


Evaluating consumer insights in water services: perspectives on health benefits, pricing tolerance, and continuous service demand

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ABSTRACT

This study investigates the relationship between consumers and water services, focusing on the global challenge of providing clean and reliable water. Employing structured questionnaires, the research explores customers' perceived health benefits, willingness to pay (WTP) for potential price increases, and service expectations. The study, primarily quantitative in nature, gathered data from both customers and non-customers of water services. The findings reveal that customers are more likely to recognize health benefits from water services compared to non-customers, emphasizing the role of health perceptions in service acceptance. A significant majority of respondents showed a willingness to accept modest tariff increases. However, this willingness sharply declines as the proposed increase grows, indicating a clear threshold in consumers' financial flexibility. A strong preference for 24-h water service emerged, underscoring the importance of continuous service in consumer satisfaction. Additionally, factors such as water consistency, cleanliness, and pressure were identified as key determinants of service adoption and satisfaction. These insights are crucial for water service providers and regulators, suggesting the need for a balanced approach to pricing, service quality, and continuity. The study highlights the importance of communication about the health benefits of water services, offering guidance for enhanced customer engagement, service adoption, and retention strategies.

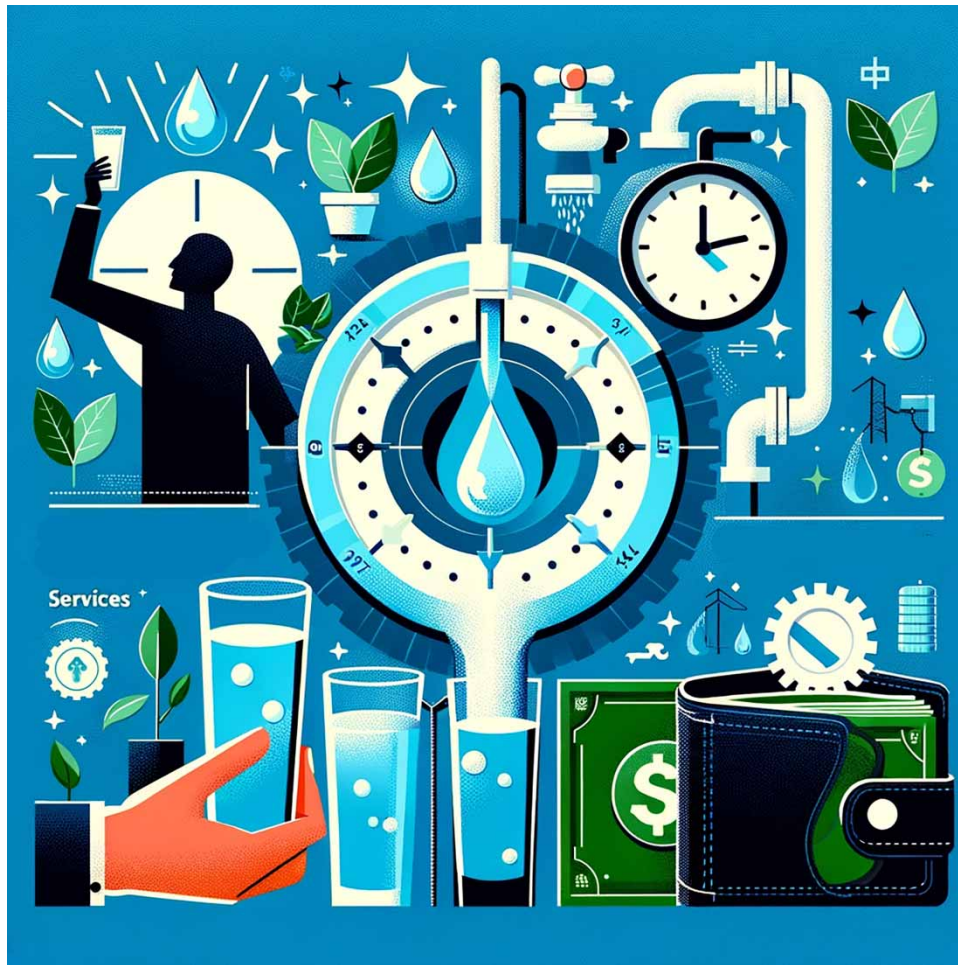
Key words: customer satisfaction, perceived health benefits, service expectations, water services, willingness to pay

HIGHLIGHTS

- This study provides an analysis of perceptions, preferences, and expectations regarding water service quality, pricing, and potential health benefits.
- This study facilitates evidence-based decision-making for local government in improving water infrastructure and delivery.
- The study uncovers the willingness to pay for improved water services, enabling better pricing strategies and potential reinvestments in infrastructure.

