

**Public Housing Works and the SDGs of the 2030 Agenda: A Perspective
on Tenders in the State of São Paulo****Simone Mariko Nakata**

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Obras Públicas de Habitação e os ODS da Agenda 2030: Uma perspectiva sobre Licitações no Estado de São Paulo

RESUMO

Objetivo - Identificar a aderência dos requisitos e cláusulas dos editais de licitação de obras públicas de habitação do Estado de São Paulo aos critérios ambientais, com ênfase no normativo nacional.

Metodologia - O estudo adota uma abordagem qualquantitativa e descritiva. Para o levantamento dos editais de licitação, foram utilizadas as bases de dados da Imprensa Oficial do Estado de São Paulo e, subsidiariamente, da Companhia de Desenvolvimento Habitacional e Urbano do Estado de São Paulo (CDHU). A pesquisa documental empregou o método de análise de conteúdo, segundo Bardin (2016), com o uso do software Atlas.ti para identificar, codificar e categorizar as Unidades de Registro (UR) e de Contexto (UC). A categorização foi feita por níveis de exigências, permitindo o confronto com as demais literaturas que estudaram as Compras Públicas Verdes (GPP), com fundamento nos critérios propostos pela Comissão Europeia.

Originalidade/relevância – O estudo auxilia na identificação de oportunidades de melhoria na implementação de critérios ambientais em licitações de obras públicas de habitação, promovendo a sustentabilidade na construção civil e alinhando-se aos Objetivos de Desenvolvimento Sustentável ao contribuir para cidades mais sustentáveis e resilientes.

Resultados – A análise dos editais revelou baixa aderência das cláusulas e requisitos aos critérios ambientais, com predominância de exigências genéricas ou ausência de critérios específicos, focando principalmente na caracterização dos materiais em detrimento de processos construtivos mais amplos. Apurou-se um percentual de aderência ao nível de exigência 0 (ausência de critérios) de 41,51%; de 22,22% ao nível de exigência 1 (critérios genéricos); 36,27% ao nível de exigência 2 (critérios principais) e 0% ao nível de exigência 3 (critérios abrangentes). Observou-se que os normativos brasileiros focam nas características do objeto, enquanto as diretrizes europeias são mais amplas, com ênfase em rótulos e certificações, evidenciando também a necessidade de um indicador global para avaliar a eficácia das Compras Públicas Sustentáveis (CPS).

Contribuições Teóricas/Metodológicas – Aplicação da análise de conteúdo de Bardin (2016) para avaliar a aderência dos editais de licitação de obras públicas de habitação aos critérios ambientais, com o uso do software Atlas.ti para codificação e categorização, comparando-os aos normativos nacionais e diretrizes da União Europeia.

Contribuições sociais e ambientais – Os resultados do estudo reforçam a necessidade de inclusão de critérios ambientais nacionais mais amplas, como as já praticadas nas licitações realizadas em países da União Europeia, considerando o ciclo de vida dos materiais e a exigência de rotulagens ecológicas. Este estudo contribui para a compreensão da implementação de políticas públicas de sustentabilidade no setor da construção civil brasileira, evidenciando a necessidade de aprimorar a legislação e as práticas de licitação.

PALAVRAS-CHAVE: Licitação. Sustentabilidade. Obras Públicas. Habitação.

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Public Housing Works and the SDGs of the 2030 Agenda: A Perspective on Tenders in the State of São Paulo

ABSTRACT

Objective – To identify the adherence of requirements and clauses in public housing works bidding notices in the State of São Paulo to environmental criteria, with an emphasis on national regulations.

Methodology – The study adopts a qualitative and quantitative descriptive approach. To gather the bidding notices, databases from the Official Press of the State of São Paulo and, subsidiarily, the São Paulo State Housing and Urban Development Company (CDHU) were used. The documentary research employed the content analysis method, according to Bardin (2016), using the Atlas.ti software to identify, code, and categorize the Recording Units (UR) and Context Units (UC). Categorization was conducted by levels of requirements, allowing comparisons with other studies on Green Public Procurement (GPP) based on the criteria proposed by the European Commission.

Originality/Relevance – The study assists in identifying opportunities to improve the implementation of environmental criteria in public housing works bidding processes, promoting sustainability in civil construction and aligning with the Sustainable Development Goals by contributing to more sustainable and resilient cities.

Results – The analysis of the bidding notices revealed low adherence of clauses and requirements to environmental criteria, with a predominance of generic requirements or the absence of specific criteria, focusing mainly on material characterization rather than broader construction processes. Adherence percentages were as follows: 41.51% at requirement level 0 (absence of criteria), 22.22% at level 1 (generic criteria), 36.27% at level 2 (main

criteria), and 0% at level 3 (comprehensive criteria). It was observed that Brazilian regulations focus on object characteristics, while European guidelines are broader, emphasizing labels and certifications, also highlighting the need for a global indicator to assess the effectiveness of Sustainable Public Procurement (SPP).

Theoretical/Methodological Contributions – Application of Bardin's (2016) content analysis to assess the adherence of public housing works bidding notices to environmental criteria, using the Atlas.ti software for coding and categorization, and comparing them with national regulations and European Union guidelines.

