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URBAN SUSTAINABILITY ASSESSMENT IN A SPONTANEOUS NEIGHBORHOOD: THE CASE OF BOUDGHENE, TLEMCEN

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Abstract
This article examines the sustainability of the spontaneous neighborhood of Boudghene, located in the city of Tlemcen, in Algeria. Empirical data were collected through a questionnaire distributed to 370 individuals. The sustainability assessment was conducted using a variety of sustainable development indicators, which allowed the creation of a concise dashboard providing a clear picture of the situation in the neighborhood studied. The results clearly indicate that this spontaneous housing exhibits some aspects of sustainable development but requires significant efforts to strengthen them. Therefore, the findings suggest a holistic approach to address the multifaceted sustainability issues affecting the neighborhood within the framework of the country's development policy.

Keywords: Assessment; Indicators; Sustainable development; Spontaneous neighborhood; Boudghene.

Resumo

Este artigo examina a sustentabilidade do bairro espontâneo de Boudghene, localizado na cidade de Tlemcen, na Argélia. Os dados empíricos foram coletados por meio de um questionário distribuído a 370 indivíduos. A avaliação da sustentabilidade foi realizada utilizando uma variedade de indicadores de desenvolvimento sustentável, o que permitiu a criação de um painel conciso que oferece uma visão clara da situação no bairro estudado. Os resultados indicam claramente que essa habitação espontânea apresenta alguns aspectos de desenvolvimento sustentável, mas requer esforços significativos para fortalecê-los. Portanto, os resultados sugerem uma abordagem holística para abordar as questões multifacetadas de sustentabilidade que afetam o bairro no contexto da política de desenvolvimento do país.

Palavras-chave: *Avaliação; Indicadores; Desenvolvimento sustentável; Bairro espontâneo; Boudghene.*

1 INTRODUCTION

Urbanization and rapid urban growth are global phenomena that affect all countries. However, in developing countries, these phenomena can have more specific effects. Indeed, the proliferation of informal housing is a phenomenon commonly observed in developing countries. Unauthorized constructions spread to the extent of forming entire neighborhoods, which are commonly referred to as "spontaneous neighborhoods." Often perceived negatively, this type of neighborhood results from rapid and emergent urban development stemming from urgent situations and a lack of resources. These neighborhoods provide housing for those who are not accommodated by the formal housing market (Clerc, 2014); they are suitable for people with insufficient and irregular incomes due to their convenient location in terms of urban employment and livelihoods (Turok; Borel-Saladin, 2016). In 2007, Petropoulou highlighted that residents of spontaneous neighborhoods were compelled to build their homes outside urban plans due to their housing needs and the socio-economic exclusion they faced. She explained that they had no alternative housing options, such as social housing or pre-built units from real estate companies, as these did not align with their circumstances, such as inconsistent income or lack of a stable salary. Consequently, their decision to build informally was both spontaneous and dictated by the context in which they lived. These spontaneous housing developments have been the subject of various policies for years, either aiming to eradicate them or transform them to minimize their impact.

Its proliferation has drawn the attention of construction professionals and has given rise to a controversial debate among practitioners. While some specialists have labeled it as chaotic housing and described it as the "worst of all possible worlds" (Davis, 2006), others have perceived it as a resource in contemporary metropolises with significant potential and another alternative for a social class with limited housing options (Turner, 1979).

In Algeria, the regional spatial imbalance has its roots in the colonial policies inherited and maintained by Algerian authorities after the country's independence. This uncontrolled and swift urbanization gave rise to a new form of urban development known as "spontaneous" peripheral neighborhoods, which have spread across all Algerian cities (Naceur, 2003).

Tlemcen is among the Algerian cities experiencing the proliferation of such spontaneous housing, accommodating a significant portion of the urban population. This wave of spontaneous urbanization in Tlemcen, unlike the traditional wave, often referred to

as "shantytowns" (constructed with salvaged materials) in urban research circles is generally characterized by the proliferation of new "permanent" constructions (built with durable materials). The precariousness of these neighborhoods is primarily due to the legal status of the land, the absence of infrastructure, their location outside the official urban planning standards, and their geographic positioning.

In Tlemcen, the neighborhood of Boudghene, nestled at the base of the immense cliff known as the "Petit Perdreau," exemplifies the production of unplanned housing. It serves as a representative case in this research field, given its history, evolution, and the diverse interventions carried out by the state to integrate it into the rest of the city. It presents a sample that warrants an in-depth study.

This article highlights the sustainable aspects of the Boudghene neighborhood. It explains how and why the assessment of sustainability in spontaneous neighborhoods has become imperative for achieving sustainable urban development. This study evaluates key sustainability indicators in the spontaneous neighborhood of Boudghene. Furthermore, this study provides insights into the upgrading of the neighborhood based on these sustainability indicators. It also offers original scope for academics to delve deeper into research in this field. Given that, no comprehensive study on the sustainability of the spontaneous neighborhood of Boudghene has been conducted.

2 CONCEPTUALIZATION OF SPONTANEOUS HOUSING AND URBAN SUSTAINABILITY

More than half of the global population now lives in urban areas (World Bank, 2023). The report World Urbanization Prospects by the United Nations (2019) states that the rate of urbanization is growing faster in developing countries than in developed countries. This rapid urbanization is often accompanied by various challenges, such as slums, the informal economy, social exclusion, and deteriorating living conditions.

In order to avoid becoming victims of their own success, cities must seek ways to develop sustainably. The concept of sustainable development appears to have been a driving force in world history during the latter part of the 20th century. Its most well-known definition is found in the Brundtland Report of 1987: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Alongside this "methodological" definition, there is also one in terms of substance, encompassing the three dimensions of social, economic,

and environmental aspects. (Aknin *et al.* 2002). Furthermore, sustainable development is considered an alternative to traditional development models and has the potential to address numerous issues such as the depletion of natural resources, ecosystem destruction, pollution, overpopulation, growing inequalities, and the degradation of human living conditions (Ferguson; Smets; Mason, 2014).

Since the 1990s, Algeria has progressively implemented various institutional, legislative, and even constitutional tools to give crucial importance to sustainable development within its governance agenda (Tedjani, 2021).

More recently, in the preamble of the National Voluntary Report of Algeria (UNICEF, 2019), the Algerian diplomacy emphasized that since the adoption of the 2030 Agenda by the international community in September 2015, Algeria has committed to its implementation. To address the challenges posed by this agenda and develop robust national responses, an Interministerial Coordination Committee was established in 2016 under the auspices of the Ministry of Foreign Affairs, tasked with monitoring and evaluating the implementation of the Sustainable Development Goals in Algeria (Tedjani, 2021). This report contends that tangible progress has been made in most of the Sustainable Development Goals, especially those addressing the essential needs of citizens, thanks to substantial public investments.