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GRAPHICAL ABSTRACT



INTRODUCTION

Water services, particularly clean drinking water, are recognized as a fundamental human right and are essential for maintaining public health (Khalil *et al.* 2022). Currently, more than 1 billion people worldwide still lack access to safely managed drinking water services despite its importance (Alrumman *et al.* 2016). As the global population continues to develop and urbanize, water scarcity and pressure on water resources are projected to increase, making the provision of dependable and clean water a pressing concern (Kassouri 2021; Stoler *et al.* 2021).

Nevertheless, the successful delivery of water services requires more than just physical access (Rahman *et al.* 2022). It also involves ensuring that consumers perceive the service as having a positive impact on their health, that they are prepared to pay for it, and that the service meets their quality and reliability expectations (Jimenez *et al.* 2016; Y. Zhang *et al.* 2020). The principle of customer-oriented service delivery, which has proven effective in a variety of service sectors, including the water sector (Han *et al.* 2015; Nur Syuhada *et al.* 2020), emphasizes the significance of comprehending these dimensions. Previous research has touched on these aspects separately, but a practical study connecting these elements within the water sector is still lacking.

The primary aim of this research is to understand consumer interactions with water services, focusing on three key aspects:

- Investigating how both customers and non-customers perceive the health benefits provided by water services. This aspect seeks to answer the question: ‘What are the perceived health benefits of water services among different consumer groups?’
- Assessing consumer readiness to bear increased costs for enhanced water services. This objective addresses the question: ‘To what extent are consumers willing to pay additional fees for improved water service quality?’

- Identifying the crucial expectations that both existing and potential customers have from water service providers. This aims to answer: ‘What are the key service requirements as identified by consumers?’

In order to achieve these objectives, the study employed an exploratory cross-sectional design, utilizing a structured questionnaire survey to gather primary data from a diverse range of consumers and non-customers in targeted locations. This research significantly contributes to the existing body of knowledge on perceptions and expectations in the context of water services. By understanding their perspectives, the study provides water service providers with strategic insights to tailor their services effectively. It also informs policymakers about potential areas for regulatory adjustments and interventions. From a societal perspective, the findings of this study aim to enhance public awareness about the importance of high-quality water services and their impact on health, thereby influencing informed decision-making at the domestic level.

The structure of this paper is as follows: First, a literature review emphasizing on perceived health benefits, willingness to pay (WTP), and service expectations is presented. The section that follows describes this research design, data acquisition, and analysis procedures. The results section presents this study’s findings, which are provided in the discussion section. The conclusion summarizes the findings, discusses limitations, and suggests future research directions.

LITERATURE STUDY

Perceived health benefits of clean water

Water is a fundamental resource whose value is universally acknowledged across health and environmental domains (Mitchell 2019). In many developing nations, a lack of consistent access to water not only affects people internally such as gastrointestinal infections to chronic conditions caused by the ingestion of contaminants over time, but also restricts the ability of people to maintain physical distance, and intensify existing health and social challenges (Stoler *et al.* 2021). This emphasizes the importance of providing water particularly during the spread and impact of recent COVID-19.

The adverse health outcomes resulting from degraded water quality have deep historical roots and continue to be reflected in current global health trends. Water-borne diseases, for instance, are responsible for substantial morbidity and mortality worldwide, with contaminated water frequently causing outbreaks of cholera and dysentery (Chauhan *et al.* 2020). These burdens, particularly in medically underserved regions, emphasize the critical need for consistent access to clean water (Kumpel *et al.* 2017).

In addition to direct physiological effects, however, the perception of water quality has profound psychological effects (Wang & Yang 2016). A person’s trust in the purity of their water source can substantially impact factors, such as mental health, life satisfaction, and even broader trust in community structures. In contexts where cultural beliefs or local norms play a role, these perceptions may become even more pronounced, with some societies placing an inherent trust in natural water sources over treated alternatives (Eichelberger 2018).

Drawing parallels with other service sectors, previous research highlights the ‘experience effect’ in which perceptions are shaped predominantly by prior experiences (Güngör-Demirci *et al.* 2016; Colburn & Kavouras 2021). Those who are acclimated to having access to clean water may overlook its significance in the context of water, whereas those with a history of water-borne diseases may value it more. Such experiential perspectives highlight the complexities of consumer perception in the domain of water service. Public awareness and targeted education play an undeniable role in further shaping these perceptions (Ahmad 2017). The importance of not only providing clean water but also ensuring its health implications is widely understood.

