



Economic Valuation of Senjoyo Spring Nature Tourism Using Travel Cost Method and Willingness to Pay

Awalina Choirunnisa Rachmawati¹, Hartuti Purnaweni², Prabawa Eka Soesanta¹

¹Universitas Terbuka, Tangerang Selatan, Indonesia

²Universitas Diponegoro, Semarang, Indonesia

*Corresponding Author: Awalina Choirunnisa Rachmawati

E-mail: awalina46@gmail.com



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Abstract

The Senjoyo Spring is a natural tourist destination in Semarang Regency that serves ecological, social, and economic functions for the surrounding community. However, the economic value of tourism in the area has not yet been comprehensively measured. This study aims to estimate the economic value of nature tourism at Senjoyo Spring using the Individual Travel Cost Method (ITCM) and Willingness to Pay (WTP) approaches. The study utilized primary data from 45 respondents obtained through a survey employing accidental sampling. The ITCM analysis was conducted using a regression model based on the relationship between travel costs, income, travel duration, perceptions of environmental quality, and visitor frequency. The WTP approach was used to measure visitors' willingness to pay additional costs for improvements in tourism facilities and environmental quality. The results indicate that travel costs have a negative and significant effect on visit frequency, while the other variables have a positive but insignificant effect. The consumer surplus value is Rp57,803 per person per visit, with a potential tourism economic value reaching Rp6.36 billion per year. The WTP results indicate that tourists are generally willing to pay higher amounts if facilities and environmental quality are improved. The combination of the ITCM and WTP approaches provides a more comprehensive estimate of tourism economic value to support sustainable tourism management.

Introduction

The tourism sector stands as one of the most strategically significant contributors to regional economic growth, driving income generation, employment creation, and the expansion of local enterprises around tourist destinations. Tourism activities contribute broadly to regional revenue while simultaneously improving community welfare through the diverse economic activities that flourish in and around tourism areas (Tietenberg & Lewis, 2012). In recent years, nature-based tourism has experienced remarkable growth, reflecting a rising public interest in recreational activities that draw on the beauty of natural environments such as forests, mountains, coastlines, and freshwater springs (Wardhani, Handayani, Az Zahra, Jordan Hasan, & Octavianida Arlina, 2023). Nature-based tourism carries particular significance for sustainable development, given its capacity to integrate economic, social, and environmental conservation dimensions within a single framework (Hanley, Shogren, & White, 2007). The sustainable management of natural tourism sites thus becomes essential to ensuring that economic benefits are optimized while the integrity of natural resources is preserved.

Senjoyo Spring, located in Semarang Regency, Central Java, represents one such natural tourism destination with considerable economic development potential. The site fulfills important ecological and social functions for surrounding communities, serving simultaneously

as a source of clean water and a recreational destination offering a range of activities including swimming, leisure, and immersion in the natural environment. The growing number of visitors to this area suggests that the site holds meaningful economic benefits for both local communities and regional government. Nevertheless, the economic value generated by tourism activities within the area has not been measured comprehensively, creating a clear need for an analytical approach capable of estimating that value in a rigorous manner.

Within the field of environmental economics, the economic value of natural resources can be estimated through environmental valuation. This approach is employed to quantify the economic benefits derived from natural resources that lack direct market prices (Haab & McConnell, 2002). Economic valuation holds particular importance in policy decision-making processes, as it provides monetary estimates of ecosystem benefits that are frequently absent from market mechanisms (Smith, 2019). Among the methods widely applied to estimate the economic value of tourism sites, the Travel Cost Method (TCM) has gained broad recognition. TCM estimates the economic value of a tourism destination based on the expenditures visitors incur when traveling to the site, and by examining the relationship between travel costs and visit frequency, the method enables researchers to estimate recreational demand and calculate the economic benefits associated with a given destination (Pirikiya, Amirnejad, Oladi, & Solout, 2016).

The TCM has evolved into two principal analytical variants, namely the Zonal Travel Cost Method (ZTCM) and the Individual Travel Cost Method (ITCM). The ZTCM uses geographic zones as the unit of analysis, whereas the ITCM relies on individual-level visitor data to estimate the recreational demand function based on socioeconomic characteristics, travel costs, and visit frequency. The ITCM allows for a more detailed examination of visitor behavior precisely because it operates at the individual level (Syuhada et al., 2023). For this reason, the present study adopts the ITCM framework to estimate the economic value of Senjoyo Spring by analyzing the relationship between travel costs and visitor frequency.

Within the ITCM framework, recreational visit demand is shaped by more than travel costs alone. Socioeconomic characteristics and visitors' perceptions of destination quality also play meaningful roles. Monthly income is among the variables most commonly incorporated into recreational demand analyses. Theoretically, income levels influence an individual's capacity to allocate expenditure toward leisure and tourism activities (Tietenberg & Lewis, 2018). Hakim et al. (2011) found that visitor income had a significant effect on visit frequency, a finding echoed by Matthew et al. (2019), who demonstrated a positive relationship between income levels and recreational demand at ecotourism sites in Malaysia.

Beyond income, travel time constitutes another important variable in ITCM analyses, as it represents the time cost visitors bear when traveling to a destination. In recreation economics, travel time is regarded as a component of total travel cost that can influence visit decisions (Loomis & Walsh, 1997). Septriani & Yusnida (2023) found that distance and travel time significantly affected visit frequency at nature-based tourism sites, while Pirikiya et al. (2016) similarly observed that higher travel costs and longer travel times tend to reduce visit frequency.

Visitors' perceptions of environmental quality constitute a further factor shaping recreational visit demand. Environmental quality perceptions reflect how visitors assess the cleanliness, comfort, natural beauty, and ecological condition of a tourism site, all of which can influence satisfaction levels and visit decisions. In the context of nature-based tourism, environmental quality functions as one of the primary determinants of destination attractiveness (Hanley et al., 2007). Munawir et al. (2023) demonstrated that environmental quality and tourism facilities

influenced visitor preferences regarding willingness to pay for site improvements, while Simanjorang et al. (2018) found that visitors were more inclined to pay higher amounts in support of conservation efforts at nature tourism sites with favorable environmental conditions.

