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Sustainability in Sanitation: A Comparative Analysis of Cities in Brazil and Canada

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Abstract

This paper presents a comparative analysis of sanitation practices in Brazil and Canada, focusing on the challenges faced and efforts made to improve sanitation facilities and universal access to clean water and hygienic treatment. The study utilizes a qualitative research design, incorporating a systematic document review methodology to examine peer-reviewed articles, governmental reports, policy documents, and official statistics from both countries. The analysis reveals the specific challenges encountered in Brazil, particularly in rural areas and marginalized communities, as well as the initiatives taken by the government to enhance sanitation. Similarly, the study explores Canada's commitment to sustainable development, including the obstacles encountered in ensuring access to clean water and sanitation, with a special emphasis on indigenous communities. Thematic analysis is employed to identify commonalities and differences between the two nations, leading to valuable insights and conclusions. While the study acknowledges limitations such as the broad scope of the topic and the absence of primary data collection, it contributes to the existing literature on sanitation issues and underscores the importance of a multi-sectoral approach in addressing water and sanitation challenges.

Key words: Sanitation scenario; Company of Water and Sewage; Comparative examination; Sustainable Development Goals; Sustainability in sanitation

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INTRODUCTION AND METHODOLOGY

This study aimed to undertake a comparative examination of sanitation in cities across Brazil and Canada, concentrating on the respective challenges and endeavors to enhance sanitation facilities and universal access to clean water and hygienic treatment. Our research design is simplified yet qualitative, intended to elucidate the complexities of sanitation scenarios in these two countries, their progressive actions, and persisting hurdles.

The authors used a systematic document review methodology to conduct this comparative analysis. This methodology entailed selecting and evaluating sources such as peer-reviewed research articles, governmental reports, policy documents, and official statistics from both countries. These data were obtained from reliable databases and government websites to ensure the credibility of the information.

In the case of Brazil, the focus was on understanding the challenges faced by this developing nation, especially in rural areas and marginalized communities. The government's initiatives towards improving sanitation and the problems faced during their execution were analyzed. Key references included research articles such as Resende, Ferreira, and Fernandes (2018) and Rodrigues et al (2022).

In the case of Canada, the government's commitment towards sustainable development was analyzed, including the steps towards improving access to clean water and sanitation, and the country's particular struggles with indigenous communities. We refer to documents like the Government of Canada's reports (2022), Cheng et al (2021), and Sarkar, Hanrahan, and Hudson (2015).

Following data collection, we performed a thematic analysis to identify commonalities and differences in the sanitation challenges, government initiatives, and progress of both nations. The findings were synthesized and comparatively analyzed to draw conclusions and insights.

We acknowledge that there are limitations in our study, including the possibility of overlooked nuances due to the broad scope of the topic. We also recognize that this study does not involve primary data collection or direct stakeholder engagement, which could enrich the analysis and is a suggestion to future researchers.

This study provides valuable insights into sanitation issues and efforts in Brazil and Canada, potentially informing future research and policy-making. Also filling a gap in the literature regarding the topic. It also underscores the importance of a multi-sectoral approach in tackling the challenges of access to water and sanitation, a lesson both nations can learn from each other's experiences.

SUSTAINABILITY, SANITATION, AND THE SUSTAINABLE DEVELOPMENT GOALS

The concept of sustainability has its roots in the history of sanitation services. The earliest records of sanitation practices indicate that the primitive man was not particularly concerned with sanitation. They obtained water from the most convenient source and discarded their waste in the least laborious manner. Those living near streams solved the problem by moving to the bank, where they drew water from the upper part of the stream and returned the sewage to the water, potentially polluting it for their downstream neighbors. Communities living far from natural watercourses soon learned the value of wells as a source of water supply. Many mentions of wells are made in the Book of Genesis, and it is stated by Blackstone that during that period (Lofrano; Brown, 2010; Porter, 2020).

The evolution of sanitation practices over time has been largely driven by advancements in science and access to necessary technologies. The modern concept of sanitation is intrinsically linked to sustainability and the Sustainable Development Goals 6 and 11. This relationship between development, fundamental rights, and proposals for constitutional amendment is examined, addressing the current legislation on sanitation and trends in its constitutionalization.

