

Forum: Practical Perspectives

Conceptual framework of environmental criteria of public procurements for federal roadwork

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Green public procurements are important to reduce the organizations' environmental impact. This study proposes a conceptual framework for adopting environmental criteria in the public procurement for federal roadworks. Content analysis of 153 bidding terms issued from 2006 to 2021 by the public agency in charge of managing Brazil's federal road network was conducted. The results were compared to the standard list of criteria for Green Public Procurements defined by the European Union. By identifying and classifying the environmental criteria and by defining their related requirement levels, we were able to assess the level of compliance with the environmental criteria in our sample of bidding terms and propose a framework relating different environmental categories, roadwork classifications, environmental criteria, and their respective indicators. The findings reveal a low level of compliance with environmental criteria in our sample (around 19%), a value below what is found in the European context. Given current challenges in developing sustainable roadworks, the proposed model underscores the need to clearly define environmental criteria in bidding terms to foster both sustainable development and the continuous improvement of roadworks.

Keywords: green public procurements; sustainable public procurements; sustainability; environmental criteria.

Modelo conceitual de critérios ambientais para contratação pública de obras rodoviárias federais




As Contratações Públicas Ecológicas constituem instrumento importante para reduzir o impacto ambiental das organizações. Este estudo tem por objetivo propor um modelo conceitual de critérios ambientais para contratação pública de obras rodoviárias federais. Para tanto, o conteúdo de 153 editais do órgão gestor da malha rodoviária federal brasileira, publicados entre 2006 e 2021, foi analisado e comparado com a lista de critérios relativos aos Contratos Públicos Ecológicos da União Europeia. Com base na identificação e categorização dos critérios ambientais e da classificação dos níveis de exigência desses critérios, foi possível definir a qualidade de atendimento aos fundamentos desses editais e, assim, propor um modelo que pudesse relacionar a categoria ambiental, o tipo de obra, o tipo de critério e os respectivos indicadores. Os resultados revelam um nível de atendimento aos critérios ambientais de 19%, valor baixo em comparação com os estudos realizados em países europeus. Diante dessa limitação, a proposição do modelo evidencia a necessidade de estabelecer claramente os parâmetros ambientais nos editais de licitação, no sentido de contribuir para o desenvolvimento sustentável e a melhoria contínua dos empreendimentos rodoviários.

Palavras-chave: contratações públicas ecológicas; contratações públicas sustentáveis; sustentabilidade; critérios ambientais.

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Modelo conceptual de criterios ambientales para la contratación pública de obras viales

La contratación pública ecológica es un importante instrumento para reducir el impacto ambiental de las organizaciones. Este estudio tiene como objetivo proponer un modelo conceptual de criterios ambientales para la contratación pública de obras viales federales. Se analizó el contenido de 153 avisos públicos emitidos por el órgano gestor de la red vial federal brasileña, publicados entre 2006 y 2021, y se comparó con la lista de criterios relacionados con los contratos públicos ecológicos de la Unión Europea. A partir de la identificación y categorización de los criterios ambientales, y mediante la clasificación de los niveles de exigencia de estos criterios, fue posible definir el nivel de cumplimiento de los criterios en los avisos públicos y, así, proponer un modelo que pueda relacionar la categoría ambiental, el tipo de obra, el tipo de criterio y sus respectivos indicadores. Los resultados revelan un nivel de cumplimiento de los criterios ambientales del 19%, un valor bajo en comparación con los estudios realizados en países europeos. Ante esta limitación, la propuesta del modelo destaca la necesidad de establecer claramente los criterios ambientales en los pliegos de condiciones, a fin de contribuir al desarrollo sostenible y a la mejora continua de los emprendimientos viales.

Palabras clave: contratación pública ecológica; contratación pública sostenible; sostenibilidad; criterios ambientales.

1. INTRODUCTION

The incorporation of the environmental variable in tendering procedures has been gradually introduced into the routines of public administration. In the context of road agencies, given the environmental impacts generated by roads, it is necessary to consider environmental issues from the planning stage and to adopt effective environmental criteria and indicators in tendering procedures (Faith-Ell, Balfors, & Folkeson, 2006; Metham, Benjaoran, & Sedthamanop, 2019).

