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TOWARDS ENHANCED PLANNING OF URBAN TRANSPORT IN ALGERIA: STRATEGIES FOR IMPROVEMENT IN THE CITY OF BOUIRA

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Abstract: This research focuses on the functioning of urban transport in Bouira and examines the difficulties that affect daily mobility. The study evaluates how routes are organized, how services are delivered, and how users perceive the system. Its purpose is to understand the elements that shape user experiences and to identify the shortcomings that limit service performance. Data were collected through a field questionnaire distributed to regular public transport passengers. The responses were analyzed statistically to determine how different service components influence overall satisfaction. The analysis shows that user satisfaction is strongly shaped by several key aspects, notably the respect of schedules, travel comfort, and the feeling of safety during trips. The results also reveal that the transport network lacks integration, as it is operated by multiple public and private actors without sufficient coordination. Many areas of the city remain underserved due to an insufficient number of routes. Furthermore, the vehicle fleet is often outdated or inadequate for the growing number of passengers. The study also points out that users have limited access to clear and updated information, which further complicates mobility. To improve the system, several measures are suggested: reorganizing routes to better cover the urban area, introducing a wider range of transport options, and strengthening cooperation between the institutions responsible for mobility. Enhancing vehicle safety and comfort is also considered essential. Overall, this work provides new insights into transport conditions in Bouira and offers practical recommendations to improve mobility and support a more sustainable and efficient urban transport system.

Keywords: urban transport, itinerary, quality of service, mobility, users, Bouira

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INTRODUCTION

Urban mobility constitutes a pivotal concern in the advancement of contemporary territories. It simultaneously serves as a vector for development, a determinant of attractiveness, and a reflection of urban life quality (Wiel, 2006). Within a global context of transitioning toward sustainable development, travel modalities that rely heavily on the utilization of private vehicles are increasingly scrutinized (Decault, 2025; Verhelst, 2025). This scrutiny is accompanied by a revitalized interest in urban public transport, which is regarded as a more sustainable alternative (Boemar et al., 2025; Cissé, 2024), in both environmental and socioeconomic dimensions (Heredia et al., 2025; Akdim et al., 2025).

In Algeria, notwithstanding rapid urbanization and the continual expansion of urban areas, collective transport systems remain inadequately structured to effectively address the escalating mobility requirements (CISSE, 2024; Mirdasse, 2025). The city of Bouira, akin to numerous intermediate cities within the nation, exemplifies this predicament. It exhibits a pronounced yet uncontrolled urban dynamic, characterized by spatial sprawl, sustained demographic growth, and adeficiency in the functional integration of its various neighborhoods (Cheriguene & Adjeroud, 2024); Public transport in Bouira is afflicted by a series of dysfunctions: uneven spatial coverage, limited service schedules, lack of user information, subpar service quality, variable pricing dependent on operators, and a network primarily reliant on buses. These constraints exacerbate dependence on personal vehicles and hinder the establishment of a sustainable mobility system at the city level (Jaroudi, 2024). In this context, the present study endeavors to examine the current state of urban public transport in Bouira to identify the factors that restrict its performance and its capacity to fulfill user needs. The aim is also to propose an update of transportation routes, founded on improved coordination among the hubs generating flows, with a view towards transitioning to a more inclusive, accessible, and interconnected mobility framework.

Such an approach is crucial for fostering the development of adequate support facilities and infrastructure for geosites. (Lestari et al., 2025). This approach aims to contribute to the integration between traditional transport infrastructure, green

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spaces, and urban development in order to improve mobility, reduce congestion, and promote sustainable development (Chelabi et al., 2025), Sustainable mobility represents a key paradigm for modern urban development (Banister, 2008).

It is complemented by an extensive evaluation of accessibility and infrastructure, ensuring that mobility solutions are inclusive, efficient, and aligned with long-term urban planning objectives.

The methodology employed is based on a combination of qualitative and quantitative approaches: documentary analysis, interviews with local institutions, questionnaire-based survey conducted among a sample of 280 users, statistical analysis via SPSS, and cartographic processing utilizing Geographic Information Systems (GIS). This cross-referencing of tools provides a comprehensive analysis of mobility dynamics and existing spatial disparities, with a view to developing operational recommendations for the restructuring of the urban public transport network.

MATERIALS AND METHODS

1. Presentation of the study area

The province of Bouira, with its administrative center situated in the city of the same name, encompasses an expanse of 4454 km² and is positioned within the North-Central region of Algeria, approximately 120 km to the southeast of Algiers. This geographical entity is bordered to the north by the province of Boumerdes and Tizi Ouzou, to the east by Béjaïa and Bordj Bou Arréridj, to the south by M'Sila and Médéa, and to the west by Blida and Médéa.The city of Bouira serves as the capital of the Wilaya of Bouira, strategically located in Grande-Kabylie, Algeria. It is situated approximately 80 km to the southeast of Algiers, nestled within the Sahel River Valley, south of the Djurdjura mountain range in the Tellian Atlas.

The focal area of the study is primarily concentrated on the principal urban agglomeration of Bouira, the capital of the eponymous wilaya (Figure. 1), which spans an approximate area of 1.300 hectares. The boundaries of the analysis are delineated as follows: To the north, it is confined by the peripheries of the newly developing urban pole; To the east, it extends to the agglomeration of Ras Bouira; To the west, it encompasses the Erriche Urban Park and the western siding; To the south, it is demarcated by the Oued D'Hous, which acts as a natural boundary to urban expansion.

