ACCESS TO DRINKING WATER IN THE AMAZON REGION OF PARÁ: A COMPARATIVE ASSESSMENT BETWEEN THE STATE OF PARÁ AND THE MUNICIPALITY OF PARAGOMINAS-PA BASED ON QUALITY AND AVAILABILITY INDICATORS

ACESSO A ÁGUA POTÁVEL NA AMAZÔNIA PARAENSE: AVALIAÇÃO COMPARATIVA ENTRE O ESTADO DO PARÁ E O MUNICÍPIO DE PARAGOMINAS-PA COM BASE EM INDICADORES DE QUALIDADE E DISPONIBILIDADE

ACCESO AL AGUA POTABLE EN LA REGIÓN AMAZÓNICA DE PARÁ: UNA EVALUACIÓN COMPARATIVA ENTRE EL ESTADO DE PARÁ Y EL MUNICIPIO DE PARAGOMINAS-PA BASADA EN INDICADORES DE CALIDAD Y DISPONIBILIDAD

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ABSTRACT

Access to potable water in Brazil is significantly unequal, a reality that intensifies in the state of Pará, located in the Amazon region of Pará. This study aims to quantitatively analyze water accessibility in the state, with an emphasis on comparing the municipality of Paragominas-PA with other municipalities in Pará. The methodology was based on the analysis of secondary data from the National Sanitation Information System (SNIS), the National Basic Sanitation Survey (IBGE), and reports from the National Water Agency (ANA), in addition to the application of perception questionnaires to 40 participants from the municipality of Paragominas. The results show that, although the overall coverage rate is low, Paragominas stands out with a high percentage of service (95.75%), similar to the capital Belém. User perception indicated a high level of satisfaction (ISA = 1.00), but low confidence in direct water consumption (ICC = 0.3), revealing a contradiction between the regularity of supply and confidence in direct consumption. It is concluded that, despite some progress, significant social inequalities related to service reliability persist, requiring integrated public policies,

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structural investments, and communication strategies to strengthen public trust. Thus, this study contributes to the water supply in Pará, ensuring the human right to access water. Objective: The objective of this study is to analyze access to potable water in the state of Pará, based on data from official sources, by comparing water supply indicators in the municipality of Paragominas-PA, the capital city of Belém, and other municipalities in Pará, aiming to assess the percentage of the population served and identify challenges and possibilities for expanding access to treated and safe water. Theoretical Framework: Access to treated water and basic sanitation was recognized in 2010 by the United Nations (UN) as a fundamental human right, indispensable to guaranteeing the dignity, health, and well-being of the population. This recognition represents a significant normative milestone, guiding the formulation of public policies aimed at reducing inequalities in access to water supply and basic sanitation services. Within this context, the role of the Sustainable Development Goals (SDGs) stands out, especially SDG 6, which establishes as a goal ensuring the availability and sustainable management of water and sanitation for all. This guideline reinforces the importance of studies that analyze the conditions of access to drinking water, especially in the Amazon region, which is still marked by social inequalities. The unequal distribution of social services remains a major difficulty. Equity in access is a condition for the well-being of the population. At this point, it is possible to assess the importance of water governance, playing a significant role in Brazil and in the State of Pará, in a way that can guide the organization of supply systems and the formulation of new public policies focused on water resources, so that social justice can begin to bear fruit related to equal access. Currently, water resource governance in Pará relies on the National Basic Sanitation Policy (Law 11.445/2007); the National Water and Basic Sanitation Agency (ANA); the State Secretariat for the Environment (SEMAS-PA); the State Water Resources Commission; the Basin Committee; and the Pará Sanitation Company (COSANPA). Therefore, this study is of paramount importance for contributing to public policies, with improvements focused on access to water and water governance in the state as a whole. It is also an important topic to be discussed in the academic world. Method: This study is characterized as a mixed-methods research (quantitative and qualitative), with exploratory and descriptive objectives, focused on access to drinking water in the state of Pará. The quantitative phase was based on the collection and analysis of secondary data from official databases, including the National Sanitation Information System (SNIS), the National Basic Sanitation Survey (PNSB), conducted by the Brazilian Institute of Geography and Statistics (IBGE), and reports from the National Water and Basic Sanitation Agency (ANA). Additionally, a documentary analysis of Ordinance GM/MS No. 888/2021, which establishes the potability standards for drinking water in Brazil, was carried out to support the discussion on the quality and safety of distributed water. The qualitative phase consisted of conducting field research in the municipality of Paragominas-PA, through the application of a structured questionnaire to the local population. The sample consisted of 40 participants selected by convenience in a public place with high traffic. The instrument included questions related to the perception of water quality, regularity of supply, and level of satisfaction with the services provided. Quantitative data were analyzed using descriptive statistics, with calculation of frequencies and percentages, allowing for comparison between the evaluated indicators. For the analysis of qualitative data, a descriptive approach was adopted, seeking to identify patterns of user perception. In addition, two synthetic indicators were developed: the Supply Satisfaction Index (ISA) and the Consumption Confidence Index (ICC), with the objective of measuring, respectively, the level of user satisfaction with the service provided and confidence in the direct consumption of water. These indicators range from 0 to 1, with values closer to 1 indicating better evaluation conditions. Results and Discussion: The results obtained show a predominantly positive perception on the part of the participants regarding the quality and

distribution of water supplied in the municipality of Paragominas-PA. Most respondents expressed satisfaction with the services provided by the municipal authority, indicating that the water supply has generally met basic demands. Research Implications: The research presents relevant implications for basic sanitation and water resource management by highlighting inequalities in access to drinking water in the state of Pará. The results indicate the need to improve public policies, both in terms of expanding coverage and strengthening public confidence in the quality of the distributed water. The proposed indicators, such as the Water Supply Satisfaction Index (ISA) and the Consumption Confidence Index (ICC), prove to be useful tools for monitoring and decision-making, contributing to more efficient and appropriate strategies for the local reality. Originality/Value: The study contributes to the literature by offering an updated quantitative analysis of accessibility to treated water in the State of Pará through official data and theoretical references on the human right to water, social justice, and water governance.

Keywords: Accessibility. Treated Water. Human Rights. Water Resources.

