RESEARCH PAPER

TRANSPORTATION AND URBAN FUNCTIONS' PLANNING IN THE CITY OF BÉJAÏA, ALGERIA: IMPROVING ENVIRONMENT AND LIFE QUALITY WITH A VIEW TO LAND VALORIZATION

Amira K. Bakour[1*], Ratiba Baouali[1], Nedjima Mouhoubi[2], Sofiane Bounouni[2]

[1]LREAU Laboratory (Laboratoire de Recherche et Etudes en Aménagement et Urbanisme), Department of Geography and Territorial Planning, Faculty of Earth Sciences, Geography and Territorial Planning (FSTGAT), University of Sciences and Technology Houari Boumediene (USTHB), BP 32 Bab Ezzouar, Algiers, 16111, Algeria

[2]Department of Architecture, Faculty of Technology, Abderrahmane Mira University, Targa Ouzemmour Road, Béjaïa, 06000, Algeria

***Corresponding author:** abakour@usthb.dz

Received: February 13th 2024 / Accepted: April 7th 2025 / Published: June 30th 2025

https://doi.org/10.24057/2071-9388-2025-3257

ABSTRACT. Several Algerian cities are increasingly experiencing notable traffic congestion due to the unequal distribution of urban functions. This research specifically analyses and assesses the urban functions planning's impacts on transportation in Béjaïa city, as well as the consequences of the traffic generated on the environment and citizens' life quality. For such objectives, the study analyzed the distribution of trip-generating activities, the adequacy of their planning with the urban transport network, and the inhabitants' perceptions regarding the environment and life quality. To this end, the study employed a mixed-methods approach for data collection and analysis. This methodology includes qualitative field observations and quantitative data collected through questionnaire surveys. The results indicated a significant correlation between the urban functions' planning and the generated traffic flows. The zoning observed in Béjaïa generates a disconnection between origin and destination, leading to longer distances traveled and a deteriorated environment. Indeed, around 80% of the respondents expressed dissatisfaction with the location of Béjaïa's urban functions and life quality. Thus, it is recommended to revise zoning regulations, reevaluate industrial zones, improve the mobility plan sustainably, and promote community participation in the urban planning process. These research findings serve as a reference for researchers and decision-makers to enhance future urban planning in Béjaïa and other cities around the world.

KEYWORDS: environment and life quality, land valorization, transportation, urban functions' planning, Béjaïa city

CITATION: Bakour A. K., Baouali R., Mouhoubi N., Bounouni S. (2025). Transportation And Urban Functions' Planning In The City Of Béjaïa, Algeria: Improving Environment And Life Quality With A View To Land Valorization. Geography, Environment, Sustainability, 2 (18), 6-19

https://doi.org/10.24057/2071-9388-2025-3257

ACKNOWLEDGEMENTS: The authors would like to thank all the residents and users of Béjaïa city who responded to the questionnaire surveys and all the department employees who helped us in the data collection.

Conflict of interests: The authors reported no potential conflict of interests.

INTRODUCTION

The significant majority of developing regions around the world, including Algeria, are continuously affected by accelerated urbanization, leading to the deterioration of urban life (Aggoune 2024; Meddour 2022). Thus, the city of Béjaïa, situated in northern Algeria, is an evolving urban space facing several challenges related to transportation and urban planning. In many cities, the latter is determined by land-use zoning (Chin et al. 2024). It organizes the disposition of inhabitants, activities, works, and means of communication in accordance with regulations and programs aimed at the well-being of the citizens (Haghani et al. 2023; Merlin and Choay 2010).

Urban functions assign specificities to the city and provide land reserves. As indicated by Zhou (2022), residents' urban life is mainly defined by residential, employment, entertainment, and leisure functions. Additionally, urban structures include industrial, traffic, and commercial functions (Hu et al. 2020; Zhou et al. 2020). Business and service functions also contribute to the vibrancy of city centers (Niu and Silva 2021) by initiating economically dynamic policies, such as family businesses and startups (Andabayeva et al. 2024). The function therefore emanates from the numerous activities that characterize it. These activities adapt to urban life requirements given the spatial distribution of the facilities (Chin et al. 2024). The intermediate objective of studying this distribution is to achieve a deeper understanding of the intra-urban supply

of services and activities as it has evolved throughout time (Erraougui 2023). In Portland, Oregon, there is a focus on encouraging mixed-use projects through zoning and land use regulations with the aim of promoting healthier cities, as they facilitate walking and riding bikes (Raea et al. 2020). The presence of these urban functions on the territory of a city, including Béjaïa, influences, to a large extent, its image and the life quality of its users.

The enhancement of quality of life is increasingly crucial for a global urban population that is expanding as a result of accelerated urbanization processes (Mouratidis 2021). Nowadays, the urban quality of life is measured through aspects beyond the limit of the variety of activities (administrative, educational, cultural, etc.). These include proximity to services and jobs, environmental quality, a sense of security, as well as access to public transport and smart mobility technologies. A case in point is Vienna, which is recognized as one of the most livable cities worldwide (Haas 2024)[1]. This city is favoring health and efficiency by embracing innovations and new technologies in mobility. In Algeria, Article 03 of Law 11-04 of February 17, 2011, laying down the rules governing the activity of real estate development, highlights the necessity for upgrading viability networks and enhancing outdoor common areas (Guerroudj 2017).

Transportation systems are also intrinsically linked to the urban functions, facilitating circulation and accessibility, according to Le Corbusier (Denèfle et al. 2006)[2]. This relationship has led to several research studies. They focus on exploring the effects of urban sprawl on displacement behavior by conducting a household survey in 2018 in Béjaïa (Bounouni et al. 2020). In addition, previous studies employed a mixed-methods approach to evaluate the relationship between urban transport policies and the self-reported needs of citizens in Port Louis, Mauritius (Thondoo et al. 2020). Their findings demonstrated that citizen-centered approaches allow the review of urban transport planning policies, thus promoting healthier and more equitable cities in developing countries. These outcomes may be of significant relevance to Algerian cities, with particular applicability in Béjaïa. The contributions also highlight the need to review urban systems and their mobility requirements (Baklanov et al. 2021). Such goals can be achieved by managing the existing infrastructure through traffic regulation (Khelf 2021). For example, Medellin, in Colombia, implemented an effective urban transport policy by means of a metro-cable system. This has encouraged the development of informal neighborhoods (Klouche 2019). Traffic flows are higher in mixed zones with significant commercial activities (Al Tal et al. 2022). Accordingly, the researchers were interested in examining the feasibility of reducing car travel by modifying land use rules. Consequently, the supply of transport conditions the configuration of rapidly urbanizing regions, as is the case in Béjaïa.

The field of urban transportation planning has notably evolved in response to accelerated urbanization. Recent literature emphasizes the fundamental role of smart transportation systems in improving mobility and city livability. The concept of Mobility-as-a-Service (MaaS) enables the users to access real-time information about available transport options and thereby reduces private car use (Signor et al. 2019). Moreover, the 15-minute city has emerged to manage the main daily activities of the citizens within a short distance, as is the case in Paris (UN-Habitat 2022). It therefore reduces traffic congestion and promotes social cohesion (University College of Estate Management 2024)[3]. Since they enhance access to essential services and reduce the negative effects of excessive motorization, implementing these approaches in Béjaïa could improve the environment and life quality.

The literature has considerably expanded on transportation systems and environmental quality. The expansion of urban fabrics has led to increased motorization, contributing primarily to air pollution and greenhouse gas emissions (Universitas Gadjah Mada 2020)[4]. Effective urban transport planning may assist in addressing these issues. The integration of sustainable transport policies consistently resulted in reduced air pollution and improved public health (Hoen et al. 2021). The green infrastructure (pedestrian pathways and parks) offers ecological advantages, as it encourages active transportation modes. Furthermore, researchers state that efficient public transportation planning can alleviate traffic congestion and consequently private car reliance (Litman 2024). Urban transport planners aim to design transport networks prioritizing pedestrians' and cyclists' accessibility. In Addis Ababa, Ethiopia, the Scaling Up Safe Street Designs has addressed road safety and environmental issues (UN-Habitat 2022). The project emphasizes the value of walking and cycling for all residents, including people with disabilities. These transport systems have the potential to preserve the environment and ensure economic growth in developing regions, such as Béjaïa.

