International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 12 No. 2, 2026
https://theaspd.com/index.php

Towards A Synergy Between Physical Comfort And Social Well-Being In Arid Climate Housing: A Case Study Of Béchar, Algeria

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Abstract
Housing in arid environments presents a persistent design challenge, where thermal stress, solar radiation, and dry conditions directly affect indoor comfort and occupant well-being. This study investigates housing quality in Béchar, a hot arid city in southwestern Algeria, through the lens of architectural typology and its relationship to indoor environmental conditions. A post-occupancy evaluation (POE) methodology was employed, combining physical environmental observations with structured questionnaires administered to building occupants. Comfort perception was assessed across key environmental dimensions — thermal comfort, humidity, air quality, acoustic conditions, and natural lighting and ventilation — using a seven-point satisfaction scale. Findings reveal that architectural typology and spatial configuration are determining factors in shaping occupant comfort: building form, façade orientation, and exposure to prevailing winds and solar angles produce measurable differences in indoor environmental quality across housing types. Compact, inward-oriented configurations with adequate shading tend to perform more favorably than outward-facing typologies with high solar exposure. These results offer empirical grounding for climate-responsive design principles in hot, dry contexts, demonstrating that passive architectural strategies remain highly relevant in contemporary housing production. The study further highlights a gap between current construction practices and climate-adapted design, reinforcing the need for an integrated approach that addresses both physical performance and social comfort simultaneously. These insights are intended to inform housing policy, architectural practice, and urban planning in arid regions facing intensifying climatic pressures.
Keywords: *post-occupancy evaluation; arid climate; housing typology; environmental factors; quality; thermal comfort;*

1. INTRODUCTION

Housing is a fundamental human need and a pillar of social stability. Beyond its primary function of providing shelter, it shapes a living environment that directly influences people's well-being, health and general equilibrium. In Algerian Saharan cities, and more specifically in Béchar, rapid urbanisation has led to massive housing construction [1].

However, this quantitative expansion has often come at the expense of addressing the actual needs of residents [1], particularly requirements for energy sustainability, thermal comfort and the integration of local architectural traditions. In this context, housing in arid environments is particularly vulnerable, as it is heavily exposed to extreme climatic conditions (intense heat, wide temperature variations, scarcity of resources), making it essential to adapt it to the environmental context in order to ensure habitability and sustainability.

The aim is to identify shortcomings in urban planning in order to develop strategies for improving quality of life whilst respecting architectural heritage. In this context, Post-Occupancy Evaluation (POE) is an essential methodological tool for measuring the actual performance of buildings once they have been taken into use [2].

This situation calls for a critical analysis of housing's ability to reconcile functional requirements, environmental constraints and the aesthetic characteristics specific to the Saharan region.

The POE is a systematic process for evaluating buildings once they are occupied, covering energy efficiency, comfort and user satisfaction. By comparing actual usage with the original design intentions, it enables:

- Identification of performance gaps.
- Optimise operating and maintenance costs.
- Improve occupant comfort and satisfaction.
- Prevent the repetition of errors in future projects.

2. LITERATURE REVIEW

Developed by the RIBA in the 1960s, the POE was initially designed to measure the environmental, functional and economic performance of buildings. Post-Occupancy Evaluation (POE) has established itself as a fundamental tool for measuring the actual performance of buildings after they have been taken into use. Historically, this methodology was formalised by the Royal Institute of British Architects [3] to compare on-site results with the designers' original intentions. More than a simple audit, POE constitutes a systematic approach aimed at assessing the environmental, functional and economic quality of occupied buildings.

As highlighted in the seminal work of Preiser [4] and the research by Leaman and Bordass [5] this tool acts as a structuring feedback mechanism. It not only enables the identification of recurring shortcomings but also fuels a virtuous cycle of continuous improvement for future projects. In this regard, the National Audit Office (2017) recommends its systematic adoption in public procurement to ensure the sustainability and cost-effectiveness of property investments.

The assessment is based on a dual interpretation of performance, combining technical aspects and human use:

- Technical performance: This encompasses critical indicators such as energy efficiency, thermal comfort, acoustics, indoor air quality, and fire safety [6].
- Functional performance: This focuses on spatial organization, the ergonomics of equipment, and accessibility, while incorporating the human factors that dictate daily use [7].

From a methodological perspective, POE is structured around three key areas: the data collection protocol (implementation), rigorous examination of systems (evaluation process) and normative comparison, which allows the building to be assessed against standards or comparable examples.

2.1. Operational Evidence And Observed Benefits

Technical literature and feedback from experience confirm the effectiveness of this approach through concrete results:

- Education sector: Studies conducted by Architype (2020) on six schools in Wolverhampton revealed a significant reduction in energy consumption, coupled with improved comfort for pupils and teachers.
- Tertiary sector: A POE carried out on the offices of the AHMM agency in Clerkenwell (Royal Institute of British Architects [8] demonstrated that a targeted refurbishment could reduce energy consumption by 69% per workstation.
- Residential sector: Between 2018 and 2020, assessments of Passivhaus-certified projects enabled ventilation and heating systems to be adjusted to optimise residents' actual thermal comfort.

2.2. Strategic Objectives And Environmental Challenges

Against a backdrop of the climate emergency and the drive towards carbon neutrality, the POE serves as a tool for quality assurance. In particular, it enables:

- Performance gap analysis: Reducing the discrepancy between theoretical thermal simulations and actual energy consumption.
- Economic optimisation: Reducing operating costs and preventing budget overruns on future projects.
- User satisfaction: Placing well-being at the heart of design, particularly through Indoor Environmental Quality (IEQ). Natural lighting and air quality are the cornerstones of occupant health. In the United States, this compliance assessment is often based on standards such as Energy and Environmental Design (LEED) certification system, using rigorous checklists (water consumption, natural light, acoustics) to validate the achievement of certification credits [9].
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3. METHODOLOGY

The POE incorporates a key sociological dimension through the collection of subjective data. As part of the study presented here, a questionnaire was administered to a sample of 354 residents of the city of Béchar to analyse housing conditions across various segments. The POE does not merely validate the technique; it reconciles architecture with its occupants, ensuring that the built environment remains efficient, sustainable and genuinely suited to human needs[10].