Empirical studies across various settings confirm that socioeconomic factors shape tourism demand. Research by Hakim et al. (2011) at the Rawapening tourism site in Central Java found that travel costs, income, age, and prior visit experience all influenced visit frequency. A study at Kilim Karst Geoforest Park in Malaysia similarly demonstrated that TCM could effectively estimate recreational benefits through visitor demand analysis (Matthew et al., 2019). Research at Bukit Kaba Nature Tourism Park further showed that travel costs, distance from place of residence, income, and educational attainment significantly influenced visit decisions (Septriani & Yusnida, 2023). Consumer surplus analysis at the Petrus Kafiir Beach tourism site also revealed that visitors derived economic benefits exceeding the actual travel costs they incurred (Rahayu & Haryati, 2022).

Alongside the travel cost approach, economic valuation of tourism sites can also be conducted through the Willingness to Pay (WTP) framework, which captures the maximum amount an individual is willing to pay to secure improvements in environmental quality or to preserve the existence of a natural resource (Tietenberg & Lewis, 2018). WTP values reflect individual preferences regarding environmental quality and the benefits drawn from natural resources, and the measure is widely used to assess the non-market value of environmental goods (Hanley et al., 2007).

In practice, WTP is most commonly measured through the Contingent Valuation Method (CVM), a survey-based technique used to elicit visitors' willingness to pay for the maintenance of environmental quality or the enhancement of tourism facilities (Haab & McConnell, 2002). CVM is among the most extensively applied techniques in environmental economic valuation because it can estimate the economic value of non-traded resources through stated preferences expressed directly by respondents (Carson, 2012). Simanjorang et al. (2018) found that visitors expressed willingness to pay additional amounts to support facility development and conservation at the Sipiso-piso Waterfall nature tourism area, and similar findings emerged from a study at BSD City Park, where the majority of visitors indicated willingness to contribute financially toward improvements in facility quality and the environmental condition of the park as a public recreational space (Munawir et al., 2023).

Despite the growing body of literature on tourism economic valuation, most existing studies rely on a single valuation approach, which limits the comprehensiveness of the resulting economic estimates. Research specifically focused on natural spring-based tourism sites remains comparatively sparse, particularly for community-grown local destinations. Prior studies have also tended to center on travel cost variables without fully integrating socioeconomic factors and environmental quality perceptions into the recreational demand model, even though variables such as income, travel time, and environmental quality perceptions are known to play important roles in shaping visitor behavior at nature tourism destinations.

Against this backdrop, the present study employs two complementary economic valuation approaches to estimate the economic value of Senjoyo Spring, namely the Individual Travel Cost Method (ITCM) and Willingness to Pay (WTP). The ITCM is used to estimate recreational benefit values by examining the relationships among travel costs, monthly income, travel time, environmental quality perceptions, and visit frequency, with consumer surplus subsequently derived as an estimate of the site's economic value (Pirikiya et al., 2016; Syuhada et al., 2023). The WTP approach, meanwhile, is employed to measure visitors' willingness to

pay additional amounts for tourism facility improvements and environmental conservation, thereby capturing visitor preferences regarding environmental quality and the available tourism services (Haab & McConnell, 2002; Tietenberg & Lewis, 2018).

By combining these two approaches, this study aims to generate a more comprehensive estimate of the economic value of Senjoyo Spring as a tourism site. The findings are expected to contribute to the academic literature on natural resource economic valuation, particularly for spring-based tourism destinations, and to provide evidence-based insights for local government and tourism managers in formulating sustainable tourism management policies. Accordingly, this study aims to estimate the economic value of the Senjoyo Spring nature tourism site in Semarang Regency through the application of the Individual Travel Cost Method (ITCM) and Willingness to Pay (WTP) approaches.

Methods

This study was conducted at the Senjoyo Spring nature tourism site located in Njubug hamlet, Tegalwaton, Tengaran District, Semarang Regency, Central Java. Senjoyo Spring serves as a primary water source for the city of Salatiga as well as parts of Semarang and Boyolali regencies, as illustrated in Figure 1. The site was selected for this study because of its multifunctional character, fulfilling protective, sociocultural, and tourism functions that are accessible to local residents and visitors from outside the Tegalwaton area alike. As an upstream river system with abundant water resources, Senjoyo holds considerable potential across several domains including hydropower, irrigation, tourism, and biodiversity conservation. Beyond its ecological and economic relevance, the site also carries historical significance, having long served cultural and spiritual functions for surrounding communities.

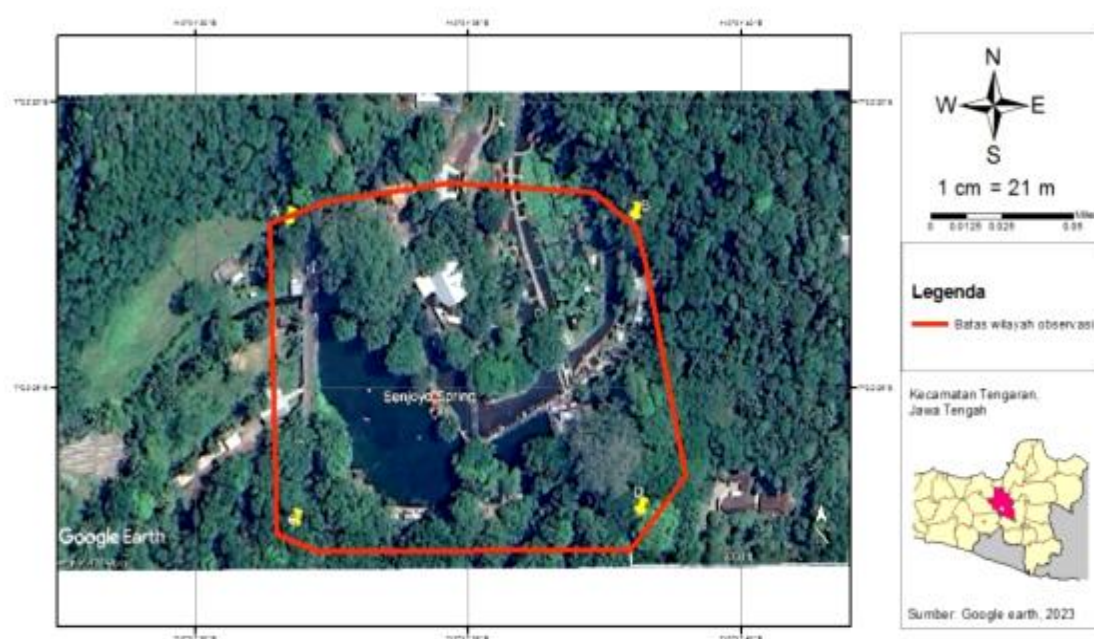


Figure 1. Location Map of Senjoyo Spring, 2021 (Reza, Cahyaningrum, & Hastuti, 2021)

This study adopted a mixed-methods design, in which quantitative data collected through structured questionnaires formed the primary basis for the ITCM and WTP analyses, while qualitative data obtained through direct interviews served a complementary role in clarifying respondents' answers and enriching the interpretation of the quantitative findings. The

qualitative component was thus treated as supportive rather than as an independent analytical strand, and no separate qualitative coding procedure was applied to the interview material.