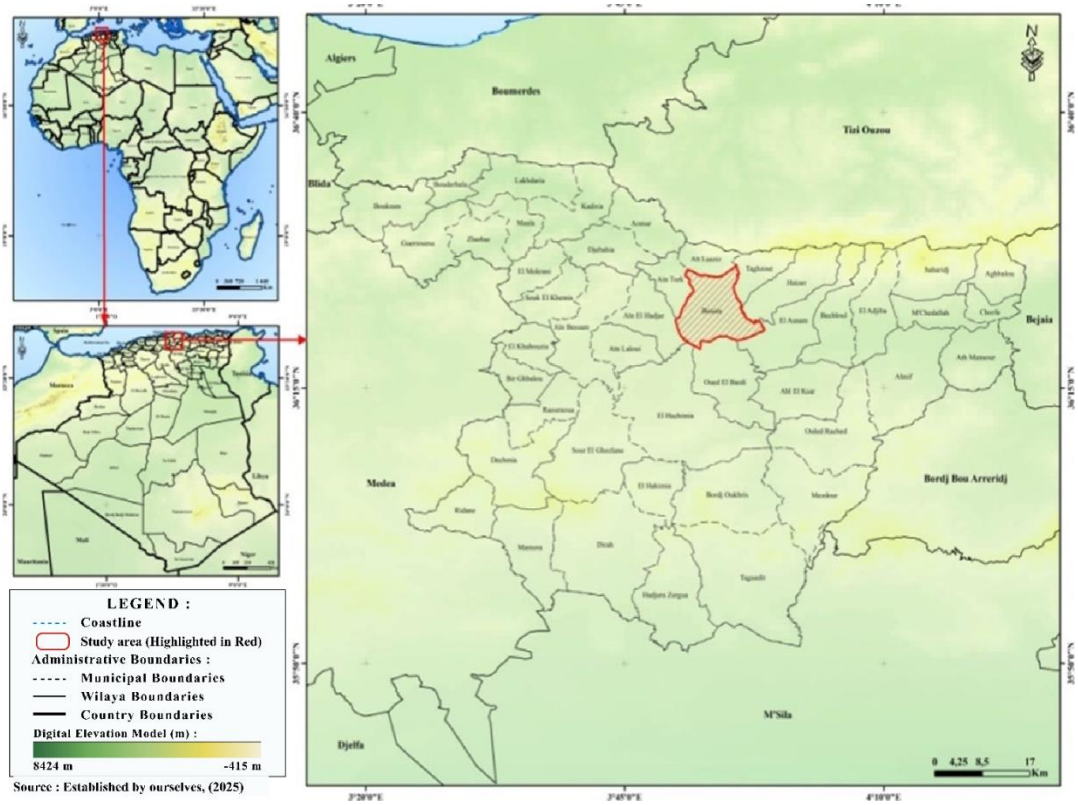

Figure 1. Location of the study area (Source: Carried out by the author)

Nevertheless, it is critical to acknowledge that the urban public transport network occasionally transcends these administrative and spatial confines. It also accommodates certain secondary agglomerations situated in the immediate vicinity (PDAU, 2014), such as the villages of Thameur, Said Abbid, Ouled Bouchia, and Ouled Bellil, thereby indicating a functional extension of the urban mobility perimeter. The town of Bouira, located within the High Plains region of central Algeria, presents a diverse topographical configuration. The examination of the relief constitutes a pivotal phase in comprehending spatial dynamics, particularly within the realms of urban mobility, land use planning, and the mitigation of natural hazards. Figure 2 represents the distribution of slopes (in percentage) across the entire municipal territory, categorized into seven distinct classifications ranging from 0 to 15%.

The town of Bouira exhibits a pronounced topographical contrast: the gentle slopes (0 to 4.9°) are primarily concentrated in the central and southwestern regions, thereby facilitating urbanization and accessibility. Conversely, the

more pronounced slopes (7.4° to over 15°), located on the periphery, hinder development and access to essential services, especially in isolated neighborhoods. The bowl-like topography also plays a significant role in structuring mobility flows.

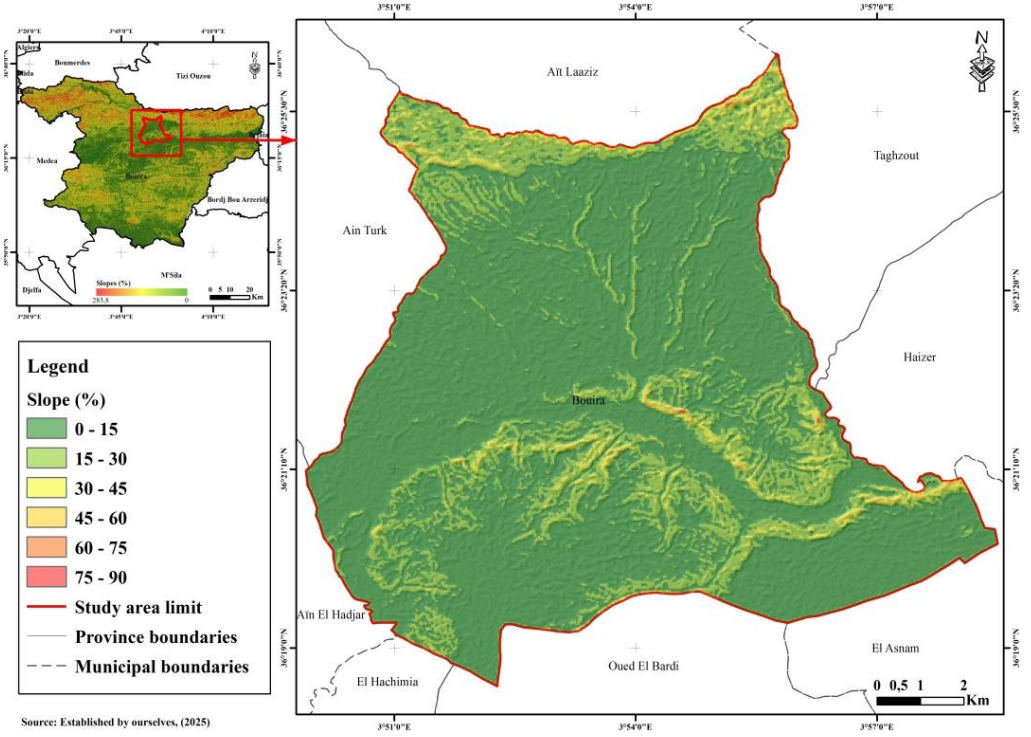

Figure 2. Slope distribution map (Source: Carried out by the author)

2. Tools and Methodology

This inquiry employs a descriptive and analytical framework designed to assess the present conditions of urban transport within (Algerian Law No. 01-13, 2001) the city of Bouira, with a particular focus on service quality and user satisfaction.