The urban fabric in the city of Béjaïa is characterized by a large number of dysfunctions, resulting in the emergence of socio-spatial segregation (Attar and Saraoui 2022). The latter can influence social cohesion and urban development. This phenomenon of urban dysfunction and socio-spatial segregation is profoundly exacerbated by inadequate transport infrastructure. It is observed in numerous cities around the world, as a result of the separation of different social groups due to unequal access to housing quality, services, and employment (Najib 2017). The same author's study has found that this phenomenon of dysfunction manifests in Besançon, Mulhouse, and Strasbourg (France). Populations in neighborhoods are disadvantaged given the presence of social housing and poor urban amenities. In England and Wales, the creation of deeply socio-spatial structures is a result of the highest levels of income inequality (Nieuwenhuis et al. 2020). The urban design in Tehran influences segregation outcomes by interfacing with physical space and social dynamics (Shamskooshki 2021). The Afro-Ecuadorian population in Machala, Ecuador, is experiencing significant disparities, resulting in inadequate housing and urban infrastructure (Uzcátegui-Sánchez et al. 2023). Therefore, the socio-spatial dynamics of cities are profoundly linked to urban transportation. The provision of appropriate transport infrastructure in Béjaïa can foster social cohesion and improve its population's

[1]Haas C. U. (2024). Smart Cities: 6 Pioneers Leading the Way in Transforming Transportation. [online] Available at: https://www.linkedin.com/pulse/smart-cities-6-pioneers-leading-way-transforming-christian-u-haas-gbloe?trk=public_post [Accessed 19 Jan. 2025].
[2]Denèfle S., Bresson S., Dussuet A., and Roux N. (2006). Living, Le Corbusier: Social practices and architectural theory. [online] Open Edition books. (In French with English summary). Available at: https://books.openedition.org/pur/12487 [Accessed 10 Feb. 2024].
[3]University College of Estate Management (2024). A guide to 15-minutes-cities: why are they so controversial. [online] Available at: https://www.ucem.ac.uk/whats-happening/articles/15-minute-city/ [Accessed 07 Nov. 2024].
[4]Universitas Gadjah Mada (2020). Trends in Urbanization and Motorization Affects Reduction in Air Quality. [online] Available at: https://ugm.ac.id/en/news/20145-trends-in-urbanization-and-motorization-affects-reduction-in-air-quality/ [Accessed 07 Nov. 2024].

quality of life. These studies referenced above employed various methodologies to understand socio-spatial segregation. They particularly utilized the mixed-methods approach that combined quantitative surveys and qualitative interviews. Thus, they calculated segregation indices and levels, as well as explored residents lived experiences and perceptions (access to services, social interactions, etc.). Furthermore, researchers utilized geospatial mapping to visualize segregation patterns and analyze spatial distributions across urban environments. Dysfunctions in the cities can lead to several negative consequences, as demonstrated in the research works (Najib 2017; Nieuwenhuis et al. 2020; Shamskooshki 2021; Uzcátegui-Sánchez et al. 2023). Social isolation diminishes interaction between disparate social groups, fostering miscommunication and discriminatory attitudes. Cycles of poverty, which are frequently witnessed by segregated populations, restrict access to employment opportunities and quality education. However, the cities mentioned in these studies tried to address the negative consequences encountered. For this purpose, they implemented inclusive urban planning strategies. The creation of more integrated urban environments leads to enhancing the residents' life quality. This approach prioritizes social equity and fosters community engagement. Therefore, this strategy contributes to renewing sensitive areas and improving accessibility. To this end, segregated zones have been connected with different activities and services through enhanced transportation networks. In Béjaïa, the residents' experiences have been shaped by socio-economic factors that have effects on patterns of dysfunction and segregation. These are revealed by the historical context of the city. Accordingly, inclusive transport and urban functions' planning could considerably address these issues.

Sparsely structured systems are defined by inequitable distribution and segregation, whereas densely structured systems are distinguished by integration (Hillier 2016). Indeed, urban activities in Béjaïa are not located in the same neighborhoods. The various civilizational events influenced contemporary socio-spatial dynamics. Thus, they have shaped Béjaïa's urban development from its Phoenician traces, through French colonization, to the present era. The application of past planning practices, namely the Master Urban Plan established in the 1970s, often ignored cultural contexts and local needs. Such neglect has led to fragmented urban structures characterized by inequality. Understanding these historical influences is essential to addressing existing disparities through effective urban policies. It is necessary to connect each Béjaïa neighborhood with its functions by an efficient transport network, facilitating access to different services. In addition, displacements generated by urban activities significantly influence the environment and life quality.

In light of these considerations and recent studies, our research work involves developing a novel approach for our study area. The main objectives are to critically analyze and assess urban functions planning's impacts on transport systems in Béjaïa and the consequences of the traffic generated on the environment and life quality. Accordingly, the following questions arise: How can the location of infrastructures whose urban functions decline be assessed? What are the impacts of urban functions' planning on the transport sector in Béjaïa? What are the consequences of the mobility generated by urban activities on the quality of life of city users and the environment? To address these questions, we will first analyze the planning and distribution of the activities generating displacement in the city. Additionally, we will analyze the adequacy of their planning in relation to the urban transport network. In the second part, the results of the questionnaire dealing with the modes and flows of travel in Béjaïa will be interpreted and analyzed. These will allow us to better understand the citizens' experiences and perceptions regarding the environment and life quality.

The purpose of this study is to identify the problems to be solved and the provisions used by the land valorization operating modes. Thus, urban planners and decision-makers can solve the inherited problems related to the planning of urban functions and transportation in Béjaïa City.

MATERIALS AND METHODS

Study area: the city of Béjaïa

Covering an area of 3,223.50 km^2 (Directorate of Programming and Budget Monitoring 2020)[5], the Béjaïa Province is located in the northeast of Algeria, east of the capital. Approximately, the Babors and Bibans surround it to the east and extend to the southeast, thus dominating the plains of Médjana and Bordj-Bou-Arreridj. Additionally, the ridges of Djurdjura surround it to the west (Gaid 2008). Administratively, the Province of Jijel delimits the Province of Béjaïa to the east, the Provinces of Tizi Ouzou and Bouira to the west, and the Provinces of Sétif and Bordj-Bou-Arreridj to the south. Our study area, the city of Béjaïa, is located north of the Béjaïa Province and rises amphitheatrically on the Mediterranean coast. The commune of Toudja surrounds it to the west, the commune of Oued Ghir to the south, and the communes of Tala Hamza and Boukhelifa to the southeast (Fig. 1). It covers an area of 120.22 km^2 (BETUR 2012).

The urban fabric of Béjaïa is the result of several mutations that took place through two key moments of its evolution: the intramural city, from the Phoenician era (7th century BC) to the period of French colonization (1833–1871), and the extramural city, from the French colonial period (1871–1962) to the present day. After independence, a massive rural exodus to the cities was observed in the territory of Béjaïa city and its surroundings. This occurred to improve the living environment and expand training and teaching opportunities, which were almost non-existent for children and teenagers in their Kabyle villages (Younes 2022).

During the 1970s, Béjaïa experienced an industrial development that allowed some citizens of the region to settle in the city to work in the industry and trade sectors. Moreover, according to Chadli and Hadjiedj (2003), the spread of industrial activity is associated with the development of urban centers and large agglomerations. The past planning practices constituted a significant factor in population growth and, consequently, a rapidly urbanized city. The implementation of strategic and inclusive urban functions' planning could ensure effective and sustainable transportation planning, with the objective of improving the environment and the city users' quality of life.

This study utilized a methodological approach to achieve the envisaged objectives through two complementary strategies: qualitative and quantitative methods. These mixed methods enabled a comprehensive analysis of the impacts of urban functions' planning on transport systems and the subsequent effects on the environment and the

[5]Directorate of Programming and Budgetary Monitoring (2020). Annual indicators for the Province of Béjaïa. Province of Béjaïa, (In French with English summary).

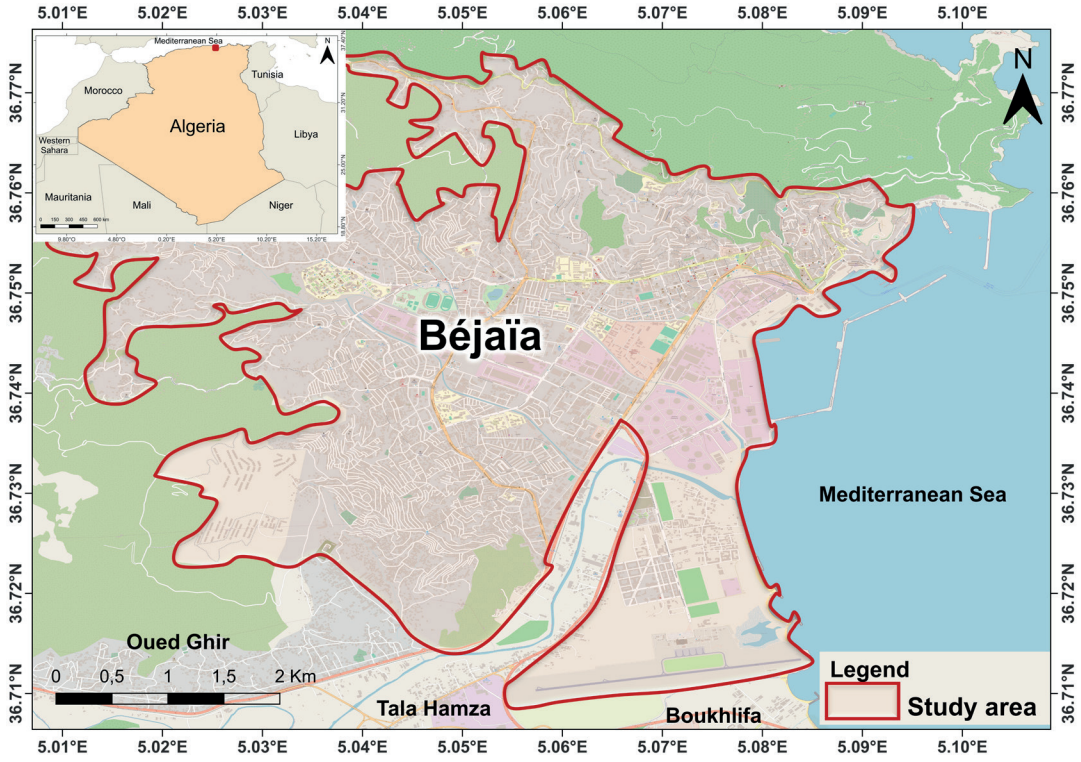

Fig. 1. Location map of the study area Béjaïa City

life quality of citizens in Béjaïa. The systematic approach presented below ensures the relevance of the results to inform future urban planning processes.

