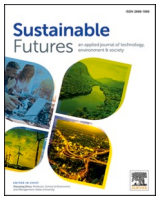
Sustainable Futures 9 (2025) 100633

Contents lists available at ScienceDirect

Sustainable Futures

journal homepage: www.sciencedirect.com/journal/sustainable-futures



Advancing the 2030 agenda with community importance-performance perspective and public relations strategies for community-based sanitation

Evi Siti Sofiyah [a,e], Imelda Masni Juniaty Sianipar [b], Ari Rahman [a,e,*], Hanifa Athaya Rafida [a], Sapta Suhardono [c,*], Chun-Hung Lee [d,e,f,*], I Wayan Koko Suryawan [a,d,e,f,*]

[a] Department of Environmental Engineering, Faculty of Infrastructure Planning, Universitas Pertamina, Jalan Sinabung II, Terusan Simprug, Jakarta, 12220, Indonesia
[b] Department of International Relations, Faculty of Social Science and Political Science, Universitas Kristen Indonesia, Jakarta,13630, Indonesia
[c] Environmental Sciences Study Program, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret, Surakarta 57126, Indonesia
[d] Department of Natural Resources and Environmental Studies, College of Environmental Studies and Oceanography, National Dong Hwa University, Hualien 97401, Taiwan
[e] Center for Environmental Solution (CVISION), Universitas Pertamina, Jalan Sinabung II, Terusan Simprug, Jakarta, 12220, Indonesia
[f] Center for Interdisciplinary Research on Ecology and Sustainability, College of Environmental Studies and Oceanography, National Dong Hwa University, Hualien, 97401, Taiwan

ARTICLE INFO

Keywords:
Sustainable sanitation
Community engagement
Public relations
2030 agenda
Importance-performance analysis
strategic communication

ABSTRACT

This study addresses the critical challenge of achieving sustainable sanitation practices in the Komodo subdistrict, focusing on the role of community engagement and public relations strategies in advancing the 2030 Agenda for Sustainable Development. Sustainable sanitation is essential for public health, environmental protection, and overall community well-being, yet its implementation often faces barriers, including community resistance, lack of awareness, and inconsistent service quality. By employing Importance-Performance Analysis (IPA), this research evaluates community perceptions of key sanitation indicators, identifying both successful aspects and areas that require improvement to meet sustainability goals. The results reveal that indicators such as septic system adoption, desludging service quality, and efficient fecal sludge management are perceived as highly important and are critical to achieving sustainable outcomes. The study also underscores the pivotal role of public relations in fostering community collaboration, building trust, and enhancing engagement among stakeholders, demonstrating that effective communication strategies can significantly influence community acceptance and participation in sanitation initiatives. These findings suggest that prioritizing community-driven approaches and strengthening communication efforts can enhance the impact of sanitation programs, ensuring they are well-received and actively supported. This research contributes a framework for integrating public relations with community engagement in sanitation planning, offering a model that can be adapted for sustainable development initiatives in other regions. Future research should explore similar frameworks in diverse settings to further validate and refine strategies that promote sustainable sanitation at scale.

1. Introduction

The adoption of the 2030 Agenda for Sustainable Development by the United Nations in 2015 marked a pivotal moment in the global pursuit of sustainability. This agenda outlines 17 Sustainable Development Goals (SDGs) designed to address a broad spectrum of global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. Of particular relevance to this study is SDG 6, which aims to ensure the availability and sustainable management of water and sanitation for all. The realization of this goal is essential not only for public health but also for the ecological sustainability and overall well-being of communities worldwide [1,2]. In regions like the Labuan Bajo in Indonesia, rapid tourist influxes have placed substantial pressure on existing sanitation infrastructure, leading to inadequate waste management and heightened health risks [3]. Traditional sanitation solutions, including septic systems and fecal

* Corresponding authors.
E-mail addresses: es.sofiyah@universitaspertamina.ac.id (E.S. Sofiyah), ari.rahman@universitaspertamina.ac.id (A. Rahman), hanifarafidaa@gmail.com (H.A. Rafida), sapta.suhardono@staff.uns.ac.id (S. Suhardono), chlee@gms.ndhu.edu.tw (C.-H. Lee), i.suryawan@universitaspertamina.ac.id (I.W.K. Suryawan).

https://doi.org/10.1016/j.sftr.2025.100633
Received 30 August 2024; Received in revised form 31 October 2024; Accepted 16 April 2025
Available online 18 April 2025

sludge management, have proven insufficient to meet the demands of growing populations and increased tourism activities [4,5]. A promising approach to these challenges is integrating community-based sanitation programs within a broader strategic communication framework [6,7]. Public relations, with its focus on building relationships and engaging stakeholders [8,9], is uniquely positioned to foster the collaboration necessary for the successful implementation of sustainable sanitation initiatives. By leveraging public relations strategies, we can enhance awareness, encourage community participation [10], and build the alliances required to achieve the objectives of the 2030 Agenda.

Despite the recognized importance of community engagement in sustainable development [11–14], there is a significant gap in understanding how different residents perceive sanitation practices in specific contexts like the Labuan Bajo. Most existing studies tend to generalize findings across various regions without accounting for the unique socio-economic, cultural, and environmental factors that influence sanitation behaviors in specific locales [15–19]. Additionally, there is a scarcity of research examining the interplay between tourism and sanitation practices in urban areas of the Global South. This study focuses on various aspects of community-based sanitation management, including septic system adoption and maintenance, septic system desludging service quality, public sanitation facility management, efficient fecal sludge management systems, community organization engagement, sanitation task force effectiveness, sustainability awareness program quality, sustainability training program efficacy, community influence in decision-making, and community involvement in sustainability projects. These indicators provide a comprehensive view of the key factors influencing sanitation management in the Labuan Bajo and reflect the multifaceted nature of sanitation challenges. Septic system adoption and maintenance are critical for ensuring effective waste management within communities [20,21]. Evaluating the extent to which these systems are adopted and maintained can provide insights into their reliability and effectiveness. Septic system desludging service quality assesses the quality and reliability of services provided for desludging septic systems [22]. Regular desludging is necessary to maintain system efficiency and prevent overflow or failure [23], which can lead to health hazards and environmental pollution.

Public sanitation facility management examines the management practices of public sanitation facilities to ensure they meet community needs and standards [24,25]. Effective management is crucial for maintaining hygiene, accessibility, and user satisfaction [26]. Efficient fecal sludge management systems measure the efficiency of systems in place for managing and processing fecal sludge [27,28]. Efficient systems help in reducing the environmental impact of waste disposal and improve overall sanitation. Community organization engagement looks at the level of engagement and participation of community organizations in sanitation efforts [29]. Active engagement of community organizations is essential for sustainable sanitation initiatives as it fosters local ownership and ensures that solutions are tailored to community needs [30]. Sanitation task force effectiveness evaluates the effectiveness of task forces dedicated to improving sanitation within the community [31]. Effective task forces can drive the implementation of sanitation projects, monitor progress, and ensure accountability. Sustainability awareness program quality assesses the quality of programs aimed at raising awareness about sustainability and sanitation. High-quality awareness programs can educate the community about the importance of sustainable practices and encourage behavioral change [32].

The exploration of community engagement in sustainable development is recognized as pivotal for the success and sustainability of environmental and public health initiatives. Our study, centered in the Komodo subdistrict, investigates how residents evaluate and participate in community-based sanitation initiatives. This involvement is crucial as it facilitates a deeper understanding of local needs and preferences, ensuring that interventions are culturally appropriate and widely accepted [11], These efforts align with the principles outlined in the 2030 Agenda for Sustainable Development, which emphasizes inclusivity and participatory processes in achieving the Sustainable Development Goals (SDGs). One vital component of our approach is the implementation of sustainability training programs, which aim to equip community members with the knowledge and skills necessary for maintaining sustainable sanitation solutions [33]. By enhancing community competence, these programs support the effective implementation and longevity of sanitation initiatives. Furthermore, our study assesses the extent of community influence in decision-making processes related to sanitation [34,35]. Inclusive decision-making is essential, ensuring community perspectives and needs are integral to developing effective and accepted sanitation solutions. Additionally, we evaluate the level of community involvement in sustainability projects, which reflects the active participation and ownership that are critical for the projects' success [36].

To systematically analyze these elements, Importance-Performance Analysis (IPA) is employed due to its effectiveness in identifying gaps between community expectations and the actual performance of sanitation services [37]. IPA provides a clear visual representation of how well services meet the community's needs, highlighting 'high-priority' areas where importance is high but performance is low, thus signaling crucial targets for immediate improvement [38–40]. This method not only helps in reallocating resources more efficiently but also in enhancing the overall service delivery by focusing on areas that exceed performance expectations. Employing IPA within the framework of the 2030 Agenda offers strategic insights that enable stakeholders to tailor interventions to address pressing community concerns effectively. This targeted approach enhances the efficacy of sanitation programs, fostering community ownership and support essential for long-term sustainability [41]. Thus, the use of IPA in exploring community engagement aligns with global sustainable development goals by ensuring that sanitation interventions are effective and supported by the community, directly contributing to the well-being of the community as mandated by SDG 6 (Water and Sanitation for all).

The primary aim of this study is to evaluate community engagement in sustainable sanitation practices by assessing how local residents perceive and evaluate community-based sanitation initiatives. The study identifies discrepancies between the perceived importance of sanitation services and their actual performance using Importance-Performance Analysis (IPA) and determines key factors that influence community willingness to participate in these programs. This approach provides practical insights to develop effective sanitation strategies that align with the community's needs [42]. This study enhances the effectiveness of sanitation programs by aligning them more closely with community expectations and needs. It provides local government and stakeholders with actionable data to improve public health and environmental sustainability in the Komodo subdistrict. The study fosters greater community participation and ownership of sanitation initiatives, crucial for their long-term success and sustainability. Additionally, it contributes to the broader goals of the 2030 Agenda for Sustainable Development by ensuring that local sanitation efforts are both effective and supported by the community.

2. Theoretical framework

Public relations plays an indispensable role in the effective implementation of community-based sanitation projects, facilitating the necessary communication and interaction for successful community involvement. In this study, Importance-Performance Analysis (IPA) is utilized in a novel context to provide new insights into how community perceptions can be accurately assessed and strategically integrated into policy development and implementation strategies. Employing IPA ensures that sanitation initiatives are not only effective but also in harmony with community expectations and contribute significantly to sustainable development goals. The theoretical framework of this study is extensively elaborated upon with an emphasis on the fundamental

principles of public relations, including stakeholder engagement, trust-building, and strategic communication. These principles are crucial as they underpin strategies for implementing community-based sanitation solutions that gain robust support and ongoing maintenance from the community. Effective public relations practices engage stakeholders at every level, creating an environment rich in open communication and mutual trust, which are essential for collaborative and sustained success in sanitation management.

