RESEARCH PAPER

Quality of drinking water and sanitation services of the city of Nazca 2025

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SUMMARY
Sanitation in Peru has significant structural deficiencies with levels of coverage at the national level that do not reach the entire population, a situation that is reflected in the EPS EMAPAVIGS S.A. This entity supplies almost fifty thousand inhabitants in Nasca and Vista Alegre, achieving an outstanding 91.6% in sewerage, but only 67.4% in drinking water. Although the company has achieved financial stability with net profits in 2024 and shows operational efficiency with a ratio of 4.47 workers per 1000 connections, its technical viability is seriously compromised by a water shortage that has reduced supply to only 3.7 hours a day. As for the sewerage system, the company does not have plants to treat wastewater, with estimated discharges of 109 lps. polluting the environment. On the other hand, the company shows problems in the execution of investments, having achieved only 24% of what was programmed, a fact that aggravates the operational situation. It should be noted that major infrastructure projects such as new sources of water, conduction and purification, and in sewerage the construction of a WWTP, depend on the Regional Government of Ica, whose management does not advance at the pace of population demand. Regarding the particles, it is important to mention that, if the projects and works of new sources of collection are not activated, the water deficit could exceed 100% in the next thirty years, reducing the service to marginal levels of one hour a day and endangering the stability of the company. In short, although EMAPAVIGSA has shown that it can be profitable, it is necessary to take into account the time required by the investment cycle, which for this type of work can be between 5 and 8 years if there are no problems.

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Introduction

The drinking water and sanitation sector has gone through various management modalities, from the 70s and backwards the services of all the urban localities of the country were in charge of a ministry of development and public works, (central government), in the 80s it was in charge of the National Service of Drinking Water and Sewerage, which was SENAPA (a state company with private law), and in the 90s onwards they are in charge of the municipalities (local governments). And if we investigate statistics and background, it can be deduced that inefficiency in management, lack of quality and accessibility, insolvency and inability to manage investments has always been the same. Despite the fact that in 2014 the United Nations (UN) proposed the development goal for the year 2030 through a list of 17 Sustainable Development Goals (SDGs) and No. 16 being the one that refers to universal access to safe drinking water and quality sanitation, nothing has changed. This indicates that it is necessary to train new and future officials in other latitudes where there is management efficiency and advanced technology, we must eliminate paradigms, be more creative, and understand that a service company is not a charity or a fiefdom to abuse users.

If we take a look at the services provided by the main companies in Latin America and the Caribbean, as can be seen in the ADERASA Report published on the website of the drinking water regulator in Peru (SUNASS), it can be seen that in general terms the levels of quality of the provision of services is very similar, with the exception of the case of Chile, which has higher standards due to its private participation model.

Ecuador with coverage problems and poor management, low level of investment and lack of participation of the population, Muñoz et al (2021). In the case of Colombia, it presents problems of coverage, political interference, corruption, financial problems,

and concealment of information, Moreno (2020). In the case of Argentina, it presents coverage problems and regulatory deficiencies, Lentini (2018). In the case of Uruguay, there is good coverage, but the investments go through the government on a non-refundable basis, its rates only include operational, administrative, and marketing costs and expenses, Moroñas et al (2020). In the case of Paraguay, there is a fragmentation of management with more than 5200 companies that does not allow planning or unifying rates, Llamosas (2020).

In Peru, the company is responsible for the provision of services in the MVCS, and has the support of the Transitional Administration Body (OTASS), the Regulatory Body (SUNASS), Pro-investment, Regional Governments, Local Governments, and the Users Board. For the provision of services in Peru, there are 51 regulated and 48 non-regulated companies, with 580 small cities administered by the UGMs, and 73,864 community organizations and user boards with the assistance of the ATMs. Perry (2025).

TABLE 1

Population and service coverage Peru 2024

Number of operators and population covered a the country level 2025

Operator Type		Quantit	Dens y	Population (Thousands of inhabitants)				
				Total	With wat P.		With Sewera	
					Hab	Cob	Hab	Cob
SEDAI AL	EPS S	1	3.75	11,0	10,35	93.8'	10,08	91.4'
LARG EPS 1	EPS G1	6	3.9(	5,52	4,95	89.8'	4,56(	82.6'
BIG EI 2	EPS G2	13	3.23	3,80	3,22	84.8'	2,76(	72.5'
MEDI M EPS	EPS M	15	3.17	1,77	1,47	83.3'	1,29	72.9'
SMAL EPS	EPS P	15	3.41	504	438	87.0'	416	82.6'
URBA OS NO EPS	UGI	48	3.44	1,14	1,03	90.1'	662	57.6'
SMAL TOWN	UGI	58(	3.73	2,31	1,97	85.4'	1,32	57.2'
RURA	OC	73,8(	3.1(	8,21	6,68	81.5'	3,24'	39.6'
TO TA L		**74, 54 2**	Iab/viv	**4,31**	**0,14**	**87.8%**	**4,34**	**0.9%**

Source: Benchmarking SUNASS

From the Benchmarking report (2023), it can be seen that Peru has a population of 34.32 million inhabitants, of which 87.8% have access to drinking water services, that is, there are 4.17 million inhabitants without access to safe water. And on the other hand, sewerage coverage is 70.9%, which indicates that there are 9.97 million inhabitants without quality sanitation service.

The operator of the services to the cities of Nazca and Vista Alegre is the "Virgen de Guadalupe Sur municipal water and sewerage company" (EMAPAVIGS S.A.), which was incorporated on May 26, 1996, as a public company with private law. It should be noted that before the creation of the company, the services in the towns of Nazca and Vista Alegre were in charge of EMAPICA S.A.