Willingness to pay for clean water services

Willingness to pay, often abbreviated as WTP, is a concept deeply rooted in economic theory that plays a crucial role in determining how much individuals are willing to spend for a specific product or service, in this instance, clean water (Freeman III *et al.* 2014). Its significance resides in its capacity to capture not only the objective value of a product, but also the subjective evaluations consumers associate with that product. Individual income levels and the perceived utility of the service, which in the case of water includes its potential health benefits and dependability, can have a significant impact on WTP (Jianjun *et al.* 2016).

The direct benefits one obtains from a specific service are a significant factor in WTP. When it comes to water services, these direct benefits can manifest as health improvements, lower medical expenses, and an overall improvement in well-being (Jianjun *et al.* 2016). For example, consumers may be more willing to pay a premium

for water services if they are persuaded of the tangible health benefits it provides, particularly in regions prone to water-borne diseases (Whittington *et al.* 1991). Comparatively, indirect benefits both from use and non-use values a result of improved water infrastructure may not immediately influence WTP, but may do so over time.

However, this willingness has limitations. When determining these thresholds, both economic and psychological factors are considered (Polyzou *et al.* 2011). Even though the economic value of clean water is substantial, consumers may have budgetary constraints that limit their WTP. Psychologically, there is frequently resistance to sudden price increases, particularly in essential services such as water, which are regarded as a fundamental right rather than a luxury (Polyzou *et al.* 2011). This resistance becomes even more pronounced if consumers believe the price increase is not proportional to the service improvement.

Current tariff perceptions play an important role in determining future WTP. Existing pricing models provide consumers with a basis for evaluating the equity of prospective price changes. This is closely related to the economic principle of price elasticity, particularly when essential utilities are involved. Drastic changes in tariff that are perceived as unreasonable can result in significant reductions in demand and water consumption (Sahin *et al.* 2017; Zhang *et al.* 2017), indicating a high degree of elasticity. Consequently, how consumers perceive the current price can considerably influence their future WTP.

METHODOLOGY

The primary goal of this study was to understand the perceptions, preferences, and expectations related to water service quality, pricing, and potential health benefits among existing customers and non-customers. An exploratory research was chosen as the most appropriate to capture a snapshot of these perceptions and attitudes at a particular point in time (Zimand-Sheiner *et al.* 2020). Exploratory research is generally more open-ended, allowing the researcher to identify patterns, hypothesize relationships, or develop new theoretical insights (Oliveros-Romero & Aibinu 2019). Methods can range from literature reviews to small-scale qualitative studies like focus groups, interviews, or open-ended surveys.

Study site and current conditions

Sukabumi City is one of the towns in West Java Province (see Figure 1) with a population of over 350,000 in 2021 and a density of approximately 6,496 inhabitants per square kilometer (Central Bureau of Statistics – Sukabumi City 2023a). Over the last 10 years (2010–2020), the population growth rate of Sukabumi City was 1.44%



Figure 1 | Map of the study area.

annually. This represents a reduction in the population growth rate of about 0.27% in age points compared to the period from 2000 to 2010, which was 1.71% (Central Bureau of Statistics – Sukabumi City 2023b). Its economic tapestry is focused on trade, services, and small to medium-sized industries (Muhyi 2017). Moreover, as a gateway to popular tourist destinations, tourism also significantly fuels the city's economic engine.

Amidst its urban vibrancy, like many cities in Indonesia, Sukabumi City faces challenges related to water access and quality (Arifianti & Raharja 2017). While a segment of the population enjoys piped water, there remains a considerable number who rely on alternative sources like groundwater, wells, or even purchasing water (Prasetiawan *et al.* 2017). These alternative solutions sometimes come into play due to infrastructure limitations or when the demand outpaces the available supply, emphasizing the criticality of a consistent and clean water source (Sutomo *et al.* 2021).

The mantle of responsibility for catering to the city's water needs primarily rests on the shoulders of PDAM Tirta Bumi Wibawa, a regional public company. As the main water provider, this Regional-Owned Enterprise plays a paramount role in not just supplying water, but ensuring that it is potable and meets the health standards set by the authorities. Yet, as with many public utilities, challenges persist. Ageing infrastructure, rapidly growing demand due to population influx, and issues of water source sustainability, potential contamination, and customer dissatisfaction on company performance are some of the hurdles they face (B Rosalina *et al.* 2018).