Furthermore, the study integrates Grunig's models of public relations, providing a foundational framework for understanding and deploying effective communication strategies within the context of community-based sanitation. Grunig's models promote a reciprocal nature of communication between an organization and its publics, advocating for an exchange that is both informative and responsive to the public's feedback and needs. This theoretical approach is particularly pertinent in sanitation management, where continuous community feedback is vital for the ongoing refinement and acceptance of sanitation systems. In practice, this research explores various specific indicators of sustainable sanitation practices. First, it examines the adoption rates and maintenance practices of septic systems within communities. Studies have shown that regular maintenance and proper adoption practices are critical for the sustainability and effectiveness of these waste management systems. Furthermore, the study evaluates the quality and reliability of septic system desludging services. These services are crucial for the efficient operation of septic systems and the prevention of environmental pollution, impacting public health and sanitation efficacy significantly.

Management of public sanitation facilities is another critical area of focus. The study scrutinizes how these facilities are managed to ensure they meet community standards and needs effectively. Proper management is crucial for maintaining hygiene, accessibility, and user satisfaction, which are essential components of effective public sanitation facilities. Additionally, the efficiency of fecal sludge management systems is analyzed. Efficient management of fecal sludge is necessary to reduce the environmental impact of waste disposal and improve overall sanitation quality. Effective fecal sludge management contributes to environmental sustainability and enhances the health outcomes of the community. Community organization engagement is extensively examined to understand the level of involvement and participation of local organizations in sanitation efforts. This engagement supports sustainable initiatives through local ownership and the development of tailored solutions, empowering communities to ensure that sanitation solutions are culturally appropriate and meet specific local needs.

The effectiveness of sanitation task forces is also evaluated within the study. These task forces play a significant role in driving the implementation and ensuring the accountability of sanitation projects. Their effectiveness can significantly influence the success of these initiatives by ensuring continuous monitoring and adaptability in project execution. Furthermore, the study assesses the quality of sustainability awareness programs. These programs are crucial for changing behaviors and promoting environmental stewardship. High-quality awareness programs educate the community about the importance of sustainable practices and encourage behavioral change towards environmental conservation. In the realm of training, the efficacy of sustainability training programs is examined to determine how well these programs equip community members with the necessary skills for maintaining sustainable sanitation practices. Effective training programs are essential as they enhance community capabilities, supporting long-term sustainability objectives.

Lastly, the study delves into the extent of community influence in decision-making processes and their involvement in sustainability projects. These factors are crucial for fostering a sense of ownership and responsibility among community members, fundamental for the success and longevity of sanitation initiatives. By addressing these various indicators and employing strategic public relations theories and practices, the study aims to enhance the effectiveness of sanitation initiatives, ensuring they are not only functionally adequate but also closely aligned with the community's aspirations and needs. This alignment is essential for contributing to the overarching goals of sustainable development, underscoring the critical role of informed and responsive public relations in achieving successful, community-supported sanitation management. This comprehensive approach demonstrates the power of combining rigorous analytical methods with robust public relations strategies to foster sustainable and community-driven sanitation solutions.

3. Method

3.1. Study location

The Komodo region, encompassing Labuan Bajo (Fig. 1), is an area of profound ecological and cultural significance, situated in the heart of Indonesia's archipelago. This region, known for its remarkable natural beauty and biodiversity, plays a pivotal role in environmental conservation efforts, both locally and globally. Labuan Bajo, once a small fishing village, has transformed into a bustling gateway to the Komodo National Park. Located on the western end of Flores Island in the Nusa Tenggara archipelago, this town has become a thriving center for ecotourism. The growth of Labuan Bajo has been driven largely by its proximity to the Komodo National Park [43,44], attracting tourists from around the world eager to experience its unique natural and marine life. The town itself offers a picturesque setting, with stunning coastal views and a landscape dotted with hills and traditional architecture. Labuan Bajo's development, while rapid, strives to balance the economic benefits of tourism with the preservation of its natural and cultural heritage. Komodo Village is situated on Komodo Island, one of the primary islands within the Komodo National Park. This village represents a more traditional aspect of the region, where the lifestyles of the local inhabitants are closely intertwined with their natural surroundings. The community here has a deep connection to the environment, with a lifestyle that revolves around fishing and small-scale tourism activities. Komodo Village is not only significant for its cultural heritage but also for being home to the Komodo dragons, the world's largest living lizard species. These dragons are a major attraction, and a symbol of the unique wildlife found in the region. The Komodo region, with Labuan Bajo and Komodo Village, is a microcosm of the challenges and opportunities in balancing conservation, cultural preservation, and sustainable development. This area's unique natural and cultural attributes make it an invaluable site for studies on environmental management and community-based conservation strategies.

3.2. Survey design and execution

The research methodology for this study, conducted in the Komodo subdistrict, was meticulously designed to gather local community viewpoints on community-based sanitation programs and to assess the effectiveness of public relations strategies aimed at improving access to sanitation. The survey utilized a hybrid method combining online surveys and face-to-face interviews to ensure broad and inclusive participation from the local community. This method facilitated extensive data collection during November 2024 and April 2024, capturing a diverse range of opinions exclusively from local residents. The study began with a pretest involving 50 local community members through direct interactions in Bahasa Indonesia to refine the survey questions for cultural relevance and clarity. After refining the survey based on pretest feedback, the main survey was conducted with 477 local participants using the hybrid method. Strategic data collection was carried out at key community gathering points in Labuan Bajo, such as local markets, community centers, and other frequented public areas, to ensure accessibility and convenience for participants.

A stratified random sampling technique was employed to ensure a representative sample of the local population. This sampling method

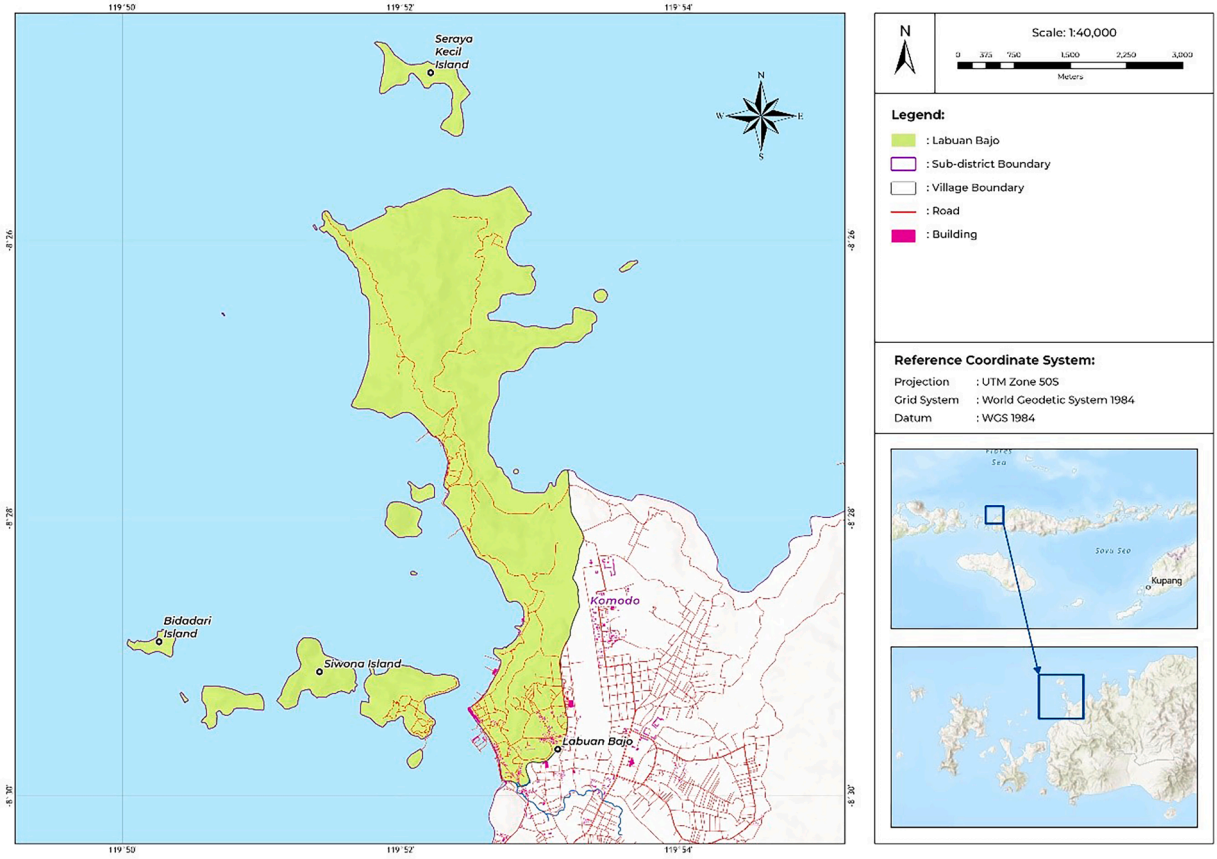


Fig. 1. Study location in Labuan Bajo, Indonesia.

was crucial for capturing a comprehensive view of the community's demographics, lifestyles, and sanitation behaviors. With a total of 477 samples collected, the study provided robust data with a 5 % margin of error, ensuring that the results are statistically significant and truly representative of the local community's views. Ethical standards were rigorously maintained throughout the research process. The research was granted approval through a local government permit, as confirmed by the approval number 503.707/IDPMPTSP/096/XI/2023. Additional permits were secured from authorities in the Komodo subistrict, ensuring the study adhered to both local and international research standards. Prior to survey participation, all local community respondents were thoroughly briefed on the research's purpose, its scope, the use of the data collected, and their rights as participants. Informed consent was obtained from each participant, ensuring they understood their involvement was voluntary and free from coercion. At the start of each survey and questionnaire, an ethical statement was provided to assure participants about the confidentiality and anonymity of their responses, and to remind them of their right to withdraw from the study at any time without repercussions.

3.3. Questionnaire design and survey execution

The questionnaire was divided into several sections to cover various aspects of sanitation access and the willingness to participate in related initiatives. The survey embarked on an exploratory journey to understand local community viewpoints regarding community-based sanitation programs for public relations achieving access to sanitation. The research foundation was laid through a detailed literature review, interactive group discussions with stakeholders, and an initial survey on community-based sanitation programs. These foundational steps informed the development of a questionnaire designed to evaluate ten key sanitation solution indicators. Presented in Bahasa Indonesia using clear and straightforward language, the questionnaire aimed to capture a comprehensive view of community-based sanitation strategies. These strategies included sustainable sanitation practices, development of eco-friendly infrastructure, agility in sanitation operations, educational support for community members, formation of community-based organizations, efforts in research and advocacy for sustainable sanitation, environmental education, training in marketing and business skills, advocacy for community rights and accountability, and inclusion of the community in sanitation planning.