Among the fundamental attributions are: administrative and sustainability management, responsible for governance, regulation, strategic planning, legal advice, human talent and the mitigation of environmental risks; commercial management, aimed at user control, measurement processes, invoicing, portfolio recovery, cadastre updating and customer service; operational management, which guarantees the functionality of the infrastructure, the technical efficiency of the systems, preventive maintenance and the execution of new investments; and economic-financial management, whose mission is to ensure the viability of the entity, obtaining the necessary funds to cover operating expenses, credit commitments and the continuous improvement of the service provider network.

From the information obtained from the SUNASS website, EMAPAVIGS S.A. is responsible for a population of 49,831 inhabitants, of which it covers 67.4%, which is approximately 33,576, which indicates that there are 16,255 inhabitants without safe (drinking) water, and in sewerage it serves 45,624 inhabitants, which represents 91.6%. The fact is that in the face of low continuity, many users in the lower sectors of the city

have chosen to drill their own wells, declaring themselves inactive in drinking water, but they do use the sewerage systems to discharge their wastewater and that this service is active. That is why there is an apparent coverage in sewerage than in drinking water.

On the other hand, it can be seen that there are important indicators such as the average continuity of the drinking water service in the year, which is 3.7 hours/day, which is a fairly low value, and the average pressure is 11.5 m.c.a. which is a value close to the minimum acceptable. And from the commercial information it can be seen that the consumption of measured domestic users is 16.50 m3/month, a value that would not be valid for projections because it is a service with high continuity restriction. And when it comes to investment management, they only reached 24%. From the financial statements it can be seen that this year they have had a positive balance, however, it is worth mentioning that the company has already been in the temporary administration regime (RAT) in charge of OTASS for several years.

TABLE

Population and service coverage

Locatio	Population				
	To	With drinking water		With Sewerage	
	Hab.	Ro m	Cover ge	H ab.	C age
Nazc an Vista Al re	49,831	33,576	67.4 %	45,624	91.6 %
T O T A L	**49,831**	**33,576**	**67.4 %**	**45,624**	**91.6%**

Source: Directorate of Tariff Regulation (DRT) – SUNASS.

Background

López (2023) investigated the provision of services provided by the company SEDALIB S.A. that the drinking water and sanitation services in La Libertad, with the aim of determining if there is a relationship between the quality of the service and user satisfaction. The methodology had a quantitative, basic, non-experimental, cross-sectional and correlational approach. Their instrument was a questionnaire with a sample of 384 active connections. Their results showed that there is a positive relationship of moderate level between the quality of the service provided by SEDALIB and user satisfaction.

Peña et al (2025) investigated the relationship between process management and service quality in public water and sewerage companies in the cantons of Machala, Santa Rosa, and Pasaje, finding discrepancies in perception between operators, managers, and users. It warns that the lack of standardized protocols and the limited training of personnel cause improvised responses to technical and climatic emergencies. Although users and managers see a direct relationship between management and quality, the operational staff does not coincide, evidencing a disconnect in the organizational structure. The research concludes that it is urgent to strengthen technical skills through international standards to guarantee the continuity of the service and protect public health.

For Gómez et al (2021), the monitoring of the SDG (N°6) faces great obstacles due to the lack of standardized data. Faced with this shortcoming, the IDB and LAPOP collected data in 18 countries, revealing a regional panorama with deep access gaps and deficiencies in service continuity and with technical teams disconnected from reality. However, on the contrary, users report high levels of satisfaction despite receiving low-quality services. Subjective and worrying result, The research concludes that the lack of social awareness about quality standards does not generate pressure on governments to demand improvements from water supply companies. and that it is imperative to deepen the analysis to propose solutions that help meet the objective.

Herrera (2023) conducted research on water stress in the city of Metropolitan Lima and the apparent indifference of the service provider company on this issue that puts public health at risk. The objective of the study was to analyze previous research on the variables; quality of service and water security. The research methodology was qualitative descriptive. The author concludes that there is water insecurity and the low quality of service received, particularly in areas where the population is most vulnerable. The authorities must focus efforts on actions that contribute to the insurance and development of the population.

Santa Cruz et al (2025) conducted research on the services provided by the provider company in Iquitos, with the aim of determining whether there is a relationship between the quality of services and user satisfaction. The methodology had a quantitative, non-experimental, cross-sectional approach. Their instrument was a survey applied to a sample of 384 people. The author concludes that, if there is a relationship between the quality of the service and user satisfaction, and in this case it rarely complies with chemical, physical and microbiological parameters, an issue that is reflected in the high rate of complaints.

Solis et al (2025) conducted research to evaluate how service quality is related to customer satisfaction in the Service and Sanitation Provider Company EPS – Selva Central Junín, 2023. To this end, the methodology had a quantitative, applied-level, non-experimental, cross-sectional, correlational descriptive design approach. I use a questionnaire for a sample of 384 people as an instrument. The researchers conclude that there is correlation and that it is important to focus on continuous improvement of service quality to enhance customer satisfaction.

Gallegos et al (2025) investigated the perception of users regarding the quality of the service received from the Municipal Board of Water and Sanitation in Chihuahua, Chihuahua, Chih. Mexico. The methodology had a mixed, empirical, cross-sectional, descriptive and correlational approach, of a non-experimental type. Their instrument was a survey applied to a sample of 400 people. The authors conclude that there is a relationship between the variables and highlight that the relationship is stronger in indicators such as Empathy followed by Responsiveness.

Rodríguez (2021) I investigate the proposal of a Quality Management Model for the SEDAPAR company in Arequipa, integrating tools such as the Deming Cycle, Six Sigma and the SERVPERF model. The research arises from problems in water treatment caused by exogenous factors. The study had a mixed and descriptive approach, allowing to locate operational and commercial critical points to establish protocols for continuous improvement and quality control. The author concludes that the production and sanitation management seeks to optimize production and sanitation management to ensure compliance with current regulations and improve user satisfaction.