This underscores the pressing need for comprehensive research focused on water services in Sukabumi City. Analyzing the efficiency and effectiveness of the current water services, understanding the gaps in service delivery, and gauging the perceptions and expectations of the populace are all pivotal. This research seeks to delve into these aspects, offering insights that could potentially steer policy-making, guide infrastructural upgrades, and ensure that every resident of Sukabumi has access to clean, safe, and reliable water services.

Data collection

This study significantly relies on a structured questionnaire survey for the collection of primary data. Each participant was asked the same questions in the same order. The structured nature of the questionnaire aids in minimizing variability that may result from differences in interpretation or question order, thereby enhancing the reliability of the collected data. In addition, by utilizing a structured questionnaire, the research can efficiently compile, quantify, and analyze the responses in order to identify patterns, trends, and insights that will inform the study's objectives (Cheung 2021). While there are numerous techniques for collecting primary data, for the purposes of this study, the structured questionnaire stands out as the most effective method for garnering accurate and actionable information from the target population.

Customers and non-customer of water in Sukabumi City, Indonesia, are the respondents of this study. The first category consists of 29 respondents, while the second consists of 25 respondents, for a combined total of 54 respondents. Participants' demographic information, including age, gender, and socioeconomic status, was omitted from the design of this study. This decision is based on the fundamental belief that perceptions of water service, particularly as they pertain to health benefits, WTP, and service expectations, can transcend demographic barriers and have universal significance. The inclusion of such variables may introduce a bias in which responses may be interpreted through the lens of these demographic factors rather than the more universal experience of water utilization. In addition, excluding these demographic details ensures the participants' privacy and anonymity, which may encourage candid responses that are unaffected by societal or cultural pressures. It is also important to note that the concentration of this study is on understanding broad patterns and trends, as opposed to segmenting and categorizing individuals based on their demographics. This holistic approach permits a broader comprehension of perceptions and expectations, unrestricted or skewed by demographic details.

Participants were addressed using a structured questionnaire format, which was administered either electronically or on paper, based on convenience and accessibility. Prior to their participation, confidentiality was guaranteed and informed consent was obtained. Five aspects of health, WTP, perception of water tariff, expectations of water service, and quality parameters were asked of the participants. In terms of perceived health benefits, participants were asked about their perceptions of the water service's health implications. The responses were categorized as 'health benefits perceived,' 'health benefits not perceived,' and 'not sure.' in the WTP aspect, and respondents were questioned about their willingness to tolerate prospective increases in water service rates. They were given distinct percentage ranges of potential price increases and asked to designate their level of acceptance for each. The participants were asked their opinion on the current water tariff, with responses ranging from

‘very expensive’ to ‘cheap’. The participants’ expectations regarding service hours were surveyed ranging from ‘at least 8 h’ to ‘24 h’.

Data analysis

The first area of focus was perceived health benefits. To understand how customers and non-customers perceive the health benefits of clean water services, this research began with descriptive analysis. This step involved categorizing the responses of 54 participants to identify patterns in their perceptions. Recognizing the need for a more nuanced understanding, a chi-squared test of independence was conducted. This statistical test was chosen for its effectiveness in determining whether there is a statistically significant association between two categorical variables – in this case, customer status and perceived health benefits. To further validate these findings, especially given the small sample size, Fisher’s exact test was conducted. This test is particularly useful for analyzing categorical data when sample sizes are small, as it does not depend on large sample assumptions. The test resulted in a p -value of 0.000726, reinforcing the significant association found in the chi-squared test.

In the second area, WTP for additional fees, descriptive analysis was used to gauge the general sentiment among customers regarding potential tariff increases. This step was crucial to establish a baseline understanding of consumer attitudes. To delve deeper into the relationship between consumers’ current tariff perceptions and their willingness to continue the subscription amidst tariff hikes, we employed the chi-squared test. This test was instrumental in revealing whether the perception of current tariffs significantly influences decisions regarding continued service subscription under tariff adjustments. Additionally, the Kruskal–Wallis test was employed to examine the relationship between tariff perceptions and the maximum acceptable percentage increase in water expenditure. This non-parametric test was chosen due to its suitability for comparing more than two groups, in this case, different tariff perception groups. The test showed a statistically significant difference (Kruskal–Wallis chi-squared = 10.827, p -value = 0.0127), indicating varying levels of willingness to accept tariff increases among different groups.