Data mapping was employed for a comprehensive understanding of the collected data. It permitted the mapping of the spatial distribution of urban functions and the transport network. To achieve this, an updated map of Béjaïa (the study area) was created using the QGIS software as a reference tool to analyze the surveys' results. To improve visual representation, the maps were processed in PowerPoint software (data and legends). This technique enabled a precise analysis aligned with the research objectives.

Analysis of the adequacy between the distribution of trip-generating activities and the urban transport network (qualitative study)

Data sources and collection methods

To assess the impacts of the urban function's planning on transportation and the consequences of the generated displacements on the environment and the citizens' quality of life, it was necessary to use a qualitative approach based on field observations. The latter is a technique used to collect, describe, and interpret spatial practices, as well as to analyze social uses and interactions in urban spaces (Morange et al. 2016). For a qualitative study (spatial analysis of trip-generating activities and the urban transport network), field observations were conducted in October 2021 in the city of Béjaïa across three key urban areas (the historic core, the University Hospital Center, and peripheral areas). These were selected on the basis of their importance in terms of trip generation and interactions with the transport network. This sampling rationale was employed to ensure that the observations were representative of the most relevant activity areas and transport nodes. Alongside an updated map of the city (created using QGIS software), a logbook was utilized to record our notes and reports regarding the different activities' distribution and their interactions with the urban transport network. The logbook provided a valuable tool for accurately organizing data, given the lack of updated sources related to the location of urban functions in our study area.

To understand and examine the history of Béjaïa and its urban planning problems, we used information from our chosen literature review, which includes reliable sources like Sidi Boumedine 2013, Lamrani 2018, and Traki and Boukrif 2019.

Along with the logbook and updated map's notes and reports, we analyzed data obtained from the different departments and directorates of the Béjaïa Province regarding statistical directories for the years 2016, 2018, and 2020, as follows: the statistical directorate for the Béjaïa Province for the year 2016, the estimation of population by gender and calculation of density at 31/12/2018, and the annual indicators for the Béjaïa Province for the year 2020, obtained from the Directorate of Programming and Budgetary Monitoring; the activity report for the year 2018, obtained from the Employment Directorate of the Béjaïa Province[6]. These data sources' collection constituted a fundamental basis for evaluating the evolution of employment and population over time.

Data analysis

Following data collection and with the aim to address this study's objectives, qualitative analysis was employed. The data from field observations was subjected to spatial analysis to identify irregularities and areas for improvement in terms of transport accessibility and the distribution of activities. To strengthen these analyses, focused on urban functions' planning and location's effects on transportation systems, several spatial analysis methods were incorporated. In the first step, we analyzed the historical context of urban planning failures, the location and distribution of displacement-generating activities throughout the city of Béjaïa, and the evolution of employment. Indeed, the activities generating trips and mobility are divided

[6]Employment Directorate of the Province of Béjaïa (2018). Activity report Year 2018. (In French with English summary).

into two parts: the activities' zones and the evolution of employment (Chabbi and Abid 2008). Next, we examined the adequacy of their planning with the urban transport network of our study area, emphasizing the distribution of nodes and the level of concentration of trips on the urban fabric (traffic congestion) compared to the distribution of urban functions.

The method of combining the analysis of urban functions' planning and the connectivity of transport networks enabled us to visualize the spatial interaction and coverage of different urban functions, examine traffic flows within urban infrastructures, and identify potential areas for further improvements that might be introduced to increase mobility. Analysis of zones around Béjaïa's main nodes identified areas experiencing a lack of access to essential facilities such as health services, schools, and shopping areas. As stated by Bakour (2023), the development and balanced functioning of territories in general and cities in particular are profoundly influenced by the traffic system, specifically the road network. An efficient and well-maintained road network contributes to reducing congestion, saving time and energy, and enhancing the quality of life.

Questionnaire survey: the perceptions of Béjaïa's citizens on the environment and life quality (quantitative study)

Data collection process

For the collection of quantitative data on the transportation modes and flows of displacements generated by the activities in Béjaïa, it was necessary to approach the inhabitants through a questionnaire. The results of this tool provided an evaluation of the citizens' perceptions regarding urban mobility, the environment, and life quality satisfaction.

The questionnaire structure consists of three parts. The first concerns the socio-demographic characteristics of the respondents. This part collected information on their gender, age, level of education, and employment status. The second part is reserved for trip patterns, where the displacement frequency is recorded, the origins and destinations for trips made during a typical day, and the mode of transport used (walking, public transport, and private car). The third part assesses the respondents' satisfaction regarding quality of life in terms of the location of urban functions, transportation services, and environmental conditions in the city of Béjaïa.

The constitution of the representative sample of 300 citizens was determined after analyzing its socio-economic characteristics, specifically the number of inhabitants and the active population of Béjaïa. These are documented in the statistical directories previously mentioned for 2018 (the estimation of population by gender, calculation of density, and the activity report) and 2020 (the annual indicators for the Béjaïa Province). The composition of the samples took into account the following criteria: gender (male and female), age (the age groups 05–19, 19–55, and over 55 were identified as the most frequent categories of the study users, according to the various statistical directories), and socio-professional category (student, worker, retired, and jobless).

The surveys were conducted during field observations (October 2021) in the different neighborhoods of the city's three key urban areas selected. The respondents were surveyed on weekdays (excluding Friday) from 09:00 a.m. to 04:00 p.m. to ensure adequate participation given the difficult circumstances of the COVID-19 pandemic (social distancing measures).

Data analysis

The analysis of the questionnaire results was conducted using statistical software that generated cross-tabulations and cross-graphs. The visual representations served to facilitate the interpretation. The quantitative analyses enabled us to effectively evaluate the consequences of the traffic generated by Béjaïa's urban functions on the environment and life quality. This analytical approach defined the citizens' perceptions of the life quality in terms of the distribution of the different urban functions, mobility (modes of transport used and flows of travel generated), and environmental quality in the city of Béjaïa.

To further enrich our interpretations, various statistical analyses were integrated. Statistical tests were applied to determine relationships between variables such as socio-demographic characteristics and modes of transport used, as well as perceptions of the environment and life quality. Additionally, the assessment of the influence of different factors on citizens' satisfaction with urban functions' planning and transportation services was established. Statistical modeling of these relationships permitted obtaining insights into the key variables that most affect quality of life perceptions.

Limitations

The limitations of field observations include their subjective nature. To avoid excessive interpretations of the results, we linked our observations with available data from statistical directories by creating an updated map of the city of Béjaïa and the results of our questionnaire survey to ensure the validation of our findings and to support them by referring to other studies.

Concerning the questionnaire survey, the limitations comprised the impact of social distancing measures caused by the COVID-19 pandemic on population participation. To address these issues, the survey was conducted on a diverse sample and utilized clear, unbiased questions to obtain accurate perceptions.

RESULTS

Analysis of the distribution of trip-generating activities and the adequacy of their planning with the urban transport network in Béjaïa City

The study of the distribution of trip-generating activities in Béjaïa reveals significant urban planning and mobility challenges. The concentration of activities in this city lacks justification. This geographically strategic site contains multiple assets of physics-spatial authorizations, while the plain of Béjaïa is a large-scale area perfectly valid to accommodate activities with high added value. In spite of this city's potential, historical urban planning decisions have led to persistent transportation problems.

A critical review of past urban planning strategies, in particular the Master Urban Plan of Béjaïa established in the 1970s, indicates that the actors of the city committed errors concerning the vision of urbanization during the study of this plan. This urban planning instrument, which was mainly used for the distribution of state programs on the territory of the city (Sidi Boumedine 2013), failed to take into account the urban environment, its physical and spatial characteristics, as well as the expectations of the residents. This was a situation that was repeated in other Provinces in Algeria. Indeed, the decision to install an industrial zone in the center of Béjaïa in 1977 (Traki and Boukrif 2019) has contributed to current mobility issues. Historical evidence

indicates that this zone was developed in the extension of several scattered businesses; for example, agribusinesses at the plains of the Soummam Valley region on the port area of Béjaïa and railway stations (Lamrani et al. 2018), dating from the time of French colonization, particularly between 1900 and 1962, including 118 industrial units in the commune of Béjaïa (Taleb-Ait Sidhoum 2011). This industrial zone's location results in a congested urban fabric characterized by inadequate transport planning.

Fig. 2 illustrates the map of the distribution of trip-generating activities in the commune of Béjaïa. Our field observations confirm that this commune has a large number of facilities offering a variety of activities, such as higher education institutions (University pole), industrial units in the center of the city, cultural centers, and administrative offices, which are mainly located on the Rue de la Liberté, one of the city's main axes, as well as health, educational, sporting, and residential activity occupying the periphery. These activities are unequally distributed. In spite of the functional mix found in the historic center, commonly known as the old city (health, educational, administrative, cultural, leisure, sports, residential, commercial, etc.), the city center is divided into functionally differentiated zones (the dominance of zoning) that have characterized the planning of Béjaïa's urban perimeter and segregated different urban functions.

In addition to this activities' distribution, the evolution of employment in Béjaïa is an important factor in generating displacements. According to the data from the Employment Directorate of the Béjaïa Province[7], the working population has increased from 372,920 in 2018 to 392,574 in 2020, compared with a total of 990,050 inhabitants at the end of the same year (Directorate of Programming and Budgetary Monitoring 2020). The 2018 statistics in Table 1 demonstrate that the building, public works, and industry sectors accounted for the highest rate of 67.39% of job offers.