Cieza (2022), conducted research on a design of internal process management to strengthen environmental management at the Jaén Wastewater Treatment Plant in 2021. The methodology had a quantitative approach, its instrument was a survey and a sample of 26 workers. The author concluded that the implementation of a structured management model is essential to correct these operational deficiencies in wastewater treatment and reduce environmental impact.

Huamán (2021) researched the relationship between regional public policies and urban wastewater treatment in the district of Ayacucho 2020. The methodology had a quantitative approach, with a correlational descriptive design. Its instrument was a survey and its sample was 95 workers. The results indicate that the treatment process is technical and that the policies are relevant. The author concludes that there is a direct and strong relationship

between regional public policies and the quality of urban wastewater treatment.

Redroban et al (2022) conducted a study on compliance in Ecuador after the pandemic and the reform of the Comprehensive Organic Criminal Code of 2021, which seeks to combat corporate corruption. The research had a quantitative qualitative approach, The regulation encourages organizations to implement compliance systems as mitigating measures against criminal sanctions and as a preferential requirement in state procurement. However, the results are discouraging. The authors conclude that the government must implement urgent public policies that foster a true culture of compliance to strengthen institutional transparency.

Fanzo (2021) conducted research with the aim of determining the level of relationship between service quality and user satisfaction in the Sanitation Service Provider Company EPSEL S.A., Chiclayo. The research had a quantitative, basic approach, with a correlational non-experimental design. The instrument was a survey and the sample was made up of 85 workers. From the analysis, discussion and interpretation of the results, the order concludes that there is a relationship between the quality of services and user satisfaction, and that the company EPSEL S.A. must implement improvements in terms of quality of service which shows many deficiencies.

Paltran et al (20209) conducted research in Latin America and the Caribbean with the aim of proposing a change that integrates uncertainty and innovation in water resources management, with a view to SDG 6. The study proposes adopting a resilience approach to face traditional threats, climate change, population growth, and other global shocks. It seeks to guide decision-makers in the implementation of actions that ensure the operability of water systems in the face of disruptive events. The document combines traditional risk measurement techniques with a cutting-edge scientific decision framework adapted to the water reality of the region. The author concludes that only by managing uncertainty can the availability and sustainability of water be guaranteed for the entire regional population.

Comexperu (2025) Conducted a study with the aim of showing how the lack of drinking water and sanitation services directly impacts public health, giving as an example that in Peru only 49.2% of rural households have sanitation compared to 86.3% in urban areas, which requires more resilient and sustainable systems. Public-Private Partnerships (PPPs) emerge as a technical alternative that should be implemented at the national level to close these gaps. Currently, the cycle of investment projects is very slow and they face constant extensions and challenges in the speed of award and technical execution. The study concludes that to ensure quality services it is imperative to strengthen governance, modernize infrastructure and ensure that investment keeps pace with urban growth.

Perry (2024) researched the provision of drinking water and sanitation services in Peru 2025, with the aim of evaluating whether there is a relationship between the quality of services and the management of companies. Considering as a measurement parameter the number of complaints by users. The methodology had a quantitative, basic approach, with a non-experimental design and descriptive level. The author concludes that there is a relationship between business management and service quality.

Perry (2024) on the provision of drinking water and sanitation services in Peru 2025, with the aim of evaluating the possibility of closing gaps. The methodology had a quantitative, basic approach, with a non-experimental design and a descriptive level. After projecting demand and making supply and demand balances and quantifying investment capacity and needs, in expansion, renewal, institutional, risk and ecosystem. The author

concludes that in order to close gaps, it is necessary to multiply the current available resources by up to 6 times and improve the efficiency of investment management. Additionally, it suggests considering in this proposal the project cycle that is estimated to be 8 years.

Perry (2025) investigated the provision of drinking water and sanitation services in Peru 2025, with the aim of evaluating the quality of services. The methodology had a quantitative, basic approach, with a non-experimental design of descriptive level. The order concludes that there are many deficiencies at all levels of service providers, which does not give guarantee or security to the user, with this descriptive research it lays the foundations for future inquiries that can delve into the underlying causes of the deficiencies.

Cairampoma et al (2016) studied public policies on drinking water and sanitation issues with the aim of identifying the relationship between public policies and the quality and accessibility of services, considering that it is a fundamental service to improve health, prevent diseases and take care of the environment. It concludes that policies are concretized in specific plans and projects, supported by laws and organizations. But to carry them out, collaboration between government, companies and the community is essential.

Ferro (2022), researched about the quality of drinking water in Ilave, Peru, To this end, they evaluated the correlation between several physicochemical, microbiological, and heavy metal parameters. All complied with Peruvian regulations with the exception of residual chlorine, with coliforms found in all samples in homes. It concludes that it is necessary to improve procedures to detect possible points of contamination and define points of continuous monitoring.

Felgendreher, S., & Lehmann, P. (2016). They investigated issues of quality of water and sanitation services in Latin America and the Caribbean. With the aim of estimating the degree of relationship between policies and quality. They consider that the implementation of reforms in the water sector, especially tariff increases, is hindered by political factors, and Peru is no exception. They conclude with a proposal for merging suppliers and communication campaigns on how tariff increases translate into tangible benefits for users.

Alegre et al (2025), investigated the quality of the water supplied by an EPS in Caraz. The objective of the study was to determine the level of relationship between the variables quality and user satisfaction. The methodology with a quantitative, basic, cross-sectional and correlational approach. The instrument used was a survey applied to a sample of 140 EPS users. The author concludes that there is a positive and strong relationship between both variables.

United Nations (2015), In September 2015, world leaders through the United Nations issued the Agenda for 2030 with 17 SDGs. Of these, No. 6 refers to universal access to safe water with quality and sanitation. And it is specified that SDG No. 16 is directly linked to the fulfillment of other SDGs. They conclude in the need to increase investment levels, and promote integrated management of water resources and protection of ecosystems, with the participation of local communities.

