

## AN ASSESSMENT OF THE ADAPTABILITY OF FUNCTIONAL RECONVERSION STRATEGIES FOR INDUSTRIAL ZONES TO EXISTING URBAN SPACES. THE CASE OF BEJAIA CITY

### ÉVALUATION DE L'ADAPTABILITÉ DES STRATÉGIES DE RECONVERSION FONCTIONNELLE DES ZONES INDUSTRIELLES AUX ESPACES URBAINS EXISTANTS. CAS DE LA VILLE DE BÉJAIA

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#### Abstract

The significant urban growth of cities remains one of the urban phenomena causing the degradation of the living environment of citizens. Urban planning instruments in Algeria have attempted to provide balanced planning through urban interventions. Indeed, the Intermunicipal Master Plan for Planning and Urban Planning of Bejaia aims to relocate the industrial zone of Bejaia City to the El Kseur municipality to generate significant areas of land. Our work aims to assess the integration and adaptability of the proposed strategies for functional reconversion of the Bejaia industrial zone to existing urban spaces. The methods applied include analyzing the data of our case study and assessing the proposed orientations. Our study findings indicate that the study area is experiencing a deficiency in its urban planning, which can be attenuated by the various strategies envisaged. This article presents recommendations for improving future urban intervention proposals.

#### Keywords

adaptability, functional reconversion, industrial zones, urban spaces, Bejaia City

#### Résumé

*La forte croissance urbaine des villes demeure l'un des phénomènes urbains entraînant la dégradation du cadre de vie des citoyens. Les instruments d'urbanisme en Algérie ont tenté d'offrir un aménagement équilibré à travers des interventions urbaines. En effet, le PDAU Intercommunal de Béjaïa prévoit la délocalisation de la zone industrielle de la ville de Béjaïa vers la commune d'El Kseur, pour générer des surfaces foncières importantes. Notre travail vise à évaluer l'intégration et l'adaptabilité des stratégies proposées de reconversion fonctionnelle de la zone industrielle de Béjaïa aux espaces urbains existants. Les méthodes appliquées incluent l'analyse des données de notre cas d'étude et l'évaluation de l'adaptabilité des orientations proposées. Notre étude montre que l'aire d'étude crée une défaillance dans son plan urbanistique qui peut être atténuée par les différentes stratégies envisagées. Cet article présente des recommandations pour améliorer les futures propositions d'interventions urbaines.*

#### Mots-clés

*adaptabilité, reconversion fonctionnelle, zone industrielle, espaces urbains, ville de Béjaïa*

## INTRODUCTION

The designed urban space is in perpetual evolution as a result of the operations, organizations, and creations of different actors. The aim is to offer the users of this space a certain harmony through its analysis in order to programme according to needs and then develop and implement a project to integrate it into its environment and context. The city represents a place where people and activities gather (Saidouni, 2000). Four main urban functions are concentrated, namely: transportation, industry, culture, and services (Bastié & Dèzert, 1980). The first actors who developed urban thought were not

planners or architects, but doctors, politicians, lawyers, or jurists. The latter have theoretically devoted themselves to the welfare of the population. Their thinking was utopian, and consequently, they were unable to concretize their conception and decision (Foura, 2012). The same author (2012) reported that the 19<sup>th</sup> century was marked by the emergence of two revolutions: an industrial revolution, covering a period of major discoveries and inventions from 1750 to 1820, followed by an application phase until the eve of the First World War. A second revolution, after 1850, was the demographic one, accompanied by an improvement in living conditions. Moreover, the 19<sup>th</sup> century saw the emergence of working-class

housing estates as part of the industrial revolution. These were economic residential estates for a social category composed of workers from the same factory and their families (Dahmani & Moudjari, 2013). In 1904, during his stay in Italy, the Lyon architect Tony Garnier commenced designing his project for the Cité Industrielle for 35,000 inhabitants. The aim was to merge the needs of citizens living in the industrial era with their environment by creating an ideal modern city that would be made up of housing, community facilities, and industry located near a river (Musée urbain Tony Garnier). This city is considered one of the first examples of vertical zoning, as it was designed according to the principle of spatial separation of functions (Semyroz *et al.*, 2020). The first industrial units were installed during the 1950s and 1960s in England and then in France, for example, at the Saint Fons chemical platform south of Lyon (Allain, 2004). Marchal (2016) argues that the motivation for the construction of industrial infrastructure in France has been the modernization of cities and the creation of priority urban planning zones and new towns. According to Chadli and Hadjiedj (2003), urban centres and large agglomerations are therefore places of production where the spread of industrial activity contributes to their development and flourishing.

With the aim of offering territories' users a new urban perspective through urban interventions, urban planning instruments in Algeria show a strong commitment to fair and balanced planning in these areas. In this sense, the Intermunicipal Master Plan for Planning and Urban Planning of Bejaia (Plan Directeur d'Aménagement et d'Urbanisme Intercommunal de Bejaia) stipulates the relocation of the industrial zone of Bejaia city to the industrial zone of El Kseur municipality in order to generate large areas of available land with a view to rationalizing land use and solving the problem of rupture that the city is experiencing with its extension and the sea, but also to reduce the negative environmental impact caused by the abovementioned zone (Société Civile Professionnelle d'Architectes Axxam, 2009). In addition, according to the guidelines of the prospective planning and development study elaborated as part of the Territorial Planning Plan for the Wilaya of Bejaia, the attractiveness of the latter and its integration into the regional and national economies will be enhanced by its provision of service facilities for the tertiary sector

and tourism, thus opening it up to the international stage (Centre National d'Etudes et d'Analyses de la Population et du Développement, Wilaya de Bejaia, 2013). According to the Professional Civil Society of Architects Axxam<sup>1</sup> (2009), Bejaia is a city that can be Algeria's gateway to the rest of the world. To achieve this, it must be equipped with a business district, also known as the Central Business District (CBD). The latter is scheduled to be developed on land reclaimed from the city's industrial and military zones, covering an area of 250 hectares (Société Civile Professionnelle d'Architectes Axxam, 2009). This was the case with the decision made to relocate industrial production units in Casablanca (Morocco) to peripheral areas in the mid-1980s in order to create commercial and office space, as well as property operations on the recovered land (Kaïoua, 2018).

