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Contingent Valuation for the Conservation of the Monumental Park, San Martín de Porres, Lima, 2024

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Abstract– The main objective of the research was to determine how much the citizens of Lima are willing to pay for the conservation of the San Martín de Porres Monumental Park. Through a quantitative and descriptive approach, and using the contingent valuation method, data were collected through a structured questionnaire applied to 64 individuals selected by probabilistic sampling. The results indicated that the average willingness to pay is S/ 3,125 per month per person. In addition, differences were found in the willingness to pay: 45.3% would pay S/ 3, while 46.9% would offer S/ 5, followed by 6.3% who would pay S/ 7, and 1.6% who would pay S/ 10. Factors such as monthly income, perception of pollution, satisfaction with green areas, air quality and higher education, particularly among people aged 36 to 45, play a significant role in this willingness to pay, with a level of precision of 95.5%.

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I. INTRODUCTION

Urban growth and economic development threaten the conservation of urban green spaces, crucial for environmental quality and social well-being. In places like Monumental Park in Lima, urban expansion exerts constant pressure. Using the Contingent Valuation Method is essential to quantify the value that the local community places on these parks, ensuring their preservation and contributing to sustainable development and urban quality of life [1]. The degradation of urban green spaces impacts biodiversity and quality of life in cities. According to the UN, 70% of the world's population will reside in urban areas by 2050, increasing pressure on parks. About 3 billion people lack adequate access to these spaces. Economically, investment in conservation is profitable, returning up to four dollars for every one invested. However, many municipalities allocate less than 2% of their budget to these spaces, diminishing the benefits in climate change mitigation and public health, according to recent studies [2]. In Peru, the management of urban green spaces is problematic, with frequent undervaluations and poor administrations. Although 92.7% of citizens are willing to pay for the conservation of these spaces, there is notable discontent and distrust towards the municipal administration, affecting 87.1% of the population [3].

In various international studies, the willingness to pay (WTP) for the conservation of natural spaces has been assessed. It has been calculated those tourists are willing to pay $10 MXN per visit to Cerro de Amalucan Park, influenced by socioeconomic factors and environmental perception [4]. The average annual value for recreational use of Mexico Park is approximately $3,691.6 MXN, highlighting the variability of payment according to the proposed amount [5]. It was shown that tourists would accept paying up to 9.8 times the current rates in Mexican protected areas, with relatively inelastic demand [6]. Additionally, it was revealed that the community of La Pita in Ecuador values water services at $195 USD per month, emphasizing the willingness to pay for the conservation of water resources despite economic constraints [7].

Nationally, the effectiveness of this method in archaeological sites was highlighted, with results varying based on the level of information and the income of respondents [8]. Significant differences in the valuation of Vinicunca Natural Heritage were demonstrated using two different methods, underscoring the utility of these techniques in conservation planning [9]. The valuation of environmental and recreational services in different regions was explored, finding a willingness to pay that reflects a recognition of the environmental and touristic value of the areas studied [10], [11]. The valuation of urban green areas was examined, revealing a high degree of willingness to contribute by residents [12]. Finally, the conservation of the Lomas de Lachay national reserve was assessed, finding strong economic support for the conservation of ecosystem services such as ecotourism and CO2 capture [13].

A. Contingent Valuation (CV)

Contingent Valuation (CV) is a tool in environmental economics used to assign monetary values to goods that are not traditionally marketed [14]. This method employs surveys that simulate a hypothetical market to estimate the economic value of ecological services and goods, capturing how much individuals are willing to pay for specific resources or accept as compensation for losses [15]. CV represents an essential quantitative approach for environmental planning, as it allows for the assessment of the valuation that people assign to natural and cultural assets [16].