Table 1 provides a comprehensive overview of the indicators used to assess the effectiveness of community-based sanitation programs within the framework of the public relations-imperative for sustainability. These indicators are crucial for evaluating various aspects of sanitation access and management, aligning with the roles public relations can play in advancing the 2030 Agenda for Sustainable Development. Each indicator is categorized based on its adaptive capacity dimension and its importance to the 2030 Agenda, highlighting how public relations strategies can enhance their implementation and impact. Designing the questionnaire involves creating items for each of the 10 indicators, asking respondents to rate both the importance and performance of each indicator using a 5-point Likert scale. The scale ranges from 1 (not important at all) to 5 (extremely important) for importance, and from 1 (very poor) to 5 (excellent) for performance. This approach ensures that the data collected reflects the community's perceptions accurately. In the data collection phase, the questionnaire is administered to a representative sample of the community, ensuring that the sample size is sufficient to provide reliable data. The sample should include diverse demographic groups and be geographically distributed to capture a comprehensive view of community perceptions.

Face-to-face interviews with 477 residents from various subdistricts were conducted in November 2023, selected through a systematic random sampling method. This approach ensured a diverse

Table 1
IPA Indicator.

Indicator	Description	Adaptive capacity dimension	Importance to 2030 agenda for public relations
Septic system adoption and maintenance [45,46]	Evaluates the extent to which septic systems are adopted and maintained effectively within the community.	Asset	Ensures sustainable water and sanitation management, contributing to SDG 6 (Clean Water and Sanitation). PR efforts can highlight successful adoption stories to encourage broader participation and support.
Septic system desludging service quality [23,47]	Assesses the quality and reliability of services provided for desludging septic systems.	Asset	Enhances the reliability and efficiency of sanitation services, aligning with SDG 6. Effective communication strategies can advocate for improved service quality and community benefits.
Public sanitation facility management [48,49]	Examines the management practices of public sanitation facilities to ensure they meet community needs and standards.	Flexibility	Promotes effective management of sanitation facilities, contributing to SDG 6. PR can play a role in educating the public on the importance of proper sanitation facility management and its benefits.
Efficient fecal sludge management systems [28,50]	Measures the efficiency of systems in place for managing and processing fecal sludge.	Flexibility	Supports efficient waste management practices, aiding SDG 6 and SDG 12 (Responsible Consumption and Production). PR efforts can focus on success stories and the environmental benefits of efficient sludge management.
Community organization engagement [51,52]	Looks at the level of engagement and participation of community organizations in sanitation efforts.	Social Organization	Encourages community involvement, crucial for achieving SDG 11 (Sustainable Cities and Communities). Public relations can facilitate community engagement by promoting the roles and successes of local organizations.
Sanitation task force effectiveness [53,5]	Evaluates the effectiveness of task forces dedicated to improving sanitation within the community.	Social Organization	Strengthens local governance and operational efficiency, contributing to SDG 11. PR can highlight the effectiveness of these task forces to garner support and enhance accountability.
Sustainability awareness program quality [54,55]	Assesses the quality of programs aimed at raising awareness about sustainability and sanitation.	Learning	Increases awareness and education on sustainability, supporting SDG 4 (Quality Education) and SDG 6. PR can amplify the reach and impact of these programs through various communication channels.
Sustainability training program efficacy [56]	Measures the effectiveness of training programs designed to educate the community on sustainable practices.	Learning	Enhances community skills and knowledge, aligning with SDG 4 and SDG 8 (Decent Work and Economic Growth). PR can promote the availability and benefits of these training programs to drive participation.
Community influence in decision-making [51,57]	Examines the extent to which the community is involved in decision-making processes related to sanitation.	Agency	Empowers communities, fostering inclusive decision-making in line with SDG 16 (Peace, Justice, and Strong Institutions). PR can showcase examples of successful community involvement to inspire similar initiatives.
Community involvement in sustainability projects [58,59]	Looks at the level of community participation in projects aimed at promoting sustainability and sanitation.	Agency	Encourages active community participation in sustainability efforts, supporting SDG 11 and SDG 13 (Climate Action). PR can highlight the positive impacts of community-led projects to motivate further involvement.

representation, with one adult from each selected household participating in the study. The sample sizes were tailored to reflect the unique demographic characteristics of each subdistrict. The survey process was initiated with a comprehensive introduction to the study's goals and a commitment to maintaining the confidentiality of the respondents' information. Additionally, the participants were offered support from the research team for any queries or clarifications. The findings of this study hold immense value for researchers, educators, policymakers, non-governmental organizations, and local community members. By shedding light on the local community's preferences and perceptions regarding community-based sanitation programs, the study paves the way for the development and implementation of tailored strategies that are closely aligned with the specific needs and contexts of the local community.

3.4. Data analysis

Data analysis was conducted using SPSS software (version 26; SPSS Statistics Inc., Chicago, IL, USA) and the NLogit program. The initial phase involved analyzing the socio-demographic data of respondents, along with their awareness and behaviors related to community-based sanitation programs. This step was crucial for establishing a baseline

understanding of the respondent profiles and their engagement with community-based sanitation programs. Following this, a matrix framework was employed to calculate and evaluate the mean scores and rankings of the Importance-Performance (I-P) indicators of sanitation solutions. This evaluation was essential in determining how the respondents perceived and valued different aspects of sanitation programs. The study then proceeded to a more nuanced analysis using paired sample *t*-tests to identify statistically significant differences in the respondents' perceptions of the I-P of sanitation solutions. For this analysis, a p-value of <0.05 was considered indicative of significant differences.

3.4.1. *Importance-performance analysis (IPA)*

In this study, Importance-Performance Analysis (IPA) was employed to assess community perceptions and guide the development of effective community-based sanitation programs in the Komodo subistrict. IPA is instrumental for visually mapping the alignment between the perceived importance of various sanitation attributes and their actual performance, as reported by the community. This methodological approach provides a structured way to understand local needs and make informed decisions to enhance sanitation practices (Fig. 2). The initial step in the process involved selecting relevant indicators that reflect critical aspects of sanitation management as experienced by the local community. These indicators were identified through a review of existing literature on environmental management and sanitation solutions, and were further refined through consultations with local stakeholders and experts in public health and environmental science. The chosen indicators encompassed a broad range of features, from the efficiency of waste management systems to the accessibility and maintenance of public sanitation facilities.

Data collection was conducted using a hybrid method that combined online surveys and face-to-face interviews, ensuring comprehensive coverage of the local community. Surveys were strategically distributed at community gathering points to capture a wide spectrum of responses. This data was essential for assessing the performance and importance of each sanitation indicator. The collected data was then plotted on an IPA grid, a two-dimensional chart that effectively visualizes the relationship between performance and importance for each indicator [37]. The X-axis of the grid represents the community's perceptions of performance for different sanitation solutions, while the Y-axis reflects their opinions on the importance of these solutions. To ensure the data used for the IPA grid was standardized and suitable for comparative analysis, a z-score normalization method was applied to the dataset [38,39,40,43]. This grid formation was adapted from established models in environmental management studies, tailored to fit the specific nuances of the local sanitation context [42–44,60,61]. The IPA grid is divided into four quadrants, each signifying a different strategic focus based on the community's assessment:

Fig. 2. IPA grid base on [37,39,40,44,60,61].

- **Quadrant I, "Impressive Sanitation Program"**: Includes indicators that are both highly important and well-performed according to community feedback. These areas are where sanitation efforts are meeting or exceeding expectations and should be continued or even used as models for other aspects of the program.
- **Quadrant II, "Focus on This Sanitation Program"**: Contains indicators deemed very important by the community but are currently underperforming. This quadrant highlights critical areas in need of immediate improvement and guides resource allocation to enhance these aspects of the sanitation system.
- **Quadrant III, "Less Significant Sanitation"**: Covers indicators that are less important and also perform poorly. These areas might require minimal intervention or could be candidates for reduced focus if resources are limited.
- **Quadrant IV, "Unnecessary Sanitation Program"**: Includes indicators that are not considered important by the community but show good performance. Resources spent on these areas could potentially be reallocated to more critical needs.

3.4.2. *Logit and probit models*

In the concluding phase, binary choice theory was employed to delve into the local community's involvement in, perceptions of, and attitudes toward sanitation solutions. The investigation centered around understanding the influence of various demographic factors, such as gender, education level, employment status, and residential area, on the community's interactions with sanitation programs. Specifically, the study examined how these factors, alongside community perceptions and behaviors toward sanitation programs, impacted the community's willingness to participate (WTP) in the program. Logit and Probit models were utilized to explore the relationship between demographic variables, community perceptions and behaviors related to sanitation programs, and the perceived importance-performance (I-P) of sanitation solutions on the community's WTP. The models particularly focused on the community's WTP in sanitation solutions in the Kecamatan Komodo area, examining factors such as the community's awareness of the importance of environmental protection, experience with waste reduction initiatives, availability of monitoring and security measures, presence of incentives and disincentives from stakeholders, and experience with current circular economy practices promoting sustainability.

Table 2 presents the socio-demographic characteristics of the respondents involved in this study. The table provides a breakdown of various factors such as gender, income levels, age, settlement type, and awareness regarding water climate impact, sanitation health impact, and access to basic sanitation. Additionally, it includes data on the respondents' willingness to participate in community-based sanitation programs. The gender distribution shows a fairly balanced representation, with slightly more females (52.6 %) than males (47.4 %). Income levels are categorized into four groups, with the majority of respondents (41.3 %) falling into the Rp. 3000,001 - Rp. 5000,000 brackets. The age distribution spans from 18 to over 50 years, with the largest group being 26–30 years old (25.2 %). The majority of respondents (93.7 %) reside in urban areas, while a smaller percentage (6.3 %) are from island areas. Awareness of water climate impact is high, with 96.2 % of respondents acknowledging its effects. Similarly, a significant portion of respondents (91.2 %) is aware of the health impacts of sanitation. Access to basic sanitation is reported by 95 % of respondents.

Four distinct models were developed to facilitate this analysis. Model I, a logit model, designated the "WTP in the overall sanitation program" as the dependent variable, examining demographic factors, community awareness, behaviors toward the sanitation program, and the overall importance of sanitation program solutions as independent variables.

Table 2
Socio-demographic of respondents.

