

Sanitation in Informal Areas with STDm: Challenges and Opportunities for Quality of Life

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Key words: Urban Land Regularization; Basic Sanitation; Quality of Life; Territorial Management; CTM; STDm.

SUMMARY

Basic sanitation is a fundamental human right, essential for health, dignity, and quality of life. In Brazil, Law No. 14.026/2020, known as the New Legal Framework for Sanitation, established the goal of universalizing water supply and sewage services by 2033. However, a significant part of the population living in informal urban settlements still faces precarious conditions without access to these services. The Urban Land Regularization Policy (REURB), created by Law No. 13.465/2017, emerges as an instrument to address this situation, but is often reduced to the issuance of land titles, neglecting the basic infrastructure required for adequate living conditions. This paper discusses the challenges and opportunities of integrating REURB and sanitation, based on a literature review, documentary analysis, and case study. The findings show that the effectiveness of land regularization depends on the articulation between titling, sanitation, and integrated territorial management, supported by tools such as the Multipurpose Cadastre (CTM) and the Social Tenure Domain Model (STDm). It concludes that quality of life goes beyond a property document: it requires sanitation as a structural axis of citizenship and social inclusion, in line with the Sustainable Development Goals of the 2030 Agenda.

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1. INTRODUCTION

Access to basic sanitation is a fundamental human right, recognized by the United Nations and consolidated as an essential element for promoting public health, dignity, and quality of life in cities. In the Brazilian context, sanitation has been elevated to a strategic priority with the enactment of Law No. 14,026/2020. Despite regulatory advances, one of the country's greatest challenges lies in making these rights effective in informal urban areas. The Urban Land Regularization Policy (REURB), established by Law No. 13,465/2017, is an essential instrument but is often reduced to the mere issuance of land titles.

As highlighted by Frota and Hosken (2021), the regulatory framework has promoted “a profound transformation in the management of sanitation services, expanding the responsibility of regulatory entities and establishing universalization targets that challenge managers and operators.”

Nevertheless, in informal settlements, the absence of basic infrastructure increases sanitary risks, deepens socio-spatial inequality, and compromises the effectiveness of Brazil's commitments to the 2030 Agenda, particularly Sustainable Development Goal (SDG) 6 – Clean Water and Sanitation.

According to Article 9 of Law No. 13,465/2017, REURB encompasses legal, urban, environmental, and social measures aimed at incorporating informal urban settlements into territorial planning and at granting secure tenure to their occupants. However, specialized literature indicates that in practice, many municipalities focus on issuing titles while neglecting the effective implementation of urban infrastructure.

This dissociation undermines the essence of urban policy. As Castanheiro (2021) states, land regularization should not be limited to legalizing tenure but must include “the integration of informal urban settlements into territorial planning, ensuring access to essential public services, particularly sanitation.”

In other words, regularizing without guaranteeing potable water, sewage collection and treatment, urban drainage, and proper waste management means perpetuating precarious conditions.

In this context, the integration between land tenure policies and sanitation policies is indispensable for REURB to fulfill its transformative role. By associating titling with the effective universalization of services, it is possible to align land regularization, social inclusion, and environmental sustainability. Therefore, this paper discusses the challenges and opportunities of linking basic sanitation and REURB, focusing on improving quality of life and health in informal areas, and defending a broader perspective that goes beyond titling, in line with the 1988 Federal Constitution and the commitments of the 2030 Agenda.

2. THEORETICAL FRAMEWORK

Urban Land Regularization (REURB), established by Law No. 13,465/2017, is a legal and urban planning instrument designed to integrate informal urban settlements into the territorial management framework through legal, urbanistic, environmental, and social measures. As highlighted in the Guidance Handbook on REURB by CREA-SC (Regional Council of Engineering and Agronomy of Santa Catarina), Article 9 of this law explicitly states that REURB must ensure not only the issuance of land titles but also the effective provision of essential urban infrastructure and public facilities. Its foundation is therefore inseparable from the fulfillment of the social function of the city and of property, which are structuring principles of Brazilian urban policy (Articles 182 and 183 of the Federal Constitution).

