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# Construction and Demolition Waste and the Contradictions of Sustainability

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# Resíduos da construção civil e as contradições da sustentabilidade

**RESUMO**

**Objetivo** – O artigo tem como objetivo desenvolver uma reflexão crítica sobre os resíduos sólidos da construção civil, analisando-os como expressão das contradições entre o discurso da sustentabilidade e as práticas produtivas que estruturam a produção do espaço urbano.

**Metodologia** – Trata-se de um estudo de natureza teórico-conceitual, fundamentado em revisão crítica da literatura especializada e de documentos normativos sobre sustentabilidade, construção civil, resíduos sólidos e educação ambiental, sem utilização de dados empíricos primários.

**Originalidade/relevância** – A originalidade do trabalho reside na abordagem dos resíduos da construção civil como categoria central para a compreensão dos limites da sustentabilidade urbana, superando leituras restritas à gestão técnica ou ao cumprimento normativo.

**Resultados** – Os resultados indicam que a persistência da geração de resíduos decorre de escolhas estruturais realizadas ao longo da cadeia produtiva da construção civil, evidenciando a distância entre avanços legais e transformações efetivas das práticas construtivas.

**Contribuições teóricas/metodológicas** – O estudo contribui ao articular sustentabilidade, normatividade, ciclo de vida e educação ambiental, reafirmando o potencial dos ensaios teórico-conceituais para a análise crítica de processos urbanos complexos.

**Contribuições sociais e ambientais** – Do ponto de vista social e ambiental, o artigo evidencia que os resíduos da construção civil intensificam desigualdades territoriais e impactos ambientais, apontando a educação ambiental como elemento estruturante para a mudança de práticas produtivas e culturais.

**PALAVRAS-CHAVE:** Resíduos da construção civil. Sustentabilidade urbana. Construção civil. Educação ambiental.

# Construction and Demolition Waste and the Contradictions of Sustainability



**ABSTRACT**

**Objective** – This article aims to develop a critical reflection on construction and demolition waste, analyzing it as an expression of the contradictions between the discourse of sustainability and the productive practices that structure the production of urban space.

**Methodology** – This is a theoretical-conceptual study, based on a critical review of specialized literature and normative documents on sustainability, construction, solid waste, and environmental education, without the use of primary empirical data.

**Originality/Relevance** – The originality of the study lies in addressing construction and demolition waste as a central category for understanding the limits of urban sustainability, going beyond approaches restricted to technical management or regulatory compliance.

**Results** – The results indicate that the persistence of waste generation stems from structural choices made throughout the construction industry's production chain, highlighting the gap between legal advances and effective transformations in construction practices.

**Theoretical/Methodological Contributions** – The study contributes by articulating sustainability, normativity, life cycle, and environmental education, reaffirming the potential of theoretical-conceptual essays for the critical analysis of complex urban processes.

**Social and Environmental Contributions** – From a social and environmental perspective, the article shows that construction and demolition waste intensifies territorial inequalities and environmental impacts, pointing to environmental education as a structuring element for changing productive and cultural practices.

**KEYWORDS:** Construction and demolition waste. Urban sustainability. Construction industry. Environmental education.

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# Residuos de la construcción y las contradicciones de la sostenibilidad

**RESUMEN**

**Objetivo** – El artículo tiene como objetivo desarrollar una reflexión crítica sobre los residuos sólidos de la construcción, analizándolos como expresión de las contradicciones entre el discurso de la sostenibilidad y las prácticas productivas que estructuran la producción del espacio urbano.

**Metodología** – Se trata de un estudio de carácter teórico-conceptual, fundamentado en una revisión crítica de la literatura especializada y de documentos normativos sobre sostenibilidad, construcción, residuos sólidos y educación ambiental, sin utilización de datos empíricos primarios.

**Originalidad/Relevancia** – La originalidad del trabajo reside en el abordaje de los residuos de la construcción como una categoría central para la comprensión de los límites de la sostenibilidad urbana, superando lecturas restringidas a la gestión técnica o al cumplimiento normativo.

**Resultados** – Los resultados indican que la persistencia en la generación de residuos se deriva de elecciones estructurales realizadas a lo largo de la cadena productiva de la construcción, evidenciando la distancia entre los avances legales y las transformaciones efectivas de las prácticas constructivas.

**Contribuciones teóricas/metodológicas** – El estudio contribuye al articular sostenibilidad, normatividad, ciclo de vida y educación ambiental, reafirmando el potencial de los ensayos teórico-conceptuales para el análisis crítico de procesos urbanos complejos.

**Contribuciones sociales y ambientales** – Desde el punto de vista social y ambiental, el artículo evidencia que los residuos de la construcción intensifican las desigualdades territoriales y los impactos ambientales, señalando la educación ambiental como un elemento estructurante para el cambio de las prácticas productivas y culturales.