The diagram drawn on the map (Fig. 3) highlights the urban transport network of Béjaïa relative to the employment centers. Our field observations indicate the continued concentration of displacements in the urban center. This is explained by the distribution of the most urban functions along the city's structuring axes, namely Rue de la Liberté, Boulevard Krim BELKACEM, and Aurès Road, which occupy the center of the city. These remain as major axes for commuting between residential areas and employment sites.

Our observations and analyses reveal realities on the nodes' magnitude scale in terms of distance and area in relation to their distribution in the urban fabric of Béjaïa. We noticed the strategic location of the major nodes at the main entrances and intersections of the primary roads within the transport network. To illustrate, the node resulting from the intersection of Rue de la Liberté and the Aurès road, as well as the node resulting from the junction of the boulevard de l'A.L.N. (National Liberation Army) and the boulevard Krim BELKACEM, serve as primary nodes facilitating access to different urban functions. However, due to the high volumes of traffic observed during peak hours, these nodes experience considerable congestion and environmental risks.

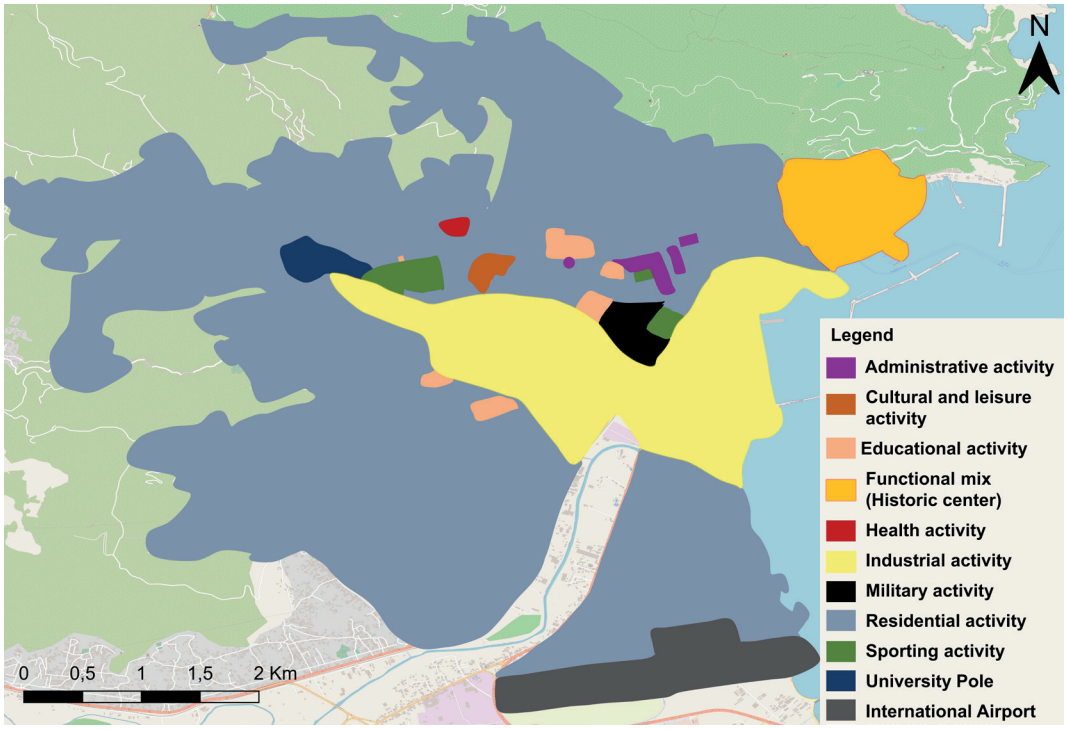

Fig. 2. Distribution of trip-generating activities in Béjaïa

Table 1. Job offers by sectors in 2018 in Béjaïa[7]

Designation	Job offers in 2018 (%)
Agriculture	1.30
Building and Public Works	**34.96**
Industry	**32.43**
Services	31.31
Total	100

[7]Employment Directorate of the Province of Béjaïa (2018). Activity report Year 2018. (In French with English summary).

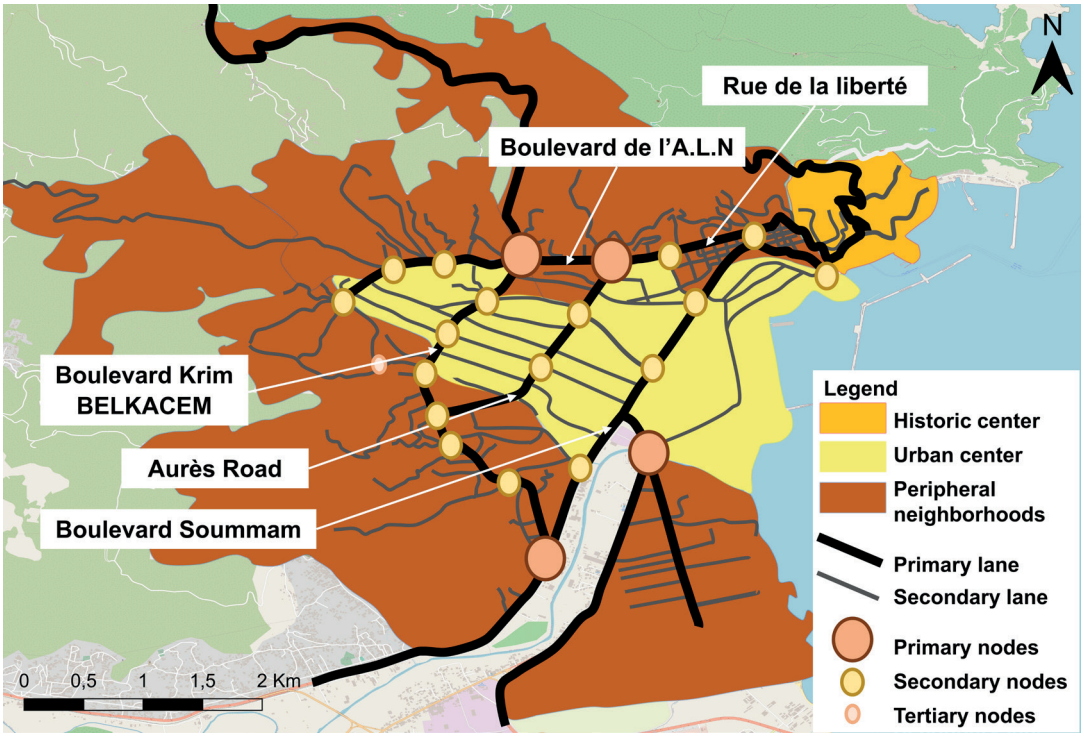

Fig. 3. Urban transport network of Béjaïa

The inadequacy of the Master Urban Plan, cited previously, to foresee an environment of central activities, particularly those of commerce and services, more appropriate to the functioning of the urban core has exacerbated these urban planning and transportation issues in Béjaïa. The design of this plan, based on a scenario of growth from the old center towards the west, has hindered the city from being endowed with a centrality of orientations east-west, to the extent of its load capacity at a sufficient scale, suitable for vertical and horizontal urban growth. This model of urbanization for this type of large area is valid for developing according to a bipolar system of multipolar peripheral character. This would enable Béjaïa to achieve the status of a city of multiple resources supporting activities of the tertiary sector, including those that are part of it, which come under finance, tourism, services provided on a large scale, higher education and scientific research, cultural institutions, travel agencies, shipping agencies, etc. What we have mentioned are branches of economic activity that could be divided into types of activities. The branches of tertiary activities are classified after the economic activity sectors, whose desired location is central. These mistakes have not allowed the local authorities to create a business center, which should radiate in all directions at regional, national, and international levels. Indeed, this multipolar system is the most suitable one for open cities occupying highly strategic sites, as is the case for the city of Béjaïa.

The peripheral residential areas are equipped with a series of proximity activities (education, health, commerce, etc.) but also two important new urban housing zones (ZHUN), namely, ZHUN of Ihaddaden and ZHUN of Sidi Ahmed. This formula was inaugurated at the end of the 1970s as an emergency solution under a new housing policy in Algeria (Dahmani and Moudjari 2013) to alleviate the pressing demand for housing by citizens. In addition, the concentration of housing around the city is due to the need for housing driven by strong population growth. From 1987 to 2013, the population of Béjaïa city increased by 56%, in addition to flows from peripheral communes at its main entrances through national roads 9, 12, and 24 (Merzoug 2016). Moreover, the resident population of our study area was estimated at 188,250 at the end of 2016 (Directorate of Programming and Budget Monitoring 2016)[8] and 190,766 at the end of 2018 (Directorate of Programming and Budget Monitoring 2018)[9].

The quality of life in Béjaïa is relatively deteriorated by an insufficient and incoherent urban transport network with overflowing traffic flows and, consequently, degradation of the environment. Users and residents of the city do not have enough pedestrian traffic spaces, particularly during peak hours, but also suffer from urban congestion constraints in the city and even on the outskirts. The consequences are undoubtedly the risk of road accidents and pollution. Moreover, what has attracted our attention is the vulnerability of the roads of the extensions (the surroundings of the city), which are winding and narrow in trees and converge towards the main axes of the city center, causing traffic and congestion problems at the nodes but also a significant flow that is difficult to evacuate.

