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Quality public space and pedestrian flows: an architectural approach to urban development

Espacio público de calidad y flujos peatonales: aproximación arquitectónica al desarrollo urbano

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ABSTRACT

Investing in the quality of urban space and pedestrian mobility not only improves the quality of life of the inhabitants, but also establishes a solid foundation for the sustainable growth and future development of a city. Under this premise, the objective of this study was to determine the relationship between the quality of urban space and pedestrian mobility in the city of Juliaca, 2024. The methodology was basic, non-experimental, cross-sectional and correlational. The instrument was a questionnaire whose reliability was a Cronbach's Alpha of 0,873, which was applied to a sample of 224 residents neighboring the unit of analysis. The results were a Spearman correlation coefficient (Rho = 0,779) and a p-value (p = 0,000) indicating a strong positive correlation between the study variables, in general, as the quality of urban space improves, pedestrian mobility increases. This strong correlation suggests that urban spaces that are architecturally designed, safe, accessible and aesthetically pleasing tend to be used more by pedestrians. In conclusion, the study has provided convincing evidence that the quality of urban space is a key determinant of pedestrian mobility in Juliaca. By focusing on improving these spaces, Juliaca has the opportunity to transform its urban environment into a more active, inclusive and pleasant place for all its citizens.

Keywords: Quality of Urban Space; Pedestrian Mobility; Architecture; Infrastructure; Accessibility; Functionality.

RESUMEN

Invertir en la calidad del espacio urbano y en la movilidad peatonal no solo mejora la calidad de vida de los habitantes, sino que también establece una base sólida para el crecimiento sostenible y el desarrollo futuro de una ciudad. Bajo esta premisa, el objetivo del presente estudio fue determinar la relación de la calidad del espacio urbano y la movilidad peatonal en la ciudad de Juliaca, 2024. La metodología fue básica, no experimental, transeccional y correlacional. El instrumento fue un cuestionario cuya confiabilidad fue un Alpha de Cronbach de 0,873, el mismo que se aplicó a una muestra de 224 pobladores vecinos de la unidad de análisis. Los resultados fueron un coeficiente de correlación de Spearman (Rho = 0,779) y un valor p (p = 0,000) lo que indica una correlación positiva fuerte entre las variables de estudio, en general, a medida que mejora la calidad del espacio urbano, aumenta la movilidad peatonal. Esta fuerte correlación sugiere que los espacios urbanos, diseñados arquitectónicamente, seguros, accesibles y estéticamente agradables tienden a ser más utilizados por los peatones. En conclusión, el estudio ha proporcionado evidencia convincente de

que la calidad del espacio urbano es un determinante clave de la movilidad peatonal en Juliaca. Al enfocarse en mejorar estos espacios, Juliaca tiene la oportunidad de transformar su entorno urbano en un lugar más activo, inclusivo y agradable para todos sus ciudadanos.

Palabras clave: Calidad del Espacio Urbano; Movilidad Peatonal; Arquitectura; Infraestructura; Accesibilidad; Funcionalidad.

INTRODUCTION

Modern cities face the challenge of creating quality urban spaces that promote safe, efficient, and accessible pedestrian mobility for all their inhabitants. A quality urban space is characterized by being safe, inclusive, sustainable, and pleasant, allowing people to move around easily, enjoy green and recreational areas, and interact with their environment in a positive way. In this context, it is crucial to consider pedestrian accessibility to key urban areas and how pedestrians perceive the infrastructure and surrounding environment, as pedestrian mobility is emerging as a fundamental element of sustainable urban development, offering multiple benefits for individual health and the environment as a non-motorized form of transport.[1,2,3]

In this regard, Casimir et al.[4] point out that public spaces have deteriorated to the point of disappearing, representing a decline in urban activities such as pedestrian mobility, which is hampered by a lack of adequate infrastructure, excessive vehicular traffic, air pollution, and insecurity. For Dobrowolska et al.[5] accessibility to commercial services, recreational facilities, and green spaces is vital to the well-being of urban residents. However, these features are often unevenly distributed throughout the city, creating disparities in the quality of life of its inhabitants. Kajosaari et al.[6] report that the quality of urban green spaces is essential for improving human well-being, as they provide places for recreation and tranquility, encourage outdoor physical activity, and contribute to reducing stress and strengthening social relationships among urban residents. Promoting pedestrian mobility can improve urban quality of life and the livability of public spaces, prioritizing the quality of the connection system and the renaturalization of urban spaces.[7]

In context, according to **Córdova** et al.[8] and Casimir et al.[4] cities around the world face the growing challenge of urban space quality and pedestrian mobility, driven by rapid urban development, the prioritization of vehicular transport, the lack of adequate infrastructure for pedestrians, and air pollution, which have created hostile urban environments for pedestrians. This situation has repercussions on the health, safety, economy, and well-being of city dwellers. Added to this is the lack of safe and accessible public spaces, which limit opportunities for recreation and physical activity, promoting a sedentary lifestyle.