*2.*1 Materials used

In the context of this investigation, various tools and data sources According to (Algerian Executive Decree N°04-416, 2004) have been mobilized to guarantee reliable and precise spatial analysis. The technological resources employed are categorized into several primary segments: the ARCGIS processing software and satellite data (imagery).

2.2 Data collection

Data was amassed through two principal sources:

- Public user survey: A meticulously structured questionnaire was disseminated among a representative cohort of urban transport users within the jurisdiction of Bouira. This survey facilitated the acquisition of data regarding their commuting patterns, anticipations, and levels of contentment concerning various service attributes (accessibility, punctuality, comfort, safety, and information dissemination).

- Operational data: Comprehensive information pertaining to operational routes, frequency of service, and the organizational framework of both private and public transport operators was sourced from local governmental authorities and transport enterprises.

- Data analysis: The data amassed through the questionnaire administered to a cohort of 280 urban public transport users in Bouira were subjected to both descriptive and inferential statistical methodologies, with the aim of discerning significant trends and evaluating the interrelations among the studied variables.

Statistical data processing:

The analytical procedures were executed utilizing the SPSS (Statistical Package for the Social Sciences) software, which enabled a rigorous structuring and examination of the data. The principal stages of the analysis are elucidated below:

- Calculation of satisfaction indexes:

A comprehensive set of indicators was formulated to assess the degree of user satisfaction with urban transport services. These indices were derived from responses to inquiries regarding various service dimensions: punctuality, bus frequency, accessibility, comfort, safety, and driver conduct. Each aspect was rated on a 5-point Likert scale (ranging from "very dissatisfied" to "very satisfied"), thereby permitting the aggregation and comparative analysis of results (Likert, 1972).

$$Satisfaction\ Index = \left(\frac{\sum_{i=1}^{n} x_i}{n \times x_{\max}} \right) \times 100$$

Where: x_i: score given by respondent i for a satisfaction criterion (e.g. punctuality, comfort…); n: total number of respondents, x_{max}: maximum possible score on the scale (for example, 5 on a Likert scale from 1 to 5).

The result is multiplied by 100 to obtain an index expressed as a percentage (ranging from 0 to 100%).

- Bilateral correlation analysis

A Pearson correlation analysis was performed at a significance threshold of $p < 0.01$ to investigate the statistical relationships among the diverse dimensions of service quality and overall user satisfaction. This methodology elucidated the intensity and directionality of associations between variables, encompassing:

The correlation between visit frequency and perceived satisfaction; the association between route accessibility and the perceived reliability of the network; the relationship between driver attitudes and the overall perception of service quality.

These analytical efforts culminated in the identification of the principal deficiencies within the public transport service in Bouira, alongside potential improvement levers most likely to enhance user satisfaction.

- Quality of service in urban transport

Service quality encompasses multiple dimensions, including punctuality, frequency, comfort, security, and the availability of information. Numerous scholarly investigations (Vuchic, 2005; Eboli & Mazzulla, 2007) have demonstrated that these factors significantly impact user perceptions and their allegiance to the transport system.

- Usersatisfaction: Satisfaction is frequently conceptualized as the subjective evaluation of users concerning their transport experiences. It serves as a critical metric for assessing service efficacy and informing enhancement strategies (Anderson, 1998; Chen & Chang, 2005).

- Relationship between Service Quality and User Satisfaction:

Empirical research has established a positive and significant correlation between service quality and user satisfaction (Fornell et al., 1996). This relationship highlights the importance of continuous service improvement to enhance satisfaction and encourage the use of public transportation.

- Urban Transport in Medium-Sized Algerian Cities: Studies specific to the Algerian context According to (Transport Department of Bouira Province, 2010), highlight common challenges such as insufficient infrastructure, fragmented operator management, and the need for integration of alternative modes to address urban growth.

- Identifying Major Problems: An examination of the urban transportation sector in Bouira has unveiled a plethora of structural and operational deficiencies that significantly impair the quality of service rendered.

Among the primary challenges discerned are: Inadequate routes: The existing transportation routes fail to comprehensively service all high-demand regions, resulting in unnecessary detours and prolonged travel durations. The current urban transport provision is fragmented, leading to disparities among residents within the same municipality regarding access to transportation. Locations designated for leisure and relaxation (such as the Errich urban forest and the environmental house) appear to be privileges exclusively enjoyed by local inhabitants and vehicle proprietors. Spatial inadequacies arise due to the overutilization of certain transportation corridors while others remain underutilized. This issue is exacerbated by the dispersed nature of certain residential areas. A lack of adherence to the established public transport framework is evident, as operators frequently deviate from designated routes and stops, particularly on lines perceived to be unprofitable. The presence of numerous non-operational or informal transportation routes impedes the overall efficacy of the transport plan and gives rise to deficiencies in the spatial scope of the transportation network (Figure3).