**PALABRAS CLAVE:** Residuos de la construcción. Sostenibilidad urbana. Construcción civil. Educación ambiental.

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## 1 INTRODUCTION

The intensification of urbanization processes over recent decades has deepened pressures on urban ecosystems, making increasingly evident the contradictions between prevailing development models and environmental limits. In this context, the construction industry occupies a central position, both due to its strategic role in urban economic dynamics and to the socio-environmental impacts associated with the intensive consumption of natural resources, land occupation, and the significant generation of solid waste. Among these impacts, construction and demolition waste stands out as one of the most visible and persistent environmental liabilities of contemporary urbanization, revealing not only operational failures in management but also structural tensions in the way urban space is produced.

Although the debate on sustainability has become consolidated within the fields of public policy and environmental regulation, a significant gap remains between normative advances and the effective materialization of sustainable practices in urban territories. In the construction sector, this gap is particularly evident in the persistent large-scale generation of waste, even in the presence of a relatively consolidated legal framework, such as the National Solid Waste Policy and CONAMA Resolution No. 307/2002. This scenario demonstrates that the issue of construction and demolition waste goes beyond the technical and regulatory sphere, requiring a critical approach that considers the economic, social, cultural, and political dimensions that structure the prevailing model of urbanization.

Against this backdrop, this article aims to develop a conceptual and critical reflection on construction and demolition waste, articulating debates on sustainability, the production of urban space, and the limits of environmental normativity. It seeks to problematize the centrality of the construction industry in the urban environmental crisis, analyzing how waste constitutes a material expression of the contradictions between sustainability discourse and effective productive practices. Additionally, the article discusses the role of environmental education as a structuring dimension of cultural change processes, capable of challenging the naturalization of waste and promoting the reorientation of construction practices and consumption patterns associated with the sector.



From a methodological standpoint, this is a theoretical-conceptual article, grounded in a critical and analytical review of specialized literature, normative documents, and classical and contemporary references on sustainability, construction, solid waste, and environmental education. The adopted approach privileges the articulation between different fields of knowledge, seeking to overcome fragmented and technicist readings of the construction waste problem. No primary empirical data or specific case studies are employed, as the focus of the study lies in the conceptual problematization and critical interpretation of the structural processes that underpin waste production and management in the urban context.

The contribution of this article lies in reinforcing the understanding of construction and demolition waste not as a residual or peripheral issue, but as a central element for a critical reading of urban sustainability. By presenting the limits of normative and technological approaches when dissociated from structural transformations in modes of production and consumption, the study seeks to engage researchers, policymakers, and professionals in the

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field, contributing to the deepening of debates on contemporary challenges of sustainability in cities.

In addition to this introduction, the article is structured into five sections. The second section discusses the concept of sustainability, highlighting its disputes, appropriations, and tensions between normative discourse and productive practice. The third section analyzes the centrality of the construction industry in the urban environmental crisis, with emphasis on the expanded production chain, the life cycle of buildings, and the intensive generation of waste. The fourth section examines the Brazilian normative framework related to construction and demolition waste, problematizing its limits of implementation and enforcement. The fifth section addresses the role of environmental education as a structuring axis for paradigm change in the construction sector. Finally, the concluding remarks revisit the main arguments developed, reinforcing the need for a critical and integrated reading of the construction waste issue within the context of urban sustainability.

## 2 SUSTAINABILITY: CONCEPT, DISPUTES, AND APPROPRIATIONS

Over recent decades, sustainability has become consolidated as a structuring concept in debates on development, public policy, and environmental management, progressively acquiring a multidimensional character. Since its most widely disseminated formulation, systematized in the Brundtland Report, sustainable development has been understood as development that meets the needs of the present without compromising the ability of future generations to meet their own needs, articulating economic growth, social equity, and environmental preservation (United Nations, 1987). Although broadly accepted, this definition inaugurates a field of conceptual and practical tensions, as it presupposes the compatibility between economic expansion and ecological limits in a context marked by profound social inequalities and intensive patterns of natural resource exploitation (Marques; Benini, 2025).



These tensions become particularly evident when sustainability is confronted with complex production chains, such as that of the construction industry, whose environmental impacts are not concentrated in a single stage but are distributed throughout the entire life cycle of buildings—from raw material extraction to demolition and waste disposal. Studies based on Life Cycle Assessment demonstrate that technical and economic decisions made in the early stages of the construction process significantly condition both the magnitude and the distribution of these impacts over time (Ortiz; Castells; Sonnemann, 2009; Sharma et al., 2011).

The theoretical deepening of the concept shows that sustainability cannot be reduced to an isolated environmental dimension. Kraemer (2023) defines it as an arrangement that combines economic efficiency, social justice, and ecological prudence, emphasizing that its transformative potential lies precisely in the articulation of these dimensions. Convergently, Iaquinto (2018) expands this understanding by arguing that sustainability encompasses, beyond the economic and environmental spheres, social, psychological, spatial, political, ethical, and technological dimensions, thus shifting the debate toward the realm of collective choices, governance, and territorial organization. From this perspective, sustainability is configured less as a set of techniques and more as a social and political project, permeated by disputes over

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priorities, the distribution of benefits and risks, and forms of appropriation of nature (Marques; Benini, 2025).