The distribution of resources for sanitation in Brazil and Canada is highlighted, providing a comparison of the distribution system in both countries and the specific challenges they face. The present analysis delves deeper into selected municipalities in the State of Santa Catarina, Brazil, and the Province of Ontario, Canada, to provide a more detailed and contextualized look at the sanitation situation in these locations.

The history of sanitation is one that has not necessarily attracted the attention of historians and researchers for a long time. It seems to be a consensus that sanitary practices came late in human history with the evolution of science and access to the technologies necessary for the development of such possibilities (Lofrano; Brown, 2010; Porter, 2020).

The history of sustainability in sanitation services is a testament to the evolution of human society and its increasing awareness of the importance of environmental, social, and economic sustainability. As we move forward, it is crucial to continue to innovate and adapt our sanitation practices to ensure their sustainability in the face of changing socio-economic and environmental contexts.

The concept of sustainability is deeply intertwined with the management of sanitation services, as it encompasses not only environmental considerations but also social and economic aspects. In the context of sanitation, sustainability implies the provision of services that are not only environmentally friendly but also socially inclusive and economically viable. This requires a shift in mindset towards a more holistic approach to managing economic and social processes, with a focus on technological innovation, rethinking our values and priorities, and establishing effective governance structures that allow for collective action in the interest of common well-being and environmental balance (Giovannini, 2018).

The importance of sustainability in sanitation is further highlighted by the Sustainable Development Goals (SDGs) set by the United Nations. In particular, SDG 6 aims to ensure access to water and sanitation for all by 2030. The attainment of this goal is crucial for both Brazil and Canada, as it directly impacts public health, environmental protection, and socio-economic development. However, the potential impact of austerity on the attainment of the SDGs in Brazil has been a subject of concern (De Souza; De Barros; Barreto et al., 2019).

In the quest for sustainable sanitation, the role of technology cannot be overstated. Technological innovation can significantly enhance the efficiency and

effectiveness of sanitation services, thereby contributing to their sustainability. Moreover, the global exchange of knowledge and ideas facilitated by globalization can be instrumental in promoting technological innovation in the sanitation sector. This is particularly relevant for countries like Brazil and Canada, which face unique sanitation challenges due to their distinct socio-economic and geographical contexts.

The concept of "sustainable" sanitation also encompasses the idea of circular economy, which involves the responsible management of solid waste post-consumption in times of planned obsolescence. This approach not only contributes to environmental sustainability but also has significant implications for public health, as improper waste management can lead to sanitation-related diseases.

The relevance of sanitation and sustainability is also manifested in the promotion of public health, improvement of quality of life, and ensuring access to basic services as essential human rights. In the context of Brazil, the current regulatory context suggests that the perpetuation of concessions in the sanitation sector could be an effective strategy to accelerate the expansion and modernization of networks for potable water supply, sewage treatment, urban cleaning, solid waste management, and drainage (Giovannini, 2018).

Lastly, the sustainability of sanitation services is closely linked to the issue of climate change. As the global climate crisis intensifies, it is becoming increasingly important to examine the impact of climate change on water resources and, consequently, sanitation services. This calls for the development of resilient sanitation systems that can adapt to changing climatic conditions, thereby ensuring their sustainability in the long run (Andersson; Dickin; Rosemarin, 2016).

SANITATION IN BRAZIL: HISTORY AND LEGAL BACKGROUND

The history of sanitation in Brazil is marked by a series of challenges and transformations. The relevance of sanitation and sustainability is manifested in the promotion of public health, improvement of quality of life, and ensuring access to basic services as essential human rights. The situation of Brazilian municipalities concerning the Sustainable Development Goals (SDGs) 6 and 11, which focus on clean water and sanitation and sustainable cities and communities respectively, has been a subject of analysis.

The evolution of basic sanitation in Brazil has been a topic of debate, particularly in the context of its privatization. The 2020 reform of the water and sanitation services sector in Brazil marked a significant shift in the country's approach to sanitation (Nunes, Anderaos, Marinho de Araujo, 2021). The reform aimed to improve access to sanitation services, particularly in rural and indigenous areas, which have historically faced significant challenges in this regard (Norberto, 2022).

