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# Management Of Drinking Water, Sewerage And Wastewater Treatment In Peru 2024

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***Abstract***
*The present study is an exhaustive analysis of the quality of drinking water, sewerage, and wastewater treatment services in the Peruvian territory. The inquiry was predicated on a fundamental research methodology employing a quantitative approach and a non-experimental design of descriptive level, with the primary focus being documentary analysis. To this end, a comprehensive review of specialized theoretical literature on service quality was conducted, along with a thorough examination of the background of previous research relevant to the subject. Additionally, the National Sanitation Plan that is currently in effect for the period 2022-2026 was reviewed, as was the regulatory framework that governs the sanitation sector in the country. Moreover, official statistical information was incorporated to complement the analysis. The objective of the research was to comprehend the present state of these vital services, to ascertain their predominant characteristics, and to identify the prevailing issues at the national level. The desk analysis enabled the collection of diverse data and perspectives on the infrastructure, management, coverage, and efficiency of drinking water and sewerage systems. A particular emphasis was placed on the policies and strategies outlined in the National Sanitation Plan, as well as the regulations and standards designed to ensure the quality and sustainability of these services. The study also considered the available statistical information on access to these services, the quality of the water supplied, the efficiency of wastewater treatment systems, and other relevant indicators. The integration of these quantitative data with the analysis of the documentation yielded a more comprehensive and detailed perspective on the sanitation situation in Peru. This descriptive research establishes the foundation for subsequent inquiries that can investigate the underlying causes of the identified deficiencies and propose more specific and effective solutions to enhance the quality of life of the Peruvian population through adequate sanitation services.*
***Keywords:*** *Quality, Sanitation Services, wastewater treatment, quality of life in Peru, Government*

**RESUMEN**
El presente estudio es un análisis exhaustivo de la calidad de los servicios de agua potable, alcantarillado y tratamiento de aguas residuales en el territorio peruano. La investigación se basó en una metodología de investigación fundamental que empleó un enfoque cuantitativo y un diseño no experimental de nivel descriptivo, con un enfoque principal en el análisis documental. Para ello, se llevó a cabo una revisión exhaustiva de la literatura teórica especializada sobre la calidad de los servicios, junto con un examen minucioso de los antecedentes de investigaciones previas relevantes para el tema. Además, se revisó el Plan Nacional de Saneamiento vigente para el período 2022-2026, así como el marco normativo que regula el sector del saneamiento en el país. Por otra parte, se incorporó información estadística oficial para complementar el análisis. El objetivo de la investigación fue comprender el estado actual de estos servicios vitales, determinar sus características predominantes e identificar los problemas más importantes a nivel nacional. El análisis documental permitió recopilar diversos datos y perspectivas sobre la infraestructura, la gestión, la cobertura y la eficiencia de los sistemas de agua potable y alcantarillado. Se hizo especial hincapié en las políticas y estrategias esbozadas en el Plan Nacional de Saneamiento, así como en las normas y estándares diseñados para garantizar la calidad y la sostenibilidad de estos servicios. El estudio también consideró la información estadística disponible para el acceso a estos servicios, la calidad del agua suministrada, la eficiencia de los sistemas de tratamiento de aguas residuales y otros indicadores relevantes. La integración de estos datos cuantitativos con el análisis de la documentación proporcionó una perspectiva más completa y detallada de la situación del saneamiento en el Perú. Esta investigación descriptiva sienta las bases para investigaciones posteriores que puedan investigar las causas subyacentes de las deficiencias identificadas y proponer soluciones más específicas y eficaces para mejorar la calidad de vida de la población peruana mediante servicios de saneamiento adecuados.
**Palabras clave:** Calidad, Servicios de saneamiento, tratamiento de aguas residuales, calidad de vida en Perú, Gobierno

**RESUMO**
O presente estudo é uma análise exaustiva da qualidade dos serviços de água potável, esgoto e tratamento

de águas residuais no território peruano. A investigação baseou-se numa metodologia de investigação fundamental que empregou uma abordagem quantitativa e um desenho não experimental de nível descritivo, com foco principal na análise documental. Para tal, foi realizada uma revisão abrangente da literatura teórica especializada sobre qualidade de serviços, juntamente com uma análise aprofundada do contexto de investigações anteriores relevantes para o tema. Além disso, foi analisado o Plano Nacional de Saneamento atualmente em vigor para o período 2022-2026, bem como o quadro regulamentar que rege o setor de saneamento no país. Além disso, foram incorporadas informações estatísticas oficiais para complementar a análise. O objetivo da pesquisa foi compreender o estado atual desses serviços vitais, determinar suas características predominantes e identificar as questões prevalecentes em nível nacional. A análise documental permitiu a recolha de dados e perspetivas diversificadas sobre a infraestrutura, a gestão, a cobertura e a eficiência dos sistemas de água potável e esgotos. Foi dada especial ênfase às políticas e estratégias delineadas no Plano Nacional de Saneamento, bem como aos regulamentos e normas destinados a garantir a qualidade e a sustentabilidade destes serviços. O estudo também considerou as informações estatísticas disponíveis sobre o acesso a estes serviços, a qualidade da água fornecida, a eficiência dos sistemas de tratamento de águas residuais e outros indicadores relevantes. A integração desses dados quantitativos com a análise da documentação proporcionou uma perspectiva mais abrangente e detalhada sobre a situação do saneamento no Peru. Esta pesquisa descritiva estabelece as bases para investigações subsequentes que possam investigar as causas subjacentes das deficiências identificadas e propor soluções mais específicas e eficazes para melhorar a qualidade de vida da população peruana por meio de serviços de saneamento adequados.
**Palavras-chave:** Qualidade, Serviços de saneamento, tratamento de águas residuais, qualidade de vida no Peru, Governo

## INTRODUCTION

The state of drinking water and sewerage services in Peru has been a source of frustration and disappointment for the Peruvian population. This assessment is supported by the findings of the Ministry of Housing, Construction and Sanitation (MVCS), the governing body, and the National Superintendence of Sanitation Services (SUNASS), the regulatory body. According to recent data, approximately 6.14 million Peruvians do not have access to potable water, and 9.28 million lack access to basic sanitation services, including sewers. This dearth of essential services compels the population to reside in precarious and unsanitary conditions, which has far-reaching public health implications. Defecating in the open has been demonstrated to have deleterious effects on child development, leading to the onset of intestinal, parasitic, and skin diseases. Moreover, it has been shown to have a detrimental effect on quality of life and economic development in general.

This situation is in direct opposition to the United Nations' sixth Sustainable Development Goal (SDG), which advocates universal access to clean water and sanitation. Despite the MVCS's five-year plans, deficiencies in these services persist and even worsen overtime.

