www.ricuc.cl
LinkedIn Revista Ingeniería de Construcción

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

Analysis of sustainability in the procurement of public works: the influence of the Covenant of Mayors

Análisis de la sostenibilidad en la contratación de obras públicas: la influencia del Pacto de las Alcaldías

Valdivieso-Ramírez, María Isabel*[1]; Montalbán-Domingo, Laura*; García-Segura, Tatiana*; Sanz-Benlloch, Amalia*; Pellicer, Eugenio*

* Construction Project Management Research GroupUniversitat Politècnica De València, Spain.

Fecha de Recepción: 13/10/2024
Fecha de Aceptación: 20/11/2024
Fecha de Publicación: 09/12/2024
PAG: 1-16

Abstract

The fight against climate change is a global challenge that must be addressed at all government levels, especially by local governments, whose potential to contribute to this process is widely recognized. Most municipalities in Spain have signed up for the Covenant of Mayors, an initiative of the European Union with three strategies: mitigation, adaptation, and the fight against energy poverty. This study aims to identify the primary measures that town councils associated with the Covenant of Mayors have committed to conducting and to analyze how environmental sustainability is promoted through local public-work procurement. Regulations related to public contracting and sustainability are analyzed to address these objectives, and measures in the action plans of the municipalities associated with the Covenant of Mayors are identified and classified according to their sectors. Finally, the environmental award criteria in public-work procurement are identified and analyzed. The results suggest that the municipalities affiliated with the Covenant of Mayors are primarily focused on energy efficiency. In contrast, public-work procurement files emphasize environmental criteria related to environmental management and energy efficiency, although these criteria receive little weight.

Keywords: Public procurement; construction; sustainability; Covenant of Mayors; environment.

Resumen

La lucha contra el cambio climático es un desafío global que debe ser abordado en todos los niveles de gobierno, especialmente por parte de los gobiernos locales, cuyo potencial para contribuir a este proceso es ampliamente reconocido. La mayoría de municipios de España se han adherido al Pacto de los Alcaldes, una iniciativa de la Unión Europea con tres objetivos: mitigación, adaptación y lucha contra la pobreza energética. Este estudio tiene como objetivo identificar las principales medidas que los ayuntamientos adheridos al Pacto de los Alcaldes se han comprometido a llevar a cabo y analizar cómo se promueve la sostenibilidad ambiental a través de la contratación pública local de obras. Para abordar estos objetivos se analiza la normativa relacionada con la contratación pública y la sostenibilidad, y se identifican y clasifican medidas en los planes de acción de los municipios asociados al Pacto de los Alcaldes según sus sectores. Finalmente, se identifican y analizan los criterios de adjudicación medioambientales en la contratación de obra pública. Los resultados sugieren que los municipios adheridos al Pacto de los Alcaldes se centran principalmente en la eficiencia energética. Mientras que, en los expedientes de contratación de obras públicas destacan criterios ambientales relacionados con la gestión ambiental y la eficiencia energética, aunque el peso que reciben los criterios ambientales es poco.

Palabras clave: Contratación pública; construcción; sostenibilidad ambiental; pacto de las alcaldías; ambiente.

Corresponding author: mivalram@posgrado.upv.es
Construction Project Management Research GroupUniversitat Politècnica De València, Spain

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

1. Introduction

The construction sector, comprising buildings and infrastructure, is a fundamental component of social and economic development (Huang et al., 2018); however, infrastructure can cause serious environmental problems during development, operation, and maintenance (Yılmaz and Bakış, 2015). In the European Union (EU), the construction sector represents 10% of the gross domestic product (GDP) and employs 7% of the workforce. In 2019, the construction sector in Spain represented around 6.1% of the GDP. Currently, it accounts for around 5.8% (Construction Industry Observatory, 2020). The construction sector is known for its productivity, high energy consumption, waste generation, natural resource usage, and greenhouse gas (GHG) generation, representing around 35% of the total GHG generated in the EU (Braulio-Gonzalo and Bovea, 2020). Hence, sustainable solutions are necessary in this sector.

Climate change is a global challenge that does not respect national borders, affecting all countries on all continents and strongly influencing the economies and quality of life of people, communities, and countries. Addressing this problem requires coordinated and precise cooperation from the entire international community to promote more sustainable and environmentally friendly economic activity (United Nations, 2018). Authorities acquire goods and services and commission diverse types of work at all government levels and public institutions through public procurement. Green public procurement (GPP) is the purchase or acquisition of products or services with a low influence on the environment and human health (Deambrogio et al., 2017). Moreover, GPP refers to integrating environmental criteria and considerations in acquiring goods and services. Braulio-Gonzalo and Bovea (2020) stated that GPP could play a crucial role in reducing the environmental effects of the construction sector because sustainability in construction as a fundamental pillar for achieving sustainability in all aspects of social development is a critical aspect (Enshassi et al., 2018).