Green Public Procurements (GPP), also known as Sustainable Public Procurements, are a powerful instrument to mitigate the environmental impacts from organizations. They are defined by the European Commission (EC, 2008) as a process by which public authorities seek to purchase goods, services, and works with a reduced environmental impact throughout their lifecycle when compared to those with the same primary function that would otherwise be procured.

In the last decade, GPPs are becoming the underpinnings of environmental policies and purchase procedures in the European Union (EU) and in other countries, such as the United States, China, and Hong Kong, including developing countries such as Malaysia and the Vietnam (European Commission [EC], 2019; Cheng, Appoloni, D'amato, & Zhu, 2018; Fuentes-Bargues, Ferrer-Gisbert, González-Cruz, & Bastante-Ceca, 2019).

Financial transactions from public procurements represent nearly 14% of the European Union's Gross Domestic Product (GDP) (EC, 2019). In Brazil, they are around 20.2% (Instituto de Pesquisa Econômica Aplicada [IPEA], 2021). Given its economic impact, GPPs can be an effective tool to ensure that companies who want to work with the government fulfil socioenvironmental sustainability requirements independently from the nature of their product, whether it be by producing or supplying goods, providing services, or by developing engineering work (Advocacia-Geral da União [AGU], 2021).

Despite national and international efforts, there are still challenges for implementing GPPs. Economic concerns are singled out by many countries as one of the most significant barriers for their implementation as, in many cases, the initial cost of solutions that comply with the environmental criteria is superior to those of conventional alternatives (Comissão Econômica para a América Latina e o Caribe [CEPAL], 2017; Varnäs, Balfors, & Faith-Ell, 2009). Moreover, a lack of clear standards allows interested parties to create generic environmental criteria based on their own assumptions (CEPAL, 2017; Faith-Ell et al., 2006).

Green tendering procedures allow the public sector to promote a more efficient and rational use of natural resources, thus, contributing to the dissemination of good practices regarding environmental, social, and economic development (AGU, 2021; Comissão Europeia [CE], 2016a; Clement, Watt, & Semple, 2016; Governos Locais pela Sustentabilidade [ICLEI], 2015). In this context, this paper proposes a conceptual framework for adopting environmental criteria in the public procurement for federal roadworks based on the analysis of the European Union’s standard list of environmental criteria for road design, construction, and maintenance.

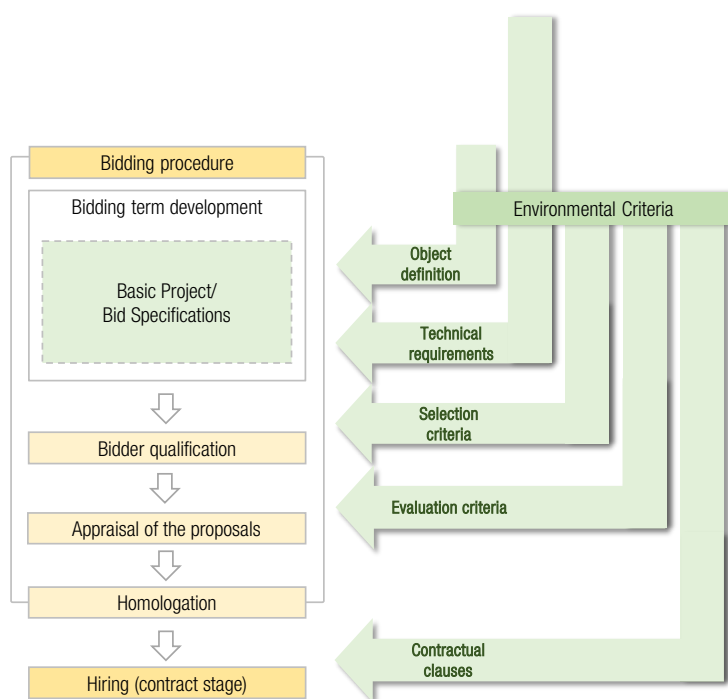
2. ENVIRONMENTAL CRITERIA IN BIDDING TERMS