Questionnaire survey analysis: Béjaïa citizens' perceptions of the environment and life quality relative to the displacements' modes and flows

Respondents' socio-demographic characteristics

The questionnaire survey provided valuable insights into the citizens' perceptions concerning the environment and life quality in relation to displacement modes and flows. As previously stated, its first part concerns the socio-demographic characteristics of the respondents. The representative sample of the surveyed population consisted of 64% women and 36% men. Fig. 4 illustrates the socio-professional categories of respondents. The largest

[8]Directorate of Programming and Budgetary Monitoring (2016). Statistical directorate for the Province of Béjaïa 2016. Province of Béjaïa, (In French with English summary).

[9]Directorate of Programming and Budgetary Monitoring (2018). Estimation of population by gender and calculation of density at 31/12/2018. Province of Béjaïa, (In French with English summary).

portion (72.67%) of respondents were aged between 19 and 55 years, of whom 46% were female and 26.67% were male. This age group is predominantly employed in different sectors of activity such as administration, health, and education, comprising 54% of the total respondents. The age group of 5–18 years, characterized mainly by an educated population, represents 22.67% of the total. Respondents over 55 were the least dominant, with 4.66% of the total. Retirement accounted for the majority of respondents in this category.

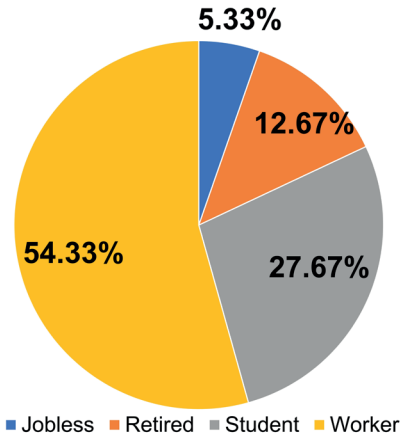

Fig. 4. Socio-professional categories of respondents

The majority of the population surveyed resided on the outskirts of Béjaïa, accounting for 70.67%. This reflects the concentration of the residential neighborhoods in this area in comparison to the lower rate of 20.67% in the city's urban center and 8.66% of the population surveyed in the historic center.

Modes of displacement used by the respondents in the city of Béjaïa

Analysis of displacement modes indicates the dominance of motorized transport use during the displacements of the respondents. Fig. 5 demonstrates that respondents mainly use private cars, particularly for commuting to work (60.13% of private car users aged between 19 and over 55 years), then for other purposes such as shopping and services (21.52%), and finally for studies (18.35%). These results are justified by the concentration of trip-generating activities in the center of Béjaïa. This situation increases the population's tendency towards incessant and excessive use of motorized means of transport, particularly private cars, to satisfy its growing mobility needs. Moreover, this aligns with the findings of the household survey among 600 households on urban sprawl and travel growth cited previously (Bounouni et al. 2020), indicating an increase in car trips from 44% in 2018 to 52.67% in 2021. This justifies the population's avoidance of using public transport, given the health situation in the country and the whole world.

The second motorized mode used by the respondents concerns public transport. Moreover, 46.56% of respondents (aged between 19 and over 55 years) chose this mode of transportation for work-related reasons, 33.59% for studies, and 19.58% of the remaining cases for other purposes (Table 2).

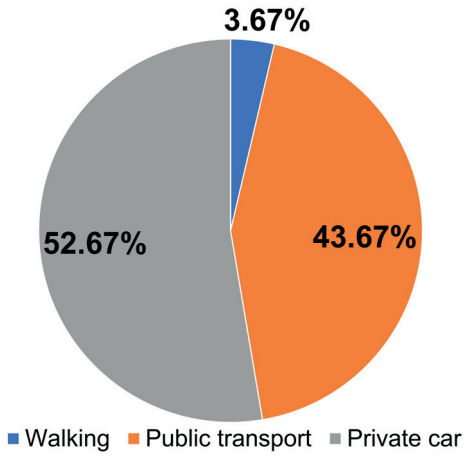

Fig. 5. Modes of displacement used by respondents

According to the results of the questionnaire, walking is primarily practiced by the educated population (aged between 05 and over 19 years). For educational reasons, 45.45% of respondents use this mode, and 36.36% of them use it in the context of work (aged between 19 and 55 years). Finally, 18.18% of the population surveyed practices walking for shopping. This strongly implies a reliance on motorized transport due to insufficient pedestrian infrastructure.

Table 2. Correlation between purposes and modes of displacement used by respondents

Modes of displacement	Purpose	Percentage (%)
Private Car	Work	60.13
	Studies	18.35
	Shopping	18.99
	Other purposes (services, leisure, etc.)	2.53
Public Transport	Work	46.56
	Studies	33.59
	Shopping	12.98
	Other purposes (services, leisure, etc.)	6.87
Walking	Work	36.36
	Studies	45.45
	Shopping	18.18

Displacement flows generated by activities

Based on the field survey results, namely the analysis of the distribution of various activities related to the urban functions in Béjaïa and the questionnaire, we have developed a map (Fig. 6) illustrating origins and destinations of displacement flows among city users.

Fig. 7 depicts that the proportion of trips that converge to the city's urban center represents 78.67% (across all age groups), due to its attractiveness reflected in the concentration of industry (the industrial zone and port are a significant source of employment), administration, and the various public infrastructures. Furthermore, according to Merzoug (2016), this attractive urban center in Béjaïa welcomes tens of thousands of people from neighboring communes as well as the resident population. However, the peripheral neighborhoods of the city accounted for 19% of total flows, mainly due to limited access to essential services such as health facilities (the University Hospital Centre of Béjaïa) or the Targa Ouzemmour university pole, which concerns a certain socio-professional category, namely teachers and students (aged between 18 and 55 years). Moreover, these peripheral neighborhoods are predominantly residential, as they contain the two ZHUNs (New Urban Housing Zones), mentioned previously, which receive only activities of proximity and basic necessity. Conversely, the flows towards the historic center of Béjaïa are reduced, thus representing 2.33%, according to the questionnaire survey. This decrease can be explained by the limited presence of cultural, recreational, and employment-generating infrastructures, in spite of the functional mix highlighted in our analysis.

The displacement flows towards the historic center, the urban center, and the peripheral areas of Béjaïa city, generated by the several urban functions related to diverse facilities, are reduced compared to the previous studies conducted in the same city. As is the case with the findings of Bounouni et al. (2020), the study mentioned above indicated that the flows towards the outskirts of the city represent 79.20%, the urban center 20.80%, and the historic center 3.16%. This finding can be justified by the challenging circumstances of the COVID-19 pandemic, including social distancing measures.

Users' satisfaction with environment and life quality

Our survey revealed that 79.33% of the users questioned expressed dissatisfaction with the location of Béjaïa's various urban functions and mobility (Fig. 8). Additionally, qualitative results indicated that perceived accessibility