The Brazilian Semi-Arid Region, in particular, has faced unique challenges in terms of rural sanitation. Public policies have been implemented to address these issues, but the region continues to struggle with access to basic sanitation services (Rodrigues et al., 2022). The financing of water and sanitation services has also been a significant challenge in Brazil, with different types of funds being used to address investment challenges in the sector (Queiroz, Nascimento, Oliveira, 2020).

The sanitation sector in Brazil has seen a shift towards the involvement of the private sector, particularly following the concession of the State Company of Water and Sewage (CEDAE) in Rio de Janeiro. This move has sparked debates about the effectiveness of private sector involvement in providing sanitation services and its implications for social effectiveness (Reis et al., 2023).

The rural sanitation context in Brazil has been a subject of study, with a focus on understanding the unique challenges faced by rural communities in accessing basic sanitation services. Efforts have been made to improve rural sanitation, but significant challenges remain, highlighting the need for continued investment and policy focus in this area (Resende, Ferreira, Fernandes, 2018).

Brazil, a developing country with a diverse population and vast geographical area, faces significant challenges in providing adequate sanitation services to its citizens. The lack of basic sanitation services in rural areas is a severe problem, leading to negative public health consequences. The absence of access to potable water and proper sewage and waste collection can increase the risk of diseases transmitted through contaminated water, potentially leading to severe complications or even death (Resende, Ferreira, Fernandes, 2018).

Moreover, the lack of sanitation can favor the proliferation of disease vectors such as mosquitoes. Another severe consequence of inadequate sanitation in rural areas is the environmental impact. The discharge of sewage and solid waste into rivers, lakes, and other water sources can contaminate these natural resources, compromising water quality and harming local fauna and flora (Resende, Ferreira, Fernandes, 2018).

Despite these challenges, Brazil has made strides in improving sanitation. There has been a movement towards public policies for improving various aspects of rural sanitation in the country. However, there is no single solution for sanitation (Rodrigues et al, 2022).

The study by Reis et al. (2023) provides an analysis of the effectiveness of social and the concession of sanitation to the private sector, focusing on the case of the auction of CEDAE in Rio de Janeiro, Brazil. The study suggests that the privatization of sanitation services could potentially contribute to the improvement of sanitation services in the country.

However, the process of privatization and concession of sanitation services is not without its challenges. The study by Do Couto and Juruena (2022) highlights the importance of user participation in the new legal framework for basic sanitation in Brazil. The authors argue that the involvement of users in the decision-making process is crucial for ensuring the sustainability and effectiveness of sanitation services.

In addition to the regulatory and social aspects, the financing of water and sanitation services is another critical factor in the concession of sanitation services in Brazil. Queiroz et al. (2020) discuss the challenges of financing water and sanitation services in Brazil and suggest that two types of funds could be instrumental in addressing these challenges (Queiroz; Nascimento; Oliveira, 2020).

SANITATION IN CANADA: HISTORY AND LEGAL BACKGROUND

The history of sanitation in Canada is marked by a complex interplay of socio-economic, cultural, and political factors. Canada, despite having the second-highest per capita water consumption in the world, has faced significant challenges related to water security, particularly in isolated and Indigenous communities. These challenges have roots in the country's colonial past and various state policies (Sarkar, Hanrahan, Hudson, 2015). The issue of access to clean water and basic sanitation in First Nations communities is described as a political-ecological problem, with water management historically being a technical and scientific mission controlled by state authorities, without significant engagement from the First Nations (Baijius, Patrick, 2019).

A significant historical event in Canadian politics occurred a year after Prime Minister Pierre Trudeau came to power in 1968. His government published a White Paper on Aboriginal policy, arguing that Canada should no longer negotiate treaties with native peoples. Trudeau believed that treaties were only something signed between sovereign nations. Thus, his government disagreed with the land rights claimed by the Aboriginals, which consequently impacted water resources (Costa, 2012).