According to Bouwer et al. (2006), GPPs are defined as an approach by which public authorities integrate environmental requirements throughout all stages of procurement processes. As the document that instructs bidding procedures, environmental criteria should be also added to bidding terms. Therefore, guiding interested parties and tying contracts and requirements defined in the bidding procedures together (Clement et al., 2016; EC, 2016a; ICLEI, 2015).

Environmental criteria can be added in bidding terms in the form of defining the object of the bidding; technical description of the good or service (technical requirements); requirement for bidder qualification (selection criterion) and appraisal of the proposals (evaluation criterion), and as definition of contractual clauses (CEPAL, 2017; Clement et al., 2016; EC, 2016a; EC, 2016b; ICLEI, 2015).

In Figure 1, a flow chart with the application of environmental criteria to bidding procedures is presented.

FIGURE 1 APPLICATION OF ENVIRONMENTAL CRITERIA TO BIDDING PROCEDURES



Source: Elaborated by the authors.

Defining the object of the bidding procedure and the technical requirements are related to the contracting planning, being defined by the roadwork inspection teams (demanding sector) and materialized in the Basic Project/Bid Specifications, document that is part of the bidding term. Qualifying environmental criteria refer to the qualification of competing companies and the competencies of interested professionals, linked to compliance with specific environmental legislation. By applying weights and scores, the environmental criteria allow to objectively assess and select proposals with the best environmental performance. Furthermore, environmental criteria can be included in contract clauses to specify how it should be executed and monitored (Clement et al., 2016; EC, 2016a; ICLEI, 2015).

3. METHODS

The main technique applied in this study was the content analysis of the bidding documents. The stages of this research are described in more detail in the following sub-sections.

3.1 Pre-analysis of bidding terms

At this stage, 153 bidding terms were selected regarding roadworks performed from May 2006 to February 2021 in the 1,679.70 km federal road network in the state of Paraná. The documents were obtained both from a bidding entity and from an online database (Departamento Nacional de Infraestrutura de Transportes [DNIT], 2021) by applying the filter ‘SUP. REG. DNIT PARANÁ’ in the ‘Sup. Regional’ field. The search results were classified into 12 bidding terms, defined based on bidding modalities and, the nature of the interventions and the degree of similarity of specific elements from the documents, as shown in Box 1.

BOX 1 DESCRIPTION OF BIDDING TERMS

Bidding term	Bidding modalities	Intervention types
Bidding term 1	Competition and price taking	Road maintenance, road rehabilitation, road construction, paving, bridge rehabilitation and Maintenance & Rehabilitation (Maintenance & Rehabilitation 1 st Program – DNIT)
Bidding term 2	Competition and price taking	Construction supervision and rehabilitation supervision
Bidding term 3	Differentiated Public Contracting Regime	Maintenance & Rehabilitation
Bidding term 4	Differentiated Public Contracting Regime	Adequacy of road infrastructure, paving and bridge construction
Bidding term 5	Differentiated Public Contracting Regime	Bridge rehabilitation

Continue

Bidding term	Bidding modalities	Intervention types
Bidding term 6	Differentiated Public Contracting Regime	Construction supervision
Bidding term 7	Differentiated Public Contracting Regime	Road sign maintenance
Bidding term 8	Electronic trading	Road maintenance and road rehabilitation
Bidding term 9	Electronic trading	Maintenance supervision and rehabilitation supervision
Bidding term 10	Electronic trading	Maintenance supervision and rehabilitation supervision (Maintenance & Rehabilitation 2 nd Program – DNIT)
Bidding term 11	Electronic trading	Road maintenance
Bidding term 12	Electronic trading	Road maintenance and bridge maintenance

Source: Elaborated by the authors.