From a technical perspective, the effectiveness of REURB depends on the incorporation of engineering and urban planning parameters that guarantee adequate living conditions. This involves: (i) land subdivision consistent with urban and environmental legislation; (ii) road systems with minimum dimensions that ensure accessibility and mobility; (iii) implementation of water supply, sewage collection and treatment, urban drainage, and solid waste management systems; and (iv) risk area mitigation to reduce socio-environmental vulnerability. The Brazilian Bar Association (OAB) Handbook further stresses that basic sanitation is governed by Law No. 11,445/2007, updated by Law No. 14,026/2020, which sets universalization targets by 2033. Technically, the regulation establishes that sanitation systems must ensure water potability (in accordance with Ministry of Health Ordinance GM/MS No. 888/2021), efficiency in sewage collection and treatment, integrated solid waste management as provided by the National Solid Waste Policy (Law No. 12,305/2010), and urban drainage systems dimensioned according to local hydrological parameters.

The absence of sanitation services in formally regularized areas generates negative externalities that undermine the very purpose of REURB. From a public health standpoint, the World Health Organization (WHO) demonstrates that inadequate sanitation is directly correlated with the prevalence of waterborne diseases. From an environmental standpoint, the lack of proper drainage and sewage treatment degrades water bodies and exacerbates urban flooding. In this context, international organizations such as UN-Habitat emphasize that adequate housing necessarily includes access to basic services—such as water and sanitation—and cannot be reduced to mere land titling (UN-Habitat). The Social Tenure Domain Model (STDM), developed by UN-Habitat, embodies this perspective by integrating information on multiple forms of tenure and linking them to urban planning, thereby enhancing governments' capacity to guide infrastructure policies.

Complementarily, the Multipurpose Cadastre (Cadastro Territorial Multifinalitário – CTM) emerges as a critical technical tool to integrate cadastral, legal, physical, socioeconomic, and environmental information. As Enemark (2010) points out, modern cadastral systems must serve as a foundation for territorial governance, operating as integration platforms across housing, sanitation, mobility, and environmental policies. In Brazil, CTM adoption is essential to support REURB processes by enabling the spatialization of infrastructure demands and prioritization of investments.

The theoretical framework thus confirms that REURB's effectiveness requires a systemic approach in which formal titling is accompanied by engineering interventions and integrated public policies. Within this framework, the New Sanitation Legal Framework (Law No. 14,026/2020) operates as a central regulatory driver, imposing deadlines and targets that

enforce convergence between land tenure policies and urban infrastructure, thereby rendering inseparable the concepts of adequate housing, universal sanitation, and integrated territorial management.

2.1 What is Required for an Effective REURB

Urban Land Regularization (REURB), under the provisions of Law No. 13,465/2017, aims to guarantee the right to housing, promote social inclusion, and foster urban development. The process takes place in two modalities: Social Interest REURB (REURB-S) and Specific Interest REURB (REURB-E), each with its own distinct characteristics.

REURB-S targets informal settlements predominantly occupied by low-income families, as defined by municipal authorities. Decree No. 9,310/2018 sets the income threshold at up to five minimum wages, although municipalities or the Federal District may adopt lower limits. In this modality, the public sector assumes the costs of the process, from technical project development to the implementation of essential infrastructure. Beneficiaries are exempt from registration fees and notarial costs, thus ensuring titling without financial burden for vulnerable populations.

REURB-E applies to informal settlements not predominantly occupied by low-income residents. In such cases, costs fall on the beneficiaries themselves or on private stakeholders such as landowners, developers, and investors. Where there is public interest, the municipality may conduct and finance the REURB-E process in public areas, subsequently transferring the costs to occupants.

In both modalities, when environmental studies are conducted, it must be demonstrated that the regularization measures improve environmental conditions compared to the prior irregular occupation. Both modalities can coexist in the same settlement, provided that low-income areas are covered by REURB-S and other sectors by REURB-E.