In response to the need to integrate environmental policies across productive sectors and human activities, new legislation, guidelines, and GPP plans have been implemented, for example, Law 9/2017 on Public Sector Contracts (Ley de Contratos del Sector Público, 2017), Law 7/2021 on Climate Change and Energy Transition (Ley 7/2021 de Cambio Climático y Transición Energética), Manual on Green Public Procurement of the European Union (European Union, 2016), and Green Public Procurement Plan for the General State Administration (Orden PCI/86/2019, 2019). These initiatives aim to enhance the consideration of environmental criteria as selection and award criteria in public-work procurement in Spain and across Europe.

In Spain, the governmental structure is defined according to the Spanish Constitution of 1978, outlining three governmental levels: central, regional, and local governments. The central government has exclusive powers, whereas regional governments have powers varying from one region to another. Local governments (town councils and provincial councils) manage basic public services and primarily depend on regional governments (Law 7/1985, April 2, Regulating the Bases of the Local Regime (Art. 4)).

In the research context, according to the (International Institute of Law and Environment, 2023), municipalities are fundamental actors in designing and implementing local strategies for mitigation and adaptation to climate change due to their proximity to the population and territory. Local climate action has gained global recognition through the Covenant of Mayors for Climate and Energy. This initiative was launched by the European Commission in 2008 as the “Covenant of Mayors,” with the objective of promoting local governments to commit to achieving and exceeding the EU climate and energy objectives. After several changes, it adopted its current name in 2015.

The Covenant of Mayors urges signatory municipalities to commit to three objectives: mitigation, adaptation, and the fight against energy poverty. These local authorities must define and monitor an action plan called the Sustainable Energy Action Plan if drawn up before 2015 or the Sustainable Energy and Climate Action Plan if drawn up after 2015. These action plans aim to cut GHG emissions by at least 40% by 2030 and increase resilience to climate change (Covenant of Mayors EU, 2015). The concepts and importance of GPP are becoming increasingly widespread as environmental sustainability gains prominence in public policies. Therefore, how public procurement processes are conducted, what sectors have received the most attention, and which require greater focus must be analyzed and evaluated.

Therefore, this study analyzes the fight against climate change through local public procurement and the influence of the Covenant of Mayors on infrastructure development. This study outlines the following goals to achieve this aim: (1) to identify the critical measures to which the municipalities participating in the Covenant of Mayors have committed and (2) to analyze how environmental sustainability is promoted through public-work procurement.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

2. Research method

A method based on three phases was proposed to achieve these goals (Figure 1). The first phase involves a literature review. This bibliographic review assesses national and European legislation, and the literature review covers journal articles, reports, procurement guidelines, and books to analyze state-of-the-art sustainability in public procurement. The second phase characterizes how municipalities address environmental measures through the Covenant of Mayors. Therefore, the measures in the municipality action plans are characterized and analyzed based on descriptive statistics. Finally, the third phase examines how environmental measures are promoted in the public-work procurement of municipalities associated with the Covenant of Mayors. This study explores the environmental award criteria considered in public procurement.

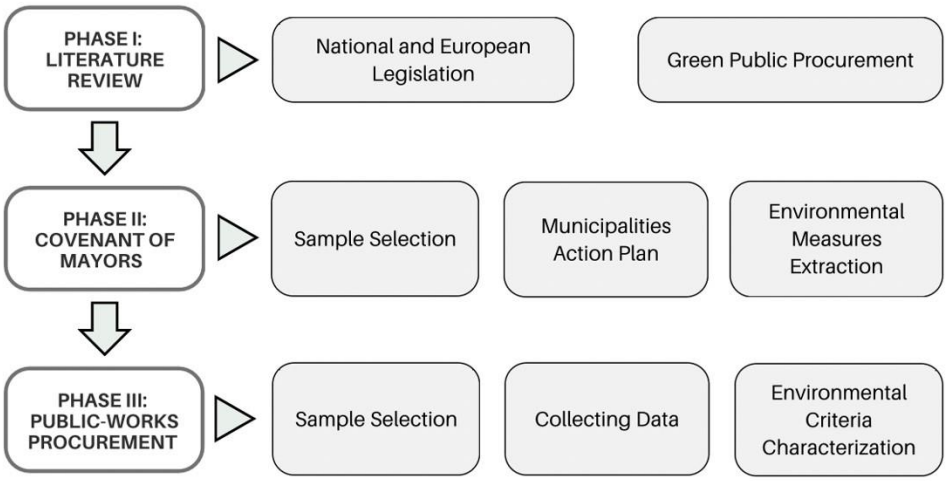

Figure 1. Research method.

3. Literature review

The literature review was conducted to explore sustainability in public procurement, focusing on the construction sector and related regulatory frameworks. Scopus was employed as the search engine, applying the following keywords: “construction,” “public procurement,” “covenant of mayors,” “green public procurement,” and “sustainability.” Of the 39 resulting articles, 23 were related to the construction sector and were selected. A detailed review of their content was conducted, selecting those with useful information for the research, resulting in 15 articles with relevant information.

4. Covenant of mayors analysis

The Covenant of Mayors of the European Commission was analyzed to identify the critical measures that participating municipalities have committed to implementing (Goal 1). When municipalities sign the covenant, they must prepare an inventory of GHG emissions and an action plan to establish strategies for mitigation and climate change adaptation. Once the action plan is approved, municipalities must execute it and prepare a monitoring and evaluation report every two years.