3.2 Coding and classification of environmental criteria

At this stage, initial search terms were obtained from reviewing the literature, which were grouped into broad environmental-related categories according to what is defined in GPP standard models from the EU (EC, 2016b; Garbarino, Quintero, Donatello, Caldas, & Wolf, 2016).

The presence of environmental criteria in our selection of bidding terms was performed by applying the search terms (keywords). With the distinction of these criteria and reviewing the literature, it was possible to establish new recording units, in order to complement those obtained in the codification phase. Thus, the new search terms were classified into specific environmental-related categories:

- Bidding companies competencies;
- Fauna and flora;
- Superficial dynamic processes;
- Materials and waste;
- Noise pollution;
- Maintenance and rehabilitation;
- Congestion.

3.3 Treatment of results

The environmental criteria identified in the 12 bidding terms were examined in comparison to a standard list of requirements for green public procurements established by the European Union (EC, 2016b; Garbarino et al., 2016). The comparative assessment of the environmental criteria in relation to the EU list was based on the attribution of the requirement levels and the respective justifications for each of the environmental criteria identified in 12 bidding terms. Requirement levels for the environmental criteria were established according to a classification proposed by Testa, Grappio, Gusmerotti, Iraldo, and Frey (2016), which was built from EU guiding materials, as reported in Box 2.

BOX 2 CLASSIFICATION OF ENVIRONMENTAL CRITERIA REQUIREMENT LEVELS

Requirement level	Description of requirement level	Reference
Level 1 (generic criteria)	Applied to criteria that include some environmental aspect, but not so demanding as to meet the requirements of the core criteria.	Bouwer et al. (2006); Renda, Egenhofer, Schrefler, Giacomo, and Selçuki (2012); Testa et al. (2016).
Level 2 (core criteria)	The core criteria are designed to allow easy application of GPP, focussing on the key area(s) of environmental performance of a product.	EC (2016a, 2016b); Garbarino et al. (2016); PwC Sustainability (2009); Testa et al. (2016).
Level 3 (comprehensive criteria)	The comprehensive criteria take into account more aspects or higher levels of environmental performance.	EC (2016a, 2016b); Garbarino et al. (2016); PwC Sustainability (2009); Testa et al. (2016).

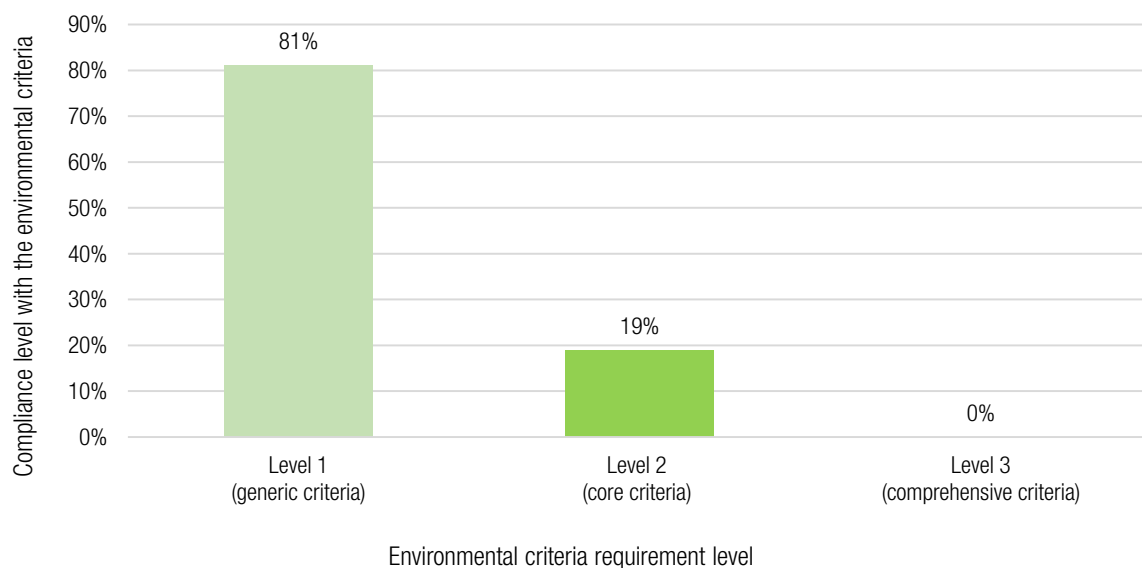
Source: Elaborated by the authors.