The population of this study consists of all visitors to Senjoyo Spring during the data collection period, a group whose exact size could not be determined precisely given the absence of an official daily visitor register at the site, though management estimates point to a substantial and continuously fluctuating flow of visitors throughout the week. Because no complete sampling frame could be established under these conditions, respondents were selected using accidental sampling, a technique in which participants are drawn from whoever happens to be present at the site during the data collection period (Ramadhani, Yuliati, & Wahyuni, 2023), with the additional criterion that respondents had visited the site voluntarily as recreational tourists rather than as vendors, staff, or transiting residents. A total of 45 respondents were surveyed, a sample size regarded as adequate for the exploratory scope of the ITCM and regression analysis undertaken here and broadly comparable to sample sizes used in prior ITCM-based valuation studies at similarly scaled tourism sites (Hakim et al., 2011; Simanjorang et al., 2018). It should nonetheless be acknowledged that accidental sampling carries an inherent risk of selection bias, since visitors present during the survey window may differ systematically from those visiting on other days, seasons, or times, and this constraint is treated as a limitation on the generalizability of the study's findings rather than a flaw that can be resolved retroactively.

Data collection was conducted directly at the main recreational area of Senjoyo Spring in Njubug hamlet, Tegalwaton, during October 2025, timed to coincide with periods of higher visitor traffic in order to reach a broader cross-section of visitors within the available survey window. Respondents who agreed to participate completed a structured questionnaire administered digitally through Google Form, accessed via a link or QR code provided directly by the research team, with assistance offered to respondents who were less familiar with digital forms. A subset of respondents also took part in brief follow-up interviews conducted immediately after questionnaire completion, which were used to clarify ambiguous responses and to probe further into visitors' perceptions of facility conditions and environmental quality, providing contextual detail that supported interpretation of the quantitative results rather than constituting a separate qualitative dataset.

The questionnaire was designed in Indonesian and covered four sections, namely respondent demographics, travel characteristics, perceptions of the recreational resource, and willingness to pay. Respondent demographics captured gender, age, occupation, and monthly income, while travel characteristics recorded transportation mode, travel time, travel expenditure, and visit frequency. Perceptions of the recreational resource were measured through a set of indicators covering cleanliness, natural ambience, and sanitation facilities, each rated on a five-point Likert scale ranging from very poor to very good, with the item scores subsequently averaged into a single composite environmental quality perception score used as X4 in the regression model. Willingness to pay was measured using an open-ended elicitation format, in which respondents stated the maximum amount they were willing to pay as an entrance fee under two scenarios, namely current site conditions and a hypothetical scenario involving facility and environmental improvements, with the stated amounts subsequently grouped into intervals for descriptive presentation in Tables 6 and 7. Formal validity and reliability testing was not conducted for this instrument, given the exploratory nature of the study and the relatively small sample size available, and this is acknowledged as a limitation of the current instrument.

The Travel Cost Method (TCM) is a non-market valuation procedure that assigns economic value to a recreational site by drawing on consumption behavior in related markets (Pirikiya et

al., 2016). In essence, TCM estimates a visitor's willingness to pay for access to a given site based on the costs they bear to reach it. This study applies the Individual Travel Cost Method (ITCM), which was chosen because it accommodates socioeconomic characteristics as explanatory variables within the demand model (Syuhada et al., 2023). In this framework, the dependent variable is the number of visits made by each individual to Senjoyo Spring, while the independent variables encompass travel expenditure consisting of transportation, food and beverages, documentation, parking, and other incidental costs. The recreational demand function was estimated using ordinary least squares regression expressed as follows.

$$V_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

In this equation, V_i represents the number of visits made by the individual to Senjoyo Spring over the reference period, measured as a count in number of visits. The constant α denotes the baseline visit frequency when all explanatory variables are held at zero, while β_1 through β_4 are the regression coefficients associated with each explanatory variable. X_1 denotes total travel expenditure incurred by the individual, measured in Indonesian Rupiah (IDR) per visit and consisting of transportation, food and beverages, documentation, parking, and other incidental costs, and is expected to carry a negative coefficient consistent with standard demand theory, in which higher implicit prices reduce visit frequency. X_2 refers to monthly income, measured in IDR, and is expected to carry a positive coefficient, reflecting the greater capacity of higher-income individuals to allocate resources toward recreational activity. X_3 captures travel time, measured in minutes required to reach the site, for which the expected direction is ambiguous a priori, since longer travel time may either discourage visits through higher time cost or, alternatively, indicate stronger destination loyalty among visitors traveling from farther locations. X_4 represents the visitor's environmental quality perception, measured on the composite Likert scale described in the instrument section, and is expected to carry a positive coefficient, given that higher perceived environmental quality is generally associated with a greater likelihood of repeat visitation. Finally, ε is the error term capturing unobserved factors influencing visit frequency.

It is acknowledged that the dependent variable in this model, visit frequency, is a count variable rather than a continuous one, which in principle makes count-data models such as Poisson or negative binomial regression more theoretically appropriate than ordinary least squares. Ordinary least squares was nonetheless retained in this study to preserve comparability with the majority of prior ITCM studies employing the same estimation approach (Pirikiya et al., 2016; Syuhada et al., 2023), and because the relatively wide range of observed visit counts in the sample reduces the practical distortion that count-data violations typically introduce into OLS estimates. A Poisson regression using the same explanatory variables was also considered as an alternative specification, but OLS was ultimately retained given its comparability with prior ITCM literature and the diagnostic results reported below.