Bravo, (2023) conducted research on the provision of services provided by the EPS of BARRANCA, with the aim of determining how the management of the company is related to the quality of services. The Methodology with a quantitative, non-experimental cross-sectional approach, with a correlational scope. Their instrument was a survey applied to a sample of 80 workers. As a result of the analysis, he obtained a Spearman Rho of 0.945. The author concludes that there is a positive and relevant relationship.

Methodology

In order to analyze the relationship between the variables "Management of drinking water and sanitation services" and "Quality of sanitation services", a

quantitative approach has been developed, cross-sectional, non-experimental, basic and descriptive correlational, because it is intended to investigate how the variables are related without delving into causes or effects in the EPS EMAPAVIGS S.A., Arispides (2020).

Result

The municipal drinking water company and Virgen de Guadalupe Sur. Known under the name of EMAPAVIGS S.A. created on May 26, 1996, its mission is to provide drinking water and sewerage services in its area of provision, and its vision is to be leaders in the sector, with quality services and contributing to the quality of life of its users. Among the main objectives of the company are: Increasing the continuity of the drinking water service, increasing the pressure in the drinking water distribution network, optimizing the financial situation, updating the commercial cadastre, and updating the technical cadastre. And it is currently responsible for the provision of services in the cities of Nazca and Vista Alegre. And before its creation it was an operating unit of the ICA provider company, maintaining certain levels of management and quality. However, over the years, the bad administrations that have passed have not had the adequate management capacity, leading it to levels of economic and financial insolvency with great operational and commercial deficiencies. In response to this institutional crisis, in 2016 the company was temporarily administered by OTASS. An organization that after several and implemented strategic programs and injected resources and equipment, has managed to reverse the institutional crisis. In terms of quality of management, this state tutelage has marked a before and after, displacing local political autonomy towards a technical and centralized direction that seeks the recovery of the fundamental service indicators.

The proposal of temporary management is to implement an organizational structure with modern standards of integrity and good corporate governance. Lately, they have formalized various management documents that reflect a maturation in the institutional culture. These advances include the approval of specific policies against conflicts of interest and the implementation of a robust strategy to strengthen institutional integrity and fight corruption. This administrative approach not only seeks transparency in the management of public resources, but also attempts to mitigate the ethical risks that have historically affected sanitation companies in Peru.

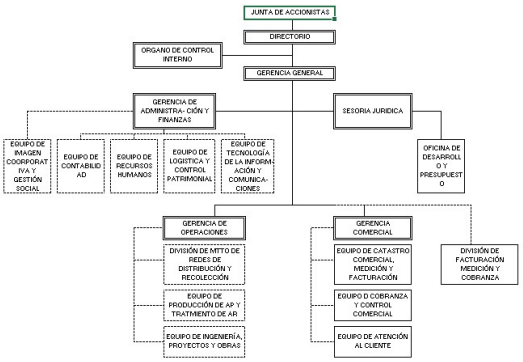
A of the efforts to recover the quality of services despite the citizens are not convinced and do not perceive improvements. That, although these are administrative issues, what the users see is that they have 3 hours of water and even more that it covers 65% of the population, the rest have had to look for their own source, which shows that the managerial response capacity to the infrastructure gap is still limited and subject to large-scale investments that depend to a large extent on financial transfers from the central government through the OTASS, rather than the company's own generation of resources, making it vulnerable to fluctuations in the public budget. a situation that has been postponing the implementation of comprehensive projects for years. And lately the dissatisfaction of the population has been exacerbated, generating mobilizations that demand not only the immediate improvement of the service, but also the definitive departure of OTASS from the administration of the company

With Resolution of the Board of Directors No. 080-2023-SUNASS-CDD of December 29, 2023 and based on a tariff study, the regulated body SUNASS approves the rates for the services provided by EMAPAVIGS S.A. for the period 2024 – 2028. With which the sustainability of the company is guaranteed. The aforementioned approval includes the tariff formulas with the proposal for tariff increases. On the other hand, it should be noted that, due to

inflationary issues, the company can apply automatic increases every time the wholesale price index (MPI) increases by 3%. The approval of the rates is accompanied by a plan of goals that condition the aforementioned rate increases.

After nine years under the transitional administration regime, the company faces the 2024-2028 period with the obligation to meet strategic goals that validate the effectiveness of the OTASS model, in order to return a healthy and efficient entity to municipal management. However, there is a stark contrast between the modernization of administrative processes and the stagnation of operational management, which remains affected by a historical deficit of investment in headline infrastructure. This technical shortcoming prevents the service from reaching the necessary standards to meet the fundamental demands of citizens for the time being

The company has an organic structure that seems to be giving results, it is relatively short and adjusts to the needs of a small business and the budget. Selection processes are convened under meritocracy rules. The company has 43 workers with a ratio of 4.47 workers per 1000 connections. And among its main weaknesses is the high turnover of positions of trust and the direct intervention of the OTASS board of directors.



Source; SUNASS Tariff Study-In original language. Spanish

In relation to the commercial management of the EPS and according to the Tariff Study prepared by SUNASS, it is found that in the area of responsibility the company has 48,894 inhabitants with a total of 14,090 homes, which is a density of 3.47 inhabitants per home. The population served with drinking water is 32,944 inhabitants and served with sewerage is 43,924 inhabitants, with coverage of 67.4% and 89.9% respectively. On the other hand, the continuity of the drinking water service is on average 3.7 hours per day, with December being the lowest with 3 hours per day, this basically generated by a problem of low capacity of water sources. And as for the pressure in the water network, it is 11.4 m.c.a., a value that is slightly above the limit. As for the average annual consumption measured, it is 13.38 m3/connection/month and average general consumption is estimated at 16.5 m3/connection/month, which includes metered and unmetered.