In this regard, in Asia, Wei et al.[9] argue that the relationship between urban structure and habitat quality is essential for urban development: more green space means better habitat quality, while dense urban construction is associated with lower quality. Sevtsuk et al.[10] conclude that urban design interventions are related to pedestrian mobility, offering planners and policymakers valuable insights into improvements in public space. These estimates provide a framework for understanding how planning decisions can influence non-motorized mobility goals. In turn, Cui et al.(11) argue that it is important to consider the relevance of public spaces, especially at night, emphasizing that the nightlife of most pedestrians is centered on main streets. They also highlight the importance of further research on these nighttime streets to improve the quality of urban environments and achieve high-quality urban development. This suggests that understanding nighttime activities on main streets can be fundamental to effectively designing and planning urban spaces that meet the needs and preferences of residents and visitors, thus contributing to a more vibrant and livable urban environment.

In Europe, Mastrolonardo[12] concluded that the quality of the built environment is related to the space between buildings, taking into account their aesthetic, environmental, and functional values, due to the specific maintenance and reuse needs of the project. This is known as sustainable mobility, which should not overlook the quality of public space. Rodríguez et al.[13] state that the quality of urban development is related to pedestrian mobility. This involves analyzing how various factors, such as population density, land use variety, accessibility to services and places of interest, and the quality of pedestrian infrastructure, influence the quantity and quality of pedestrian activity in specific urban areas. Trolese et al.[2] report that the quality of urban spaces is related to sustainable urban mobility, and transportation systems should be designed to support and encourage it.

In North America, Aras et al.[14] concluded that improvements in the quality of urban space are related to pedestrian access to points of interest. Hematian et al.[15] concluded that the quality of public spaces is related to people's mental health, and that the design of these roads can significantly influence the psychological well-being of citizens. Widera[16] addresses the quality of urban space and its relationship to pedestrian mobility in the context of jaywalking regulation, discussing how the enactment of laws such as AB 2147 in California affects

the dynamics of urban space by largely legalizing jaywalking and changing the way pedestrian mobility is regulated in cities. In addition, they analyze how these regulations impact the interaction between pedestrians and vehicles, as well as the public perception of road safety and individual responsibility in accident prevention.

In Central America, Vargas et al. [17] address the quality of urban space and pedestrian mobility in the DistritoTec. They analyzed various aspects such as tree cover, vegetation , streets, sidewalks, crossings, roundabouts, and storm drains in terms of accessibility, dimensions, signage, condition, presence, and deterioration. According to this classification system, 11 % of roads were found to be in good condition, 19 % were fair or had deficiencies, 56 % were in poor condition, and 14 % were in very poor condition. Quijada et al. [18] concluded that the quality of sidewalks is related to safe mobility in modern cities. For their part, Caballero et al. mention that pedestrian spaces should be attractive areas that guarantee good circulation and are accessible regardless of the physical condition of the individual.

In South America, Zumelzu et al. [1] highlight that the quality of urban space, including elements such as the presence of trees, wide sidewalks, and uniform textures, is related to pedestrian mobility and walkers' perceptions. These elements contribute to urban vitality and the active use of public space. In addition, the presence of green areas, heritage architecture, and low vehicle traffic are positive aspects of the urban environment that were highlighted by participants in interviews on pedestrian perception. Figueroa et al. [19] concluded that the quality of accessibility is directly related to urban mobility. Therefore, urban planners and transportation managers must develop more effective solutions to improve pedestrian safety in developing countries. In turn, Govea et al. [20] highlight the importance of implementing green areas to improve urban environmental management, specifically in reducing noise concentrations, which contributes significantly to both scientific understanding and practical application in the planning and management of urban environments.

This leads us to describe the problematic reality of the unit of analysis, which, as in many rapidly developing and growing urban areas, has brought with it a series of significant challenges that affect the quality of urban space and pedestrian mobility. The problem in the city of Juliaca is that urban expansion has not been accompanied by architecturally planned pedestrian infrastructure, leaving many areas without safe or accessible sidewalks, which puts pedestrians at risk and limits their mobility. In addition, increased vehicular traffic, resulting from the increase in private vehicle ownership, contributes to congestion and raises air pollution levels. These factors not only degrade the urban environment but also deteriorate public health and the quality of life of residents with. Therefore, this research project seeks to address the issue of the quality of public spaces and pedestrian mobility. As a result, the overall objective is to determine the relationship between the quality of urban space and pedestrian mobility in the city of Juliaca in 2024.