When applied to cities, sustainability embraces the metaphor of metabolism. A city is considered to progress towards sustainability when it reduces its intake of resources (such as land, energy, water, and materials) and diminishes its waste outputs (including air, liquid, and solid waste), all while enhancing its quality of life (such as health, employment opportunities, income levels, housing conditions, leisure activities, access to public spaces, and community cohesion) (Newman; Kenworthy, 2003).

In Sustainable Development Goal 11, the world aims to ensure that cities and human settlements are inclusive, safe, resilient, and sustainable. This goal particularly addresses what is commonly referred to as spontaneous housing. The term "spontaneous housing" encompasses different realities depending on the region and the context in which it is used. In a general sense, spontaneous housing refers to illegal constructions that originate from individual initiatives and develop into entire neighborhoods. These are primarily residential buildings constructed urgently and in the context of financial and land scarcity (Gerbeaud, 2012).

Regardless of the various names and forms that spontaneous housing may have taken, in Algeria, it can be broadly categorized into two forms slums or Precarious Housing

are constructed using reclaimed materials and typically lack essential infrastructure services. solid Neighborhoods are more prevalent and involve more permanent construction methods. These distinctions are based on the materials used, the level of infrastructure development, and the permanence of the housing structures (Meskaldji, 1993).

At the urban scale, these spontaneous neighborhoods maintain strong interactions with the planned urban fabric, and sometimes even have economic complementarity. Some of these neighborhoods indeed become attractive to commercial hubs, and over time, they contribute to urban sprawl by investing in areas initially unsuitable for housing and integrating them effectively into their immediate contexts. The quality of their buildings also improves over time, gradually meeting the standards of private residential development.

Egyptian researcher and urbanist Heba Allah Essam E. Khalil (2010) identify the presence of numerous sustainability aspects, in line with new urban planning trends, in informal areas in Egypt through four significant examples. She highlights some of their ecological characteristics: these areas are compact, walkable, and dense. They meet lifetime needs with a variety of housing options and mixed uses. They are initially need-based and rely heavily on community participation in their development. However, some missing sustainability aspects should be introduced, such as green transportation and promoting access to nature, along with providing more sustainable housing opportunities and transit-oriented development.

A study conducted by Prismawan *et al*. (2017) analyzing Krajan Kampung Krian - Sidoarjo, in accordance with sustainable development aspects, revealed several environmental, social, economic, and cultural potentials. These include effective waste management and clean water availability, the possibility of transforming land near the river into green spaces, the proximity of housing to Krian markets and commercial areas, and access to educational, religious, and healthcare infrastructure. Community participation in the village's development is active, with significant contributions from residents. Traditional cultural values are also well-preserved. However, the study also identified challenges that require solutions, improvements, and further development.

Between advantages and disadvantages, spontaneous housing requires thorough study. Evaluating sustainability in these neighborhoods can yield theories and guidelines for enhanced formal planning, and especially by identifying the shortcomings in these areas, it facilitates their improvement and modernization to achieve sustainable urban development.

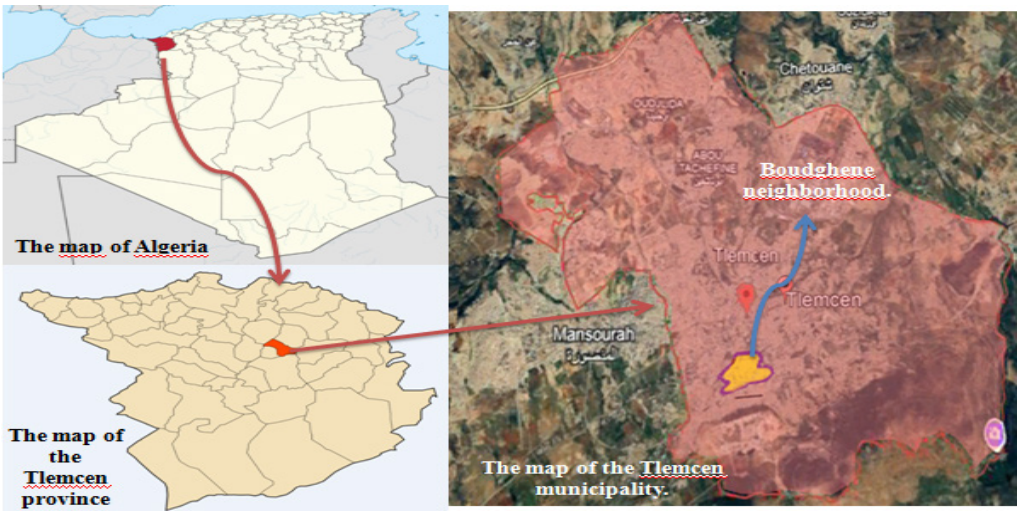
3 THE STUDIED SITE

Boudghene (Figure 1), an old and popular neighborhood located at the base of the Lalla Setti plateau (Figure 2), exemplifies the type of space resulting from unplanned housing production (Conference on the urbanization of Tlemcen, 1982). It is bordered to the north by the Bel Air neighborhood, to the south by the Lalla Setti plateau, to the east by El Kalaa, and to the west by the Ouali Mustapha neighborhood (Figure 3). Due to its elevation, it overlooks the entire city of Tlemcen.

Figure 1 - Overview of Boudghene neighbourhood

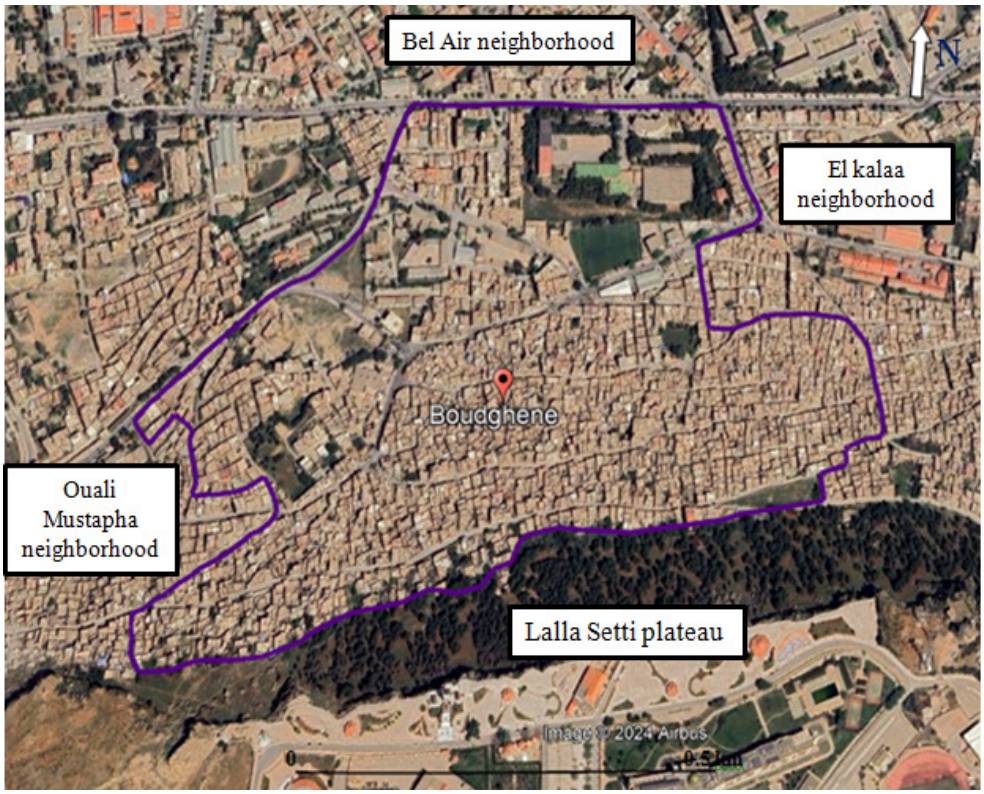
Source: The authors, 2023 (Photo taken from the Lalla Setti plateau).