This interpretation directly dialogues with approaches that adopt the life cycle as an analytical key, by demonstrating that environmental impacts cannot be understood in a fragmented manner. Life Cycle Assessment reveals that upstream decisions—related to design, material selection, and construction methods—condition not only the environmental performance of buildings, but also waste generation and associated social impacts throughout their existence (Ortiz; Castells; Sonnemann, 2009; Sharma et al., 2011).

Linares (2012) contributes to this debate by proposing that sustainability be understood as the maintenance of non-declining levels of well-being, distributed fairly both within the present generation and among different generations. This well-being results from the interaction between different types of capital—economic, built, natural, human, and social—reinforcing the idea that sustainability requires a dynamic balance among multiple dimensions. This formulation makes it possible to overcome simplistic approaches and demonstrates that policies or practices centered exclusively on economic growth, even when framed by environmental discourse, tend to reproduce asymmetries and compromise long-term sustainability. Studies applied to the management of construction and demolition waste confirm this limitation by indicating that the absence of an integrated life cycle perspective undermines the effective reduction of environmental and social impacts, even in contexts where specific normative instruments exist (Rosado et al., 2019).

Despite this conceptual density, a significant tension persists between the normative discourse of sustainability and the productive practices actually adopted. The incorporation of the term into legislation, international agendas, public policies, and certification instruments has contributed to its wide diffusion and social acceptance; however, this institutionalization does not always translate into structural transformations in modes of production and consumption (Marques; Benini, 2025). In many contexts, sustainability comes to operate as an abstract normative principle, while concrete practices remain guided by short-term logics, centered on the maximization of immediate economic gains and cost reduction.



Recent literature on the circular economy points out that this mismatch is associated with the persistence of linear models of production and consumption, in which waste generation is treated as an inevitable final stage rather than as the result of structural choices made throughout the productive process (Geissdoerfer et al., 2017; Kirchherr; Reike; Hekkert, 2017). In this sense, Plessis (2002) observes that building a truly sustainable industry may require not only the adoption of more efficient technologies, but also the redefinition of economic growth patterns themselves. From this perspective, sustainability is not limited to the continuation of productive expansion, but involves the possibility of growing differently—or even restraining certain processes—in order to preserve harmony between natural and built environments. This critique is reinforced by authors who treat the circular economy as a paradigm capable of questioning the linearity of productive systems, by emphasizing strategies of source reduction, reuse, and the maintenance of material value, especially in the context of construction and demolition waste (Geissdoerfer et al., 2017; Purchase et al., 2022).

When dissociated from these structural dimensions, sustainability runs the risk of being converted into legitimizing rhetoric, used to confer an appearance of environmental

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responsibility on practices that remain essentially unchanged. Under such conditions, the concept is selectively appropriated, emptying it of its critical and transformative content. Kraemer (2023) warns that sustainability only acquires effective meaning when linked to real changes in patterns of production, consumption, and governance; otherwise, it tends to be reduced to a consensual discourse, incapable of challenging the foundations of the prevailing development model. The persistence of intensive construction and demolition waste generation thus demonstrates the limits of approaches that fail to incorporate material life cycles and the logic of circularity as structuring elements of policies and productive practices (Rosado et al., 2019; Purchase et al., 2022).

Understanding sustainability therefore requires recognizing it as a field of conceptual and practical disputes, permeated by conflicts between different temporalities, interests, and rationalities. Far from representing a neutral consensus, sustainability expresses the permanent tension between the normativity that enshrines it as an ideal and the concrete limitations of its materialization in productive practices. This gap is particularly evident in strategic sectors such as construction, where sustainability often manifests more as a discursive promise than as a structuring principle of decisions and productive processes. The incorporation of life cycle–based and circular economy approaches thus contributes to making these contradictions explicit, by demonstrating that the waste problem does not constitute a punctual deviation, but rather an integral component of the very model of urban space production.

## 3 THE CONSTRUCTION INDUSTRY AT THE CENTER OF THE URBAN ENVIRONMENTAL CRISIS



The construction industry occupies a strategic position in contemporary urban dynamics, simultaneously functioning as a driver of economic development and as one of the main agents of transformation—and degradation—of the urban environment. Traditionally associated with job creation, the expansion of the real estate market, and the activation of extensive production chains, construction activity is often presented as an engine of urban development. However, this economic centrality contrasts sharply with the high environmental impacts associated with the sector, particularly with regard to the intensive consumption of natural resources, land occupation, and the massive generation of solid waste. This contradiction demonstrates that the economic role of the construction industry cannot be analyzed separately from its socio-environmental effects, under the risk of perpetuating a structurally unsustainable urban model (Marques; Benini, 2025).