This work is justified at the social level, since it aims to improve the quality of life of people living in urban environments, where understanding the relationship between the quality of space and pedestrian mobility is fundamental for well-being and health. It is justified at a theoretical level because it is essential to understand the relationship between the physical structure of cities and the daily lives of their inhabitants, proposing to document and analyze this relationship in the reality of Juliaca, with the aim of generating theoretical knowledge that can be applied in similar contexts.

On a practical level, this study is justified because its results have the potential to inform and shape public policies focused on sustainable development, based on the premise that by implementing evidence-based strategies that improve pedestrian mobility and the quality of public spaces, authorities could promote a safer and more attractive environment.

METHOD

The proposed research was carried out using a non-experimental, specifically cross-sectional design. This approach involved observing the phenomena in their natural context without manipulating variables. Instead, data were collected at a single point in time to analyze the situation, allowing for an examination of the relationship between urban space quality and pedestrian mobility in urban environments without directly intervening in them. [21]

Furthermore, this article was correlational in nature, as this type of study focuses on identifying and analyzing the relationship between two variables without directly manipulating them. Through this approach, the connection between the quality of urban spaces and pedestrian mobility is better understood, allowing for the detection of patterns and significant associations that can inform future urban interventions and policies in this regard. [22]

The study population consisted of 535 residents of Juliaca living in the city's civic center. The sample, according to the simple random sampling formula, was 224 residents. The inclusion criterion was that the residents were born in the city of Juliaca. Passers-by and other residents under the age of and those who did not have Juliaca citizenship were excluded. For Baena [23] ,the study population refers to the complete set of individuals, objects, or events that have common characteristics and about which information is sought and conclusions are drawn in a research study. Arias et al. [24] argue that an appropriate sample selection guarantees

reliable results and allows these results to be extrapolated.

To collect information, a survey technique was used, employing a questionnaire as an instrument, which was previously validated by a panel of experts and knowledgeable individuals on the subject matter, and whose statistical reliability through Cronbach's alpha was 0,873. Regarding the questionnaire, Casas et al.[25] state that it is a document containing a series of questions written in a coherent manner and organized sequentially, following a previously established objective.

The information was processed using SPSS v.26 statistical software, into which the data provided in the questionnaires was downloaded. A Kolmogorov-Smirnov normality test was also performed to determine the statistic to be used to prepare the respective contingency tables.

RESULTS
Descriptive results

Table 1. Descriptive statistics			Statistical
Quality of urban space	Average		27,31
	95 % confidence interval for the mean	Lower limit	26,4
		Upper limit	28,1837
	Mean trimmed to 5 %		27,3363
Pedestrian mobility	Average		26,4152
	95 % confidence interval for the average	Lower limit	25,45
		Upper limit	27,3786
	Mean trimmed to 5 %		26,1052

Table 1 provides a summary of the results obtained when applying the analysis tool to the study unit. This table shows the descriptive values calculated from the data collected. It should be noted that a 95 % confidence interval was used, which implies a high level of certainty in the information derived from the tools used. The values presented in table show that, within this 95 % confidence interval, the mean of the variables studied is representative and reliable. This means that the actual values of the mean of the variables can be trusted to lie within the upper and lower limits established by the confidence interval. These results suggest that the information provided by the instruments is robust and reliable for analysis and consideration in the study conducted.

Table 2. Descriptive results for urban space quality			
	Infrastructure	Accessibility	Functionality
Low	65	48	70
Average	29	52	30
High	6	0	0
Total	10	100	100

Table 2 shows the descriptive results of urban space quality in Juliaca. The interpretation of these data reflects critical aspects of the configuration and quality of urban space in Juliaca.

The quality of urban infrastructure is low (65 %), which means that most urban spaces in Juliaca have infrastructure quality in which the materials, design, and maintenance of urban physical spaces are insufficient or inadequate, which can contribute to a less safe and less attractive environment for pedestrians. It is average (29 %), which implies that a significant portion of the spaces are of average quality, indicating that, although some aspects are being addressed, there is still room for improvement. It is high (6 %), meaning that only a small fraction of urban spaces have high-quality infrastructure. This implies that there are few examples of well-designed and well-maintained spaces that could serve as models to be replicated in other areas of the city.