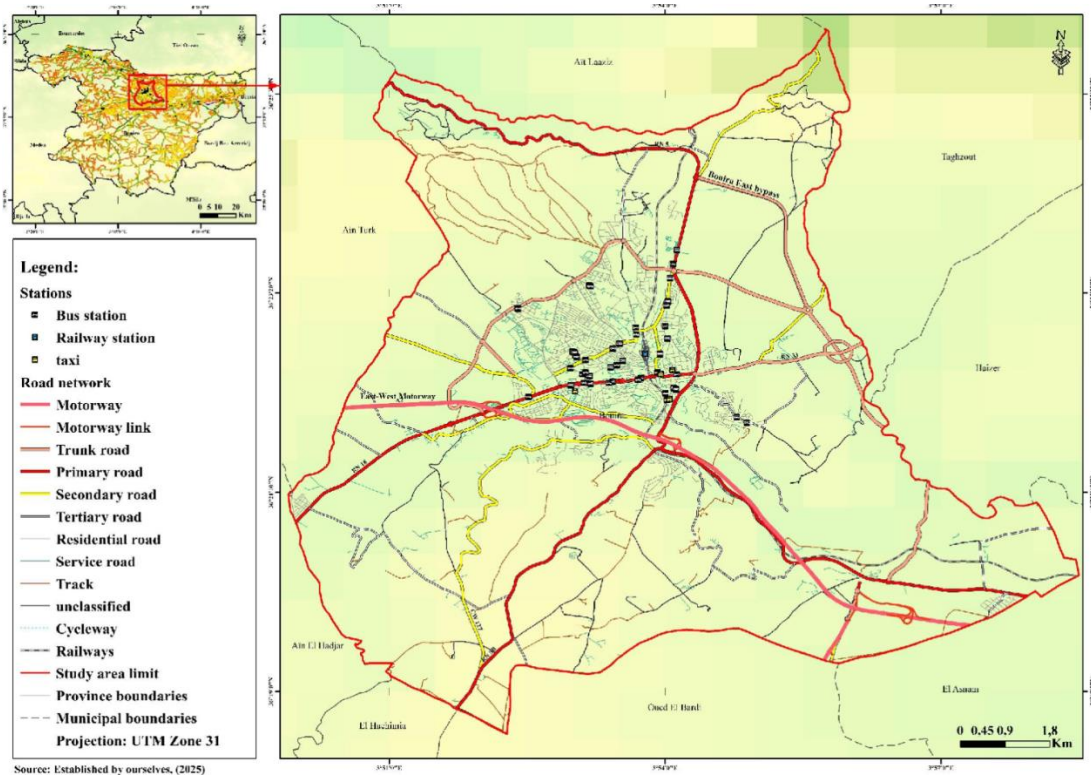

Figure 3. Road network of Bouira province (Source: Carried out by the author)

Substandard service quality has been reported, with persistent issues related to vehicle maintenance, comfort, punctuality, and safety being documented. A multitude of operational practices by transport providers adversely impacts users, compelling them to curtail their travel or endure the unpredictability associated with alternative, unconventional transport systems, which in turn restricts other urban activities. Implementing sustainable optimization strategies, as suggested by (Fatorachian & Kazemi, 2025), could improve efficiency and reduce energy consumption in on-demand transportation systems, mitigating these negative effects on users. The inconsistency in transportation service schedules, characterised by limited operational hours during the day (from 7 a.m. to 5 p.m.), presents significant challenges for city dwellers commuting between home and workplaces located outside the urban core, while also serving as a barrier to evening commercial and recreational pursuits, rendering the city devoid of vitality post-5:30 p.m.

The provision of information to the public within this sector is alarmingly deficient, as bus routes are not displayed at stops, and there is a conspicuous absence of information regarding intervals or waiting times.

The inferior quality of service is particularly pronounced at various junctures, notably among private operators, who demonstrate non-compliance with established routes, exhibit unprofessional conduct towards users, and display disregard for halting protocols. The disregard for regulatory standards by transport operators has intensified perceptions of inadequate service quality; particularly concerning the voluntary or involuntary absence of tickets and travel documentation, as well as the unsanitary conditions of the transport vehicles.

Furthermore, the lack of designated terminal points for certain transport lines compels operators to congregate exclusively in areas designated for passenger pick-up in the city center, resulting in congestion and traffic obstructions. The parking of private vehicles in zones allocated for public transport stops, coupled with the widespread non-compliance with traffic regulations by city residents, further exacerbates the challenges faced in the urban transportation landscape. Finally, the type of vehicles currently in operation does not contribute to the optimal use of the fleet.

Fragmented management

The simultaneous operation of private and public entities without optimal coordination engenders both redundancies and deficiencies within the transportation network: An excessive proliferation of operators complicates administrative oversight, and the fleet designated for collective public transport activities fails to satisfy the requisite standards concerning the types and sizes of vehicles utilized by the various operators. A systematic pick-up operational modality adversely impacts service quality, particularly in relation to waiting times at intermediary bus stops, which often result in protracted queues at stations. Furthermore, the mandatory full occupancy of vehicles from the outset obstructs access for other public transport users at intermediary stops. There exists a disparity in pricing structures among different operators. The urban transport system is predominantly unimodal, relying exclusively on buses, with a minimal incorporation of taxi services.

- The inadequacy of private operators concerning their legal obligations as stipulated in the standard specifications governing the operation of public passenger transport services is notable. The presence of 160 taxis engaging in unfair competition constrains the operational capacity of public transport vehicles and adversely affects the functionality of the road network in terms of traffic management. Problems related to infrastructures and road networks:

Conversely, the road network is afflicted with various dysfunctions that hinder the effective execution of transportation tasks:

- A pronounced deficiency in infrastructure and equipment to facilitate urban transport activities is evident, particularly with respect to the scarcity of essential facilities such as rest areas, bus stops, and parking zones.
- A lack of equilibrium in road sizing is apparent.
- The limited availability of one-way routes imposes significant challenges on transport operators.
- The complete absence of traffic-related signage throughout the network, including indicators for bus stops and horizontal markings that enable the proper integration of transport vehicles, is conspicuous.

All these factors indicate that the existing operational framework could achieve enhanced efficiency if the aforementioned obstacles were systematically addressed.

In conclusion, it is imperative to initiate an update of the Traffic Plan approved in 2014 at the earliest opportunity, with the aim of optimizing the organization of the city of Bouira and thereby facilitating improved utilization of both the road and urban transport networks, to optimize network performance and connection regulation, as demonstrated by (Laichour, 2002), providing insights for more efficient and sustainable urban mobility planning..

RESULTS OF THE USER SURVEY

The public survey conducted among urban transport users yielded critical insights into their perceptions and expectations. A significant proportion of users express dissatisfaction regarding the punctuality and frequency of bus services. The comfort level aboard the vehicles is deemed inadequate, particularly due to overcrowding and a lack of maintenance and hygiene standards. Users have articulated a desire for enhanced real-time information pertaining to schedules and routes. There is a pronounced demand for the diversification of transport modalities to alleviate congestion.

1. Statistical analysis

Correlation between service quality and user satisfaction

The statistical analysis has demonstrated a substantial correlation at the 0.01 significance level (two-tailed) between the perceived quality of service and user satisfaction. This finding substantiates that: The enhancement of quality metrics (punctuality, comfort, safety) is intrinsically connected to an elevation in user satisfaction. User satisfaction may serve as a dependable metric for assessing the efficacy of initiatives designed to enhance service quality.