Social and Environmental Contributions – The results of the study reinforce the need to include broader national environmental criteria, such as those already practiced in tenders held in European Union countries, considering the life cycle of materials and the requirement for eco-labeling. This study contributes to understanding the implementation of public sustainability policies in the Brazilian construction sector, highlighting the need to improve legislation and bidding practices.

KEYWORDS: Bidding. Sustainability. Public Works. Housing.

Las obras públicas de vivienda y los ODS de la Agenda 2030: una perspectiva sobre las licitaciones en el Estado de São Paulo

RESUMEN

Objetivo – Identificar la adherencia de los requisitos y cláusulas de los pliegos de licitación de obras públicas de vivienda del Estado de São Paulo a los criterios ambientales, con énfasis en la normativa nacional.

Metodología – El estudio adopta un enfoque cuali-cuantitativo y descriptivo. Para recopilar los pliegos de licitación, se utilizaron las bases de datos de la Imprenta Oficial del Estado de São Paulo y, de manera subsidiaria, de la Compañía de Desarrollo Habitacional y Urbano del Estado de São Paulo (CDHU). La investigación documental aplicó el método de análisis de contenido, según Bardin (2016), con el uso del software Atlas.ti para identificar, codificar y categorizar las Unidades de Registro (UR) y de Contexto (UC). La categorización se realizó por niveles de exigencias, permitiendo comparaciones con otras investigaciones sobre Compras Públicas Verdes (GPP), basadas en los criterios propuestos por la Comisión Europea.

Originalidad/Relevancia – El estudio ayuda a identificar oportunidades de mejora en la implementación de criterios ambientales en licitaciones de obras públicas de vivienda, promoviendo la sostenibilidad en la construcción civil y alineándose con los Objetivos de Desarrollo Sostenible al contribuir a ciudades más sostenibles y resilientes.

Resultados – El análisis de los pliegos de licitación reveló una baja adherencia de las cláusulas y requisitos a los criterios ambientales, con predominio de exigencias genéricas o ausencia de criterios específicos, centrándose en la caracterización de materiales en lugar de procesos constructivos más amplios. Se identificaron los siguientes porcentajes de adherencia: 41,51% en el nivel 0 (ausencia de criterios), 22,22% en el nivel 1 (criterios genéricos), 36,27% en el nivel 2 (criterios principales) y 0% en el nivel 3 (criterios amplios). Se observó que las normativas brasileñas se enfocan en las características del objeto, mientras que las directrices europeas son más amplias y destacan el uso de etiquetas y certificaciones, evidenciando también la necesidad de un indicador global para evaluar la eficacia de las Compras Públicas Sostenibles (CPS).

Contribuciones Teóricas/Metodológicas – Aplicación del análisis de contenido de Bardin (2016) para evaluar la adherencia de los pliegos de licitación de obras públicas de vivienda a los criterios ambientales, utilizando el software Atlas.ti para la codificación y categorización, comparándolos con las normativas nacionales y las directrices de la Unión Europea.

Contribuciones Sociales y Ambientales – Los resultados del estudio refuerzan la necesidad de incluir criterios ambientales nacionales más amplios, como los que ya se practican en las licitaciones de los países de la Unión Europea, considerando el ciclo de vida de los materiales y la exigencia del etiquetado ecológico. Este estudio contribuye a la comprensión de la implementación de políticas públicas de sostenibilidad en el sector brasileño de la construcción, destacando la necesidad de mejorar la legislación y las prácticas de licitación.

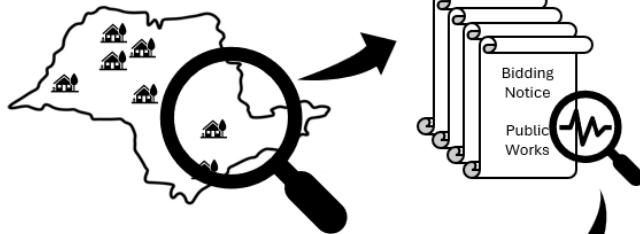
PALABRAS CLAVE: Licitación. Sostenibilidad. Obras Públicas. Vivienda.

GRAPHIC SUMMARY

Content Analysis

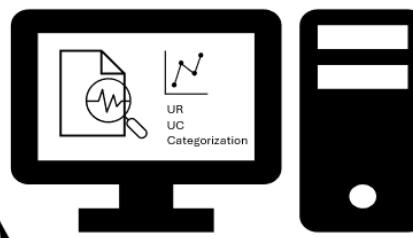
Pre-Analysis

- Corpus Formation;
- Skim Reading;
- Representativeness, Completeness and Relevance.



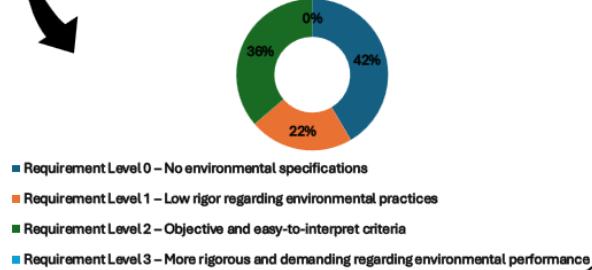
Material Exploration

- Coding:
 - UR: Word;
 - UC: Context.
- Categorization.