In the design of surveys and questionnaires within the Contingent Valuation Model (CVM), the structure and quality of questions are fundamental to obtaining precise and relevant responses for the valuation of goods or services. Questions must be designed to adequately reflect the study's purpose and are typically divided into categories such as open-ended, closed-ended, and multiple choice. Open-ended questions allow for detailed personal expressions, whereas closed-ended questions simplify analysis by limiting responses to defined options, and multiple-choice questions facilitate understanding preferences among a set of alternatives [15, 17].

Regarding the estimation of willingness to pay (WTP), there are methods like the Dichotomous Choice Valuation Model, which uses binary options to determine whether respondents would pay a specific price for a service or good. This method can be implemented using probit or logit models, where the WTP is calculated from the estimated probability that an individual agrees to pay, using a cumulative distribution function [18]. Additionally, logistic regression allows re-expressing the probability as a linear function of the predictors, identifying the impact of each variable on the willingness to pay, which is crucial for establishing optimal pricing and understanding consumer behavior in economic contexts.

B. Socioeconomic Characteristics of Citizens

The socioeconomic characteristics of an individual encompass factors that describe their economic and social position, including gender, age, and marital status. Gender influences social roles and opportunities, addressed by theories aiming for equity [19]. Age is analyzed under the life cycle theory to tailor public policies [20]. Moreover, marital status affects household economics and resource distribution, illustrating how personal aspects intertwine with social economics.

C. Environmental Awareness of Citizens

Environmental awareness encompasses the perception of pollution, evaluation of air quality, and satisfaction with green areas, highlighting the importance of interaction with the environment [21,22,23,24]. These indicators are crucial for measuring how people value and experience their surroundings, directly influencing their expectations about conservation policies and urban management.

D. Suggested Payment for Environmental Services

The suggested payment for environmental services is assessed using the Contingent Valuation technique, identifying how much people value environmental benefits [25]. This method estimates the willingness to pay, including the suggested price and the probability of making the payment [26,27]. These indicators are essential for the formulation of effective environmental policies and the justification of investments in conservation.

II. METHODOLOGY

The research adopted a quantitative approach that facilitated the collection of numerical data to analyze behavioral patterns and test theories through statistical techniques. It is classified as basic or theoretical research, aimed at generating new knowledge about the contingent valuation method applied to the conservation of natural spaces. Additionally, it is descriptive and focuses on documenting how visitors perceive and economically value the park, without manipulating variables or establishing causal relationships. The non-experimental and cross-sectional design allows for observing and collecting data in its natural context at a specific moment, offering a clear view of current attitudes [28,29].

The population of this study includes 457,228 citizens of the San Martín de Porres district in Lima, aged between 15 and 64 years, as confirmed by INEI [30]. The sample, selected through probabilistic sampling, includes 64 citizens to ensure representativeness. The determination of the sample size was based on a calculation that took into account the population size, the level of confidence, and the margin of error, resulting in an effective sample of 385 citizens.

A. Location of the Park

The Monumental Park of San Martín de Porres, also known as Mayta Cápac Ecological Park, is located in the district of San Martín de Porres, within the department of Lima. Spanning approximately 7 hectares, this green space is situated between Universitaria Avenue, Germán Palomino Avenue, Fray Bartolomé de las Casas Avenue, and the Evacuation Route. The coordinates of its location are -11.734400, -77.076039.

B. Data Collection

Data collection was conducted through structured surveys divided into three sections: socioeconomic characteristics (gender, marital status, age, family, education, occupation, income), environmental awareness (perception of pollution, air quality, satisfaction with green areas), and economic value (willingness and amount to pay). Citizens were informed about the objectives of the study prior to administering the surveys, ensuring their understanding and willingness to participate.

C. Data Analysis

The data analysis procedure involved using Microsoft Excel for preliminary tasks of cleaning, coding, and organizing the data, which is crucial for ensuring the quality of the information. Subsequently, a detailed descriptive analysis was carried out, and the willingness to pay was determined using logistic regression in SPSS v26. This facilitated the interpretation of how various factors affect this willingness.