1.1. Operational structure of the transport network

The investigation further examined the operational mechanisms of the urban transport framework within Bouira:

Six routes are primarily managed by private operators utilising smaller buses, which afford certain flexibility yet also impose limitations on capacity. USTCB (Urban and Suburban Transport Company of Bouira Province) administers the service on select routes via larger buses, thus ensuring augmented capacity. This dual operational framework presents both prospects for service diversification and challenges associated with the coordination and harmonisation of services.

1.2. Simple presentation

The survey was conducted over a period of three (03) months (March, April, and May) of the year 2025 among users of urban public transport in the city of Bouira, employing a simple random sampling method executed at bus stops and onboard buses. Out of the 292 questionnaires gathered, 280 were validated subsequent to a thorough verification and processing procedure. The sample exhibits perfect gender parity, with a notable predominance of young adults aged 20 to 29 (68.6%). The extreme age demographics (under 19 and over 50) constitute merely 10%.

In terms of socio-professional categories, students represent the majority (116), followed closely by civil servants (112), the unemployed (36), and finally a total of 16 self-employed and retired individuals. Regarding residential location, 68.6% of respondents reside within the urban perimeter, whereas 31.4% dwell on the periphery. The frequency of public transport utilization is considerably high: 85.8% of respondents engage in daily or frequent use of public transportation services.

1.3. Accessibility to transport

-Distribution of the transport offer: The analysis of urban residents' responses, as illustrated in the Table 1. Figure 1 and Figure 4, underscores an inequitable distribution of transport services across different neighborhoods. Consequently, 38.57% of respondents perceive the transport offer as “average” 47.17% characterise it as “poor,” and 14.28% deem it as “good.” This perception is intricately associated with the proximity of bus stops to residential areas, as evidenced by a cross-analysis utilising Multiple Correspondence Analysis (MCA)

Table1. Factor of accessibility for users (2025) (Source: Fieldwork carried out between March and May 2025)

Accessibility	Nomber	Percentage
Good	40	**14.28**
Average	108	**38.57**
Poor	132	**47.17**
Total	**280**	**100**

Offer perceived as good: nearby stops, irrespective of the number of service lines.

- Average offer: accessible yet non-immediate stops (not direct).
- Poor offer: neighbourhoods distant from stops, even if they are served. Specific zones (338 lots, Ben Mahdi, Ras Bouira, Draa El Bordj Ouest, Cité Erriche, etc.) have been identified as particularly underserved.

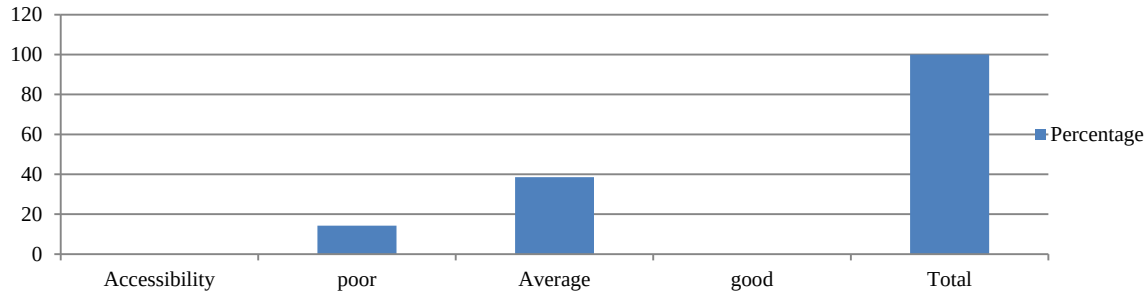

Figure 4. Accessibility to means of transport (Source: Field survey data)

Specific demand for transport lines

The transport lines that exhibit the highest utilization rates include n°12, n° 4, n°3, collective taxis, n° 5, n°2, and n°6, each accounting for usage levels ranging from 11% to 22%, This pronounced frequency of use can be attributed to their provision of services along the principal thoroughfares of the urban landscape. In stark contrast, lines n°7, n°8, n°11, and n°13, which serve peripheral regions, experience infrequent patronage.

Quality of service. Cleanliness and comfort

An examination of users' perceptions concerning the cleanliness and comfort of urban transportation modalities indicates a notable level of dissatisfaction, as evidenced by Table 2 and Figure 5

Table 2. User assessments regarding the comfort of public urban transport (Source: Field survey data)

User opinion	Number	Percentage
Confortable	24	9 %
Acceptable	102	36 %
Not confortable	154	55 %

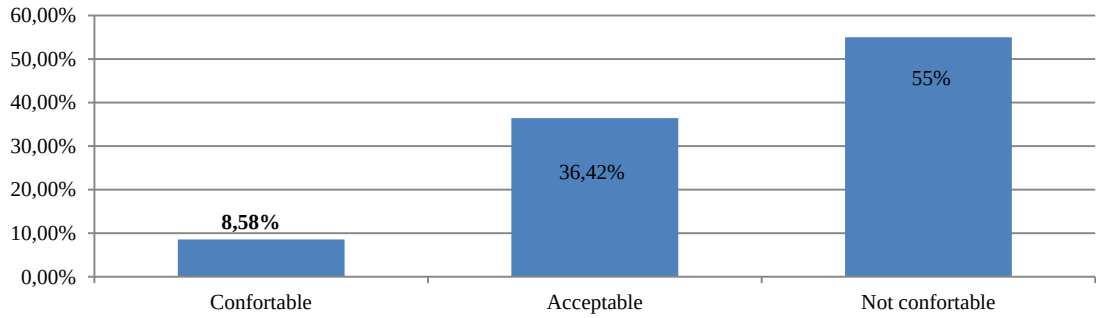

Figure 5. User opinions regarding the comfort of collective urban transport means (Source: Field survey data)

Figure 5 illustrates that merely 8.58% of respondents perceive the modes of transport to be clean and comfortable. A significant portion of the population (36.42%) categorizes cleanliness as "average," while 55% assert that the vehicles lack comfort. This finding is corroborated by direct observational data collected in the field.