Conversely, a significant segment of the population that utilizes these services encounters various quality issues, including low pressure, interruptions, inaccurate metering, and billing errors. Furthermore, inadequate wastewater treatment has been observed, resulting in environmental contamination. Operators utilize infrastructure that is no longer state-of-the-art, which is characterized by a multitude of leaks and water losses. This infrastructure is further compounded by flooding and subsidence of tracks. A similar situation is observed with sewage systems, which are subject to collapsed collectors and uncapped mailboxes. This results in untreated sewage being discharged directly into water sources, leading to environmental contamination.

This study aims to ascertain the underlying factors that have contributed to the substandard quality of drinking water and sewerage services in Peru since their inception over a century ago.

### Background

In their research, Alvarado and Marrache (2020) emphasize the importance of sanitation services in promoting population health and enhancing quality of life. They also underscore sanitation as a pivotal indicator of economic progress in a nation. In their research, they identified and analyzed the primary issues afflicting this sector in Peru.

In his research, Motero (2022) addresses Sustainable Development Goal (SDG) No. 6, which refers to universal coverage of sanitation services. The objective of SDG No. 6 is to guarantee access, sustainable management, and quality of drinking water for all. Their statistical analysis indicates that the absence of these services constitutes the primary cause of diarrhea and mortality among children under five years of age, as reported by the WHO.

Carlos, D. (2023) conducted research with the objective of evaluating the impact of results-based public management on the quality of life of citizens in the Junín region during the year 2021. A quantitative approach and a non-experimental design were employed, with a hypothetical deductive method being applied. The results indicated that results-based public management had a direct and significant impact on the reduction of gaps in the Junín region. The report recommends the implementation of the program in other locations.

Pastor, O. (2023) makes reference to the active involvement of the United Nations (UN) since the beginning of the twenty-first century, both in intellectual and diplomatic terms, to exert influence on the national policies of its member countries and achieve universal coverage of drinking water and sanitation services. These objectives were initially endorsed from 2005 to 2015 as components of the Millennium Development Goals (MDGs), and were subsequently revised, augmented, and expanded in the Sustainable Development Goals (SDGs) that took effect after 2015.

In an effort to guarantee a sustainable future, the National Water Authority (2023) has presented a comprehensive plan to manage the water of the Mantaro River basin. This document, produced in 2023, underscores the pivotal role of water in fostering sustainable development and enhancing community well-being. The plan's objective is to ensure the equitable and efficient use of water. To this end, it involves all relevant actors, including those in the energy, agriculture, and sanitation sectors.

In 2021, Baltodano (2021) proposed a series of measures designed to enhance the quality of water and sanitation services in Pacasmayo. This proposal identified the pivotal factors that influence user satisfaction as well as that of employees. A survey of 55 stakeholders and 25 officials revealed that the quality of service and technical aspects are priorities. In addressing this challenge, a co-responsibility strategy is proposed, emphasizing shared leadership and the valuation of water.

In his doctoral research, Silva (2022) analyzes the performance of JASS in rural areas, identifying their strengths and weaknesses in drinking water management. The research proposes a management model to guarantee the sustainability of the service, emphasizing administration, operation, maintenance, and education. The findings indicate that the operation and maintenance activities are adequately evaluated, while the management requires enhancements.

The doctoral research of Soncco, Y. (2019) sought to economically evaluate the health impact of a change in the quality of drinking water and sewerage services in households located on the periphery of the city of Juliaca. To this end, the researchers employed the indirect assessment methodology known as the Health Production Function, which utilizes disease as a dependent variable to gauge the impact on the health of the surveyed households. The findings of the study indicate that the population is willing to incur a higher cost for the benefit of their health, which would generate a total economic benefit of 3,617,974.21 soles for improving the quality of water for human consumption.

Carhuanayocc et al. (2022) implemented an irrigation analysis using the Monte Carlo model in a sanitation project in a town in northern Peru. The objective of this analysis was to evaluate the sustainability of the project. The result of this study underscored the necessity to implement substantial improvements to mitigate complaints and enhance user satisfaction. These improvements included enhancing water quality, ensuring greater continuity, optimizing water pressure, expanding coverage, reducing losses, and emphasizing the efficiency of public spending.

A team of researchers, led by Ferro, P. (2022), conducted a study on the quality of drinking water in Ilave, Peru. To accomplish this objective, the researchers evaluated the correlation between several physicochemical, microbiological, and heavy metal parameters in the water samples. The findings indicated that, with the exception of residual chlorine, which registered below the recommended level, all parameters were in accordance with Peruvian regulatory standards. The presence of coliforms was detected in all household samples, indicating the need to enhance infrastructure maintenance procedures, identify potential contamination and cross-connection points, and augment chlorine dosing. The study underscores the significance of continuous monitoring and the potential for seasonal variations in water quality.

According to the findings of Ramírez et al. (2017), the objective of the study was to delineate the challenges and strategies employed by the Physikalisch-Technische Bundesanstalt (PTB) in collaboration with institutions in Peru, Bolivia, and Nicaragua to enhance the quality of infrastructure in water and sanitation services in Latin America. The methodology entails collaboration with regional partners to address the identified challenges. The results of the study include case studies of infrastructure projects in Bolivia and Peru, which demonstrate the practical implementation of quality infrastructure services. The conclusion underscores the significance of international collaboration in enhancing water and sanitation services, with a particular emphasis on the beneficial impact of Germany's development cooperation initiatives in Latin America.

The research developed by Bonifaz J. (2014) sought to analyze the provision of water and sanitation services in Peru, focusing on the performance of supplier companies and tariff schemes. The methodology entails a thorough investigation into the political economy of the Peruvian water and sanitation sector, with a particular focus on its pricing scheme. The findings indicate that in 2004, 71% of the Peruvian population had access to water services, while 63% had access to sanitation services. This suggests that there is potential for enhancement in the provision of these services. In summary, the study indicates deficiencies in the performance of water and sanitation providers in Peru. It emphasizes the necessity to enhance comprehension of the political economy and tariff structures of the sector to improve service delivery.

According to the research developed by Eagin & Graham (2014), the objective was to analyze trends in access to water supply and sanitation (WS&S) in Peru to determine whether improvements were equitable in different subpopulations. The researchers utilized data from demographic and health surveys, with a particular emphasis on access to safe drinking water and sanitation at the household level. While significant progress has been made in terms of access to services, disparities between subpopulations persist. The implementation of specific interventions to improve equity in access to services, especially for high-risk populations, was recommended.