III. RESULTS AND DISCUSSION

A. Socioeconomic Characteristics and DAP

Figure 1 shows that 68.4% (26 women and 18 men) expressed a willingness to contribute economically to the conservation of the park, while 31.6% (13 women and 7 men) are not willing, which could indicate varied priorities or perceptions regarding the value of conserving the park.

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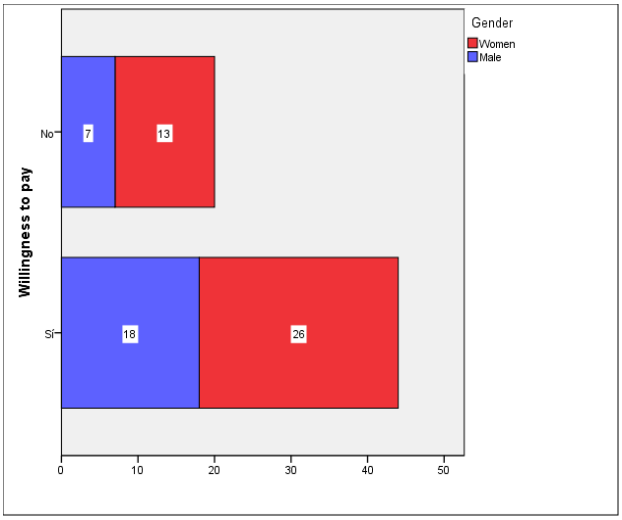

Fig. 1 Willingness to Pay by Gender

Figure 2 indicates that the age group of 36 to 45 years showed the highest willingness to pay, with 17 out of 22 in favor. The age groups of 46 to 55 years and over 55 also expressed high willingness, with 11 out of 13 and 7 out of 9 respectively. However, the majority of the 26 to 35 age group is not willing, with 11 out of 20 against. In total, 44 respondents support the conservation of the park, with especially strong support from the older age groups.

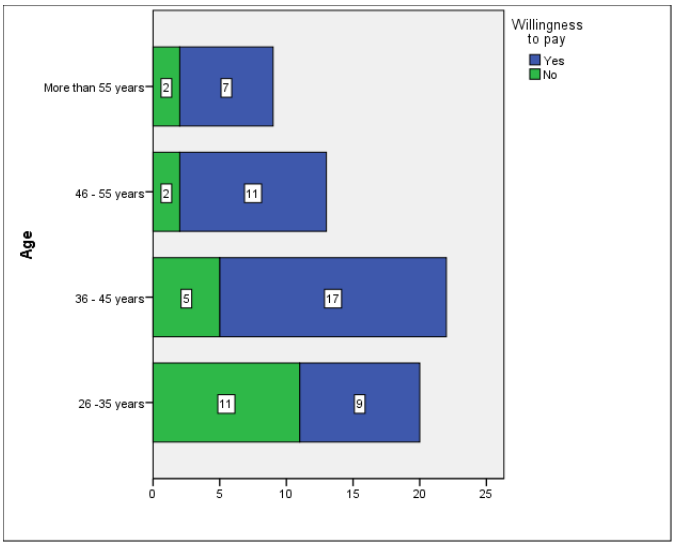

Fig. 2 Willingness to Pay by Age

Figure 3 indicates that 25.0% of respondents have between 1 and 3 family members, 60.9% have between 4 and 6, and 14.1% have more than 6. Among those willing to pay, 27.3% belong to the first group, 56.8% to the second, and 15.9% to the third. This reflects that, although the majority of citizens from all family sizes are willing to contribute to the conservation of the park, households with 4 to 6 members show a higher willingness, possibly due to more intensive use or a higher valuation of the park.