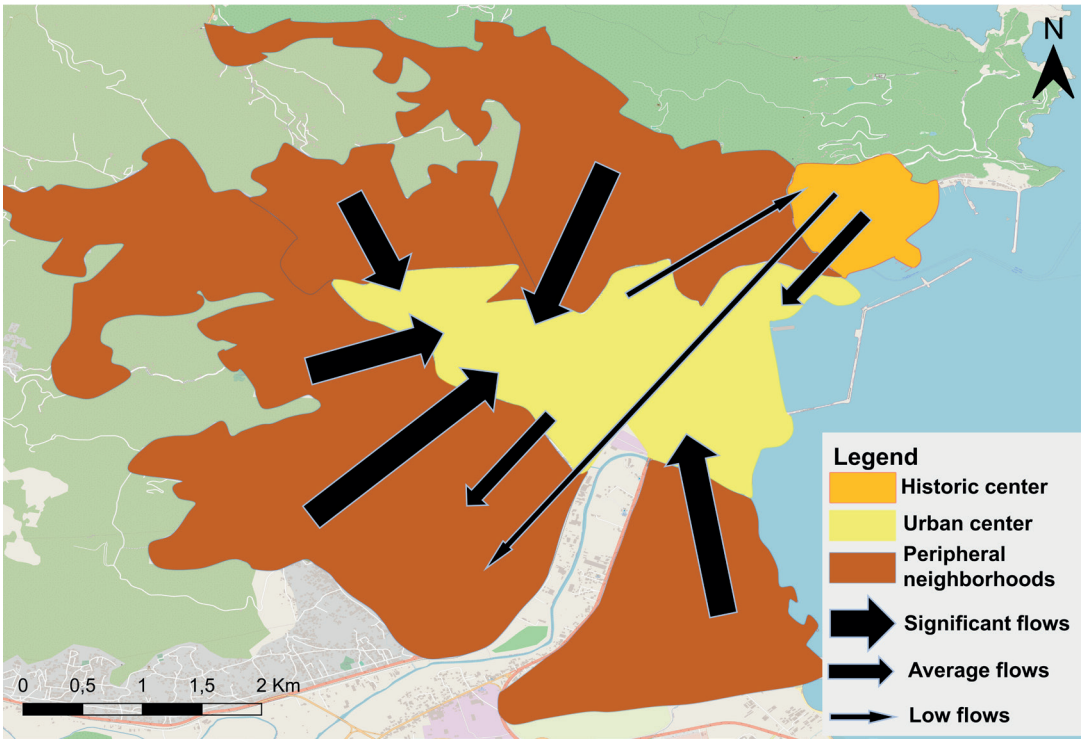

Fig. 6. Displacement flows generated by activities in Béjaïa

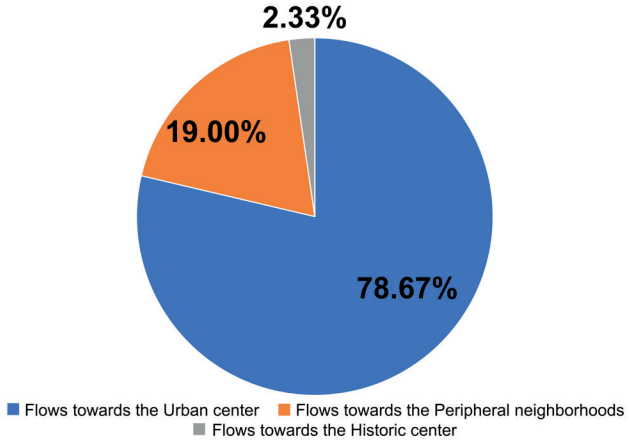

Fig. 7. Rates of displacement flows generated by activities in Béjaïa

significantly predicts satisfaction levels. This is mainly influenced by the numerous constraints cited previously and highlighted by the respondents: exacerbated zoning, lack of activities in the peripheral, limited accessibility to essential services, inadequate urban transport network, considerable distances traveled, and high transportation expenses. Consequently, 80.67% of the respondents expressed their deep dissatisfaction with the environment and life quality because of the presence of several forms of pollution, repetitive congestion, excessive use of motorized transport modes, and insufficient infrastructure for pedestrians.

These surveys' findings highlight that the Béjaïa citizens face significant challenges in terms of urban and transportation planning; thus, improving accessibility could improve residents' quality of life.

DISCUSSION

In this study, the analysis and assessment of urban functions' planning and their adequacy with the urban transport network in the city of Béjaïa provide a novel contribution to the field of urban planning. The integration of users' perceptions regarding the environment and life quality reveals several critical insights that address existing gaps in the literature reviewed. Compared to the previous studies, our research work develops an innovative approach that emphasizes the interconnection between urban planning and transportation. This result is achieved by evaluating the impacts of the distribution of the trip-generating activities that emanate from the diverse urban functions on the transport systems. This approach provides practical implications and an understanding of urban dynamics in our study area. Indeed, it enables planners' decisions to be aligned with the real experiences and needs of the city's users. The results of our study serve as a basis for the initiation of appropriate measures that optimize both functional efficiency and residents' satisfaction in terms of environment and life quality.

The findings demonstrate a significant correlation between the distribution of activities within Béjaïa's urban fabric, the traffic generated, and its subsequent effects on the environment and the citizens' quality of life. The analyses and surveys identified substantial challenges that contribute to urban planning and mobility issues on a broader scale. The significant differences in social and spatial conditions we found in our study area match well with earlier research, which showed that disadvantaged neighborhoods often have fewer urban activities nearby (Najib 2017; Nieuwenhuis et al. 2020; Shamskooshki 2021; Uzcátegui-Sánchez et al. 2023). The historical context of the Master Urban Plan reveals major deficiencies and failures in responding to the needs of the residents and the city's spatial characteristics. The current land-use rules, the exacerbation of the zoning observed, and the flows analyzed result in a disconnection between the city's urban facilities and urban mobility needs. This can lead to solutions to the issue concerning the revision of urban systems and their needs for mobility mentioned by Baklanov et al. (2021). The dominant residential function in peripheral areas disconnects the places of origin (home) from the destination (work). This disconnection generates longer distances traveled and encourages private car dependence. Consequently, this disconnection leads to an increase in traffic congestion and repetitive slowdowns, posing significant obstacles to mobility throughout the city. These planning inadequacies give rise to a considerable distance-time ratio in Béjaïa and contribute to urban sprawl, a phenomenon affecting many cities globally. These findings support the study of Bakour and Baouni (2015), who reported that this phenomenon is undoubtedly more pronounced in developing countries, given the lack of social, legislative, technical, financial, and political measures. The same patterns that Béjaïa is currently facing in relation to the challenges of accelerated urbanization have also been observed in other Mediterranean cities. To illustrate, the study of Tebbane Bouktit et al. (2024) indicated that Oued-Ghir and Tala-Hamza are encountering difficulties in optimizing their mobility needs to align with their spatial expansion. Indeed, developed countries have a duty to implement measures to prevent it. Béjaïa reliance on private cars underscores the urgent need to improve public transport systems and pedestrian infrastructure.

The analysis of traffic flows and simulation of the impacts on the perimeter of the city illustrate a correlation between the level of attractiveness of an area and the number of trips generated, reinforcing findings from the broader literature on urban sprawl, which also confirm that this situation

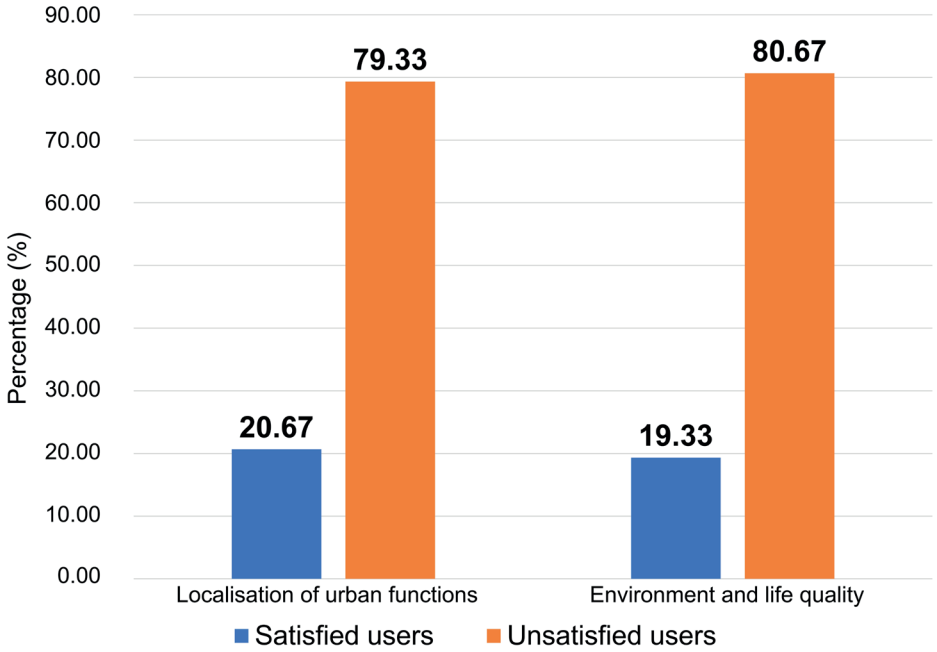

Fig. 8. Users' satisfaction with localization of urban functions, environment, and life quality in Béjaïa

leads to high traffic volumes (Bounouni et al. 2020). Thus, the observed concentration of employment opportunities and essential services' facilities generates significant flows of people in the city's urban center from the peripheral residential areas, the old city, and the communes bordering Béjaïa. This observation is corroborated by the study, which has stated that in addition to the local residents, Béjaïa's urban center attracts a large number of people from the surrounding communes (Merzoug, 2016). This conclusion highlights the need for decision-makers to implement effective transportation and urban planning to alleviate traffic congestion and accordingly ensure accessibility for citizens.

Our research findings also unexpectedly revealed that industrial zones can, to a large extent, stifle mobility and compromise the quality of life of the city's users. Although industrial activities are part of the non-agricultural economic sector, their locations often contradict the fundamental principles of urban planning, especially when situated in city centers. Moreover, the location of the industrial zone occupying most of the city of Béjaïa poses a significant threat to air quality and residents' health (fires, toxic fumes, explosions, etc.). These insights correlate with the consumption of land by transport that has a major impact on quality of life: air pollution, with harmful long-term health consequences (Du et al. 2021), causes a considerable number of cases of illness among people living near road traffic (ADEME 2022)[10]. This contradiction demonstrates a gap in the existing literature concerning the balance between economic development and urban life quality. Consequently, these core areas should be subjected to a re-evaluation of the industrial activity location, in addition to sufficient debate in terms of risks and correlational anomalies, to reduce industry negative effects on urban livability in Béjaïa and other similar regions.

The findings related to the assessment of the consequences of the displacements generated by urban functions on the environment and life quality emphasize the necessity for the promotion of sustainable transportation solutions. Our results align with global concerns about the issues related to greenhouse gas (GHG) emissions and land consumption (Padeiro 2010). The French Ministry of Ecological Transition (2023)[11] reported in their study on the climate in France, Europe, and the world that transport is the second largest emitter of carbon dioxide (CO^2) in the world, accounting for 21% of emissions, underlining the need to address this issue in the context of urban planning. According to the Ecological Transition Agency (ADEME 2022)[10], road infrastructure in urban spaces is the main source of noise emissions and a multitude of air pollutants, such as fine particles and nitrogen oxide emissions. Urban functions that generate significant flows in the center of Béjaïa may also contribute to the problem. Additionally, the respondents expressed their profound dissatisfaction with transportation conditions and life quality, namely traffic congestion and environmental degradation. The survey results showed that we need to tackle these issues and the health problems caused by pollution by using global strategies focused on sustainable development, like promoting public transport (Legendre 2003).