Figure 2 - The location of the Boudghene neighborhood in Tlemcen, Algeria



Source: The authors (based on Google Earth 2024).

Figure 3 - Administrative Boundaries of the Boudghene Neighborhood



Source: The authors (based on Google earth 2024)

3.1 BOUDGHENE: ORIGIN AND EVOLUTION

Boudghene has ancient origins, as evidenced by prehistoric artisanal artifacts discovered in the area's caves. These caves, which are numerous, were subject to excavations in the early 20th century (Conference on the urbanization of Tlemcen, 1982).

During the French colonial era, there was an emergence of rudimentary housing in the area. Land acquisition for construction in this neighborhood (before 1958) was conducted through two methods. While private lands were sold by word of mouth without written records, municipal lands were informally occupied by three major rural-origin groups. The first group consists of a less fortunate population among the nomads from Ain Sefra, Mecheria, and El-Bayadh. The second group included tribes from regions close to Tlemcen, such as a significant number of the Beni Ouernid who inhabited the plateau south of Tlemcen, the Ouled N'har from the desert gates, and the Béni'Ad. Finally, the third group consisted of a portion of the population that used to nomadize along the western Figuig region (Bekkar, 1996). It should be noted that right after the independence of Algeria, sedentarization of nomadic populations put more pressure on Algerian cities by increasing housing needs. This also profoundly transformed these tribes' organization and the nature of their social life.

3.1.1 Population

According to the statistical services of the Tlemcen municipality, the current population residing in Boudghene has reached 11,997 inhabitants, with an area of approximately 43.06 hectares.

4. METHODOLOGY

The primary objective of this article is to assess the sustainability of the Boudghene neighborhood by carefully developing a set of indicators based on well-defined criteria.

4.1 MEASURING SUSTAINABILITY THROUGH SUSTAINABLE DEVELOPMENT INDICATORS (SDIS)

One of the most common methods for measuring sustainable development is to identify and select a set of indicators for each of the dimensions: economic, environmental, social, and governance. Sustainable Development Indicators (SDIs) should serve to inform decision-makers, the public, and all active forces in society, in a clear and accessible manner, about the state and progress of sustainable development. Furthermore, they can also be used by decision-makers as a tool for decision-making in implementing actions and as communication elements. SDIs should be understandable to all because they are intended for both the public and political decision-makers.

4.1.1 Criteria for Selecting Sustainable Development Indicators

The purpose of these indicators is to provide a concise dashboard that illustrates the situation of the Boudghene neighborhood in terms of sustainable development. This dashboard serves as both an educational tool for understanding sustainable development and a practical tool for guiding local policies. The selection of these indicators was guided by the following approaches. Firstly, we drew inspiration from existing frameworks, particularly the Algeria Voluntary National Review (UNICEF, 2019), which broadly implements measures aligned with the 17 Sustainable Development Goals (SDGs) of the UN's Agenda 2030. Key goals considered include No poverty (SDG 01), good health and well-being (SDG 03), quality education (SDG 04), clean water and sanitation (SDG 06), Access to Reliable Energy Services for All (SDG 07), decent work and economic growth (SDG 08), reduce inequality (SDG 10), sustainable cities and communities (SDG 11), and Peace, justice, and strong institutions (SDG 16).This review also highlights Algeria's intention to develop its own national indicators for sustainable development in the near future. Additionally, Morocco's Sustainable Development Indicators (2014) were a source of inspiration, particularly their focus on themes such as poverty (theme 01), governance (theme 02), health (theme 03), education (theme 04), economic development (theme 12), and consumption and production patterns (theme 14).

To complement these frameworks, a comprehensive search was conducted to gather communal data across four key themes: environment, economy, social, and governance.

From this process, we have selected 23 indicators (Table 1) based on the following criteria: I) Neighborhood scale; II) Availability of data at this scale; III) Relevance to the Agenda 2030; IV) Clarity of the indicator for the widest audience; V) Ease of data collection

and updating.

In this study, a sample of 370 household heads was selected from a population of 1,949 households (comprising 11,997 inhabitants). The sample size calculation was based on rigorous statistical principles, with a 95% confidence level and a margin of error of 4.59%. This statistical precision ensures that the results obtained from this sample reliably reflect the characteristics of the entire population studied.

Data collection was carried out in 2022 using a semi-structured questionnaire designed to gather detailed and relevant information aligned with the study's objectives. These questionnaires were directly distributed to household heads to ensure authentic and contextualized responses. In cases where the household head was unavailable, the questionnaire was administered to the second most significant household member, thereby minimizing non-response bias and ensuring a comprehensive and representative data collection process.

The sampling was conducted using the simple random sampling method, which provides an equal probability for each household head to be included in the sample. This approach is particularly relevant to ensuring the representativeness of the results, as it reduces the risk of selection bias and allows for generalizing conclusions to the entire target population. Finally, graphs were used for the presentation of information.

4.1.2 The Selected Indicators

Table 1 - Selected Sustainable Development Indicators in relation to SDGs and Dimensions of sustainability

Dimensions	Theme	Sub-theme	Selected Indicator
Social,economic and environmental dimension	**Poverty**	Equity (In relation to the SDG 01)	The percentage of the employed population living with an income below or above the minimum wage
		Sanitary conditions (In relation to the SDG 06)	The access rate to sanitation
		Access to clean drinking water (In relation to the SDG 06)	The rate of access to clean drinking water
		Access to energy (In relation to the SDG 07)	The rate of household access to electricity and city gas
Social and environmental dimension	**Health (**In relation to the SDG 03**)**	Healthcare services	Access to primary healthcare services
		Well-being	This is the percentage of the population reporting feeling good to very good.
		Noise pollution (in relation to the SDG 03 and SDG 11)	Area exposed to Lnight > 55dB.
Social dimension	**Education (**In relation to the SDG 04**)**	Educational level	Level of education attained by the community.
Economic dimension	**Economic development (**In relation to the SDG08**)**	Employment	"Employed population" "Unemployed population"
		Information and communication technology (ICT)	The percentage of people with access to internet, mobile, and fixed services."