Perception of technical characteristics. Range of service

Despite the official operational hours being delineated as 6 a.m. to 8 p.m., both observational data and user testimonies suggest that actual service often commences around 7 a.m. and concludes between 5 p.m. and 6 p.m. The public transportation entity USTCB stands as an exception to this pattern. Approximately 67% of users express dissatisfaction regarding this issue. A weak correlation ($r = 0.3$) has been identified between users' residential locations and their levels of satisfaction.

Itinerary knowledge

A significant majority of users (62.9%) exhibit a lack of familiarity with the transport routes. This lack of knowledge appears to be independent of demographic factors such as age or gender, as well as frequency of use, and is instead influenced by the presence or absence of a well-structured information system.

Journey times and intervals

Travel durations are classified as "very long" by 54.3% of users, while 44% categorize them as "average." Only 1.7% of respondents consider travel times to be "short." Furthermore, 71.4% of participants report dissatisfaction with the waiting times, attributing these delays to inadequate stop management and exceedingly low commercial speed. Summary: Overall satisfaction index. An overall satisfaction evaluation was conducted utilizing the Eckert satisfaction scale:

Not at all satisfied: score < 3; Not satisfied: 3 ≤ score < 5; Unsatisfied: 5 ≤ score < 7; Satisfied: score ≥ 7;

The findings reveal a predominance of dissatisfied individuals across all assessed criteria, including quality of service, pricing, access to information, familiarity with routes, travel duration, and range of service.

Table 3. summary of satisfaction levels by criterion (Eckert scale) (Source: Fieldwork carried out between March and May 2025)

Criteria	Not satisfied at all (<3)	Not satisfied (3 to <5)	Slightly satisfied (5 to <7)	Satisfied (≥7)	Total respondents
Service quality	47	111	0	0	158
Pricing	19	38	16	7	80
Information	35	32	9	2	78
Routes	24	76	66	25	191
Service duration	40	66	34	20	160

The data presented in Table 3 is graphically illustrated in Figure 6. The prevalence of user dissatisfaction appears to be pronounced across all modes of transport. With regard to service quality, a predominant majority of respondents, totalling 202 individuals, express dissatisfaction, with 60 of these indicating a complete lack of satisfaction, in stark contrast to a minimal minority who report being satisfied. In the context of pricing, a discernible inclination towards dissatisfaction is observed among a cohort of 152 participants, attributable to the discrepancies in fare structures, specifically 20da for USTCB buses, 25da for alternative buses operated by private entities, and collective taxis.

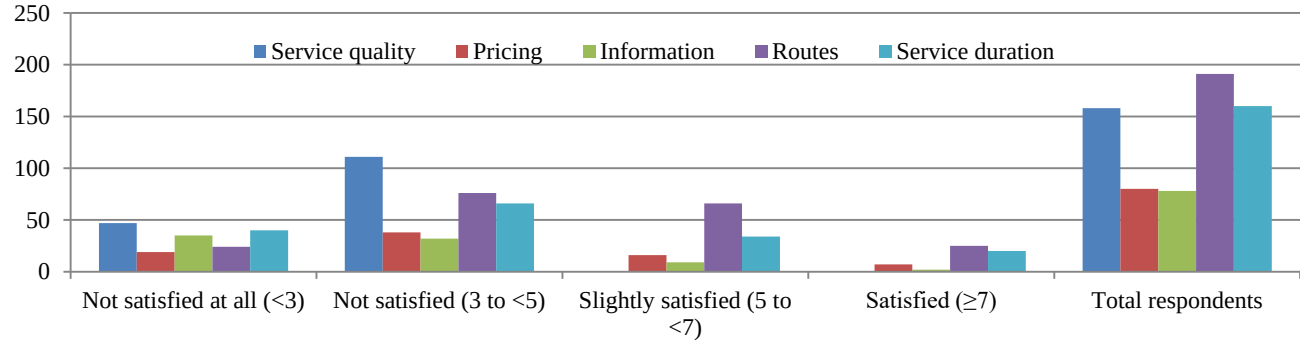

Figure 6. Summary of user satisfaction

The dissemination of information to users within the urban transport sector appears to be limited or ineffective, as evidenced by the result indicating that 124 individuals express total dissatisfaction with the informational services provided regarding transportation. Concerning transport route availability, the majority of users assigned ratings exceeding 5/10; however, 110 individuals reported dissatisfaction, while 42 expressed satisfactions.

Notably, 128 out of 280 participants lack awareness of the transport routes currently available, prompting particular interest in the dissatisfied segment, who articulate a perceived deficiency in route availability necessitating enhancements. Finally, the assessment of service duration reveals patterns analogous to those of other indicators, with 186 out of 280 interviewed users indicating dissatisfaction by scoring this criterion below 5 out of 10.

DISCUSSION

The comprehensive examination of urban public transportation in Bouira delineates an array of dysfunctions pertinent to spatial accessibility, service quality, and the institutional framework governing the network. These structural deficiencies exert a direct influence on user satisfaction and overall system efficacy, undermining the objectives of sustainable mobility and social equity. Integrating landscape and territorial planning approaches, as emphasized by (Guerrouche, 2023), could enhance the organization of urban space, improve the attractiveness of travel routes, and foster more sustainable and coherent mobility patterns.

1. Inequalities in access and poor territorial planning

The investigation uncovered a dissimilar distribution of transport services, characterized by chronic under-provision in peripheral locales such as Ras Bouira and the area known as the city of 338 lots. This discrepancy epitomizes a deficiency in multimodal and integrated planning, thereby corroborating the findings of (Delbosc & Currie, 2011) regarding "transport disadvantage," which underscores the perpetuation of social inequalities resulting from the inadequacies of mobility infrastructure.

2. Low quality of service and the challenge of user adherence

User satisfaction has been demonstrated to be deficient across multiple dimensions: punctuality, comfort, overcrowding, and inadequate information. These findings substantiate the conclusions drawn by (Davidson et al., 2007) which assert that the perception of quality exerts a more significant influence than objective technical performance on the utilisation of public transport. The perceived inadequacy of service quality, coupled with a rigid and ambiguous service offering, is contributing to a gradual decline in public transport usage in favour of private alternatives, thereby generating adverse externalities such as congestion, pollution, and insecurity.