3.1. Study Context: The City Of Béchar

Béchar, located in south-western Algeria (see Figure 1), is experiencing sustained growth, leading to a proliferation of collective and individual housing schemes. However, there is evidence of a decline in the resilience of contemporary buildings, which is having a negative impact on ecosystems and the built environment [11].

Figure 1. Location of the town of Bechar. Source: authors, 2025

The arid climate (see Figure 2) of the region necessitates specific architectural solutions to mitigate climatic constraints and reduce energy consumption [12, 13]. This study draws on a social survey to understand the problems experienced by residents.

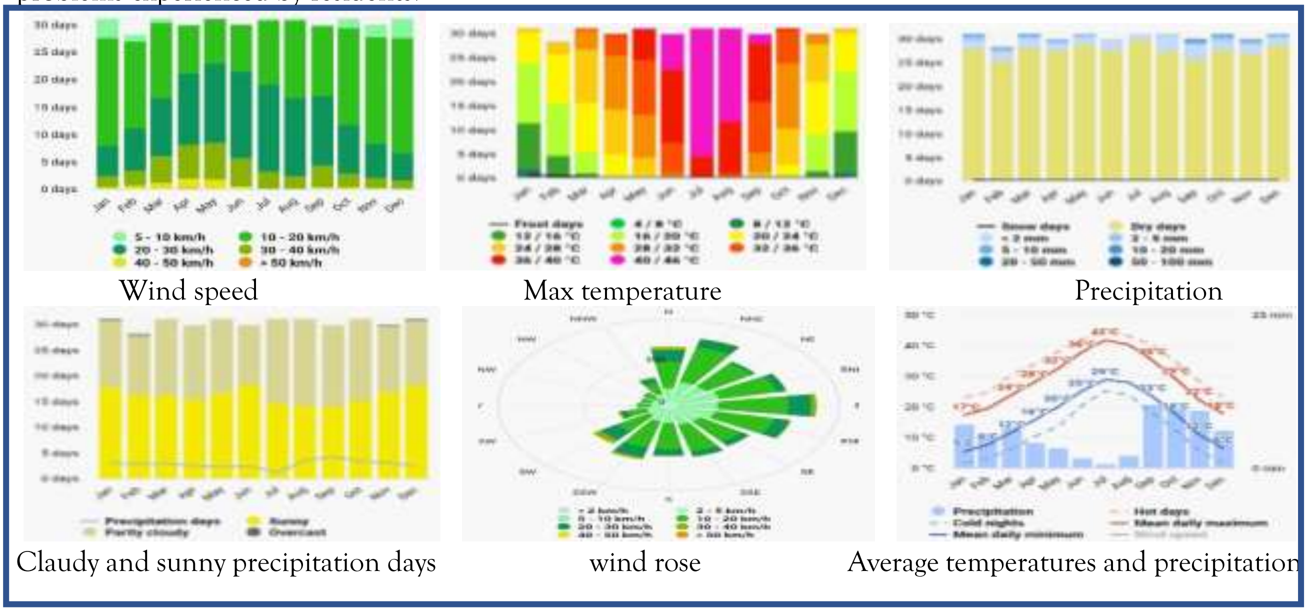

Figure 2. Climate data for the city of Bechar Source: Météo Béchar – meteoblue, 2019

4. RESULT AND DISCUSSION

The use of a questionnaire is a fundamental methodological approach for accurately understanding living conditions within the housing complex as well as the daily practices of its residents. In order to ensure the scientific validity of this study's conclusions, it is essential to rely on a sample whose size and diversity guarantee optimal representativeness. With this in mind, the present survey, administered via a digital platform, has enabled the creation of a robust database thanks to the responses of 354 citizens residing in the city of Béchar.

4.1. Typology Of The Data Collected

4.1.1. Demographic And Socio-Occupational Profile Of Respondents

This first part of the analysis focuses on identifying the participants' individual characteristics, including factors such as age group, gender and occupational category. By cross-referencing these indicators, we can map out the different occupant profiles. The aim here is to assess the influence of these characteristics on the level of satisfaction felt, whilst incorporating a comparative analysis based on housing tenure status, whether owners or tenants.

4.1.2. Architectural Parameters And Building Characteristics

The issues raised in this chapter focus on the physical and technical configuration of the building. The data collected relates in particular to the building's construction period, its floor area, and its layout, defined by the number of exposed façades and the distribution of the rooms comprising the dwelling.Key indicators include:

- The age of the building;;
- The building's volume (floor area and number of rooms);
- Exposure (number of facades), a determining factor for climatic influences.

4.1.3. Physical Performance And Environmental Comfort

a. Indoor air quality and air renewal systems

This section of the study focuses in particular on methods of air regulation, whether these rely on natural ventilation, mechanical systems or the frequent use of air conditioning. The analysis also incorporates indicators of environmental comfort such as humidity levels, the perception of odour nuisance and, more generally, residents' assessment of the healthiness of the indoor atmosphere

This study analyses the thermal performance of the dwelling. It takes into account::

- Ventilation methods (natural, mechanical or hybrid);
- The use of air-conditioning systems;
- Sensory comfort relating to humidity, odours and air freshness.

b. Characterisation of lighting conditions

The assessment of the visual environment is based here on the subjective perception of occupants within their living space. This evaluation encompasses both the quality of natural light penetration during the day and the suitability of artificial lighting systems, in order to determine whether the built environment meets the occupants' requirements for visual comfort.