RESUMO

O acesso a água potável no Brasil possui uma desigualdade significativa, realidade que se intensifica no estado do Pará, inserido na Amazônia Paraense. Este estudo tem como objetivo analisar, de forma quantitativa, a acessibilidade à água no estado, com ênfase na comparação entre o município de Paragominas-PA e outros municípios paraenses. A metodologia baseou-se na análise de dados secundários provenientes do Sistema Nacional de Informações sobre o Saneamento (SNIS), da Pesquisa Nacional de Saneamento Básico (IBGE) e de relatórios da Agência Nacional de Águas (ANA), além da aplicação de questionários de percepção com 40 participantes do município de Paragominas. Os resultados evidenciam, que embora os resultados apresentem baixo índice de cobertura de abastecimento, Paragominas destaca-se com elevado percentual de atendimento (95,75%), semelhante a capital Belém. A percepção dos usuários indicou alto nível de satisfação (ISA = 1,00), porém baixa confiança no consumo direto da água (ICC = 0,3), o que revelou uma contradição entre regularidade do abastecimento e confiança no consumo direto. Conclui-se que, apesar dos avanços pontuais, persiste desigualdades sociais significativas relacionadas a confiabilidade do serviço, sendo necessárias políticas públicas integradas, investimentos estruturais e estratégias de comunicação para o fortalecimento da confiança da população. Desta forma o estudo contribui para o abastecimento hídrico do Pará, de maneira que assegure o Direito Humano de acesso à água. Objetivo: O objetivo deste estudo é analisar a acessibilidade à água potável no Estado do Pará, com base em dados de fontes oficiais, por meio da comparação entre os indicadores de abastecimento de água do município de Paragominas-PA, da capital de Belém e de outros municípios paraenses, visando avaliar o percentual da população atendida e identificar desafios e possibilidades para ampliação do acesso a água tratada e segura. Referencial Teórico: O acesso a água tratada e o saneamento básico foi reconhecido, em 2010, pela Organização das Nações Unidas (ONU) como direito humano fundamental, indispensável, à garantia da dignidade, da saúde e do bem-estar da população. Esse reconhecimento representa um marco normativo relevante, ao orientar à formulação de políticas públicas, voltadas a redução das desigualdades no acesso aos serviços de abastecimento de água e saneamento básico. Dentro desse contexto, destaca-se o papel dos Objetivos de Desenvolvimento Sustentável (ODS), especialmente a ODS 6, que estabelece como meta assegurar a disponibilidade e a gestão sustentável da água e do saneamento para todos. Esta diretriz reforça a importância de estudos que analisem as condições de acesso à água potável, sobretudo na região Amazônica, que ainda é marcada por desigualdades sociais. A distribuição desigual de

serviços sociais ainda é uma grande dificuldade. A equidade em acesso é uma condição para o bem-estar populacional. Neste ponto é possível aferir a importância da Governança da água, desempenhando um importante papel no Brasil e no Estado do Para de maneira que pode orientar a organização dos sistemas de abastecimento e a formulação de novas políticas públicas voltadas aos recursos hídricos, para que de certa forma a justiça social comece a trazer frutos relacionados ao acesso igualitário. Atualmente a governança dos recursos hídricos no Pará contam com a Política Nacional de Saneamento Básico (lei 11.445/2007); a Agência Nacional de Água e Saneamento Básico (ANA); Secretaria de Estado de Meio Ambiente (SEMAS-PA); A Comissão Estadual de Recursos Hídricos, o Comitê de Bacia e a Companhia de Saneamento do Pará (COSANPA). Dessa forma este estudo é de suma importância para a contribuição para políticas públicas, com o aprimoramento voltado ao acesso à água e Governança Hídrica no Estado como um todo. Também é um importante tema a ser discutido no mundo acadêmico. Método: O presente estudo caracteriza-se como uma pesquisa de abordagem mista (quantitativa e qualitativa), com objetivos exploratórios e descritivos, voltado ao acesso à água potável no estado do Pará. A etapa quantitativa baseou-se coleta e análise de dados secundários provenientes de bases oficiais, incluindo o Sistema Nacional de Informações sobre Saneamento (SNIS), a Pesquisa Nacional de Saneamento Básico (PNSB), realizada pelo Instituto Brasileiro de Geografia e Estatística (IBGE), e relatórios da Agência Nacional de Águas e Saneamento Básico (ANA). Adicionalmente, foi realizada análise documental da Portaria GM/MS nº 888/2021, que estabelece os padrões de potabilidade da água para consumo humano no Brasil, a fim de subsidiar a discussão sobre qualidade e segurança da água distribuída. A etapa qualitativa consistiu na realização de pesquisa de campo no município de Paragominas-PA, por meio da aplicação de questionário estruturado junto à população local. A amostra foi composta por 40 participantes selecionados por conveniência, em local público de grande circulação. O instrumento contemplou questões relacionadas à percepção da qualidade da água, regularidade do abastecimento e nível de satisfação com os serviços prestados. Os dados quantitativos foram analisados por meio de estatística descritiva, com cálculo de frequências e percentuais, possibilitando a comparação entre os indicadores avaliados. Para a análise dos dados qualitativos, adotou-se abordagem descritiva, buscando identificar padrões de percepção dos usuários. Além disso, foram elaborados dois indicadores sintéticos: o Índice de Satisfação do Abastecimento (ISA) e o Índice de Confiança no Consumo (ICC), com o objetivo de mensurar, respectivamente, o nível de satisfação dos usuários com o serviço prestado e a confiança no consumo direto da água. Esses indicadores variam de 0 a 1, sendo que valores mais próximos de 1 indicam melhores condições de avaliação. Resultados e Discussão: Os resultados obtidos evidenciam uma percepção predominante positiva por parte dos participantes em relação a qualidade e distribuição de água fornecida no município de Paragominas-PA. A maioria dos respondentes demonstrou satisfação com os serviços prestados pela autarquia municipal, indicando que o abastecimento, tem atendido, de forma geral, às demandas básicas. Implicações da Pesquisa: A pesquisa apresenta implicações relevantes para o saneamento básico e a gestão de recursos hídricos ao evidenciar desigualdades no acesso à água potável no estado do Pará. Os resultados indicam a necessidade de se aprimorar as políticas públicas, tanto no âmbito da expansão da cobertura, como no fortalecimento da confiança da população quanto à qualidade da água distribuída. Os indicadores propostos, como o Índice de Satisfação do Abastecimento (ISA) e o Índice de Confiança no Consumo (ICC), mostram-se ferramentas úteis para o monitoramento e a tomada de decisão, contribuindo para estratégias mais eficientes e adequadas à realidade local. Originalidade/Valor: O estudo contribui para a literatura ao oferecer uma análise quantitativa atualizada sobre a

acessibilidade à água tratada no Estado do Pará por meio dos dados oficiais e referências teóricas sobre o direito humano à água, justiça social e governança hídrica.

Palavras-chave: Acessibilidade. Água Tratada. Direitos Humanos. Recursos Hídricos.