Result Processing

- Interpretation or inferences.



1 INTRODUCTION

Environmental conservation, as guaranteed by Article 225 of the 1988 Brazilian Constitution, is a right that imposes on both the government and society the responsibility to protect and preserve natural resources for present and future generations. This principle has been reinforced by national regulations and international commitments, such as the 2030 Agenda, adopted by the United Nations (UN) in 2015, which outlines 17 Sustainable Development Goals (SDGs) to address global challenges (UN, 2015).

Among the SDGs, Goal 12, which focuses on responsible consumption and production, emphasizes Target 12.7, promoting sustainable public procurement practices. This target encourages governments to adopt policies that drive structural changes in consumption and production patterns by incorporating environmental criteria into public bidding processes (UN, 2015). This approach is strategic, as government procurement represents a significant portion of global GDP, according to the Organisation for Economic Cooperation and Development (OECD, 2021).

However, the construction sector remains one of the largest contributors to environmental degradation, accounting for 38% of global energy-related CO₂ emissions, as reported by the United Nations Environment Programme (UNEP, 2020). The 6th Assessment Report of the IPCC (2022) underscores the urgent need for immediate and structural changes in the sector's practices to mitigate irreversible climate impacts. In this context, sustainable public procurement emerges as a critical tool to align the construction sector with sustainable development principles.

The depletion of natural resources has spurred discussions on urban sustainability. In Brazil, there is a legal framework that supports urban sustainability, but appropriate methodologies are needed to reduce subjectivity in sustainability assessments (Leal *et al.*, 2022).

Public governance plays a central role in promoting sustainability, and the recently enacted General Bidding Law (Law No. 14.133/2021) strengthens the possibility of incorporating environmental criteria into bidding documents, marking significant regulatory progress (COSTA; MOTTA, 2020). The adoption of such criteria in public housing projects is particularly relevant, given the sector's socioeconomic and environmental impacts and its contribution to achieving the SDGs.

Given the urgency of implementing actions to meet the 2030 Agenda targets, this study sought to answer the following research question: **What is the level of adherence of public housing construction bidding notices in the state of São Paulo to environmental criteria based on national regulations?** By addressing this question, the study aims to contribute to understanding the alignment between São Paulo's public housing bidding documents and environmental guidelines, while also offering insights into integrating sustainability criteria into the construction sector.

1.1 Objective

The general objective was to assess the adherence of requirements and clauses in

public housing construction bidding notices in the state of São Paulo to environmental criteria, based on national regulations.

2 THEORETICAL FRAMEWORK

2.1 Public Works Bidding: Legal Aspects

Public works generally require a bidding process to ensure the most advantageous proposal for direct and indirect public administration (PAULO et al., 2013). This requirement is stipulated in Article 37, Item XXI of the 1988 Federal Constitution, although in some cases, contracts may be awarded without prior bidding through exemptions or waivers.

The Federal Law No. 14.133/2021 is the new general regulation governing public bidding and contracting. Previously, the applicable legislation was Federal Law No. 8.666/1993, supplemented by other legal instruments, such as Law No. 10.520/2002 (on pre-qualification bidding), Law No. 12.462/2011 (establishing the Differentiated Procurement Regime, RDC), Law No. 13.303/2016 (governing public companies and mixed-economy companies), and Laws No. 8.987/1995 and No. 11.079/2004 (regulating common and special concessions, respectively) (MARINELA, 2021).

Public officials must comply with legal regulations when conducting bidding processes and may be held accountable for any damages caused to third parties, with the right to recourse in cases of intent or negligence. Notably, the principle of national sustainable development was introduced into Law No. 8.666/1993 by Law No. 12.349/2010 and was incorporated into the new Bidding Law, aligning with Article 225 of the 1988 Federal Constitution, which mandates the government to protect the environment for current and future generations.

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2.2 Public Housing Works

According to Justen (2021), public housing works have specific preparatory, bidding, and contracting procedures. The author defines a public work as a human activity aimed at permanently altering the natural environment, focusing on construction on real estate and requiring oversight by engineers under specific legal regulations.

The Brazilian Federal Court of Accounts (TCU), in its 2014 public works manual, defines a public work as any construction, manufacturing, renovation, recovery, or expansion activity carried out directly by a public agency or indirectly through third-party contracts awarded via bidding. Engineering services, as per Confea Resolution No. 1.116/2019, involve intellectual, scientific, and technical solutions and should not be confused with engineering works.

Studies on housing inadequacy highlight deficiencies that prevent homes from providing a good quality of life for residents, measured by the building, urban infrastructure, and property titling (ROSSO, SOUZA, & SEABRA, 2024).

In this study, the focus is on engineering works for the construction of low-income housing. According to Law No. 8.666/1993, contracting such works generally requires

providing bidders with a detailed Basic Project, except in specific cases provided by law. This project must include sufficient technical elements and an appropriate level of precision to characterize the work or service to be performed.

According to the Brazilian Institute of Public Works Auditing (IBRAOP) Technical Guidance IBR 001/2006, Basic Project components must be developed by legally qualified professionals, with a registered Technical Responsibility Annotation (ART) and identification of the author on each graphic piece and document produced.