The company has 7,745 total connections between users of the 5 categories (Domestic, Commercial, State, Industrial and Social), being at the same time the same number of active users. Generating an average income of 3.71 million soles per year from the sale of water and sewerage services, income of 0.13 million soles per year from sales of drinking water only services, and 0.51 million soles per year from the sale of sewerage only services, which means annual income of 4.4 million soles per year. The level of delinquency is 479,988 soles per year, which represents 11% of income. On the other hand, there are 2,221 users who receive some tariff subsidy and it is aimed at low-income users and minimum subsistence consumption. With regard to the fleet of meters, by 2025 they are an average age of 5 years, which indicates that they are already reaching the end of their useful life. And finally, in relation to the geo-referenced commercial cadastre, it is still at 90%.

The company's mission is to provide drinking water and sewerage services in its area of provision, and its vision is to be leaders in the sector, with quality services and contributing to the quality of life of its users. Among the main objectives of the company are: The increase of the continuity of the drinking water service, the increase of pressure in the drinking water distribution

network, the optimization of the financial situation, the updating of the commercial cadastre, and the updating of the technical cadastre.

Regarding the projection of the balance of supply demand of the supply capacity, there are parameters of population base year (2025) of 49,831, average consumption per capita per connection of 16.5 m3/month, estimated water losses of 30%, and year zero supply according to the production report year 2025 of 86.0 lps. And the coefficient of maximum daily demand K1 = 130%.

TABLE

Projection of the Supply-Demand Balance.

Projection of the demand for drinking water production in lps.						
Year		0	5	10	15	20
		2025	2030	2035	2040	2045
Font Capacity	Lps	86.00	86.00	86.00	86.00	86.00
Demand	Lps	152.44	167.49	184.01	202.17	222.12
Balance	Lps	-66.44	-81.49	-98.01	-116.17	-136.12
Continuity	H/d	3.00	?	?	?	?
Projection of wastewater treatment demand in lps.						
Treatment Offer	lps	30.00	30.00	30.00	30.00	30.00
Demand	lps	82.99	91.18	100.17	110.06	120.92
Deficit	lps	-52.99	-61.18	-70.17	-80.06	-90.92

Source: Own elaboration

As can be seen, the operating conditions have been seen to be extremely deficient at present, with a production capacity deficit of 66.44 lps, which indicates that an average of 56% of the total demand required for a continuous service and universal access is being produced. And on the side of the wastewater treatment capacity, the capacity of the existing plant only treats 36% of the wastewater produced. But if we look at 20 years, the forecast would be that production capacity would only reach 38.7% of demand and wastewater treatment capacity would only reach 24.8% of demand. This indicates that if the problem of investments in major infrastructure works is not resolved, the future outlook is quite discouraging for the company.

With regard to the operational system, as mentioned in the tariff study prepared by SUASS, for the supply of drinking water the system is divided into five sectors; Nasca, Cercado, San Carlos, Cajuca and Vista Alegre. The water source is purely underground and is captured through the exploitation of eight wells that form seven subsystems; The Trigal subsystem, the Pajonal subsystem, the old Bisambra subsystem, the Cajuca subsystem, the Nueva Unión subsystem, the Vista Alegre subsystem, the Portachuelo subsystem.

With regard to the collection systems and production capacity equivalent to 24 hours of operation, there are a; The Cajuca No. 1 well with 3.92 lps., the Cajuca No. 2 well with 5.67 lps., the Cajuca 3 well with 11.81 lps., the Vista Alegre well with 5.20 lps., the Unión well currently inoperative, the Pajonal well with 12.94 lps., the portachuelo well with 25.88 lps., the El Trigal filtering gallery with 29.46 lps., the Bisambra catchment with 8.35 lps. 94.88 lps. The water is of good physicochemical quality and is treated with chlorine prior to distribution.

The supply system has five pumping stations, 8 supported reservoirs with 4,250 m3 of total capacity. It has seven raw water pipelines with a total of 16,678 m of pipes with diameters between 6" and 12". It has three raw water impulsion lines with a total of 4,082 m of pipes with diameters of 8". It has five treated water pipelines with a total of 2,676 m of pipes with diameters from 4" to 10". With seventeen treated water supply lines with a total of 8,838 m of pipes with diameters between 4" and 08". With a primary distribution network with 2,844 m of pipes with diameters between 4" and 10". With a secondary distribution network with 77.5616 m of pipes with diameters between

2" and 8", the network includes fittings, valves, and fire faucets. It has 9,761 connections and 2,322 micrometers.

As far as the sewer system is concerned, the company has 12,925 drainage connections. With a network of secondary collectors with 93,081 m of pipes with 8" in diameter. With a network of primary collectors with 6,958 m of 8" pipes. With a pumping station in Portachuelo, with a 2,938 m drive line with 4" pipes. With three emitters totaling 3,132m of pipes with diameters from 10" to 14". With a "Pangaravi" wastewater treatment plant, it is estimated that 40 lps enter, The plant made up of lagoons is saturated with sediments and lack of maintenance which makes the treatment ineffective, and the discharges do not comply with the Maximum Allowed Limits, finally the wastewater is evacuated so that the effluents from the plant are reused by farmers and those from the pumping chamber and without treatment they are discharged into a barren field.

According to its management indicators, coverage is 67.4%, sewerage coverage is 89.8%, micro metering coverage 24%, continuity of service is 3.7 hours/day, the average pressure in the network is 11.4 m.c.a., the average consumption is 16.5 m3/connection/month, the level of non-revenue water shows an erroneous value of 8.5% because 76% of the population that does not If the meter is billed for consumption assignment that is higher than the actual consumption, the company estimates that the ANF is 26.5%. There is no geo-referenced and updated cadastre, the capacity for investment execution has been 39%, the nominal treatment capacity 50%, however it is currently 0%.