RESUMEN

El acceso al agua potable en Brasil es significativamente desigual, una realidad que se intensifica en el estado de Pará, ubicado en la región amazónica de Pará. Este estudio tiene como objetivo analizar cuantitativamente la accesibilidad al agua en el estado, con énfasis en la comparación del municipio de Paragominas-PA con otros municipios de Pará. La metodología se basó en el análisis de datos secundarios del Sistema Nacional de Información Sanitaria (SNIS), la Encuesta Nacional Básica de Saneamiento (IBGE) e informes de la Agencia Nacional del Agua (ANA), además de la aplicación de cuestionarios de percepción a 40 participantes del municipio de Paragominas. Los resultados muestran que, si bien la tasa de cobertura general es baja, Paragominas se destaca con un alto porcentaje de servicio (95,75%), similar al de la capital, Belém. La percepción de los usuarios indicó un alto nivel de satisfacción (ISA = 1,00), pero baja confianza en el consumo directo de agua (ICC = 0,3), lo que revela una contradicción entre la regularidad del suministro y la confianza en el consumo directo. Se concluye que, a pesar de algunos avances, persisten importantes desigualdades sociales relacionadas con la fiabilidad del servicio, lo que requiere políticas públicas integradas, inversiones estructurales y estrategias de comunicación para fortalecer la confianza pública. Por lo tanto, este estudio contribuye al suministro de agua en Pará, garantizando el derecho humano al acceso al agua. Objetivo: El objetivo de este estudio es analizar el acceso al agua potable en el estado de Pará, con base en datos de fuentes oficiales, comparando los indicadores de suministro de agua en el municipio de Paragominas-PA, la capital Belém y otros municipios de Pará, con el fin de evaluar el porcentaje de la población atendida e identificar desafíos y posibilidades para ampliar el acceso a agua tratada y segura. Marco teórico: El acceso al agua tratada y al saneamiento básico fue reconocido en 2010 por las Naciones Unidas (ONU) como un derecho humano fundamental, indispensable para garantizar la dignidad, la salud y el bienestar de la población. Este reconocimiento representa un hito normativo significativo, que guía la formulación de políticas públicas dirigidas a reducir las desigualdades en el acceso al suministro de agua y a los servicios básicos de saneamiento. Dentro de este contexto, destaca el rol de los Objetivos de Desarrollo Sostenible (ODS), especialmente el ODS 6, que establece como meta asegurar la disponibilidad y la gestión sostenible del agua y el saneamiento para todos. Esta directriz refuerza la importancia de los estudios que analizan las condiciones de acceso al agua potable, especialmente en la región amazónica, que todavía está marcada por desigualdades sociales. La distribución desigual de los servicios sociales sigue siendo una dificultad importante. La equidad en el acceso es una condición para el bienestar de la población. En este punto, es posible evaluar la importancia de la gobernanza del agua, que juega un rol significativo en Brasil y en el estado de Pará, de manera que puede guiar la organización de los sistemas de suministro y la formulación de nuevas políticas públicas enfocadas en los recursos hídricos, para que la justicia social pueda comenzar a dar frutos relacionados con el acceso igualitario. Actualmente, la gobernanza de los recursos hídricos en Pará se basa en la Política Nacional de Saneamiento Básico (Ley 11.445/2007); la Agencia Nacional de Agua y Saneamiento Básico (ANA); la Secretaría de Estado del Medio Ambiente (SEMAS-PA); la Comisión Estatal de Recursos Hídricos; el Comité de Cuenca; y la Compañía de Saneamiento de Pará (COSANPA). Por lo tanto, este estudio es de suma importancia para contribuir a las políticas públicas, con mejoras enfocadas en el acceso al agua y la gobernanza del agua en el estado en su

conjunto. También es un tema importante para ser discutido en el mundo académico. Método: Este estudio se caracteriza como una investigación de métodos mixtos (cuantitativos y cualitativos), con objetivos exploratorios y descriptivos, enfocados en el acceso al agua potable en el estado de Pará. La fase cuantitativa se basó en la recolección y análisis de datos secundarios de bases de datos oficiales, incluyendo el Sistema Nacional de Información Sanitaria (SNIS), la Encuesta Nacional de Saneamiento Básico (PNSB), realizada por el Instituto Brasileño de Geografía y Estadística (IBGE), e informes de la Agencia Nacional de Agua y Saneamiento Básico (ANA). Adicionalmente, se realizó un análisis documental de la Ordenanza GM/MS No. 888/2021, que establece los estándares de potabilidad para el agua potable en Brasil, para respaldar la discusión sobre la calidad y seguridad del agua distribuida. La fase cualitativa consistió en realizar una investigación de campo en el municipio de Paragominas-PA, mediante la aplicación de un cuestionario estructurado a la población local. La muestra consistió en 40 participantes seleccionados por conveniencia en un lugar público con mucho tránsito. El instrumento incluyó preguntas relacionadas con la percepción de la calidad del agua, la regularidad del suministro y el nivel de satisfacción con los servicios prestados. Los datos cuantitativos se analizaron mediante estadística descriptiva, con cálculo de frecuencias y porcentajes, lo que permitió la comparación entre los indicadores evaluados. Para el análisis de los datos cualitativos, se adoptó un enfoque descriptivo, buscando identificar patrones de percepción del usuario. Además, se desarrollaron dos indicadores sintéticos: el Índice de Satisfacción con el Suministro (ISA) y el Índice de Confianza en el Consumo (ICC), con el objetivo de medir, respectivamente, el nivel de satisfacción del usuario con el servicio prestado y la confianza en el consumo directo de agua. Estos indicadores varían de 0 a 1, con valores más cercanos a 1 que indican mejores condiciones de evaluación. Resultados y Discusión: Los resultados obtenidos muestran una percepción predominantemente positiva por parte de los participantes respecto a la calidad y distribución del agua suministrada en el municipio de Paragominas-PA. La mayoría de los encuestados expresó satisfacción con los servicios prestados por la autoridad municipal, indicando que el suministro de agua ha satisfecho en general las necesidades básicas. Implicaciones de la investigación: Esta investigación presenta implicaciones relevantes para el saneamiento básico y la gestión de los recursos hídricos, al destacar las desigualdades en el acceso al agua potable en el estado de Pará. Los resultados indican la necesidad de mejorar las políticas públicas, tanto en términos de ampliar la cobertura como de fortalecer la confianza pública en la calidad del agua distribuida. Los indicadores propuestos, como el Índice de Satisfacción con el Suministro de Agua (ISA) y el Índice de Confianza en el Consumo (ICC), demuestran ser herramientas útiles para el monitoreo y la toma de decisiones, contribuyendo a estrategias más eficientes y adecuadas a la realidad local. Originalidad/Valor: Este estudio contribuye a la literatura al ofrecer un análisis cuantitativo actualizado de la accesibilidad al agua tratada en el estado de Pará, a través de datos oficiales y referencias teóricas sobre el derecho humano al agua, la justicia social y la gobernanza del agua.

Palabras clave: Accesibilidad. Agua Tratada. Derechos Humanos. Recursos Hídricos.