Finally, for the third area, expectations from water services, this research analyzed preferences for water service hours among various customer segments. Descriptive analysis provided an initial overview of these preferences, revealing a strong inclination toward 24-h service. To assess the statistical significance of the differences in service hour preferences across different customer groups, the chi-squared test was applied. The choice of this test was driven by its ability to handle categorical data and assess associations between different groups. However, to address potential inaccuracies due to the chi-squared approximation, especially in a table with small expected frequencies, we conducted the Fisher’s exact test. This test provided a more accurate assessment of the preference for 24-h service between customers and non-customers, showing no significant difference and suggesting a uniform demand for continuous service across customer statuses.

RESULTS AND FINDINGS

Perceived health benefits

This study investigates the association between customer status (customers vs. non-customers) of PDAM Tirta Bumi Wibawa and their perceptions of health benefits from receiving clean water services. Utilizing descriptive analysis, a chi-squared test, and Fisher’s exact test, the section aims to uncover patterns that might inform service improvement and communication strategies.

Descriptive analysis (see Table 1) revealed the distribution of perceptions regarding the health benefits of clean water services among 54 respondents. A small fraction, specifically four respondents, affirmed perceiving health benefits from the service. In contrast, three non-customers did not perceive any health benefits, and a significant majority, 18 respondents, remained unsure about the health benefits. This uncertainty among non-customers suggests a potential gap in awareness or skepticism about the tangible health benefits of clean water services.

Table 1 | Descriptive analysis

Customer status	No (perceived health benefit)	Yes (perceived health benefit)	Not sure (perceived health benefit)	Total
Non-customer	3	4	18	25
Customer	3	18	8	29

On the other hand, the customer group, comprising 29 respondents, showed a more pronounced perception of health benefits, with 18 customers acknowledging these benefits. Similar to non-customers, three customers did not perceive health benefits, whereas a smaller portion, eight respondents, were undecided. The higher affirmation rate among customers compared to non-customers indicates a correlation between direct service usage and the recognition of its health benefits.

An analysis employing a chi-squared test of independence (see Table 2) found a statistically significant association ($X^2 = 12.528$, $df = 2$, $p\text{-value} = 0.001904$), indicating that perceptions of health benefits vary significantly between customers and non-customers. This finding underscores the importance of clean water services in influencing customer perceptions of health benefits. Further analysis using Fisher's exact test (see Table 3) yielded a statistically significant $p\text{-value}$ of 0.000726, indicating a strong association between being a customer and the perception of health benefits from the water service.

Table 2 | Summary of chi-squared analysis

Variable	chi-squared statistic	Degrees of freedom	p-value
Health improvement	12.528	2	0.001904

Table 3 | Summary of Fisher's exact test

Metric	Value
$p\text{-value}$	0.000726
Alternative hypothesis	Two-sided

The combined findings from the descriptive analysis, chi-squared test, and Fisher's exact test offer a nuanced understanding of how perceptions of health benefits from clean water services vary between customers and non-customers of PDAM Tirta Bumi Wibawa. Specifically:

- The descriptive analysis highlights a clear difference in perceptions, with a higher proportion of customers recognizing health benefits.
- The chi-squared and Fisher's exact test confirm this difference as statistically significant, suggesting that customers are more likely to perceive health benefits from the service compared to non-customers, highlighting the value that clean water services add to customer well-being.

Willingness to pay for additional fees

In the analysis of consumer responses to potential tariff increases for improved water service by PDAM Tirta Bumi Wibawa, two statistical tests, alongside descriptive analysis, were employed to understand the relationship between consumers' current tariff perceptions, their willingness to continue the subscription, and their acceptance of potential tariff increases. In this section, only those who are already customers (29 respondents) of the water service are being analyzed. The findings from these analyses offer insightful implications for both consumer behavior understanding and policy formulation for water service providers.

The descriptive analysis (see Table 4) revealed that a majority of respondents (65%) expressed willingness ('Yes') to continue their subscription even if the tariff were to increase, provided that the service quality improved correspondingly. However, a notable proportion of respondents (25%) remained uncertain ('Not sure'), indicating a conditional consideration of potential tariff increases against the perceived value of service improvements. Only a small fraction (10%) categorically rejected ('No') the idea of continuing their subscription under any tariff increase scenario. This diversity in responses underscores the necessity for PDAM Tirta Bumi Wibawa to engage in transparent communication, outlining how tariff increases directly contribute to service quality improvements.