Variable	Category	Frequency	Percent (%)
Gender	Male	226	47.4
	Female	251	52.6
Income	Less than Rp. 1000,000	33	6.9
	Rp. 1000,000 – Rp. 3000,000	154	32.3
	Rp. 3000,001 – Rp. 5000,000	197	41.3
	More than Rp. 5000,000	93	19.5
Age	18 - 25 years	48	10.1
	26 - 30 years	120	25.2
	31 - 35 years	140	29.4
	36 - 40 years	102	21.4
	41 - 45 years	41	8.6
	46 - 50 years	16	3.4
	Above 50 years	10	2.1
Settlement type	Urban Area	447	93.7
	Island Area	30	6.3
Awareness of water climate impact	Yes	459	96.2
	No	18	3.8
Awareness of sanitation health impact	Yes	435	91.2
	No	42	8.8
Access to basic sanitation	Yes	453	95
	No	24	5
Willingness to participate in community-based sanitation programs	Yes	318	66.7
	No	159	33.3

Model II, also a logit model, was similar to Model I but replaced the overall importance mean with the overall performance mean of the program solutions. Models III and IV mirrored Models I and II, respectively, but were constructed as Probit models. The primary goal of these models was to gain insights into the determinants of the local community's WTP for the sanitation program, thereby providing a comprehensive understanding of the factors driving community engagement in environmental conservation efforts within the region. The indicator IPA for this study includes septic system adoption and maintenance, septic system desludging service quality, public sanitation facility management, efficient fecal sludge management systems, community organization engagement, sanitation task force effectiveness, sustainability awareness program quality, sustainability training program efficacy, community influence in decision-making, and community involvement in sustainability projects.

4. Result

Table 3 provides a detailed Importance-Performance Analysis (IPA) of key indicators related to community-based sanitation programs, emphasizing their role in achieving sustainability goals under the 2030 Agenda. The importance scores reflect how crucial each indicator is perceived to be by the community, while the performance scores indicate how well these indicators are being implemented. The gap (I-P) between importance and performance scores is calculated to identify discrepancies, with a positive gap indicating areas where performance needs to catch up with importance. The I-P rank orders the indicators based on the size of these gaps, helping prioritize areas for improvement. Additionally, the t-values provided in the table represent the statistical significance of the differences between the importance and performance scores, with values indicating high significance marked. For instance, the indicator "Septic system adoption and maintenance" has a high importance mean score of 4.459 and a performance mean score of 3.493, resulting in a significant gap of 0.966. This indicates a strong community perception of its importance, yet a lag in performance, highlighting a critical area for intervention. By focusing on the indicators with the largest gaps and highest significance levels, policymakers and stakeholders can develop targeted communication and engagement strategies to enhance community-based sanitation programs.

Fig. 3 presents the Importance-Performance Analysis (IPA) Indicator Grid for the community-based sanitation program indicators. The "Impressive Sanitation Program" quadrant contains indicators that are considered very important and are performing well. These are the strengths of the current sanitation program and should be maintained. "Septic system adoption and maintenance" and "Efficient fecal sludge management systems" fall into this category, indicating high performance in crucial areas. The "Focus on This Sanitation Program" quadrant includes indicators that are highly important but are underperforming, suggesting areas that require immediate attention and improvement. "Septic system desludging service quality" and "Public sanitation facility management" are found here, highlighting critical areas for enhancement. The "Less Significant Sanitation" quadrant encompasses indicators perceived as less important and having lower performance scores. While these areas might not be the primary focus, their improvement could still contribute to overall program effectiveness. Indicators such as "Community influence in decision-making" and "Community involvement in sustainability projects" are located in this quadrant. Finally, the "Unnecessary Sanitation Program" quadrant includes indicators that are not deemed highly important by the community but are performing adequately. These areas, like "Sustainability training program efficacy," may not require immediate action but should still be monitored to ensure they do not decline in performance.

Table 4 provides an in-depth analysis of the factors influencing participation in community-based sanitation programs using Probit and Logit models. The Probit Model I examines the baseline factors

Table 3
Paired sample *t*-test of Importance-Performance Analysis (IPA) of key indicators related to community-based sanitation programs.

Indicators	Importance		Performance		GAP I-P	I-P Ranak	t-value
	Mean (Std. Dev)	Rank	Mean (Std. Dev)	Rank			
Septic system adoption and maintenance	4.459 (0.595)	1	3.493 (1.054)	3	0.966	3	18.654***
Septic system desludging service quality	4.423 (0.649)	2	3.384 (1.201)	8	1.04	1	15.973***
Public sanitation facility management	4.379 (0.580)	4	3.377 (1.167)	9	1.002	2	16.747***
Efficient fecal sludge management systems	4.361 (0.683)	5	3.509 (1.137)	2	0.851	9	14.499***
Community organization engagement	4.348 (0.692)	6	3.421 (1.106)	5	0.927	6	15.805***
Sanitation task force effectiveness	4.302 (0.684)	9	3.532 (1.129)	1	0.769	10	12.511***
Sustainability awareness program quality	4.394 (0.648)	3	3.434 (1.142)	4	0.96	4	16.379***
Sustainability training program efficacy	4.277 (0.657)	10	3.403 (1.131)	6	0.874	8	14.760***
Community influence in decision-making	4.335 (0.680)	7	3.394 (1.161)	7	0.941	5	15.737***
Community involvement in sustainability projects	4.304 (0.599)	8	3.377 (1.077)	9	0.927	6	16.853***

Note: The asterisks indicate the significance levels:.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

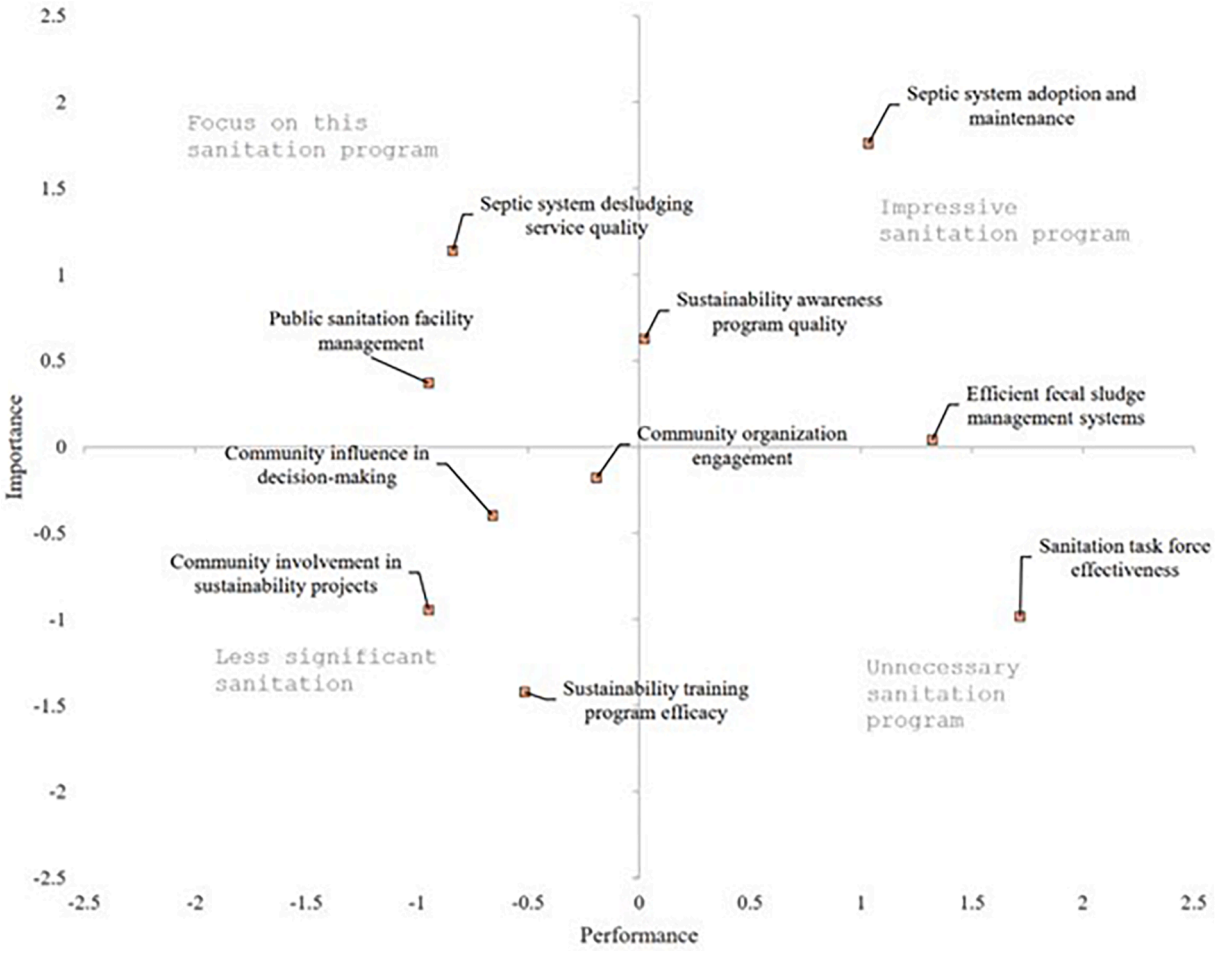


Fig. 3. IPA indicator grid.

influencing participation, revealing that gender ($p > 0.01$) and income ($p > 0.01$) are positively associated with participation in sanitation programs. This suggests that females and those with higher income levels are more likely to engage in these initiatives. Additionally, awareness of water climate impact ($p > 0.01$) and sanitation health impact ($p > 0.01$) significantly increase participation likelihood, indicating that individuals who recognize the importance of water and sanitation issues are more inclined to participate. Conversely, residing in urban communities negatively affects participation ($p > 0.01$), suggesting potential barriers in urban settings. Probit Model II builds on this by incorporating mean importance adaptation, although it does not show significant results for this variable. The log likelihood ratio for Model II (99.253) and McFadden Pseudo R-squared value (0.163) indicate a moderate fit for the model.

Logit Model III extends the analysis by including mean performance adaptation. Gender remains a significant positive factor ($p > 0.01$), along with income ($p > 0.01$), awareness of water climate impact ($p > 0.01$), and awareness of sanitation health impact ($p > 0.01$). Urban settlement continues to be a significant negative factor ($p > 0.01$). The inclusion of mean performance adaptation in Model III ($p > 0.01$) indicates that higher perceived performance of sanitation programs boosts participation. This model has a log likelihood ratio of 100.043 and a McFadden Pseudo R-squared value of 0.165, suggesting an improved fit. Logit Model IV, which also includes mean performance adaptation, confirms these findings with a log likelihood ratio of 227.642 and a McFadden Pseudo R-squared value of 0.375, demonstrating the model's robustness. Key variables such as gender ($p > 0.01$), income ($p > 0.01$), awareness of water climate impact ($p > 0.01$), and awareness of sanitation health impact ($p > 0.01$) remain significant, while urban settlement continues to negatively impact participation ($p > 0.01$).