The classical assumptions underlying the OLS estimation were subsequently examined through a series of diagnostic tests, with the full results reported in Table 5 in the Results and Discussion section. Multicollinearity among the explanatory variables was assessed using the variance inflation factor, yielding a mean VIF of 1.48 and a highest individual value of 1.89 for travel time, both comfortably below the conventional threshold of 5 and thus indicating no meaningful multicollinearity in the model. Heteroskedasticity was tested using the Breusch-Pagan/Cook-Weisberg test, which returned a chi-square value of 1.87 with a p-value of 0.171, providing no evidence of heteroskedasticity in the residuals. Normality of the residuals was assessed using the Shapiro-Wilk test, which produced a statistic of 0.973 with a p-value of 0.386, indicating that the residuals did not deviate significantly from a normal distribution.

Taken together, these diagnostic results confirm that the classical OLS assumptions were reasonably satisfied, lending support to the validity of the coefficient estimates and significance levels reported in Table 3. Future studies are encouraged to adopt Poisson or negative binomial regression as a robustness check against the OLS estimates reported here.

The results of the TCM regression were subsequently used to estimate consumer surplus (CS), which serves as the core economic indicator in this analysis. Consumer surplus represents the difference between what a visitor is willing to pay for access to a recreational site and what they actually spend to visit it, thereby reflecting the net economic benefit derived from the recreational experience (Ian J. Bateman (ed.), 2001). In the ITCM framework, consumer surplus per visit is calculated as the negative inverse of the travel cost coefficient obtained from the demand function, expressed as follows.

$$CS = \frac{-1}{\beta_1}.$$

The Willingness to Pay (WTP) approach complements the ITCM analysis by capturing the maximum amount visitors are prepared to pay to obtain environmental benefits from the site (Tietenberg & Lewis, 2012). Champ et al. (2017) further describe WTP as an individual's readiness to exchange a monetary sum in return for a perceived benefit or improvement. The mean WTP across all willing respondents was calculated using the following formula. The payment vehicle used in this study was a site entrance fee, consistent with the current absence of formal ticketing at Senjoyo Spring, and respondents were asked to state their maximum willingness to pay for this entrance fee under two distinct payment scenarios, namely current site conditions and a hypothetical scenario involving facility and environmental improvements. Respondents who stated a WTP value of zero were retained in the calculation of mean WTP rather than excluded as protest bids, since follow-up interview responses indicated that these respondents genuinely regarded the current facility conditions as insufficient to warrant any payment rather than rejecting the valuation exercise itself.

$$EWTP = \sum_{i=1}^n W_i / n$$

In this formula, EWTP denotes the average WTP value across respondents, W_i is the WTP amount stated by the i -th respondent, and n is the total number of respondents (Rahayu & Haryati, 2022).

Finally, the potential economic value (PEV) of the tourism site was estimated by multiplying the consumer surplus per visit by the total number of annual visitors, following the formula proposed by Firman et al. (2018).

$$PEV = CS \times N$$

Here, N represents the total number of visitors to the site within a given year, and the resulting PEV figure reflects the aggregate economic benefit that the site provides to its visitors beyond what they actually spend to access it.

Ethical considerations were observed throughout the data collection process. Prior to participation, all respondents were informed of the purpose and scope of the study and provided verbal consent before completing the questionnaire or taking part in the follow-up interview. No personally identifying information was collected, and all responses were recorded and reported only in aggregated form to protect respondent confidentiality.

Result and Discussion

The demographic profile of respondents presented in Table 1 reveals that the majority of visitors surveyed were female, accounting for 75.6% of the total sample. Most respondents fell within the 21 to 30 years age group, representing 64.4% of the 45 participants. In terms of occupation, 60% were employed as workers or staff, while income levels were predominantly in the lower-to-middle range, with 44.4% earning below IDR 2,000,000 per month and 46.7% earning between IDR 2,000,000 and IDR 3,000,000. Motorcycles were the dominant mode of transportation, used by 88.9% of respondents, and more than half of the visitors (53.3%) reached the site in under 20 minutes. These characteristics suggest that the majority of visitors to Senjoyo Spring originate from the surrounding area and belong to relatively modest socioeconomic backgrounds.

Table 1. Demographic Profile of Respondents (n=45)

Characteristic	Category	Number	Percentage (%)
Gender	Male	11	24.4
	Female	34	75.6
Age	≤20 years	6	13.3
	21–30 years	29	64.4
	>30 years	10	22.2
Occupation	Unemployed	10	22.2
	Employee	27	60.0
	Educator	2	4.4
	Other	6	13.3
Monthly Income (IDR)	<2,000,000	20	44.4
	2,000,000–3,000,000	21	46.7
	>3,000,000	4	8.8
Transportation	Car	5	11.1
	Motorcycle	40	88.9
Visit Frequency	2 times	6	13.3
	3 times	6	13.3
	≥4 times	33	73.3
Travel Time	<20 minutes	24	53.3
	20–40 minutes	16	35.6
	>40 minutes	5	11.1
Group Size	1–5 persons	35	77.8
	6–10 persons	4	8.9
	>10 persons	6	13.3

Source: Authors' own research, 2025

The descriptive statistics for travel costs are presented in Table 2. The mean travel cost per visit was IDR 33,639, with a minimum of IDR 10,000 and a maximum of IDR 100,000, reflecting the relatively affordable nature of visiting Senjoyo Spring for the surrounding community.

Table 2. Descriptive Analysis of Travel Cost

Variable	Mean	Median	Standard Deviation	Min	Max
Travel Costs (IDR)	33,639	30,000	19,451	10,000	100,000

Source: Authors' own research, 2025

Beyond travel cost, respondents' perceptions of environmental quality were also assessed descriptively prior to being entered into the regression model as X4. As explained in the instrument section, this variable was measured through three indicators, namely cleanliness, natural ambience, and the condition of sanitation facilities, each rated on a five-point Likert scale ranging from 1 (very poor) to 5 (very good), with the three item scores averaged into a single composite score for each respondent. Across the 45 respondents, the composite environmental quality perception score yielded a mean of 3.73 on the five-point scale, with a standard deviation of 1.03 and scores ranging from 1.94 to 5.00. This mean falls within the good category on the conventional five-point interpretation range, indicating that visitors generally regarded the environmental condition of Senjoyo Spring, namely its cleanliness, natural ambience, and sanitation facilities, in a favorable light despite the site's largely informal management and the absence of dedicated tourism infrastructure. This relatively favorable perception helps contextualize the positive though statistically insignificant coefficient this variable subsequently returns in the regression model. This descriptive pattern was also echoed in the follow-up interviews conducted alongside the questionnaire, which offered a more personal account of how visitors experienced the site's environmental condition. One respondent described her impression of the site as follows.