Economic and environmental dimension	**Consumption and production patterns (**In relation to the SDG 12**)**	Food consumption	Place where residents do their shopping.
		Waste production and management"	Collection, sorting, and recycling of household waste.
Environmental dimension	**Transportation (**In relation to the SDG 11**)**	Mode of transportation	Mode of transportation within the neighborhood
			Mode of transportation outside the neighborhood
	Security (In relation to the SDG 16**)**	Criminality	Crime rate
Social dimension		Feeling safe in the neighborhood	Rate of people who feel safe
	Entertainment	Sports**(**In relation to the SDG 03, 04 and 10**)**	Percentage of participants in sports activities
	Solidarity (In relation to the SDG 11, 10 and 16**)**	Community	The participation rate in neighborhood parties and activities
			The relationship of the resident with their surroundings
Governance	**Citizenship and Democracy (**In relation to the SDG 16**)**	Participation in legislative elections	The percentage of citizen participation in elections.
		Participation in neighborhood committees	The percentage of participation in neighborhood committees
		Reporting remarks to the municipality and staying informed about projects.	The percentage of people who report their comments to the city hall and stay informed about future projects.
		Participation in community life.	The membership rate in associations.

Source: The authors, 2023.

In the following section, we will develop and analyze all the indicators presented in the table above.

5 ASSESSMENT OF THE SUSTAINABILITY OF THE BOUDGHENE NEIGHBORHOOD

To achieve sustainability, the selected indicators must reflect favorable conditions that enable progress toward sustainability.

5.1 HOUSEHOLD CHARACTERISTICS: AGE AND GENDER

Out of the 370 household heads surveyed, 32.43% were women. Regarding age, there are noticeable differences in the distribution of household heads by age. The age of the household head varies from 20 years to over 65 years. The three dominant age groups are 26-30 years and 41-45 years, followed by the age group 21-25 years (Table 2).

Table 2 - Proportion of age groups of the head of the household

Age groups	Total	(%)	Age groups	Total	**(%)**
20–25	52	14.05%	46–50	38	10.27%
26–30	76	20.54%	51–55	29	7.83%
31–35	32	8.64%	56–60	17	4.59%
36–40	43	11.62%	61–65	13	3.51%
41–45	54	14.59%	66 years and older	16	4.32%
			Total	370	100%

Source: The authors, 2023.

This age structure highlights a predominantly young and economically active population, which may have important implications in terms of employment needs and local development strategies.

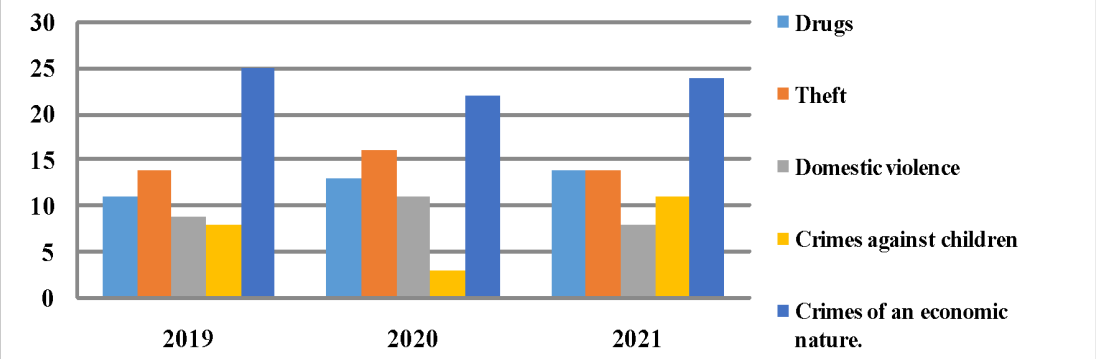
5.2 SUSTAINABILITY ASSESSMENT

5.2.1 Theme: Poverty

5.2.1.1 Subtheme: Equity

This indicator represents the percentage of the employed population living with an income below or above the minimum wage (20000DZD1). It measures social disparities in the neighborhood. The dominant incomes in the surveyed sample range between "20,000 DZD2 and 30,000 DZD" at 42.68%, followed by incomes ranging between "30,000 DZD and 40,000 DZD at 30.03% (Figure 4).

Figure 4 - Percentage of the employed population living with an income below the minimum wage



Source: The authors, 2023.

These results suggest that extreme poverty is relatively limited in the neighborhood, as the majority of the employed population earns more than the minimum wage. However, most incomes remain within modest ranges.

5.2.1.2 Sub-theme: Sanitary Conditions

1 20,000 DZD is equivalent to 150 dollars
2 Algerian Dinars (uniformiser DZD)

The Access to Sanitation Rate expresses the proportion of the population (or households) with access to an adequate sanitation system. This indicator is considered significant for a hygienic environment. Proper disposal of waste is essential to prevent diseases and represents a real threat to both the environment and public health. Based on the sample surveyed, 99.18% of households have access to private toilets, while the remaining households rely on latrines. This indicates that local authorities have made significant efforts to improve the sanitation system in the area.

5.2.1.3 Sub-theme: Access to Drinking Water

Access to clean drinking water is a fundamental element of a country's development and has significant implications for all aspects of sustainable development. This indicator represents the percentage of the population benefiting from a drinking water supply system (public taps, individual connections, improved sources, or others). The lack of access to clean drinking water is a major cause of illness and mortality, and increasing access to it has a positive impact on economic activity. When populations no longer must worry about this essential element for their survival, they can focus on other tasks.

All households surveyed have access to a clean drinking water supply system. However, only 93.24% of them are supplied with water through a direct individual connection. Therefore, there is a need to continue efforts to improve access to clean drinking water.

5.2.1.4 Sub-theme: Access to Energy (Electricity)

This indicator is defined by the rate of households that have access to electricity. The lack of access to energy services contributes to poverty and limits economic development. Out of the 370 household heads surveyed, 97.83% of them have formal access to electricity. The remaining 2.16% obtain it informally. This indicates the success of the national policy in providing access to electricity in the Boudghene neighborhood.

5.2.1.5 Sub-theme: Access to Energy (Gas)

This indicator is defined by the percentage of households with access to city gas.

Among the 370 household heads surveyed, 93.24% have access to city gas, while the rest use cylinder gas. This indicates that there is a need to continue efforts to increase access to city gas and reach 100%. Full access to city gas is an important goal to ensure reliable and sustainable energy for urban households, improve living standards, and support economic development.