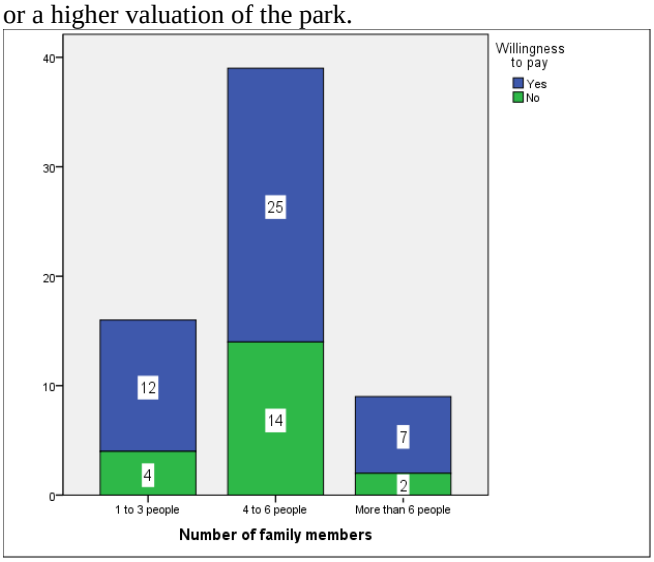

Fig. 3 Willingness to Pay by Family Size

Figure 4 shows that 31.3% of respondents are married, 54.7% are single, and 14.1% are in other marital statuses. Among those willing to pay for the conservation of the park, 34.1% are married, 50% are single, and 15.9% are from other statuses. The majority of single individuals and a significant participation of married individuals and other marital statuses show a willingness to contribute, reflecting broad support for the conservation of the park.

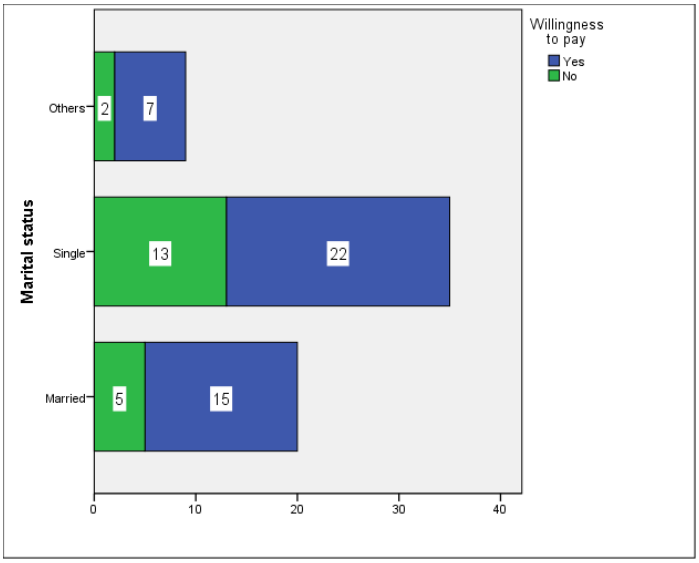

Fig. 4 Willingness to Pay by Marital Status

Figure 5 indicates that 26.6% of respondents have basic education and 73.4% have higher education. Among those willing to pay for the conservation of the park, 18.2% have basic education and 81.8% have higher education. This reflects that those with higher education are more willing to contribute, likely due to greater environmental awareness and economic capacity.