This refers to a redevelopment and revitalization operation led by urban renewal, using public investment to encourage private investment in different underdeveloped sectors (Johnson & Tashman, 2002). This operation tends towards another term, reconversion, that has been the subject of several previous studies, such as the study on the reconversion of urban wastelands into green public spaces (Perrin, 2017), where the author defined reconversion as a modification inserted in relation to the initial destination; the study providing an introduction to the rehabilitation, reconversion, and renewal of degraded industrial and urban spaces by Deshaies (2006), which gave meaning to reconversion through the rehabilitation of deteriorated and degraded spaces by introducing them into the new economic system and giving them a new use through their redevelopment; and finally, the analysis of the transformation of four military sites in Paris, Rome, Metz, and Udine since 1990 and the relationships between urban governments and state actors around these sites in the study by Artoli (2016), which focuses on public land policies, namely: the reconversion of military sites in French and Italian cities between army reforms, budgetary constraints, and urban planning. The problem of reconversion was posed before the Second World War (1939–1945) in the country with the longest history of industrialization, namely Great Britain, as mentioned previously, where the London agglomeration experienced decentralization, a territorial intervention that persisted for forty years (Merlin & Choay, 2010).

The choice of the industrial area of Bejaia City, installed in the 1970s, as a study area is motivated by several reasons. Its strategic location at the centre of a city, which is the economic hub of the region, makes it an optimal location for projects of high added value. As it is intersected by three main roads, namely: Boulevard Soummam, Aurès Road, and Boulevard Krim Belkacem, our study area is home to several functions, such as industry, housing, and trade, thus generating jobs. According to the activity report elaborated by the Directorate of Employment of the Wilaya of Bejaia (2018), the employment offered by the industrial zone represents a rate of 32,43% of Wilaya job offers. In addition, Bejaia's industrial zone is unable to express its vocation so as to be able to identify itself spatially. It is an area constituting a functional rupture between the historic centre of the town and its extension, as well as the sea (presence of industrial activity in relation to port activity). Furthermore, it represents a harmful pathology to the environment, being a source of a multitude of nuisances (air, noise, and odour pollution) and congestion problems due to its location in the centre (an area fairly frequented by motorized and public transport users). Finally, the location of the industrial zone in the heart of a city, occupying the majority of it, contradicts the principles of urban planning. This leads us to the assessment of the adaptability of the proposed orientations and strategies for the functional reconversion of the study area to the needs of the existing urban context.

Given that the industrial zone of Bejaia City constitutes a threat to its spatial and environmental balance, the following questions arise: what operations and strategies are envisaged as part of the functional reconversion of Bejaia's industrial zone? Can these strategies adapt the study area to existing urban functions and spaces? This article provides an answer to the question posed, leading to the hypothesis that will guide the investigations and field surveys: in order to adapt the industrial zone of Bejaia City to the existing urban environment, the urban planning instruments present orientations in the context of its functional reconversion. These orientations could be implemented in the framework of various urban interventions, including the restructuring and redevelopment of the zone through the introduction of cultural activities and higher tertiary services. This aligns with the city's status as a tourist, historical, and chief town of the wilaya. In this context, the objective

of this research work is to assess the adaptability of the functional reconversion strategies for the industrial zone of Bejaia, as proposed by the actors responsible for urban production, to existing urban spaces. Furthermore, this article aims to contribute to the enrichment of the scientific literature on the evaluation of urban projects, providing an aid and a reference for decision-makers. To achieve this, the case study was first analyzed based on the results of the field survey. In a second part, the integration and adaptability of the proposed orientations for functional reconversion of the study area have been evaluated based on criteria drawn from the lessons of the literature review. This evaluation has led us to conclude the article with a proposal of recommendations to address the problems encountered in the industrial zone analyzed, as well as to improve future proposals for urban operations.

## I. METHODOLOGY

In order to respond to the posed problem and achieve the expected objectives, this article follows a methodology divided into two main stages: diagnosis of the industrial zone by analyzing it and highlighting its strengths and constraints, and in the second step, an assessment of the adaptability of proposed strategies for the functional reconversion of the study area. To this end, the methodology is based on a field survey using the following techniques: exploratory observation, bibliographical research, and data collection, analysis, and evaluation.

### A. Data analysis of Bejaia's industrial zone

In the first step, a diagnosis of the study area was established, which is based on two complementary phases. The first is the analysis of implantation, socio-economic (demographics and jobs), and geotechnical data in the study area. This first phase is based on data collection and field observation. The latter is used to analyze social interactions in space; moreover, it is also a method for collecting data, describing, and interpreting spatial practices (Morange & Schmoll, 2016). In the case of the Bejaia industrial zone, the technique of exploratory observation was applied by crossing the main axes of the study area while recording notes and information in our logbook. In addition, the collection of statistical and cartographic data (using QGIS software and PowerPoint to enhance the rendering)

was initiated in order to exploit them for analysis at the various departments of Bejaia municipality: the Directorate of Programming and Budgetary Monitoring, the Centre for Urban Planning Studies and Achievements, known as URBAS, and the Employment Directorate, where those concerned with the management of urban planning instruments were interviewed (urban planners, architects, technicians, etc.). The analysis of Bejaia's industrial zone characteristics and data represents a crucial step in verifying whether the proposed orientations are aligned with the requirements and constraints of the study area.

The second phase is to interpret the findings and analyses through the conclusion of the potential and constraints of the industrial zone (location, activities, environment, mobility, and transport), thus completing the first stage of the study.

### **B. Assessing the adaptability of strategies proposed by urban planning instruments**

In the second step, the adaptability of the strategies proposed by the urban planning instruments for the functional reconversion of the land to be relocated and recuperated from the industrial zone of the city of Bejaia was evaluated. The criticism and understanding of these orientations, which were discussed during the interviews (as previously mentioned), focused on a set of criteria adapted to our study context.