"The water is still very clear and the atmosphere is cool. I usually come here with my family because it feels natural and relaxing, although some public facilities such as toilets and seating areas could still be improved" (Participant 12, female, 27 years old).

Such accounts suggest that visitors' generally favorable perception of environmental quality coexists with a clear awareness of the site's remaining infrastructural limitations, a nuance that the composite score alone does not fully capture.

To examine the relationship between visit frequency and travel cost, the data were analyzed using a regression demand function estimated under the Individual Travel Cost (ITCM) specification with Stata. The regression results are reported in Table 3.

Table 3. Regression Results

Variable	Coefficient	Std. Error	t	Prob.
Travel cost	-0.0000173	0.0000050	-3.16	0.003
Monthly income	5.32e-08	7.81e-08	0.68	0.499
Travel time	0.002004	0.003279	0.61	0.545
Environmental quality perception	0.495692	0.5224607	0.95	0.348
Constant	3.649149	0.5089702	7.17	0.000

Source: Authors' own research, 2025

Based on the regression estimation, the recreational demand function is expressed as $V_i = 3.649 - 0.0000173X_1 + 0.0000000532X_2 + 0.002004X_3 + 0.495692X_4 + \varepsilon$, where V_i represents the number of visits made by each individual. X_1 captures total travel expenditure incurred by the visitor, encompassing transportation, food and beverages, documentation, parking, and other related costs. X_2 refers to monthly visitor income, X_3 denotes travel time to the site, and X_4 reflects the visitor's environmental quality perception, covering assessments of cleanliness, natural ambience, and sanitation facilities.

The travel cost variable yielded a negative and statistically significant coefficient, indicating an inverse relationship between travel expenditure and visit frequency. This finding is consistent with the view expressed by Field & Field (2016) that travel cost functions as a financial proxy for the utility derived from a recreational site, and that rising travel costs will

correspondingly reduce the frequency with which individuals choose to visit. Champ et al. (2017) similarly affirm that the tourism demand function exhibits a negative relationship between travel cost and individual visit frequency, in line with the fundamental logic of demand theory. Beyond these theoretical explanations, the interview data offer a more concrete illustration of how travel cost shapes actual visitation behavior. One respondent explained his own reasoning in the following terms.

"I like visiting Senjoyo Spring because it is close to my home. If transportation and other expenses became much higher, I would probably visit less often" (Participant 8, male, 31 years old).

This account grounds the regression finding in visitors' own reasoning, reinforcing that travel cost is not merely a statistical abstraction but a factor visitors themselves recognize as shaping how often they return.

The remaining three variables, namely monthly income, travel time, and environmental quality perception, all returned positive coefficients, yet none reached statistical significance based on their p-values. The non-significant effect of income aligns with findings Djeri et al. (2014), who argued that income level does not necessarily drive tourism decision-making; while income may influence the choice of destination, the frequency of visitation is more often governed by psychological motivation than by financial capacity. The insignificant effect of travel time is similarly interpretable, as visitors appear to regard the time invested in reaching the site as commensurate with the satisfaction they derive from the experience. This pattern is further supported by Karnowahadi et al. (2021), who noted that travel-related factors and environmental quality perceptions do not consistently determine visit frequency. Ozdemir & Tosun (2023) add a further dimension to this finding by drawing attention to what they describe as an environmental paradox, whereby destinations experiencing environmental degradation still attract high visitor numbers, driven largely by social media visibility rather than the quality of the site itself. A similar pattern of reasoning emerged from the interviews with respect to travel time. One respondent recalled her experience in the following way.

"Even though it takes around forty minutes to get here, I don't mind because the place is worth the trip and I usually come with friends on weekends" (Participant 21, female, 24 years old).

This willingness to overlook travel time in favor of the overall recreational experience helps explain why travel time failed to emerge as a statistically significant predictor of visit frequency in the regression model. The model fit statistics are summarized in Table 4.

Table 4. Model Statistics

Indicator	Value
Number of Observations	45
F-Statistic	3.31
Prob > F	0.0195
R-Squared	0.2489
Adj. R-Squared	0.1738
Root MSE	0.6543

Source: Authors' own research, 2025

The F-statistic probability of 0.0195, which falls below the 5% significance threshold, confirms that the model is statistically significant overall. The R-squared value of 0.2489 indicates that the independent variables in the model account for approximately 24.89% of the variation in

individual visit frequency, while the remaining 75.11% is attributable to factors outside the scope of the current model.

Beyond overall model fit, the classical assumptions underlying the OLS estimation were examined through a series of diagnostic tests, summarized in Table 5.

Table 5. Diagnostic Test Results

Test	Statistic	p-value	Interpretation
Multicollinearity, mean VIF	1.48	not applicable	No meaningful multicollinearity, all VIF values fall below the threshold of 5
Multicollinearity, highest VIF (travel time)	1.89	not applicable	Within acceptable range
Heteroskedasticity, Breusch-Pagan/Cook-Weisberg	chi-square 1.87	0.171	No evidence of heteroskedasticity
Normality of residuals, Shapiro-Wilk	0.973	0.386	Residuals do not deviate significantly from a normal distribution

Source: Authors' own research, 2025

The mean VIF of 1.48, together with a highest individual value of 1.89 for travel time, indicates that multicollinearity among the explanatory variables does not pose a concern for the reliability of the coefficient estimates. The Breusch-Pagan test result, with a chi-square value of 1.87 and a p-value of 0.171, provides no evidence of heteroskedasticity in the residuals, consistent with the assumption of constant error variance required for valid OLS inference. The Shapiro-Wilk test further indicates that the residuals do not depart significantly from normality, given a p-value of 0.386. Taken together, these results confirm that the classical OLS assumptions are reasonably satisfied, lending support to the validity of the coefficient estimates and significance levels reported in Table 3.

It is nonetheless important to note that these diagnostic tests only address the classical assumptions of the linear regression framework and do not by themselves resolve the more fundamental concern that visit frequency, the dependent variable in this model, is a count variable rather than a continuous one. The satisfactory diagnostic results reported above therefore indicate that the OLS estimates are internally consistent given the data at hand, while the broader question of model suitability for count outcomes remains best addressed through future application of Poisson or negative binomial regression, as noted in the methodology.