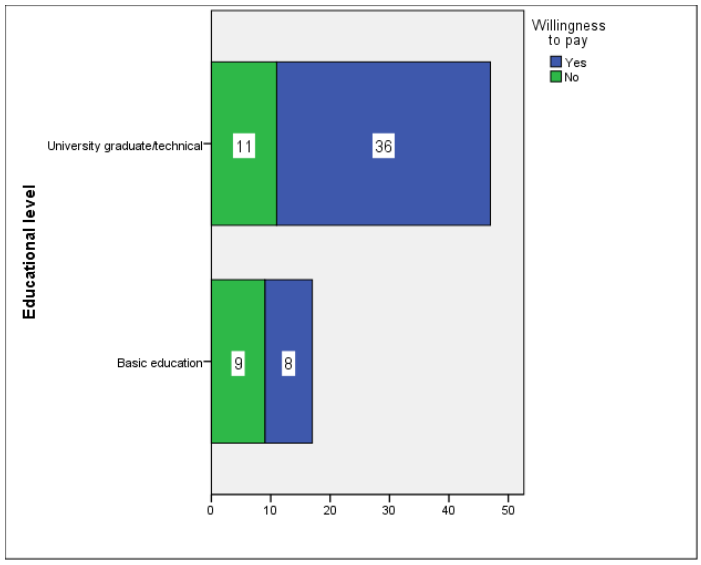

Fig. 5 Willingness to Pay by Educational Level

Figure 6 shows that 18.8% of respondents are housewives or unemployed, 54.7% are self-employed, 1.6% are retired, and 25% are employed. Among those willing to pay for the conservation of the park, the proportions are 20.5%, 47.7%, 2.3%, and 29.5% respectively. Self-employed and employed individuals show a high willingness to pay, while retirees, though few in number, have a 100% willingness, highlighting their strong appreciation for the conservation of the park.

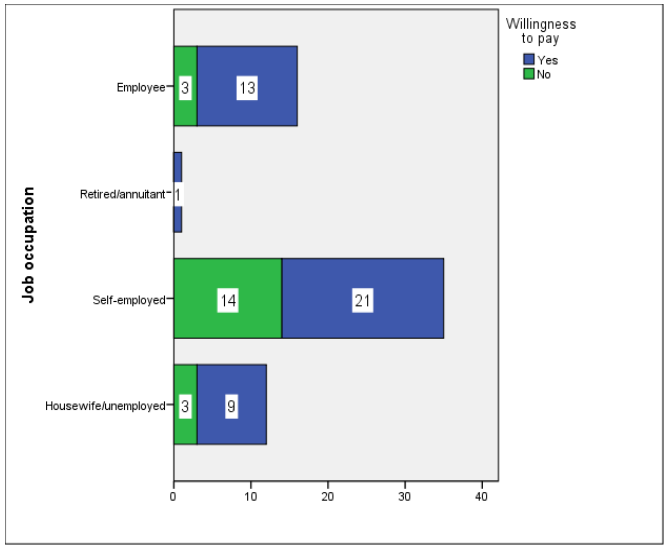

Fig. 6 Willingness to Pay by Occupation

Figure 7 reveals that 31.3% earn up to S/.1025, 45.3% between S/.1025 and S/.2500, 21.9% between S/.2501 and S/.3500, and 1.6% between S/.3501 and S/.4500. Among those willing to pay for the conservation of the park, 36.4% earn up to S/.1025, 36.4% between S/.1025 and S/.2500, 25% between S/.2501 and S/.3500, and 2.3% more than S/.3501. The willingness to pay is relatively uniform across all income levels, with a slight preference in the low and middle-income groups, suggesting a strong valuation of park conservation in these groups.