According to the classification of the requirement levels of the environmental criteria, the level of compliance with the environmental parameters in the bidding terms was specified according to a methodology proposed by Testa et al. (2016). Each environmental requirement found in the bidding term in this study was compared to the standard list from the EU, for which a requirement level was attributed (1, 2, or 3). Each bidding term was classified according to the highest requirement level attributed to the environmental standards belonging to that document. A bidding term is only considered as having reached an adequate requirement level if it has at least one level 2 environmental criteria. In this sense, the level of compliance with environmental criteria was obtained by the comparing the number of level 2 or 3 bidding terms to the amount of bidding terms evaluated.

4. RESULTS

4.1 Level of compliance with the environmental criteria

Graph 1 summarizes the results in terms of the environmental criteria requirement levels identified in the analysed bidding terms. Each bidding term was classified according to the highest level of requirement attributed to the environmental standards pertained to that document. The content analysis of the bidding terms reveals that the overall level of compliance with the environmental criteria is of 19% (sum of bidding terms that achieved requirement levels 2 or 3), while 81% of bidding terms have only generic criteria.

GRAPH 1 LEVEL OF COMPLIANCE WITH THE ENVIRONMENTAL CRITERIA

Source: Elaborated by the authors.

The limited inclusion of environmental criteria, as most of the criteria in the EU's standard list of requirements was missing from the studied bidding terms, might uncover a lack of knowledge in how to implement them, indirectly confirming the results of previous studies (Brammer & Walker, 2011; Testa, Iraldo, Frey, & Daddi, 2012; Testa et al., 2016; Varnäs et al., 2009; Zhu, Geng, & Sarkis, 2013). Additional difficulties identified are the imprecision and lack of clarity of the environmental criteria themselves, since on many occasions, the adopted environmental criteria are too generic, making verifying compliance a challenge and hindering monitoring and inspection practices (Fuentes-Bargues, González-Cruz, & González-Gaya, 2017).

4.2 Comparison to findings from other studies

The results from this content analysis were also compared with those of other studies concerning the European context with similar methodologies, as Box 3 makes clear.

BOX 3 COMPLIANCE LEVELS WITH THE ENVIRONMENTAL CRITERIA FROM STUDIES CONCERNING THE EUROPEAN CONTEXT

Reference	Compliance level with the environmental criteria	Period	Object of study	Research method	Number of bidding terms
Fuentes-Bargues et al. (2019)	19,7%	2016 to 2017	Construction sector	Content analysis	967
PwC Sustainability (2009)	27,0%	2006 to 2007	Construction sector	Survey	-
Nissinen et al. (2009)	28,0%	2003	Diverse sectors	Content analysis	50
Kahlenborn, Frijdal, Moser, and Essig (2011)	31,0%	2010	Diverse sectors	Survey	-
Testa et al. (2016)	35,0%	2012 to 2013	Construction sector	Content analysis	164
Fuentes-Bargues et al. (2017)	35,0%	2008 to 2011	Diverse sectors	Content analysis	100
Bouwer et al. (2006)	36,0%	2005 to 2006	Construction sector	Survey	1000
Kippo-Edlund, Hauta-Heikkilä, Miettinen, and Nissinen (2005)	47,0%	2003	Diverse sectors	Survey	258
PwC Sustainability (2009)	55,0%	2006 to 2007	Diverse sectors	Survey	-
Renda et al. (2012)	62,0%	2009 to 2010	Construction sector	Survey	-