Hernandez-Vasquez et al. (2021) developed a research study with the objective of assessing socioeconomic inequalities in access to drinking water in Peruvian households according to the size of the city between 2008 and 2018. The result indicated an overall increase in access to water, but with disparities between city sizes. A lack of change was observed in small cities, while medium- and large-sized cities demonstrated improvements. The study revealed that socioeconomic disparities between the wealthiest and poorest households increased during the specified study period. The conclusion of this study indicates a necessity for the implementation of specific policies and strategies to address disparities and promote equitable access.

Mendoza, M. (2016). An examination of the Local Water and Sanitation Management Committee of the AAHH of Cerro Las Animas. The research employed a mixed methods approach, encompassing document analysis and interviews with water operators, engineers, and residents. The Water Committee, established through international collaboration, was found to have deficiencies in technical and operational capacity, as well as in the areas of sustainability, equity, and transparency. The rationale behind this phenomenon is that the subject is situated within an urban area. The municipal company is the primary entity responsible for the system's operation, and its operational scope does not extend to other operators. Consequently, the company has determined that the implementation of inclusive policies is imperative.

Felgendreher, S., & Lehmann, P. (2016). The researchers examined the impact of the policy on the quality and management of water utilities. They concluded that the implementation of reforms in the water sector, especially tariff increases, is hindered by political factors in many developing countries. In Peru, the electoral structure and the interests of local politicians have impeded the implementation of higher rates, despite their critical role in enhancing service quality. In order to surmount the aforementioned impediments, a more profound institutional reform is hereby posited. This reform would entail the amalgamation of local and regional water suppliers, complemented by information campaigns that elucidate how tariff increases translate into substantial benefits for users.

**Theoretical basis**

Edwards Deming, widely regarded as the progenitor of total quality and continuous improvement, developed a planning model known as the four-phase cycle. The continuous improvement process is initiated with the identification and analysis of problems. This is followed by the implementation of

solutions, the monitoring and verification of results, and the evaluation of the effectiveness of the actions. Inefficiencies are then reevaluated and corrected, and a new cycle begins. This process is repeated in succession, and it is referred to as continuous improvement.

Drucker, a pioneering figure in the field of modern management, posited that human resources constitute the fundamental element for achieving quality and productivity in organizational settings. For him, the development of human capital was pivotal to the economy of the twentieth century. Drucker underscored the significance of an organizational culture that esteemed employees as assets, promoting their growth and well-being. According to Drucker, leadership should prioritize leveraging the strengths of teams and establishing structures that enable the attainment of total quality, conceptualized as a comprehensive objective encompassing all facets of the organization. In summary, Drucker proposed a vision of business management in which people are the engine of change and quality is achieved through leadership focused on human development and the creation of a positive organizational culture.

According to Parasuraman, A., Zeithaml, A., & Berry, L. (1988), the term "customer experience" refers to the perception that customers have regarding the excellence and satisfaction they experience when interacting with a company or institution. The objective is to consistently meet and, if possible, surpass user expectations at every point of interaction. Nevertheless, he posits that the term "customer satisfaction" is inherently subjective and contingent on the individual customer's perception. In essence, he contends that the quality of a given service may be perceived as either satisfactory or unsatisfactory, depending on the customer's specific circumstances and expectations.

The term "public services" refers to business activities developed by the state to address the needs of the population. While most of these services receive subsidies and users do not bear the full cost of their use, they are ultimately funded by society through taxation. The state is obligated to utilize these resources in an efficient manner to ensure the quality of services.

In essence, the quality of a service can be defined as the extent to which it fulfills or surpasses the needs and expectations of its customers.

The quality of services is comprised of various elements that interact with each other to create a positive customer experience. Among the most salient elements are:

- Reliability: Ability to deliver the promised service accurately and reliably.
- Answer: Willingness to help customers and provide prompt service.
- Competence: Knowledge and skills of the employees to provide the service.
- Accessibility: Ease of contacting the company and obtaining the service.
- Courtesy: Kindness and respect in dealing with customers.
- Communication: Clarity and efficiency in communication with customers.
- Credibility: Trust that employees and the company inspire.
- Security: Protection of customers' interests.
- Tangible: Physical appearance of facilities, equipment and materials.
- Empathy: Understanding of customers' needs and feelings.

These elements, known as the 10 dimensions of service quality and are widely used in service quality management.

## METHODOLOGY

The objective of the study was to assess the quality of drinking water and sewerage services received by users according to the size and type of sanitation service providers in Peru. To this end, quality indicators were evaluated, including the coverage of drinking water and sewerage services, the continuity of the service, the water pressure in the network, the percentage of treated wastewater, the percentage of non-billed water, the number of blockages and the number of blowouts, and the number of claims. Consequently, the objective is to identify the factors contributing to the quality of services by the year 2024.

The research design was of a basic, quantitative nature, employing a non-experimental approach and functioning at a descriptive level. The study's findings were grounded in statistical data derived from SUNASS. It is imperative to acknowledge that the proposal under consideration places significant emphasis on the Sustainable Development Goals (SDGs). The SDGs encompass a wide range of targets, including but not limited to the promotion of universal access to sanitation services and environmental

protection. Furthermore, the proposal underscores the importance of ensuring the quality of services provided.

## DISCUSSION AND RESULTS

The Ministry of Housing, Construction and Sanitation (MVCS) serves as the regulatory authority for the sanitation sector in Peru. In conjunction with the regional governments (GORE), provincial municipal governments (MP), and district municipalities (MD), they have been entrusted with the operational responsibility for sanitation services at the national level.

The organizational structure for the provision of services is as follows: At the urban level, 51 Service Provider Entities (EPS) are in operation, of which one is SEDAPAL, a mega company under the responsibility of the state (FONAFE). The remaining 50 EPS are under the jurisdiction of the MP. The group of companies is divided into four categories: Large EPS 1 (G1), Large EPS (G2), Medium EPS (M), and Small EPS (P).

A subsequent group of 143 urban cities with over 15,000 inhabitants does not fall under the purview of an EPS. These cities are instead administered by the MD through the Municipal Management Units (UGM). Additionally, there are small urban cities with over 2,000 and a population of 15,000 inhabitants that are also administered by the UGM. Finally, the administration of rural areas is entrusted to the user boards, with the provision of technical assistance from municipal technical areas (ATM).

Table 1 presents the organization previously delineated, along with the population engaged in each sector. According to recent estimates, the population of Peru as of 2024 is approximately 34.67 million. A significant proportion of the population, approximately 11 million, lacks access to basic drinking water services, while a further 13.7 million do not have access to adequate sewerage systems.