In summary, the distinction between REURB-S and REURB-E lies in eligibility criteria, financing responsibilities, and registration exemptions. While REURB-S is aimed at low-income populations and financed by the State, REURB-E is directed toward other groups and must be financed by beneficiaries or the private sector.

Regardless of the modality, REURB seeks to provide legal security, foster social inclusion, and promote territorial planning while guaranteeing access to public services and adequate infrastructure. By integrating informal settlements into urban planning, it contributes to sustainable city development and to improving population quality of life.

As Castanheiro (2021) emphasizes, land regularization must be understood as an integrated public policy, not limited to documentary legalization but linked to full urbanization: “to regularize is to incorporate the territory into the urban fabric with all the rights, duties, and infrastructures that follow.” Thus, the effectiveness of REURB depends on its articulation with infrastructure policies, especially sanitation, transport, and housing.

2.2 What is required for effective REURB

REURB entails a set of multidimensional actions that encompass legal measures (titling and registration), urbanistic measures (adjustment of subdivisions and road networks), environmental measures (risk protection and mitigation), and social measures (community participation and social inclusion). However, both the literature and practical experience show

that, in many municipalities, the emphasis falls primarily on titling, without due attention to the implementation of urban infrastructure (Castanheiro, 2021).

This gap undermines the very purpose of the policy, as it perpetuates precariousness in territories that, although legally formalized, remain without essential services.

The CREA-SC (Regional Council of Engineering and Agronomy of Santa Catarina) handbook highlights that regularization must incorporate structural measures; otherwise, it risks being reduced to a mere “dry” formalization, disconnected from quality of life: “irregular settlements are, in most cases, inhabited by low-income populations without access to water, energy, and sanitation; regularization means addressing this reality.”.

2.3 Basic sanitation: concept and minimum conditions

According to the Brazilian Bar Association (OAB), basic sanitation, as defined by Law No. 11,445/2007, comprises the services of potable water supply, sewage collection and treatment, solid waste management, and stormwater drainage. The New Sanitation Legal Framework (Law No. 14,026/2020) reinforced the goal of universalization by 2033, establishing that 99% of the population must have access to potable water and 90% to sewage services.

These services constitute the minimum conditions for habitability. As highlighted by the OAB handbook, “the provision of sanitation services must be understood as a fundamental social right, whose absence directly impacts public health, environmental quality, and the reduction of social inequalities.”

Regarding solid waste management, the National Solid Waste Policy (Law No. 12,305/2010) establishes principles such as shared responsibility and waste minimization, reduction, reuse, recycling, and environmentally appropriate disposal. In this context, regular waste collection services and the implementation of selective collection systems are essential components of basic sanitation. Beyond guaranteeing public health and reducing environmental impacts, selective collection also fosters social inclusion and income generation through the work of recycling cooperatives and municipal programs. Integrated solid waste management thus connects sanitation infrastructure to the circular economy, promoting both environmental sustainability and livelihood opportunities for vulnerable families.

Therefore, sanitation must not be treated as a secondary aspect of urbanization, but as a structuring axis.

2.4 Consequences of the absence of sanitation

The lack of basic sanitation has direct effects on public health and environmental quality. According to data from the Instituto Trata Brasil, millions of Brazilians still live without sewage collection, and much of the sewage that is collected remains untreated. This situation contributes to the spread of waterborne diseases such as diarrhea, hepatitis A, and leptospirosis, while also favoring the proliferation of vector-borne diseases in flood-prone areas. Studies by the WHO indicate that every dollar invested in sanitation generates a four-dollar saving in public health.

As noted in the Handbook on the New Sanitation Legal Framework, the absence of sanitation also compromises water sources, worsens environmental degradation, and perpetuates socio-spatial segregation.

In terms of solid waste, the lack of regular collection and appropriate disposal systems leads to the proliferation of open-air dumps, which pose serious environmental and health threats. These sites act as breeding grounds for disease vectors—such as flies, rats, and mosquitoes—while contaminating soil and aquifers and releasing greenhouse gases like methane. Poor management of urban solid waste not only affects population health but also undermines ecosystem quality and increases social costs. Conversely, the absence of selective collection and recycling policies also means missed opportunities for the socioeconomic inclusion of waste pickers, who could otherwise be integrated into reverse logistics and circular economy programs, generating work and income for vulnerable families.