In the field of urban planning, a number of approaches and tools for assessing the adaptability, integration, and flexibility of urban projects to their contexts have recently been created and implemented, aimed at project developers and public decision-makers (Baïetto-Beysson, 2022). According to the same reference, an approach linking the socio-economic and environmental assessment of urban projects, elaborated by a group of professionals, researchers, and experts in the field, is based on the results of the impact study in order to understand the environmental impact of planning operations but also takes into account the effects of these operations on urban organization, the composition of urban societies, the living conditions, the quality of public spaces, the health of citizens, and the exposure of urban populations to risks. In addition to this approach, other tools can provide a basis

for analyzing and assessing the urban projects initiated and proposed by the actors involved in city-making, namely the Boussole21 method, which is an online platform that aims to assess the sustainability of projects and enables decision-makers to define their strengths and weaknesses (Ghennai *et al.*, 2022). Furthermore, it provides points for improvement based on twenty criteria: mobility, land use, outdoor and indoor air quality, living environment and public space, energy, climate change and risks, biodiversity and natural space, soil and water quality, wealth creation, framework conditions for the economy, economic resilience, competitiveness of the economy and innovation, consumption of resources, training and education, equal opportunities, social cohesion, health and prevention, culture, sport and leisure, public management, and governance and partnership (BOUSSOLE 21). Similarly, the IMPETUS tool employs indicators to compare different urban project scenarios and assess their economic and environmental impacts while promoting dialogue between the various stakeholders involved (Bonin & Laterrasse, 2015).

In order to evaluate the strategies proposed by the urban planning instruments for the functional reconversion of the industrial zone of Bejaia, it was necessary to define criteria adapted to our study context and local needs. These evaluation criteria were selected by combining the methods and tools mentioned above in order to ensure an effective and rigorous assessment, as well as optimal results. To achieve this, it was essential to use the following criteria: urban organization, functional mix and social cohesion, transportation and mobility, resilience to climate change and natural risks, environmental impacts and management of natural resources, employment opportunities, and, finally, governance and citizen participation.

## **II. PRESENTATION OF THE CASE STUDY: THE INDUSTRIAL ZONE OF BEJAIA**

The wilaya of Bejaia covers an area of 3,223.50 km<sup>2</sup> (Direction de la Programmation et de Suivi Budgétaires, 2020) and is surrounded by the ridges of the Djurdjura to the east and to the southeast by the Babors and Bibans, which dominate the plains of Bordj Bou-Arredj and Médjana (Gaid, 2008). It is home to three industrial zones on its territory:



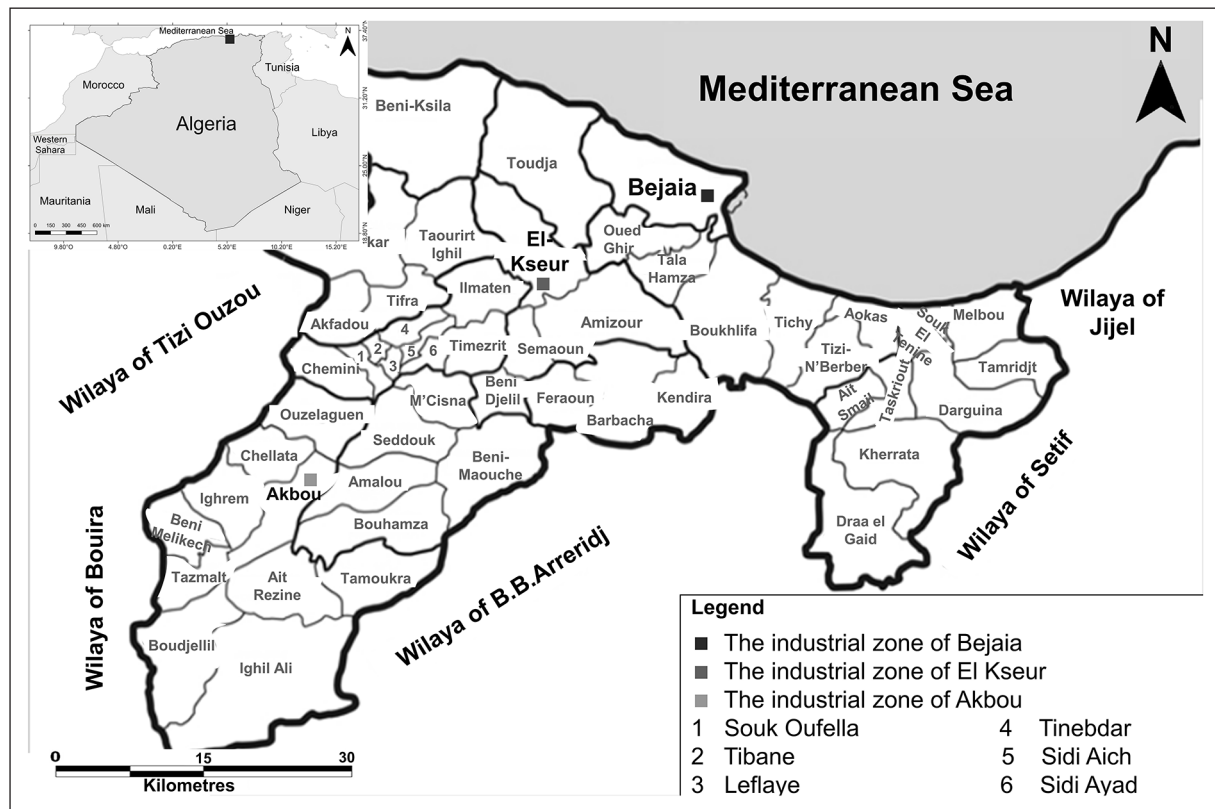
the industrial zone of Bejaia, in continuity with the presence of the port; the industrial zone of El Kseur; and the industrial zone of Akbou (Figure 1).

The city of Bejaia, the chief town of Wilaya, is located in the northeast of the central region of Algeria and to the east of the capital (Algiers). With a surface area of 120.22 km<sup>2</sup> (Bureau d'Etudes des Transports filiale de l'Entreprise Métro d'Alger, 2012), it opens onto the Mediterranean Sea to the north and is surrounded by the municipality of Toudja to the west, the municipality of Oued Ghir to the south, and the municipalities of Tala Hamza and Boukhelifa to the southeast.