The aforementioned insights correlate intriguingly with responses to a prospective tariff increase. While the majority of respondents indicate they would remain subscribers even if the price increased, a sizeable proportion are unsure, suggesting they may evaluate the situation based on the specifics of the increase, its magnitude, the

Table 4 | Descriptive analysis of consumer responses

Response category	Percentage (%)	Description
Willing to continue subscription	65	Respondents willing to continue if tariffs increase
Uncertain	25	Respondents are uncertain about continuing subscription
Unwilling to continue subscription	10	Respondents unwilling to continue if tariffs increase
Mean acceptable tariff increase	15	Average maximum increase in tariffs respondents willing to accept
Tariff perception: reasonable	40	Respondents who find current tariffs reasonable
Tariff perception: very expensive	45	Respondents who find current tariffs very expensive
Tariff perception: expensive	15	Respondents who find current tariffs expensive
Tariff perception: cheap	<5	Respondents who find current tariffs cheap

reasons for it, and whether it results in a perceptible improvement in the quality of the service. This uncertainty among consumers emphasizes the need for the service provider to carefully manage any price increase and clearly communicate its rationale, potentially through detailed consumer education campaigns about the tangible improvements funded by increased tariffs.

Regarding the maximum acceptable percentage increase in water expenditure, the responses varied significantly, with a mean willingness to accept a 15% increase in tariffs for improved service quality. The range of acceptable increases spanned from 0 to 50%, highlighting the diversity in consumer price sensitivity and perceived value of service improvements. This broad spectrum of acceptance could be understood in a variety of ways. One interpretation could be that consumers view the current tariffs as reasonable or that their financial circumstances prevent them from supporting larger fee increases. This insight suggests an opportunity for PDAM Tirta Bumi Wibawa to implement a tiered approach to tariff increases, which considers consumer feedback and service improvement benchmarks.

On the other hand, the current perception of water tariffs showed that a substantial number of respondents (40%) considered the existing tariffs to be 'reasonable,' suggesting a baseline satisfaction with current pricing. However, nearly half of the respondents (45%) viewed the tariffs as 'very expensive,' indicating a significant concern about current pricing levels. A smaller segment (15%) found the tariffs to be 'expensive,' while a minimal number (less than 5%) perceived the tariffs as 'Cheap,' reflecting a broad spectrum of consumer perceptions regarding the affordability and fairness of current water tariffs. These findings suggest that PDAM Tirta Bumi Wibawa should strategically address tariff concerns among consumers who currently view rates as 'very expensive' by demonstrating the direct benefits of service improvements, potentially easing their willingness to accept higher tariffs.

The Pearson chi-squared test (see Table 5) revealed a statistically significant association between consumers' perceptions of current tariffs and their willingness to continue subscribing to PDAM Tirta Bumi Wibawa's services in the face of tariff increases ($\chi^2 = 29$, $df = 6$). This significant result suggests that the way consumers perceive the current tariff – whether as 'very expensive' 'expensive' 'reasonable' or 'Cheap' – has a substantial impact on their decision-making regarding continued service subscription under the condition of tariff adjustments. However, it is important to note the accompanying warning that the chi-squared approximation may be incorrect, potentially due to small expected frequencies in some cells of the contingency table. This caveat necessitates a cautious interpretation of the chi-squared test results, acknowledging the potential limitations posed by the data distribution.

Table 5 | chi-squared test results for tariff perception vs. subscription willingness

Statistic	Value	Description
χ^2	29	chi-squared statistic
Df	6	Degrees of freedom
p-value	6.084e – 05	Statistical significance of the association

Further analysis using the Kruskal–Wallis (see Table 6) rank sum test examined the relationship between consumers' tariff perceptions and their maximum willingness to accept a percentage increase in their water expenditure. The test yielded a Kruskal–Wallis chi-squared value of 10.827 with 3 degrees of freedom, resulting in a *p*-value of 0.0127. This indicates a statistically significant difference in the willingness to accept tariff increases among different tariff perception groups. Specifically, consumers who perceive the current tariffs as 'reasonable' or 'Cheap' are more likely to accept higher percentage increases in their water bills for improved service quality compared to those who view the tariffs as 'expensive' or 'very expensive' Given the significant findings from both the chi-squared and Kruskal–Wallis tests, these analyses underscore the critical role of consumer perception in tariff policy and service improvement strategies for water utilities. The results suggest that understanding and addressing consumer perceptions of current tariffs are essential in managing and communicating about future tariff adjustments. Moreover, the demonstrated variability in consumers' WTP for service improvements highlights the importance of targeted communication strategies that consider different consumer segments based on their tariff perceptions.