The analysis of this phase focused on collecting the municipality action plans associated with the Covenant of Mayors and extracting and characterizing the action measures they committed to implementing. The study assessed municipalities satisfying two conditions. First, the municipality must have committed to mitigation, adaptation, and combating energy poverty. Second, the results of applying the action plans must have been monitored. Under these premises, 870 municipalities have published monitoring reports; however, only 202 have committed to the three pillars. Therefore, the study population comprised 202 municipalities.

A minimum sample of 53 elements is needed for a population of 202 municipalities with a confidence level of 95% (commonly accepted in research to balance precision and certainty, implying Z = 1.96; (Vivanco, 2005). Of these 202 municipalities, 53 were indiscriminately selected, and their action plans were collected. These documents were gathered from the official website of the Covenant of Mayors for Climate and Energy Europe, under the “Local plans and actions” menu and were filtered using “Local action plans,” “Spain,” and “Commitment 2020.” Next, the corresponding action plans were individually downloaded for the municipalities.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

Once the action plans were collected, the action areas targeted by the proposed measures in the action plans were analyzed. These action areas were grouped into the following sectors: energy efficiency, transport and mobility, water, waste, emergencies, tourism, maritime management, biodiversity, urban planning, and agriculture. In each sector, categories and subcategories were defined to specify the focus areas of the action measures using the affinity diagram technique (Montalbán-Domingo et al., 2020), laying the foundation for classifying the action plan measures.

The municipalities were divided into three groups according to the population to conduct the analysis: (1) less than 10,000 inhabitants, (2) between 10,000 and 100,000 inhabitants, and (3) over 100,000 inhabitants. This division was conducted to obtain more accurate results because municipality size is related to environmental performance (Brammer and Walker, 2011); (Fuentes-Bargues et al., 2017).

5. Public-work procurement

The third phase focused on characterizing how environmental measures in action plans were considered in the public-work procurement of municipalities associated with the Covenant of Mayors (Goal 2). Thus, 150 public procurement procedures from municipalities affiliated with the Covenant of Mayors were compiled to characterize the inclusion of environmental criteria as award criteria.

(Montalbán-Domingo et al., 2023) highlighted that environmental award criteria are usually included in public procurement of the construction sector; however, their inclusion entails several drawbacks, such as low inclusion percentages, low weights, and poor criterion definitions. Numerous authors have stated that knowledge about defining environmental criteria is lacking (Testa et al., 2016); (Ruparathna and Hewage, 2015b); (Oltean-Dumbrava and Miah, 2016). These criteria tend to be assessed subjectively (Montalbán-Domingo et al., 2023). Therefore, the analysis in this phase aims to identify the inclusion of environmental criteria as award criteria in public-work tendering processes, analyze the importance assigned to this criterion type, and assess whether these criteria are currently assessed subjectively or objectively. Second, the analysis assessed the special execution conditions and contractor obligations defined in the procurement procedures and how the environmental aspects were considered. Finally, this study assessed the relationship between the environmental criteria and measures in the action plan of each municipality.

The data regarding procurement procedures was collected from the Public Sector Procurement Platform. Five municipalities were randomly selected for each group (fewer than 10,000 inhabitants, between 10,000 and 100,000 inhabitants, and over 100,000 inhabitants), and 10 procurement procedures were collected for each selected municipality (150 procurement procedures). The procurement procedure selection conditions were to (1) be awarded and resolved within the last 10 years, (2) involve a municipality associated with the Covenant of Mayors, and (3) have information about the tender characteristics. The following information was collected for each contract file: municipality, public owner, contract objective, initial budget, publication year, environmental award criteria, environmental award criteria definition, environmental criteria weight (on the score out of 100 points), environmental special execution conditions and obligations of the contractor, and whether the administrative clauses document considers environmental criteria.

The contracts were initially divided into two groups: those with and without environmental criteria as award criteria. Award criteria were classified into the 10 action sectors using the affinity diagram technique (Carnevalli and Miguel, 2008) and considering the classification established in previous studies (e.g., (Montalbán-Domingo et al., 2023)); (Fuentes-Bargues et al., 2017); (Testa et al., 2016). Based on this, the action sectors were classified as environmental management, energy efficiency, noise, waste, sustainable use of wood, water, transport and mobility, urban planning, forestry, and fauna.

(Soto et al., 2020) found that environmental criteria should be associated with indicators for evaluation. Moreover, (Fuentes-Bargues et al., 2017) argued that environmental criteria are often subject to value judgments. Therefore, the study analyzed whether the environmental criteria were defined objectively or subjectively. Objective criteria preferably use a numerical indicator, and subjective criteria do not. In contrast, the special conditions of execution and environmental obligations of the contractor were identified in each file. Organizing the extracted information regarding the action plan measures and environmental criteria considered in public-work contracting processes enables defining and analyzing which sectors the municipality action plans focus on and helps identify the primary environmental criteria in the contracting processes.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

6. Results

6.1 Key environmental measures in municipalities with the Covenant of Mayors

The sample comprises 53 municipalities distributed in three population groups. These municipalities meet the criteria for commitment to the three objectives of the Covenant of Mayors. In addition, the action plan was implemented, and the results were monitored. (Table 1) presents the composition of the sample.