1 INTRODUCTION

International Organizations, known worldwide, such as: United Nations (UN), Food and Agriculture Organization of the United Nations (FAO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), warn that water scarcity tends to intensify in the coming decades. Estimates indicate that by 2025, approximately 1.8 billion people will live in regions with characteristics of water scarcity. It can lead to more than two-thirds of the world's population facing water stress.

According to information from UN-Water, water scarcity has become a growing problem in several regions of the world. Some of the reasons are demand exceeding supply, population growth and climate change that has been directly impacting. Water is a finite resource whose availability varies according to geographic location and according to the pressures for use, this is a factor that aggravates the problem when the quantity and quality of available water decreases, which contributes to situations of water stress.

Water, as it is a finite resource, requires proper management. Population growth on a global scale, combined with continuous economic development, has intensified the pressure on water resources, resulting in the inability of several countries to meet the growing demand for water.

Water is essential for the maintenance of life on earth. However, their distribution on the planet is uneven: approximately 97% are found in the ocean; 2.2% are stored in glaciers; and only 0.8% correspond to available fresh water. Of this 0.8% of freshwater available, 97% of this water is underground and 3% is available superficially (Von Sperling, 2022).

It is noteworthy that surface water resources are, in general, more easily accessible, while groundwater requires greater technical and operational complexity for its collection.

According to the report of the United Nations Conference on Water, approximately 26% of the world's population does not have access to safe drinking water, and about 46% do not have adequate basic sanitation services.

Ordinance No. 888 of the Ministry of Health establishes guidelines for the control and surveillance of the quality of water that will be destined for human consumption. The ordinance defines potability standards that must be met, specifying parameters that characterize drinking water with compliance with microbiological criteria for this (Brasil, 2021).

These potability standards must be met so that there is no damage to human health, since it is important to regulate the internal temperature and the very functioning of the body.

In Brazil, especially in the Amazon region, high water availability can convey a perception of water abundance. However, it is important to emphasize that quantity does not translate

quality, the current risks are made up of its potability (Sottili, 2022).

Water quality can be affected by several factors such as natural phenomena, through atmospheric precipitation and runoff (climatic, geological and hydrological characteristics) and through human action such as land occupation, agricultural practices, industrial and domestic waste (Brasil, 2005).

Currently there are three distinct conceptions about water quality: the desired quality, necessary to meet a certain use; the actual quality available, which corresponds to the current conditions of that water resource; and the intended quality, which represents the quality standard that is desired for that water through management and control actions.

The management of water resources within the country faces several structural challenges, we can first talk about the territorial extension, which results in a broad complex monitoring of resources. Along with this factor , economic and population growth intensifies the demand for water, which results in pressure on supply systems. Finally, the lack of priority attributed in the political sphere to the implementation of public policies makes everything more difficult.

The objective of this study is to analyze data from official sources to verify the accessibility of water in the State of Pará in a quantitative way. It seeks to evaluate the percentage of the population served with access to treated and safe water in Pará, in addition to comparing the water supply indicators in the state capital with the municipality of Paragominas-PA and how it would be possible to expand access. Additionally, it is intended to analyze the perception with an interview in a public place of easy access and without identification to acquire information about the Paragominas Sanitation Agency (SANEPAR).

2 THEORETICAL FRAMEWORK

The quality of water and drinking standards need concreteness so that society in general does not suffer losses. For each use intended for water, there are standards to be followed. In Brazil, the National Council for the Environment (CONAMA) establishes the classification of water bodies and the guidelines for their classification. As provided for in article 3 of CONAMA Resolution No. 357/2005:

> "Art.3 - The fresh, brackish and saline waters of the National Territory are classified, according to the quality required for their preponderant uses, into thirteen quality classes."

Basic sanitation is essential, as proper sewage treatment prevents domestic, industrial,

and hospital waste from being thrown directly into contact with rivers and lakes. According to the World Health Organization (WHO), about 80% of diseases in developing countries come from contaminated water, that is , from diseases arising from waterborne water. In addition, the better the water is collected, the lower the expenses with its treatment. A better water supply reduces the incidence of waterborne diseases.

The absence of adequate water supply and sanitation services disproportionately affects women and children, as it compromises hygiene practices and increases exposure to waterborne diseases, especially diarrheal diseases. Studies warn that the use of water sources and sanitation systems that are not improved are associated with a higher occurrence of childhood diarrhea, evidencing the direct relationship between poor health and the health impacts of these population groups (Asgedom et al., 2023).

The United Nations (UN), through General Assembly Resolution A/RES/64/292 of 2010, formally recognized access to drinking water and basic sanitation as a fundamental human right, indispensable to the guarantee of human dignity, health and well-being. However, despite the efforts for this recognition at the international normative level and the commitments assumed by Brazil, there is still a distance between the legal consecration of this right and its practical implementation. The evidence appears with the permanence of inequalities in access to quality water and basic sanitation services.

The Sustainable Development Goals (SDGs), especially goal 6, highlight water and sanitation as one of the goals to achieve sustainable development in the country. To achieve this goal, the availability and sustainable management of water and sanitation for all must occur.

When it comes to the Amazonian context, this contradiction between the objective and reality is evident. Although the Amazon is home to one of the largest water availability in the country and on the planet, the population encounters difficulties in relation to access to water and adequate sanitation, with the most affected being rural, riverside and urban periphery populations

The difficulty in implementing this objective in the Amazon reveals not only technical and economic obstacles, but also challenges related to water governance, territorial equity and socio-environmental justice, reinforcing the need for public policies that consider regional specificities for the effective realization of the human right to water. All of this causes socio-environmental vulnerability.

Studies indicate that this reality is due to socio-spatial inequalities, precarious infrastructure and failures in the governance of supply services, which in fact forms the paradox between water abundance and social exclusion in access to water (Castro, 2007; Hellerr;

Castro, 2013).

The Northern Region of Brazil has a total population of approximately 17.3 million inhabitants, according to data from the Brazilian Institute of Geography and Statistics (IBGE).

According to data from the National Sanitation Information System (SNISA), 64.2% of the population in the northern region is served with water supply, while only 14.7% have sanitary sewage service.

These data show that almost half of the population in the northern region has not had access to water supply and 85.3% of the population does not have sanitary sewage. Within this statistic, the treatment of this generated sewage has 19.8% of treatment.

The rate of service of the population with water supply in the state of Pará is 55.4%, for sanitary sewage the service is 9.2% of the population, and almost the entire population (90.8%) without service for sanitary sewage. Of this estimate, treated sewage in the state is 8.7%

The lack of service when it comes to basic sanitation is remarkable, the reality needs to change urgently so that there is a better quality of life for all the state population.

Access to drinking water is intrinsically linked to the principle of the dignity of the human person, being indispensable for health, especially when it comes to the minimum condition for the existence of a dignified life. It is an essential factor for meeting the basic needs of the individual such as drinking, preparing food, and having personal hygiene.