Ontario, a province in Canada, has a long and complex history with sanitation and water distribution. During the 19th century, cities in the province began to face severe public health problems related to lack of sanitation and pollution of drinking water sources (Ontario..., 2001). From the mid-19th century, several cities in Ontario began to implement measures to improve sanitation and water distribution. The Ontario Clean Water Agency (OCWA) was established, responsible for water and sewage treatment, maintenance of distribution networks, and waste management in over 600 communities throughout the province (Ontario, 2001).

The 1990s saw significant changes in how the provincial government of Ontario approached water issues. With the election of the Progressive Conservative Party led by Mike Harris in 1994, the so-called "Common Sense Revolution" was launched, aiming to reduce taxes, deregulate, and decrease the provincial government's role in providing public services. This policy resulted in substantial cuts in public spending, with a large portion of the resources intended to support municipal water and sewage services being channeled through the Ontario Clean Water Agency (Rosenberg, 2013).

A notable event in the province's history is the "Walkerton Tragedy" of May 2000, which involved bacterial contamination of municipal water in the town of Walkerton, Ontario, by Escherichia coli O157:H7. The public investigation of the case revealed inadequate practices and systematic fraud by public service operators, recent privatization of municipal water testing, the absence of criteria governing test quality, and a lack of provisions for notification of results to various authorities (Salvadori et al, 2009)

Canada, a developed country, has a different set of challenges and approaches to sanitation. The Canadian government works in partnership with different actors to promote the 2030 Agenda and advance the 17 Sustainable Development Goals (SDGs). Actions include poverty reduction, sustainable economic growth, support for reconciliation with indigenous peoples, promotion of gender equality, combating climate change and promoting clean energy (Cheng et al, 2021).

A key component of the government's commitment is to close the socio-economic gaps between indigenous and non-indigenous peoples in Canada, addressing challenges in access to potable water and sanitation in First Nations communities. Since 2016, the Canadian government has committed over $5.2 billion for the construction and repair of water and sewage infrastructure, as well as support for the management and maintenance of water systems in indigenous reserves (Government of Canada, 2022).

However, despite these efforts, Canada faces challenges related to potable water security in isolated and indigenous communities. Most studies focus on a simplified interpretation of accessibility, availability, and quality issues, including some common waterborne infections as the only health outcomes. Several governmental initiatives to provide potable water, especially for indigenous communities, have been implemented (Sarkar, Hanrahan, Hudson, 2015).

COMPARED CITIES AND DATA

The comparison between municipalities in the state of Santa Catarina, Brazil, and the province of Ontario, Canada, provides a comprehensive overview of the differences and similarities in their approach to

basic sanitation and sustainable development. The municipalities selected for this study include Caçador, Videira, and Concórdia in Santa Catarina, and Sault Ste. Marie, Thunder Bay, North Bay, Chatham-Kent, Woodstock, and Kenora in Ontario.

Municipality	Population	Access to potable water (%)	Access to sanitation (%)
Caçador, SC	79,641	99.80%	58.10%
Videira, SC	53,930	99.30%	49.50%
Concórdia, SC	74,116	100.00%	60.10%
Sault Ste. Marie, ON	73,368	99.90%	99.50%
Thunder Bay, ON	121,621	99.90%	99.50%
North Bay, ON	51,553	99.90%	99.50%
Chatham-Kent, ON	101,647	99.90%	99.50%
Woodstock, ON	40,902	99.90%	99.50%
Kenora, ON	15,096	99.90%	99.50%

In Santa Catarina, the state's sanitation company, CASAN, has faced challenges over the years due to management issues and insufficient investments in infrastructure. However, in the 2000s, the company underwent a restructuring process, adopting new management policies and investing in technology and infrastructure. Despite these efforts, some rural areas in the state still face precarious sanitation conditions. For instance, in the region of Treze Tílias, the lack of toilets, septic tanks, and other sanitary measures has led to an environment conducive to the spread of diseases, affecting the health and well-being of residents.