Table 1. Number of analyzed municipalities with the Covenant of Mayors.

Municipality size (inhabitants)	Sample size
>100,000	5
10,000–100,000	18
<10,000	30
	53

The action plans of these 53 municipalities were analyzed, and 2,348 environmental measures were collected. (Table 2) lists the total number and percentage of action measures identified by the sector (energy efficiency, transport and mobility, water, urban planning, waste, emergencies, agriculture, tourism, maritime management, and biodiversity). Regardless of the population size, the energy efficiency and transport and mobility sectors cover the highest percentage of action measures (64.52% and 24.23%, respectively), reflecting the focus on these sectors. The analysis results indicated that groups with the smallest and largest populations do not consider action measures for some action sectors; instead, they focus on energy efficiency, transport and mobility, water, urban planning, and waste actions.

Table 2. Environmental measures by municipality size and sector.

Action Sector	Municipality size						Total	
	>100,000		10,000–100,000		<10,000			
	Number	%	*Number*	%	*Number*	%	*Number*	%
Energy efficiency	253	17 %	598	39%	664	44 %	**1,515**	**64.52 %**
Transport and mobility	112	20 %	312	55%	145	25 %	**569**	**24.23 %**
Water	21	17 %	43	36%	57	47 %	**121**	**5.15%**
Urban planning	13	22 %	34	59%	11	19 %	**58**	**2.47%**
Waste	21	41 %	29	57%	1	2%	**51**	**2.17%**
Emergencies	0	0%	10	100 %	0	0%	**10**	**0.43%**
Agriculture	0	0%	5	71%	2	29 %	7	**0.30%**
Tourism	0	0%	7	100 %	0	0%	7	**0.30%**
Maritime management	0	0%	6	100 %	0	0%	**6**	**0.26%**
Biodiversity	0	0%	4	100 %	0	0%	**4**	**0.17%**
	420		1,048		880		**2,348**	**100%**

The environmental measures of each action sector were classified into categories. (Table 3) and (Table 4) display the classification of the energy efficiency and transport and mobility action sectors, representing more than 80% of the measures. Regarding the energy efficiency sector, the categories were municipal facilities, work with citizens and stakeholders, local energy production, tertiary sector, residential sector, and street lighting. (Table 3) lists the number of measures covered by each category and the percentage of the total measures in the energy efficiency sector. The action plans focus on work on municipal facilities and with citizens and stakeholders.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

Table 3. Distribution of measures by category: energy efficiency.

Sector	Category	Environmental measures	
		Number	%
Energy efficiency	Municipal facilities	413	27.3%
	Working with citizens and stakeholders	395	26.1%
	Local energy production	240	15.8%
	Tertiary sector	171	11.3%
	Residential sector	157	10.4%
	Street lighting	139	9.2%
		1515	**100%**

Five categories were defined in the transport and mobility sector: transport and mobility planning, work with citizens and stakeholders, and municipal, private and commercial, and public fleets. (Table 4) displays the number of measures covered by each category and the percentage of the total in the transport and mobility sector. The action plans focus on the measures in transport and mobility planning and on working with citizens and stakeholders.

Table 4. Action measures by category: transport and mobility.

Action Sector	Category	Environmental measures	
		Number	%
Transport and mobility	Transport and mobility planning	316	55.5%
	Working with citizens and stakeholders	99	17.4%
	Municipal fleet	63	11.1%
	Public fleet	48	8.4%
	Private and commercial fleet	43	7.6%
		569	**100%**

6.2 Environmental considerations in public procurement of construction work

(Table 5) presents 150 public-work tender files in both awarded and resolved states for 15 municipalities across the three population sizes.

Table 5. Number of analyzed municipalities.

Municipality size (inhabitants)	Municipalities (*N*)	Public-work tender files (*N*)
>100,000	5	50
10,000–100,000	5	50
<10,000	5	50
	15	**150**

(Table 6) displays the number and percentage of public procurement procedures per municipality group that included environmental criteria or considerations based on the information from each procurement procedure. If a procurement procedure included environmental award criteria and environmental special conditions of execution and obligations, it was considered only once. (Table 6) reveals that more than 81% of the procurement procedures included some environmental considerations.

Table 6. Percentage of procurement procedures with environmental considerations.

Municipality size	Procurement procedure	
(inhabitants)	*Number*	%
>100,000	46	92%
10,000–100,000	48	96%
<10,000	28	56%
	122	**81%**

6.3 Environmental award criteria

The inclusion of environmental award criteria in the procurement procedure varies according to municipality size. (Table 7) presents the percentage of municipalities for each municipality size that considered environmental criteria in their procurement procedures and the percentage of procurement procedures that included environmental criteria.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

In (Table 7), 60% of municipalities included environmental criteria as award criteria in their procurement procedures, and only 40% of the procurement procedure considered environmental award criteria. Larger municipalities tend to include environmental award criteria more frequently than smaller municipalities.

Table 7. Inclusion of environmental award criteria by municipality size.