4.2. Interpretation Of Results: Analysis Of Occupants' Perceptions And Housing Typology

Once the examination of the building's physical properties and thermal comfort parameters has been completed, the research turns its attention to the subjective dimension of users' experiences. The aim of this approach is to compare these qualitative accounts with the technical and objective indicators previously established, in order to identify and quantify any significant correlations between the built environment and perceived well-being.

4.2.1. Breakdown Of The Sample By Housing Type

The study is based on a dataset comprising 354 participants (who responded online). Analysis of residential structure reveals a marked predominance of apartment-style housing, which comes in several configurations (see Figure 3):

Terraced flats: This category represents the largest share with 234 individuals (66%). Within this group, two distinct situations can be identified:

- Flat in a semi-detached property: This category represents the largest share, with 234 individuals (66%). Within this group, there are two distinct situations: on the one hand, 131 people who live in a flat within the family home alongside their parents; and on the other hand, 103 respondents whose flat is located in a detached house.
- Collective and semi-collective housing: This segment comprises 100 participants (28%) of the total sample. The internal breakdown shows that 72 residents live in multi-storey blocks comprising at least two floors, whilst 28 people are housed in single-storey structures, akin to semi-collective housing.
- Detached houses: Finally, a minority of the sample, namely 20 participants (6%), live in detached houses.

These demographic data clearly highlight that the vast majority of the population surveyed lives in an apartment-style setting, whether within a family home or in a block of flats.

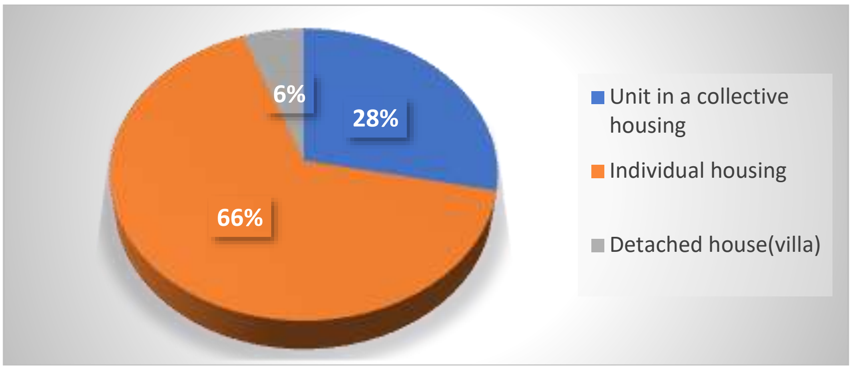

Figure 3. Distribution of housing types. Source: authors, 2025

4.2.2. Analysis Of The Age Of The Building And Its Insulation Performance

An analysis of the age of the buildings reveals significant differences depending on the type of housing. The data show that the oldest dwellings are flats within family homes, which have an average age of 18 years. In contrast, the most recent buildings are found in the block of flats sector, where the average age does not exceed 10 years. Between these two chronological extremes, terraced flats occupy an intermediate position with an average age of 14 years (see Figure 4).

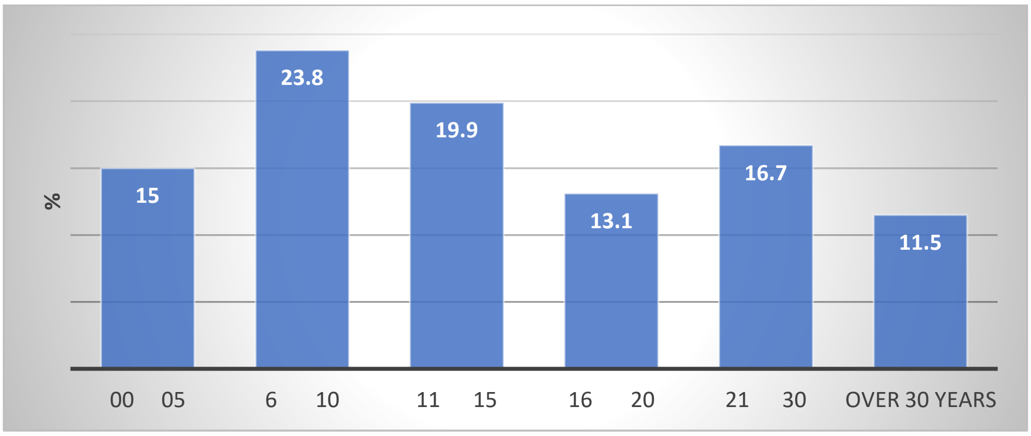

Figure 4. Distribution of housing types. Source: authors, 2025

By correlating these structural and temporal characteristics, the study highlights that detached houses stand out clearly from the rest of the sample. They show the most convincing results in terms of energy efficiency, with an insulation performance rate of 62%.