Table 6 | Kruskal–Wallis test results for tariff perception vs. maximum acceptable tariff increase

Statistic	Value	Description
Kruskal–Wallis chi-squared	10.827	Test statistic
df	3	Degrees of freedom
<i>p</i> -value	0.0127	Statistical significance of the differences

Expectations from water services

The study aimed to explore preferences for water service hours among various segments, including staying-subscribed customers, stop-subscribed customers, undecided subscribed customers, non-customers willing to subscribe, undecided non-customers, and non-customers not willing to subscribe (see Table 7). Both customers and non-customers (54 respondents) are included in the analysis. Utilizing a combination of descriptive analysis, chi-squared tests, and Fisher's exact test, the research sought to uncover patterns and associations that could inform service delivery improvements for PDAM Tirta Bumi Wibawa.

Table 7 | Water service preferences

Customer status	At least 8 h	At least 12 h	At least 16 h	At least 20 h	24 h	Total
Staying-subscribed customer	1	1	1	1	12	16
Stop-subscribed customer	0	0	1	0	1	2
Undecided subscribed customer	0	3	1	0	5	9
Non-customer willing to subscribe	0	2	1	0	4	7
Undecided Non-customer	0	6	0	0	6	12
Non-customer not willing to subscribe	1	1	0	1	3	6
Total	2	13	4	2	31	54

The descriptive analysis revealed a clear preference for 24-h water service across most customer segments. Specifically, a significant majority of staying-subscribed customers (73.3%) expressed a preference for continuous service availability. This preference was also notably strong among non-customers willing to subscribe (57.1%) and undecided subscribed customers (55.6%), indicating a broad-based demand for around-the-clock water service. The analysis highlighted a diverse range of service hour preferences, underscoring the complexity of customer expectations and the potential for tailored service offerings.

The chi-squared test (see Table 8) further examined the association between customer segments and their service hour preferences. With a chi-squared statistic of 80.143 and a *p*-value of 3.713e – 09, the test indicated a statistically significant difference in service hour preferences across different customer groups. This finding suggests that customer status significantly influences preferences for water service hours, highlighting the importance of segment-specific service strategies. However, a cautionary note regarding the chi-squared

Table 8 | chi-squared test results for expectation from water services

Statistic	Value	Description
χ^2	80.143	chi-squared statistic
df	20	Degrees of freedom
<i>p</i> -value	3.713e – 09	Statistical significance of the association

approximation's accuracy prompted a further examination using Fisher's exact test for a more nuanced analysis of preferences for 24-h service.

Fisher's exact test (see Table 9) focused on the preference for 24-h service between customers and non-customers, yielding a *p*-value of 1. This result indicates no statistically significant difference in the preference for 24-h water service between the two groups, suggesting a uniform demand for continuous service across customer statuses. The odds ratio of 1.140797, with a 95% confidence interval ranging from 0.2727169 to 4.7186986, points to a slight, though not statistically significant, inclination toward 24-h service among customers compared to non-customers.

Table 9 | Summary of Fisher's exact test

Metric	Value
<i>p</i> -value	1
Alternative hypothesis	True odds ratio is not equal to 1
95% confidence interval	0.2727169 to 4.7186986
Odds ratio estimate	1.140797

The juxtaposition of descriptive analysis with chi-squared and Fisher's exact test results offers a comprehensive view of customer preferences regarding water service hours. While the descriptive analysis and chi-squared test highlight varied preferences and significant differences among customer segments, Fisher's exact test underscores a universal appeal for 24-h service across both customers and non-customers.

This combination of findings suggests a dual strategy for PDAM Tirta Bumi Wibawa. On one hand, the significant variation in service hour preferences among different segments calls for a segmented approach to service delivery, where customer-specific preferences are acknowledged and addressed. On the other hand, the universal demand for 24-h service presents an opportunity for PDAM Tirta Bumi Wibawa to consider expanding or emphasizing continuous service availability as a key feature of its offering.