**Table 1 Population and service coverage**

| INDICADORES I | | | | | | | |
|---|---|---|---|---|---|---|---|
| OPERADOR | | | POBLACIÓN (MILES DE HAB.) | | | COBERTURAS | |
| TIPO | | CANTIDAD DE EPS | TOTAL | CON AGUA POTABLE | CON ALCANTARILLADO | AGUA POTABLE | ALCANTARILLADO |
| SEDAPAL | EPS - S | 1 | 10,519 | 9,863 | 9,610 | 93.77% | 91.36% |
| EPS GRANDES 1 | EPS - G1 | 6 | 5,277 | 4,736 | 4,356 | 89.76% | 82.55% |
| EPS GRANDES 2 | EPS - G2 | 13 | 3,643 | 3,090 | 2,643 | 84.80% | 72.54% |
| EPS MEDIANAS | EPS - M | 15 | 1,701 | 1,417 | 1,241 | 83.30% | 72.94% |
| EPS PEQUEÑAS | EPS - P | 15 | 489 | 425 | 404 | 87.01% | 82.58% |
| URBANOS NO EPS | UGM | 143 | 7,855 | 5,358 | 4,735 | 68.21% | 60.28% |
| PEQUEÑAS LOCALIDADES | UGM | 618 | 2,948 | 1,545 | 1,087 | 52.40% | 36.88% |
| RURALES | OC | 5,926 | 2,246 | 1,829 | 1,020 | 81.46% | 45.41% |
| **A NIVEL PAÍS** | | | **34,677** | **28,264** | **25,095** | **81.50%** | **72.37%** |

Source: Benchmarking SUNASS

As of December 2023, the country's population stood at 34.67 million, with 62% of the population having access to drinking water and sanitation services provided by an EPS, while the remaining 38% received these services from the municipalities through the UGM and ATM, with some of these municipalities providing services through unregulated EPS. Moreover, a significant proportion of the population, amounting to 81.5% of the total, has access to drinking water services, while 72.37% of the population has access to sewerage services. This indicates that a substantial segment of the population, amounting to 6.14 million individuals, lacks access to water services, and a further 9.58 million individuals lack access to sewerage services. These values are not aligned with Sustainable Development Goal (SDG) No. 6, which aims to ensure universal access to water and sanitation services.

It is evident that as the size of the urban city diminishes, the coverage indicator exhibits a corresponding decline in both services. Conversely, at the rural level, the coverage indicator demonstrates a notable increase, attributable to the prevalence of readily accessible technologies, such as supply through small springs and the utilization of sanitary latrines.

This phenomenon can be interpreted as indicative of a deficiency in the state's level of attention, given that it has proposed two sanitation plans, accompanied by five-year policies and programs. However, these plans have remained largely theoretical, with no tangible implementation for a period of three decades.

Concurrently, the population has been experiencing a rapid increase in its growth rate, which is indicative of the state's failure to expeditiously execute the necessary investments. As time has passed, the discrepancy has only continued to widen. It has been estimated that the annual birth rate is 660,000. Concurrently, the gap is being both built up and widened.

**Table 2 Quality of Service Indicators**

| INDICADOR II | | | | | | | |
|---|---|---|---|---|---|---|---|
| OPERADOR | | INDICADOR | | | | | |
| TIPO | | CANTIDAD DE EPS | CONTINUIDAD horas / día | PRESIÓN m.c.a. | AGUA NO FACTURADA % | AGUAS RESIDUALES TRATADAS % | MICRO MEDIDOR |
| SEDAPAL | EPS - S | 1 | 21.6 | 23.2 | 31% | 97.0% | 90.3% |
| EPS GRANDES 1 | EPS - G1 | 6 | 19.4 | 20.8 | 36% | 91.1% | 80.5% |
| EPS GRANDES 2 | EPS - G2 | 13 | 18.8 | 19.9 | 36% | 83.6% | 75.2% |
| EPS MEDIANAS | EPS - M | 15 | 18.8 | 20.0 | 36% | 85.6% | 75.9% |
| EPS PEQUEÑAS | EPS - P | 15 | 18.8 | 19.9 | 36% | 83.4% | 75.1% |
| **A NIVEL PAÍS** | | | **18.61** | **20.12** | **36.74%** | **83.38%** | **75.08%** |

Source: Benchmarking SUNASS

With regard to the indicators of management and quality of the provision of services, to date there is only information at the level of EPS, which is compiled, processed, and published on its website by SUNASS, the Regulatory Body for sanitation services in Peru.

A review of the extant data reveals that the mean continuity of service is 18.61 hours per day (h/d), which reflects a fairly acceptable value as a country average. However, certain cities, such as Pasco (1.7 h/d), Utcubamba (1.9 h/d), and Nasca (3.7 h/d), demonstrate significant variations in service continuity.

Regarding the pressure of the water service, the indicator also reflects an average value that can be considered acceptable nationwide. This average is 20.12 meters of water column (m.c.a.), which is less than the 15 m.c.a. that the National Building Regulations propose. However, it is important to note that some cities, such as Tumbes, Piura, Lambayeque, and Juliaca, have an average pressure of less than 6.8 m.c.a. In these cities, there is a probability that the water will only reach the services on the first floor.

With regard to non-revenue water, the indicator reveals that of the 100% of drinking water produced and directed to the network, 36.74% remains unaccounted for. From a corporate perspective, the valuation is considered unacceptable. However, when taking into account the nature of the business, the infrastructure utilized, the conditions under which certain systems are operated, and the market failures themselves, it is conceivable that a portion of the water produced will not be subject to billing.

In principle, a portion of the losses can be attributed to operational inefficiencies, which have not been utilized by users and are precipitated by infrastructure leaks and deterioration. Another component pertains to commercial losses, which refer to instances where water has been consumed but not billed, often attributable to clandestine connections, errors in the allocation of consumption, under-registration of meters, and related issues. In conclusion, the losses must be considered as well. These losses refer to the portion of water utilized for the maintenance of infrastructure and for the provision of water to firefighters.

The mean value of the index is estimated to be 30%, which is considered moderately acceptable. However, it is important to note that the average value in Peru is 23%, which is lower than the global mean. It is imperative to acknowledge that the mean encompasses elevated values, such as those observed in Tumbes (64%), Loreto (58%), and Piura (59%), among other regions. It is noteworthy that the companies with the highest levels of losses are also those with the shortest hours of continuity and the least pressure on the network.

With respect to the wastewater treatment indicator, it is important to note that over the past decade, it has gained prominence in the context of environmental conservation. As demonstrated by the available data, 83.4% of wastewater undergoes treatment, with a subsequent increase in the percentage of treated wastewater discharged into the sea. A portion of this wastewater is subsequently utilized by governing bodies for agricultural purposes, such as irrigating rivers. As anticipated, the mean does not account for the fact that 17 EPS do not manage their wastewater.