2.5 Quality of life and the UN-Habitat perspective

UN-Habitat stresses that adequate housing goes far beyond the mere existence of a formal housing unit. According to the agency, adequate housing involves tenure security, service availability, affordability, location, and cultural adequacy (UN-Habitat, 2012). Within this framework, basic sanitation is a central element of the concept of “adequate housing,” inseparable from the right to the city.

The Social Tenure Domain Model (STDM), developed by UN-Habitat, is an example of an instrument that expands the notion of tenure beyond formal titling, allowing for the registration of different forms of occupancy and linking them to urban and service planning.

2.6 Territorial management and integrated public policies

The integration of land regularization, sanitation, and territorial management is an essential condition for promoting fair and sustainable cities. The Multipurpose Cadastre (CTM), widely discussed in Brazilian literature, represents a database capable of integrating information on property, land use, infrastructure, and the environment, serving as a planning instrument.

According to Enemark (2010), modern cadastre systems should function as “platforms for integrated public policies.” In the Brazilian context, adopting CTM in conjunction with STDM represents an opportunity to align land regularization policies with sanitation and urban development strategies.

2.7 The New Sanitation Legal Framework

Law No. 14,026/2020 promoted a structural shift in the sector by establishing clear universalization targets and expanding the participation of private operators under the regulation of the National Water and Sanitation Agency (ANA). According to Frota and Hosken (2021), the law brought about “a profound transformation in service management, imposing efficiency and regulatory standards that demand strong planning by federative entities.”

The legal framework reinforces the urgency of integrated public policies: it is not enough to grant land titles without guaranteeing sanitation services, nor is it viable to expand infrastructure networks without linking investments to territorial planning. Thus, the articulation between REURB and the Sanitation Legal Framework is the pathway to achieving universalization by 2033.

3. METHODOLOGY

The research adopted a qualitative approach, with an exploratory and analytical character, grounded in a bibliographic review. This method allowed the identification of gaps and opportunities in the integration between REURB and sanitation.

4. RESULTS AND DISCUSSION

The research showed that there is an excessive emphasis on land titling, as well as weaknesses in municipalities due to fragmented public policies. It also highlighted the consequences of the absence of sanitation (disease, environmental degradation, and social exclusion).

The literature review and case studies pointed to solutions such as condominium sewage networks, decentralized systems, the integration of CTM and STDM, and the importance of community participation as strategies for ensuring adequate sanitation and quality of life within REURB implementation.

4.1 Obstacles to the effectiveness of REURB integrated with sanitation

The analysis of legal frameworks and literature reveals that REURB, despite its relevance, faces significant obstacles when associated with sanitation:

- Documentary emphasis: in many municipalities, regularization has been limited to the issuance of titles, without ensuring the implementation of urban infrastructure, reducing the policy to a mere legal act.
- Institutional and financial fragility: law No. 13,465/2017 assigns municipalities the central role in conducting REURB, yet many local administrations lack the technical and financial resources to carry out structural sanitation works.
- Fragmentation of public policies: land regularization often occurs disconnected from Municipal Basic Sanitation Plans (PMSBs), undermining coordination and the sustainability of solutions.

This set of challenges compromises the effectiveness of REURB and perpetuates precariousness in vulnerable territories.

4.2 Consequences of the absence of sanitation in regularized areas

Regularizing urban land without guaranteeing access to basic sanitation means institutionalizing precarious living conditions. The CREA-SC handbook warns that irregular settlements, mostly inhabited by low-income populations, face chronic lack of public services such as water, electricity, and sanitation.

The consequences of this reality are well documented:

- Public health: increase in waterborne diseases and vector-borne epidemics.
- Environmental: contamination of water sources and worsening of flooding in risk areas.
- Social: perpetuation of inequality, territorial exclusion, and devaluation of inhabited areas.

Castanheiro (2021) reinforces that there is no dignified housing without access to sanitation and essential public services, making titling alone an incomplete solution.