DISCUSSION

The study's investigation into the perceived health benefits of clean water services revealed significant differences in perceptions between customers and non-customers. The analysis highlights the critical role that health perceptions play in consumers' water service decision-making processes. Existing customers perceive the service to be beneficial to their health, which may explain their continued use. This suggests that direct experience with the service enhances awareness and appreciation of its health benefits, potentially due to firsthand experience with improved water quality and its impact on health.

The significant association between customer status and perceived health benefits underscores the critical role of clean water services in public health. This aligns with existing literature that emphasizes the importance of access to clean water in improving community health outcomes (Angoua *et al.* 2018; Huck 2022). The findings highlight the need for water providers to enhance its communication strategies, particularly targeting non-customers, to bridge the gap in awareness and skepticism about the tangible health benefits of its services.

On the other hand, the analysis of consumer responses to potential tariff increases for improved water service revealed a nuanced landscape of consumer WTP. While the majority of consumers appear to be tolerant of a moderate increase in tariffs, there is an unexpected drop in acceptance for larger increases, highlighting the

financial flexibility of the water service. This diversity in consumer responses underscores the importance of transparent communication from water providers regarding how increased tariffs directly contribute to service quality enhancements.

Moreover, the perception of the existing tariff is skewed toward rationality, but a significant minority considers it to be excessive. This indicates that any price increase must be carefully considered, as a significant portion of the customer base is already price sensitive. The statistically significant association between current tariff perceptions and willingness to continue the subscription suggests that consumer perceptions of current tariffs significantly influence their decisions regarding service continuation under tariff adjustments.

The exploration of preferences for water service hours among various customer segments revealed a clear preference for 24-h water service, a demand that transcends customer status. The overwhelming demand for 24-h service demonstrates the indispensability of water and the importance placed on its continuous availability. The significant difference in service hour preferences across customer groups highlights the importance of segment-specific service strategies. This universal demand for 24-h service presents an opportunity for water providers to consider expanding or emphasizing continuous service availability. Simultaneously, the variation in preferences among different segments calls for a segmented approach to service delivery, acknowledging and addressing customer-specific preferences.

CONCLUSIONS

This study's exploration into PDAM Tirta Bumi Wibawa's service perceptions, WTP for enhanced services, and expectations of water service hours provides a nuanced understanding of consumer behavior and expectations. It underscores the pivotal role of access to clean water in shaping public health perceptions, revealing that direct service experience heightens awareness and appreciation of health benefits. Additionally, the research delineates consumer financial flexibility and sensitivity to price changes, offering critical insights for tariff policy adjustments. The universal demand for continuous water service, transcending customer status, emphasizes the necessity for reliable access to clean water.

The findings contribute significantly to the discourse on consumer-provider dynamics in the water service sector, highlighting the influence of health benefit perceptions on consumer decisions. This suggests that first-hand experiences with water services can enhance the recognition of their health advantages, potentially due to observed improvements in water quality and its impact on health. Moreover, the study reveals a nuanced landscape of consumer responses to potential tariff increases, indicating a tolerance for moderate price hikes but a marked resistance to substantial increments. This highlights the importance of transparent communication from the utility regarding how tariff adjustments directly contribute to service quality enhancements.

The research suggests several actionable strategies for water providers. Enhanced communication efforts are needed to bridge the awareness gap regarding the health benefits of its water services, particularly among non-customers. Additionally, the utility should adopt a transparent approach when considering tariff increases, ensuring consumers understand how these adjustments will enhance service quality. Acknowledging varied service hour preferences, a segmented service delivery approach could cater to the specific needs of different consumer segments, enhancing customer satisfaction and service utilization.

Future research directions include longitudinal studies to observe changes in consumer perceptions and behaviors following the implementation of targeted interventions based on this study's findings. Comparative analyses with other utilities, both within and outside Indonesia, could identify best practices and innovative solutions. Furthermore, assessing the tangible impacts of improved water service quality on public health outcomes would provide empirical evidence to support increased investment in water infrastructure.

This study not only illuminates the current state of consumer perceptions regarding water services but also offers actionable insights for water providers to enhance its service delivery, communication strategies, and tariff policies. By addressing the gaps identified and capitalizing on opportunities for service improvement, Water providers can significantly contribute to public health, consumer satisfaction, and sustainable water service delivery, setting a precedent for utilities nationwide. However, it is important to note the limitations of this study, such as the unspecified sample size and demographics, which may affect the generalizability of the findings. Future research could benefit from a broader and more detailed qualitative investigation to gain deeper insights into consumer perceptions and decisions, especially regarding health benefits and price sensitivity across different groups.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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