Another set of indicators shows that the level of residual chlorine in 100% of samples was satisfactory. The density of complaints is 0.01 per 1000 connections, with the average in the sector being 0.04. The density of breaks in the water network is 0.04 events per kilometer of water pipes per year, with the average in the sector being 0.30. The density of blockages in the collector network was 0.19 events per kilometer of pipes, with the average in the sector being 1.85. Non-revenue water was 28.83%, with the average in the sector being 35%.

As can be seen, these indicators reflect a very poor operational management, and a high dependence on what the Regional Government, local governments, the MVCS through the PNSR and OTASS can make in investments, in itself the company is not able to develop or execute projects of that magnitude. However, it is important that action is taken in this regard as soon as possible, because if we consider what the investment project cycles represent, we would be talking about there being no solution in at least 8 years. By the time the continuity there has reached less than an hour a day, considering the population growth and the consequent increase in demand.

In relation to the economic and financial diagnosis of the company, a summary of the EEFF for the years 2023 and 2024 is shown, which will serve as a basis for estimating the respective ratios and their interpretation, which will give us an image of the current situation of the company and whether or not there was progress during the 2024 fiscal year.

TABLE

Comprehensive income statements of EPS EMAPAVIGS S.A.

YEAR	31.12.2024	31.12.2023
Revenue from the provision of services	5,072,782	4,759,233
Cost of Sales	-3,315,640	-3,404,400
Gross Profit (Loss)	**1,757,782**	**1,354,833**
Sales and distribution expenses	-875,072	-746,001
Administration Fees	-1,346,960	-1,067,268
Other Operating Income	629,478	672,029
Operating Profit (Loss)	164,588	213,593
Financial income	8,423	8,405

Profit before income tax	173,011	221,892
Income tax expense	-52,102	-64,854
Net Profit (Loss) from Continuing Operations	120,909	157,038
Net profit (Loss) for the year	120,909	157,038
Total comprehensive income (after tax)	120,909	157,038

Source: SUNASS Tariff Study
EPS EMAPAVIGS S.A. EFF (SUNASS website)

The 2024 financial year represents a year of structural heritage transformation. The company has gone from a situation of financial vulnerability and undercapitalization in 2023 (with assets of just S/ 1.18 million) to a position of exceptional solidity with assets of S/ 20.15 million. This change is mainly due to a revaluation of assets or an increase in reserves. Despite this balance sheet strengthening, net profitability has experienced a 23% decline, signaling a disconnect between infrastructure growth and current operational efficiency.

TABLE
Balance General de la EPS EMAPAVIGS S.A.

YEAR	31.12.2024	31.12.2023
ACTIVE		
Current Assets		
Cash and cash equivalents	8,967,136	9,350,791
Accounts by Salespeople	1,568,719	1,057,074
Other accounts receivable	0	2,275
Accounts receivable from related entities	46,424	32,598
Inventory	334,297	306,287
Prepaid expenses	0	46,827
Total, Current Assets	**10,916,576**	**10,795,853**
Non-Current Assets		
Trade Receivables	6,780,131	6,760,131
Property, Plant & Equipment	26,844,983	8,459,614
Intangible assets	5,951	11,273
Total, Non-Current Assets	**33,611,065**	**15,231,018**
TOTAL, ASSETS	**44,527,641**	**26,026,871**
LIABILITIES AND EQUITY		
Current Liabilities		
Trade Accounts Payable	44,994	15,575
Other accounts payable	2,3.0,061	2,470,819
Employee Benefits	101,586	16,228
Total, Current Liabilities	**2,447,641**	**2,502,622**
Non-Current Liabilities		
Financial obligations	9,390,736	9,390,736
Employee Benefit	58,658	111,399
Net Deferred Revenue	12,473,790	12,836,993
Total, Non-Current Liabilities	**21,923,182**	**22,836,993**
TOTAL, PASSIVE	**24,370,823**	**24,841,750**
Heritage		
Capital	2,025,701	2,025,701
Additional capital	3,144,803	3,144,803
Cumulative results	-3,803,751	-3,985,383
Other heritage reserves	18,790,065	0
TOTAL, EQUITY	**20,156,818**	**1,185,121**
TOTAL, LIABILITIES AND EQUITY	**44,527,841**	**26,026,871**

Source: SUNASS Tariff Study
EPS EMAPAVIGS S.A. EFF (SUNASS website)

From an economic point of view, it can be seen that in 2024, EPS EMAPAVIGS S.A. recorded income from the provision of services for approximately S/ 5.07 million, this amount is higher than that obtained in 2023, when its revenues reached S/ 4.76 million, a positive result that represents an increase of 6.5%. For its part, the cost of sales for 2024 has remained very similar to those of 2023 with a slight desire of S/ 0.09 million, achieving a gross profit of S/ 1.76 million, approximately 27% higher than in 2023 with S/ 0.40 million more. On the other hand, administrative and sales expenses together reached around S/ 2.22 million, approximately 22.5% higher than in 2023

with S/ 0.41 million more, however, the company managed to offset this situation thanks to other operating income, which allowed it to achieve an operating profit of S/ 0.16 million, with S/ 0.05 million less than the previous year. Finally, EPS EMAPAVIGS S.A. closed 2024 with a net profit of S/ 0.12 million, which represents S/ 0.036 million less than that obtained in 2023. This result shows that, despite the slight variations between revenues, costs and expenses, the company had a management aimed at ensuring financial balance and continuity of service and that although they ended with a positive balance, the profit was slightly lower than that of 2023, which shows that it shows that the company is achieving more sustained economic stability.

To understand the current financial situation of the company, we are going to develop a comparative analysis of the main ratios of EPS EMAPAVIGS S.A. corresponding to the fiscal years 2023 and 2024. The aim is to show, in a simple and clear way, how the company's situation has evolved between the two years.