The recreational demand function derived from the ITCM regression was subsequently used to calculate consumer surplus. In environmental economic analysis, consumer surplus serves as the key indicator of the net economic benefit that individuals obtain from recreational activity. It represents the difference between the maximum amount a visitor would be willing to pay to access a tourism site and the actual travel cost they incur (Hanley et al., 2007; Tietenberg & Lewis, 2018). Under the ITCM framework, consumer surplus per visit is derived as the negative inverse of the travel cost coefficient from the demand function, given that this coefficient captures the responsiveness of visit frequency to changes in travel expenditure.

This calculation proceeds in three steps. First, the coefficient of the travel cost variable is taken directly from the regression output reported in Table 3, namely β_1 equal to -0.0000173. Second, this coefficient is entered into the consumer surplus formula, CS equal to negative one divided by β_1 . Third, carrying out the division yields CS equal to negative one divided by negative

0.0000173, which equals IDR 57,803 per person per visit. This value indicates that visitors to Senjoyo Spring receive a net economic benefit from their recreational experience that substantially exceeds what they actually spend to reach the site, reflecting a level of satisfaction and perceived value well above the financial cost they bear. The finding points to the relatively high recreational benefit value that Senjoyo Spring provides as a nature tourism destination for the surrounding community.

While consumer surplus captures the economic value derived from actual visit behavior, it does not directly reveal how visitors would respond to changes in facility quality. To complement this, a Willingness to Pay (WTP) analysis was conducted to assess the amounts visitors are prepared to pay for site access under both current conditions and a scenario involving facility improvements. Table 6 presents the distribution of WTP values under existing conditions.

Table 6. Visitor Willingness to Pay Under Existing Conditions

WTP Amount (IDR)	Number of Respondents	Percentage (%)
0	2	4.4
1,000–5,000	13	28.9
6,000–10,000	16	35.5
11,000–15,000	3	6.7
16,000–20,000	7	15.6
21,000–25,000	3	6.7
26,000–30,000	1	2.2
>30,000	0	0.0
Total	45	100

Source: Authors' own research, 2025

The results show that the largest share of respondents, at 35.5%, indicated willingness to pay between IDR 6,000 and IDR 10,000, followed by 28.9% in the IDR 1,000 to IDR 5,000 range. Approximately 15.6% were willing to pay between IDR 16,000 and IDR 20,000, while proportions declined progressively at higher payment thresholds, with 6.7% in the IDR 21,000 to IDR 25,000 range and only 2.2% willing to pay between IDR 26,000 and IDR 30,000. The overall distribution indicates that most visitors hold relatively modest payment preferences, centered in the IDR 5,000 to IDR 10,000 range. This pattern likely reflects visitors' perceptions of the current facility conditions as still limited, which in turn constrains their sense of received value and reduces their inclination to pay higher entrance fees. The mean WTP under existing conditions was calculated as $EWTP = \sum W_i = \text{IDR } 11,244$ per person per visit, representing the average entrance fee that visitors are willing to pay given the current state of facilities at the site.

Of the 45 respondents surveyed, one did not provide a valid response when asked about willingness to pay under the facility improvement scenario and was therefore excluded from this particular analysis, resulting in a slightly reduced sample of 44 respondents for this scenario alone. Table 7 presents the corresponding WTP distribution under the facility improvement scenario.

Table 7 presents the corresponding WTP distribution under the facility improvement scenario.

Table 7. Visitor Willingness to Pay Under a Facility Improvement Scenario

WTP Amount (IDR)	Number of Respondents	Percentage (%)
0	0	0.0

1,000–5,000	5	11.4
6,000–10,000	14	31.8
11,000–15,000	7	15.9
16,000–20,000	6	13.6
21,000–25,000	7	15.9
26,000–30,000	5	11.4
>30,000	0	0.0
Total	44	100

Source: Authors' own research, 2025

When presented with a facility improvement scenario, the WTP distribution shifted upward in a meaningful way. The modal response remained in the IDR 6,000 to IDR 10,000 range at 31.8%, but a considerably larger proportion of respondents expressed willingness to pay amounts above IDR 10,000 compared to the existing condition scenario. The IDR 11,000 to IDR 15,000 and IDR 21,000 to IDR 25,000 ranges each attracted 15.9% of respondents, while 13.6% indicated willingness to pay between IDR 16,000 and IDR 20,000, and 11.4% were prepared to pay between IDR 26,000 and IDR 30,000. Notably, no respondent indicated a willingness to pay of IDR 0 in this scenario, demonstrating that every visitor was prepared to make a financial contribution if facilities were improved. The mean WTP under this scenario, calculated using the same formula applied to the existing condition scenario, rose to IDR 15,644 per person per visit, indicating a clear upward shift in payment preferences when facility quality is enhanced. The interview responses help explain the reasoning behind this upward shift. One respondent stated her willingness in the following terms.

"If the toilets, parking area, and cleanliness are improved, I would not mind paying a higher entrance fee because the experience would be much better" (Participant 17, female, 26 years old).

This account reflects the broader pattern observed in Table 7, in which visitors' willingness to pay rises in tandem with expected improvements to facility and environmental conditions, rather than being driven by price alone.

A visual comparison of WTP distributions under both scenarios is provided in Figure 2.

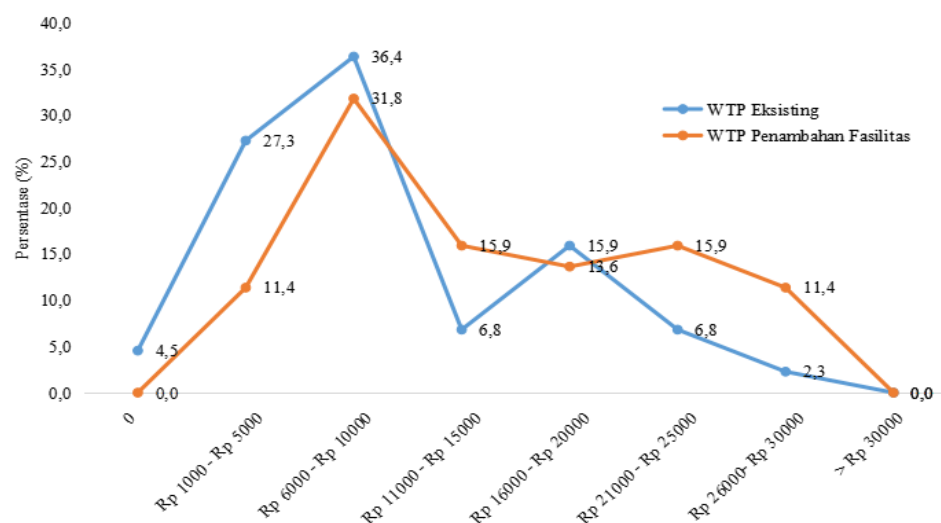


Figure 2. Comparative Chart of Willingness to Pay Under Existing Conditions and the Facility Improvement Scenario

The comparison between the two WTP scenarios confirms an upward shift in visitors' payment preferences following the introduction of facility improvements, underscoring that facility and environmental quality play a meaningful role in shaping visitors' economic valuation of the site. This finding suggests that investment in facility development holds the potential to increase the economic returns generated by the tourism sector at Senjoyo Spring.

