public transport services. Emerging residential developments, exemplified by Hai Yasmine district, demonstrate significant growth potential warranting strategic infrastructure investments, whereas peripheral neighborhoods necessitate comprehensive integrated planning approaches to address connectivity deficiencies.

The convergent findings from both statistical modeling and AHP analysis substantiate that urban mobility patterns are fundamentally structured by three dominant factors: perceived service quality, travel frequency characteristics, and spatial accessibility. This evidence base establishes clear hierarchical priorities, with public transport enhancement (A1, 0,34) constituting the primary strategic focus, followed by active mobility infrastructure (A3) and tramway network expansion (A2). The multi-criteria analytical framework thus provides a robust, synthesized perspective that validates both territorial development priorities and public policy decision-making processes for sustainable urban transport planning

DISCUSSION

This study aimed to elucidate mobility dynamics in Bir El Djir and identify, through an integrated multi-criteria framework, strategic intervention priorities for enhancing travel attractiveness and service quality. The empirical findings reveal substantial methodological convergence between statistical modeling outcomes and AHP-derived prioritization hierarchies, thereby conferring enhanced robustness to the policy recommendations articulated herein.

Metropolitan Integration and Supra-Municipal Attractiveness

Statistical evidence substantiates Bir El Djir's pivotal role as a structural node within the greater Oran metropolitan system. The finding that 67% of facility users originate from extra-municipal jurisdictions unequivocally demonstrates that the territory's sphere of influence transcends conventional administrative demarcations. This supra-local attractiveness derives from multiple, mutually reinforcing dynamics extensively documented in the urban planning literature: economic agglomeration effects concentrated in hypertrophied employment poles, strategic investments in tertiary education infrastructure, and accelerated urban tissue expansion (Belguidoum & Madani, 2019). Multi-temporal satellite imagery analysis corroborates continuous spatial growth trajectories since the 1970s, positioning Bir El Djir as an organic extension of the Oran urban core rather than a peripheral satellite municipality.

This metropolitan integration, while economically beneficial, engenders substantial externalities manifested through intensive commuting flows. Observable consequences include systematic traffic congestion, infrastructure capacity stress, and reinforced automobile dependency—phenomena characteristic of polycentric metropolitan evolution in developing contexts.

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Employment-Centric Mobility: Structural Patterns and Temporal Regularities

Travel demand analysis reveals pronounced correlation with employment-related trip purposes, which constitute 59% of total mobility flows. This dominance aligns with established theoretical frameworks describing mobility structures in economically polarized territories (Banister, 2008). The preponderance of daily, systematic travel patterns empirically validates Bir El Djir's functional classification as a primary activity center within the metropolitan spatial economy.

Particularly noteworthy is the robust statistical association between employment trip purpose and travel frequency (Spearman's ρ = 0.721; p < 0.001), which reflects high temporal regularity in commuting behaviors. This pattern implies critical dependence on operationally reliable, predictable transport services—a finding consistent with Ettema et al.'s (2011) seminal work demonstrating that service regularity constitutes a primary determinant of user satisfaction in transit-dependent populations.

Perceived Service Quality as the Primary Satisfaction Driver

Multivariate logistic regression identifies perceived transport quality (OR = 4.29) and travel frequency (OR = 3.08) as the predominant predictors of user satisfaction. These quantitative findings substantiate extensive qualitative literature demonstrating that subjective service perception dimensions—including punctuality, comfort, and availability—exert disproportionate influence on both modal choice decisions and aggregate satisfaction evaluations (Macharis & Bernardini, 2015; Urry, 2007).

Nevertheless, the persistently elevated private automobile mode share (61%) reveals a critical disjuncture: despite generally favorable subjective assessments, the existing public transport offering fails to achieve sufficient competitive attractiveness to induce substantial modal shift. A particularly illuminating paradox emerges from the juxtaposition of high self-reported satisfaction (68%) with widespread perception of road infrastructure inadequacy (55% rating "not suitable"). This apparent contradiction suggests that users prioritize service availability and operational reliability over physical infrastructure quality—a preference hierarchy with significant implications for investment allocation strategies.

Ultimately, this research has provided relevant insights into Bir El Djir mobility while proposing a methodological framework mobilizable by local decision-makers. It contributes to reflection on sustainable mobility policies and constitutes a valuable tool for accompanying urban transformations, strengthening territorial attractiveness, and improving user quality of life.

Based on these observations, several action perspectives are identified:

1. Public transport strengthening and diversification: Development of Bus Rapid Transit (BRT), tramway extensions, and intermodality promotion to absorb growing commuting flows.

2. Integrated urban planning: Coordination of urban planning, mobility, and development of residential and economic zones to ensure harmonious and sustainable development.

3. Establishment of an Urban Mobility Organizing Authority (UMOA): Ensure planning, regulation, and coordination of transport and infrastructure policies.

4. Promotion of soft and sustainable mobility: Encourage walking, cycling, and use of alternatives to private automobiles to reduce congestion and environmental impacts.

5. Deepening of future studies: Integrate qualitative surveys and longitudinal monitoring to better understand user behaviors and perceptions, as well as flow evolution related to urban growth.

In conclusion, Bir El Djir perfectly illustrates the challenges facing peripheral municipalities in Maghreb metropolises: strong economic attractiveness, intensive inter-municipal mobility, and rapid urban expansion. An integrated approach combining urban planning, public transport, automobile regulation, and territorial governance appears indispensable for ensuring sustainability and efficiency of urban mobility, while strengthening inhabitants' quality of life and the competitiveness of the Oran metropolis.