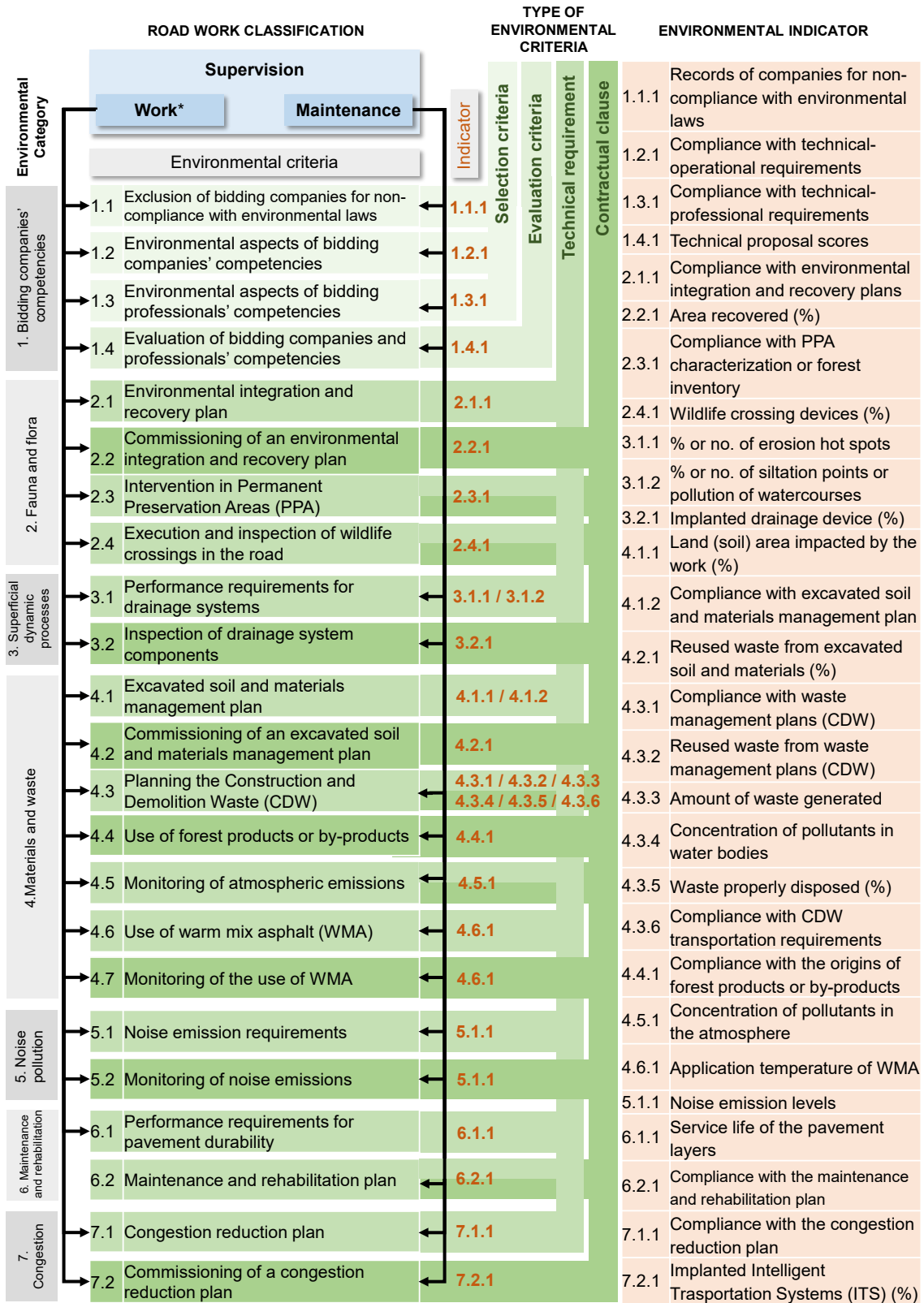
Source: Elaborated by the authors.

The studies within the European context reported higher levels of compliance with environmental criteria than what was found in this research (Graph 1, previous). Even though it is not able to state to what level different analytical approaches influence the results obtained across different studies, the fact that the more limited compliance with the environmental criteria in this study, makes it possible to conclude the existence of differences in the way in which green procurement practices are developed across the studied regions. The fact that GPPs have become one of the underpinnings of environmental policies and purchase procedures in the EU (Fuentes-Bargues et al., 2019), reflects in more promising results in these countries.