5.2.2 Theme: Health

5.2.2.1 Sub-theme: Healthcare Services Provision

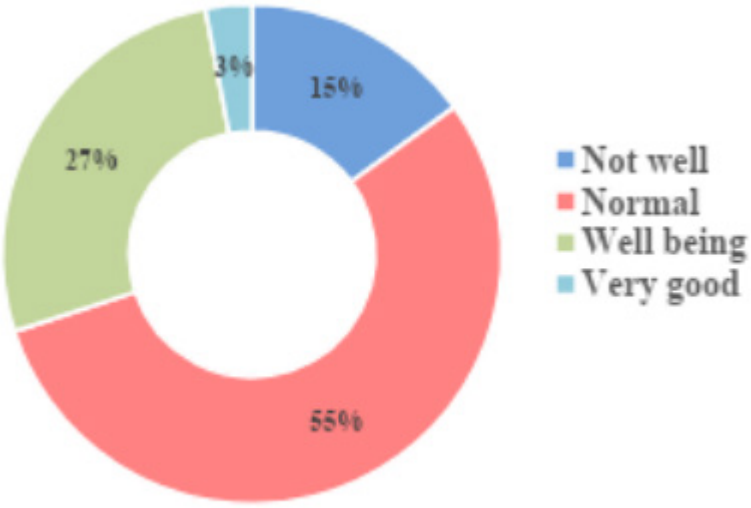
Access to healthcare services, including prevention, treatment, and follow-up, is necessary to achieve sustainable development. There is no disparity between the residents of the Boudghene neighborhood and residents of other neighborhoods in Tlemcen. They have access to healthcare services without discrimination, with the presence of a specialized consultation polyclinic in the neighborhood and a university hospital center nearby.

Equal access to health care is a fundamental principle to ensure the well-being of all residents of a region. This helps ensure that no one is left behind when it comes to medical care and that everyone can benefit from the health services they need, regardless of where they live.

5.2.2.2 Sub-theme: Well-being

This is the percentage of the population reporting their well-being, ranging from "not well" to "very good." The percentage of the population reporting not feeling well represents a minority compared to the rest (Figure 05). This highlights the mindset of the neighborhood's residents, who clearly accept living in Boudghene.

Figure 05 - Percentage of the population reporting feeling good to very good.



Source: The authors, 2023.

This may indicate a strong sense of belonging to the local community and an acceptance of Boudghene as a place to live. The sense of well-being could also reflect their ability to create a viable and stable environment.

5.2.2.3 Sub-theme: Noise Pollution

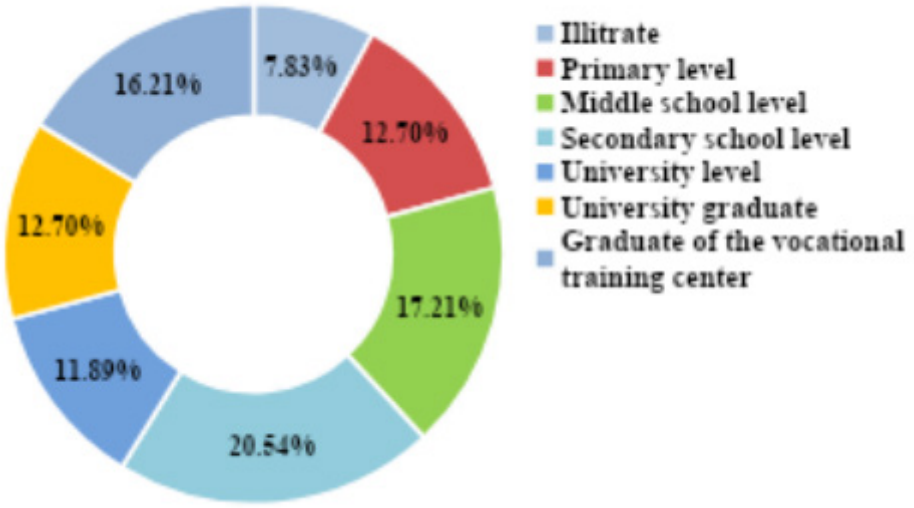
Considering that the Boudghene neighborhood is pedestrian, noise caused by vehicles is not significant. Indeed, only 22% of the neighborhood's area is exposed to noise levels exceeding 55 decibels during the night, and this typically occurs in the early evening. The rest of the district remains quite quiet (It is important to note that 55 dB is associated with relatively quiet environments). The nighttime tranquility is a comfort factor and a real asset for the physical and mental health of the residents, contributing to a better quality of life daily.

5.2.3 Theme: Education

5.2.3.1 Sub-theme: Level of education

Out of the 370 people surveyed, the most significant percentage is observed among individuals with a secondary level of education, accounting for 20.54%. They are followed by those with a middle-level of education at 17.26% and graduates from vocational training centers at 16.21% (Figure 6).

Figure 6 - The education level of the inhabitants



Source: The authors, 2023.

However, even though the rate of illiteracy is the lowest, it is imperative to intensify efforts in literacy education. However, although Algeria has achieved significant development in the education sector, by increasing literacy and schooling, it is important to note that the illiteracy rate persists, even though it is the weakest among the mentioned groups.

Literacy is fundamental to individual autonomy and participation in society, and it is essential to intensify efforts to reduce this even lower rate. This could include adult literacy programs, community initiatives and awareness campaigns to encourage those who cannot

read and write to acquire these foundational skills.

5.2.4 Theme: Economic Development

5.2.4.1 Sub-theme: Employment

This indicator includes all individuals engaged in paid employment (This survey is conducted without considering unemployment benefits). A maximum employment rate is essential for the harmonious development of society, as a low employment rate can have serious repercussions: delinquency, insecurity, reduced consumption, etc. The rate of employed population for the surveyed sample is 68.10%, with a corresponding unemployment rate of 22.97%. The rates of retirees, those who receive their husbands' pensions, drug dealers, and Moujahideen (the fighters of the Algerian War against French colonialism) are respectively as follows: 5.40%, 1.08%, 1.89%, and 0.54%.

The employed population rate of 68.10% in the sample survey indicates that most people in this sample are currently employed or have a professional occupation. This can be seen as a positive sign of economic activity in the region or among the population surveyed. However, it is important to note that the unemployment rate of 22.97% is significant. Unemployment can have important economic and social implications, including financial difficulties for unemployed individuals, reduced economic productivity and broader social challenges.

5.2.4.2 Sub-theme: Information and Communication Technology

Information and communication technologies are important components of sustainable development in all its dimensions. They are a means to achieve better individual performance by facilitating access to knowledge and are also linked to the economic development of society.

Fixed Telephone

This indicator provides the percentage of people with access to landline telephone services compared to the entire population surveyed. The landline telephony penetration rate for the surveyed sample is 43.24%. This rate may still decrease as people tend to use mobile phones more frequently.

It is common to find that fixed telephony is losing ground to mobile telephony, as mobile phones offer many advantages, such as the ability to stay connected on the go, advanced features, instant messaging, and more. However, it is important to note that the availability of a fixed telephone line may still be essential in certain situations, such as for businesses, emergency services, or in regions where mobile coverage is limited.

Fixed Internet

This indicator provides the percentage of people with access to internet services at home compared to the entire population surveyed. The internet penetration rate is 44.59%. This rate follows landline telephony penetration, except for 4G modems and fiber optics.