5. Discussion

The Importance-Performance Analysis (IPA) conducted in this study offers a detailed visualization of community perceptions regarding various sanitation program indicators, laid out in a grid categorizing these indicators based on their importance and performance. The placement of indicators such as "Septic System Desludging Service Quality" and "Public Sanitation Facility Management" in the "Focus on This Sanitation Program" quadrant highlights their critical yet underperforming status, reflecting significant community concern [62,63]. These indicators, vital for public health and environmental cleanliness, have elicited feedback suggesting dissatisfaction due to infrequent and substandard service. To mitigate these issues, it is recommended to enhance service frequency by optimizing route schedules and boosting workforce training to elevate service quality. Additionally, community awareness campaigns could educate residents about the benefits of regular desludging and its impact on public health [64,65]. Conversely, "Community Influence in Decision-Making" appears in the "Less Significant Sanitation" quadrant, indicating a perceived disconnect between the community's influence over sanitation decisions and the actual impact of their input. Strengthening community engagement through robust feedback mechanisms and involving them in decision-making processes can bridge this gap [66,67]. Meanwhile, the "Sustainability Training Program Efficacy," positioned in the "Unnecessary Sanitation Program" quadrant, suggests that while these programs perform well,

Table 4
Model for participation in community base sanitation programs.

Variable Names	Model I Coeff. (Std. Error)	Model II Coeff. (Std. Error)	Model III Coeff. (Std. Error)	Model IV Coeff. (Std. Error)
Constant	0.083 (0.857)	−3.844*** (0.469)	0.288 (1.455)	−6.454*** (0.859)
Gender (1=female)	0.601*** (0.131)	0.650*** (0.151)	0.292*** (0.223)	1.030*** (0.265)
Income (> IDR 1 million)	0.387*** (0.134)	0.356** (0.152)	0.633*** (0.226)	0.580** (0.266)
Settlement (1=urban)	−2.085*** (0.455)	−1.397*** (0.471)	−3.958*** (0.945)	−2.954*** (1.054)
Awareness of water climate impact	1.069*** (0.311)	0.761** (0.340)	1.823*** (0.537)	1.291** (0.596)
Awareness of sanitation health impact	1.034*** (0.392)	0.922** (0.438)	1.821** (0.714)	1.687** (0.822)
Access to basic sanitation	0.753* (0.390)	0.698 (0.433)	1.471** (0.728)	1.547* (0.890)
Mean importance adaptation	−0.186 (0.201)	–	−0.313 (0.341)	–
Mean performance adaptation	–	0.888*** (0.085)	–	1.535*** (0.160)
Goodness of Fit Measures				
Log Likelihood	99.253	228.6	100.043	227.642
McFadden Pseudo R-squared	0.163	0.376	0.165	0.375
$\chi 2\ (0.01, 7) = 18.475$				

Note: The asterisks indicate the significance levels:.
*** $p < 0.01$,.
** $p < 0.05$,.
* $p < 0.1$.

they are not deemed essential by the community. This misalignment necessitates a reevaluation of program content to better align with community priorities and an increase in marketing efforts to highlight the program's relevance and benefits.

Furthermore, indicators like "Septic System Adoption and Maintenance" and "Efficient Fecal Sludge Management Systems" in the "Impressive Sanitation Program" quadrant are well-received and effective, indicating the success of current practices which should be maintained and possibly expanded [45,46]. Using these successful initiatives as benchmarks could set a standard for other sanitation efforts. Operationalizing these recommendations involves enhancing communication to strengthen the channels through which communities can voice their concerns and receive feedback. Increasing transparency in the processes and results of sanitation efforts can build accountability [68,69], while actively involving community members in the planning and evaluation of sanitation programs ensures initiatives are responsive and tailored to their needs. By aligning operational practices with community expectations and actively involving the community in sanitation management, these strategies aim to improve the effectiveness of sanitation programs [70], leading to better public health outcomes and enhanced community well-being.

IPA has been instrumental globally in refining community sanitation programs by aligning them with community expectations and operational realities. In Kuala Lumpur, the adaptation of the servqual model into suserv highlighted areas needing improvement within water and sewerage services [71]. This led to enhanced infrastructure and increased customer satisfaction through targeted public relations efforts that communicated the changes effectively to the public. In Taiwan, the application of IPA to municipal solid waste management allowed for a better allocation of resources to crucial yet underperforming areas [72]. Public relations strategies, including community engagement programs, were key in educating residents about sustainable waste practices, significantly improving urban environmental management. In the United States, IPA helped local governments align service performance with citizen expectations [73], enhancing service delivery and fostering a collaborative environment were public input influences policy adjustments through strategic communication. Public relations efforts increased community awareness and participation in these initiatives, demonstrating the importance of combining technical analysis with effective communication to enhance service acceptance and effectiveness.

The findings from this study provide a comprehensive understanding of the factors influencing participation in community-based sanitation programs in the Komodo subdistrict. Utilizing a robust methodological framework that includes Probit and Logit models, the study reveals significant insights into how various demographic and awareness-related factors drive engagement in these essential programs. The Probit and Logit models highlight the baseline factors influencing participation. Notably, gender and income emerged as significant positive factors. Specifically, females and individuals with higher income levels were more likely to participate in sanitation programs. This aligns with existing literature suggesting that women often play a critical role in community health and sanitation efforts [74–76]. Higher income levels typically correlate with greater access to resources and education [77–79], which in turn can foster a heightened awareness and capacity to engage in community initiatives.

Awareness of water climate impact and sanitation health impact also significantly increased the likelihood of participation. This underscores the importance of environmental and health awareness in driving community engagement. Individuals who understand the critical connections between sanitation, health, and environmental sustainability are more inclined to contribute to such initiatives. This finding supports the notion that public education and awareness campaigns are vital for mobilizing community action towards sustainable sanitation practices [80–83]. Conversely, residing in urban communities was found to negatively impact participation. This suggests potential barriers in urban settings that need to be addressed. Urban residents might face unique challenges such as limited space, higher population density, and possibly a reduced sense of community, all of which can hinder their participation in communal sanitation efforts. This finding aligns with previous studies that highlight the complexities of implementing community-based programs in urban areas [84,85]. The models incorporating mean performance adaptation show that higher perceived performance of sanitation programs boosts participation. This indicates that when community members perceive sanitation programs as effective and well-performing, they are more likely to engage. This finding emphasizes the need for not only implementing sanitation programs but also ensuring their high performance and effectiveness to sustain community engagement.

Public relations theory and practice have an important role in advancing the goals of the 2030 Agenda, specifically in building alliances. The 2030 Agenda aims to address complex global challenges through collaboration among diverse stakeholders, including governments, private sectors, and civil society. Effective PR strategies are essential for fostering communication, trust, and mutual understanding among these stakeholders [86–89]. The findings of this study provide critical insights into the importance and performance of various indicators in sanitation programs. These insights are particularly useful for PR practitioners in advancing the 2030 Agenda. For instance, the study reveals that the community places high importance on "Septic system adoption and maintenance" and "Septic system desludging service quality," indicating a preference for reliable and efficient sanitation infrastructure. Public relation practitioners can use this information to design targeted communication campaigns highlighting the benefits and successes of these programs, which can encourage greater community engagement and support. The study also highlights the significance of effective public sanitation facility management and efficient fecal sludge management systems. This emphasizes the need for proper management practices to meet community standards and needs. Public relation efforts

can focus on educating the public about the importance of proper sanitation facility management and the environmental benefits of efficient sludge management, thereby increasing public awareness and participation.

Community organization engagement and the effectiveness of sanitation task forces are key factors in achieving sustainable sanitation outcomes [53,90]. Public relation can facilitate community engagement by promoting the roles and successes of local organizations and task forces. This can strengthen local governance and enhance operational efficiency, building trust and credibility among stakeholders and encouraging broader participation and support for sanitation initiatives. The study also identifies sustainability awareness program quality and sustainability training program efficacy as important indicators. Public relation professionals can play a crucial role in developing and disseminating educational materials and training programs [91–93], enhancing community awareness and skills in sustainability. By fostering a culture of learning and continuous improvement, public relation can contribute to the long-term sustainability of sanitation programs and help achieve the broader aims of the 2030 Agenda [94,95].

Community influence and involvement are critical in decision-making and sustainability projects to ensure that sanitation programs meet the needs and preferences of the community [21,96,97]. Public relations can create platforms for dialogue and collaboration, allowing community members to share their perspectives and co-create solutions. This collaborative approach enhances the effectiveness and sustainability of sanitation programs by tailoring them to the specific needs and contexts of the community. The study's findings provide a comprehensive understanding of the factors influencing participation in community-based sanitation programs in the Labuan Bajo. Gender, income, and awareness of water, climate, and sanitation health impacts significantly drive participation. However, urban settlement poses challenges that need addressing. These insights can inform targeted interventions to enhance community engagement in sanitation initiatives, contributing to the broader goals of the 2030 Agenda. Public relations theory and practice play a critical role in advancing the alliance-building goals required for the 2030 Agenda's development. Progress on the SDGs has also advanced public relation theory and practice, emphasizing the need for integrated communication strategies aligned with sustainability objectives.

Fig. 4 presents a comprehensive evaluation framework designed to assess both the importance and performance of community-based sanitation programs, with a specific emphasis on adaptive capacity in Labuan Bajo. This framework focuses on key factors such as assets, flexibility, organization, learning, and agency, which play pivotal roles in influencing the community's willingness to participate in sanitation programs. Additionally, the framework incorporates demographic variables like gender, income, settlement type, and access to sanitation facilities. These variables are crucial in understanding the diverse factors that affect community engagement and participation in these programs. The framework aims to systematically identify the strengths and weaknesses of existing sanitation programs by evaluating how well these programs address the community's needs and adaptability to climate-related challenges. By focusing on both the importance of specific program elements and their performance in practice, the framework provides a clear picture of where improvements are needed. This evaluation is critical for developing more effective and sustainable sanitation strategies that enhance the resilience of the community in the face of urbanization and climate change.

Change management communication is essential for providing meaning and building support for sustainability initiatives. Various models and frameworks, such as the Triple Bottom Line, Integrated Reporting, and Social Return on Investment, offer new ways of assessing public relation outcomes that capture sustainability goals [98–101]. Through raising awareness, facilitating stakeholder engagement, supporting advocacy efforts, and monitoring program outcomes, public relation contributes to achieving the SDGs and building a more sustainable future. Aligning public relation strategies with sustainability goals ensures that communication efforts are not only effective but also contribute meaningfully to broader sustainable development agendas. This study highlights the potential of public relation as a catalyst for change, driving the adoption of sustainable practices and fostering a collaborative approach to global challenges. Through strategic communication and community engagement, PR helps bridge the gap between policy and practice, ensuring that the vision of the 2030 Agenda is realized in tangible and impactful ways.