2.3 Environmental Criteria in Public Procurement

To align administrative actions with society's evolving needs and improve bidding procedures, the Ministry of Planning, Budget, and Management issued Normative Instruction No. 01/2010, in accordance with Article 28, Annex I, of Decree No. 7.063/2010. This instruction represents an initial step toward implementing a policy aimed at ecosystem preservation (SOARES et al., 2017).

Although not mandatory for states, Normative Instruction No. 01/2010 provides objective parameters for incorporating sustainability requirements into public works bidding notices, offering key environmental guidelines for Brazil's bidding processes.

In December 2010, Law No. 12.349 amended the then-general bidding law (Law No. 8.666/1993), adding the principle of promoting sustainable development to Article 3, which outlines public contracting principles. Additionally, Federal Decree No. 7.746/2012 was enacted to regulate sustainable development in public procurement, establishing guidelines for implementing Sustainable Public Procurement (SPP) in Brazil.

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Internationally, Directive No. 2014/24/EU, published on February 26, 2014, by the European Parliament and Council, aims to standardize public procurement provisions in the European Union. This directive establishes general principles, contract rules, special procurement regimes, governance, and competencies (EU, 2014).

Complementing this directive, the European Commission published specific documents to guide Green Public Procurement (GPP). According to the Green Public Procurement Manual (EC, 2016), these documents categorize sustainability criteria by product and service groups, facilitating their application in bidding documents and promoting the integration of environmental standards into procurement processes.

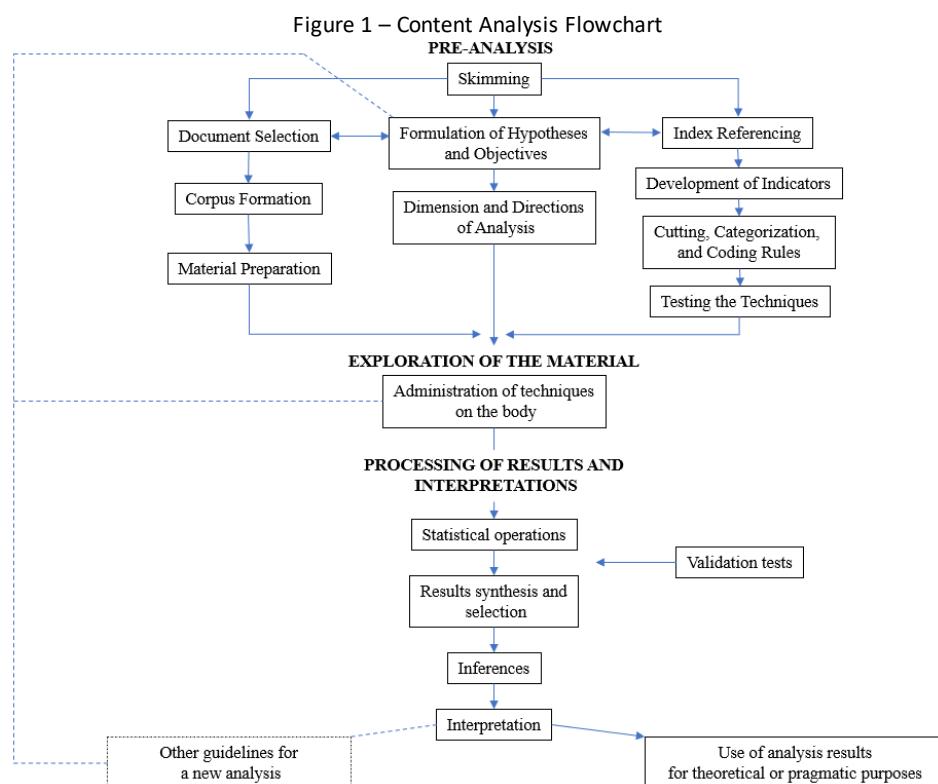
3 METHODOLOGY

3.1 Application of Content Analysis to Bidding Documents

The study adopted a quali-quantitative, descriptive approach, grounded in content analysis to evaluate bidding notices. The documentary research focused on public housing construction bidding documents in the state of São Paulo, systematically analyzed to identify elements related to environmental criteria.

The content analysis followed Bardin's (2016) methodology, structured in three phases: pre-analysis, material exploration, and result interpretation. In the pre-analysis phase, documents were selected based on predefined criteria, and initial hypotheses were formulated to guide the analysis. The material exploration phase involved identifying and categorizing clauses and requirements related to sustainability in the bidding documents. Finally, results were processed and interpreted to infer the alignment of the documents with national environmental guidelines.

This methodology enabled a detailed analysis of the bidding documents, identifying gaps and opportunities for expanding the use of environmental criteria in public housing procurement. It provided a comprehensive view of how the public sector can integrate sustainable practices into the contracting of works and services, contributing to the 2030 Agenda goals. The structure proposed by Bardin (2016) is illustrated in Figure 1.



Source: Bardin, 2016.

The analyzed bidding documents were those issued between January 1, 2022, and December 31, 2022. The sample was selected using the Atlas.ti software, which facilitated the identification of Units of Record (UR) based on keywords. The semantic context was then defined to form Units of Context (UC), enabling a deeper analysis. The UC were categorized into levels of environmental requirements, allowing comparison with previous studies on Green Public Procurement (GPP) using criteria proposed by the European Commission as a reference.

