RURAL WATER SUPPLY IN THE CONTEXT OF SDG 6: GOVERNANCE AND RESILIENCE

ABASTECIMENTO RURAL DE ÁGUA NO CONTEXTO DO ODS 6: GOVERNANÇA E RESILIÊNCIA

ABASTECIMIENTO DE AGUA RURAL EN EL CONTEXTO DEL ODS 6: GOBERNANZA Y RESILIÊNCIA

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Anderson da Silva Rodrigues[1] Junior, Camily Martins[2], Anna Virginia de Muniz Machado[3]

ABSTRACT

This study discusses the challenges for the sustainability of rural water supply systems in light of the SDG 6 targets. Recent reports from the World Health Organization and UNICEF show that the rural population continues to be the most affected by the lack of adequate access. The research was developed using a qualitative approach, based on a literature review and documentary analysis of national and international studies, aiming to understand the main factors that influence the continuity of these systems over time. As an illustrative study, the multi-community management model implemented in Ceará thru the Integrated Rural Sanitation System (SISAR) is cited, whose structure combines community participation and permanent technical support. It is concluded that models that combine decentralization and structured institutional support have greater potential to ensure equitable and lasting access to safe water in rural areas.

Keywords: Rural Supply. Sustainability. Water Governance. Inequalities. SDG 6.

RESUMO

Este estudo discute os desafios para a sustentabilidade dos sistemas rurais de abastecimento de água diante das metas do ODS 6. Relatórios recentes da Organização Mundial da Saúde e do UNICEF mostram que a população rural continua sendo a mais afetada pela falta de acesso adequado. A pesquisa foi desenvolvida a partir de abordagem qualitativa, com base em revisão bibliográfica e análise documental de estudos nacionais e internacionais, buscando compreender os principais fatores que influenciam a continuidade desses sistemas ao longo do tempo. Como estudo ilustrativo, é citado o modelo de gestão multicomunitário implementado no Ceará por meio do Sistema Integrado de Saneamento Rural (SISAR), cuja estrutura combina participação comunitária e suporte técnico

[1] Graduated in Electrical Engineering. Universidade Federal Fluminense (UFF). E-mail: andersonj@id.uff.br Orcid: 0009-0009-0601-607
[2] Undergraduate Student in Petroleum Engineering. Universidade Federal Fluminense (UFF). E-mail: camily_martins@id.uff.br Orcid: 0009-0000-5804-778
[3] Dr. in Civil Engineering. Universidade Federal Fluminense (UFF). E-mail: annavirginia@id.uff.br Orcid: 0000-0001-5793-8591

permanente. Conclui-se que modelos que conciliam descentralização e apoio institucional estruturado apresentam maior potencial para assegurar acesso equitativo e duradouro à água segura em áreas rurais.

Palavra-chave: Abastecimento Rural. Sustentabilidade. Governança da Água. Desigualdades. ODS 6.

RESUMEN
Este estudio analiza los desafíos para la sostenibilidad de los sistemas rurales de abastecimiento de agua a la luz de los objetivos del ODS 6. Informes recientes de la Organización Mundial de la Salud y UNICEF muestran que la población rural sigue siendo la más afectada por la falta de acceso adecuado. La investigación se desarrolló con un enfoque cualitativo, basado en una revisión bibliográfica y un análisis documental de estudios nacionales e internacionales, buscando comprender los principales factores que influyen en la continuidad de estos sistemas a lo largo del tiempo. Como estudio ilustrativo, se cita el modelo de gestión multicomunitaria implementado en Ceará a través del Sistema Integrado de Saneamiento Rural (SISAR), cuya estructura combina la participación comunitaria y el apoyo técnico permanente. Se concluye que los modelos que concilian la descentralización y el apoyo institucional estructurado tienen mayor potencial para garantizar un acceso equitativo y duradero al agua potable en las zonas rurales.

Palabras clave: Abastecimiento Rural De Agua. Sostenibilidad. Gobernanza del Agua. Desigualdades. ODS 6.

1 INTRODUCTION

According to the report *Progress on household drinking water, sanitation and hygiene 2000 –2024: special focus on inequalities*, published by the World Health Organization and UNICEF (2025), 2.1 billion people in the world, approximately 1 in 4 still live without access to safely managed water supply. Recent data released by UN-Water, in the SDG 6 Progress Reports, indicate that, despite the efforts made, global progress remains insufficient to meet the eight goals established. Achieving universal access to safe water would require accelerating the current pace of progress eightfold. (UNICEF, 2025)

According to the definition adopted by the World Health Organization and UNICEF, safe water is considered to be water from an improved source, accessible at the facilities, available when necessary and free of fecal contamination and priority chemical substances. Inequalities persist markedly, reflected in subnational disparities between rural and urban areas, rich and poor populations, and different ethnic groups (UN; UNICEF, 2025).