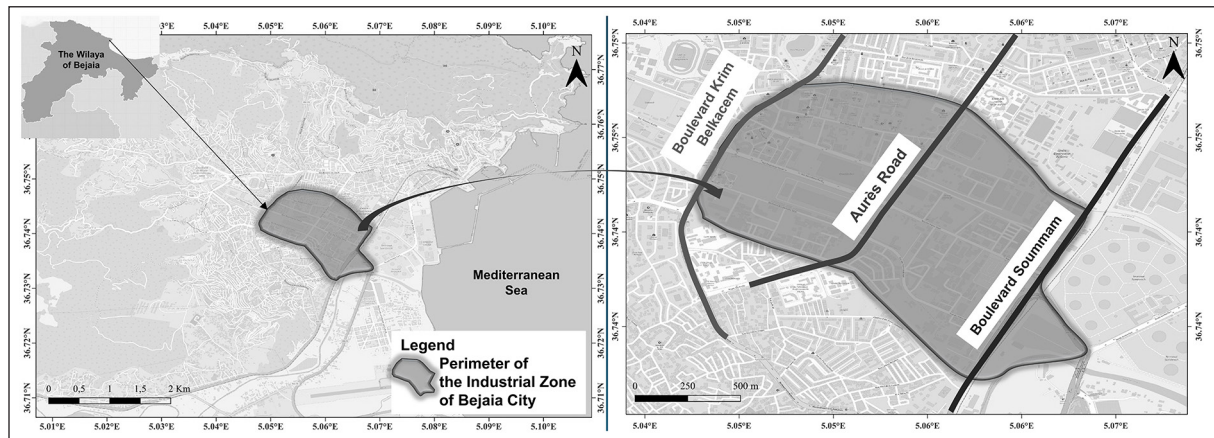
The industrial zone of Bejaia, with a surface area of 190.83 hectares (Société Civile Professionnelle d'Architectes Axxam), was established and created by interministerial decree N° 7241 DPU/77 of 17/04/1977 and subdivision permit under N° 02 of 14/09/1992, whose managing land agency is URBAS (Traki & Boukrif, 2019). According to the urban planning regulations of the Bejaia Intermunicipal Master Plan for Planning and Urban Planning, this zone is part of Urbanized Sector 128, Land Use Plan B18, which

is the former Land Use Plan 5A–4D–10 Industrial Zone—Boulevard Soummam, also known as the Aurès Soummam Land Use Plan. The latter is bordered to the north and south by Oued Seghir, to the east by the railway line linking Bejaia City to Béni Mansour, and to the west by Boulevard Krim Belkacem.

This area, situated at the centre of the city, is crossed by three roads as follows: the main arterial road, Boulevard Soummam; the level I inter-district central axis, Boulevard Krim Belkacem; and the level II inter-district central axis, Aurès Road. In addition to the industrial units, the study area covers residential and university halls of residence located in its north-eastern and south-western parts, as well as facilities for various activities, namely, administrative (directorates, banks), commercial (shopping centres), tourist (hotels), health (clinic), and transport (Bejaia bus station). The national centre for applied studies and research in urban planning has taken the initiative to establish regional industrial units, including one in Bejaia. These units, categorized as large regional utility industrial zones, are mainly located near ports in order to ensure technical



**Figure 1.** Geographical location of the industrial zones of Bejaia, El Kseur, and Akbou in the Wilaya of Bejaia. Source: authors, 2024, based on data from <http://ighilali.free.fr/geographie-bejaia.html>



**Figure 2.** Location of the industrial zone in the city of Bejaia. Source: Authors, 2024

requirements such as sanitation, drinking water supply, and transportation (Meza, 2023).

### III. RESULTS AND DISCUSSIONS

#### A. Diagnosis and analysis of data and characteristics of the Bejaia industrial zone

Similarly to other Algerian cities, the city of Bejaia has not been spared from the disadvantageous situation resulting from irrational expansion and growth accompanied by a lack of coherence in the evolution of the urban organism, which has become uncontrolled. The mistake commenced in the early 1970s, particularly with the advent of industrialization, which saw the establishment of industrial units without prior study and to the detriment of peri-urban agriculture, without anticipating the saturation of the city or considering the galloping demography, even less the phenomenon of rural exodus.

The first stage of the diagnosis consists of analyzing the data of the industrial zone of Bejaia, which has been collected from bibliographical research, the various departments, and exploratory observation in the field.

##### 1. Implantation of Bejaia industrial zone

The installation of an industrial zone in a region requires an evaluation and analysis of the offer, taking into account various criteria for land selection, including the expectations of industry and future users, given that industrial zones represent a significant contribution to the economic activity of a region (Weber, 2013). From this perspective, the establishment of an industrial zone in an urban space depends on a variety of criteria that need

to be taken into account in terms of economic, environmental, and social objectives. According to our exploratory observations and field surveys, Table 1 presents an analysis and evaluation of the implantation of Bejaia's industrial zone based on criteria taken from different documentary sources (Brûlé & Mutin, 1982; Weber, 2013; Meza, 2023).

The establishment of Bejaia's industrial zone in the geometric centre of the city represents a potential threat to the coherence and integrity of its urban plan and generates environmental and public health risks. In order to create resilient cities that meet the principles of sustainable urban development, it is essential to conduct a detailed assessment and analysis of the criteria used to choose the location of industrial zones. This necessitates a close collaboration between urban production actors and businesses in order to implement coherent and effective urban policies that take into account the needs of the local population, the availability of infrastructure, and regulatory constraints.

##### 2. Socio-economic data: demography and employment

The population of Bejaia City increased from 188,250 at the end of 2016 (Direction de la Programmation et de Suivi Budgétaires, 2016) to 190,766 at the end of 2018 (Bounouni *et al.*, 2020). In 2020, the wilaya of Bejaia was home to around 990,050 inhabitants (Direction de la Programmation et de Suivi Budgétaires, 2020). The city's demographic evolution was the result of a massive rural exodus after independence. During the French occupation, the difficult living conditions led the population to settle in other urban areas, namely the city of Bejaia, in order