In this sense, Luís Roberto Barroso, in his work The Dignity of the Human Person in Contemporary Constitutional Law, highlights dignity as a structuring principle of the Constitutional State, from which other fundamental rights radiate, comprising dimensions that involve the intrinsic value of the human person, individual autonomy and the social dimension of dignity (BARROSO, 2012).

The principle of human dignity is a pillar for the protection of several other fundamental rights such as the right to life, health, education, housing and food. It is unfeasible to enforce all other rights without the minimum, that is, access to drinking water and basic sanitation services.

In this way, the research becomes relevant given the insufficiency in access both for coverage and for the quantity and quality of water and sanitation. This reality compromises other rights that are guaranteed in the Universal Declaration of Human Rights and in the Federal Constitution of 1988 itself, evidencing the distance between the norm and the practical realization of these rights.

The municipality of Paragominas has distanced itself from state statistics, being notoriously one of the municipalities that seek to advance more and more in access to water. Currently, the municipality has an estimated population of 105,550 inhabitants, the total water

service in the municipality is 95.75%.

The municipality is one of the few in the state that is closer to the capital (Belém) that has total access to water at 95.52% and has distanced itself from the little access to other municipalities such as Portel with access of 12.07%; Altamira with 49.8%; São Felix do Xingu, with 4%, among others.

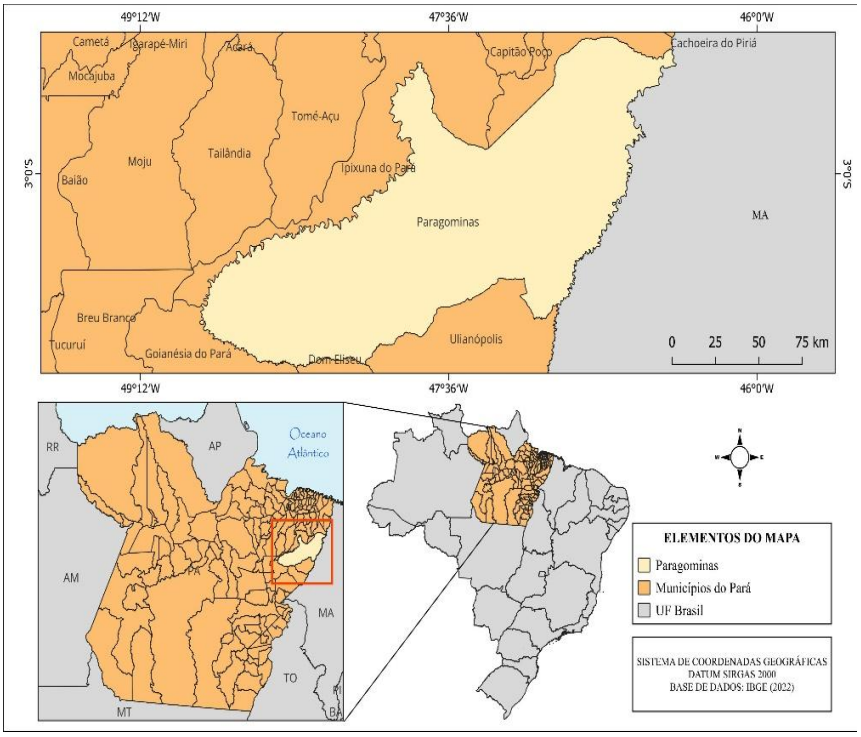
What has been evidenced as the main difference is the water supplier in which it is a municipal autarchy - SANEPAR, distancing itself from the current provider in most of the municipalities in the state that use COSANPA. The Municipality of Paragominas-PA is the focus of this study to obtain a perspective of accessibility to drinking water.

2.1 CHARACTERIZATION OF THE STUDY AREA

The study area covers the municipality of Paragominas, in the state of Pará, as shown in Figure 1. This municipality is located in the North of Brazil, belonging to the region of the Capim River and according to the regional geographic division, prepared by the Brazilian Institute of Geography and Statistics (IBGE) of 2023 it is located in the southeast region of Pará. It has an approximate area of 19,341.9 km² and a population of 105,538 inhabitants (IBGE, 2024).

Figure 1

Location of the Municipality of Paragominas, State of Pará



Source: Prepared by the authors based on data obtained from IBGE (2022).

3 METHODOLOGY

The present study is characterized as a mixed approach research (quantitative and qualitative), with exploratory and descriptive objectives. The methodology adopted is structured in four stages:

3.1 BIBLIOGRAPHIC AND DOCUMENTARY RESEARCH:

A bibliographic, jurisprudential, documentary and legislative survey on basic sanitation was carried out. Thus, it based the legal analysis of the right to water on current legislation and doctrine.

3.2 DATA COLLECTION (SNIS):

Data were extracted from the National Sanitation Information System (SNIS). The analysis was based on indicators of coverage of water supply in the state of Pará, so that a direct comparison with the municipality of Paragominas was established.

3.3 FIELD RESEARCH:

Data collection took place in January 2026, through a satisfaction survey on the water supply at Praça Célio Miranda, downtown Paragominas-PA. The research instrument was applied in accordance with the ethical precepts of research with human beings; The anonymity of the participants was fully preserved, and participation occurred on a voluntary basis.

A structured questionnaire consisting of nine questions was applied, as shown in Table 1, focusing on the perception of quality, regularity and satisfaction with the services provided by the Paragominas Sanitation Agency (SANEPAR).

The sample was composed of 40 (forty) participants who passed through the place, and the approach was based on accessibility criteria, due to the large flow of citizens from different neighborhoods.

Initially, the application of the instrument to a universe of approximately 100 respondents was estimated. However, due to operational limitations, the final sample consisted of 40 participants. The sample allowed the analysis to be carried out in a consistent manner, providing the necessary support regarding the users' perception of the service provided.

Table 1

Satisfaction questionnaire of the Paragominas Sanitation Agency

What age, gender and place of residence?
What was the water supply like before the creation of SANEPAR?
How do you currently perceive the water supply by SANEPAR?
Is there an interruption in supply? If so, how often?
What is your opinion about water quality?
Do you feel any unpleasant taste or odor?
Do you trust the use of water for food production?
Do you trust the use of water for human consumption?
Do you identify the presence of color in the water?

Source: Authors.

3.4 ANALYSIS OF THE DATA OBTAINED:

The collected data will be analyzed in two descriptive stages, through the direct counting of the number of responses in each response category and the conversion of this value into a percentage so that it allows the proportional comparison between the different items of the questionnaire.

These data were treated manually, following the rule of three, where the total number of interviewees (N=40) corresponds to 100%; identification and "n" as the number of people who chose the option.