Inequalities in access to safe water also have a strong gender dimension. UN Women highlights that, in contexts of water scarcity, women and girls are disproportionately responsible for water collection, which directly impacts their educational and economic participation. Water insecurity, therefore, reproduces structural inequalities, reinforcing the need to incorporate gender perspectives in the formulation and implementation of public policies for rural sanitation. (Un Water, 2023)

Faced with the need for acceleration to ensure the availability and sustainable management of water and sanitation for all, the United Nations General Assembly, through Resolution A/79/L.101 (2025), established six themes for the interactive dialogues of the 2026 UN Water Conference: (a) Water for people; (b) Water for prosperity; (c) Water for the planet; (d) Water for cooperation; (e) Water in multilateral processes; and (f) Investment in water. These axes highlight the need to address cross-cutting dimensions, such as the human right to water, climate change, and financing mechanisms. (United Nations General Assembly, 2025).

The challenge becomes even more significant in rural areas, where approximately 1.366 billion people remain without access to safely managed water, compared to 778 million in urban areas. Geographic dispersion and distance from urban centers make it difficult for medium and large utilities to operate and maintain systems, especially in low- and middle-income countries. (Forni et al. 2021)

In Brazil, water supply initiatives in rural communities have been implemented since the 1980s, with support from the National Rural Sanitation Project. Over the years, systems with collection, treatment and distribution networks were implemented, whose operation

began to be carried out by community associations, after training carried out by state concessionaires. This model of community management has also been adopted in several countries as a strategy for decentralizing the provision of services.

National and international studies on rural supply have identified critical factors for the sustainability of these systems, highlighting: (i) existence of a consistent legal and institutional framework; (ii) articulated national, state and municipal planning; (iii) adequate investments; (iv) definition of tariffs compatible with the users' ability to pay; (v) guarantee of water quality in accordance with current legislation; and (vi) presence of local providers responsible for the day-to-day operation. (Machado et al., 2019)

Recent literature reviews indicate that the most recurrent factors associated with the success or failure of community systems are related to technical, financial and management capacity. Often, communities receive the initial infrastructure without continued support for technical training or corrective and preventive maintenance. In addition, projects often do not adequately consider climatic conditions, territorial specificities or local operational capacity, which compromises the efficiency and longevity of the systems. (BARRETO; VITAL, 2024)

Climate vulnerability is an additional risk factor. The Intergovernmental Panel on Climate Change warns that vulnerable regions will face greater variability in water availability in the coming decades. The intensification of prolonged droughts compromises the sustainability of systems, requiring adaptive planning and institutional strengthening to promote water resilience. (IPCC, 2022)

Climate vulnerability is another critical factor. Drought events directly affect water availability, leading communities to turn to alternative, often unsafe sources, with implications for public health. Tariff inadequacy and the absence of structured financial support aggravate the situation, making services susceptible to failures and interruptions over time. In this context, although it is essential to consider regional particularities, it is pertinent to build strategic plans that serve as a guiding structure for the sustainability of rural systems. (Machado et al, 2022)

In Brazil, a promising strategy has been the multi-community operating model, initiated in the state of Bahia through the so-called Centrals, with more than three decades of operation. Subsequently, in 1996, the Integrated Rural Sanitation System (SISAR) was implemented in the state of Ceará, with the objective of supporting the maintenance of the systems implemented by the Water and Sewage Company of the State of Ceará in rural communities (BARRETO; VITAL, 2024)

Currently, the model in Ceará covers the entire state territory, with eight regional units serving thousands of rural locations. Membership occurs through an agreement with

community associations, which participate in institutional governance through the election of directors and councils. The model operates as a federation of associations, offering technical, administrative and social assistance, as well as continuous training.

The experience of SISAR has been the subject of academic studies aimed at understanding its institutional arrangements, information flows and support mechanisms for affiliated communities, contributing to the debate on sustainable models of rural supply. The deepening of knowledge in this field also benefits from participation in international networks, such as Sanitation and Water for All, which promote the exchange of experiences and strengthen the articulation between teaching, research and extension.

Despite the advances identified, relevant gaps persist in the literature, especially with regard to the performance assessment of multi-community models, long-term financial sustainability, and the integration between climate policies and rural sanitation. The consolidation of empirical evidence on these aspects is essential to guide public policies capable of accelerating the achievement of SDG 6, without leaving rural populations behind.