The gross margin indicator shows how much the company has left after covering the direct costs of the service, in this regard in 2023 the gross margin was 28.5%, while in 2024 it increased to 34.6%, this means that in the last year the company had a lower margin after covering its basic costs.

TABLE 5

Ratios Económicos de la EPS EMAPAVIGS S.A.

Ratio	Formula	2023	2024
Gross margin	Gross Profit / Revenue	28,5 %	34,6 %
Operating margin	Operating Result / Revenue	4,49 %	3,20 %
Net margin	Net Income / Revenue	3,30 %	2,38 %
Employment relationship	(Disbursable Costs and Expenses) / Operating Income	0.92	0.96
ROA	Net Income / Assets	0,60 %	0,27 %
SWIR	Net Income / Equity	13,25 %	0,60 %

Source: Own elaboration

On the other hand, the operating margin went from 31.0% in 2023 to 39.6% in 2024. This result indicates that, despite achieving lower revenues and higher expenses, the company managed to have operating profit, although 30% less than the previous year, this is mainly explained by a significant increase in accounts receivable that helped offset higher administrative and operating expenses. As for the labor ratio indicator, it is observed that it went from 0.92 at the end of 2023 to 0.96 in 2024, which indicates that almost all income goes to operating costs and expenses, leaving no margin for investments or reserves and are far from ideal values of 60%. On the other hand, the net margin decreased slightly from 3.3% in 2023 to 2.38% in 2024. And as for the return on assets, it can be seen that it has decreased from 0.6% in 2023 to 0.27% in 2024, a variation generated by an increase in non-current assets with approximately S/ 18 million higher than in 2023. While the return on assets fell from 13.25% to only 0.60% for the same reason as above.

TABLE 5

Ratios Financieros de la EPS EMAPAVIGS S.A.

Ratio	Formula	2023	2024
Liquidity ratio	Current Assets / Current Liabilities	4,31	4,46
Solvency ratio	Total Liabilities / Total Assets	0,89	0,54
Equity leverage	Total liabilities / Equity	20,96	1,21
Financial autonomy	Equity / Total Assets	4,55 %	45,2 %

Source: Own elaboration

The current liquidity ratio had a slight reduction from 7.3 in 2023 to 6.4 in 2024, and despite this decrease, the level of liquidity remains high. On the other hand, the company has sufficient resources to meet its short-term obligations without major difficulties. It can also be seen that the level

of indebtedness decreased from 0.62 in 2023 to 0.58 in 2024. This result indicates that a smaller proportion of assets are being financed with debt, which represents an improvement in the company's financial structure. Equity leverage fell from 1.61 in 2023 to 1.37 in 2024, reflecting a strengthening of equity and less reliance on third-party financing. And in relation to financial autonomy, it can be seen that it increased from 38% to 42%, which means that a greater part of the company's assets are financed with its own resources. This result is positive and contributes to the financial stability of EPS EMAPAVIGS S.A.

In summary, of the economic and financial information of EPS EMAPAVIGS S.A. of the year 2024 analyzed, it can be seen that the company maintains a solid economic and financial situation. which generates positive results, with adequate liquidity and manageable debt levels.

Conclusions

"After carrying out a detailed evaluation of the management management of EMAPAVIGS S.A. during the 2024 financial year and previous periods, the critical factors that compromise both institutional administration and the efficiency of services have been identified. It is evident that, since its foundation in 1993, management at the municipal level did not achieve the expected objectives, showing deficient operational indicators. This situation of financial insolvency was the trigger for the company to be intervened and managed by OTASS in 2017."

The results reveal that OTASS, despite incorporating managers with vast experience, has not yet managed to solve the most critical internal conflicts that affect the organization's operations. A substantial improvement is perceived in the administrative and financial spheres when balancing the accounts with marginal profits, although the commercial sector continues to be weighed down by a high rate of inactive users. On the other hand, the lack of water resources is the main challenge that distorts management, limiting coverage to 76% with just three hours of daily service and a budget execution of 50%. The sanitation infrastructure represents another critical point, as the existing plant only properly processes 30% of the water, discharging the untreated surplus and damaging the natural environment of the area.

It is important to note that the solution to these large-scale problems does not depend exclusively on the EPS, which shows a lack of interest of the Regional Government in these multipurpose works necessary for the city. The hot desert climate aggravates the perception of shortages, damaging the institutional image, which is why it is imperative that OTASS manages external support with the MVCS and Proinversión. Even financing through international banks or the works for taxes scheme must be considered to finally materialize the investments in infrastructure that the population urgently requires.

Precautions must be taken, because any definitive solution will not be in less than 8 years, which is the time of maturity of investment projects in Peru, and considering that this has not resulted in arbitration that could trap it for an indefinite period of time. For this reason, it is recommended that they be very professional in the preparation of the project, that it is complete and well prepared so that it does not require additional work. And on the other hand, transparency in the bidding process, selecting a company that demonstrates experience and not a consortium created only for these works.

References

Lentini et al (2018), Urban drinking water and sanitation services in Argentina: Current status and challenges. (pp. 1-15). Buenos Aires: Universidad de San Martín. https://ri.unsam.edu.ar › PFAH 2018 CLEBFMA

Moreno (2020), The challenges of access to drinking water and basic sanitation in rural areas of Colombia. Journal of Engineering, 28-38. https://revistas.uniandes.edu.co › RDI › article › view

Moroñas et al (2020), State of the Water, Sanitation and Solid Waste Sector in Uruguay. Montevideo: Inter-American Development Bank (IDB). https://publications.iadb.org › the-state-of-the-water-sector...