On the other hand, Ontario has a different approach to sanitation and sustainable development. The province has made significant progress in reducing the number of deaths and people affected by natural disasters over the years. This has been achieved through investing in early warning systems, risk assessment, and risk communication; disaster preparedness; and reducing disaster risk in the development and implementation of land use planning, housing, and infrastructure projects.

Municipalities exhibit similarities and differences based on population and distance from the capital. Access to potable water surpasses 99% in all cities, showcasing effective implementation and prioritization. However, a significant contrast arises in access to sanitary sewage, with Brazilian cities at 49.50% to 60.10% and Canadian cities at 99.50%. This points to insufficient investment and prioritization of sanitation in Santa Catarina compared to Ontario.

Factors like financial resources, infrastructure, and public policies influence the variance in sanitary sewage access. Enhancing basic sanitation in Santa Catarina requires more effective measures and resource allocation to ensure well-being and health. Access to potable water is a priority in all analyzed locations, with rates exceeding 99% in both Brazil and Canada.

Data highlight the urgency for effective public policies, suitable infrastructure, and financial resources to improve access to sanitary sewage in disadvantaged areas. Authorities must take decisive actions to ensure a healthy and safe environment for all residents, regardless of their location or socioeconomic status.

Sanitation superiority in Canadian municipalities is evident, with access rates near 100% irrespective of economic matrix, population, or proximity to the capital. Conversely, Santa Catarina municipalities range from 49.50% to 60.10% in access. Similar economic matrices alone do not guarantee the effectiveness and efficiency of sanitation systems, as external factors like financial resources, management, urban planning, and policy prioritization play a crucial role.

Access to potable water is high in both Brazil and Canada, with rates exceeding 99% in all municipalities. This aligns with national surveys that indicate comparable levels of piped water connections in Latin America and Canada. However, the significant difference in sanitary sewage access emphasizes the need for investment, infrastructure improvements, and public policies in Santa Catarina.

Brazilian municipalities must learn from successful practices in Ontario and implement effective measures to ensure a healthy and safe environment for all residents, regardless of their location or socioeconomic status. Additionally, analyzing these disparities offers valuable insights for future research and urban planning, enabling the identification and implementation of best practices and solutions in different contexts.

The new Legal Framework for Basic Sanitation in Brazil, which included the entry of private initiatives in service provision and municipal regionalization, faced resistance from many states and state companies. This resistance arguably hindered service to the population. Furthermore, the lack of awareness of municipalities about their responsibility for sanitation and the electoral stance of governors and mayors about grants to the detriment of universalization, lack of prioritization of tariffs, and universalization to the detriment of grants and long-term investments are some of the challenges faced.

RESULTS AND FINAL CONSIDERATIONS

The sanitation landscapes in Brazil and Canada present distinct challenges influenced by their unique socio-economic and geographical contexts. Brazil faces a lack of sanitation services, particularly in rural areas, resulting in significant public health and environmental issues. In contrast, Canada struggles to provide access to potable water and sanitation in isolated and indigenous communities, despite its overall high level of sanitation services.

Both countries recognize the importance of access to water and sanitation and have initiated efforts to address

these challenges. However, achieving sustainable water management remains an ongoing journey. Our study offers insights into sanitation issues and initiatives in Brazil and Canada, informing future research and policy-making. A multi-sectoral approach involving governments, the private sector, civil society, and affected communities is crucial to effectively address water and sanitation challenges.

Based on our findings, we recommend specific strategies for improving sanitation in each country. In Brazil, leveraging public-private partnerships can enhance sanitation services, particularly in rural and indigenous areas. In Canada, targeted and inclusive approaches are needed to address the challenges faced by isolated and indigenous communities in accessing water and sanitation services.

Future research should delve deeper into the sanitation situations of Brazil and Canada, including in-depth case studies focused on specific regions. Incorporating primary data collection methods involving the people directly affected by these issues can provide firsthand accounts and intimate perspectives. Exploring successful public-private partnership models within the sanitation sector and harnessing technological advancements can inform future strategies. Considering the impact of climate change on water resources and sanitation services is also vital. Additionally, analyzing the evolution of sanitation policies and influential factors in both countries can serve as a valuable backdrop for policymaking.

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