6. Theoretical and practical implication

The application of IPA in this context underscores the theory that

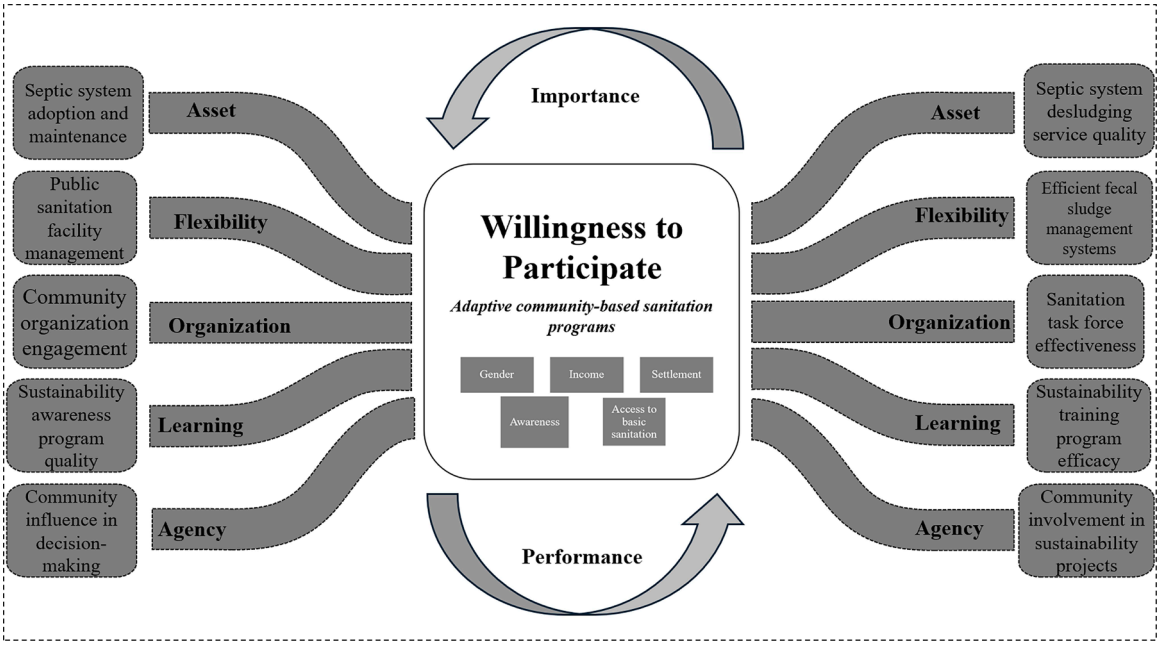


Fig. 4. Evaluation framework of importance performance of community adaptive community base sanitation programs.

engaging communities in the evaluation of public services can significantly influence program refinement and implementation. The clear categorization of sanitation services into quadrants based on community feedback directly informs service prioritization and resource allocation, aligning with theories of participatory governance and community-based management. By integrating community input into decision-making processes, the study reinforces the theoretical notion that community-involved planning leads to more sustainable and accepted public services, thereby advancing the goals outlined in the 2030 Agenda for Sustainable Development. From a practical standpoint, the findings from this study are instrumental for local government and sanitation program managers in the Komodo subistrict. By identifying specific areas of sanitation services that require immediate attention and improvement, such as enhancing the quality of septic system desludging services, local authorities can allocate resources more effectively to improve these services. Moreover, the positive feedback on well-performing areas like septic system adoption indicates where efforts are successful, providing a model that can be replicated in other less effective areas.

The demographic analysis from Probit and Logit models reveals that gender and income significantly influence community participation in sanitation programs. This insight is crucial for designing targeted engagement strategies that consider these demographic factors, potentially leading to increased participation rates. Awareness of water climate impact and sanitation health impact also plays a critical role in driving community engagement. Therefore, enhancing public education and awareness initiatives about the health and environmental impacts of inadequate sanitation can further motivate community involvement. On a policy-making level, this study offers evidence-based recommendations that can be used to revise existing sanitation policies or draft new ones that reflect the actual needs and priorities of the community. For instance, policies could be introduced to provide subsidies or financial assistance for sanitation facilities in areas where income levels significantly impact participation rates. Additionally, urban planning strategies could be adjusted to incorporate more effective sanitation solutions tailored to high-density urban settings where participation is currently less favorable. By integrating community feedback through IPA, this study provides a methodological blueprint for more sustainable and widely accepted sanitation solutions, which is essential for advancing the 2030 Agenda. The practical insights gained can guide local governments in refining their sanitation management practices to better meet the needs of their communities, while also providing a model that can be replicated in similar contexts globally.

7. Conclusion

The Importance-Performance Analysis (IPA) provides a clear understanding of community perceptions regarding various sanitation program indicators. Indicators such as "Septic system adoption and maintenance," "Septic system desludging service quality," and "Efficient fecal sludge management systems" were deemed highly important and performed well, highlighting their crucial role in community sanitation efforts. Conversely, indicators like "Public sanitation facility management" and "Community organization engagement" require improvement to meet community expectations and enhance overall sanitation outcomes. Public Relations (PR) theory significantly informs the practice by facilitating the strategic alignment of communication efforts with organizational goals, particularly in the context of public sanitation management. PR theory advocates for a strategic communication process that not only disseminates information but also builds and maintains mutually beneficial relationships between organizations and their publics. This approach is instrumental in managing perceptions and fostering a positive public image of sanitation efforts, which is crucial for their success. Effective PR strategies are essential for fostering collaboration among diverse stakeholders, including government entities, private companies, and the general public. These strategies help build trust and promote mutual understanding, which are pivotal for addressing the complex challenges posed by sustainable development goals under the 2030 Agenda. Leveraging PR models such as the Triple Bottom Line and Integrated Reporting, sanitation management can effectively communicate the economic, social, and environmental benefits of their programs, thus aligning public perceptions with the reality of their efforts.

Moreover, change management communication plays a vital role in these initiatives by providing clarity about the changes, why they are necessary, and the benefits they bring, thereby fostering a shared vision and enhancing stakeholder support. The findings from this study highlight that strategic communication and community engagement are critical to the success of sanitation programs and achieving sustainable development. Targeted and effective sanitation programs can be developed by understanding the factors that influence community participation and addressing the identified gaps. These programs should focus on enhancing community engagement, improving service quality, and promoting sustainability practices, ultimately contributing to the overall resilience and sustainability of the Komodo subdistrict and aligning with the broader objectives of the 2030 Agenda.

CRediT authorship contribution statement

Evi Siti Sofiyah: Writing – review & editing, Writing – original draft, Visualization, Data curation, Conceptualization. **Imelda Masni Juniaty Sianipar:** Writing – review & editing, Visualization, Conceptualization. **Ari Rahman:** Writing – review & editing, Writing – original draft, Conceptualization. **Hanifa Athaya Rafida:** Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Sapta Suhardono:** Writing – review & editing, Writing – original draft, Visualization, Methodology. **Chun-Hung Lee:** Writing – review & editing, Visualization, Supervision, Formal analysis, Data curation, Conceptualization. **I Wayan Koko Suryawan:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.sftr.2025.100633.

Data availability

Data will be made available on request.

References

[1] G. Matta, P. Kumar, D.P. Uniyal, D.U. Joshi, Communicating water, sanitation, and hygiene under sustainable development goals 3, 4, and 6 as the panacea for epidemics and pandemics referencing the succession of COVID-19 surges, ACS. ES. T. Water. 2 (2022) 667–689.
[2] H. Pearsall, V.H. Gutierrez-Velez, M.R. Gilbert, et al., Advancing equitable health and well-being across urban–rural sustainable infrastructure systems, npj Urban Sustain. 1 (2021) 26, https://doi.org/10.1038/s42949-021-00028-8.
[3] N.M.U. Dwipayanti, A. Nastiti, H. Johnson, et al., Inclusive WASH and sustainable tourism in Labuan Bajo, Indonesia: needs and opportunities, J Water, Sanit. Hyg. Dev. 12 (2022) 417–431, https://doi.org/10.2166/washdev.2022.222.
[4] A. Schrecongost, D. Pedi, J.W. Rosenboom, et al., Citywide Inclusive sanitation: a public service approach for reaching the urban sanitation SDGs, Front. Environ. Sci. 8 (2020).
[5] D. Spuhler, V. Germann, K. Kassa, et al., Developing sanitation planning options: a tool for systematic consideration of novel technologies and systems, J. Environ. Manage 271 (2020) 111004, https://doi.org/10.1016/j.jenvman.2020.111004.

[6] M.M. Adamu, A.C. Ali, The practice of health communication in urban sanitation, J. Dev. Comm. 31 (2020) 46–65.

[7] D. Gupta, P.N. Jai, S.J. Yadav, Strategic Communication in Health and Development: concepts, applications and programming, J. Health. Manage. 23 (2021) 95–108, https://doi.org/10.1177/0972063421994943.

[8] J. Field, Communications for infrastructure: successful stakeholder engagement on transport and infrastructure projects, Communicating Construction. Routledge (2021) 107–130.

[9] H. Park, Y. Kim, B. Popelish, Corporate social responsibility and stakeholder engagement: a content analysis of PRSA silver anvil award-winning CSR campaigns, J. Sustain. Res. 3 (2021).

[10] M.E. Warfield, L. Lorenz, H.N. Ali, J.H. Gittell, Strengthening community participation by people with disabilities in community-based group homes through innovative action research, Front Public Heal. 10 (2022).

[11] B. Anthony, The role of community engagement in urban innovation towards the Co-creation of smart sustainable cities, J. Knowl. Econ (2023), https://doi.org/10.1007/s13132-023-01176-1.

[12] B. Gilmore, R. Ndejjo, A. Tchetchia, et al., Community engagement for COVID-19 prevention and control: a rapid evidence synthesis, BMJ. Glob. Heal. 5 (2020) e003188.

[13] E.A. Moallemi, S. Malekpour, M. Hadjikakou, et al., Achieving the sustainable development goals requires transdisciplinary innovation at the local scale, One Earth. 3 (2020) 300–313.

[14] M.M. Vanegas Cantarero, Of renewable energy, energy democracy, and sustainable development: a roadmap to accelerate the energy transition in developing countries, Energy Res. Soc. Sci. 70 (2020) 101716, https://doi.org/10.1016/j.erss.2020.101716.

[15] A. Ademas, M. Adane, A. Keleb, et al., Water, sanitation, and hygiene as a priority intervention for stunting in under-five children in northwest Ethiopia: a community-based cross-sectional study, Ital. J. Pediatr. 47 (2021) 174, https://doi.org/10.1186/s13052-021-01128-y.

[16] M. Harter, J. Inauen, H.-J. Mosler, How does Community-led Total Sanitation (CLTS) promote latrine construction, and can it be improved? A cluster-randomized controlled trial in Ghana, Soc. Sci. Med. 245 (2020) 112705, https://doi.org/10.1016/j.socscimed.2019.112705.