In addition, two indicators were developed with the objective of systematizing the perception of users regarding water supply services and the proportion of confidence for direct consumption.

4 SANEPAR SATISFACTION QUESTIONNAIRE

During the study, a field research was carried out to understand the population's perception of population satisfaction with the municipality responsible for the supply and sanitation of the municipality, as shown in Table 2.

The collection took place in a public space with a large circulation of people so that data could be collected so that we could get the largest possible number of perceptions.

Table 2

Satisfaction questionnaire of the Paragominas Sanitation Agency

Number	Question	Response Category	Number of responses
1	What is the Age, Gender and Neighborhood of Residence?	18 to 29 years old 30 to 44 years old 45 to 59 years old 60 years or older Gender: Female; male; another; I prefer not to inform	40

2	What was the water supply like before the creation of SANEPAR?	Terrible Using wells in an alternative way He did not know how to inform	40
3	How do you currently perceive the water supply by SANEPAR?	Very Satisfied Good Bad	40
4	Is there an interruption in supply? If so, how often?	Frequent interruption Eventual interruption There is no interruption	40
5	What is your opinion about water quality?	Very Satisfied Good Bad	40
6	Do you feel any unpleasant taste or odor?	Yes No	40
7	Is the water supplied suitable for food production?	Yes No	40
8	Do you consider the water supplied fit for human consumption?	Yes No	40
9	Do you identify the presence of color in the water?	Yes No	40

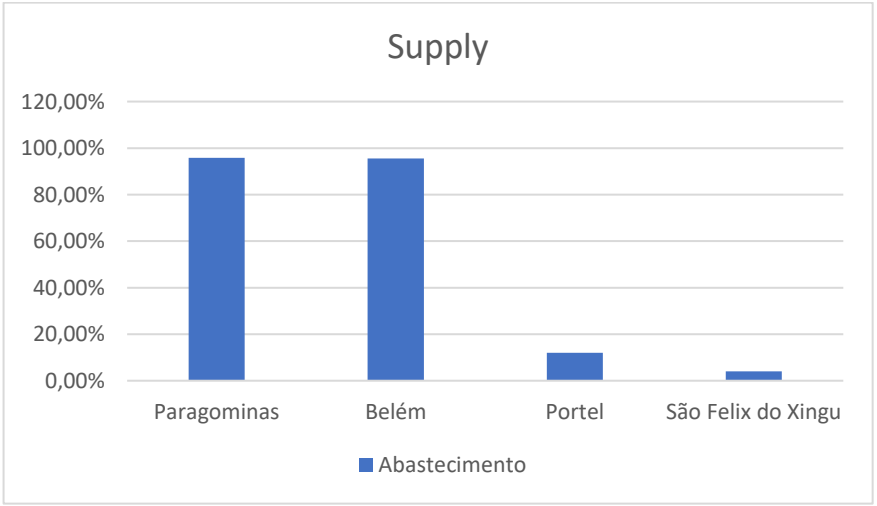
Source: Authors.

5 ANALYSIS OF RESULTS AND DISCUSSIONS:

Graph 1 shows the comparison between the water supply service indexes between the North Region, the state of Pará and selected municipalities. It is observed that the city of Paragominas has a high coverage rate (95.75%), above the state average of 55.4% and the regional average of 64.2%, approaching the indicators of the state capital.

Figure 2

Comparison of access to water supply in the North Region, Pará and selected municipalities.



Source: SNIS (2023), prepared by the authors (2026).

The contrast with the other municipalities located in the interior such as Portel (12.07%) and São Felix do Xingu (4%) have low levels of coverage, which demonstrates the inequalities of access within the state of Pará itself.

The following equation was used to analyze the questionnaire data:

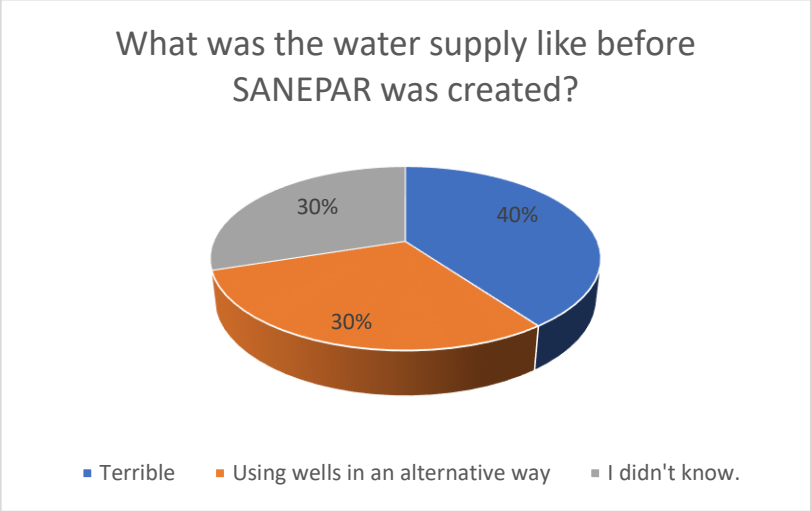
$$P = \frac{n \times 100}{N} \quad (1)$$

Where **P** stands for the percentage; **n** the response group in a response category; **N** total number of respondents.

Among the individuals who answered the questionnaire, 4 (four) were between the ages of 18-29 years; 20 (twenty) between the ages of 30-44 years; and 16 (sixteen) between the ages of 45-59 years.

Figure 3

Users' perception of water supply before the implementation of SANEPAR in Paragominas-PA

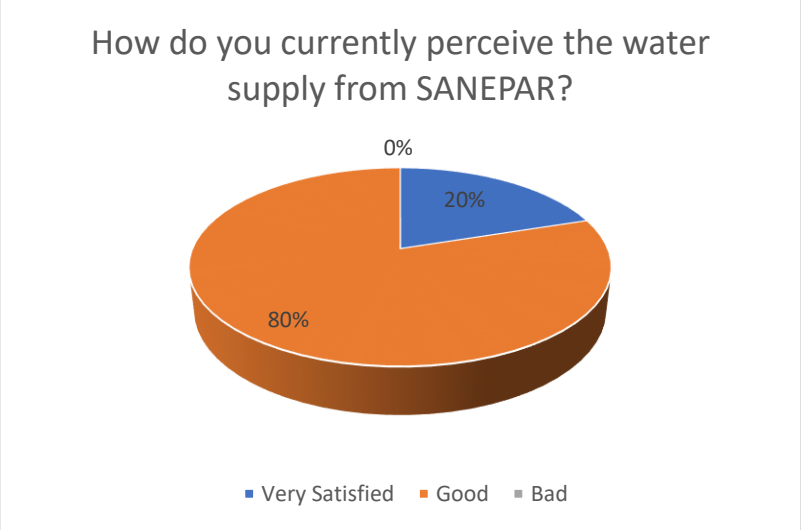


Source: Prepared by the authors, 2026.