2 METHODOLOGY

This chapter was developed from a qualitative approach, based on literature review and documentary analysis. Initially, a survey of the national and international scientific literature on the sustainability of rural water supply systems was carried out, focusing on the institutional, technical and financial factors that influence their permanence over time.

Academic articles and technical reports produced by international organizations, such as the World Health Organization, UNICEF, and the Intergovernmental Panel on Climate Change, were considered in order to contextualize the global debate on water governance, equity, and resilience.

In addition, the multi-community operation model implemented in the state of Ceará was analyzed, with emphasis on the Integrated Rural Sanitation System. The analysis was based on institutional documents, available public data and academic production on the subject. The articulation between the international debate and the Brazilian experience allowed us to examine convergences, limitations and possibilities for improving rural management models.

3 DISCUSSION

The international literature shows that the sustainability of community rural water supply systems faces recurrent challenges in different geographical contexts. Studies conducted in countries in Africa, Asia and Latin America indicate that maintenance problems

and weaknesses in infrastructure are determining factors for the failure of several systems. Frequent equipment failures, absence of preventive maintenance, shortage of spare parts, and long periods of downtime compromise the reliability of services and reduce their longevity. These elements indicate that the delivery of infrastructure, unaccompanied by continuous technical support, tends to generate cycles of progressive deterioration.

In the field of financial management, the literature points to structural difficulties related to the collection of tariffs, transparency in the use of resources and the instability of community contributions. The limitation of own revenues and dependence on external financing increase the vulnerability of systems, especially when there are no formal mechanisms for financial control and planning. Economic sustainability, therefore, proves to be a central component of long-term viability.

Local technical capacity also emerges as a critical factor. Several studies show that the lack of trained professionals and the absence of permanent technical assistance make it difficult to properly operate the systems and solve failures. In many cases, the technologies deployed are not compatible with the level of qualification available in the communities, which compromises the appropriation and continuity of the service.

With regard to community management, the literature shows that formal participation does not necessarily translate into effective engagement. Inoperative committees, low decision-making transparency, exclusion of women and vulnerable groups, and internal conflicts reduce social capital and weaken local governance. Active participation, through frequent assemblies, transparent deliberative processes, and participatory monitoring mechanisms, is associated with a greater sense of belonging and collective responsibility, factors that contribute to fundraising and infrastructure conservation.

Socio-cultural and economic aspects also influence the performance of the systems. Language barriers, socioeconomic inequalities, and a preference for individual solutions can limit community buy-in. The social exclusion of women and the underrepresentation of certain groups reduce equity and compromise the effectiveness of the model. UN Women reports reinforce that the inclusion of women in decision-making processes tends to strengthen sustainability and expand the social benefits of supply.

In addition, political and institutional factors play a relevant role. The absence of specific legislation, political interference and low public investment weaken community arrangements, especially when there is excessive dependence on municipal administrations for corrective maintenance.

The intensification of extreme weather events adds an additional layer of complexity. As highlighted by the Intergovernmental Panel on Climate Change, vulnerable regions tend

to face greater water variability, which requires adaptive strategies, diversification of sources, and integrated planning between sanitation and climate adaptation policies.

On the other hand, the literature also shows positive factors associated with the success of community systems. Strengthening the sense of collective ownership, cooperation, solidarity, and shared learning contribute to greater institutional resilience. Processes of co-production of solutions, participatory monitoring and valorization of local knowledge tend to expand community appropriation and the durability of structures.

In this scenario, the multi-community model implemented in Ceará, through the Integrated Rural Sanitation System, presents elements that dialogue with international recommendations by combining social participation with structured technical support, continuous training and federative organization of associations. Such an arrangement suggests that overcoming the weaknesses observed in exclusively community models can be associated with the construction of institutional support networks that preserve local protagonism, but guarantee technical, administrative and financial support.

4 CONCLUSION

Progress towards universal access to safe water, as recommended by SDG 6, requires addressing the inequalities that persist more intensely in rural areas. The analysis developed in this chapter shows that the sustainability of community systems is conditioned to the articulation between institutional governance, financial viability, technical training and adaptation to climate change.

The Brazilian experience of multi-community operation demonstrates that hybrid models can offer a promising alternative to balance decentralization and permanent technical support. However, challenges remain related to systematic performance evaluation, long-term financial sustainability, and the integration between sanitation and climate adaptation policies.

Thus, the consolidation of sustainable rural systems requires not only investments in infrastructure, but also institutional strengthening and continuous production of applied knowledge, capable of guiding public policies that ensure the human right to water in a universal, equitable, and resilient manner.

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