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Local Perception Regarding the Prospect of Water Reuse in Southern Santa Catarina

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Highlights:

- SWOT analysis applied to water reuse
- Case study on non-potable water reuse
- Local perception regarding the prospect of water reuse
- Opportunities and threats to water reuse

Keywords: Water Scarcity; Regional Planning; Reclaimed Water.

INTRODUCTION

In different continents and countries, water scarcity events resulting from droughts have been observed with increasing frequency and intensity, bringing harmful consequences and impacts to the economy, society, and the environment, as well as posing risks to public health. In this context, water reuse from treated effluent stations represents an important practice not only to mitigate the consequences and impacts of water scarcity but also for the preservation of water resources and regional environmental sustainability.

For the successful implementation of water reuse at a regional level, a fundamental step is the development of a plan based on the knowledge of local potentialities and strengths, considering the characteristics and specificities of each region, and the involvement of stakeholders identified as interested parties. Among the methodologies and tools used for scenario evaluation in the strategic planning process, also applied to water reuse, is the SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). Studies by Pérez & Berbel (2020), Mainali et al. (2021), Nourbakhsh et al. (2022), and Canaj & Mehmeti (2024) used SWOT analyses to evaluate scenarios and potentialities for water reuse in different regions in the United States, Europe, and Iran.

In this context, this study used SWOT analysis to assess the local perception of the southern region of the State of Santa Catarina, Brazil, covered by Hydrographic Region 10 (HR10/SC), regarding the prospect of water reuse. HR10/SC has a total area of approximately 4,992 km², encompassing the total or partial area of 29 municipalities and a population of 677,030 habitants. According to the Santa Catarina State Water Resources Plan (PERH/SC, 2017), in terms of qualitative and quantitative water balance, HR10/SC presents the highest level of criticality, with its situation classified as "unsustainable."

METHODOLOGY

To assess HR10/SC's perception of the prospect of water reuse, a SWOT analysis was conducted through the application of a semi-structured electronic questionnaire to a set of local stakeholders. The questionnaire was developed with aspects considered as "Strengths," "Weaknesses," "Opportunities,"

and "Threats" based on studies conducted in other countries that evaluated water reuse at a regional level. In the SWOT analysis, an internal environment evaluation was conducted to identify aspects considered as strengths and weaknesses, and an external environment evaluation was carried out to identify opportunities and threats. A combination matrix was developed, correlating the information and defining critical points that would require specific initiatives and actions to enhance the success of the planning process (LOZANO & VALLES, 2007). Scores were assigned to each aspect on a relevance scale from 1 point (aspect of no relevance) to 5 points (highly relevant aspect). Aspects considered to have little relevance were disregarded for the final consolidation of the SWOT analysis for HR10/SC.

RESULTS

For the application of the electronic questionnaire, 16 governmental and non-governmental institutions were identified as stakeholders with potential involvement in water reuse in the region. These included Regulatory Agencies, Sanitation Service Providers, Municipal Governments, State Government Agencies, Environmental Agencies, and Industry. After administering the questionnaires to the stakeholders, the average scores assigned to the aspects evaluated in each factor of the SWOT analysis were calculated. In general, all factors scored above 3, indicating that the evaluated aspects were relevant to the reality of HR10/SC. The “Opportunities” factor received the highest score with 4.06, while the “Weaknesses” factor had the lowest score with 3.73 (Table 1).

Table 1 - Results of the SWOT analysis.