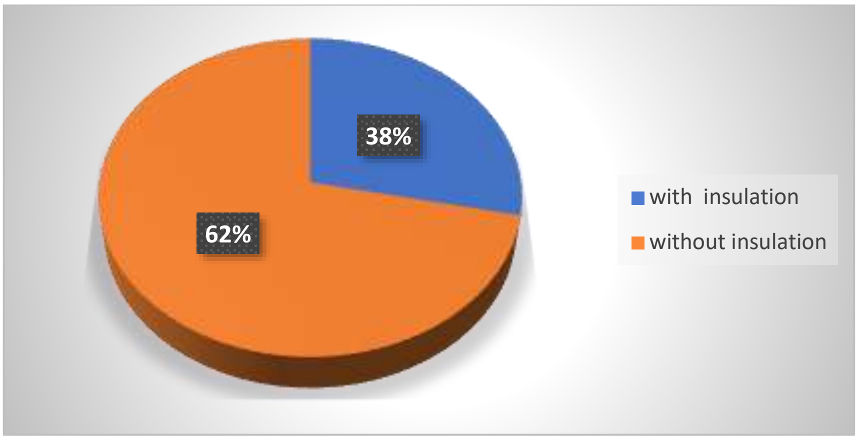

Figure 5. Insulation housing. Source: authors, 2025

4.2.3. Housing Tenure And Residential Market Dynamics

An analysis of the relationship between housing type and tenure reveals significant contrasts. On the one hand, it is evident that home ownership is the predominant tenure among residents of detached houses, accounting for over 67% of this category. Conversely, the opposite trend characterises the stock of residential blocks, where renting is the predominant tenure. This predominance of renting within multi-occupancy housing reflects, to some extent, a form of housing insecurity or, at the very least, the temporary and transitional nature of households' settlement in these structures.

At the same time, it should be noted that the growing pressure of housing demand observed in recent years has acted as a driver of urban transformation. This phenomenon has stimulated the rise and proliferation of new architectural solutions, leading to a notable diversification of the types of housing available on the market (see Figure 6).

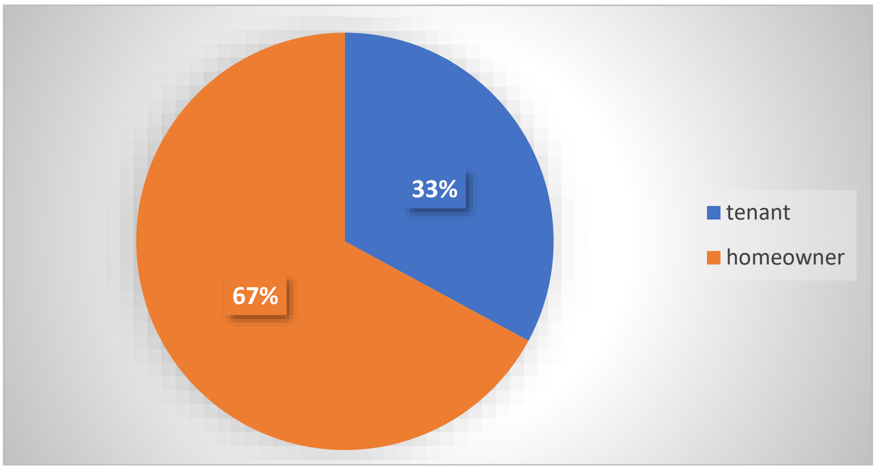

Figure 6. Type of housing tenure. Source: authors, 2025.

4.2.4. Analysis Of Living Space By Housing Type
An examination of the spatial dimensions of dwellings reveals a clear hierarchy based on architectural form. Detached houses stand out as the largest units in the sample, with a living area exceeding 300 m². Terraced houses, meanwhile, occupy an intermediate segment, with floor areas ranging from 101 to 300 m².
At the other end of the spectrum, flats in multi-storey buildings are the smallest units, with an average floor area of less than 100 m². It is worth noting that these compact housing types account for only 36% of the total housing stock covered by this study, thus highlighting a heterogeneous spatial distribution within the urban fabric analysed (see Figure 7).

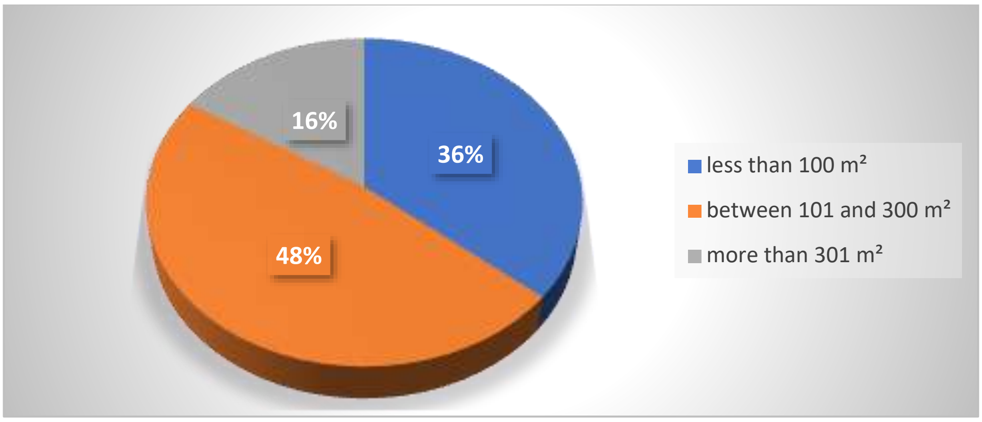

Figure 7. Housing size. Source: authors, 2025.

4.2.5. Design Of Facades And User Perception
Given the prevalence of flats as the dominant form of housing, a large proportion of residents report having only a single main façade. This structural reality is reflected statistically in the 45% of dwellings recorded in the survey (see Figure 8).
However, it is essential to qualify this data: respondents generally tend to consider only the main façade as a constituent element of their living environment. They thus tend to omit other external walls, particularly when these are dedicated to utilitarian or economic functions, such as commercial premises or garages, where domestic use is virtually non-existent. This distinction between the 'experienced' façade and the 'functional' façade was explicitly corroborated by the comments of several participants during the survey.