Before the implementation of SANEPAR, 40% of the respondents classified the supply as very poor, while 30% reported the use of alternative sources, such as wells, evidencing the precariousness of the previous system. And 30% did not know how to inform, as shown in Figure 3.

Figure 4

Users' perception of the water supply by SANEPAR in the municipality of Paragominas-PA

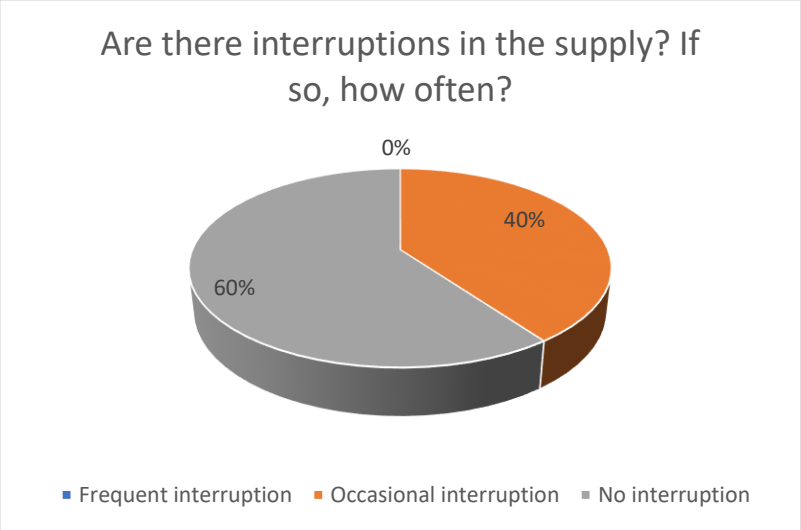


Source: Prepared by the authors, 2026.

Faced with the question about how the water supply is currently perceived by the current supplier SANEPAR, 80% of the participants evaluated the service as "good" and 20% classified the supply as "very satisfied", with no record of negative evaluations, as shown in Figure 4. These results indicate a significant improvement in the perception of the service.

Figure 5

Frequency of interruptions in the water supply in the municipality of Paragominas-PA



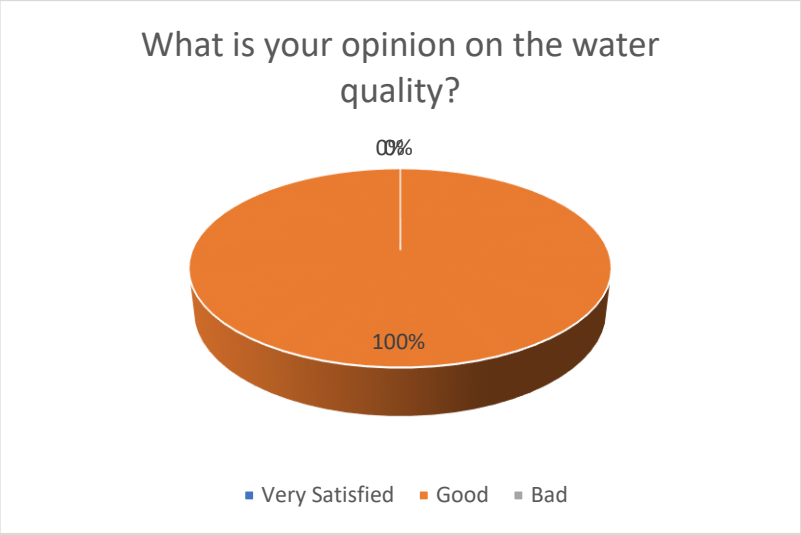
Source: Prepared by the authors, 2026.

In view of the questioning about the interruption in supply, evidenced in Figure 5, it reinforces the positive perception of users regarding the regularity of the service. However, when analyzed together with the Consumption Confidence Index (CCI), it is observed that the

continuity of supply does not necessarily translate into confidence for intake, evidencing the need for actions aimed at transparency and education about water quality.

Figure 6

Water quality



Source: Prepared by the authors, 2026.

Faced with the questioning about the quality of the water, many claimed that it was a good quality. As shown in Figure 6, however, some reported that in rainy periods they notice a certain bleaching in the water, which may be the use of chemicals to maintain the standard required by the Ministry of Health ordinance No. 888.

Figure 7

Taste and odor of water

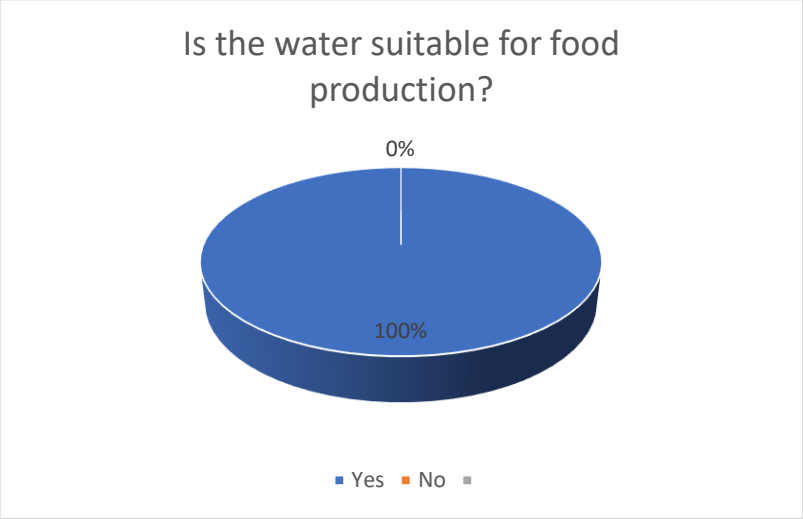
Source: Prepared by the authors, 2026.

The perception of the interviewees regarding the presence of unpleasant taste or odor in the water supplied by SANEPAR demonstrates a totally favorable result. As shown in Figure 7, 100% of the participants stated that they did not perceive any sensory alteration related to odor or taste.

This result reinforces the positive evaluation of users regarding water quality, especially with regard to organoleptic parameters, which are directly perceptible by the population. The absence of unpleasant odor and taste is a relevant indicator of service acceptance, since such characteristics directly influence the population's confidence and water consumption.