Municipality size (inhabitants)	Municipalities that considered environmental award criteria (%)	Procurement procedures with environmental award criteria (%)
>100,000	100%	58%
10,000–100,000	60%	46%
<10,000	40%	20%
	67%	**41%**

The environmental award criteria were classified into the 10 action sectors. (Table 8) displays the total number and percentage of environmental award criteria for each action sector. This analysis reflects that most environmental award criteria belong to the environmental management sector (46%), followed by the energy efficiency, noise, and waste sectors at lower percentages. Moreover, this table also indicates the number and percentage of procurement procedures with at least one environmental award criterion in each action sector. The environmental criteria in most procurement procedures (63%) are related to environmental management.

Table 8. Environmental criteria per sector.

Action Sector	Environmental criteria		Procurement procedure	
	Number	%	*Number*	%
Environmental management	40	46%	39	63%
Energy efficiency	11	12.6%	10	16%
Noise	11	12.6%	11	18%
Waste	10	11.5%	8	13%
Sustainable use of wood	4	4.6%	4	6%
Water	4	4.6%	3	5%
Transport and mobility	3	3.4%	3	5%
Urban planning	2	23%	2	3%
Afforestation	1	1.1%	1	2%
Fauna	1	1.1%	1	2%
	87	**100%**		

(Table 9) presents the primary environmental award criteria in the following most relevant action sectors: environmental management, energy efficiency, noise management, and waste management.

Table 9. Main environmental award criteria by action sector.

Environmental criteria by action sector	Procurement procedures	
	Number	%
Environmental management		
- Environmental management certification according to ISO 14001 or equivalent	16	11%
- Define environmental management measures	10	7%
Energy efficiency		
- Define energy-saving measures	7	5%
Noise management		
- Define noise reduction measures during construction	11	7%
Waste management		
- Develop a waste management plan	6	4%

The analysis identified the weights, varying from 0 to 100 points, assigned to the environmental award criteria in each procurement procedure. (Table 10) displays the maximum and minimum weights assigned to the environmental award criteria by municipality size. In the smallest municipalities, the environmental award criteria tend to be weighted at 1 out of 100 points. In the other two municipality sizes, the weight of the environmental criteria ranges from 5 to 30 points and from 2 to 30 points out of 100.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

Table 10. Environmental award criterion weight by municipality size.

Municipality size (inhabitants)	Weight		
	Minimum	Maximum	Average
>100,000	2	30	5.8
10,000–100,000	5	30	7.4
<10,000	1	1	1

An analysis was conducted on the weights assigned to the environmental award criteria individually, according to their action sector, identifying each assigned weight range. (Figure 2) depicts the weight distribution of the environmental criteria for each sector. The environmental award criteria tend to be weighted from 1 to 10. However, the weight in water and transport and mobility action sectors reach values of 15. Only energy efficiency and waste sectors assigned weights of 20 to environmental award criteria. Contrarily, urban planning and noise sectors tend to be assigned weight values of less than 5.

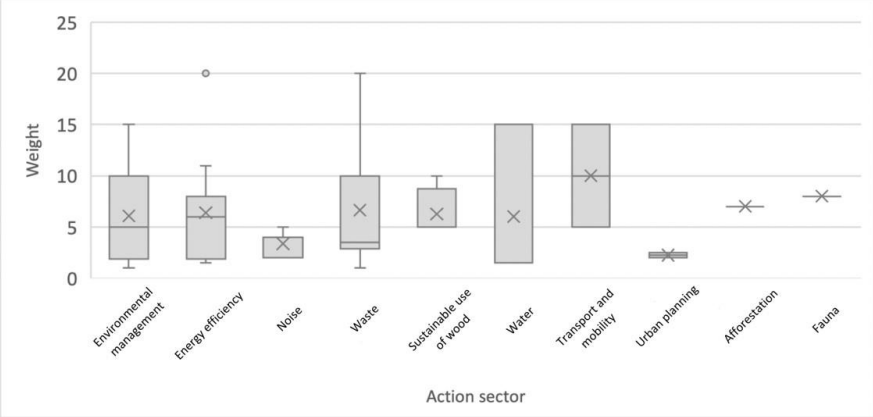

Figure 2. Weights assigned to environmental criteria by action sector.

Finally, the analysis evaluated how these environmental award criteria were assessed. The assessment was considered objective when assessed via a numerical indicator and subjective when no indicator assessed the criterion and the assessment was at the discretion of the evaluator. (Figure 3) displays the results, revealing that municipalities with a smaller population size assessed the criteria more objectively.

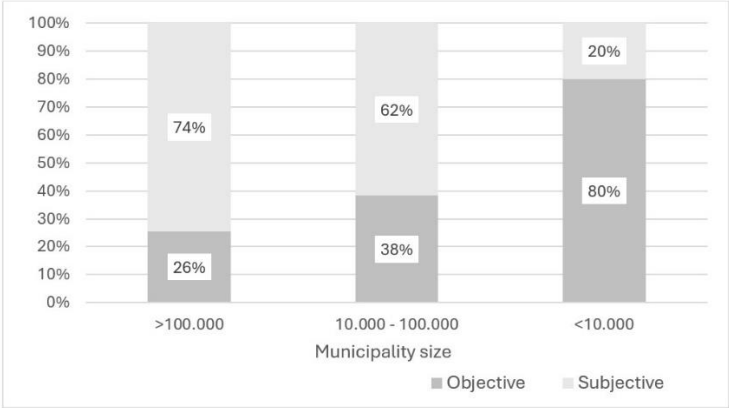

Figure 3. Type of environmental award criteria assessment.