4.3 Conceptual framework for the adoption of environmental criteria

Considering current compliance levels with environmental criteria found in this analysis (19%) and the standard list of criteria from the EU (EC, 2016b; Garbarino et al., 2016), a conceptual framework is proposed including the adoption of EU environmental criteria adapted to the Brazilian context, as explained in Figure 2. Furthermore, indicators related to environmental criteria were proposed.

FIGURE 2 CONCEPTUAL FRAMEWORK FOR THE APPLICATION OF ENVIRONMENTAL CRITERIA



Source: Elaborated by the authors.

Through the proposed framework, the decision to use a determined environmental criterion in a bidding term depends on compliance with the following application limits:

- Environmental categories: are defined in the environmental criteria classification stage, according to the identification of common elements;
- Roadwork classifications: are defined in consonance with the bidding term pre-analysis stage, considering the classification of bidding term types, as depicted in Box 1;
- Type of environmental criteria: are defined based on green public procurement practices adopted by the European Union. Environmental criteria can be included in bidding terms as the following: to define the object of the bidding procedure, to technically describe a good or service (technical requirements), as a selection criterion, as an evaluation criterion, and to define contractual clauses (CEPAL, 2017; Clement et al., 2016; EC, 2016a, 2016b; ICLEI, 2015);
- Environmental indicators: are defined according to the green public procurement guidelines established by the European Commission (CEPAL, 2017; Clement et al., 2016; EC, 2016a, 2016b; ICLEI, 2015).

The decision to use a determined environmental criterion in a bidding term should be a joint decision involving both those responsible for bidding procedures and the roadwork inspection teams. It is worth mentioning here that it is up to the requesting area to prepare the bidding documents (Basic Project/ Bid Specifications) given that it has the technical knowledge of works, while the bidding sector is responsible for the procedures for selecting and judging the proposals.

5. CONCLUSIONS

The findings from this study give evidence to the low use of environmental criteria in bidding terms in the Brazilian context (19%) when compared to country-members of the European Union. Most of these criteria found were classified as generic (81%), thus, characterized by being ill-defined and vague in their descriptions. These finding indirectly corroborate previous studies which maintain that lack of knowledge in how to formulate core environmental criteria is one of the main challenges for green public procurement practices.

Based on the level of compliance with the environmental criteria of the bidding terms (19%) and the standard list of EU criteria, the framework proposed in this study calls for the establishment of clearly defined environmental requirements in bidding procedures. Given the peculiarities of each work and each road management agency, it is important to emphasize that the proposed framework should not be taken as a single and definitive solution. Therefore, the decision to use certain criteria in bidding terms must be made by bidding sectors in collaboration with demanding sectors.

A limitation of this study is that it is not able to consider the opinion of those involved in bidding processes. It would be interesting for further research to combine the use of content analysis and questionnaires to identify challenges faced by bidding organizations and bidders as well as their perceptions on GPP requirements. Furthermore, it appears that the bureaucratic structure in the public administration can be an obstacle in the application of environmental criteria. When there is an inability to incorporate instruments that allow for a more effective and efficient public activity,

the environmental issue can be placed in the background. Faced with these obstacles, it is necessary to develop policies that regulate and encourage the use of environmental parameters in the public works in question.

Beyond proposing a new framework for bidding terms, it is recommended the implementation of normative instructions, good practice guides, and working groups dealing with environmental protection procedures targeting roadwork procurements. Moreover, it involves applying the proposed conceptual framework to evaluate the level of compliance with environmental criteria in bidding terms and compare that to the actual environmental performance of the works. With the primary purpose of promoting the preservation of the environment throughout the scope of road activities, the adoption of environmental criteria in bidding procedures would enable the the public administration to promote the rational and efficient use of natural resources and encourage the dissemination of environmental-friendly good practices.

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