Figure 8

Population's perception of water quality

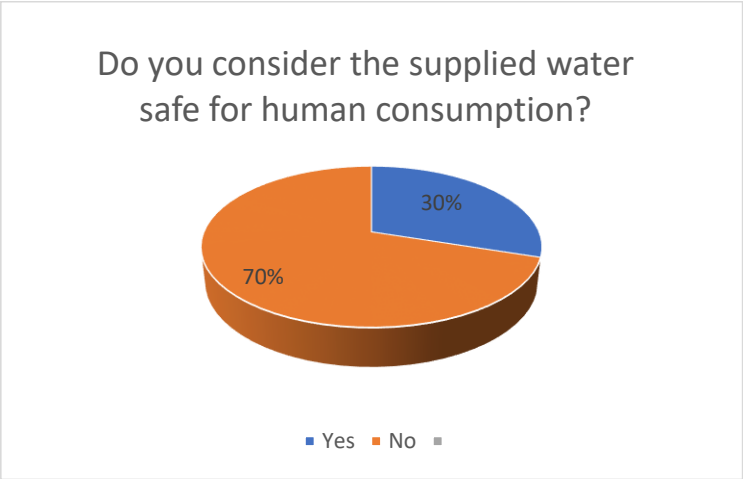


Source: Prepared by the authors, 2026.

When it comes to the confidence for the use of water in food production, all of them answered that they consider water suitable for this purpose. As shown in Figure 8, however, some, as we will see in the next graph (Figure 9), also consider it good enough for their own consumption.

Figure 9

Perception of the potability of water for human consumption

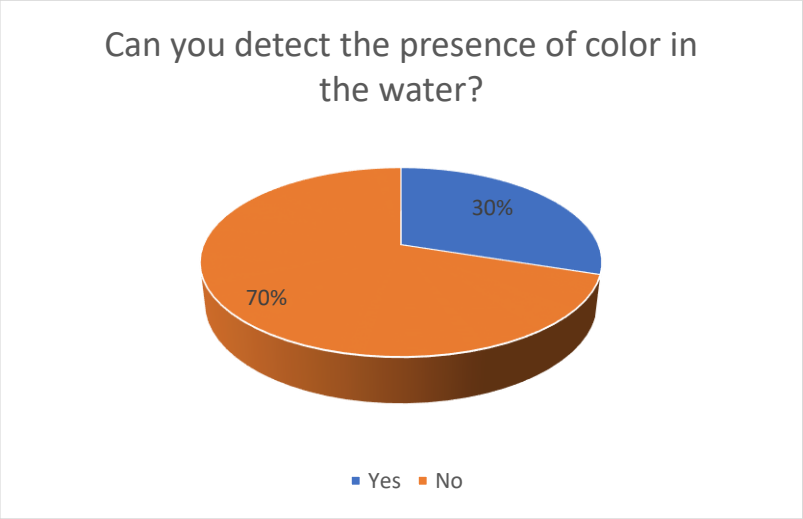


Source: Prepared by the authors, 2026.

Regarding those questioned about the adequacy of the water supplied for human consumption, 70% of the interviewees stated that they did not trust its use for direct ingestion, while 30% stated that they trusted the use of water for this purpose.

Figure 10

Population's perception of the presence of color in the water



Source: Prepared by the authors, 2026.

70% answered that they did not identify the presence of color in water, but 30% stated that they identified a whiter color at some times of the year, even compared to fruit salt, as shown in Figure 10.

The data collected are important and present a positive way in relation to the perception of water supply, especially when compared to other municipalities in the state.

It is possible to observe a predominantly positive perception on the part of the participants in relation to the quality and distribution of water in the municipality of Paragominas-PA.

Most respondents showed satisfaction with the services provided, showing that the supply has been meeting the basic needs of the population. The data show a good starting point for the perception of users of the services provided by SANEPAR.

Expanding the application of this questionnaire is essential so that it enables data collection on a larger scale, increasing the representativeness of users' perceptions. Even so, the present study constitutes an important starting point, being an initial model the current model of water supply by SANEPAR for the improvement in the quality of water distribution in the state of Pará.

With the data obtained, the Supply Satisfaction Index (ISA) was elaborated. Its objective is to measure the general level of satisfaction of users in relation to the service provided, considering the positive responses of good and satisfied. The ISA result will vary between 0 and 1, in which values closer to 1 indicate a higher level of user satisfaction.

Formula:

$$ISA = \frac{(\%\ positive\ responses)}{100} \qquad (2)$$

From the participants' answers, 80% were considered good and 20% were very satisfied. Applying it to the formula, we will have the ISA of 1.00. This result indicates a high level of satisfaction of users of the services provided by the current supplier in the water supply.

The second indicator developed refers to the Consumer Confidence Index (CCI). Here it is possible to see that 30% of the answers say they trust the use for consumption of the water supplied and the others do not trust for such use.

Formula:

$$ICC = \frac{(\%\ \text{who trust in consumption})}{100} \qquad (3)$$

The CCI in this case had the result at 0.3 where it is visible that the population's confidence in self-consumption is still low, when compared to the portion that does not trust the use for ingestion.

In a joint analysis of the indicators elaborated: Supply Satisfaction Index (ISA) and Consumption Confidence Index (CCI), it is evident that the ISA presented the maximum (1.0),

being a high level of satisfaction. This results in aspects of regularity in the provision of services and attendance to basic demands.

The CCI, which presented a value of (0.3), shows the low level of confidence of the population in the direct consumption of water. It is evident that there is a contradiction between satisfaction with the service provided and the perception of the quality of the water for ingestion.

The explanation may be based on sensory perceptions such as the change in color at certain times and lack of information about the treatment process of the water itself. Thus, they are indicators that demonstrate the evaluation of efficiency in the provision of the service, but fragility in terms of safety in consumption.

6 CONCLUSION

Water must be treated as a scarce resource, it is possible to see that even today many think that it is an infinite resource.

A very important step towards good management is an Integrated Water Resources Management that provides a framework in which governments can align water use patterns and the needs and demands of different users, as well as their priorities.

This scenario, despite efforts in Brazil by Law No. 9,433/1997 (Water Law), is still occurring in an incipient way to materialize, given the difficulty in collecting and systematizing data, as well as the lack of interest and priority given to the theme by political managers.

It is interesting to observe the approval of the respondents in front of the service provider company in the municipality of Paragominas-PA, which is a different metric in contrast to the other municipalities in the state of Pará that do not obtain an adequate supply and a considerable population failure. It would be a model to follow, or at least, an initial model for changes, because although the municipality stands out, there is still a lack of improvements that serve the population as it deserves.

These results suggest that the perception of quality and supply is linked to the regularity of supply and reliability of the service. Even if initially, the regulations pertaining to drinking water and other regulations have been in line with the regulations. In addition, any discrepancies in the answers indicate that in the future, it will be necessary to deepen future studies, with expansion on a larger scale, in order to obtain a more comprehensive and representative analysis of the population's perception.

Although the indicators point to a positive initial scenario for the provision of the service, it is also evident the need for actions aimed at strengthening the population's confidence, through transparency, environmental education and dissemination about water quality.

The results show that satisfaction with the service does not necessarily imply the confidence of this water for consumption, and it is important to integrate operational management and transparent public communication.

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