With regard to the quality of urban space accessibility, it is low (48 %), meaning that almost half of urban spaces have low accessibility, indicating significant barriers to universal access, including problems for people with disabilities, families with baby carriages, and the general population who find it difficult to move around freely. It is average (52 %), which means that most spaces have average accessibility, showing that, although accessible to a cer , these spaces are not completely free of barriers, thus limiting efficient and safe mobility. The lack of spaces with high accessibility is alarming and highlights the urgent need for inclusive and universal

approaches to urban design.

The quality of urban space functionality is low (70 %). This proportion of spaces with low functionality suggests that they do not adequately meet the needs and activities of residents, which could discourage pedestrian use of these spaces. It is average (30 %), meaning that one-third of spaces have average functionality, indicating that, although they are used, they could be significantly improved to increase their usefulness and attractiveness. The absence of spaces with high functionality is a clear indication that Juliaca needs to review and redesign its public spaces to better respond to the demands and activities of its citizens.

Table 3. Descriptive results for pedestrian mobility				
	Freq.	**%**	**% Val.**	**% Accum.**
Low	116	52	52	52
Average	58	26	26	78
High	50	22	22	100
Total	224	100	100	

Table 3 presents pedestrian mobility levels as low (52 %), medium (26 %), and high (22 %), offering valuable insight into how Juliaca residents interact with their urban environment.

Low pedestrian mobility (52 %) is the most representative level in the results, indicating that more than half of the areas observed have unfavorable conditions or significant disincentives for pedestrian mobility. This high percentage could be associated with factors such as inadequate infrastructure, lack of safety, limited accessibility, or low functionality of public spaces, all related to the absence of professional architectural design.

Medium pedestrian mobility (26 %) indicates that, although some spaces are usable and accessible to a certain extent, there are still barriers or limitations that prevent an optimal pedestrian experience. These spaces could benefit from specific interventions to improve accessibility and attractiveness.

With regard to high pedestrian mobility (22 %), it is encouraging to see that a considerable percentage of pedestrian mobility is categorized as high, although this figure also reflects that there is room for improvement. Spaces that already have high pedestrian mobility and accessibility are likely to have good infrastructure, safety, and pedestrian- -oriented design, serving as models for other areas of the city.

Inferential results

Table 4. Contingency table for general hypothesis			
			Pedestrian mobility
		Correlation coefficient	0,779**
Spearman's rho	Quality of urban space	Sig. (bilateral)	0,000
		N	224
Note: **. The correlation is significant at the 0,01 level (bilateral).			

Table 4 reveals a Spearman correlation coefficient (Rho = 0,779) and a p-value (p = 0,000). These statistical results are fundamental to understanding the relationship between urban space quality and pedestrian mobility from a scientific and architectural perspective. This value indicates a strong positive correlation between the study variables, in general, as the quality of urban space improves, pedestrian mobility increases. This strong correlation suggests that architecturally designed, safe, accessible, and aesthetically pleasing urban spaces tend to be used more by pedestrians.

Table 5 presents statistically significant and highly revealing findings on the interrelationship between different aspects of urban space quality and pedestrian mobility. The quality of urban space infrastructure includes elements such as paving, lighting, street furniture, and signage. A coefficient of 0,861 suggests that improvements in these aspects are highly associated with an increase in pedestrian use of spaces. The quality of urban space accessibility refers to how easy it is for all people, including those with disabilities, to access and move through these spaces. A correlation of 0,758 highlights the importance of removing physical barriers and improving connectivity to facilitate greater pedestrian traffic. The quality of urban space functionality refers to how spaces meet the needs and activities of users, such as rest areas, play areas, and spaces for community events. A Rho of 0,992 and a p=0,000 indicate that the presence and quality of these features are

almost decisive in the amount of pedestrian use a space will receive.

These findings demonstrate the critical importance of architecturally designing and maintaining urban spaces that are not only aesthetically pleasing but also highly functional, accessible, and well-infrastructured. To enhance pedestrian mobility in Juliaca.

			Infrastructure	Accessibility	Functionality	Pedestrian mobility
Spearman's Rho	Infrastructure	CC	1,000			
		Sig. (b)	0,000			
		N	224			
	Accessibility	CC	0,860**	1,000		
		Sig. (b)	0	0		
		N	224	224		
	Function	CC	0,555**	0,114**	1,000	
		Next (b)	0	0	0	
		N	224	224	224	
	Pedestrian Mobility	CC	0,861**	0,758**	0,992**	1,000
		Next (b)	0	0	0	0
		N	224	224	224	224

Table 5. Contingency table for specific hypotheses

Note: CC=Correlation coefficient; b=bilateral. **. The correlation is significant at the 0,01 level (bilateral).