This suggests that wireless communication technologies, such as 4G, and broadband connections, such as fiber optics, are gaining popularity faster than traditional fixed-line telephony. This is a trend in many parts of the world, as these technologies offer faster connection speeds and greater flexibility. To further promote Internet connectivity, governments and telecommunications service providers can continue to invest in expanding network infrastructure, particularly in rural or underserved areas.

Mobile Phone

This indicator provides the percentage of people with access to mobile services compared to the entire population surveyed. In our study, 93.78% of the surveyed heads of households own a mobile phone. The remaining 6.22% are elderly people.

Older people may be less likely to use mobile phones for various reasons, including lack of familiarity with technology, preference for landlines, or limited communication needs. In summary, a mobile phone ownership rate of 93.78% among heads of household indicates

strong mobile connectivity within this population, which can have a positive impact on communication, access to information and participation in the digital society.

Internet on Mobile

This indicator provides the percentage of people with access to internet services on mobile devices compared to the entire population surveyed. In our case study, most people who own a mobile phone have access to mobile internet services. Out of the 93.78%, 66.48% have internet access.

Mobile Internet access has become increasingly widespread worldwide due to the growth of 4G and 5G networks, as well as the availability of increasingly affordable mobile devices. Mobile Internet access offers many possibilities, including web browsing, application access, online communication and many other services.

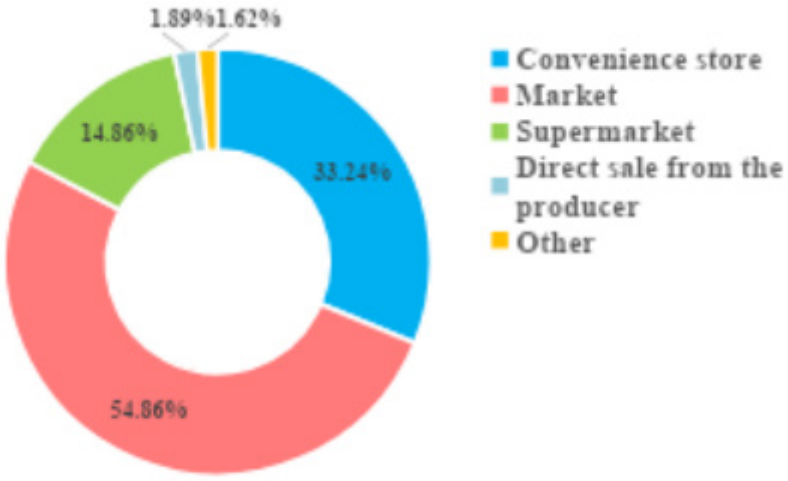
The penetration rates of mobile, landline, and internet services are linked to the economic development of society. Therefore, it is necessary to intensify efforts in this field.

5.2.5 Theme: Consumption and Production Patterns

5.2.5.1 Sub-theme: Food Consumption

This indicator corresponds to the places where residents of the neighborhood do their grocery shopping. More than 54% of the surveyed residents do their shopping at the market, followed by 33.24% (Figure 7) who do it at nearby stores, indicating a degree of self-sufficiency in terms of food consumption.

Figure 7 - Shopping Locations



Source: The authors, 2023.

Purchases at the market can be associated with the purchase of fresh, local and often seasonal products, which can be beneficial from a nutritional and economic point of view. In addition, convenience stores can offer a convenient option for buying everyday essentials.

5.2.5.2 Sub-theme: Waste Management

Waste Sorting and Recycling

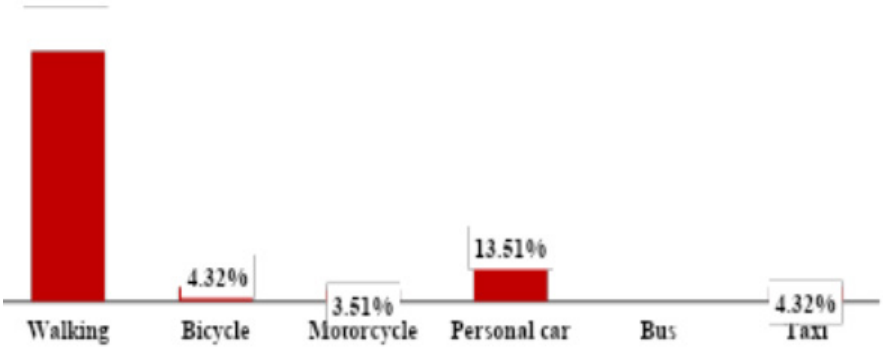
Waste sorting and recycling is everyone's concern. They contribute to saving natural resources, preventing waste, and limiting pollution. Like most Algerian residents, the surveyed heads of households are not very interested in waste sorting and recycling, with only 25.94% of households sorting, and 23.51% recycling their household waste. However, it is also understandable that waste sorting and recycling is not widely practiced by the population, as this may require specific awareness, education and infrastructure. Nevertheless, there are currently no issues with waste collection since the municipality has made significant efforts in this regard.

5.2.6 Theme: Transportation

Sub-theme: Mode of Transportation

This indicator represents the percentage of public transportation users compared to other means of transportation (knowing that respondents were allowed to choose multiple modes of transport in their responses). The neighborhood of Boudghene is compact, which explains why walking is the primary mode of travel within the neighborhood, with a percentage representing slightly more than 75% (Figure 8).

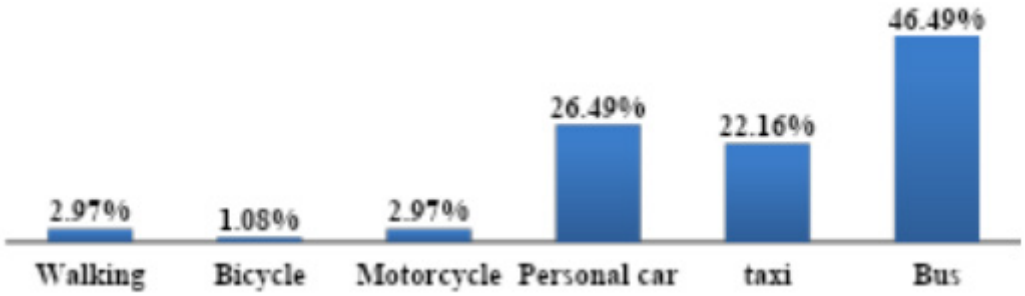
Figure 8 - Mode of transport within the neighborhood



Source: The authors, 2023.

This compactness, combined with a certain degree of self-sufficiency in food consumption, reduces the need for frequent trips outside the neighborhood. Local access to markets, shops, and small-scale food production enables residents to meet their daily needs conveniently on foot, which offers significant environmental benefits (reduction of air pollution, health promotion, improvement of neighborhood friendliness, etc.). However, for activities or needs requiring travel outside the neighborhood, the modes of transport vary between public transportation and private vehicles, with public transportation being the dominant choice at 67% (Figure 9).

Figure 9 - Mode of transport outside the neighborhood



Source: The authors, 2023.