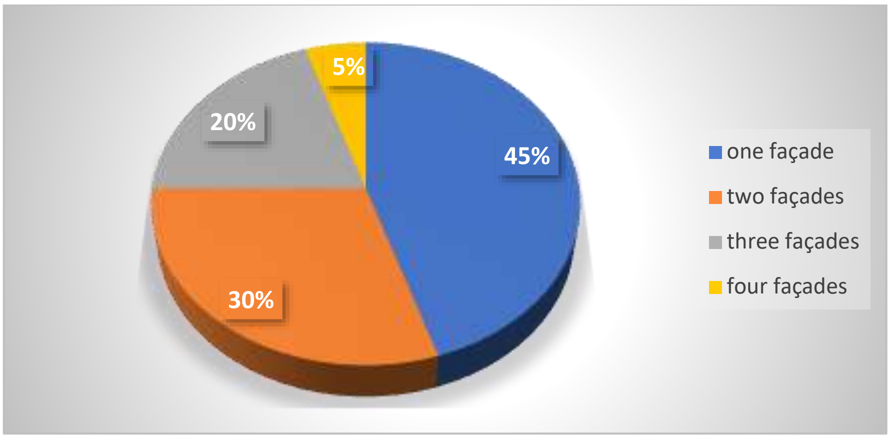

Figure 8. Number of main façades per dwelling according to the survey. Source: authors, 2025.

4.2.6. Mobility and Access to Services
An analysis of daily journeys reveals a spatial disconnect between where people live and where they work: the majority of respondents live a considerable distance from their place of work. Conversely, there is a positive correlation regarding access to amenities, with residents generally living in close proximity to shopping centres and local services (see Figure 9).
This urban configuration, characterised by a distance from employment areas, creates a structural dependence on motorised transport. Consequently, the intensive use of private cars or reliance on transport networks becomes a systematic necessity for users, regardless of their housing type (multi-occupancy, terraced or detached).

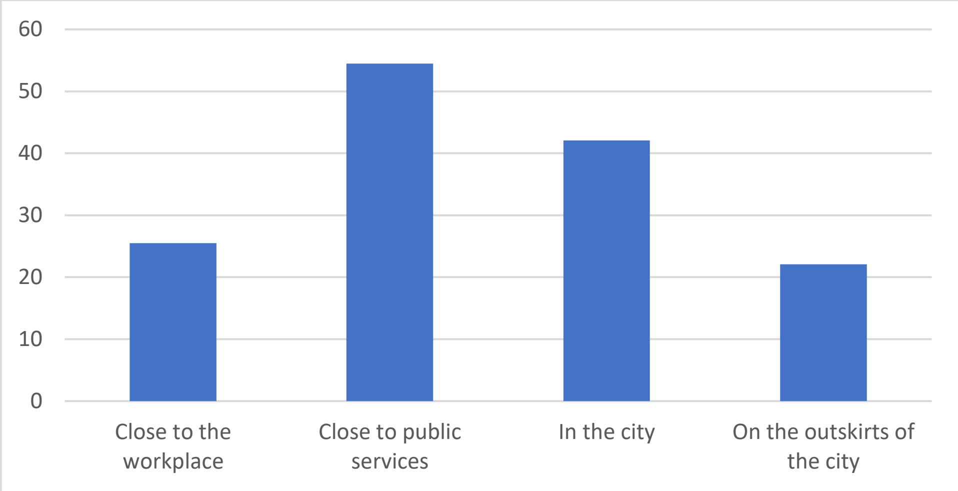

Figure 9. Distance between dwellings, workplaces, and urban services according to the survey. Source: authors, 2025.

In summary, the analysis of physical performance highlights significant differences depending on the type of property:

- Detached houses and villas: These offer the best performance thanks to their spatial flexibility, better insulation (62% for villas) and a floor area often exceeding 300 m².
- Multi-occupancy dwellings: These are the most compact (often < 100 m²) and have the lowest satisfaction levels. They suffer from limited exposure (a single main façade in 45% of cases).

4.3 Occupant Satisfaction Survey

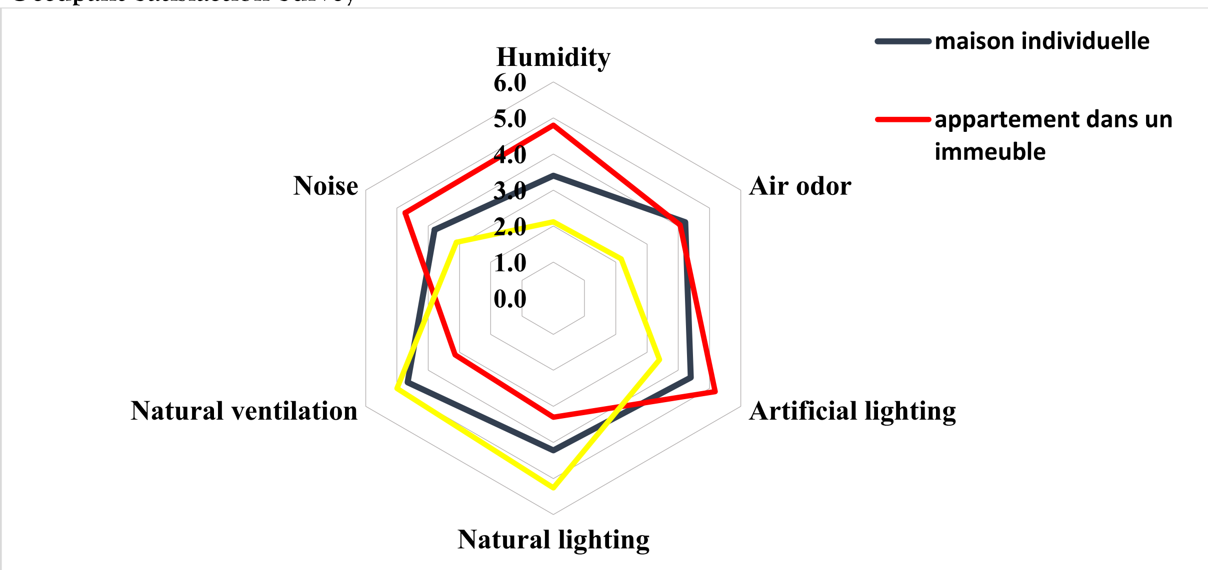

Figure 10. Occupant Satisfaction Level. Source: authors, 2025.