This approach ensured a systematic and consistent analysis, evaluating not only the presence of environmental criteria but also the level of adherence and rigor applied in each

bidding notice. Categorizing by levels of requirement was crucial for identifying progress and gaps in the use of sustainable practices in public housing procurement.

3.2 Pre-Analysis – Research Corpus Constitution

The systematic collection of bidding documents relied on the database of the Official Press of the State of São Paulo, supplemented by the São Paulo State Housing and Urban Development Company (CDHU) database for accessing annexes not available in the primary source.

The Official Press search tool was used to filter bidding notices by area, subarea, status, and period, according to predefined criteria (see Table 1). This selection was guided by the research objectives, ensuring sample representativeness.

It is worth mentioning that pre-analysis was essential for establishing initial parameters that guided both the exploration of the material and subsequent inferences.

Table 1 – Search and Selection Criteria for Bidding Documents in Databases

Database Filter	Scope
Area	Public Works
Subarea	Housing
Status	Closed
Period	01/01/2022 a 31/12/2022

Source: Authors, 2023.

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After initial screening, a detailed review of each bidding document's subject was conducted to select those exclusively related to the complete construction of housing units. Documents related to the completion of unfinished works were excluded to avoid duplication and ensure focus on the full construction process. This exclusion was justified, as unfinished works may not accurately reflect environmental criteria applicable to complete construction.

From this selection, 53 bidding notices were identified. Due to the large number, a sampling strategy was necessary to enable detailed analysis. Stratified sampling was used, as described by Gil (2002), involving the selection of a sample from each subgroup or stratum defined by a specific characteristic.

The selected bidding notices were classified into three categories based on similar housing typologies, as defined by the CDHU Technical Manual and ABNT NBR 15575-1:2021 (CDHU, 2018), as shown in Table 2. The sample was derived by analyzing the subject of each bidding notice, separating those aimed at constructing single-family housing, vertical multi-family housing, and horizontal multi-family housing.

Table 2 – Classification of Bidding Notices by Housing Type.

Classification	Type of housing unit	Notices for the year 2022
Class 01 Notice	Single-Family Residential Buildings	32
Class 02 Notice	Vertical Multifamily Housing Buildings	17
Class 03 Notice	Horizontal Multifamily Housing Buildings	04

Source: Authors, 2023.

To represent each class, one bidding document with the most recent tender opening date was selected for each category: Class 01 (Bidding Notice No. 166/2022), Class 02 (Bidding Notice No. 088/2022), and Class 03 (Bidding Notice No. 170/2022). This methodology was based on Giamberardino et al. (2023) but adapted to the specific focus of this study.

3.3 Material Exploration: Coding

Units of Record (UR) were established based on environmental criteria identified through bibliographic studies. These criteria were grouped into two main areas: company competencies and technical specifications, as proposed by Giamberardino et al. (2023), the Procura+ Manual by ICLEI (2015), and the National Guide to Sustainable Procurement by the Brazilian Attorney General's Office (AGU).

Technical specifications were subdivided into six categories aligned with Decree No. 7.746/2012, amended by Decree No. 9.178/2017. Each category included environmental criteria from Normative Instruction No. 01/2010, totaling 14 criteria grouped into six thematic sets, as per the decree's guidelines, enabling a structured analysis of the bidding notices.

The categorization of technical specifications and distribution of UR were critical for establishing an analytical standard and ensuring data consistency. Table 3 details the six categories, associated environmental criteria, and respective Units of Record (UR), providing a clear overview of the analyzed elements.

Table 3 – Units of Record by Environmental Criterion

Environmental category	Environmental Criterion	Unit of Record (UR)
I. Company Competences (GIAMBERARDINO <i>et al.</i> , 2023; ICLEI, 2015; BRASIL, 2020)	01. Inclusion of sustainability criteria in the qualification requirements (GIAMBERARDINO, 2023; ICLEI, 2015; BRAZIL, 2020) 02. Inclusion of sustainability criteria in evaluation criteria (GIAMBERARDINO, 2023; ICLEI, 2015; BRAZIL, 2020)	Certificate, certification, attestation, sample, and technical report. Technique and technique and price.
II. Greater efficiency in the use of the energy resources (BRAZIL, 2012)	03. Use of mechanical or efficient air conditioners (BRAZIL, 2010); 04. Lighting automation (BRAZIL, 2010); 05. Use of high-efficiency fluorescent lamps (BRAZIL, 2010); 06. Use of solar energy or other clean energy (BRAZIL, 2010); 07. Use of individual energy consumption meters (BRAZIL, 2010);	Air conditioning, air conditioning, and cooling Automation, automate, and sensor. Fluorescent, LED, and high-performance. Renewable energy, solar energy, solar heating, solar heater, photovoltaic, and boiler. Meter.
III. Greater efficiency in the use of the water resources (BRAZIL, 2012)	08. Use of individual water consumption meters 09. Reuse and treatment of generated effluent (BRAZIL, 2010); 10. Rainwater harvesting (BRAZIL, 2010);	Meter. Reuse, treatment, effluent, and sewage treatment plant. Harvesting, rainwater, rain, and capture.
IV. Low impact on natural resources (BRAZIL, 2012)	11. Proof that the bidder adopts sustainable disposal or recycling practices for goods that are no longer usable for the reuse process (BRAZIL, 2010); 12. Use of standards from the National Institute of Metrology, Standardization and Industrial Quality (INMETRO) and ISO 14000 standards from the International Organization for Standardization, related to environmental management systems (BRAZIL, 2010);	Discard, disposal, disposal, disposal, recycling, recycle, reuse, and reuse. INMETRO, ISO e 14.000.
V. Local use of resources (BRAZIL, 2012)	13. Locally sourced labor, materials, technologies, and raw materials (BRAZIL, 2010);	Local origin, labor, resources, materials, technology, and raw materials.
VI. Use of forest products of controlled origin (BRAZIL, 2012)	14. Proof of Wood Origin (BRAZIL, 2010);	Certificate, certification, attestation, CADMADEIRA, and wood origin.
VII. Sustainable sourcing of natural resources (BRAZIL, 2012)	15. Use of recyclable, reused, and biodegradable materials (BRAZIL, 2010); 16. Mandatory use of recycled aggregates in contracted works, whenever recycled aggregates are available, have the capacity to supply them, and are at a lower cost than natural aggregates (BRAZIL, 2010);	Recycling, recyclable, recycle, reuse, reuse, reusable, biodegradable, and biodegrade. Aggregate.