Criteria for the implantation of industrial zones within an urban space	Evaluation of the implantation of Bejaia industrial zone	Observations
<b>Accessibility and infrastructure quality</b>	-	In spite of its proximity to the port, railway, and mechanical routes, the industrial zone of Bejaia presents limited accessibility to sites and urban infrastructure, notably public transportation networks.
<b>Territorial planning and urban regulations</b>	-	The implantation of our study area in the centre of the city of Bejaia does not conform to the principles of urban space planning. This operation occurred without consideration for the physical and spatial characteristics of the city, as well as urban planning regulations, safety, zoning, and environmental regulations.
<b>Resource supply and availability</b>	+	Availability of resources such as water, electricity, natural gas, and sanitation services. Moreover, the proximity to municipalities with raw materials ensures reductions in transportation and procurement costs.
<b>Labour availability</b>	+	The situation of our industrial zone in an urban centre where labour is available remains a key factor in developing the competitiveness of companies.
<b>Engaging civil society</b>	-	The absence of civil society involvement (associations, citizens, etc.) in the process of planning and managing the Bejaia industrial zone.
<b>Environmental impact</b>	-	Our study zone poses a significant risk to environmental quality and public health due to its location in the centre of a city. The degradation of green spaces and the blue network, combined with the presence of waste and the intensive use of motorized transport, give rise to various forms of pollution.
<b>Economic development of the region</b>	+	The implantation of the industrial zone in the city of Bejaia is a determinant factor in the economic development of the region, promoting job creation.

**Table 1.** Evaluation of the implantation of Bejaia industrial zone. Source: authors, 2024, based on results of the data analysis. Note: (+) for Meets the Criterion; (-) for Does Not Meet the Criterion.

to meet their health and education needs for their children (Younes, 2022). When an industrial zone was created in the centre of Bejaia in 1977, citizens were encouraged to return to the city to work in the industrial and commercial sectors. The exodus was intended to improve the living

conditions of the population (Younes, 2022). Despite the presence of industrial units in the study area, our field observation revealed a relatively high concentration of people throughout the zone, mainly in residential and university halls of residence.

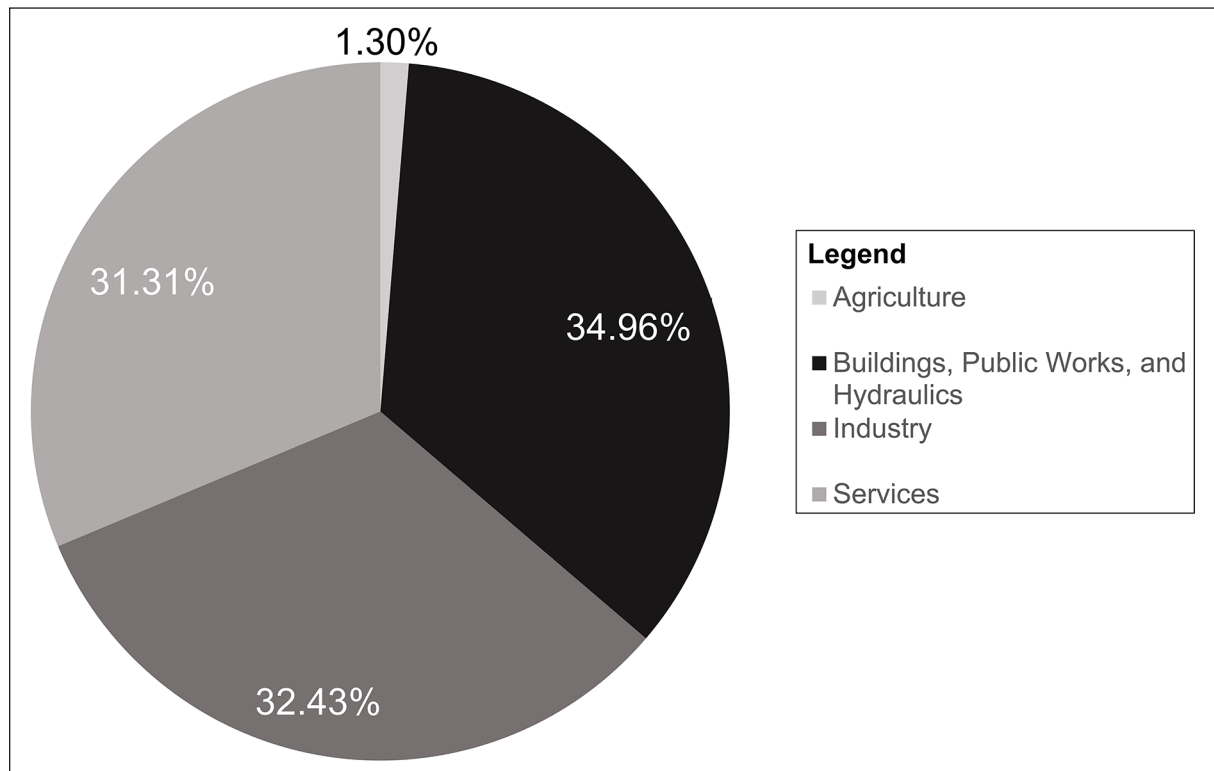
In terms of employment, the wilaya of Bejaia had a working population of 492,329, a rate of 49.79%, and an unemployment rate that increased from 8.36% in 2016 (Direction de la Programmation et de Suivi Budgétaires, 2016) to 8.96% in 2018, with a working population of 372,920 (Direction de l'Emploi de la Wilaya de Bejaia, 2018). As for the industrial sector in our study area, it was estimated at 7453 job offers throughout 2018, compared to a total of 22,982 job offers in the entire wilaya (Direction de l'Emploi de la Wilaya de Bejaia, 2018), a rate of 32.43% (Figure 3).

The industry sector was the second-largest sector in terms of job offers in 2018 after the building, public works, and hydraulics sector with 8,034 offers, followed by the services sector with 7,196 registered job offers.