Drawing on the consumer surplus estimate of IDR 57,803 per visitor per visit, the potential economic value of Senjoyo Spring was calculated by multiplying this figure by the total annual visitor count. Since no official visitor register is maintained for the site, the annual visitor figure used in this calculation, approximately 110,000 visitors in 2024, was obtained through interviews with site management during fieldwork. With this figure, the total potential economic value of the site is estimated at IDR 6,358,330,000 per year. This figure should accordingly be read as an indicative estimate rather than a precise measurement, and it reflects the aggregate net economic benefit that visitors receive from the existence of Senjoyo Spring as a tourism destination, over and above the travel costs they personally bear. Even under this indicative estimate, the magnitude of the value suggests that Senjoyo Spring carries considerable economic weight as an environmental resource, delivering recreational, social, and economic benefits to both the local community and the broader surrounding region.

Taken together, these findings directly address the research objectives set out at the beginning of this study. The ITCM procedure, from the estimation of the demand function through to the derivation of consumer surplus, demonstrates that travel cost functions as an implicit price capable of explaining variation in visit frequency, thereby confirming that Senjoyo Spring holds a measurable recreational value beyond what visitors formally spend to access it. The WTP procedure complements this finding by capturing visitors' own valuation of potential improvements, showing that willingness to pay rises meaningfully when facility and environmental conditions are enhanced. Read alongside one another, the ITCM and WTP results converge on a consistent conclusion, namely that Senjoyo Spring already generates substantial recreational and economic value under its current informal management, while also holding clear potential for greater value capture should facility quality be improved. This combined evidence provides the empirical basis for the policy implications discussed in the following section.

The significant negative relationship between travel cost and visit frequency confirms that access expenditure functions as an implicit admission price for Senjoyo Spring. Visitors facing higher transportation, food, parking, and incidental expenses tend to reduce the frequency of their visits. This result is consistent with Amiri and Mohammadi Limaiei (2021), who found that increasing travel expenditure reduced visitation to the Kahman forest area because recreational trips compete with other household expenditures. Similarly, Juutinen et al. (2022) demonstrated across six Nordic landscapes that travel expenses substantially influenced recreational demand, although the magnitude varied according to accessibility and landscape characteristics. The present result is also aligned with Septriani and Yusnida (2023), whose count-data analysis of Bukit Kaba Nature Tourism Park identified travel cost as a central determinant of visitation. Together, these comparisons indicate that the recreational demand for Senjoyo Spring follows conventional demand theory: even where formal entrance charges are limited, visitors respond to the total cost of reaching and using the destination.

The result is particularly relevant because most respondents travelled by motorcycle and lived relatively close to the site. This visitor structure suggests that Senjoyo Spring primarily operates as an accessible local recreation area rather than a high-cost destination attracting predominantly long-distance tourists. Wardhani et al. (2023) similarly found that the economic

value of Sungai Mudal was closely connected to its accessibility and the costs incurred by individual visitors. Karnowahadi et al. (2021) further demonstrated that tourism demand at Lawang Sewu was affected not only by the attractiveness of the destination but also by the economic burden associated with making the trip. More recently, Adu et al. (2024) reported an inverse relationship between travel costs and visitation at Bunso Eco-Park, while also showing that knowledge of alternative destinations influenced recreational choices. Therefore, keeping Senjoyo Spring physically and financially accessible is important. Substantial increases in entrance fees or indirect visitor costs could reduce repeat visitation, particularly among the lower-income groups that dominate the current market.

Monthly income did not significantly predict visit frequency. This does not necessarily imply that income is irrelevant; rather, the relatively low cost and local character of the destination may allow visitors from different income groups to access it without major financial constraints. Rahayu and Haryati (2022) reported that visitors to Petrus Kafiir Beach obtained recreational benefits exceeding their actual travel expenditure, illustrating how low-cost natural destinations can generate substantial utility without being strongly dependent on income. Wubalem et al. (2023) similarly showed that socioeconomic variables did not uniformly determine recreational demand at Lake Tana because site accessibility, visitor motivation, and substitution possibilities also shaped visitation. Adu et al. (2024) found several demographic variables insignificant after travel cost and destination-related factors were controlled. In the present study, the concentration of respondents within relatively similar lower- and middle-income categories may also have limited income variation, thereby reducing its statistical explanatory power. Consequently, the insignificant income coefficient should be interpreted within the characteristics of the sample and destination rather than as evidence that purchasing power never influences tourism behavior.

Travel time was also positively related to visitation but statistically insignificant. Its positive direction may indicate that some visitors travelling farther are highly motivated or already familiar with Senjoyo Spring; however, the estimate is not sufficiently precise to establish a systematic effect. Czajkowski et al. (2024) demonstrated that the effect of distance and travel time depends strongly on site quality, environmental conditions, and the availability of substitute destinations. Visitors may accept longer journeys when the expected recreational benefits compensate for the time cost. Juutinen et al. (2022) likewise found considerable spatial variation in recreational demand across different landscape types, indicating that travel time cannot be interpreted independently from destination attributes. At Senjoyo Spring, the large proportion of repeat visitors and the dominance of short travel durations may have produced insufficient variation to detect a significant effect. Future analysis should therefore incorporate the monetary value of travel time, alternative-site availability, trip purpose, and whether Senjoyo Spring was the respondent's sole destination.