The implications of these results provide valuable perspectives for urban planners and decision-makers in Béjaïa and similar regions, extending beyond just academic contributions. In this context, our findings emphasize the need for a more equitable urban planning strategy that harmoniously combines residential and commercial activities, thus reducing the pressure on the urban center, alleviating travel distances, and promoting sustainable mobility solutions in our study area. This proposed perspective is consistent with the efficient urban planning interventions executed in various cities to enhance transportation networks and, consequently, accessibility between segregated zones and diverse activities and services (Najib 2017; Nieuwenhuis et al. 2020; Shamskooshki 2021; Uzcátegui-Sánchez et al. 2023). Introducing similar principles in Béjaïa could improve the environment and life quality, as it fosters connectivity between segregated zones.

In order to improve citizens' quality of life, the findings underscore the need for comprehensive strategies that integrate land use planning with sustainable transportation infrastructure development. By addressing historical failures in planning strategies and prioritizing inclusive mobility solutions, the city of Béjaïa has the potential to become a more resilient and accessible city.

Limitations

Our study provides valuable insights into urban and transportation dynamics in Béjaïa, but it is essential to acknowledge its limitations. First, the absence of updated sources related to the location and the definition of urban functions in the city of Béjaïa, such as inventories or statistical directories, in addition to the lack of data regarding the real composition and number of people in the city, does not allow us to capture all demographic nuances within the study area. The statistical directories provided only an estimation of the population. Also, the 2020 and 2021 statistics for Béjaïa were unavailable (there were only annual indicators of the Province, which covers the city of Béjaïa and other municipalities for the year 2020). Furthermore, our study mainly concerns examining the current conditions without detailed analysis to evaluate changes over time or the impact of specific interventions, for example, to define specific effects of industrial activities on transportation systems and life quality. However, the establishment of an updated map of urban functions and transport networks and the constitution of a representative sample allowed us to obtain accurate and comprehensive findings according to our research objectives.

CONCLUSIONS

The study provides a detailed analysis of the various urban functions' location, the urban transport network, as well as the environment and quality of life in the city of Béjaïa. Critical insights into the interactions between urban planning and transportation dynamics have been identified through a mixed-methods approach that combines qualitative observations and quantitative surveys.

The findings reveal that the distribution of trip-generating activities within Béjaïa's urban fabric is strongly correlated with the resulting traffic flows. The monocentric urbanization model is no longer relevant for medium-sized cities, as is the case for our study area. The research also indicates that the city of Béjaïa continues to experience multiple pressures related to the inability of its urban fabric to adapt to its functional dynamics. This imbalance

[10]ADEME (2022). Expertise: Impacts of transport on the environment. [online] (In French with English summary). Available at: https://www.ademe.fr/expertises/mobilite-transports/elements-contexte/impacts-transports-lenvironnement [Accessed 21 Mar. 2022].
[11]French Ministry of Ecological Transition (2023). Key climate statistics for France, Europe, and the world. Paris: Statistical data and studies departments, p. 92 (In French with English summary).

is clearly reflected in the zoning observed, caused by the historical planning failures. Additionally, the city's urban center serves as a focal point for various activities, attracting considerable displacement from peripheral residential areas and communes. This concentration underscores the attractiveness of the urban center, leading to negative impacts on the environment and quality of life for residents, such as increased distance from the center, frequent traffic congestion, and environmental degradation. Furthermore, the study demonstrates that socio-spatial disparities are emerging between the urban center and the peripheral neighborhoods, in which limited access to essential services is exacerbating the dependence on motorized transport. This contributes to longer travel distances, increased congestion, and a diminished quality of life for residents. Moreover, our research indicates that the industrial zone located in or near residential areas imposes significant risks for air quality and public health, in contradiction with the fundamental principles of urban planning. This can also be justified by the profound dissatisfaction of Béjaïa's citizens regarding life quality in terms of mobility and the environment.

These findings provide substantial alignment with the study's stated objectives. By analyzing and evaluating the impact of the location and planning of the various urban functions in Béjaïa on the urban transport network, as well as the consequences of the displacements generated on the environment and life quality, critical areas for intervention in the framework of this city's urban planning have been identified. The research offers valuable and practical insights for researchers and decision-makers to enhance future urban planning strategies with a view to land valorization in Béjaïa and other Algerian and similar cities around the world.

Based on the findings of our study, we propose several practical and critical recommendations related to land valorization's operating modes to address the issues uncovered. The impact of the location of urban functions on mobility is increasingly important, alongside improving urban planning vision, transportation systems, and life quality in Béjaïa and other similar regions around the world:

- Adopting integrated urban planning by changing the conditions of land use. The approach is based on the principle of revising zoning regulations to promote a mix of functions. Thus, it reduces car travel, enhances accessibility, and increases density to offer more proximity.

- Promoting sustainable transportation solutions by encouraging soft modes of transport with a small footprint, such as implementing pedestrian and cycling infrastructure, in order to alleviate traffic congestion and reduce greenhouse gas emissions.

- Revaluating strategically the industrial zones by assessing their location to minimize their negative impacts on public health and urban livability while ensuring economic development by integrating higher tertiary activities.

- Encouraging community engagement by fostering active participation from citizens in the urban planning process to ensure that decisions related to various developments closely meet their needs.

A comprehensive and global revision of Béjaïa's mobility plan through appropriate planning of the numerous activities could have significant practical implications for improving and optimizing transport strategies, promoting sustainability, and reducing constraints related to mobility. The key expectations of this vision are equally strategic, namely, the effective spatial integration of urban activities through urban fabrics, the establishment of social equity by promoting mixed-use developments, the prioritization of energy efficiency through the rational use of natural resources, and the promotion of a healthy environment that protects the well-being of the city's residents. Therefore, transportation is one of the priority sectors for land valorization, being responsible for the safety and health of the city's residents and users. Implementing the proposed practical recommendations in Béjaïa or other similar cities around the world may lead to enhanced urban planning focusing on accessibility and improved transportation systems prioritizing sustainability. These changes should thus promote a healthier environment and have a positive effect on Béjaïa and other cities' users' life quality, aiming to increase land value.

Based on our study's results and recommendations, further research should define the specific effects of industrial activities on transportation dynamics, as well as environmental and life quality. Moreover, it would be advantageous to explore the effectiveness of sustainable transportation strategies in alleviating emissions and, thus, improving urban air quality. Conducting comparative studies and analyses with other cities that experiencing accelerated urbanization and facing similar challenges could identify more practical solutions for improving transportation and urban planning issues. Future investigations addressing these areas could notably contribute to developing more accessible and resilient cities that emphasize the importance of the environment and quality of life, and thus the land valorization. By prioritizing these impactful research works, significant progress towards sustainable urban futures that will benefit all relevant stakeholders (decision-makers, urban planners, citizens, etc.) can be achieved.

REFERENCES

Aggoune K. (2024). A dynamic urban landscape in Algeria: actors, mechanisms and governance challenges. Al Bashaer Economic Journal, X(02), 650-662.

Al Tal R., Theodory R., and Bazlamit S.M. (2022). Assessing The Intersected Relationship Between Land Use And Transportation Planning. Geography, Environment, Sustainability, 4(15), 80-89, DOI: 10.24057/2071-9388-2022-008.

Andabayeva G., Movchun V., Dubovik M., Kurpebayeva G., and Cai X. (2024). Labor market dynamics in developing countries: analysis of employment transformation at the macro-level. Journal of Innovation and Entrepreneurship, 13(65), https://doi.org/10.1186/s13731-024-00417-0

Attar A. and Saraoui S. (2022). Evaluation of the main properties of the urban system by the correlation between the method of space syntax and the empirical approach of Kevin Lynch. The case of Béjaïa City in Algeria. International Journal of Innovative Studies in Sociology and Humanities, 7(6), 141-157, DOI: https://doi.org/10.20431/2456-4931.0706014.

Baklanov A., Chubarova N. E., Kolosov V. A., Malkhazova S. M., and Porfiriev B. N. (2021). Introduction To Geography Of Covid-19 Pandemic: Environmental Issues, Public Health And Socio-Economic Consequences. Geography, Environment, Sustainability, 14 (4), 105-108, DOI: 10.24057/2071-9388-2021-044.

Bakour M. and Baouni T. (2015). Urban sprawl and the dynamics of the Algiers metropolitan area: Should administrative structures be promoted? Cahiers de géographie du Québec, 59(168), 377 - 406 (In French with English summary). https://doi.org/10.7202/1037255ar

Bakour M. (2023). Implementing a decision-making system for better sustainability of mobility infrastructures. The case of the road network. Journal de la Ville, de l'Urbanisme et du Développement Durable, 2, 6-13 (In French with English summary).

BETUR (Transport Studies Office Subsidiary of the Algiers Metro Company). (2012). Study of the traffic plan for the city of Béjaïa: Site reconnaissance. Transport Directorate of the Province of Béjaïa, (In French with English summary).

Bounouni S., Baouni T., and Belli-Riz P. (2020). Growth of car travel in the face of urban sprawl case of the city of Béjaïa. Les Cahiers du Cread, 36 (4), 111 - 140 (In French with English summary).

Chabbi M. and Abid H. (2008). Urban mobility in greater Tunis: trends and prospects. Marseille: Plan Bleu, (In French with English summary).

Chadli M. and Hadjiedj A. (2003). The contribution of small towns to the urban growth in Algeria. Cybergeo: European Journal of Geography, [online] 251, p. 12 (In French with English summary) https://doi.org/10.4000/cybergeo.3851

Chin W. C. B., Fu Y., Lim K. H., Schroepfer T., and Cheah L. (2024). Identifying urban functional zoning by analysing the spatial distribution of amenities. Environment and Planning B: Urban Analytics and City Science, 51(6), 1274-1289, DOI: 10.1177/23998083231217376.