4.3.1 *A Comparative Analysis Of Indoor Comfort Across Different Housing Types*

The radar chart (Figure 10) allows us to visualise and compare average satisfaction levels, measured on a scale of 1 (total dissatisfaction) to 7 (complete satisfaction), regarding the physical factors that determine indoor comfort: humidity, air quality, acoustics, natural ventilation, as well as artificial and natural lighting. This comparative study focuses on three distinct residential models within the city of Béchar: the detached house, the flat in a block of flats, and the villa.

a- The precarious nature of living standards in multi-occupancy housing (flats)

An analysis of the data identifies flats in apartment blocks as the most problematic housing type in terms of overall comfort. The lowest satisfaction scores relate to noise and humidity, revealing a marked vulnerability to noise pollution and inadequate temperature and humidity control. This lack of comfort is exacerbated by underperforming natural ventilation, which forces occupants into an almost systematic reliance on mechanical air conditioning. Furthermore, the mixed scores regarding odours suggest inefficient air exchange, particularly in areas characterised by high building density or proximity to industrial activities.

b- The intermediate profile of a detached house

Detached houses are characterised by a more stable balance of various comfort factors. They outperform multi-occupancy housing in terms of ventilation and natural lighting, benefiting from greater architectural flexibility that allows for better orientation and optimised window sizing. However, this type of housing is not without its weaknesses: perceptions of humidity and noise pollution remain variable, depending closely on the quality of the materials used, the immediate urban environment and the occupants' domestic practices.

c- The villa: superior bioclimatic performance

Villas stand out as the highest-quality residential model. They achieve the highest levels of satisfaction in terms of natural ventilation and daylighting, demonstrating the effectiveness of passive design strategies in the Saharan environment. The low surrounding density and the structure's independence allow for effective bioclimatic orientation. Nevertheless, the study highlights that even this model remains dependent on the arid context of Béchar, as evidenced by only moderate levels of satisfaction regarding air quality and humidity, confirming the persistence of local climatic constraints on all types of buildings.

d- Summary and design considerations

In conclusion, this analysis demonstrates that thermal and sensory comfort in Béchar is closely linked to architectural form and its ability to adapt to the local climate. The results support an integrated design approach, where the optimisation of passive measures (ventilation, orientation, wall management and acoustic insulation) becomes essential to limit the use of energy-intensive mechanical solutions and ensure a healthy living environment in arid climates.

4.3.2. Contrasting Trends In Residential Satisfaction

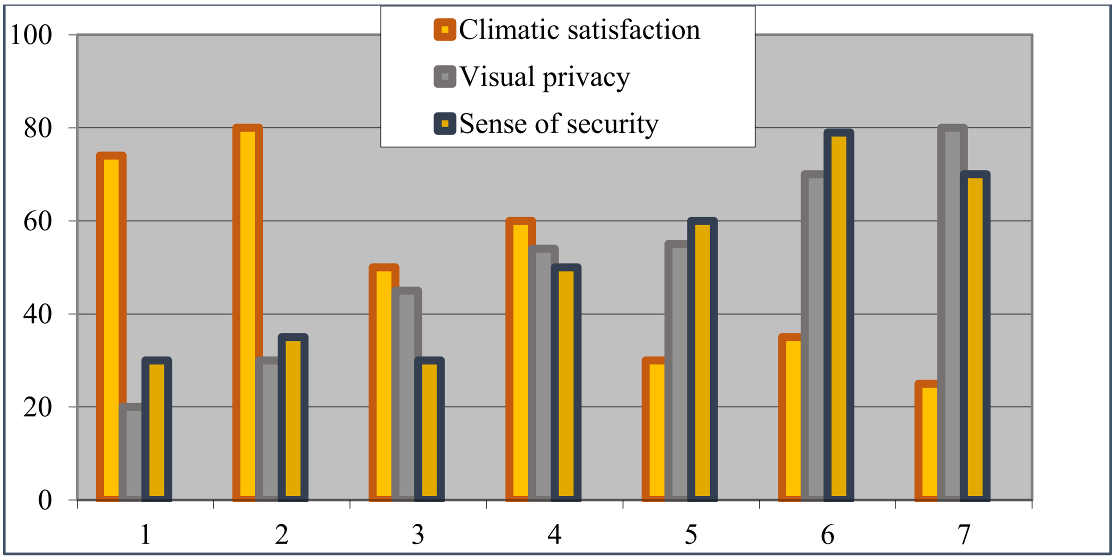

Figure 11. Residents' Social Satisfaction. Source: authors, 2025.