### 3. Geological and geotechnical data of Bejaia's industrial zone

According to our interviews at URBAS, the grounds in the industrial zone are characterized by an alluvial nature, with beige calcareous clays that are sometimes silty and sandy, with the presence of a few pebbles. The soils appear

to be fairly homogeneous, and three main facies can be identified, namely, clay of stiff consistency, beige-olive clay, grey to black organic clay, and a Miocene marl bedrock. The nature of the soils and their layout can influence the bearing capacity of soils that may be urbanized. To this end, the URBAS multi-disciplinary team, responsible for managing and studying the Aurès Soummam Land Use Plan, was able to collect the conclusions of soil study reports for the study perimeter, which is currently occupied by industrial units and equipment. These conclude that the soil is formed of alluvium with poor geotechnical characteristics and heterogeneous vertical and horizontal facies. With regard to the road geotechnical data, boreholes and wells were drilled, and laboratory tests were performed. The interpretation of the results concluded that the geotechnical quality of the ground was mediocre. For backfill requirements, it is recommended to use materials with good properties to compensate for those of the natural soil: 27 cm for the foundation layer, 23 cm to 30 cm for the base layer and the revetment, depending on the planned traffic. According to the classification established by the National Centre for Applied Research in Earthquake Engineering, the Bejaia region belongs to zone



**Figure 3.** Job offers according to the legal sector and branch of activity in 2018. Source: authors, 2024, based on data from the Employment Directorate of the wilaya of Bejaia, 2018



03, which is characterised by low seismicity and should be taken into account. Given the flat terrain of the study area, the risk of instability, such as landslides, is low. However, a strong earthquake could cause instability in the subsoil.

In summary, our study area presents significant heterogeneity both in terms of the nature of the subsoil and the relationship between its different layers. This diversity of facies leads us to recommend additional studies that will enable us to define all the data required for the siting of any equipment, structures, or collective housing in the area. It is also important to consider the problems associated with the presence of both surface and groundwater. Their presence at shallow depths will reduce the possibility of constructing basements.

#### *4. Potentials and Constraints of the Study Area*

The second stage of the diagnosis and analysis involves identifying the potential and constraints of the study area. This is based on listing the conclusions drawn during field observations in Table 2, taking into account the influence of the city of Bejaia.

Table 2 presents the results of the data and characteristics analysis of the industrial zone. The aim is to benefit from its potential and propose solutions and recommendations to overcome the obstacles and constraints of vulnerable areas. The city of Bejaia is experiencing spatial dysfunction, which prevents it from ensuring a mix of functions. The urban fabric of the municipality is not homogeneous or continuous, either functionally or in terms of urban planning. The location provides an urban setting where the contrasts caused by the zoning present throughout the area are exacerbated. These include residential areas, industrial zones, and a university pole.

#### **B. Assessment of the proposed functional reconversion strategies adaptability for the Bejaia industrial zone to the existing urban spaces**

Many urban spaces around the world have experienced tertiarization and de-industrialization. As a result, functional reconversions have taken place in a variety of forms, depending on the socio-economic

profile and size of the cities concerned. In addition, in the context of the functional reinvention of urban environments, arrangements for recycling industrial heritage have been implemented.

According to our interviews and reading of documentation from the various departments of the Bejaia municipality, the strategies proposed as a part of the functional reconversion of the industrial zone consist of restructuring the zone's road system, densifying residential neighbourhoods, and encouraging the urban mix. The latter refers to the equitable distribution of urban functions within an agglomeration, taking socio-economic factors into account, as opposed to urban specialization or zoning. In order to materialize this mix and to be consistent with the Territorial Planning Plan for the wilaya of Bejaia, the orientation report of the intermunicipal Master Plan for Planning and Urban Planning of Bejaia stipulates the projection of a mixed-use business district consisting of housing, commerce, and high-standard services after the recovery of the land containing the industrial infrastructure to be relocated, as demonstrated in Figure 4.

This proposal is currently premature. Although the study has been conducted, the project has not yet been implemented due to administrative, technical, and financial constraints. Our field surveys indicate that the targeted industrial units are operating regularly and employing a large number of workers. However, these employees are unwilling to be transferred to the El Kseur industrial zone due to time and transportation constraints. Furthermore, the authoritarian approach has led to the exclusion of civil society, as represented by citizens' associations, from the decision-making process. Moreover, the principles of citizen participation, as outlined in the Master Plan for Planning and Urban Planning approaches, are not being implemented in practice (Sidi Boumedine, 2013).

In the Algerian Laws, Article 03 of Law 11-04 of February 17, 2011, defining the rules governing property development, stipulates that the restructuring concerns road networks and buildings. It involves the partial destruction of city blocks, a modification of the characteristics of neighbourhoods and buildings, and their decommissioning with a view to a different use through the transfer of activities of all types (Guerroudj, 2017). Urban den-

Potentials	Constraints
<p>A strategic location at the heart of a city with ambitions to expand internationally, through:</p> <ul style="list-style-type: none"> <li>- Its importance as a pole is due to the existence of structuring facilities: port, international airport, universities, etc.</li> <li>- Its influence on the neighbouring municipalities (capital of the wilaya),</li> <li>- Its population: Bejaia is one of the most densely populated municipalities in Algeria.</li> </ul>	<p>The location of industrial activity in the centre of a city presents a significant deficiency in its urban planning, contradicting the principles of urban space design and planning.</p>
<ul style="list-style-type: none"> <li>- The presence of commercial areas and facilities for a diverse range of activities offers residents a convenient lifestyle and a functional mix.</li> <li>- The industrial sector in the study area provides significant employment opportunities.</li> </ul>	<p>A notable absence of spaces for social interaction, such as squares, leisure, and cultural activities, leads to a weakening of social ties.</p>
<p>Neglected outdoor spaces can be strategic by creating multifaceted green spaces or recreational areas.</p>	<ul style="list-style-type: none"> <li>- Absence of interest in the needs of the elderly and people with reduced mobility in the industrial zone.</li> <li>- The road network in this area is in a critical state due to insufficient street lighting and the absence or non-functioning of traffic lights at intersections.</li> <li>- The public transport network is deficient, resulting in the intensive use of private cars. The roads are often long and lined with walls, and the pavements are degraded, which marginalizes pedestrian walkability.</li> </ul>
<p>The risk of instability, such as landslides, is low as the terrain in the study is flat.</p>	<ul style="list-style-type: none"> <li>- The road's geotechnical quality is mediocre.</li> <li>- The study area is characterized by high heterogeneity due to the nature of the subsoil and the relationship between its various layers.</li> <li>- The presence of shallow water tables will reduce the possibility of establishing basement levels.</li> </ul>
<p>Local authorities are implementing initiatives for waste collection and management through selective recycling in the residential neighbourhoods of the study area, indicating a growing focus on environmental protection.</p>	<ul style="list-style-type: none"> <li>- Pollution takes many forms, including visual, olfactory, noise, and air pollution. It is caused by the omnipresence of waste and motorized transport, particularly private cars. Additionally, the state of the sewerage networks is deteriorating.</li> <li>- The blue network (Oued Seghir) is neglected and is a source of pollution, insecurity, and a potential risk to public health.</li> </ul>