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CONCLUSION AND RESEARCH PERSPECTIVES

Synthesis of Principal Findings

This investigation sought to elucidate mobility dynamics in Bir El Djir, identify behavioral determinants shaping user travel patterns, and establish evidence-based intervention priorities for enhancing transport system attractiveness and operational performance. Employing a methodologically pluralistic framework integrating statistical modeling, spatial analysis, and Analytical Hierarchy Process (AHP) multi-criteria decision analysis, the research delivers a comprehensive, systematically structured, and policy-actionable characterization of mobility within this rapidly urbanizing territorial unit.

Empirical findings substantiate Bir El Djir's role as a significant metropolitan attractor: 67% of facility users originate from extra-municipal jurisdictions, empirically validating its evolving centrality within the functional-economic organization of the greater Oran region. This supra-local gravitational pull, amplified by accelerated urban development trajectories and strategic concentration of structuring amenities—including tertiary education campuses, economic activity poles, and commercial zones—generates substantial daily commuting volumes that impose considerable strain on existing transport infrastructure capacity.

Theoretical and Empirical Contributions

Statistical analyses establish that mobility behavioral patterns exhibit pronounced structuration around employment-related trip purposes and daily travel frequency characteristics. Perceived public transport service quality and temporal trip regularity emerge as the predominant determinants of aggregate user satisfaction—findings that underscore public transport's instrumental role as a foundational vector for sustainable mobility paradigms and metropolitan social cohesion.

The integration of AHP methodology transcends conventional diagnostic approaches by operationalizing robust hierarchical prioritization of both mobility-influencing criteria and system-improvement alternatives. Expert elicitation procedures yielded consensus assignment of maximal decision weights to perceived transport quality (41%) and service frequency/reliability (27%), thereby corroborating methodological triangulation with quantitative empirical results derived from regression modeling.

Strategic alternative evaluation revealed public transport system enhancement as the unequivocal highest priority (global weight 0.34), succeeded by active mobility infrastructure development (0.23) and tramway network extension (0.18). This evidence-based prioritization hierarchy furnishes a rigorous analytical foundation for strategic transport planning initiatives and resource allocation decision-making processes.

Policy Implications

This investigation demonstrates the imperative for Bir El Djir to implement an integrated, multi-dimensional mobility policy framework encompassing:

- **Service enhancement:** Public transport network capacity augmentation, frequency optimization, and quality improvements

- **Modal diversification:** Strategic development of active transport infrastructure and micro-mobility systems

- **Infrastructure upgrading:** Physical facility rehabilitation addressing safety, accessibility, and operational deficiencies

- **Land use-transport integration:** Enhanced coordination between spatial development patterns and mobility provision

Study Limitations and Future Research Directions

Methodological constraints warrant acknowledgment: limited sample size (N=100) circumscribes generalizability; expert judgment elicitation in AHP retains inherent subjectivity despite aggregation protocols; the investigation

focuses on current transit users, excluding non-user populations; and satellite-derived spatial data preclude granular assessment of actual circulation conditions.

These limitations delineate productive avenues for subsequent inquiry, including: expanded probabilistic sampling frameworks, micro-simulation traffic modeling, integration of complementary MCDA methodologies (PROMETHEE, TOPSIS, ELECTRE), stated preference experiments for latent demand estimation, and longitudinal panel studies tracking behavioral evolution concurrent with infrastructure development.

Strategic Action Perspectives

Based on empirical findings, the following strategic intervention domains merit prioritization:

1. Public Transport System Enhancement and Diversification

Deployment of Bus Rapid Transit (BRT) infrastructure, tramway network spatial extension, and comprehensive intermodal integration to accommodate intensifying commuter flows while facilitating modal shift from private automobiles.

2. Integrated Spatial-Mobility Planning

Systematic coordination of land use planning, transport network development, and strategic positioning of residential/employment nodes to ensure spatially efficient, sustainable metropolitan development trajectories.

3. Institutional Capacity Building: Urban Mobility Organizing Authority (UMOA)
Establishment of a dedicated institutional entity vested with comprehensive planning, regulatory, and coordination authority over transport and infrastructure policy domains—a governance prerequisite for achieving coherent, multi-sectoral mobility strategies.

4. Active and Sustainable Mobility Promotion

Strategic investment in pedestrian infrastructure, cycling networks, and alternative micro-mobility systems, complemented by demand management instruments targeting private automobile dependency reduction and associated congestion/environmental externalities mitigation.

5. Longitudinal Research Programs

Implementation of qualitative inquiry methodologies and temporal monitoring frameworks to advance understanding of user behavioral dynamics, perception evolution, and flow pattern transformations correlated with ongoing urban growth processes.

Concluding Remarks

Bir El Djir exemplifies archetypal challenges confronting peripheral municipalities within North African metropolitan systems: pronounced economic attractiveness generating intensive inter-municipal mobility demand, coupled with accelerated, often uncoordinated urban spatial expansion. Evidence presented herein demonstrates that ensuring long-term sustainability and operational efficiency of urban mobility systems necessitates adoption of holistic policy frameworks systematically integrating urban planning, public transport investment, automobile use regulation, and multi-level territorial governance structures. Such integrated approaches prove essential not only for enhancing metropolitan inhabitants' quality of life but also for sustaining regional economic competitiveness within increasingly globalized urban networks.

This research contributes both substantive empirical insights into Oran metropolitan mobility dynamics and a transferable methodological framework applicable to analogous contexts throughout the Maghreb region and broader Global South. By demonstrating the analytical utility of triangulated quantitative-qualitative-participatory approaches, the investigation provides evidence-based guidance for transport planning professionals and policy-makers confronting the multifaceted challenges of sustainable urban mobility transition in rapidly developing metropolitan areas.

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