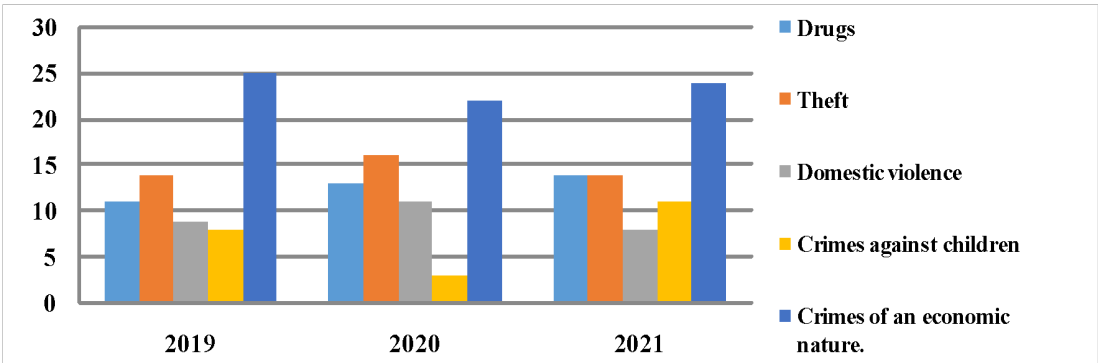
Public transit is more environmentally efficient than a personal car, as it allows multiple passengers to share a single vehicle, thereby reducing the number of vehicles on the road. In summary, the combination of walking enabled by a compact and self-sufficient neighborhood and the use of public transportation for external trips contributes to more sustainable mobility and a reduced environmental impact.

5.2.7 Theme: Security

Sub-theme: Crime rate and the feeling of security in the neighborhood

Reducing the risks associated with crime is a goal that contributes to sustainable development. The crime rate in Boudghene has fluctuated during the last years, with an increase in drug consumption and trafficking and instability in other areas of crime (Figure 10).

Figure 10 - Crime Rate



Source: Information by the police station, graph made by the authors, 2023.

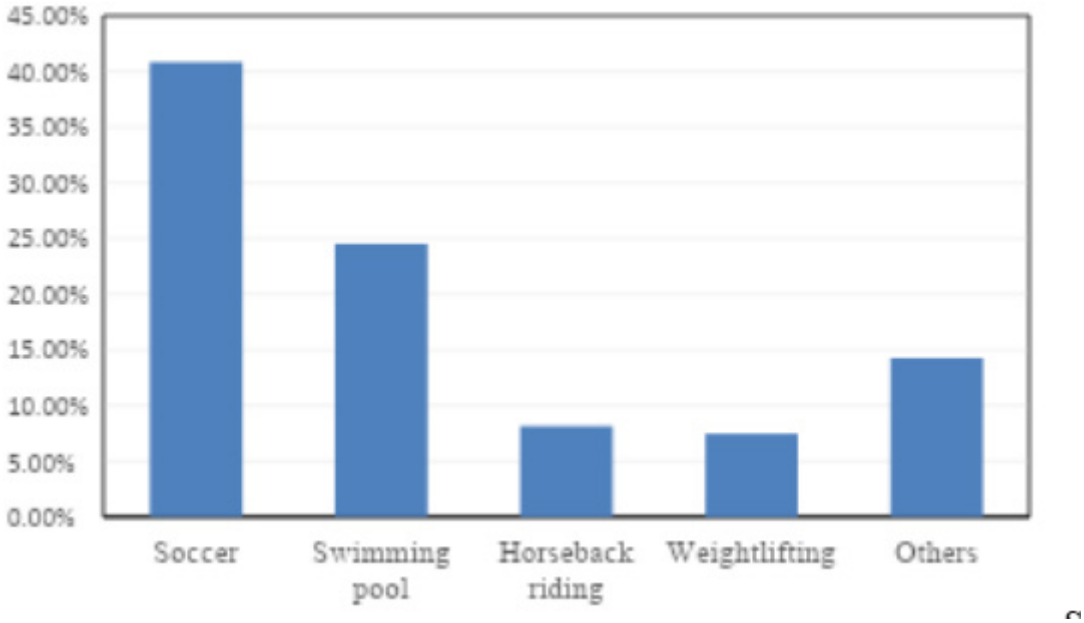
However, contrary to popular belief, 86% of the surveyed heads of households feel safe in Boudghène. Public safety is a pillar of sustainable development. When residents feel safe in their neighbourhood, they are more likely to invest in their community, actively participate in social life and support local development initiatives. While most residents feel safe, it is important to continue to monitor and address crime issues, including drug use and sale.

5.2.8 Theme: Entertainment

Sub-theme: Participation in sports activities

The participation of residents in sports activities allows everyone to live a healthy life and promote the well-being of all at any age. This indicator determines the rate of participation in sports activities, which corresponds in our case study to 39.72%, with football being the most popular sport (Figure 11).

Figure 11 - Type of Sports Activity



Source: The authors, 2023.

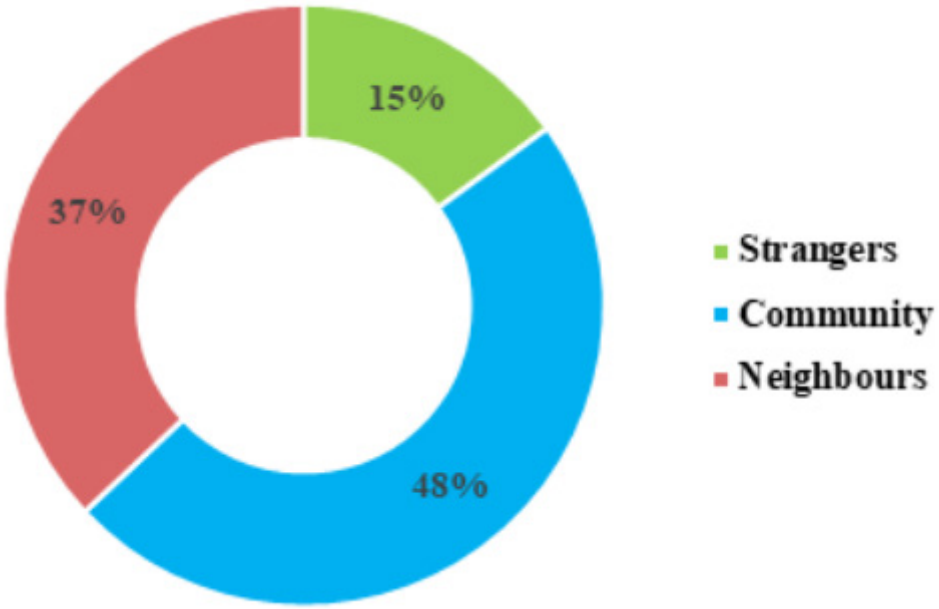
Although the participation rate remains relatively moderate, the strong interest of the population in sports provides a promising foundation for strengthening engagement through targeted campaigns and improved access to facilities, thereby promoting a more active and healthier lifestyle.