With respect to micro metering, the indicator reflects a moderately acceptable value, with 75% of water connections having meters installed. The primary issue associated with micro metering is its high maintenance cost. Its useful life span, on average and in the most favorable circumstances, is six years. Additionally, the financial burden of its renewal and the necessity of ongoing maintenance contribute to its overall cost. It is imperative to ascertain the operational status of micro meters and the accuracy of their readings to ensure precise measurement. Despite the 75% coverage with micro meters, it is crucial to verify their functionality and the validity of their readings within the meter's operational range. It is imperative to acknowledge that the standard stipulates that a new meter can be procured with an initial reading error of 2%. As the meter undergoes utilization and undergoes wear and tear, it begins to generate under-registrations. Once these under-registrations reach 10%, the meter must be decommissioned and replaced.

In certain instances, corporate entities may face constraints in their resources, which can result in their decision to forgo the renewal of meters. This phenomenon is further compounded by the presence of underreporting levels that surpass 20%. The occurrence of these cases is particularly prevalent in companies that experience elevated levels of water loss.

**Table 3 Service Management Indicators**

| INDICADOR II | | | | | | | |
|---|---|---|---|---|---|---|---|
| OPERADOR | | INDICADOR | | | | | |
| TIPO | | CANTIDAD DE EPS | ROTURA DE TUBERÍAS AGUA # / Año | ATORO DE TUBERÍAS DESAGÜE # / Año | EJECUCIÓN DE INVERSIONES % | RELACIÓN DE TRABAJO % | CANTIDAD DE RECLAMOS # / Año |
| SEDAPAL | EPS - S | 1 | 2,311 | 25,818 | 100% | 64.7% | 111,685 |
| EPS GRANDES 1 | EPS - G1 | 6 | 4,269 | 26,531 | 34% | 68.4% | 160,528 |
| EPS GRANDES 2 | EPS - G2 | 13 | 6,281 | 20,692 | 24% | 70.3% | 108,665 |
| EPS MEDIANAS | EPS - M | 15 | 3,393 | 7,080 | 24% | 70.5% | 51,744 |
| EPS PEQUEÑAS | EPS - P | 15 | 1,270 | 1,904 | 28% | 70.4% | 11,051 |
| **A NIVEL PAÍS** | | | **17,524** | **82,025** | | **67.83%** | **443,673** |

Source: Benchmarking SUNASS

As illustrated in Table 3, there were 17,524 events of pipe loss in the drinking water networks and 82,025 events of pipe loss in the collector network. These values are relatively high, indicating that a significant portion of the existing infrastructure has already reached the end of its useful life and requires renewal, particularly in terms of sewer collectors. It is imperative to acknowledge that water pipes are subjected to persistent fluctuations in pressure, seismic movements, and ground deflection resulting from the transit of heavy vehicles. These factors can lead to the obstruction or fracture of the pipes. In the case of collectors, it is important to note that these tubes are capable of conducting both liquid and gases. The gases are able to run through the pipe until it collapses.

The same table also presents the efficiency indicator for investment execution. SEDAPAL is the only entity that achieves a level of efficiency, with an investment of 1,193 million soles during 2023. However, the remaining regions exhibited a significant deficiency in their capacity to execute investment decisions. Specifically, the proportion of "G1" companies that successfully executed investments was only 34%, while "G2" and "M" companies (medium-sized and small, respectively) achieved a mere 24% and 28%, respectively. It is noteworthy that these values have persisted over the past five years, which partially elucidates the observed low performance indicators within corporate entities.

In the absence of investment in renovation and rehabilitation, production and distribution capacity is at risk of diminution. Concurrently, the magnitude of losses escalates, impeding the anticipated convergence of disparities.

It has been determined that the issue under discussion is not limited to the water and sanitation sector; rather, it is a problem that extends beyond that sector. The problem has been in existence for more than a decade and has been primarily caused by issues related to corruption. However, if this issue remains unresolved, it is projected that the water and sanitation systems will continue to deteriorate, resulting in the exacerbation of existing gaps.

In regard to the aforementioned working relationship, which represents the income generated by disbursable costs and measures the amount of resources allocated to operating expenses, it is observed

that the figure stands at 67.83%, a percentage that is regarded as acceptable within the context of the water and sanitation sector. This is due to the fact that the execution of its functions necessitates the presence of administrative personnel, commercial personnel, operational personnel, personnel dedicated to user service, and personnel responsible for image management. However, it should be noted that the salary level in water and sanitation companies, with very few exceptions, is well below the salary levels in other services, such as energy and telephony, among others.

The institution likely employs more personnel than would be customary due to the age and deterioration of its infrastructure, the absence of state-of-the-art technology, and the inadequacy of existing equipment. This requirement exceeds that of a model company.

Consequently, the claims indicator reveals that during 2023, there were 443,673 claims nationwide out of a total of 4,146,969, indicating that approximately one in 10 users has made a claim in person following the regulatory procedures. Nevertheless, this value is contingent upon the representation of user dissatisfaction. It is imperative to acknowledge that the submission of a claim necessitates the allocation of a full morning, a resource that not all individuals possess due to professional obligations. Furthermore, the procedure is considered cumbersome, and the level of attention it garners is deemed suboptimal. It has been observed that the majority of users exhibit a more passive demeanor. Despite their discontent with the service, they predominantly discuss it with their friends and neighbors, rather than filing an effective complaint.

In relation to Quality

A review of the 2023 management indicators published by SUNASS, which correspond to information from the 51 EPS, suggests interpretations of the 10 dimensions of the term "quality of service" proposed by Parasuraman, A., Zeithaml, A., & Berry, L. (1988).

In terms of reliability, it is important to note that all EPS are subject to a regulated supply schedule, which is subject to oversight by the Regulator. Any modifications to these schedules must be communicated to affected users a minimum of 48 hours in advance, with the exception of circumstances deemed to be fortuitous events.

In terms of response, the EPS demonstrate the capacity to respond promptly and effectively to occurrences derived from the provision of the service. However, they lack the preparation, personnel, and resources necessary to address emergency situations derived from natural phenomena.

With respect to the issue of competition, it is noteworthy that, despite the high rate of personnel turnover in the EPS, the majority of the seasoned staff remains consistent, thereby ensuring the caliber of services rendered.

In terms of accessibility, it should be noted that the EPS receive and serve all the people who come to their facilities. However, the possibility of access to new users depends on the existence of the technical conditions, which are issued with the feasibility of favorable or negative services.

In terms of amiability, the EPS is equipped with a department dedicated to customer service. The personnel in this department are trained to actively listen to users' concerns, provide appropriate assistance, and refer them to the relevant regulations when necessary. In the event that a company does not align with the values and needs of its users, it may lead to a perception of inadequacy in the company's service delivery.