Understanding these impacts requires shifting the analysis beyond the construction phase itself. Agopyan and John (2011) demonstrate that the environmental effects of the construction industry are distributed throughout the entire production chain, from raw material extraction to the demolition or deconstruction of buildings. This expanded chain involves highly energy- and material-intensive processes, such as mining, industrial production of inputs, transportation, construction execution, building use and maintenance, and, finally, the disposal of the waste generated. By adopting this perspective, the authors move the analysis from a punctual view to a systemic approach, in which each stage contributes to the intensification of environmental pressures on urban and peri-urban ecosystems.

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In this context, the building life cycle emerges as a central category for understanding the magnitude and persistence of impacts associated with the construction industry. Amaral (2024) emphasizes that contemporary urban expansion, marked by the incorporation of new materials, technologies, and construction standards, has become increasingly aggressive toward the environment, especially when associated with disordered land occupation, deforestation, and construction in environmentally fragile areas, such as slopes and riverbanks. Moreover, the author draws attention to the fact that the use phase of buildings—often neglected in conventional analyses—accounts for significant water and energy consumption, extending environmental impacts far beyond the construction site and highlighting the continuity of these effects over time.

Maciel et al. (2018) reinforce this interpretation by showing that the construction industry is responsible for a substantial share of natural resource consumption and emissions associated with urban activities. In the Brazilian context, the sector consumes a large proportion of available water, uses between 40% and 50% of extracted natural resources, and accounts for significant greenhouse gas emissions, placing it at the center of discussions on urban sustainability and climate change. These data indicate that the construction industry not only reflects the prevailing urban development model, but also reproduces and reinforces it by sustaining patterns of intensive resource use and low environmental efficiency.

Among the most visible and problematic impacts of construction activity is the intensive generation of construction and demolition waste (CDW). Roth and Garcias (2011) point out that such waste constitutes one of the main sources of urban environmental degradation, whether through irregular disposal in natural areas, valley bottoms, and vacant lots, or through the obstruction of drainage systems, soil contamination, and the degradation of the urban landscape. Beyond direct environmental impacts, CDW generates significant social and public health effects, contributing to the proliferation of disease vectors, the deterioration of public spaces, and increased costs for municipalities, which often assume the corrective management of these liabilities.



The centrality of construction and demolition waste in the urban environmental crisis highlights that the problem lies not only in the volume of waste generated, but in the very productive model that guides the sector. The prevailing logic—based on rapid execution, immediate cost reduction, and the low valuation of material reuse—contributes to the naturalization of waste and the externalization of environmental impacts. In this sense, inadequate waste management does not constitute an isolated failure, but rather a concrete expression of the dissociation between the economic role attributed to the construction industry and the environmental responsibility that should accompany its activity in urban territory.

Understanding the construction industry as a central axis of the urban environmental crisis therefore implies recognizing that its impacts are not inevitable side effects, but the result of technical, economic, and political choices. The analysis of the expanded production chain, building life cycles, and intensive waste generation reveals that sustainability in the sector cannot be achieved through punctual interventions or isolated technicist solutions. On the contrary, it requires the structural reorientation of productive processes, the incorporation of environmental criteria from the earliest planning stages, and a critical review of the urbanization model that underpins the continuous expansion of the construction industry in Brazilian cities.

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## 4 CONSTRUCTION AND DEMOLITION WASTE: NORMATIVITY AND LIMITS

Construction and demolition waste currently constitutes one of the main environmental liabilities associated with contemporary urbanization, making visible the limits of sustainability when it remains confined to the normative sphere and faces difficulties in materializing within urban territories. In Brazil, the National Solid Waste Policy (Política Nacional de Resíduos Sólidos – PNRS), established by Law No. 12,305/2010, represents the most comprehensive legal framework for addressing this issue, as it sets out principles, objectives, and instruments aimed at integrated management and environmentally sound waste management. Among its central pillars is the solid waste management hierarchy, which prioritizes, in this order, non-generation, reduction, reuse, recycling, treatment, and, only as a last resort, the environmentally adequate final disposal of rejects (Brazil, 2010; Brazil, 2022).

This hierarchy represents an important shift by moving the focus from mere final disposal to the prevention of waste generation, recognizing that the problem cannot be solved solely through technical solutions related to treatment or disposal. In the case of the construction sector, this orientation implies rethinking design practices, construction methods, material choices, and execution processes in order to reduce losses, waste, and discards throughout the entire life cycle of buildings. However, despite the clarity of normative provisions, the effective implementation of these principles faces persistent obstacles, especially when confronted with the dominant productive logic of the sector, which remains strongly oriented toward speed of execution, immediate cost reduction, and the low internalization of environmental impacts.