Dahmani K. and Moudjari M. (2013). Social housing practises: setbacks and successes. Algiers: Office des Publications Universitaires, (In French with English summary).

Du W., Chen D., Petäjä T., and Kulmala M. (2021). Air pollution: a more serious health problem than COVID-19 in 2020. Boreal Environment Research, 26, 105–116.

Erraougui K. (2023). Urban functions and attractiveness of the territory: the case of the city of Sidi Allal El Bahraoui Province of Khémisset, Morocco. Revue Territoire Environnement et Développement, 2(2), 67-74 (In French with English summary), https://doi.org/10.34874/IMIST.PRSM/ted-v2i2.39382

Gaid M. (2008). History of Béjaïa and its region, from antiquity to 1954. Algiers: Editions MIMOUNI, (In French with English summary).

Guerroudj T. (Sous la direction) (2017). Thematic compendium of planning laws and rules. Algiers: Les Alternatives Urbaines, (In French with English summary).

Haghani M., Sabri S., De Gruyter C., Ardeshiri A., Shahhoseini Z., Sanchez T W., and Acuto M. (2023). The landscape and evolution of urban planning science. Cities, 136 (2023), 104261, 1-24. https://doi.org/10.1016/j.cities.2023.104261

Hillier B. (2016). What are cities for? And how does this relate to their spatial form? The Journal of Space Syntax, 6(2), 199-212.

Hoen A., Hilster D., Király J., de Vries J., and de Bruyn S. (2021). Air pollution and transport policies at city level. Module 2: policy perspectives. Report for CE Delft, p. 67.

Hu F., Liu W., Lu J., Song C., Meng Y., Wang J., and Xing H. (2020). Urban function as a new perspective for adaptive street quality assessment. Sustainability, 12(4), 1296, doi:10.3390/su12041296.

Khelf M. (2021). Contribution to the study of congestion and road traffic regulation for the evaluation of traffic in urban areas (Doctoral thesis, Constantine 1 - Frères Mentouri University (Constantine)). (In French with English summary).

Klouche D. (2019). The four "P"s: The imperative necessity of renaissance through urbanism. Vies de Villes: Architecture, urbanisme & société, 27, p. 134 (In French with English summary).

Lamrani L., Bellache Y., and Ferguene A. (2018). Territorial construction and local dynamics: the case of the Soummam valley in Algeria. Les Cahiers du Cread, 34(1), 5 - 41. (In French with English summary).

Legendre M. (2003). Environment and health. Santé publique, 15(3), 291 – 302 (In French with English summary), doi.org/10.3917/spub.033.0291

Litman T. A. (2024). Evaluating Public Transit Benefits and Costs: Best Practices Guidebook. Victoria Transport Policy Institute, p. 141. Available at: https://vtpi.org/tranben.pdf [Accessed 07 Nov. 2024].

Meddour O. (2022). Sustainable Urban Development and the Challenge of Urban Risks in Algeria. International Journal of Innovative Studies in Sociology and Humanities, 7(10), 64-74. DOI: https://doi.org/10.20431/2456-4931.071007

Merlin P. and Choay F. (Sous la direction) (2010). Dictionary of urbanism and planning. Paris: Presses Universitaires de France (PUF), (In French with English summary).

Merzoug S. (2016). Urban centres in Algeria: how to reconcile attractivity and mobility through the management of urban transport? Case of the city of Béjaïa. Recherche - Transports – Sécurité, 32, 1 - 17 (In French with English summary). Available at: https://hal.science/hal-01670585/document [Accessed 22 Jan. 2022].

Morange M. and Schmoll C. (2016). Qualitative tools in geography: methods and applications. Dunod Editeur, Armand Colin: Collection Cursus, (In French with English summary).

Mouratidis K. (2021). Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being. Cities, 115, 103229, https://doi.org/10.1016/j.cities.2021.103229

Najib K. (2017). Socio-spatial inequalities in the cities and their recent evolutions: comparison between Besançon, Mulhouse, and Strasbourg. Cybergeo: European Journal of Geography. Espace, Société, Territoire, [online] document 808 (In French with English summary). https://doi.org/10.4000/cybergeo.27975

Nieuwenhuis J., Tammaru T., van Ham M., and Manley D. (2020). Does segregation reduce socio-spatial mobility? Evidence from four European countries with different inequality and segregation contexts. Urban Studies, 57(1), 176-197, DOI: 10.1177/0042098018807628

Niu H. and Silva E. A. (2021). Delineating urban functional use from points of interest data with neural network embedding: A case study in Greater London. Computers, Environment, and Urban Systems, 88, 101651, https://doi.org/10.1016/j.compenvurbsys.2021.101651

Padeiro M. (2010). Location of economic activities and sustainable development: a review of the current state of research. Report for PUCA: Laboratory City Mobility Transport, p. 57 (In French with English summary). Available at: https://www.researchgate.net/publication/260451467_Localisation_des_activites_economiques_et_developpement_durable_une_revue_de_l'etat_actuel_des_travaux [Accessed 29 Jul. 2024].

Raea S.M., Alsulami A. N. M., Aljuaid T. H., Alruqaie R. I. M., Albather M. H., Alamri B. J., Alharbi M. A. M., Albalawi M. F., Alhawiti M. E., Alsanad I. S., Aljohani M. A., Alhejaili M. A. M., Alarfi M. D. M., and Alyamani A. M. A. (2020). Designing healthy cities: Linking infrastructure to quality of life. International Journal of Health Sciences, 4(S1), 509-529. https://doi..org/10.53730/ijhs.v4nS1.15432

Shamskooshki H. (2021). The perception of socio-spatial segregation: The Interaction of Physical and Social Urban Space. Study case of Tehran Neighborhoods (Doctoral thesis, Fakultät Architektur und Urbanistik der Bauhaus-Universität Weimar). Available at: https://www.db-thueringen.de/servlets/MCRFileNodeServlet/dbt_derivate_00063622/Shamskooshki.pdf [Accessed 18 Sep. 2024].

Sidi Boumedine R. (Sous la direction) (2013). Urban planning in Algeria. Failure of instruments or instruments of failure? Algiers: Les Alternatives Urbaines, (In French with English summary).

Signor L., Karjalainen P., Kamargianni M., Matyas M., Polydoropoulou A., Pagoni I., Tsirimpa A., Stefanelli T., Galli G., Malgieri P., Bousse Y., Mizaras V., Aifadopoulou G., Hoadley S., De Roeck M., Kishchenko K., and Geier T. (2019). Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning. ERTICO – ITS Europe (editor), p. 42. Available at: https://urban-mobility-observatory.transport.ec.europa.eu/document/download/6b706858-11c6-41c2-b9f7-466e2bec0499_en?filename=maas_and_sustainable_urban_mobility_planning.pdf [Accessed 07 Nov. 2024].

Taleb – Ait Sidhoum H. (2011). Economic openness and entrepreneurial dynamics: An essay on modelling the territorial determinants of company creation in the Province of Béjaïa (Doctoral thesis, Mouloud MAMMERI University (Tizi Ouzou)), (In French with English summary). Available at: https://dspace.ummto.dz/items/ada43e73-d0b0-4b60-8b73-9ba12b6160c8 [Accessed 26 Jan. 2022].

Tebbane Bouktit K., Alkama D., and Bensehla S. (2024). Analyzing urban sprawl and urbanisation dynamics: a case study of Béjaïa, Oued-Ghir, and Tala-Hamza. Bulletin of the Serbian Geographical Society, 104(1), 95-112, https://doi.org/10.2298/GSGD2401095T.

Thandoo M., Marquet O., Marquez S., and Nieuwenhuijsen M. J. (2020). Small cities, big needs: Urban transport planning in cities of developing countries. Journal of Transport and Health, 19, 100944, https://doi.org/10.1016/j.jth.2020.100944

Traki D. and Boukrif M. (2019). The articulation of local economy and territorial and local development: the case of industrial zones in the Province of Béjaïa. Arsad Journal For Economic and Management Studies, 1, 345 – 374 (In French with English summary).

UN-Habitat. (2022). Chapter 6: Urban Planning for the Future of Cities. World Cities Report, 179-210. Available at: https://unhabitat.org/sites/default/files/2022/07/chapter_6_wcr_2022.pdf [Accessed 08 Jan. 2025].

Uzcátegui-Sánchez C., Zerpa-de Hurtado S., and Santamaría-Mendoza A. (2023). Socio-spatial segregation in Machala- Ecuador. An analysis of inequalities and possible challenges. Revista Metropolitana de Ciencias Aplicadas, 6(3), 179-190. Available at: https://www.redalyc.org/articulo.oa?id=721778125021 [Accessed 18 Sep. 2024].

Younes K. (2022). Béjaïa, Past – Present. Algiers: Editions DALIMEN, (In French with English summary).

Zhou G., Li C., and Zhang J. (2020). Identification of urban functions enhancement and weakening based on urban land use conversion: A case study of Changchun, China. PloS ONE, 15(6), https://doi.org/ 10.1371/journal.pone.0234522

Zhou N. (2022). Research on urban spatial structure based on the dual constraints of geographic environment and POI big data. Journal of King Saud University – Science, 34(3), 101887, https://doi.org/10.1016/j.jksus.2022.101887