4.3 Good practices and innovative solutions

Despite difficulties, national and international experiences demonstrate pathways to effectively integrate REURB and sanitation:

- Condominium sewage networks: adopted by SABESP in São Paulo communities, these networks have lower implementation costs and adapt to local conditions, serving informal settlements without requiring large-scale infrastructure (Tucci, 2008).
- Decentralized treatment systems: ANA (National Water and Sanitation Agency) highlights that compact and community-based wastewater treatment solutions are sustainable alternatives for settlements where conventional sewer networks are not feasible (CARTILHA, 2021).
- Multipurpose Cadastre (CTM) + Social Tenure Domain Model (STDM): the integration of these instruments enables the mapping of informal occupations and the planning of urban infrastructure expansion, reconciling land titling, land use, and network implementation.
- Community participation: the experience of the Papaquara community in Florianópolis shows that resident engagement in the regularization process enhances sustainability and strengthens the link between titling and quality of life.

4.4 Integrated territorial management as a key to quality of life

The analysis confirmed that the integration of REURB and sanitation must be guided by a vision of integrated territorial management, where housing, infrastructure, environmental, and health policies operate in a coordinated manner.

In this sense, UN-Habitat emphasizes that adequate housing presupposes access to basic services and cannot be limited to tenure security. The lack of sanitation in regularized areas contradicts this principle, making regularization an incomplete act.

Therefore, the effectiveness of REURB as a public policy will only be achieved when linked to consistent investments in basic sanitation, so that it promotes not only documentary legalization but also the structural transformation of urban living conditions.

5. CONCLUSION

Urban Land Regularization (REURB) is essential to addressing the socio-spatial inequalities present in informal urban settlements. However, its effectiveness cannot be limited to the issuance of property titles. To regularize without providing infrastructure is to legally legitimize precarious conditions. Integration with basic sanitation is the key for this policy to produce real impacts on quality of life, transforming documents into citizenship, health, and dignity.

In this context, the Multipurpose Cadastre (CTM) emerges as a strategic instrument. By consolidating legal, physical, socioeconomic, and environmental information into a single georeferenced database, the CTM enables decision-makers to identify where precarious

settlements are located, which services are lacking, and which investments should be prioritized. In this way, the cadastre goes beyond a merely registry function, becoming an instrument of urban planning and social justice.

Territorial management based on integrated cadastral systems fosters alignment between REURB, sanitation policies, and urban planning. Through models such as the Social Tenure Domain Model (STDM), it is possible to register different forms of tenure and occupancy, ensuring that traditionally excluded communities are incorporated into public policies. This enhances the legitimacy of regularization and strengthens social inclusion.

Another crucial aspect is the cadastre's ability to support the financial and operational planning of municipalities. Identifying areas lacking infrastructure guides resource allocation, prevents overlapping investments, and strengthens territorial governance. Moreover, integrating cadastres with Municipal Basic Sanitation Plans (PMSBs) ensures that the goals of the 2020 Sanitation Legal Framework—universal access to water and sewage by 2033—are pursued in a rational and efficient manner.

It is concluded that urban quality of life cannot be reduced to a property title. It depends on the articulation between REURB, basic sanitation, and territorial management supported by robust and inclusive cadastres. Sanitation is health, citizenship, and dignity; the cadastre is the technical and institutional foundation that ensures the effectiveness of this policy. Integrating these elements is essential to promoting more resilient, inclusive, and sustainable cities, in line with the 2030 Agenda and with the right to the city enshrined in the Federal Constitution.

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BIOGRAPHICAL NOTES

Roberta Maas dos Anjos is a civil, sanitary, environmental, and occupational safety engineer. She is currently President of Senge-SC and Financial Director of Mútua-SC. Former President of CASAN, she works as a consultant for sanitation, innovation, and ESG projects. She is a Master's student in Transport Engineering and Territorial Management (UFSC) and holds international training in Innovation Management from École des Mines de Saint-Étienne, France. She has extensive experience in securing international funding for sanitation projects and is the author of technical papers on REURB and environmental management.

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