Within the specific scope of construction and demolition waste (CDW), CONAMA Resolution No. 307/2002 constitutes the main regulatory instrument, as it establishes guidelines, criteria, and procedures for the management of such waste. The regulation defines CDW as waste originating from construction, renovation, repair, demolition, and land preparation activities, encompassing a wide diversity of materials—such as concrete, mortars, ceramics, soils, metals, wood, gypsum, plastics, and glass—historically treated in a generic manner as debris (Brazil, 2002). By classifying waste and assigning responsibilities to generators, the resolution sought to organize a field traditionally marked by informality and irregular disposal, providing greater visibility and control over a problem long naturalized within urban space.

The PNRS reinforces this framework by establishing the principle of shared responsibility for the product life cycle, which extends to the construction chain and involves material manufacturers, distributors, construction companies, developers, contractors, and public authorities (Brazil, 2010). This conception breaks with the logic of transferring full responsibility to the State and recognizes waste management as a collective process that requires coordination and shared accountability among different actors. In practice, however, this shared responsibility has proven fragile, often restricted to the formal preparation of waste management plans, without translating into effective changes in productive routines or in the environmentally adequate destination of waste.

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These limitations become even more evident at the municipal level, where responsibilities for inspection, licensing, and final disposal are concentrated. Marotti, Pereira, and Pugliesi (2017) observe that, although the PNRS establishes clear guidelines, many municipalities face significant technical, institutional, and financial constraints, which compromise the implementation of efficient construction waste management systems. The absence or precariousness of Municipal Integrated Solid Waste Management Plans often results in fragmented and reactive responses, based on corrective actions and poorly aligned with the principles of prevention, reuse, and source reduction.

Insufficient enforcement further aggravates this scenario. Even when norms and planning instruments exist, the fragility of control mechanisms and the low application of sanctions favor the persistence of illegal practices, such as waste disposal in natural areas, valley bottoms, riverbanks, and vacant lots. Roth and Garcias (2011) highlight that such irregular disposal compromises urban drainage, intensifies erosive processes, contaminates soil, and degrades the landscape, constituting a problem that goes beyond the environmental dimension and directly affects the quality of urban space and living conditions.

In addition to institutional constraints, a deeply rooted culture of disposal persists within the construction sector, marked by the naturalization of waste and the low valuation of material reuse. Amadei et al. (2011) point out that this culture is associated both with a lack of specific technical training and with the absence of economic and educational incentives capable of encouraging more responsible practices. In this context, even materials with reuse or recycling potential are prematurely discarded, increasing the volume of waste generated and the environmental and social costs associated with its management.



Construction and demolition waste therefore does not constitute merely a technical management problem, but rather a multifaceted phenomenon involving environmental, social, public health, and landscape impacts. From an environmental standpoint, inadequate disposal contributes to the degradation of urban and peri-urban ecosystems; socially, it disproportionately affects populations living in peripheral areas; in public health terms, it favors the proliferation of disease vectors and area contamination; and, at the landscape level, it compromises the perception, use, and appropriation of urban space (Amadei et al., 2011; Gouveia, 2012). These effects demonstrate that the CDW problem concretely expresses the contradictions of the prevailing urban model and the limits of a sustainability that remains restricted to formal legal compliance.

Thus, although the Brazilian legal framework represents a significant advance, the gap between what is established in legislation and what materializes in urban territories reveals that construction waste management remains one of the main challenges of urban sustainability. Overcoming these limits requires not only the improvement of normative instruments, but also the transformation of productive practices, the strengthening of municipal institutional capacity, and the promotion of cultural changes that recognize waste not as inevitable, but as indicators of the choices that structure the production of urban space.

## 5 ENVIRONMENTAL EDUCATION, CONSTRUCTION CULTURE, AND PARADIGM SHIFT

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The complexity of the problems associated with construction and demolition waste demonstrates that the limits of urban sustainability cannot be addressed exclusively through normative instruments or isolated technical solutions. In this context, environmental education assumes a central role as a structuring axis of processes capable of promoting deeper transformations in the ways cities are produced, consumed, and inhabited. As established by the National Environmental Education Policy (Política Nacional de Educação Ambiental – PNEA), environmental education should be understood as a continuous and permanent process, oriented toward the construction of values, knowledge, attitudes, and competencies that contribute to environmental conservation and to the improvement of quality of life (Brazil, 1999). It is therefore a dimension that goes beyond punctual awareness-raising actions, constituting an ethical and political foundation for the reorientation of social practices.

Dias (2017) emphasizes that environmental education is not limited to the transmission of technical information or the dissemination of codes of conduct, but rather involves the formation of critical subjects capable of understanding the relationships between society and nature and of consciously intervening in the reality in which they are embedded. This approach acquires particular relevance in the construction sector, historically marked by productive practices that naturalize waste and tend to dissociate the act of building from its environmental and social impacts. By shifting the focus from mere normative compliance to critical reflection on productive processes, environmental education contributes to questioning the logic of disposal as something inevitable, opening space for more responsible practices throughout the entire life cycle of buildings.