With regard to the term "communication," prior to the approval of the five-year tariff program, an awareness plan was developed in all sectors of the city. The phenomenon under scrutiny has been observed in a variety of settings, including but not limited to: markets, schools, institutions, popular organizations, radio, and the written press. Subsequent to this, the company is obligated to provide its users with a minimum of 48 hours' advance notification of any modifications.

In terms of credibility, it is important to note that in each region, there is a decentralized office of SUNASS called ODS. The primary function of ODS is to permanently monitor the provision of services in the locality. This is done in order to ensure that the EPS complies with the goals and conditions approved by the regulator. This fact lends credibility to the provision of services.

In terms of safety, it is imperative to acknowledge that the paramount concern in the provision of services is the assurance of the suitability of the water supplied at the level of connections for consumption in all regions of the city, in accordance with national and international health standards. The presence of this indicator in medium-quality water supplies is strictly prohibited in urban areas. This indicator is subject to continuous monitoring by various institutional entities.

In regard to the company's intangibles, specifically its infrastructure, it should be noted that a significant portion of the infrastructure has already reached the end of its useful life. This necessitates the implementation of new technologies to enhance the efficiency of the enterprise.
The Electric Power Supply (EPS) is arguably the service provider with the closest proximity to the population. The provision of electricity is an essential service for human life and economic development. Conversely, the expense is considerably lower in comparison to other services, including energy, cell phones, cable, and analogous expenses.

## CONCLUSIONS

As is evident, the analysis has been conducted on the basis of the mean of the 51 EPS per indicator. While the mean indicators appear to be satisfactory, they do not reflect the extreme conditions experienced by the Sanitation Service Provider Companies in Peru, which necessitate support to enhance their management practices. However, the analysis indicates that this phenomenon is attributable to the presence of a substantial corporation that is analogous to the remaining 50 corporations, exhibiting commendable indicators that elevate the average quality at the national level.
For instance, the mean continuity is 21.6 h/d, which is an acceptable value; however, examining specific cases such as Pasco (1.7 h/d), Utcubamba (1.9 h/d), Nasca (3.7 h/d), and the cities of Piura and Tumbes (6.5 h/d) reveals that they are not within the acceptable range. The same phenomenon occurs with the water pressure indicator in the network. The average is 20.12 m.c.a., which is an acceptable value. However, localities such as Piura, Tumbes, Lambayeque, and Cañete have pressures below 7 m.c.a., with a minimum of 15 m.c.a.
A review of the issues pertaining to water coverage, sewerage, and micro-metering reveals that they fall short of the sustainable development goals (SDGs) established by the United Nations. The SDGs aim to ensure universal access, yet their realization is impeded by deficiencies in the execution of investments. This issue is not exclusive to the EPS but rather pervades the sanitation sector as a whole, which falls under the purview of the Ministry of Housing, Construction, and Sanitation. The responsibility for addressing these challenges does not lie solely with the regional and local governments, but also with the provincial and district authorities.
With regard to the levels of non-revenue water (NRW), the same perception of the average number is observed. Although it indicates 36.7%, which is relatively high, it is not appreciated that localities with critical values, such as those of the EPS of Tumbes, Piura, Loreto, among others, exceed 58% of losses of produced water. It has been demonstrated that, consequently, they exhibit the lowest levels of continuity, pressure, coverage, and micromeasurement.
Upon completion of the research, it can be concluded that, at the country level, there is a relatively satisfactory management culture. However, at the company level, there is considerable heterogeneity in the results, as each company is unique with its own challenges and varying degrees of efficiency. The same phenomenon is observed in the quality of the service. On average, the perception of quality is favorable, as indicated by the 51 EPS. However, the extent to which these elements are emphasized varies significantly among different EPS. Perry, P. (2023) conducted a study that demonstrated a direct relationship between the quality of management and the quality of service. In essence, the higher the level of management efficiency in an EPS, the greater the perception of quality among its users.
This text presents an overview of the issues currently impacting the Peruvian drinking water, sanitation, and wastewater treatment sectors:
Persistent Access Gap: A significant portion of the Peruvian population, especially in rural and peri-urban areas, still does not have access to safe drinking water services or sewage systems.
Unsafe Water: Even where there is coverage, the quality of the drinking water supplied often does not meet sanitary standards, exposing the population to health risks.
Low Service Continuity: Many localities suffer from frequent interruptions in water supply, limiting its availability and forcing users to resort to unsafe alternative sources.
Low Supply Pressure: In urban areas, low water pressure is a common problem, making it difficult to properly and fully use domestic services.
Poor Wastewater Treatment: A large proportion of the country's wastewater is not properly treated or is not treated at all, being discharged directly into rivers and seas, causing serious environmental pollution.

Obsolete and Deteriorated Infrastructure: Much of the water and sewer infrastructure is many years old and has completed its useful life, leading to leaks, constant breakages, and significant water losses.
High Water Losses (Non-Revenue Water): Due to leaks in the network, clandestine connections and micrometering problems, service providers (EPS) lose a considerable volume of water that is not billed.
Inefficient Management of EPS: Sanitation Service Provider Companies (EPS) face serious management problems, including technical, administrative, and financial deficiencies, which directly impact the quality of the service.
Poor Micrometering and Billing Problems: The lack of water meters or their malfunction leads to billing estimates, generating distrust in users and hindering efficient consumption management.
Low Rates and Inefficient Collection: In many cases, the rates do not cover the operating and maintenance costs of the systems, nor do they allow the generation of surpluses for new investments, which perpetuates the precariousness of the service.
Lack of Sustained Investment: Despite the magnitude of the gap, investment in new water and sanitation infrastructure has been insufficient and not always well prioritized, preventing significant progress.
Central Resource Dependence: Many EPSs are overly dependent on transfers from the central government, which limits their financial autonomy and long-term planning capacity.
Direct Impact on Public Health: Lack of access to safe water and basic sanitation is a leading cause of gastrointestinal, parasitic and other diseases, disproportionately affecting children and vulnerable populations.
Compromised Child Development: Unhealthy conditions affect children's physical and cognitive development, impacting their school performance and future well-being.
Effect on Quality of Life: The precariousness of these basic services drastically reduces the quality of life of families, affecting hygiene, dignity and time dedicated to productive or educational activities.
Poor Resilience to Climate Phenomena: The current infrastructure is vulnerable to events such as the Coastal El Niño or intense rains, causing network collapses and flooding, which interrupts the service and causes material damage.
Delay in Compliance with SDGs: Peru lags behind in meeting Sustainable Development Goal 6 (Clean Water and Sanitation), evidencing the magnitude of the challenge.
Social Conflicts over Access and Quality: Dissatisfaction and lack of access to sanitation services are often a source of social conflicts in various communities.
Lack of management capacity of regional and local governments in infrastructure issues.: At the regional and local levels, the capacity to formulate, implement and monitor sanitation projects is limited, delaying investments.
Urgent Need for a Comprehensive Approach: The solution requires a multisectoral and long-term approach that combines investment in infrastructure, strengthening the management of EPS, health education and effective oversight.
Lack of trained personnel in the Sector: As is known, to date there are companies that do not have engineers specialized in infrastructure operation and maintenance, in the preparation of technical investment files, in the execution of works and in the supervision of works and studies.
Lack of young professionals; it is necessary to train and encourage new professionals to enter the sanitation sector in the various operational and administrative areas, so that the Sanitation Service Provider Companies (EPS), the Municipal Management Units (UGM) and the Municipal Technical Areas (ATM) can be strengthened at the national level.