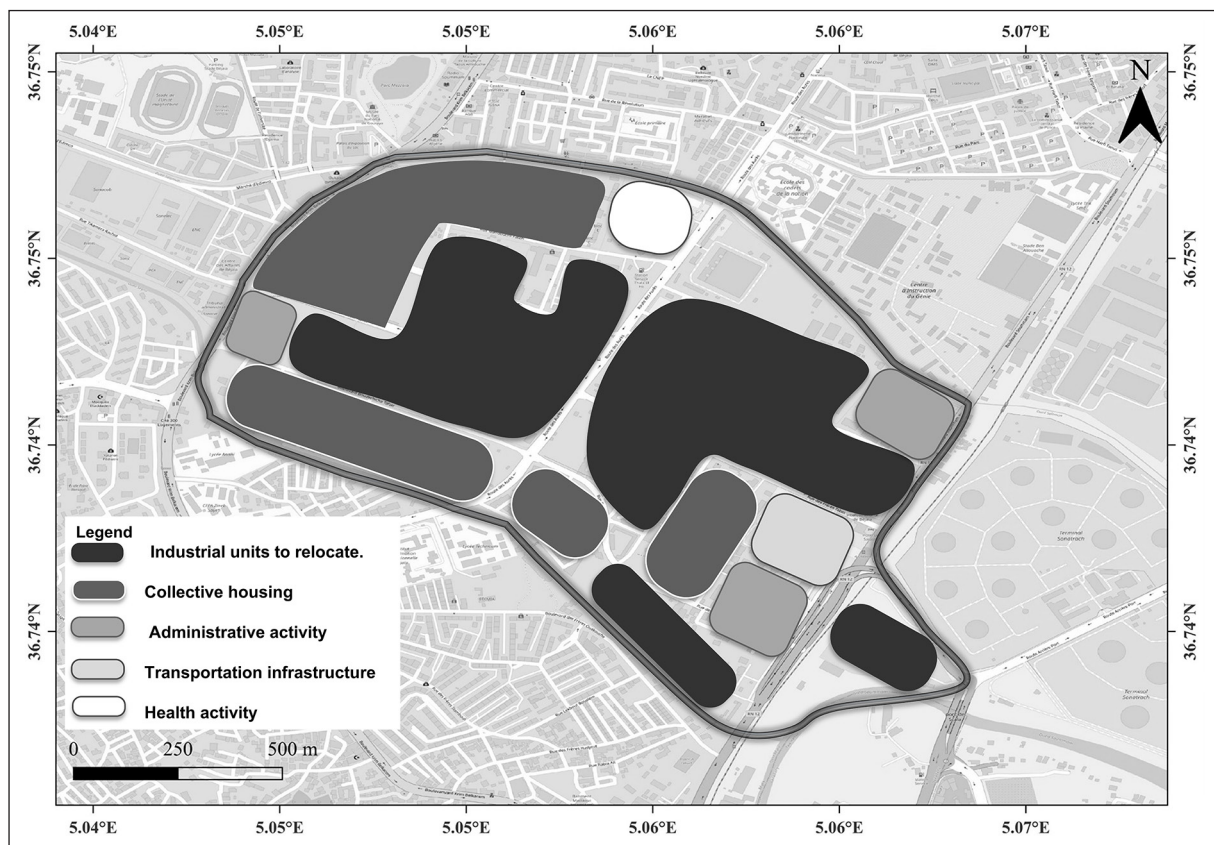
**Table 2.** Potential and Constraints of Bejaia's industrial zone. Source: authors, 2024, based on results of the data analysis

sification consists of housing the maximum number of people in an urban space. An example of this is the transition from a neighbourhood of individual housing to a neighbourhood of collective housing.

Based on our exploratory observations and field surveys, Table 3 presents an assessment of the adaptability of these operations and strategies for the functional reconversion of the industrial zone

of the city of Bejaia to existing urban spaces, in accordance with the criteria mentioned previously (methodology) drawn from the findings of the literature review.

Analyzing the data on the Bejaia industrial zone, identifying its assets and constraints, and understanding the redevelopment operations presented in the urban planning instruments are the appro-



**Figure 4.** Land to be recovered and distribution of activities in the industrial zone of Bejaia City. Source: authors, 2024, based on results of the data analysis

prate stages for assessing the adaptability of the proposed strategies for the functional reconversion of the industrial zone through the decommissioning and relocation of its land that is vulnerable and ecologically pathological for the environment and constitutes a major constraint to the harmonious urbanization of the city.

Accordingly, the results of our research and surveys in the field confirm our hypothesis, which assumes that functional reconversion can be achieved as part of various restructuring and redevelopment projects through the inclusion of cultural and service activities. These will enable the industrial zone to be adapted to its existing urban context and are necessary for the revitalization and development of the city. In fact, there are numerous examples of reconversions involving the transformation of industrial zones and their adaptation to their urban environment. Djallal Himeur (2021) stated that the buildings in the Hussein Day industrial zone in Algiers possess significant spatial, morphological, constructional, and typological qualities, offering opportunities for new forms of use and projects that could enhance the district's identity and improve

the quality of urban life by moving from industrial production to intellectual production. These projects are based on a programme that respects the existing buildings and adapts to the needs of the current population.