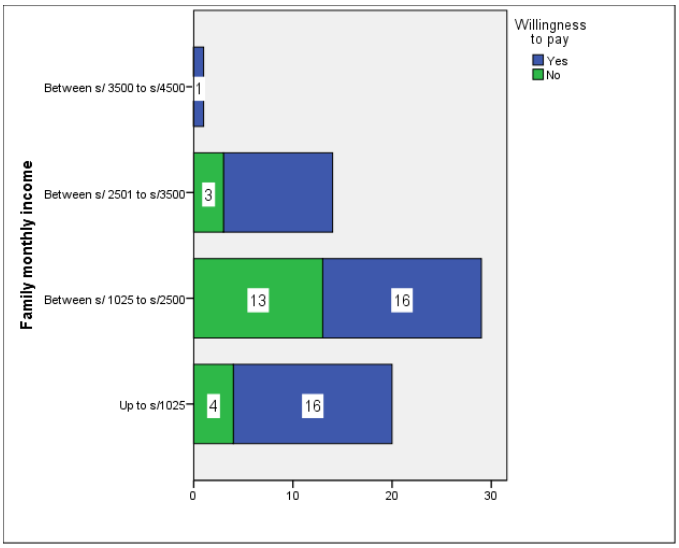

Fig. 7 Willingness to Pay by Monthly Family Income

B. *Environmental Awareness and DAP*

Figure 8 indicates that 57.8% have a negative perception of pollution, and among these, 65.9% are willing to pay for the conservation of the park. Those with average (39.1%) or positive (3.1%) perceptions show less willingness to contribute. This suggests that concern about pollution motivates many to support park conservation.

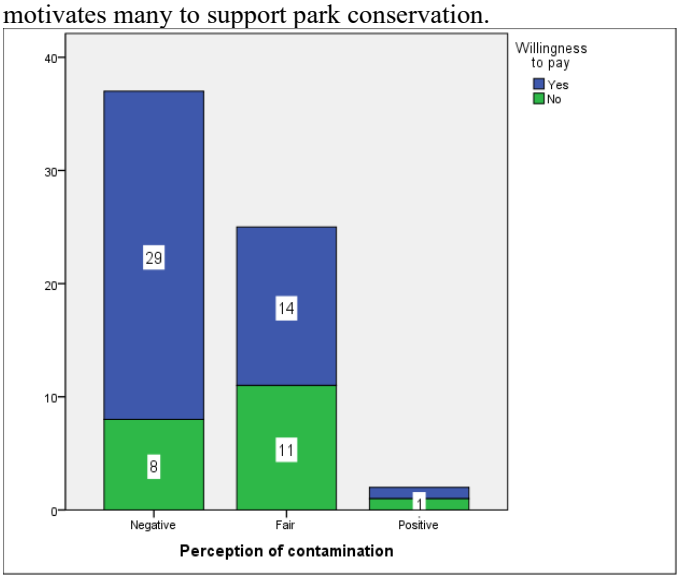

Fig. 8 Willingness to Pay by Perception of Pollution

Figure 9 indicates that 40.6% have a negative perception of air quality, 46.9% view it as average, and 12.5% as positive. Among those willing to pay for the conservation of the park, 47.7% perceive the air quality negatively, 40.9% as average, and 11.4% positively. This suggests that those with a negative perception are more likely to contribute economically, highlighting the need for greater environmental

awareness among those who perceive air quality more favorably.

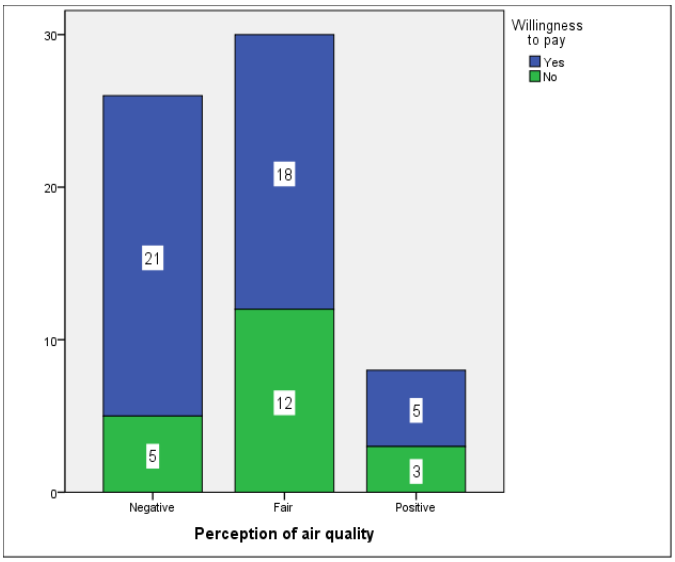

Fig. 9 Willingness to Pay by Perception of Air Quality

Figure 10 indicates that 6.3% are very dissatisfied, 35.9% are dissatisfied, 40.6% have regular satisfaction, and 17.2% are satisfied. Among those willing to pay, 4.5% are very dissatisfied, 36.4% are dissatisfied, 50.0% have regular satisfaction, and 9.1% are satisfied. This shows that the majority of those who support the conservation of the park are either dissatisfied or have regular satisfaction, indicating that the perception of deficiencies in green areas motivates their financial contribution.