Source: Authors, 2023.

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3.4 Material Exploration: Categorization

The categorization of environmental criteria followed the European Commission's (2016) recommendations, with adaptations from Testa *et al.* (2016) and

PricewaterhouseCoopers (2009). This approach ensured a systematic structure, guaranteeing consistency and effectiveness in evaluating environmental aspects in the bidding documents.

The European Commission's Green Public Procurement Manual recommends categorizing environmental criteria into two levels: "Main" and "Comprehensive." This structure facilitates practical application and enhances sustainability promotion efficiency (EC, 2016).

Testa et al. (2016) introduced the "Generic Criteria" category, reflecting less rigorous environmental criteria in Italian Green Public Procurement, which could lead to less sustainable procurement. These Generic Criteria represent a lower level of sustainability rigor.

The "non-ecological criterion" (absence of environmental criteria) was also adopted by Testa et al. (2016) and PricewaterhouseCoopers (2009) in their study of environmental criteria in GPP in the Green-7 countries (Austria, Denmark, Finland, Germany, Netherlands, Sweden, and the United Kingdom), recognized for high sustainability rates.

Table 4 presents the categories applied to the Units of Record/Context, detailing the criteria used for categorization and their descriptions. This categorization was essential for identifying the level of environmental rigor in the bidding notices and enabling comparisons with international sustainability standards.

Table 4 – Categories Applied to Units of Record/Context Aligned with Analyzed Environmental Criteria

Categorization	Criteria	Description
Requirement Level 0	Lack of criteria (TESTA et al., 2016; PWC, 2009)	Indication that environmental specifications were not met
Requirement Level 1	Generic Criteria (TESTA et al., 2016; Giamberardino et al., 2023)	The term "generic criteria" refers to criteria that take into account certain environmental factors but are not as rigorous or demanding as the main criteria. Simply put, generic criteria do not impose such stringent standards regarding adherence to environmental practices.
Requirement Level 2	Main Criteria (TESTA et al., 2016; CE, 2016; PWC, 2009; Giamberardino et al., 2023)	The main objective of the main criteria is to streamline the implementation of Green Public Procurement by placing emphasis on crucial aspects of the ecological impact of a product or service. The intention is to reduce the administrative burden on companies, ensuring that the assessment and compliance with environmental standards becomes a simpler process.
Requirement Level 3	Comprehensive Criteria (TESTA et al., 2016; CE, 2016; PWC, 2009; Giamberardino et al., 2023)	Authorities seeking to improve environmental and innovation objectives use comprehensive criteria that cover a broader range of environmental performance aspects and higher levels of sustainability. These criteria are designed to be more rigorous and demanding, emphasizing a commitment to sustainability and minimizing environmental impact.

Source: Authors, 2023.

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4 ANALYSIS OF RESULTS AND DISCUSSION

4.1 Analysis of Environmental Criteria and Determination of Adherence Levels

The analysis of Units of Record (UR) and Units of Context (UC) from the 2022 São Paulo public housing bidding notices enabled categorization into different levels of requirement. The frequency of categorization followed the methodology of Giamberardino et al. (2023), where, if a UR meets two levels simultaneously, the higher level prevails. The results are presented in Table 1, showing the adherence of Class 01, 02, and 03 bidding notices to the

established environmental criteria levels.