[17] L.R. Sunaryo, P. Soewondo, Determinants of the influence of community participation on the sustainability of local system community-based sanitation programs in Temanggung Regency, E3S Web. Conf. 485 (2024).

[18] Harahap RH Susilawati, M.B. Mulya, L.S. Andayani, Behavior model of community-based sanitation management in coastal areas: confirmatory factor analysis, Heliyon. 8 (2022), https://doi.org/10.1016/j.heliyon.2022.e11756.

[19] C. Wang, J. Zhang, J. Sun, et al., Public environmental facilities: hygiene factors for tourists' environmental behaviour, Environ. Sci. Policy. 106 (2020) 40–47, https://doi.org/10.1016/j.envsci.2020.01.009.

[20] S. Dasgupta, N. Agarwal, A. Mukherjee, Moving up the on-site sanitation ladder in urban India through better systems and standards, J. Environ. Manage 280 (2021) 111656, https://doi.org/10.1016/j.jenvman.2020.111656.

[21] M.F. Prescott, M.F. Dobbie, D. Ramirez-Lovering, Green Infrastructure for sanitation in settlements in the Global South: a narrative review of socio-technical systems, Sustainability. 13 (2021).

[22] A. Seleman, S. Gabrielsson, T.S.A. Mbwette, R. Kimwaga, Drivers of unhygienic desludging practices in unplanned settlements of Dar es Salaam, Tanzania. J Water, Sanit Hyg. Dev. 10 (2020) 512–526, https://doi.org/10.2166/washdev.2020.179.

[23] J. Jaiswal, D. Mehta, M. Mehta, Impacts of scheduled desludging on quality of water and wastewater in Wai city, India. Environ. Plan. B. Urban. Anal. City. Sci. 49 (2022) 2216–2229, https://doi.org/10.1177/23998083221078596.

[24] V.A. Beard, D. Satterthwaite, D. Mitlin, J. Du, Out of sight, out of mind: understanding the sanitation crisis in global South cities, J. Environ. Manage 306 (2022) 114285, https://doi.org/10.1016/j.jenvman.2021.114285.

[25] E. Hastuti, R. Riyana, B. Joy, et al., Integrated community Onsite Sanitation system for close loop faecal management, E3S. Web. Conf. 249 (2021).

[26] V.A. Sembiring, W.D. Prabandari, E. Taviprawati, in: The Effect of Personal Hygiene on Customer Satisfaction at Aston Bellevue Hotel Jakarta During the Covid-19 Pandemic BT - Proceedings of the Palembang Tourism Forum 2021 (PTF 2021), Atlantis Press, 2021, pp. 33–41.

[27] B. Levira, L. Bright-Davies, J. Carmargo, et al., Decentralised treatment solutions for on-site faecal sludge: quantifying the removal efficiencies of two novel systems in an East African city, Environ. Sci. Water Res. Technol. 9 (2023) 603–619.

[28] A.A. Zewde, Z. Li, Z. Xiaoqin, Improved and promising fecal sludge sanitizing methods: treatment of fecal sludge using resource recovery technologies, J. Water, Sanit Hyg. Dev. 11 (2021) 335–349, https://doi.org/10.2166/washdev.2021.268.

[29] World Health Organization, Guidance On Engagement of Communities and Civil Society to End Tuberculosis, World Health Organization, 2023.

[30] M.A. Ali, M. Kamraju, in: A.K. Yadav, K. Yadav, V.P. Singh (Eds.), The Role of Community Participation in Sustainable Integrated Water Resources Management: Challenges, Opportunities, and Current Perspectives BT - Integrated Management of Water Resources in India: A Computational Approach: Optimizing for Sustainability, Springer Nature Switzerland, Cham, 2024, pp. 325–344.

[31] K. Adu-Boahen, I. Boateng, E.Y. Okyere, S. Kyeremeh, An assessment of water quality and the locals' perception of coastal lagoon pollution in Ghana: a case study of Chemu lagoon in Tema, Asian. Rev. Environ. Earth. Sci. 10 (2023) 28–39.

[32] N.M. Ardoin, A.W. Bowers, E. Gaillard, Environmental education outcomes for conservation: a systematic review, Biol. Conserv. 241 (2020) 108224, https://doi.org/10.1016/j.biocon.2019.108224.

[33] N.I. Mohamad, A. Mokhtar, I.A. Rahman, A.S. Othman, Development of a structural model for sustainable environment training and knowledge transfer, Sustainability. 15 (2023).

[34] E. Bisung, S. Dickin, Who does what and why? Examining intra-household water and sanitation decision-making and autonomy in Asutifi North, Ghana, J. Water, Sanit. Hyg. Dev. 11 (2021) 794–804, https://doi.org/10.2166/washdev.2021.039.

[35] R.K. Mugambe, T. Ssekamatte, J.B. Isunju, et al., Facilitators and barriers to the utilisation of sanitation-related decision-making support tools among environmental health practitioners in Uganda, J. Public Health (Bangkok) (2023), https://doi.org/10.1007/s10389-023-02087-w.

[36] N.K. Muhamad Khair, K.E. Lee, M. Mokhtar, Sustainable City and community empowerment through the implementation of Community-based monitoring: a conceptual approach, Sustainability. 12 (2020).

[37] J.A. Martilla, J.C. James, Importance-performance analysis, J. Mark. 41 (1977) 77–79.

[38] S. Suhardono, L. Fitria, I.Y. Septiariva, et al., Community-centric importance and performance evaluation of Human-Orangutan conflict management in Aceh, Indonesia. Trees, For People 15 (2024) 100510, https://doi.org/10.1016/j.tfp.2024.100510.

[39] I.W.K. Suryawan, V.D. Gunawan, C.-H. Lee, Assessing the importance-performance analysis of adaptive capacity programs for sustainable mangrove conservation in the Taman Nasional Bali Barat conservation area, Ocean. Coast. Manage 257 (2024) 107345, https://doi.org/10.1016/j.ocecoaman.2024.107345.

[40] I.W.K. Suryawan, S. Suhardono, V.V. Nguyen, C.H. Lee, Importance-Performance Evaluation of Coral Reef Conservation in Advancing the Bioeconomy of Marine Tourism in Bali, Indonesia, Aquat. Conserv.: Mar. Freshw. Ecosyst. 35 (2025) e70085, https://doi.org/10.1002/aqc.70085.

[41] J. Tribbe, V. Zuin, C. Delaire, et al., How do rural communities sustain sanitation gains? Qualitative comparative analyses of community-led approaches in Cambodia and Ghana, Sustainability. 13 (2021).

[42] E.S. Sofiyah, B. Ridhosari, S. Suhardono, C.H. Lee, I.W.K. Suryawan, Impact of COVID-19 on Subjective Well-being and Community Importance-Performance in Sanitation Programs in Jakarta, Indonesia, Forum Geografi 39 (2025) 64–78, https://doi.org/10.23917/forgeo.v39i1.5366.

[43] S. Imelda, C.-H. Lee, H.-J. Wang, D-C Kim, Determinant of importance-performance and willingness to participate in Komodo adaptive conservation programs, J. Nat. Conserv. (2024) 126697, https://doi.org/10.1016/j.jnc.2024.126697.

[44] A. Rahman, I.W.K. Suryawan, S. Suhardono, V.V. Nguyen, C.H. Lee, Determinants of electric vehicle adoption in urban and peri-urban areas, Energy Sustain. Dev. 85 (2025) 101664, https://doi.org/10.1016/j.esd.2025.101664.

[45] A.N. Rudman, K.K. Mulvaney, N.H. Merrill, K.N. Canfield, Factors in homeowners' willingness to adopt nitrogen-reducing innovative/alternative septic systems, Front. Mar. Sci.. 10 (2023).

[46] L.A. Warner, L.S. Krimsky, S.D. Rampold, Using a diffusion of innovation lens to understand homeowner support for septic system to sewer system conversions, J. Environ. Manage 319 (2022) 115651, https://doi.org/10.1016/j.jenvman.2022.115651.

[47] J Mac Mahon, J. Knappe, L.W. Gill, Sludge accumulation rates in septic tanks used as part of the on-site treatment of domestic wastewater in a northern maritime temperate climate, J. Environ. Manage. 304 (2022) 114199, https://doi.org/10.1016/j.jenvman.2021.114199.

[48] N.M. Koseoglu, R. Ellis, D. Biswas, Scenario-based life-cycle cost assessment to support sustainable investment in rural communal sanitation facilities: application to a school-based sanitation facility, J. Water, Sanit. Hyg. Dev. 11 (2021) 771–784, https://doi.org/10.2166/washdev.2021.230.

[49] M. Odagiri, A. Thomas, M. Listyasari, et al., Safely managed on-site sanitation: a National assessment of Sanitation services and potential fecal exposure in Indonesia, Int. J. Environ. Res. Public Health 18 (2021).

[50] M. Jain, M. Upadhyay, A.K. Gupta, P.S. Ghosal, A review on the treatment of septage and faecal sludge management: a special emphasis on constructed wetlands, J. Environ. Manage. 315 (2022) 115143, https://doi.org/10.1016/j.jenvman.2022.115143.

[51] S. Nelson, D. Drabarek, A. Jenkins, et al., How community participation in water and sanitation interventions impacts human health, WASH infrastructure and service longevity in low-income and middle-income countries: a realist review, BMJ. Open. 11 (2021) e053320.

[52] E. Tsekleves, M. Fonseca Braga, C. Abonge, et al., Community engagement in water, sanitation and hygiene in sub-Saharan Africa: does it WASH? J. Water, Sanit Hyg. Dev. 12 (2022) 143–156, https://doi.org/10.2166/washdev.2022.136.

[53] A.S. Narayan, M. Maurer, C. Lüthi, The clean plan: analysing sanitation planning in India using the CWIS planning framework, J. Water, Sanit. Hyg. Dev. 11 (2021) 1036–1047, https://doi.org/10.2166/washdev.2021.130.

[54] I.R. Abubakar, K.M. Maniruzzaman, U.L. Dano, et al., Environmental sustainability impacts of solid waste management practices in the Global South, Int. J. Environ. Res. Public Health 19 (2022).

[55] T. Schellenberg, V. Subramanian, G. Ganeshan, et al., Wastewater discharge standards in the evolving context of urban sustainability–The case of India, Front. Environ. Sci.. 8 (2020).