Environmental quality perception showed a positive but insignificant association with visit frequency. This direction indicates that better perceptions of cleanliness, natural ambience, and sanitation may encourage visitation, but the evidence is insufficient to establish an independent effect after controlling for travel cost, income, and travel time. Özdemir and Tosun (2023) found that environmental quality affects tourism demand through destination attractiveness and visitor evaluation, although its influence may be mediated by satisfaction, perceived value, and behavioural intention. Wang et al. (2023) similarly demonstrated that satisfaction data can be translated into the economic value of national forest parks, suggesting that environmental quality may affect tourism demand indirectly through the visitor experience. At Senjoyo Spring, environmental quality may therefore be more closely associated with satisfaction, intention to revisit, or willingness to pay than with the number of past visits. The use of a short

composite measure and the absence of formal validity and reliability testing may also have reduced its sensitivity. Future instruments should distinguish water quality, cleanliness, sanitation, landscape condition, crowding, safety, and supporting facilities rather than combining them into a single broad indicator.

The estimated consumer surplus indicates that Senjoyo Spring generates recreational benefits substantially greater than the direct costs incurred by visitors. This supports the interpretation of the spring as an economically valuable environmental asset rather than merely a free or inexpensive recreation site. Amiri and Mohammadi Limaiei (2021) found that ITCM produced a higher valuation than contingent valuation because it captured benefits reflected in actual visitor behaviour. Xu et al. (2022) similarly showed that revealed-preference and stated-preference methods capture different components of recreational value: travel-cost analysis represents realised use value, whereas preference-based approaches capture the value visitors assign to particular environmental improvements. The estimated annual value of Senjoyo Spring should nevertheless be interpreted cautiously because it was extrapolated using a management estimate of annual visitation rather than a formal visitor register. Wubalem et al. (2023) emphasised that aggregate recreational values are highly sensitive to annual visitor counts and model specification. Establishing systematic visitor recording is therefore necessary before the annual estimate is used in budgeting, investment appraisal, or formal policy evaluation.

The increase in mean WTP under the facility-improvement scenario shows that visitors do not evaluate admission prices independently of service and environmental quality. They appear willing to accept a higher fee when payment is associated with visible improvements in toilets, parking, cleanliness, and environmental management. Munawir et al. (2023) obtained a comparable result at BSD City Park, where visitors' WTP was connected to expected improvements in facilities and environmental conditions. Durán-Román et al. (2021) likewise found that most tourists were willing to pay more when additional charges were explicitly linked to sustainability and an improved destination experience. Liu et al. (2024) further demonstrated that younger, better-educated, and revisit-oriented visitors were more likely to support payments for park improvements. The upward shift in Senjoyo Spring's WTP should therefore be interpreted as conditional support for better management, not as unconditional acceptance of higher prices. Any fee adjustment should be accompanied by transparent allocation, visible service improvements, and clear communication regarding conservation benefits.

The combination of ITCM and WTP provides a broader interpretation than either method alone. ITCM reveals the benefit reflected in actual visitation behaviour, whereas WTP identifies the additional amount visitors state they would contribute under specified improvement conditions. Xu and He (2022) demonstrated that combining individual travel-cost analysis with stated-preference techniques can distinguish current use value from preferences for improved recreational attributes. Gross et al. (2023), based on a systematic review of 152 studies, concluded that monetary valuation remains dominant but cannot represent all the social, cultural, intrinsic, and relational values attached to natural areas. This limitation is especially important for Senjoyo Spring because it performs recreational, ecological, water-supply, historical, and community functions. Accordingly, the monetary estimates should support—not replace—ecological assessment and community consultation. The results justify gradual facility development and conservation financing, but management must preserve water quality and prevent recreational expansion from undermining the spring's essential ecological function, which has also been emphasised in the sustainability assessment conducted by Reza et al. (2021).

Overall, the findings imply that Senjoyo Spring should adopt a value-based and conservation-oriented management model. A moderate fee aligned with the observed WTP could be considered, provided that the revenue is earmarked for sanitation, waste management, parking organisation, water-source protection, safety, and routine maintenance. Vázquez-Rodríguez et al. (2024) showed that willingness to pay an entrance fee depends partly on how visitors perceive the legitimacy and purpose of the charge, meaning that transparency can be as important as the fee level itself. The systematic evidence reviewed by Gross et al. (2023) also warns that economic valuation has limited policy impact when it is disconnected from stakeholders and institutional decision-making. Therefore, local government, site managers, residents, and water-resource stakeholders should jointly determine the fee structure and expenditure priorities. Because the present estimates are based on 45 accidentally selected visitors, one survey period, an open-ended WTP format, and an OLS model for count data, the values should be treated as preliminary. Larger seasonal samples, validated measurement scales, official visitor counts, and zero-truncated Poisson or negative-binomial models are required to confirm the robustness of the valuation.

Conclusion

The findings of this study confirm that travel cost bears a negative and statistically significant relationship with visit frequency at Senjoyo Spring, meaning that as travel expenditure increases, visitors tend to reduce how often they visit, a pattern consistent with recreational demand theory under the ITCM framework, where travel cost functions as the implicit price of tourism activity. Monthly income, travel time, and environmental quality perception all showed positive yet statistically insignificant effects on visit frequency, suggesting that visitation decisions are shaped by a broader constellation of influences beyond economic factors alone, including recreational preferences, tourism motivations, and the social appeal of the natural setting. The consumer surplus per visit was estimated at IDR 57,803 per person, and with approximately 110,000 annual visitors, the total potential economic value of Senjoyo Spring reaches IDR 6.36 billion per year. Since this annual visitor figure was derived from management interviews rather than official records, given the absence of a formal visitor registry at the site, this estimate should be interpreted with appropriate caution and treated as a starting point for future verification once official visitation data become available.

The WTP analysis further demonstrated that visitors are willing to pay higher entrance fees when facility quality and environmental conditions are improved, with the mean WTP rising from IDR 11,244 under existing conditions to IDR 15,644 under the facility improvement scenario, affirming that environmental and facility quality meaningfully shape visitors' economic valuation of the site. The combined application of ITCM and WTP proved more effective in generating a comprehensive economic valuation than either approach would yield independently. On the basis of these findings, local government authorities and tourism site managers are encouraged to prioritize investment in facility improvements, environmental conservation, and sustainability-oriented tourism governance, as such efforts hold clear potential to increase both the perceived and measurable economic value of Senjoyo Spring while safeguarding its natural resource integrity for future generations. Future research is also encouraged to expand the sample size, incorporate additional socioeconomic and behavioral variables, and extend the valuation framework to other natural spring-based tourism destinations in Indonesia, where evidence-based economic valuation studies remain comparatively scarce in the existing literature.

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