(Figure 4) illustrates how the environmental award criteria were assessed per action sector. The energy efficiency, noise, urban planning, afforestation, and fauna action sectors were evaluated subjectively. In contrast, most award criteria related to the transport and mobility sector

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

and the sustainable use of wood were objectively assessed. Finally, criteria related to environmental management, waste, and water were assessed objectively and subjectively.

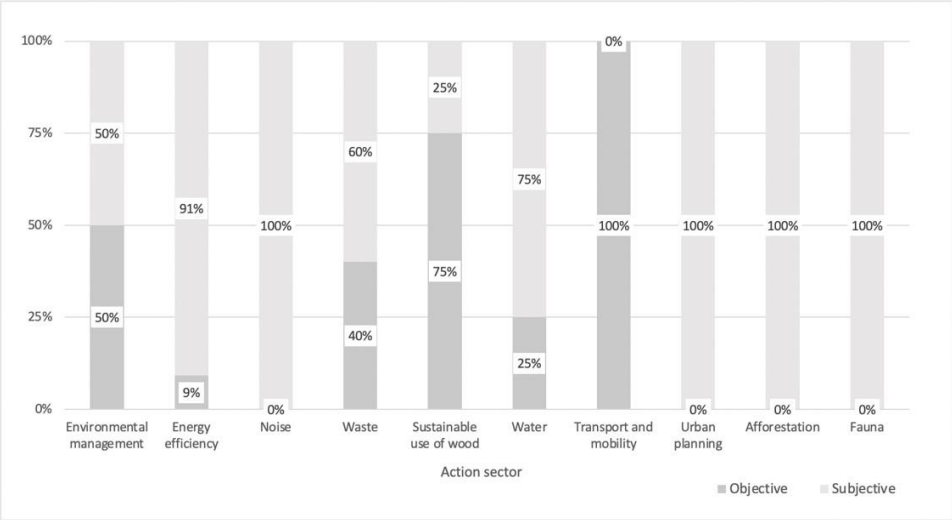

Figure 4. Type of environmental award criteria assessment by sector.

6.4 Special execution conditions and environmental obligations of the contractor

In the procurement procedures, environmental conditions related to special execution conditions and environmental obligations were identified. (Table 11) indicates that 63% of the analyzed procurement procedure included environmental aspects, with a greater incidence in the middle population size.

Table 11. Environmental conditions in public-work procurement.

Municipality size	Environmental conditions (*N*)	Procurement procedure with environmental conditions (%)
>100,000	36	72%
10,000–100,000	41	82%
<10,000	18	36%
	95	**63%**

6.5 Relationship between municipality action plans and environmental criteria in public-work procurement

The analysis assessed the relationship between the criteria in the public procurement of municipalities associated with the Conveyor of Mayors and the environmental measures that these municipalities established in their action plans. (Figure 5) indicates a high percentage of procurement procedures without environmental criteria, and when the environmental criteria are included, these procedures tend not to be related to the strategies in the municipality action plans. Only 40% of procurement procedures of municipalities over 10,000 inhabitants present award criteria related to their action plan strategies.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

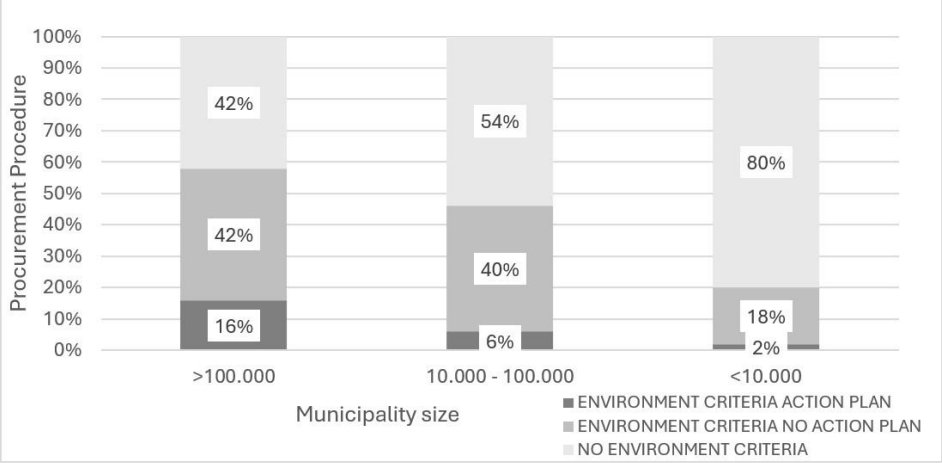

Figure 5. Inclusion of environmental criteria related to municipality action plans.

(Figure 6) reveals that only the energy efficiency, transport and mobility, and water sectors use award criteria related to the action plans.