DISCUSSION

The results of this study show a clear need for intervention in terms of infrastructure improvement, increased accessibility, and optimized functionality, with urban policies focused on improving existing infrastructure and ensuring its proper maintenance, implementing inclusive designs that eliminate barriers and promote accessibility for all, and thus increasing the functionality of spaces to encourage greater use and enjoyment by the community. In line with Wei et al.[9] addressing these points could significantly improve urban quality of life and pedestrian mobility, creating a more attractive, accessible, and livable environment for all residents.

The predominance of low pedestrian mobility is a clear indication that there are significant challenges in the design and maintenance of urban space in Juliaca. As Sevtsuk et al.[10] point out, to promote a more pedestrian-friendly environment, it is crucial to adopt an integrated approach that considers renovating sidewalks, crosswalks, and signage to ensure that spaces are accessible and safe for all users, especially people with disabilities. Furthermore, in agreement with Zumelzu et al.[1] it is necessary to improve lighting in public areas, increase surveillance, and design spaces that minimize blind spots and areas prone to criminal activity, creating spaces that offer multiple functions to attract more people, such as rest areas, green spaces, recreational and commercial facilities that invite pedestrians to use and enjoy the public space. Similar to Rodríguez et al.[13] policies should be integrated that contribute to adequate urban densification, mixed land use, and planning that prioritizes pedestrians over private vehicles.

The results of this study highlight the importance of the work of architects and urban planners, who are responsible for considering that the quality of urban design directly influences the way people interact with their environment. For their part, authorities should consider that the quality of urban space also impacts the psychological well-being of individuals. In line with Trolese et al.[2] well-designed, high-quality public spaces can reduce stress, increase happiness, and promote social interaction, encouraging greater pedestrian use and strengthening the sense of community.

The results are also consistent with Aras et al.[14] who not only highlight the interconnection between the quality of urban space and pedestrian mobility, but also offer a clear mandate for urban planning and architectural design policies. They are similar to Vargas et al.[17] who pointed out that by promoting improvements designed and thought out through the lens of architecture in the infrastructure, accessibility, and functionality of urban spaces, Juliaca can foster a more active, healthy, and cohesive urban environment.[26]

CONCLUSIONS

In relation to the overall objective, this study has demonstrated a strong positive correlation between urban space quality and pedestrian mobility in Juliaca. This finding and robust statist confirm that the quality of urban space design and implementation are critical factors that directly influence the frequency and comfort with which pedestrians use these spaces. Urban spaces that are safe, accessible, and aesthetically appealing not

only encourage greater pedestrian activity but also improve the quality of urban life by facilitating healthy social interactions and promoting active lifestyles. This study underscores the importance of integrating architectural design principles that prioritize the pedestrian experience. Investment in quality should not only focus on aesthetics, but also on practical functionality, safety, and universal accessibility. Evidence suggests that improving elements such as lighting, signage, street furniture, and accessibility barriers can have a direct impact on increasing pedestrian mobility.

In relation to the first specific objective, the results have shown a strong correlation between the quality of urban infrastructure and pedestrian mobility in Juliaca, which is statistically significant. This robust relationship implies that aspects such as adequate paving, effective lighting, functional street furniture, and clear and understandable signage are fundamental to increasing the use of urban spaces by pedestrians. This relationship underscores the importance of infrastructure design and maintenance in urban public spaces. Urban planners and architects should consider these elements as key priorities in urban design, with the aim of improving not only the aesthetics of the city, but also its functionality and safety.

With regard to the second specific objective, the results indicate that ease of access, including adequate consideration of the needs of people with disabilities, plays a crucial role in the pedestrian use of public spaces. The removal of physical barriers and improved connectivity are key factors that positively influence the increase in pedestrian traffic. This strong relationship underscores the need to adopt an inclusive and holistic approach to urban planning and architectural design. Accessibility must be a priority at all stages of urban development, ensuring that all citizens, regardless of their physical abilities, can move freely and safely through urban spaces.

In relation to the third specific objective, the results have shown an extremely high correlation between how urban spaces meet the needs and activities of users and pedestrian mobility. This finding reinforces the idea that urban design must go beyond aesthetics and simple spatial planning to include a deep understanding of users' functional needs. Therefore, urban spaces must be designed architecturally as living places, adapted to daily activities and special events that foster social interaction and community well-being.

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