The graph illustrates how satisfaction levels have evolved across three fundamental pillars of domestic quality of life: thermal comfort, visual privacy and a sense of security. Analysis of this data reveals contrasting trends, highlighting the complexity of housing issues.

a- Deterioration in perceived climate conditions

There has been a gradual decline in satisfaction with the indoor climate. This trend suggests a decline in perceived thermal comfort, likely attributable to increasing exposure to harsh local weather conditions and the obsolescence (or inadequacy) of passive climate control systems. The building design appears to be struggling to maintain a stable indoor environment in the face of external constraints.

b- Strengthening the socio-spatial sphere

At the same time, visual privacy and the sense of security are steadily increasing. This upward correlation demonstrates that protection from prying eyes and the ability to claim private spaces act as catalysts for a sense of security. These findings confirm that spatial configuration and urban planning are key factors in the socio-psychological quality of the living environment.

c- The paradox of enclosure: the conflict between thermal and social considerations

However, a cross-analysis reveals a paradoxical disconnect: improvements in social factors (privacy and security) appear to come at the expense of thermal performance. This phenomenon highlights the limitations of urban forms that are increasingly inward-looking or excessively closed off; whilst they protect users socially, they hinder climate regulation (notably by reducing air circulation or controlled light intake).

d- **Summary and outlook**

Ultimately, these observations call for a review of design strategies. It is becoming imperative to develop integrated architectural solutions that do not sacrifice bioclimatic comfort for the sake of safety. The challenge lies in reconciling these often conflicting requirements to ensure a sustainable and balanced quality of living.

4.3.3. The impact of building orientation on residents' satisfaction levels

The orientation of dwellings emerges as a key biophysical factor, largely determining the comfort experienced by occupants. Analysis of the data collected reveals a clear hierarchy of spatial preferences, directly correlated with the characteristics of solar and wind exposure.

a- The prevalence of comfort in north-south orientations

North-facing façades stand out for having the highest satisfaction scores, a trend confirmed by over 60% of users who identify them as the most favourable thermal configuration. As for south-facing facades, although they receive slightly lower ratings, they are still widely accepted and deemed acceptable by residents (see Figure 12), no doubt offering a more stable seasonal balance.

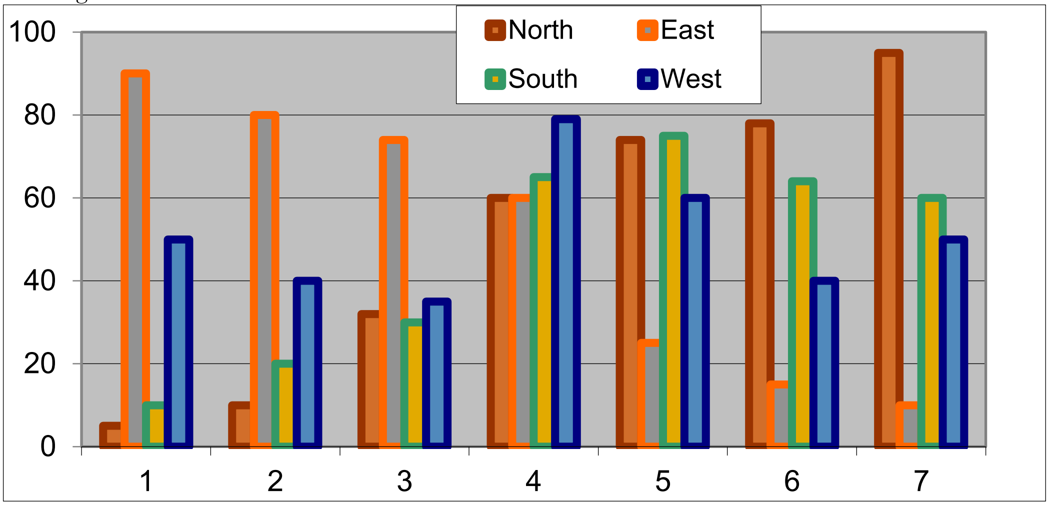

Figure 12. Differences in Satisfaction According to Dwelling Orientation. Source: authors, 2025.

b- The underperformance of the eastern and western routes

In contrast, east-facing dwellings are identified as the least comfortable, likely due to the morning heat gain without any effective means of regulation. West-facing properties are also viewed very unfavourably. This situation is specifically due to the climatic conditions in Béchar, where west-facing façades bear the full brunt of the prevailing westerly winds. These atmospheric currents exacerbate thermal discomfort and intensify the sense of discomfort felt by residents in the face of harsh external weather conditions.

c- Design recommendations

Ultimately, these findings highlight the need to give careful consideration to bioclimatic design from the very earliest stages of architectural planning. A detailed analysis of local meteorological parameters, particularly the sun's path and wind patterns, is essential for sustainably optimising residential comfort and reducing the thermal vulnerability of dwellings in arid environments.

Analysis of the data collected confirms the close correlation between building typology, architectural layout and users' perceptions within the urban ecosystem of Béchar. The marked prevalence of flats in our sample reflects the rapid transformation of the urban landscape, where collective housing is emerging as the structural response to growing demographic pressure. Nevertheless, this transition is accompanied by a critical observation: this residential model appears to offer environmental and physical performance that falls short of expectations compared to more traditional or individual forms of housing

4.4 The influence of timing and building type on thermal performance

The study shows that the age of buildings, combined with their type, significantly influences spatial and thermal comfort.

- Older buildings: Traditional structures (large family homes) often benefit from superior thermal inertia, a legacy of solid construction methods, although they may lack modern environmental features.
- Newer buildings: In contrast, contemporary apartment blocks suffer from architectural standardisation that frequently ignores the bioclimatic specificities of the Saharan environment, prioritising density at the expense of adaptation to the arid context.

4.4.1 Spatial Determinism And The Façade Interface

The morphological parameters – surface area, orientation and porosity of the façades – appear to be critical factors in overall comfort.

- The advantage of detached housing: Les villas et maisons individuelles tirent profit de leur flexibilité spatiale et de leurs multiples façades, facilitant une ventilation naturelle traversante et un éclairage diurne optimal. The advantage of detached housing: Detached houses and villas benefit from their spatial flexibility and multiple façades, facilitating natural cross-ventilation and optimal daylighting.
- The constraints of collective housing: Conversely, a flat with a single aspect suffers from major structural limitations affecting air quality, light levels and sound insulation.