Proposals for the planning and functional conversion of the Bejaia industrial zone as a whole, in accordance with the relevant instruments, enable the recovery of urbanisable and vulnerable land in the long term. The aim is to alleviate the problem of a limited supply of land while avoiding the need to acquire sites on agricultural land in the communes bordering Bejaia in order to control urban sprawl, a major urban phenomenon. In addition, these proposals present planning operations that consider the characteristics of the existing urban space and its needs through its adaptation by creating complementarity with the functions housed in the area while benefiting from its potential and dealing with its constraints that hinder the city's development. Functional reconversion involves a variety of contexts and projects, such as innovative urban redevelopment, revitalization, and regeneration, targeting

<b>Criteria for assessing the adaptability of the proposed operations and strategies to existing urban spaces</b>	<b>Assessment of the adaptability of the proposed functional reconversion strategies for the Bejaia industrial zone to the existing urban context</b>	<b>Observations</b>
<b>Urban organization</b>	+	The restructuring of the urban networks, specifically the primary and secondary roadways within the study area, can serve as a framework for targeted developments such as intersections, boulevards, and rights-of-way in relation to buildings. This operation also facilitates traffic flow and improves the integration of the various neighbourhoods within the study area, the planned business district, and the entire city in a harmonious manner.
<b>Functional mix and social cohesion</b>	+	The densification of the neighbourhoods and the provision of the land recuperated from the zone with service facilities for the tertiary sector, culture, and business tourism, in addition to communal living spaces, will promote their dynamism and a diversity of usages in harmony with the cultural, historical, and tourist status of the city of Bejaia, as well as with its territorial vocation as the capital of the wilaya, through the revitalization of our zone located in the geometric centre of the city. These proposed urban activities are intended to prevent the zoning that characterizes the city's urban fabric and to encourage social mixing through the reinforcement of social links and interactions between citizens, as well as fostering a sense of belonging to the community.
<b>Transportation and mobility</b>	+	The spatial reorganization and transport supply proposed by the urban planning instruments (soft modes of transport with low environmental impact, such as the tramway) can largely secure and optimize mobility for pedestrians and people with reduced mobility. In addition, the planned infrastructure will improve the accessibility and fluidity of transport in the city of Bejaia.



<b>Resilience to climate change and natural risks</b>	+	In order to face and resist severe climatic events, the instruments have taken into consideration the environmental risks by proposing the maintenance of the canals, the improvement and surfacing of the two lanes alongside the Oued Seghir, and the construction of collection structures to ensure efficient drainage and the recovery of rainwater in order to reduce the risk of flooding. In addition, these instruments are designed to take account of the geological and geotechnical constraints encountered during the construction process.
<b>Environmental impacts and management of natural resources</b>	+	The design of green spaces, the planting of a variety of trees, the development of waste management measures (selective waste separation, recycling, raising public awareness), and the maintenance of the waterways, which are a component of the study area, contribute to the reduction of olfactory and visual nuisances, environmental protection, and the sustainable and rational management of water resources and green spaces.
<b>Employment opportunities</b>	+	The establishment of a mixed business centre in the urban centre of the city of Bejaia constitutes a decisive element for the economic development of the region by ensuring the generation of employment, in particular in the higher tertiary services sector, and the competitiveness of enterprises.
<b>Governance and citizen participation</b>	-	The absence of civil society involvement (associations, citizens, etc.) in the planning and development process for projects proposed by urban planning instruments.

**Table 3.** Assessment of the adaptability of proposed strategies for the functional reconversion of the Bejaia industrial zone. Source: authors, 2024. Note: (+) for Meets the Criterion; (-) for Does Not Meet the Criterion.

buildings and zones, including industrial ones, with a view to adapting them to the existing urban environment as well as to the current and future needs and living conditions of urban populations in Bejaia and other Algerian cities.

## CONCLUSION

As is the case in every country on our planet, urban space has undergone multiple configurations as a

result of economic and social evolution, engendering functional reconversion operations conducted as part of the process of relocating industrial or activity zones comprising harmful units present in many cities. According to the field surveys, research, and analyses, the results demonstrate that the study area has created a significant failure in the city's urban planning, caused by the functional rupture between the historic centre of the city and its extension, but also represents a definite negative

impact on the environment. Furthermore, this zone, which occupies the majority of the urban fabric, was created at a time when exacerbated zoning affecting the whole of the city was favoured, with negative repercussions for its functioning.

This research has allowed us to critically observe, analyze, and evaluate the adaptability of the functional reconversion strategies for the industrial zone of Bejaia City to existing urban spaces and to the expectations of development projects. In order to achieve this, the methodology was based on an analysis of the study area, establishing a two-stage diagnosis: the first stage was to analyze the data collected and the characteristics of the industrial zone from the surveys performed in the field, which consisted of exploratory observation and data collection at the various directorates of the municipality; the second stage was to identify the potential and the constraints encountered. This fieldwork enabled us to assess the adaptability of the orientations proposed in the urban planning instruments in terms of the functional reconversion of the study area to the existing urban spaces. The proposals aim to revitalize and renovate the area, with a view to developing the city and offering a new urban vision adapted to the needs of city users, being the central element of each project or urban intervention. The results highlight the absence of citizen involvement in the decision-making process for the proposed projects and orientations, which would ensure their social acceptability.

The case of the industrial zone of Bejaia reveals specific challenges while also reflecting broader Algerian and North African realities. As is the case with many cities in the region, the urban evolution of Bejaia has been shaped by the post-colonial industrial policies. These have often prioritized accelerated industrialization, ignoring social and environmental impacts. The resulting urban areas often present similar patterns of functional fragmentation, environmental degradation, and social exclusion. However, our case study also provides valuable insights for other cities facing similar challenges.

This article therefore presents recommendations in response to the constraints identified in the analyses that are hampering the dynamism and development of the city of Bejaia and other similar contexts, but also to improve future urban intervention proposals:

- Encouraging and reinforcing the participation of citizens through associations and local councillors to take effective action in areas that affect people's needs, thereby improving their quality of life (public consultations, numeric platforms, etc.).
- Provide systems for monitoring and assessing the impact of projects based on defined criteria to enable them to be adjusted according to feedback from critics and evaluations.
- Provide training for local actors in participatory urban planning and sustainable project management.

This article presents a reflection conducted in order to achieve the objectives and respond to the problem posed. To this end, a study based on a process consisting of several stages has been implemented, concluding with an assessment of the adaptability of the proposed strategies, whose translation on the ground is desired, as part of the functional reconversion of the land to be relocated and recovered from the Bejaia industrial zone to the existing urban spaces. Additionally, the study proposed appropriate measures and solutions to mitigate the negative consequences of the industrial legacy, create more liveable and equitable urban spaces, and improve future urban proposals in Algeria, North Africa, and other similar regions around the world.

## NOTE

<sup>1</sup>The Professional Civil Society of Architects Axxam is the company in charge of the Intermunicipal Master Plan for Planning and Urban Planning of Bejaia.

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