However, one of the main obstacles to the effectiveness of environmental education lies in the predominance of technicist approaches, which reduce environmental issues to operational procedures, legal requirements, or standardized solutions. Techio (2014) warns that this instrumental perspective limits the scope of environmental education by disregarding the cultural, economic, and symbolic factors that sustain prevailing patterns of production and consumption. In the context of the construction industry, excessive emphasis on technical solutions—such as formal waste management or the adoption of so-called “cleaner” technologies—may obscure the need for deeper transformations in the values that guide the sector, leaving intact the productivist logic responsible for the massive generation of waste.

Overcoming these limits requires understanding environmental education as a process of cultural transformation, oriented toward changes in habits, values, and everyday practices. The Environmental Education and Social Communication Program (Programa de Educação Ambiental e Comunicação Social – PECS) reinforces this perspective by emphasizing the importance of shared responsibility among different social actors, encouraging practices that incorporate consumption reduction, material reuse, and the valorization of reuse (Brazil, 2018). In the construction sector, this implies rethinking not only construction site routines, but also the stages of project conception and planning, so that environmental criteria are incorporated as a constitutive part of the construction process rather than perceived as external impositions or mere bureaucratic requirements.

Gouveia (2012) deepens this debate by arguing that the sustainable management of solid waste depends largely on changes in consumption patterns and in society’s relationship with material goods. For the author, waste does not constitute merely a final disposal problem,

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but results directly from choices made throughout the production chain and the consumption cycle. In this sense, environmental education plays a strategic role by making explicit the connection between consumption, construction, and disposal, rendering visible impacts that remain hidden in everyday urban life. This understanding helps to break down the fragmentation between those who consume, those who build, and those who deal with waste, promoting a more integrated and critical reading of the problem.

By articulating environmental education, the construction industry, and solid waste, it becomes possible to understand that urban sustainability depends less on the adoption of isolated solutions and more on the construction of a shared environmental rationality (Marques; Benini, 2025). This rationality presupposes the internalization of values that recognize ecological limits, collective responsibility, and the ethical dimension of productive choices. In this sense, environmental education does not act as a mere complement to public policies, but as a structuring element of a broader paradigm shift, capable of reorienting the relationship between the production of urban space, resource consumption, and waste generation.

## 6 FINAL CONSIDERATIONS

The analysis developed throughout this study demonstrates that the issue of construction and demolition waste cannot be understood as an isolated deviation, a localized management problem, or an operational failure to be corrected through normative adjustments or technical improvements. On the contrary, it constitutes a concrete and persistent expression of the contradictions that permeate the contemporary model of urban space production, which is deeply anchored in productivist, linear, and socially unequal logics. In this sense, construction and demolition waste functions as a material indicator of a system that continues to operate under the premise of continuous expansion, intensified resource consumption, and the systematic externalization of environmental and social impacts.



Sustainability, as discussed in this article, reveals itself as a field marked by conceptual and political disputes whose institutionalization, although it has produced important normative advances, has not been able to promote, in a generalized manner, structural transformations in the ways cities are produced, consumed, and inhabited. The gap between normative discourse and effective productive practices—especially in the construction sector—exposes the limits of a sustainability that is often mobilized as legitimizing rhetoric, more oriented toward formal compliance than toward a critical revision of the foundations of the prevailing urban development model. In this context, the persistence of large-scale waste generation demonstrates that the incorporation of the language of sustainability has not been sufficient to challenge the material and symbolic bases that sustain the production of urban space.

The centrality of the construction industry in the urban environmental crisis reinforces this observation. By occupying a strategic position in economic and territorial dynamics, the sector not only reflects but also reproduces and deepens patterns of intensive natural resource use, predatory land occupation, and continuous waste generation. The approach based on the expanded production chain and the life cycle of buildings has shown that the environmental impacts associated with construction accumulate over time and across territories, rendering interventions restricted to the final disposal stage or corrective waste management insufficient.

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The problem of construction and demolition waste, therefore, cannot be dissociated from the technical, economic, and political choices that structure the sector from the earliest stages of design and planning.

Although the Brazilian normative framework—represented by the National Solid Waste Policy and CONAMA Resolution No. 307/2002—constitutes a significant advance in recognizing and regulating the issue, its effectiveness remains limited by institutional fragilities, particularly at the municipal level, and by the difficulty of breaking with a deeply entrenched culture of disposal. Shared responsibility, although provided for by law, has materialized unevenly and is often restricted to formal compliance with documentary requirements, without substantively altering productive practices and material flows that give rise to waste.

In this scenario, environmental education emerges not as a complementary solution or an auxiliary instrument, but as a structuring dimension of a broader paradigm shift. By moving the debate from a strictly technical sphere to the realm of culture, values, and collective choices, environmental education makes it possible to question the naturalization of waste, the dissociation between consumption, construction, and disposal, and the fragmentation of responsibilities along the production chain. This involves recognizing that the necessary transformation is not limited to the adoption of new technologies or the improvement of management practices, but requires the construction of an environmental rationality capable of critically reorienting the social practices that sustain the production of urban space.