Table 1 – Categorization by Level of Requirement per Environmental Criterion

Env. Cat	Environmental Criteria	Categorization – Notices Class 01, 02 and 03			
		Requirement Level 00	Requirement Level 01	Requirement Level 02	Requirement Level 03
I	01. Qualification Requirements	1	0	2	0
	02. Judging Criteria	3	0	0	0
II	03. Use of Mechanical or Efficient Air Conditioners	3	0	0	0
	04. Lighting Automation	3	0	0	0
	05. Use of High-Efficiency Light Bulbs	0	0	3	0
	06. Use of Renewable Energy	0	0	3	0
	07. Use of Individual Energy Meters	0	0	3	0
III	08. Use of Individual Water Meters	2	0	1	0
	09. Effluent Reuse and Treatment	0	3	0	0
	10. Rainwater Harvesting	3	0	0	0
IV	11. Sustainable Disposal Practices	0	3	0	0
	12. Use of INMETRO and ISO 14000 standards	0	0	3	0
V	13. Use of Locally Sourced Resources	3	0	0	0
VI	14. Proof of Wood Origin	0	0	3	0
VII	15. Use of Recyclable, Reused, and Biodegradable Materials	0	3	0	0
	16. Use of Recycled Aggregates	3	0	0	0
TOTAL		21	9	18	0

Source: Authors, 2023.

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Among the 16 environmental criteria evaluated, six were categorized as Level 0 (absence of criteria), three as Level 1 (Generic Criteria), and seven as Level 2 (Main Criteria). No criteria reached Level 3 (Comprehensive Criteria).

The absence of criteria related to evaluation criteria, efficient air conditioners, lighting automation, local resources, and recycled aggregates highlights the low adherence to environmental standards. The predominance of Level 0 (41.51%) underscores this gap.

Abreu (2016) attributes this to the complexity of Brazil's Sustainable Public Procurement legal framework, which may discourage public officials from including restrictive environmental requirements due to concerns about limiting competition. However, where clauses and requirements were present, adherence was often generic (Level 1), though Level 2 criteria were more prevalent, indicating progress. Clear and objective criteria, as noted by Abreu (2016), are essential for successful Green Public Procurement.

For qualification requirements, Class 01 and 02 bidding notices required experience in renewable energy activities, such as photovoltaic systems. Similarly, Giamberardino et al. (2023) found environmental criteria in the evaluation of company competencies in federal road construction bids from 2006 to 2021.

Table 2 summarizes the categorization by bidding notice class, highlighting the

predominance of Levels 0 and 2 and the absence of Level 3 criteria.

Table 2 – Categorization by Bidding Notice Class

Sample	Requirement Level 00	Requirement Level 01	Requirement Level 02	Requirement Level 03
Class 01	7	4	7	0
Class 02	8	4	6	0
Class 03	9	4	5	0
Total	24	12	18	0

Source: Authors, 2023.

4.2 Comparison with Studies in European Union Countries

Comparisons with international studies (Figures 2 and 3) reveal significant differences in environmental criteria adherence, especially those conducted in European Union countries. While in this study 41.51% of São Paulo's bidding documents were categorized as Level 0, Green-7 countries (Austria, Denmark, Finland, Germany, Netherlands, Sweden, United Kingdom) achieved over 60% compliance at Levels 2 and 3 (PricewaterhouseCoopers, 2009). This gap reflects the disparity between Brazilian practices and global sustainability leaders. The results in Table 3 were calculated by multiplying the number of bidding notices in each category by the respective adherence level, obtaining: 41.51% at Level 0 (absence of criteria), 22.22% at Level 1 (generic criteria), 36.27% at Level 2 (main criteria), and 0% at Level 3 (comprehensive criteria).

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Table 3 – Results by Compliance Level

Notices	Unit	Total Notices	Requirement Level 00	Requirement Level 01	Requirement Level 02	Requirement Level 03
Class 01	Unit	32	224	128	224	0
	%	60,38%	23,48%	13,42%	23,48%	0,00%
Class 02	Unit	17	136	68	102	0
	%	32,08%	14,26%	7,13%	10,69%	0,00%
Class 03	Unit	4	36	16	20	0
	%	7,55%	3,77%	1,68%	2,10%	0,00%
Total	unit	53	396	212	346	0
	%	100%	41,51%	22,22%	36,27%	0,00%

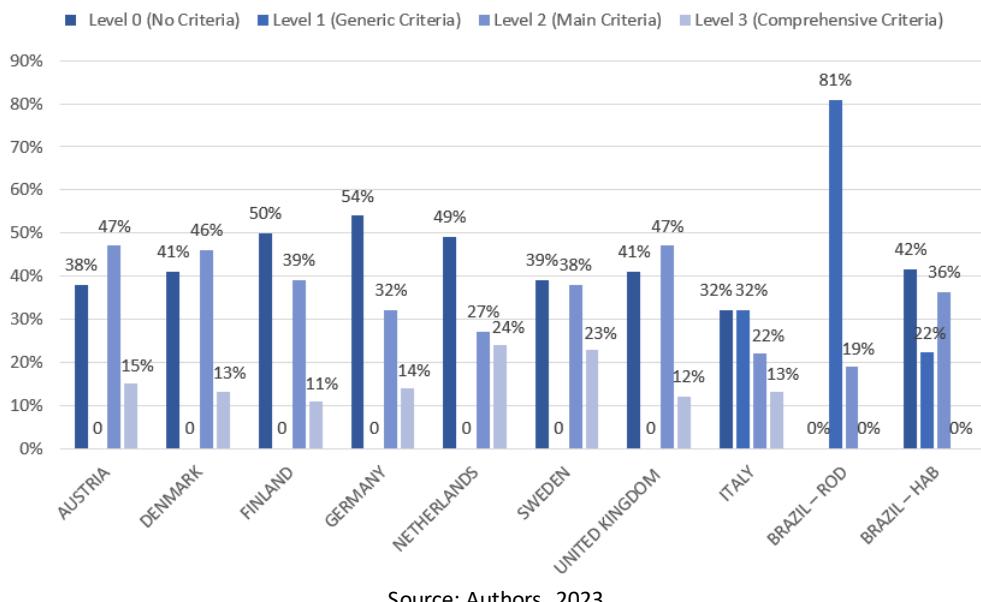
Source: Authors, 2023.