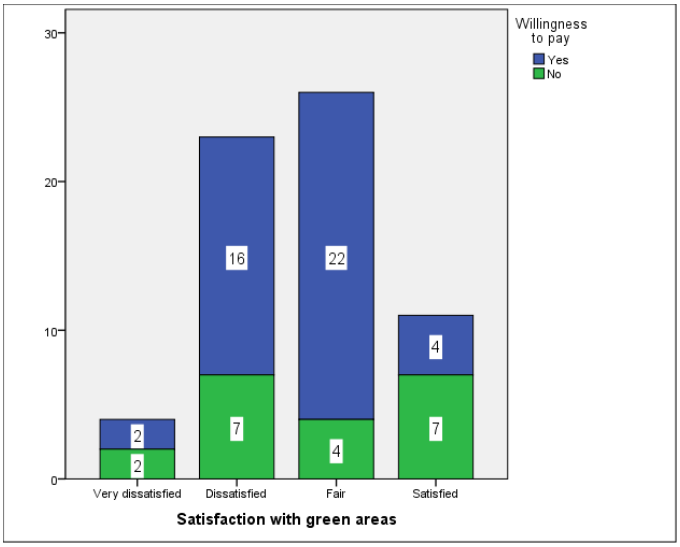

Fig. 10 Willingness to Pay by Satisfaction with Green Areas

C. *Suggested Price and DAP*

Table 1 reveals that 68.8% of respondents are willing to pay for the conservation of the park, showing a positive perception and a valuation of the green space among the inhabitants of the district. However, the 31.3% who do not wish to contribute economically represents a significant fraction of the population, indicating the existence of challenges in awareness and willingness to financially support the conservation of the space.

TABLE 1
WILLINGNESS TO PAY

Willingness to Pay					
		Frequency	%	Valid %	Cumalative%
Valid	Yes	44	68,8	68,8	68,8
	No	20	31,3	31,3	100,0
	Total	64	100,0	100,0	

D. *Determination of DAP*

The initial model is conducted with the inclusion of all study variables. In the study using binary logistic regression, it was found that variables such as gender, marital status, number of family members, and educational level do not significantly impact the willingness to pay. However, monthly income, perception of pollution, and satisfaction with green areas showed a marginal influence. Age and the perception of air quality did present a significant impact, being negative and positive respectively. Occupation, although not significant, showed a trend that could influence the willingness to pay depending on the type of work.

TABLE 2
BINARY LOGISTIC REGRESSION

Classification Table[a]					
Observed			Predicted		
			Willingness to Pay		Correct Percentage
			Yes	No	
Step 1	Willingness to Pay	Yes	42	2	95,5
		No	9	11	55,0
	Overall Percentage				82,8
a. The cut-off value is,500					

The model demonstrated high accuracy by correctly predicting 95.5% of cases (42 out of 44) where respondents were willing to pay. However, it was less effective at identifying those who were not willing to pay, achieving accuracy in only 55.0% of cases (11 out of 20). Overall, the model reached 82.8% accuracy in the general classification of willingness to pay, indicating good overall performance. According to the theoretical foundations of contingent valuation on binary modeling, the calculation of willingness to pay presents the following formula 1:

$$DAP = -a/b \quad (1)$$

With respect to the variables selected for the final model, formula 2 would be as follows:

$$DAP = \frac{\beta_0 + \beta_{edad} + \beta_{ingr} + \beta_{ocup} + \beta_{perconta} + \beta_{perccalidad} + \beta_{satisareas}}{\beta_1 Precio} \quad (2)$$

To evaluate willingness to pay, processed data were used with the statistical software SPSS, including a new variable called PRE_1 with the predicted probabilities of willingness to pay. Based on responses to a direct question from the survey that requested specific amounts (S/.3, S/.5, S/.7, S/.10), the average willingness to pay (DAP) was calculated using a formula that multiplies the predicted probability by the maximum monetary value, assuming that each person is willing to pay an amount proportional to this predicted probability.