Life cycle–based and circular economy approaches, when understood critically rather than instrumentally, help to make these contradictions explicit by demonstrating that construction and demolition waste is a constitutive part of the still-dominant linear model of production and consumption. Far from representing an automatic solution, these approaches reveal the limits of responses centered on recycling or punctual reuse, reinforcing the need for interventions that reach the stages of design, planning, and decision-making, where the material and energy flows that shape urban space are defined.



Thus, addressing the issue of construction and demolition waste requires recognizing that urban sustainability will not be achieved through marginal adjustments, but demands a critical revision of the very development model that guides contemporary urbanization. This is a challenge that involves ethical, political, and territorial choices, and that calls upon public authorities, the productive sector, and society as a whole to assume responsibility for the material consequences of space production. By highlighting the limits of normativity, the contradictions of productive practice, and the central role of environmental education, this study seeks to contribute to a debate that does not close itself off in ready-made solutions, but instead opens space for the collective construction of other ways of thinking, building, and inhabiting the city.

## REFERENCES

AGOPYAN, Vahan; JOHN, Vanderley M. **O desafio da sustentabilidade na construção civil**. São Paulo: Blucher, 2011.

ISSN 2318-8472, v. 14, n. 91, 2026

AMADEI, Daysa Ione Braga; PEREIRA, Juliana Alves; SOUZA, Rafael Alves de; MENEGUETTI, Karin Schwabe. A questão dos resíduos de construção civil: um breve estado da arte. **Revista NUPEM,** Campo Mourão, v. 3, n. 5, ago./dez. 2011.

AMARAL, Beatrice Fernandes do. A relação entre a construção civil e o meio ambiente: construções sustentáveis. **Revista Foco**, Curitiba (PR), v. 17, n. 5, p. 01–24, 2024.

BRASIL. Conselho Nacional do Meio Ambiente – CONAMA. **Resolução nº 307**, de 5 de julho de 2002. Estabelece diretrizes, critérios e procedimentos para a gestão dos resíduos da construção civil. Diário Oficial da União, Brasília, DF, 17 jul. 2002.

BRASIL. **Decreto nº 10.936**, de 12 de janeiro de 2022. Regulamenta a Lei nº 12.305/2010, que institui a Política Nacional de Resíduos Sólidos. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2022/decreto/D10936.htm. Acesso em: 30 jul. 2024.

BRASIL. **Lei Federal nº 12.305,** de 02 de agosto de 2010. Institui a Política Nacional de Resíduos Sólidos; altera a Lei nº 9.605, de 12 de fevereiro de 1998; e dá outras providências. Disponível em: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm. Acesso em: 05 set. 2014.

BRASIL. **Lei nº 9.795**, de 27 de abril de 1999. Dispõe sobre a educação ambiental, institui a Política Nacional de Educação Ambiental e dá outras providências. Diário Oficial da União, Brasília, DF, 28 abr. 1999.

BRASIL. Ministério do Meio Ambiente. **Programa de Educação Ambiental e Comunicação Social – PECS**. Brasília: MMA, 2018.

DIAS, Genebaldo Freire. **Educação ambiental: princípios e práticas**. 13. ed. São Paulo: Gaia, 2017.

GEISSDOERFER, Martin; SAVAGET, Paulo; BOCKEN, Nancy M. P.; HULTINK, Erik Jan.
The Circular Economy – A new sustainability paradigm? **Journal of Cleaner Production,** v. 143, p. 757–768, 2017.
DOI: https://doi.org/10.1016/j.jclepro.2016.12.048.

GOUVEIA, Nelson. Resíduos sólidos urbanos: impactos socioambientais e perspectiva de manejo sustentável com inclusão social. **Revista Ciência & Saúde Coletiva**, Rio de Janeiro, v. 17, n. 6, p. 1503–1510, jun. 2012.

IAQUINTO, Beatriz Oliveira. A Sustentabilidade e Suas Dimensões. **Revista da ESMESC**, v. 25, n. 31, p. 157–178, 2018. DOI: http://dx.doi.org/10.14295/revistadaesmesc.v25i31.p157.

KIRCHHERR, Julian; REIKE, Denise; HEKKERT, Marko.
Conceptualizing the circular economy: An analysis of 114 definitions. **Resources, Conservation and Recycling**, v. 127, p. 221–232, 2017.
DOI: https://doi.org/10.1016/j.resconrec.2017.09.005.

KRAEMER, Maria Elisabeth Pereira. **Responsabilidade Social – uma alavanca para sustentabilidade.** Disponível em: https://cdn.ambientes.ambientebrasil.com.br/wp-content/uploads/anexos/457.pdf. Acesso em: 09 jun. 2023.

LINARES, Pedro. **El concepto marco de sostenibilidad: variables de un futuro sostenible.** Madrid: Universidad Pontificia Comillas, 2012. Disponível em: https://pacua.iit.comillas.edu/pedro/documents/sostenibilidadeAsinja.pdf. Acesso em: 10 mar. 2023.