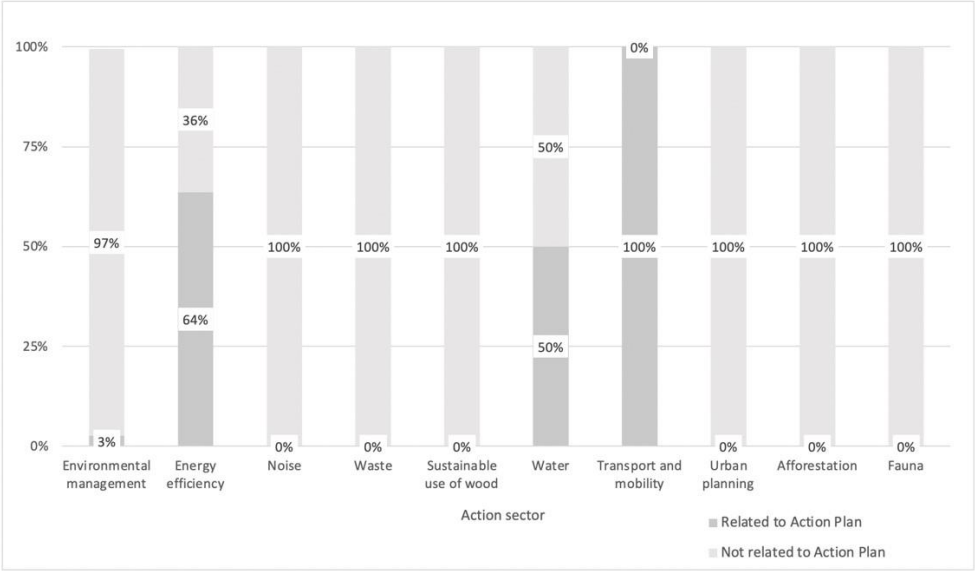

Figure 6. Environmental criteria related to municipality action plans.

7. Discussion

Promoting GPP contributes to sustainability and significantly affects quality of life (PricewaterhouseCoopers, 2009). Further, GPP can encourage the reduction of approximately 25% of carbon dioxide emissions, implying less pollution, better air quality, and a cleaner and healthier atmosphere (PricewaterhouseCoopers, 2009). Implementing sustainable practices, such as using nontoxic materials and efficient energy systems, in the construction sector is essential, leading to better air quality and less exposure to harmful pollutants and positively affecting health and well-being (Lützkendorf, 2019). According to (Tarantini et al., 2011), in the construction industry, GPP encourages using environmentally friendly materials and life-cycle assessments, reducing the carbon footprint and resource depletion and directly supporting environmental sustainability. This procurement fosters healthier ecosystems and air quality, benefiting the overall quality of life in affected communities. (Tsimisaraka et al., 2022) stated that implementing GPP in the construction industry supports sustainable economic growth by promoting green logistics and innovative practices in the construction supply chain, strengthening local economies and enhancing community resilience. This can improve local infrastructure and provide long-term economic stability, benefiting society. Therefore, enhancing GPP in construction advances sustainability goals and significantly enhances the quality of life by fostering healthier environments, stable economies, and community well-being. Therefore,

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

many countries have enacted local initiatives to combat climate change (Reckien et al., 2018). The most important initiative at the international level is the Covenant of Mayors for Climate and Energy in Europe, which has empowered local governments to take environmental action.

In Spain, the effect of the pact has been reflected in measures related to energy efficiency and transport and mobility. The most significant aspects of energy efficiency are municipal facilities, working with citizens and stakeholders, and local energy production in the tertiary and residential sectors. According to (Lucchitta et al., 2024), the Covenant of Mayors has defined these sectors as "key sectors" because local authorities can influence and achieve the reduction of related emissions in these sectors. (Soto et al., 2020) emphasized that reducing energy consumption in buildings in the energy efficiency sector is essential, given that this sector is responsible for about 40% of energy consumption worldwide. Currently, around 75% of EU buildings are energy inefficient. Additionally, (Shovkva, 2020) noted that energy efficiency in designing and constructing buildings is essential to contributing to sustainable urban development and reducing environmental effects.

The results of including environmental considerations in public-work procurement were about 81%, as award criteria or special execution conditions. Environmental award criteria were included in 41% of procurement procedures, whereas environmental special execution conditions were included in 63%. Some results are related to those obtained by (Montalbán-Domingo et al., 2023), who found that 90% included some environmental considerations, whereas only 21% included environmental criteria as award criteria in an analysis of 343 procurement procedures at the international level. In contrast, environmental aspects, such as special execution conditions or technical specifications, were identified in 87% of the procurement procedures. This figure is much higher than that recorded by (Fuentes-Bargues et al., 2017), who studied environmental criteria in 100 construction contract files in Spain and found that 35% included environmental criteria or aspects. However, further efforts are necessary because the effective inclusion of environmental criteria must be promoted, covering elements that could generate the most significant influence depending on the infrastructure type, guaranteeing an objective evaluation of the environmental criteria and execution compliance.