TABLE 3
WILLINGNESS TO PAY RELATIVE TO PRICE

Willingness to Pay Relative to Price					
		Frequency	%	% valid	% cumulative
Valid	S/.3	29	45,3	45,3	45,3
	S/.5	30	46,9	46,9	92,2
	S/.7	4	6,3	6,3	98,4
	S/.10	1	1,6	1,6	100,0
	Total	64	100,0	100,0	

Table 3 indicates that the majority of respondents prefer lower amounts for their contribution: 45.3% opt for S/.3 and 46.9% for S/.5, totaling 92.2% who are willing to pay up to S/.5. Only 6.3% chose S/.7 and 1.6% S/.10. This pattern reflects a preference for economical contributions, with a notable decrease in willingness to pay as the amount increases, demonstrating a high price sensitivity among participants.

TABLE 4
CALCULATION OF THE AVERAGE FOR THE DAP VARIABLE

Statistics		
DAP		
N	Valid	64
	Missing	0
Mean		**3,1250**

This value represents the average willingness to pay based on the predicted probabilities and the maximum amount willing to be paid that you defined, where it is determined that the willingness to pay of the citizens of the San Martin District is S/.3.125 per month.

IV. DISCUSSION AND CONCLUSIONS

In the present study, it has been determined that sociodemographic characteristics, such as sex, age, family size, marital status and educational level, have a different influence on citizens' willingness to pay (WTP) for the conservation of the San Martín de Porres Monumental Park. Although the initial descriptive analysis showed a clear relationship between these characteristics and the willingness to pay, the analysis using logistic regression allowed us to identify with greater precision which of these variables exert a significant influence and which do not.

The results indicate that variables such as age and perception of air quality are key determinants in predicting willingness to pay, with the group of people between 36 and 45 years of age being especially relevant. This group showed the greatest propensity to pay, which may be linked to a stage of life in which there is greater economic stability and greater awareness of the need to conserve the environment. The negative perception of air quality also turned out to be a significant factor in the decision to contribute financially, which underlines the relevance of environmental perceptions in pro-environmental decision-making. These results are consistent with previous studies that have also found a correlation between environmental awareness and willingness to pay for natural resource conservation [6].

On the other hand, variables such as marital status, educational level, and gender did not show a statistically significant impact on willingness to pay, which contrasts with previous research in which it has been found that these factors can influence pro-environmental behavior [3]. However, the lack of statistical significance in this study could be explained by the relative homogeneity of the sample in these aspects or by the prevalence of other more determining factors, such as environmental perceptions. The choice of logistic regression was appropriate given that this method is suitable for binary dependent variables, such as willingness to pay (yes/no). In addition, it allowed us to accurately identify the factors that influence this decision. Although logistic regression has limitations, such as not capturing complex non-linear relationships, its application was effective for the purposes of this study.

As for practical implications, the results suggest that park conservation policies could benefit from campaigns highlighting air quality issues, as this factor motivated greater willingness to pay. In addition, it is essential to continue exploring other factors that may influence WTP, beyond traditional sociodemographic characteristics.

In conclusion, this study reinforces the relevance of environmental perceptions in the willingness to pay for the conservation of urban green spaces and highlights the usefulness of logistic regression to analyze this type of behavior. Future studies could broaden the approach, incorporating other factors that more accurately explain citizens' behavior in relation to environmental conservation.

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