Compared to Giamberardino et al. (2023), which focused on road construction bids and found 81% adherence at Level 1, this study shows greater adherence to Level 2 (36.27%). The inclusion of Level 0 and the use of national regulations, supplemented by official sustainable procurement guides, explain this difference. Combining Levels 0 and 1 results in 63.73% compliance, approaching Giamberardino et al.'s 81%.

Internationally, PricewaterhouseCoopers (2009) reported that Green-7 countries achieved over 10% adherence at Level 3, while this study found no Level 3 criteria. Combining Levels 2 and 3, Green-7 countries significantly outperform Brazil's 36.27%, demonstrating that national notices fall short of the sustainability levels observed in leading countries in green

public procurement.

Figure 2 – Study Results with Original Categorization

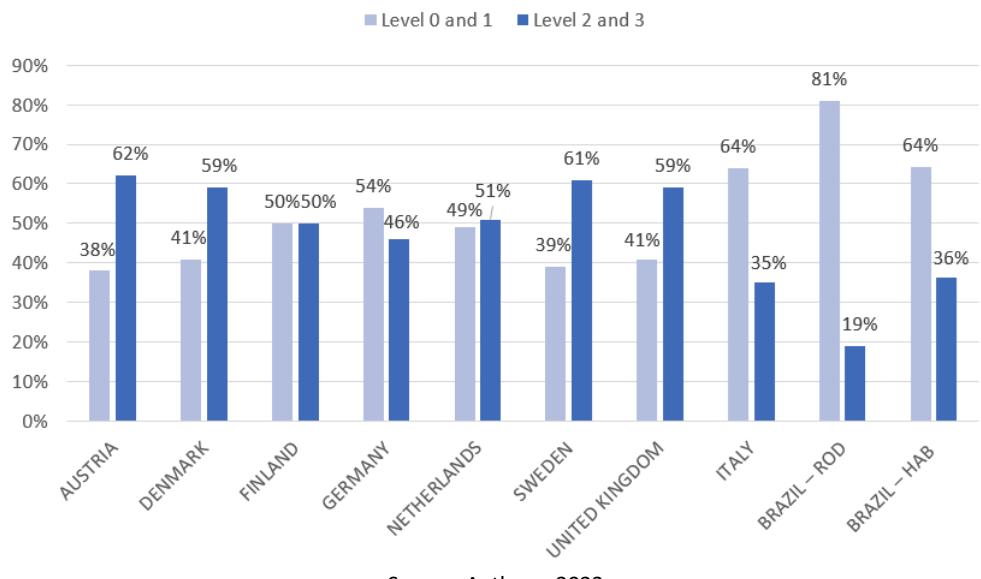


Source: Authors, 2023.

Despite differences, similarities with Testa et al.'s (2016) Italian study suggest common challenges in countries at early stages of sustainable procurement implementation. The inclusion of Level 0 highlights a critical issue: the absence of environmental criteria in a significant portion of bidding notices.

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Figure 3 – Study Results Segregated into Low (0 and 1) and High (2 and 3) Levels



Source: Authors, 2023.

5 FINAL CONSIDERATIONS

This study revealed that most public housing construction bidding notices in São Paulo shows low adherence to environmental criteria. While progress is evident at Level 2, the

lack of categorization at level 3 criteria highlights significant gaps in sustainable practices in Brazil. Comparisons with leading countries in Green Public Procurement, such as those in Green-7, underscore the need for greater alignment between Brazilian regulations and international guidelines to meet global sustainability goals.

Future research should explore the relationship between local factors and the adoption of environmental criteria, as well as develop robust indicators to measure the impact of Sustainable Public Procurement. This will enable more effective alignment with SDG 12, promoting responsible consumption and production and integrating sustainability into government procurement practices more broadly and strategically.

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DECLARATIONS

CONTRIBUTION OF EACH AUTHOR

When describing each author's involvement in the manuscript, use the following criteria:

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- **Funding Acquisition:** -
- **Research:** Simone Mariko Nakata.
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- **Writing - Critical Review:** Ana Paula Branco do Nascimento e Cláudia Terezinha Kniess.
- **Review and Final Editing:** Ana Paula Branco do Nascimento e Cláudia Terezinha Kniess.
- **Supervision:** Ana Paula Branco do Nascimento e Cláudia Terezinha Kniess.

DECLARATION OF CONFLICTS OF INTEREST**18**

We, Simone Mariko Nakata, Ana Paula Branco do Nascimento and Cláudia Terezinha Kniess, declare that the manuscript entitled "Public Housing Works and the SDGs of the 2030 Agenda: A perspective on Tenders in the State of São Paulo":

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