**Recommendations**

Proposal for the Transformation of the Sanitation Sector in Peru
After an in-depth analysis of the sanitation sector in Peru, I propose the implementation of practical, effective, creative, innovative, depoliticized, disinterested and comprehensive solutions, with a clear short, medium and long-term vision that guarantees tangible and measurable results.
Formation of a Strategic Multidisciplinary Team
To achieve this, it is essential that the governing body (Ministry of Housing, Construction and Sanitation) forms a high-level multidisciplinary team. This team must be made up of professionals of recognized technical, professional and ethical capacity, with exclusive dedication to this task. Its mission will be to meet with authorities, designated personnel and volunteers from all institutions, organizations, entities and offices directly or indirectly linked to sanitation services.

The goal of these meetings is not to organize mass events in convention centers where few have a voice, and the same ineffective solutions are repeated. On the contrary, it is sought that this strategic team captures the strengths and weaknesses of each member of the interest group and receives detailed contributions on the needs for improvement in the sector and proposals to develop comprehensive solutions. This would provide a real opportunity to contribute to all levels of staff willing to contribute ideas, not just the authorities.

Identification of Key Actors and Information Gathering

The interest group is broad and ranges from state agencies such as MVCS, MEF, MIDAGRI, MINSA, MINAM, MIDIS, to regulatory entities such as SUNASS and administrators such as OTASS. It would also include the National Association of Sanitation Companies (ANEPSA), Pro Inversión, PASLC, SEDAPAL, the National Rural Sanitation Program (PNSR), the National Urban Sanitation Program (PNSU), municipal associations (AMPE), the National Assembly of Regional Governments (ANGR), the Chamber of Commerce, the Ombudsman's Office, and representatives of international and national banks, among others.

With the information gathered from these interactions, it will be possible to develop a solid strategic plan. This plan will allow the effective implementation of state policies related to drinking water, sewerage and wastewater treatment at the national level. It is crucial to recognize that, in order to solve a problem, we must first identify, analyze, and study it thoroughly, and then understand the strengths and weaknesses of each actor involved. These meetings will allow you to determine what aspects to reinforce, what to improve, what to change and how to optimize roles and functions.

Efficient Planning and Rigorous Control

Effective planning requires that all those involved have clarity in their roles, participation, and goals. It must be a programming that ensures the required financing and administrative efficiency such that the resources arrive on time, preventing management from becoming an obstacle.

Finally, any comprehensive solution proposal for this sector will require a significant amount of economic and financial resources. Therefore, the joint and active participation of the Office of the Comptroller General of the Republic will be essential from the beginning. This will guarantee transparency, prevent acts of corruption and contribute to the efficient and effective achievement of the objectives set.

**Conceptual basis**

**Drinking water**: Water processed and suitable for human consumption, in accordance with the physical, chemical and microbiological requirements established by current regulations.

**Wastewater**: Water that has been used in domestic or non-domestic activities and that, due to its quality characteristics, requires treatment prior to its final disposal or reuse.

**Raw Wastewater**: Wastewater not yet treated

**Scope of responsibility**: Territorial space under the responsibility of a provider.

User Associations: A non-profit board or association of users for the purpose of managing sanitation services in a JASS locality.

**Service gap**: Population that does not have access to water or sanitation services in a conventional way.

**Supply contract**: A contract signed between a resident and a provider to receive sanitation services through connections.

**Rate:** Payment made for the service received in the urban area

**Family fee**: Payment made in rural areas and in small urban cities administered by a UGM for the provision of services.

**Tariff study**: Technical document that supports the rates approved by the regulatory entity of sanitation services for the EPS.

**Conventional technological options**: Techniques commonly used to provide drinking water and sanitation services.

**Non-conventional technological options**: Innovative and special techniques of alternative use to provide drinking water and sanitation services,

**Optimized Master Plan (PMO):** Management and planning plan for 30 years of the EPS and at the level of efficiency.

**National Plan for Drinking Water and Sanitation (PNAS):** This is the main instrument for planning and implementing the National Policy on Drinking Water and Sanitation.

**Drinking water and sanitation services**: Includes the supply of drinking water, the collection of wastewater and subsequent treatment or the sanitary disposal of excreta.
**EPS:** Entity providing sanitation services, responsible for providing service in urban areas.
**Municipal Management Unit**: Municipal organic area responsible for the provision of sanitation services in rural areas and in small urban cities that are not in an EPS.
**ATM:** Municipal Technical Area, in charge of assisting rural localities in the provision of services.
**User**: Natural or legal person to whom drinking water and/or sanitation services are provided.
**Peri-urban zone**: A partially populated area that grows around a consolidated urban area.
**Drinking water coverage**: Percentage of the population that has conventional drinking water service.
**Sewerage coverage**: Percentage of the population that has conventional sewerage service.
**Continuity of service**: Number of hours that the water supply is received during a day.
**Service pressure**: The level of pressurization of the public water distribution network.
**Non-revenue water**: Percentage of drinking water produced and non-revenue, including operational losses, business losses, and shrinkage.
**Complaints**: A right that users have when they consider that their rights have been violated by a service provider.
**Blowout with flooding**: An accident that occurs when drinking water pipes burst, generating flooding, to the detriment of third parties.
**Clogs with flooding**: An accident that occurs when a drainage pipe gets clogged, generating flooding, to the detriment of third parties.