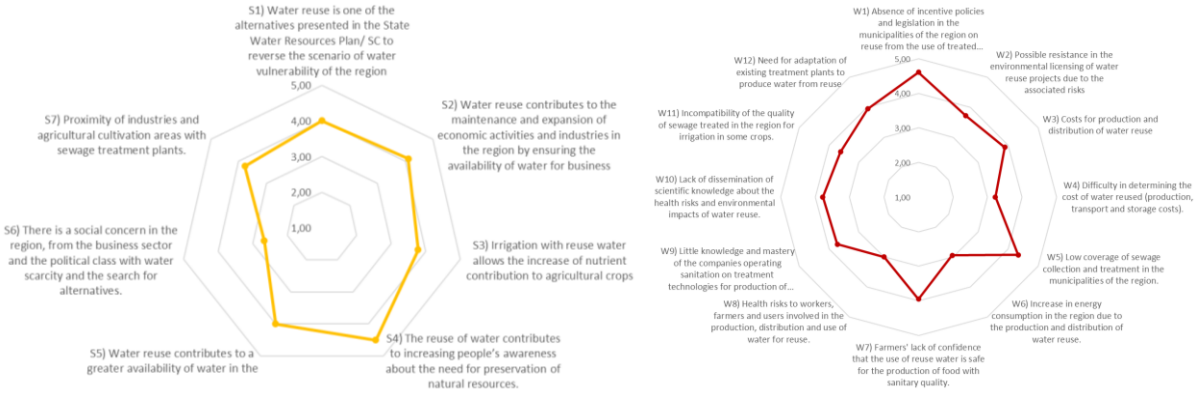
Results of the SWOT Analysis	Brazil (Santa Catarina)	Italy (Apulia)	Belgium (Limburg)	Bulgaria (Plovdiv)	Germany (Braunschweig)	Greece (Thesaloniki)	Portugal (Alentejo)	France (Occitan)	Spain (Andalusia)	Iran (Sabzevar))
Strengths	3,83	4,21	3,75	2,73	3,58	3,48	4,25	2,92	3,90	2,70
Weaknesses	3,73	2,8	4,19	3,16	3,03	3,23	3,86	2,29	3,80	2,60
Opportunities	4,06	4,2	4,04	3,14	3,57	3,14	3,55	2,44	3,90	3,00
Threats	3,76	3,21	4,02	3,13	3,21	3,28	3,94	2,44	3,80	2,50

Source: Elaborated by the author.

Among the "Strengths," the aspect S6 "There is social, business, and political concern in the region regarding water scarcity and the search for alternatives" was evaluated as having little relevance, while aspects S2 and S4 were considered highly relevant for contributing to environmental awareness and the continuity of the region's economic activities. Public awareness about water scarcity, the potential for water reuse, and the associated social, environmental, and economic benefits were also identified as strengths in the SWOT analysis conducted by Mainali et al. (2011) and Canaj & Mehmeti (2024) in studies carried out in Australia and Italy.

Regarding the “Weaknesses,” the aspect W8 "Health risks to workers, farmers, and users involved in the production, distribution, and use of reclaimed water" was evaluated as having little relevance, while aspect W1, which refers to the importance of adopting water reuse in an appropriate legal and regulatory framework, was considered highly relevant. Nazari et al. (2018), in a study involving SWOT analysis for evaluating water reuse in Iran, also observed similar results. According to these authors, the absence of institutions focused on sector management, as well as insufficient regulation and oversight, were considered significant weaknesses in the context of water reuse. The results presented by Pérez & Berbel (2020) in their use of SWOT analysis to assess the perception of agricultural reuse in eight countries of the European Union also identified perceived high costs of reclaimed water for farmers,

consumer health risk perceptions regarding irrigated crops, and the need for implementing a comprehensive regulatory framework as weaknesses (Figure 1).



(a) (b)

Figure 1 - Strengths (a) and Weaknesses (b) of water reuse in HR10/SC.

All aspects evaluated as "Opportunities" for HR10/SC were deemed relevant, with aspect O9, which refers to the need for a higher level of wastewater treatment at the wastewater treatment plants (WWTPs) for the provision of reclaimed water, being considered highly relevant. Winker et al. (2020) identified the quality of treated effluent at WWTPs and environmental protection as opportunities in a SWOT analysis conducted in a pilot study on reclaimed water application in Germany. Concerns over water scarcity and the lower cost of reclaimed water compared to potable water were identified as opportunities in the study conducted by Canaj & Mehmeti (2024), which used SWOT analysis to evaluate opportunities and barriers for wastewater reuse for agricultural purposes in the Apulia region of southern Italy.

Among the "Threats" to water reuse, only the aspect T12 "Impact on soil productivity and yield of crops irrigated with reclaimed water" was evaluated as having little relevance. Aspects T2, T3, and T6 were considered highly relevant and are related to the region's challenges in advancing the implementation of sewage systems. Mainali et al. (2011), Nourbakhsh et al. (2022), and Pérez & Berbel (2020) used SWOT analysis to help identify critical aspects for the successful implementation of water reuse in different countries and found that public distrust regarding water quality and health concerns were significant threats, creating an environment of mistrust and resistance to using reclaimed water.

CONCLUSIONS

The results of this study were similar to those obtained by Pérez & Berbel (2020), Mainali et al. (2011), Nourbakhsh et al. (2022), and Canaj & Mehmeti (2024), highlighting that even in developed countries, the perception of local stakeholders regarding water reuse was similar to the perception obtained in Brazil, a developing country with significant sanitation infrastructure deficiencies. The involvement of local stakeholders and the use of appropriate concepts, tools, and methods, as employed in this study, were essential for a better understanding of HR10/SC's reality regarding the prospect of water reuse.

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