In this context, the façade should no longer be viewed as a simple wall, but as a multidimensional interface. It ensures hygrothermal regulation (air flow, solar gain) whilst acting as a sociological filter. It strikes a balance between openness to the city and the fundamental need for privacy and security, thereby structuring the relationship between private and public space.

4.4.2 Towards A Holistic Approach To Residential Sustainability

The findings obtained call for a redefinition of sustainable residential development in Béchar. Sustainability cannot be limited to energy performance alone; it lies in striking a balance between responding to extreme climatic conditions and meeting the psychosocial needs of occupants. Comfort must therefore be understood as a hybrid concept, where physical indicators intersect with the subjective experiences of residents.

Ultimately, this research highlights the imperative for systemic coherence between climate, architecture and socio-spatial dimensions. Improving the quality of life in Béchar depends on a rigorous optimisation of orientation, building envelope design and spatial organisation. Such an approach is a prerequisite for creating an urban environment that is not only sustainable but also resilient to the specific challenges of arid regions.

Sustainable design in Béchar must necessarily incorporate:

L'optimisation de l'orientation bioclimatique. Optimisation of bioclimatic orientation.

- Optimisation of bioclimatic orientation.
- Promotion of passive strategies (natural ventilation, skylighting).
- A spatial layout that takes socio-cultural needs into account.

5. CONCLUSION

This research aimed to assess the quality of housing and its suitability for the climatic conditions of the city of Béchar. Drawing on a Post-Occupancy Evaluation (POE) centred on users' perceptions and satisfaction, the study demonstrates that architectural typology, building orientation and spatial configuration are the key determinants of comfort—both physical and social—in arid regions.

The investigation highlights a structural fragility in the model of the apartment block. This type of housing proves to be the most vulnerable to environmental stresses, hampered by a lack of surface area for heat exchange (limited facades), poor natural ventilation and high permeability to noise and humidity. In contrast, detached houses and villas are distinguished by superior performance. Their spatial flexibility, combined with optimised natural lighting and passive ventilation, confirms the relevance of bioclimatic design principles for housing in the Sahara.

A key contribution of this study is the redefinition of the façade as a regulatory element. Far from being a mere envelope, it acts as a dynamic interface that manages climatic flows (solar radiation, wind circulation, thermal inertia) whilst shaping the social sphere. By controlling visual permeability, it ensures privacy and reinforces the occupants' sense of security. Thus, domestic comfort emerges from a fusion of technical performance and subjective perceptions of socio-spatial needs.

In conclusion, the data collected argue for a paradigm shift in architectural practice in Bechar. It is imperative to prioritise an integrated approach that reconciles:

- Passive strategies (precise orientation, cross-ventilation);
- The environmental performance of the building;
- The psychosocial well-being of residents.

This synergy is the essential lever for establishing sustainable residential development, capable of transforming the extreme climatic constraints of arid regions into a resilient and satisfying living environment.

6. REFERENCES

[1] Messafri, N., and Biara, R. W., 2021, "Architectural Production in the Saharan Establishment Between Yesterday and Today: The Case of Bechar Ville," *Journal of Architecture and Child Environment*, **11**(1), pp. 27–35.

[2] Mili, M., Farhi, A., and Boutabba, H., 2015, "Évaluation post-occupationnelle des logements sociaux transformés en copropriété: Cas de la ville de M'Sila en Algérie," *Courrier du Savoir*, (20), pp. 141–158.

[3] Royal Institute of British Architects (RIBA), 1965, *Handbook of Architectural Practice and Management*, RIBA Publications.

[4] Preiser, W. F. E., 1995, *Post-Occupancy Evaluation: How to Make Buildings Work Better*, Van Nostrand Reinhold.

[5] Leaman, A., and Bordass, B., 2001, "Assessing Building Performance in Use 4: The PROBE Occupant Surveys and Their Implications," *Building Research & Information*, **29**(2), pp. 129–143.

[6] McGrath, P. T., and Horton, M., 2011, "A Post-Occupancy Evaluation (POE) Study of Student Accommodation in an MMC/Modular Building," *Structural Survey*, **29**(3), pp. 244–252. https://doi.org/10.1108/02630801111148211
[7] Zhang, Y., and Barrett, P., 2010, "Findings from a Post-Occupancy Evaluation in the UK Primary Schools Sector," *Facilities*, **28**(13/14), pp. 641–656. https://doi.org/10.1108/02632771011083685
[8] Royal Institute of British Architects (RIBA), 2017, *Building Knowledge: Pathways to Post Occupancy Evaluation*, RIBA, London. https://www.riba.org/media/edul2w5z/buildingknowledgepathwaystopoepdf.pdf
[9] Prakash, P., 2005, *Effect of Indoor Environmental Quality on Occupant's Perception of Performance: A Comparative Study*, M.S. thesis, University of Florida.
[10] Royal Institute of British Architects (RIBA), 2010, *Higher Education Design Quality Forum: Better Communications = Better Projects*, RIBA Publications.
[11] Meknaci, M. E. F., Wang, X., Biara, R. W., and Zerouati, W., 2024, "Analysis of the Urban Form of Bechar Through the Attributes of Space Syntax for a More Sustainable City," *Buildings*, **14**(7). https://doi.org/10.3390/buildings14072103
[12] Khencha, K., Biara, R. W., and Belmili, H., 2022, "L'effet de l'orientation et de l'angle d'inclinaison des modules BIPV sur la production d'énergie: Application sur bâtiment en milieu aride," *Revue d'Architecture*, **2**(1), pp. 32–46.
[13] Biara, R. W., and Alkama, D., 2014, "La dynamique d'un spécimen de place publique dans la ville saharienne," *Courrier du Savoir Scientifique et Technique*, **15**(15), pp. 65–71.