**REFERENCES**

1. Alvarado, J. & Marrache, I. (2020) Agua y Saneamiento en el Perú, Estado, Retos y Reflexiones (Vol. 19). (2020). Revista De Derecho Administrativo. oai:repositorio.pucp.edu.pe:123456789/182151
2. Montero, C. (2022). Impacto de los Servicios de Agua y Saneamiento sobre las enfermedades diarreicas em los niños de la Sierra del Perú. Revista de Análisis Económico y Financiero, 5(1), 1–8. https://doi.org/10.24265/raef.2022.v5n1.45
3. Carlos, D. (2023). La gestión pública por resultados en la calidad de vida de los ciudadanos de la región Junín 2021. https://repositorio.usmp.edu.pe/handle/20.500.12727/12540
4. Pastor, O. (2023). El conocimiento hegemónico y el derecho humano al agua: El caso peruano. Scientia, 23(23), 267–283. https://doi.org/10.31381/scientia.v23i23.4597
5. Drucker, (2013). Calidad & Gestión – Consultoría para Empresas. Calidad & Gestión - Consultoría para Empresas. Recuperado el 12 de septiembre de 2024, de https://calidadgestion.wordpress.com
6. Plan de gestión de recursos hídricos de la cuenca Mantaro. (2023). https://repositorio.ana.gob.pe/handle/20.500.12543/5592
7. Baltodano, W. (2021). Factores de éxito y satisfacción sobre el servicio de agua y saneamiento en Pacasmayo, 2021. Universidad César Vallejo. https://hdl.handle.net/20.500.12692/72256
8. Silva, M. (2022). Gestión de los sistemas de agua y saneamiento para su ordenación sostenible en poblaciones rurales de Chota, Cajamarca. Universidad César Vallejo. https://hdl.handle.net/20.500.12692/78854
9. Soncco, Y. (2019), Valoración económica del efecto en la salud por el cambio en la calidad del agua en la ciudad de Juliaca. Universidad Nacional Del Altiplano. http://repositorio.unap.edu.pe/handle/20.500.14082/13497
10. Carhuanayocc, R., Cisneros, N., Condori, R., & Pérez, G. (2022). A Monte Carlo simulation for the improvement of drinking water and seraje services in a northern settlement in Perú. Environment and Ecology Research, 10(5), 614–625. https://doi.org/10.13189/eer.2022.100509.
11. Ferro, P. et al (2022). Quality control of drinking water in the cita of Ilave, región of Puno, Perú. International Journal of Environmental Research and Public Health, 19(17), 10779. https://doi.org/10.3390/ijerph191710779.
12. Ramírez, A.-K. P., & Wolff, C. F. (2017). Building quality infrastructure services for water and sanitation providers in Latin America – examples from German development cooperation. Periódico Tchê Química, 14(28), 18–22. https://doi.org/10.52571/ptq.v14.n28.2017.18_periodico28_pgs_18_22.pdf.
13. Ramírez, A.-K. P., & Wolff, C. F. (2017). Building quality infrastructure services for water and sanitation providers in Latin America – examples from German development cooperation. Periódico Tchê Química, 14(28), 18–22. https://doi.org/10.52571/ptq.v14.n28.2017.18_periodico28_pgs_18_22.pdf
14. Bonifaz, J. (2014). The water and sanitation service provision in Perú. Research Papers in Economics.
15. Eagin, B., & Graham, J. P. (2014). A study of water and sanitation access trends in Perú: where do inequities persist Journal of Water, Sanitation, and Hygiene for Development: A Journal of the International Water Association, 4(3), 499–508. https://doi.org/10.2166/washdev.2014.113.
16. Hernández-Vasquéz, A. et al (2021). Inequalities in access to safe drinking water in Peruvian households according to city size: an analysis from 2008 to 2018. International Journal for Equity in Health, 20(1). https://doi.org/10.1186/s12939-021-01466-7.
17. Mendoza, M. (2016). En la periferia de la ciudad y la gobernanza: un estudio de caso sobre la gestión local del agua y saneamiento en el Asentamiento Humano del Cerro Las Ánimas.

18. Felgendreher, S., & Lehmann, P. (2016). Public choice and urban water tariffs—analytical framework and evidence from Perú. Journal of Environment & Development, 25(1), 73–99. https://doi.org/10.1177/1070496515619651.
19. El proceso estratégico un enfoque de gerencia (3ra edición). (2015, agosto 18). Centrum Think - La plataforma de investigación de Centrum PUCP. https://centrumthink.pucp.edu.pe/libroseinformestecnicos/el-proceso-estrategico-un-enfoque-de-gerencia-3ra-edicion/
20. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality. Journal of retailing, 64(1), 12-40.
21. Organización de las Naciones Unidas (ONU). (16 de 03 de 2015). Objetivos de Desarrollo Sostenibles ODS. https://www.cepal.org/es/temas/agenda-2030-desarrollo-sostenible/objetivos-desarrollo-sostenible-ods
22. Ministerio de Economía y Finanzas (MEF). (2023) Consulta Amigable, consulta de ejecución de gasto, de https://www.mef.gob.pe/es/seguimiento-de-la-ejecucion-presupuestal-consulta-amigable
23. Superintendencia Nacional de Servicios de Saneamiento (SUNASS). (2022). Benchmarking de EPS. https://www.sunass.gob.pe/ sunass-te-informa/publicaciones/benchmarking-de-empresas-prestadoras/
24. Superintendencia Nacional de Servicios de Saneamiento. (2024). Reporte y seguimiento de inversiones N°4, de https://www.gob.pe/institucion/ sunass/informes-publicaciones/5558294-reporte-de-seguimiento-de-inversiones-n-4
25. Decreto Ley N°1280. (2016). Ley Marco de la gestión de prestación de los servicios de saneamiento. https://elperuano.pe › normaselperuano › 2016/12/29
26. Decreto Supremo N°019-2017-Vivienda. Aprueba el Reglamento del Decreto Ley N°1280. https://www.minam.gob.pe › disposiciones › decreto-supremo-N°019-2017-vivienda
27. Decreto Supremo N°031-2010-SA. Reglamento de la calidad de agua para consumo humano. http://www.digesa.minsa.gob.pe › descargas › Reglamento › calidad › agua.pdf.
28. Resolución de Consejo Directivo Nº 058-2023-SUNASS-CD. Reglamento de Calidad de la Prestación de Servicios de Saneamiento https://www.gob.pe › sunass › normas-legales › 4722102–058–2023–sunass-cd.
29. Perry P. (2024). Proceso de reclamaciones como indicador de mejora en la gestión del sector saneamiento en el Perú. Dilemas contemporáneos: educación, política y valores. https://doi.org/10.46377/dilemas.v12i1.4331
30. Perry P. (2025). Acceso universal a los servicios de saneamiento con calidad y sostenibilidad Perú 2025 – 2055. Journal of Information Systems Engineering and Management. https://www.jisem-journal.com/index.php/journal/article/view/9828