3. Institutional fragmentation and governance deficit

The research illuminated the fragmentation inherent within the network, particularly between public and private operators, characterised by inadequate operational coordination. The disparity between the officially designated operational hours (6h—20h) and the actual service hours (7h—17h) exemplifies this disorganisation. This phenomenon is indicative of a broader trend observed in urban areas across the Global South, where regulation remains weak, information systems are absent, and service management suffers from a lack of transparency and monitoring.

4. Operational and Strategic Recommendations

The city of Bouira is experiencing a significant increase in mobility demand, exacerbated by the creation of new residential hubs such as Ouled Bellil and the new urban centre. In response to this dynamic, public transport users express a set of recommendations aimed at improving the current service offering, without questioning the organization of lines or the overall operating mode of the system. Among these recommendations (Figure 7), those related to user information are recurrent. These primarily concern the implementation of electronic displays at bus stops as well as clear route signage on accessible cartographic supports. This need for information reflects a strong expectation regarding network readability and reliability. From a technical standpoint, users emphasise the necessity of extending service operating hours, increasing commercial speed of vehicles, and reducing waiting time between services. Such expectations reflect a desire to optimize frequency and service speed, essential conditions for public transport attractiveness.

Furthermore, recommendations concern sector management, notably the strict compliance with official stops by transport operators as well as limiting the number of passengers in vehicles. These practices, if better regulated, could significantly improve transport conditions. Some users go further by suggesting structural reforms, such as creating new tramway lines, encouraging individual taxis, or reorganising urban lines to shorten journeys and better serve peripheral areas. These proposals, while ambitious, require thorough technical studies and targeted investments.

5. Revision of Existing Lines

Line n°13, currently connecting Nessis village to the new urban center, follows the same route as lines n°3 and 4. Within the framework of this study, it is proposed to modify its route in order to serve high-density and poorly connected areas, such as the university campus, the sports complex, the female university residence, and the 338-lot housing development. This new 14.4 km route (round trip), including 7 existing stops and 9 to be created, would allow for better spatial coverage. In the medium term, the line could be split into two sections: Nessis–bus station and bus station–new urban center. Line n°. 6 provides a connection between the new urban center and the Civil Protection housing development. Its informal extension to Chaabet Brahem, due to the lack of suitable rural lines, has generated imbalances. It is therefore proposed to eliminate

this section and create a loop line serving majorneighbourhoods such as the university, the Errich district, the 2000 AADL housing development, and the eastern extension zone of the RN5. This 11 km route would include 19 stops (11 existing and 8 new). Chaabet Brahem could, in parallel, be served by a more suitable rural line.

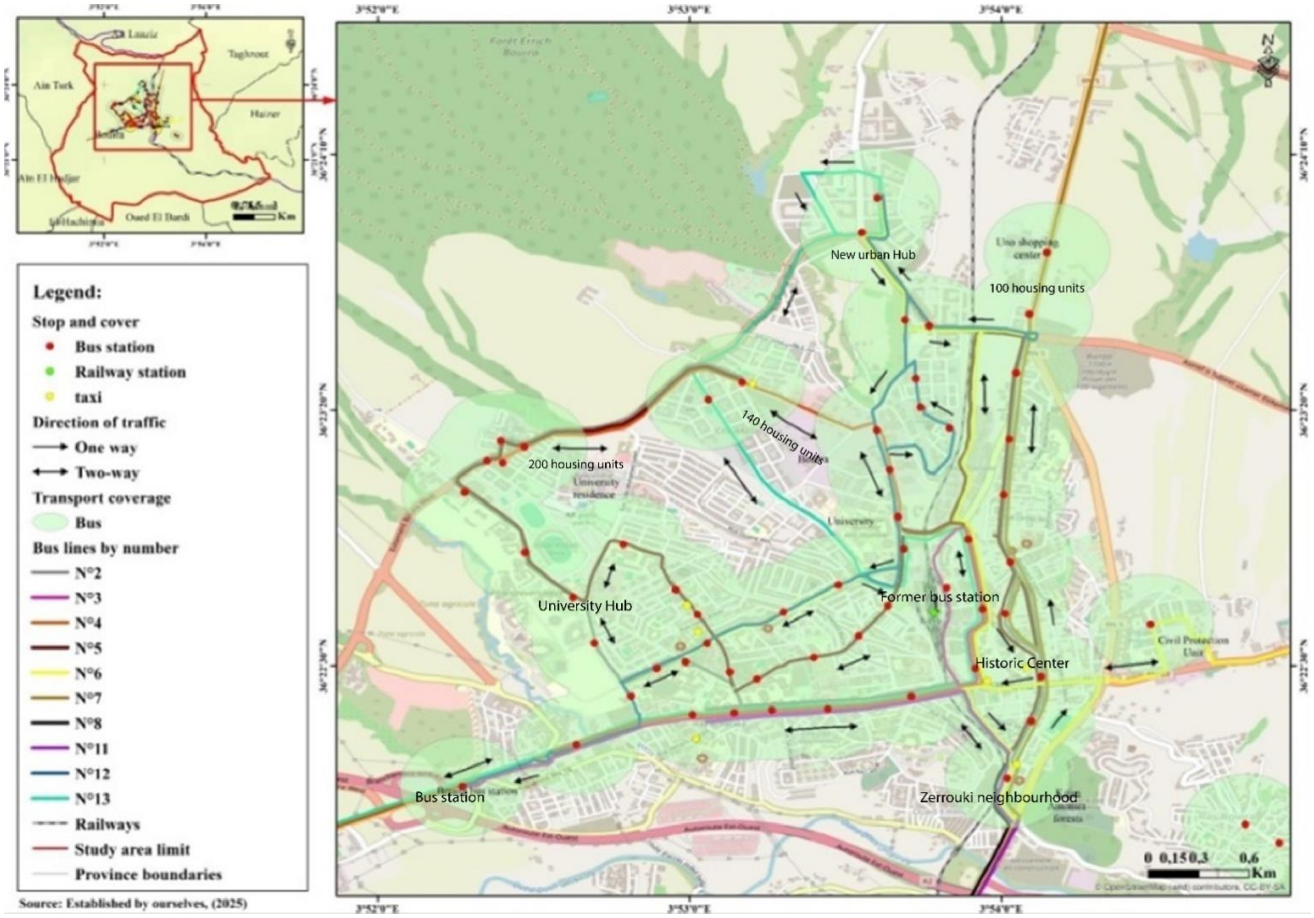

Figure 7. Proposal for line reorganization **(**Source: Carried out by the author)