[56] D.M. Anderson, A.K. Gupta, S. Birken, et al., Successes, challenges, and support for men versus women implementers in water, sanitation, and hygiene programs: a qualitative study in rural Nepal, Int. J. Hyg. Environ. Health 236 (2021) 113792, https://doi.org/10.1016/j.ijheh.2021.113792.
[57] T. Foster, J. Falletta, N. Amin, et al., Modelling faecal pathogen flows and health risks in urban Bangladesh: implications for sanitation decision making, Int. J. Hyg. Environ. Health 233 (2021) 113669, https://doi.org/10.1016/j.ijheh.2020.113669.
[58] T. Bayu, H. Kim, T. Oki, Water governance contribution to Water and sanitation access equality in developing countries, Water. Resour. Res. 56 (2020) e2019WR025330, https://doi.org/10.1029/2019WR025330.
[59] C. Tortajada, Contributions of recycled wastewater to clean water and sanitation Sustainable Development Goals, NPJ. Clean. Water. 3 (2020) 22.
[60] I.W.K. Suryawan, C.H. Lee, Green transition management: The key role of community participation in developing resilient waste management policies for coastal and inland communities, Environ. Sci. Pollut. Res. (2025) 1–18, https://doi.org/10.1007/s11356-025-36185-x.
[61] B.C. Yang, C.H. Lee, I.W.K. Suryawan, Consumers' willingness to pay and importance-performance gaps for resilient e-waste management in Taiwan, J. Clean. Prod. 484 (2024) 144313, https://doi.org/10.1016/j.jclepro.2024.144313.
[62] A.P. Mishra, S. Singh, M. Shekhar Sarkar, et al., Integrating community perceptions, scientific data and geospatial tools for sustainable water quality management, Results. Eng. 23 (2024) 102563, https://doi.org/10.1016/j.rineng.2024.102563.
[63] I. Sarfefa, W. Rengkung, R.N. Wurarah, The synergy between the government and the society for sustainable sanitation, Soc. Ecol. Econ. Sustain Dev. Goals J. 1 (2024).
[64] M. Amarille, C. Balomaga, Awareness and practices on domestic wastewater sanitation of select Coastal Barangay in Surigao City, Philippines. J. Ecosyst. Sci. Eco-Governance. 3 (2021) 14–24.
[65] A.K. Yushinta, M. Martaleni, R. Astuti, Implementing sanitation marketing as a form of social marketing: a case scheduled desludging service, Malang City. J Manaj Strateg dan Apl. Bisnis 5 (2022) 319–338.
[66] M. Choudhury, H. Wu, A.K.M. Shahidullah, Improving the feedback loop between community- and policy-level learning: building resilience of coastal communities in Bangladesh, Sustain. Dev. 32 (2024) 1508–1524, https://doi.org/10.1002/sd.2686.
[67] A. Teladia, H. van der Windt, Citizen participation gaps and challenges in the heating transition: learning from Dutch community initiatives, Renew. Sustain. Energy Rev. 189 (2024) 113975, https://doi.org/10.1016/j.rser.2023.113975.
[68] S. Dickin, A. Syed, N. Qowamuna, et al., Assessing mutual accountability to strengthen national WASH systems and achieve the SDG targets for water and sanitation, H2Open. J. 5 (2022) 166–179, https://doi.org/10.2166/h2oj.2022.032.
[69] D. Wibowo, K. Hashimoto, K.E.S. Ram, Accountability Mechanisms in the public Sector: a literature review on the benefits and challenges in the water and sanitation sector, Account Mech Incl. City-Level Public Serv. Asia 16 (2023).
[70] R.D. Nandineni, S.P. Dash, Capacity building in water resource management in developing countries. Clean Water and Sanitation, Springer, 2022, pp. 49–61.
[71] A. Salleh, N. Othman, An importance-performance analysis of sustainable service quality in water and sewerage companies, Ind. Eng. Manag. Syst. 18 (2019) 89–103.
[72] M.-L. Tseng, Importance–performance analysis of municipal solid waste management in uncertainty, Environ. Monit. Assess. 172 (2011) 171–187, https://doi.org/10.1007/s10661-010-1325-7.
[73] G.G. Van Ryzin, S. Immerwahr, Importance-performance analysis of citizen satisfaction surveys, Public Adm. 85 (2007) 215–226, https://doi.org/10.1111/j.1467-9299.2007.00641.x.
[74] N. Carrard, J. MacArthur, C. Leahy, et al., The water, sanitation and hygiene gender equality measure (WASH-GEM): conceptual foundations and domains of change, Womens. Stud. Int. Forum. 91 (2022) 102563, https://doi.org/10.1016/j.wsif.2022.102563.
[75] P. Pouramin, N. Nagabhatla, M. Miletto, A systematic review of water and gender interlinkages: assessing the intersection with health, Front. Water. 2 (2020) 6.
[76] R. Sibarani, P. Simanjuntak, E.J. Sibarani, The role of women in preserving local wisdom Poda Na Lima 'five advices of cleanliness' for the community health in Toba Batak at Lake Toba area, Gac. Sanit. 35 (2021) S533–S536, https://doi.org/10.1016/j.gaceta.2021.10.086.
[77] Y. Duan, J. Shi, Z. Wang, et al., Disparities in COVID-19 vaccination among low-, middle-, and high-income countries: the mediating role of vaccination policy, Vaccines. (Basel) 9 (2021).
[78] O.M. Garbasevschi, H. Taubenböck, P. Schüle, et al., Learning income levels and inequality from spatial and sociodemographic data in Germany, Appl. Geogr. 159 (2023) 103058, https://doi.org/10.1016/j.apgeog.2023.103058.
[79] T. Lomas, Exploring associations between income and wellbeing: new global insights from the Gallup World Poll, J. Posit. Psychol. 19 (2024) 629–646, https://doi.org/10.1080/17439760.2023.2248963.
[80] K. Altaf, K. Zahra, Shifting the paradigms: empowering slum dwellers through hygiene training and educational awareness, J. Heal. Rehabil. Res. 4 (2024) 3–4.
[81] A.C. Babalola, P.Y. Akpomuje, Advocating attitudinal change to waste disposal and environmental health promotion through adult and non-formal education in Nigeria, J. Teach. Teach. Educ. 8 (2020).
[82] M. Manisha, Y. Madhavi, Diffusion and adoption of sanitation facilities among urban poor: navigating challenges, Sustain. Water. Resour. Manage 10 (2024) 64, https://doi.org/10.1007/s40899-024-01046-x.
[83] N. Ramathan, Bridging the gap: Community participation in sanitation for enhancing adoption and usage, Int. Multidiscip. J. Res. Dev. 10 (2023) 17–21.
[84] S. Nickel, O. von dem Knesebeck, Effectiveness of community-based health promotion interventions in Urban areas: a systematic review, J. Community Health 45 (2020) 419–434, https://doi.org/10.1007/s10900-019-00733-7.
[85] J. South, D. Button, A. Quick, et al., Complexity and community context: learning from the Evaluation design of a National Community Empowerment Programme, Int. J. Environ. Res. Public Health 17 (2020).
[86] Y.-R.R. Chen, C.-J.F. Hung-Baesecke, S.A. Bowen, et al., The role of leadership in shared value creation from the public's perspective: a multi-continental study, Public. Relat. Rev. 46 (2020) 101749, https://doi.org/10.1016/j.pubrev.2018.12.006.
[87] Y. Lee, C.A. Yue, Status of internal communication research in public relations: an analysis of published articles in nine scholarly journals from 1970 to 2019, Public. Relat. Rev. 46 (2020) 101906, https://doi.org/10.1016/j.pubrev.2020.101906.
[88] N. Logan, A theory of corporate responsibility to race (CRR): communication and racial justice in public relations, J. Public. Relations Res. 33 (2021) 6–22, https://doi.org/10.1080/1062726X.2021.1881898.
[89] C. Troise, M.A. Camilleri, The use of digital Media for marketing, CSR communication and stakeholder engagement, in: M.A. Camilleri (Ed.), Strategic Corporate Communication in the Digital Age, Emerald Publishing Limited, 2021, pp. 161–174.
[90] S. Mariwah, in: PO-W Adjei, S. Adu-Gyamfi (Eds.), Decentralization and Resource Capacity For Sustainable Sanitation Services Delivery in Ghana BT - Democratic Decentralization, Local Governance and Sustainable Development: Ghana's Experiences For Policy and Practice in Developing Countries, Springer International Publishing, Cham, 2022, pp. 193–208.
[91] J. Hagelstein, S. Einwiller, A. Zerfass, The ethical dimension of public relations in Europe: digital channels, moral challenges, resources, and training, Public. Relat. Rev. 47 (2021) 102063, https://doi.org/10.1016/j.pubrev.2021.102063.
[92] P.S. Ngondo, A. Klyueva, Exploratory study of public relations roles in Zimbabwe, Public Relat. Rev. 46 (2020) 101961, https://doi.org/10.1016/j.pubrev.2020.101961.
[93] G.A. Yudarwati, A. Gregory, Improving government communication and empowering rural communities: combining public relations and development communication approaches, Public Relat. Rev. 48 (2022) 102200, https://doi.org/10.1016/j.pubrev.2022.102200.
[94] J. Antony, S. Bhat, M. Sony, et al., Sustainable development through quality management: a multiple-case study analysis of triumphs, trials and tribulations, TQM. J. (2024), https://doi.org/10.1108/TQM-12-2023-0424 ahead-of-p.
[95] A. Raiden, A. King, Social value, organisational learning, and the sustainable development goals in the built environment, Resour. Conserv. Recycl. 172 (2021) 105663, https://doi.org/10.1016/j.resconrec.2021.105663.
[96] C.P.Y. Rossio, Y. Seo, Participatory approaches in the planning of drinking water supply and basic sanitation projects in the rural areas of Colombia, KSCE. J. Civ. Eng. 24 (2020) 1374–1382, https://doi.org/10.1007/s12205-020-1091-1.
[97] D. Spuhler, C. Lüthi, Review of frameworks and tools for urban strategic sanitation planning: considering technology innovations and sustainability, J. Water, Sanit Hyg. Dev. 10 (2020) 768–785, https://doi.org/10.2166/washdev.2020.062.
[98] S. Cantele, S. Landi, S. Vernizzi, Measuring corporate sustainability in its multidimensionality: a formative approach to integrate ESG and triple bottom line approaches, Bus. Strateg. Environ. n/a (2024), https://doi.org/10.1002/bse.3872.
[99] C. de Villiers, R. Dimes, Critical analysis of the contribution of Integrated Reporting (IR) to sustainability. Handbook of Accounting and Sustainability, Edward Elgar Publishing, 2022, pp. 210–223.
[100] S. Hamad, M.U. Draz, F.-W. Lai, The impact of corporate governance and sustainability reporting on integrated reporting: a conceptual framework, Sage. Open. 10 (2020) 2158244020927431, https://doi.org/10.1177/2158244020927431.
[101] K. Lueg, R. Lueg, Deconstructing corporate sustainability narratives: a taxonomy for critical assessment of integrated reporting types, Corp. Soc. Responsib. Environ. Manage 28 (2021) 1785–1800, https://doi.org/10.1002/csr.2152.