MACIEL, Marco Aurélio Diniz; ANDREAZZI, Márcia Aparecida; BARROS JUNIOR, Carlos; LIZAMA, Maria de Los Angeles Perez; GONÇALVES, José Eduardo. Emissões de gases de efeito estufa na construção civil. **Revista da Universidade Vale do Rio Verde**, v. 16, n. 1, 2018. ISSN: 1517-0276 / E-ISSN: 2236-5362.

MAROTTI, Ana Cristina Bagatini; PEREIRA, Gisele Sant'Ana Fiorini; PUGLIESI, Erica. Questões contemporâneas na gestão pública dos resíduos sólidos: análise dos princípios da Política Nacional de

ISSN 2318-8472, v. 14, n. 91, 2026

Resíduos Sólidos a partir de seus objetivos e instrumentos. **Revista de Políticas Públicas**, São Luís, v. 21, n. 1, p. 339–364, 2017.

MARQUES, Maurício Dias; BENINI, Sandra Medina. Construção sustentável em Mato Grosso: paradoxos entre normatividade e efetividade. **Boletim de Conjuntura (BOCA),** Boa Vista, v. 24, n. 73, p. e8048, 2025. DOI: 10.56238/bocav24n73-022. Disponível em: https://revistaboletimconjuntura.com.br/boca/article/view/8048. Acesso em: 02 jan. 2026.

ORTIZ, Oscar; CASTELLS, Francesc; SONNEMANN, Guido.
Sustainability in the construction industry: A review of recent developments based on LCA. **Construction and Building Materials**, v. 23, n. 1, p. 28–39, 2009.
DOI: https://doi.org/10.1016/j.conbuildmat.2007.11.012 .

PLESSIS, Chrisna du. **Agenda 21 for Sustainable Construction in Developing Countries.** CIB and UNEP by CSIR Building and Construction Technology, Pretoria, 2002. ISBN 0-7988-5540-1.

PURCHASE, Callun Keith; AL ZULAYQ, Dhafer Manna; O'BRIEN, Bio Talakatoa; KOWALEWSKI, Matthew Joseph; BERENJIAN, Aydin; TARIGHSALESMI, Amir Hossein; SEIFAN, Mostafa. Circular economy of construction and demolition waste: a literature review on lessons, challenges, and benefits. ***Materials*****,** v. 15, n. 1, p. 76, 2022. DOI: https://doi.org/10.3390/ma15010076 .

RELATÓRIO BRUNDTLAND – **Nosso Futuro Comum. Instituto EcoBrasil – Ecoturismo – Edodesenvolvimento.** Disponível em: Nosso Futuro Comum - Relatório Brundtland (ecobrasil.eco.br). Acesso em: 09 fev. 2023. Revista Metropolitana de Sustentabilidade, 2020, v. 10, n. 2, p. 5–31.

ROSADO, L. P.; VITALE, P.; PENTEADO, C. S. G.; ARENA, U. Life cycle assessment of construction and demolition waste management in a large area of São Paulo State, Brazil. **Waste Management**, v. 85, p. 477–489, 2019. DOI: 10.1016/j.wasman.2019.01.011.

ROTH, Caroline das Graças; GARCIAS, Carlos Mello. Construção civil e a degradação ambiental. **Desenvolvimento em Questão**, v. 7, n. 13, p. 111–128, out. 2011. DOI: https://doi.org/10.21527/2237-6453.2009.13.111-128.

SHARMA, Aashish; SAXENA, Abhishek; SETHI, Muneesh; SHREE, Venu; VARUN. Life cycle assessment of buildings: a review. **Renewable and Sustainable Energy Reviews,** v. 15, n. 1, p. 871–875, 2011. DOI: 10.1016/j.rser.2010.09.008.

TECHIO, Andréa. **Educação ambiental: fundamentos teóricos e metodológicos.** Curitiba: InterSaberes, 2014.



## DECLARATIONS

## AUTHOR CONTRIBUTIONS

- **Study Conception and Design:** Maurício Dias Marques and Sandra Medina Benini
- **Data Curation:** Maurício Dias Marques
- **Formal Analysis:** Maurício Dias Marques and Sandra Medina Benini
- **Funding Acquisition:** None
- **Investigation:** Maurício Dias Marques
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- **Supervision:** Sandra Medina Benini

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**DECLARATION OF CONFLICTS OF INTEREST**

I/We, Maurício Dias Marques and Sandra Medina Benini, declare that the manuscript entitled **"Construction and Demolition Waste and the Contradictions of Sustainability"**:

1. **Financial Relationships:** Has no financial relationships that could influence the results or interpretation of the work. No funding institution or entity was involved in the development of this study.
2. **Professional Relationships:** Has no professional relationships that could impact the analysis, interpretation, or presentation of the results. No professional relationship relevant to the content of this manuscript was established.
3. **Personal Conflicts:** Has no personal conflicts of interest related to the content of the manuscript. No personal conflict related to the content was identified.

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