Line n°1, initially intended to connect Ras Bouira to Mohamed Boudiaf Hospital, is only partially operated due to the rugged terrain of Ras Bouira. It is therefore recommended to adapt the route to serve the new bus station via collective taxis in the short term, while awaiting the consolidation of the collective housing zone planned in the PDAU. The proposed new route (11.6 km) includes strategic stops, notably in the Zerrouki district, in order to cover a high-demand area.

Line n°8, currently limited to the connection between Ouled Bellil and Bourouba Said stadium, proves insufficient given the demographic growth induced by the AADL housing project in this area.

It is therefore proposed to extend this line to the 2000 AADL housing development, via the RN5 and several structural arteries of the city center. The new route, over 13 km long, will serve the slaughterhouse market, the Zerrouki intercommunal station, Martyrs' Square, the Château district, and several public facilities.

6. Creation of New Lines

Given the rapid development of the Ouled Bellil district, particularly with the construction of 1,800 AADL housing units across three distinct sites, the creation of two new lines (n°14 and n°15) proves essential. These will directly connect this agglomeration to the new bus station via the municipal road CC4, without passing through the city center. This connection aims to improve access to major interchange hubs. In the short term, operation by minibus or minicoach is recommended, given the current state of the road infrastructure.

7. Towards Modernisation of the Transport System

The urban transport system in Bouira relies essentially on buses and collective taxis, which limits the flexibility and complementarity of modes. It is proposed, in the medium term, to introduce Bus Rapid Transit (BRT) systems, operating on the city's main axes with dedicated lanes. This mode of transport, which is faster and less polluting, can constitute a first step towards progressive electrification of the network. In the longer term, the implementation of a tramway network could be considered, although it would require profound adaptations to the transport plan and circulation scheme.

The introduction of the tramway would allow the city to accompany structural transformations while addressing sustainability challenges. Finally, the development of individual taxis, currently underutilised, is proposed through the creation of specific circuits. This strategy would strengthen the territorial coverage of the network and offer users a more flexible alternative, thereby improving the quality of daily travel.

8. The prospects

This study, although based on a solid empirical foundation, has certain limitations, notably the partial representativeness of the sample and the lack of real-time data. Complementary research should focus on measuring the longitudinal impact of adopted measures, as well as studying the integration of digital technologies in network management (geolocation systems, smart ticketing, user feedback platforms).

The urban transport system of the city of Bouira is characterised by a predominance of buses and collective taxis, but exhibits low modal diversification, limiting the overall efficiency of urban mobility. This situation generates travel difficulties for users and limits network integration. In order to improve system performance, a transition strategy towards sustainable transport modes is proposed. In the medium term, the introduction of Bus Rapid Transit (BRT) operating on reserved lanes is envisaged, ensuring priority passage and increased regularity on structural axes. In the longer term, the implementation of a tramway network could constitute a structural solution, subject to a thorough revision of the existing circulation plan to enable its effective integration. Simultaneously, the development of individual taxis, through the establishment of dedicated circuits, would strengthen the transport offering while improving service quality.

Contemporary scholarly assessments indicate that the governance framework of the transportation system is characterised by pronounced fragmentation, which can be attributed to the lack of a centralized regulatory body. Despite this institutional shortcoming, there exist isolated examples of operational excellence, particularly within the Soummam Urban Transport Company (USTCB) located in Bouira, which exhibits comparatively superior performance indicators.

In light of these systemic inadequacies, this research advocates for the establishment of an integrated intelligent transportation management framework, supported by sophisticated digital infrastructure. The proposed model includes the implementation of sensor networks and cloud-computing architectures to enable real-time data dissemination via mobile applications and dynamic information display systems. Such technological integration is expected to enhance journey planning capabilities while concurrently improving public transport utilization rates.

Moreover, the integration of personalized taxi management platforms, exemplified by applications such as YASSIR, holds considerable promise for furthering the modernization initiative and increasing the operational adaptability of urban mobility ecosystems. This multi-modal integration strategy signifies a paradigmatic transition toward comprehensive smart city transportation solutions.

CONCLUSION

The study conducted on urban transport in the city of Bouira has enabled a precise diagnosis of the challenges facing the sector, based on an in-depth analysis of routes, service quality, and user perceptions. The results revealed a significant correlation between service quality and user satisfaction, emphasizing the importance of investing in continuous improvement to strengthen the attractiveness of public transport.

The identified issues, such as inadequate routes, operational fragmentation between public and private operators, as well as deficiencies in maintenance and information provision, constitute major obstacles to system performance. Numerous recommendations formulated following fieldwork based on user opinions highlight specific areas for improvement: strengthening information at stops, reducing waiting times, increasing frequency, respecting maximum vehicle capacities, and improving operational management.

Furthermore, more structural proposals emerge, notably the reorganization of lines, the creation of new routes to better serve expanding areas, and the introduction of alternative transport modes, such as tramway or collective taxis. The case of line No. 13, recently created, illustrates this dynamic. Its reorientation towards areas with high demand potential and its functional dissociation between rural and urban environments align with a network rationalization logic.

Ultimately, this research makes a significant contribution to understanding local urban transport dynamics in Bouira and proposes a clear roadmap for developing a more integrated, equitable, and sustainable mobility system. It also opens perspectives for complementary studies, particularly on the integration of digital technologies, multimodal planning, and long-term evaluation of implemented policies. Such investigations will be essential to support the transition towards intelligent, inclusive, and resilient urban mobility.

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