5.2.9 Theme: Solidarity

Sub-theme: Community

This indicator determines the participation rate in neighborhood parties and activities and the relationship of residents with their neighbors. Approximately 63.24% of the heads of households participate in neighborhood parties and activities, demonstrating the involvement of residents in communal life. Social interaction is important in the Boudghène neighborhood. The existing social aspect is reflected in the mutual support and solidarity of citizens. Hence, the high percentage of individuals who feel like one big family (Figure 12).

Figure 12 - The relationship of the inhabitants with their surroundings



Source: The authors, 2023.

Mutual aid and solidarity between citizens are important values that strengthen the social fabric and help create a positive environment. The fact that many residents feel like one family is an encouraging sign of unity and friendliness within the community.

5.2.10 Theme: Citizenship and Democracy

This indicator is important for sustainable development as it provides information about the level of citizen participation in society. It is an essential element of good governance. It allows us to assess their involvement in major collective debates and reflects their trust in institutions. Good governance is fundamental for achieving sustainable development goals, as it ensures effective, equitable, and inclusive management necessary to address global challenges while meeting local needs.

To evaluate Citizenship and Democracy, four sub-themes have been chosen, represented as follows: i) Sub-theme: Participation in municipal elections3; II) Sub-theme:

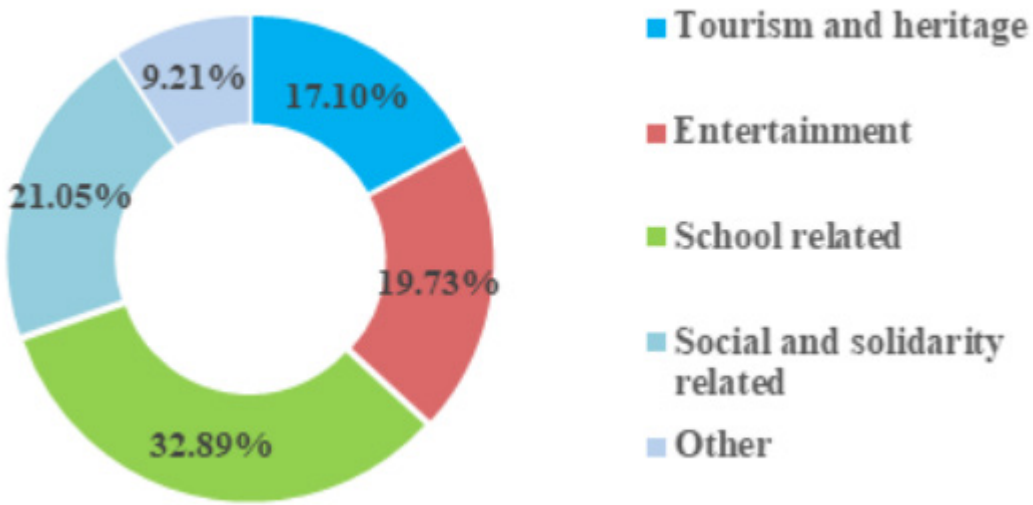
3 Voting in Algeria is not mandatory. Algerian citizens have the right to vote, but there is no law requiring them to participate in elections.

Participation in neighborhood committees; III) Sub-theme: Reporting comments to the city hall and staying informed about projects; IV) Sub-theme: Participation in community life.

More than half of the respondents participate in municipal elections, and 18.37% of them participate in neighborhood committees, demonstrating citizens' involvement in public life and their interest in improving their neighborhood. Additionally, 41.35% of household heads report their concerns to the municipality regarding issues in the neighborhood, while only 21.89% of them stay informed about future projects that should be improved and 20.54% participate in community life.

Regarding the fourth theme, this indicator reflects the existence or absence of a strong civil society and is an element of assessing residents' involvement. In our case study, 20.54% of household heads are members of an association. We also observe that the membership rate in school associations is the highest, with a percentage of 32.89% (Figure 13).

Figure 13 - Type of associations



Source: The authors, 2023.

This suggests that while overall engagement remains limited, certain types of associations, particularly those linked to education, play a more prominent role in community life.

5.3 ANALYSIS OF THE URBAN FABRIC

The neighborhood of Boudghene has undergone various urban and architectural changes and developments, leading to its current state of typological and morphological homogeneity. The housing in this neighborhood reflects the implementation of sophisticated techniques compared to other spontaneous neighborhoods.

Land occupation has occurred through a gradual filling process by adding rooms and floors as the number of occupants increased. Land shares or transfers, land use, the layout of streets and alleys, dead ends, and parcel distribution exhibit several regularities that could suggest the existence of stable rules or principles (Bekkar, 1995).

In the neighborhood of Boudghene, most houses are built with durable materials. The older houses are constructed using masonry, while the more recent ones or extensions/ renovations are made of reinforced concrete with a column/beam system and semi-industrial flooring (using beams and fillers).

Finally, unlike houses in hard-to-reach areas (Figure 14), the quality of construction in houses located on main (Figure 15) or secondary roads (Figure 16), providing vehicle access, has improved over time, allowing them to meet the standards of private residential production.

Figure 14: Dwellings located in a hard-to-reach area

Figure 15: Dwelling located on a main road

Figure 16: Dwelling located on a secondary road

Source: The authors, 2023.

These developments reflect a gradual transformation towards a more structured urbanization, where accessibility and available resources strongly influence the quality of construction and the spatial organization of the neighborhood.

6 CONCLUSION

This article has highlighted that the neighborhood of Boudghene carries both problems and solutions in equal measure. The recognized qualities of this neighborhood align with the three pillars of sustainable development. Due to its location, it maintains strong interactions with the planned urban fabric, including economic complementarity. The quality of the buildings has improved over time in the main thoroughfares of the neighborhood, matching the standards of private residential production in the market. It is compact, pedestrian-accessible, and dense, thereby reducing noise and air pollution and offering pedestrian safety, especially for children.

From a social and economic perspective, attention is drawn to its functional diversity, economic efficiency with proximity to workplaces for residents, and its role as an important zone for production and employment (commerce, craftsmanship, services). It depends on the participation of its community in development. However, other aspects of sustainability are lacking and should be introduced, such as access to nature, which is nonexistent. Housing quality must also be improved, especially in the interior areas of the neighborhood. Security should also be enhanced, particularly in areas exploited by criminals. The government should continue its efforts to provide access to water, electricity, and natural gas, as well as to regularize the land tenure status of homes.

In general, it can be said that the way in which residents have developed is "smart," but their settlements need a more comprehensive approach to ensure satisfaction of needs—housing and services—in a more environmentally friendly scheme. This should be the foundation of modernization or redevelopment projects. Redevelopment projects have shown how important it is to maintain high densities, the possibility of walking, functional diversity, mixed housing, and integration with the surrounding area. Access to clean water, sanitation, security, and sustainable housing should not divert projects from paying attention to other aspects of sustainability. Finally, planned new neighborhoods should not ignore the lessons learned from spontaneous neighborhoods.

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