Lamosas (2020), Sanitation and water for all. Country Summary Paraguay, 1-7. https://sanitationandwaterforall.substack.com/p/como-paraguay-esta redesigning-them

López (2023), Quality of the provision of sanitation services and user satisfaction of the company SEDALIB, year 2020, *LATAM Latin American Journal of Social Sciences and Humanities*, *4*(4. https://doi.org/10.56712/latam.v4i4.1278

Peña et al (2025). Process Management and its Relationship with the Quality of Service in Public Environmental Sanitation Companies. *Revista Veritas de Difusão Científica*, *6*(2), 4811–4834. https://doi.org/10.61616/rvdc.v6i2.864

Gómez et al (2021), Inter-American Development Bank, Water and sanitation services in Latin America: access and quality overview https://publications.iadb.org › spanish › document

Herrera (2023). Quality of service and water security of consumers in Metropolitan Lima – Peru. *REVISTA VERITAS ET SCIENTIA - UPT*, *12*(02). https://doi.org/10.47796/ves.v12i02.859

Santa Cruz et al (2025). Quality of service and user satisfaction in relation to drinking water and sanitation service in Iquitos - Peru. *UNF Journal of Scientific Research – Aypate*, *4*(2), 28–37. https://doi.org/10.57063/ricay.v4i2.161

Solis et al (2025). *Relationship of service quality with customer satisfaction in the service and sanitation provider company - EPS – Selva Central Junín, year 2023*. Repository of the San Ignacio de Loyola University; San Ignacio de Loyola University. https://repositorio.usil.edu.pe/handle/20.500.14005/16265

Gallegos et al (2025), Perception of users regarding the quality of the service received by a public body of drinking water, sewerage and sanitation in the City of Chihuahua, Chih. Mexico, *1Autonomous University of Chihuahua.* https://www.researchgate.net › ... › Servqual.

Rodríguez (2021), Quality management model for drinking water production and sanitation services, based on the Deming cycle, Six Sigma and SERVPERF. Case: E.P.S. SEDAPAR S.A. Arequipa, 2021. National University of San Agustín http://hdl.handle.net/20.500.12773/13838

Cieza (2022), Management of internal processes for the environmental management of the wastewater treatment plant, Jaén, Doctoral thesis, UCV repository https://doi.org/10.33996/revistaalfa.v6i16.149

Huaman (2021), Regional Public Policies and Urban Wastewater Treatment in the District of Ayacucho 2020, Master's thesis, Alicia concytec. https://alicia.concytec.gob.pe › vufind › Record

Redroban et al (2022), Compliance in Ecuador, tripartite challenge between government, business and academia: The diagnosis, scientific journal EPISTEMIA, https://revistas.uss.edu.pe/index.php/EPT/article/view/2293

Fanzo (2021). Quality of service and user satisfaction in the Sanitation Service Provider Company of Lambayeque -

Chiclayo. [Master's thesis, César Vallejo University.

https://repositorio.ucv.edu.pe/handle/20.500.12692/53937

Paltán et al (2020). Resilient drinking water and sanitation services in Latin America and the Caribbean. https://doi.org/10.18235/0002596

Comexperu (2025), Advances and delays in access to drinking water and sanitation, Comexperu / Weekly 1282 / Present. https://www.comexperu.org.pe › article › advances-and-d.

Perry, P, (2024). Claims process as an indicator of improvement in the management of the sanitation sector in Peru. Mexican Journal Contemporary Dilemmas. https://doi.org/10.46377/dilemas.v12i1.4331

Perry, P, (2025). Universal Access to sanitation services, with quality and sustainab ility, Peru 2025 – 2055. Revista Venezolana Journal of Information Systems Engineering and Management. https://www.jisem-journal.com / index. php / journal /article / view /9828

Perry, P, (2025). Management of drinking water, sewerage and wastewater treatment services in Peru 2024. Venezuelan Interscience Journal. https://www.interciencia.net/ in.

Cairampoma, A. & Villegas, P. (2016), Universal Access to Drinking Water. The Peruvian Experience, PUCP Law, (76), 229-249.

https://doi.org/10.18800/derechopucp.201601.009

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.

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

Alegre et al (2025), Quality of water sanitation services and user satisfaction of a service provider company. Asampitakoyote Journal of Intercultural Research, 1(1), 52–60. https://doi.org/10.58719/yt9wjn80

United Nations (2023). Goal 6: Ensure the availability and sustainable management of water and sanitation for all.

https://www.un.org/sustainabledevelopment/es/water-andsanitation/.

Bravo et al (2023). Quality management systems in drinking water and sewerage utilities in Barranca, Peru. Suma de Negocios,14(30),12-19. https://doi.org/10.14349/sumneg/2023.V14.N30.A2.

United Nations (UN). (2015, 03, 16). Sustainable Development Goals SDGs. https://www.cepal.org/es/temas/agenda-2030-desarrollo-sostenible/objetivos-desarrollo-sostenible-ods

Decree Law No. 1280. (2016). Framework Law on the Management of the Provision of Sanitation Services. https://elperuano.pe › normaselperuano › 2016/12/29

Supreme Decree No. 019-2017-Housing. Approves the Regulations of Decree Law No. 1280. https://www.minam.gob.pe › provisions › supreme-decree-N°019-2017-housing

Supreme Decree No. 031-2010-SA. Regulations on the quality of water for human consumption. http://www.digesa.minsa.gob.pe › downloads › regulations › quality › agua.pdf.

Board of Directors Resolution No. 058-2023-SUNASS-CD. Regulation on the Quality of the Provision of Sanitation Services https://www.gob.pe › sunass › norms-legal › 4722102–058–2023–sunass-cd.

Hernández-Sampieri, R., & Mendoza, C. P. (2018). Research methodology: quantitative, qualitative and mixed routes. Mexico: McGraw-Hill Interamericana Editores, S.A. de C. V. https://doi.org/10.17993/CcyLl.2018.15