Regarding the relationship between the population size of municipalities and the inclusion of environmental criteria in contracting processes, a larger population size results in a greater number of considered environmental criteria and procurement procedures with environmental criteria, as supported by other authors. For example, (Fuentes-Bargues et al., 2017) maintained that smaller administrations include fewer environmental criteria in contracting processes because of the lower availability of economic and technical resources, such as a highly trained work team in environmental sustainability and sustainable public procurement. (Reckien et al., 2018) highlighted that municipality size is influential in adopting climate action by local governments. In contrast, (Testa et al., 2016) maintained that the knowledge of tools to implement and apply sustainable public procurement by municipalities and their authorities is a crucial factor in adopting sustainable practices in public procurement. Therefore, including environmental practices in public procurement is more likely to be identified in larger cities. The analysis of the positive aspects of municipalities with larger populations reveals that making the situation of smaller municipalities visible and exploring and removing the barriers so that they can access the support and necessary resources from the appropriate government level is critical to improving their procurement processes and employing the same approach as larger municipalities.

The analysis of the individually identified award criteria in public procurement found that the criteria are related to environmental management, as identified in 63% of the analyzed files. The following criteria are related to energy efficiency, noise management, and waste management but appear in only about 10% of the procurement procedures. (Montalbán-Domingo et al., 2023) noted that the criteria related to environmental management are the most frequent in public-work procurement; however, the criteria related to implementing energy measures have a low inclusion at 14.6%, close to that identified in this study, reaching 16%. In contrast, (Shen et al., 2017a), (Shen et al.,2017b) highlighted the importance of including sustainable practices in public contract processes in terms of energy efficiency, waste management, and using sustainable materials. Finally, (Fuentes-Bargues et al., 2018) emphasized the importance of GPP for sustainable development, which must be studied in greater depth to better guide and define its implementation in the future.

Most identified environmental criteria are subject to a subjective assessment without a numerical indicator. The assigned score depends on the evaluator's criteria. The weight assigned to the environmental criteria in municipalities with a larger population is greater than those identified in municipalities with smaller populations. (Fuentes-Bargues et al., 2017) highlighted that a higher contract size results in a greater weight assigned to environmental criteria, similar to the findings of this study in that larger administrations typically enter contracts with higher amounts. This finding supports that the weight assigned to environmental criteria is greater in municipalities with a larger population. (Brammer and Walker, 2011) suggested that the availability of economic resources from public administrations is the primary barrier to implementing sustainable

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

practices in public procurement, causing administrations to resist spending more to obtain more sustainable solutions. This barrier is more transparent in smaller local governments, where budgets are quite limited.

Environmental criteria received an average of 5.9 points out of 100, regardless of the population size. Compared with other studies, the study results are slightly higher than those obtained by (Fuentes-Bargues et al., 2017), with an average weight in local government contracts reaching 4.7 points. In contrast to studies conducted in other EU countries, (Nissinen et al., 2009) found an average of 3.3 points in Switzerland, Finland, and Denmark.

The Covenant of Mayors has been a determinant in moving municipalities toward GPP, defining environmental strategies to mitigate, adapt, and fight against energy poverty. However, the analysis of the public procurement of municipalities associated with the Covenant of Mayors reveals no relationship between the environmental criteria that municipalities include in their public procurement and the environmental strategies defined in their action plans. Therefore, more efforts are needed to train public administrations to address municipality needs in terms of environmental performance through public procurement. Nevertheless, this situation is not exclusive to Spain. As (Brammer and Walker, 2011) suggested, in Europe, the application of sustainable public procurement varies widely, implying that the national and international political framework is a determining aspect in the degree of application of sustainable public procurement. This study emphasizes that governments must provide contracting institutions with the necessary support in legislative and regulatory fields for the inclusion of sustainability in public procurement and provide local governments with budgetary flexibility to invest in environmentally sustainable goods and services.

(Brammer and Walker, 2011) conducted a comparative study of public procurement in parts of Europe, identifying that sustainable public procurement is more developed in the United Kingdom and Eastern Europe. Regarding the performance of the UK in terms of sustainable public procurement, (Thomson and Jackson, 2007) found that sustainable public procurement has been promoted through legislation, information and training for contractors, and barrier identification and elimination. Regarding GPP in North America, specifically in Canada, (Brammer and Walker, 2011) stated that this aspect is widespread and has been considered for several years owing to government measures, such as the creation of an Office of Green Government Operations and the development of a green procurement policy that includes training responsible staff in green procurement. In Japan, the situation is similar to that in Canada; GPP has been implemented since 2001, when a green procurement law was passed in which public administrations were obliged to develop and implement a sustainable public procurement policy (European Coalition for Corporate Justice, 2007).

However, (Ruparathna, 2015) noted some limitations, such as the existence of few explicit legal instruments covering sustainable public procurement, the lack of standard methods for implementing sustainable procurement, and the lack of knowledge in local administrations. Thus, (Ruparathna, 2015) concluded that more tools are needed to support the implementation of sustainable public procurement.
(Palmujoki et al., 2010) analyzed the inclusion of environmental criteria in procurement processes in two “Green 7” countries, Finland and Sweden, identifying that, although inclusion was increasing and the concept of green or sustainable public procurement was becoming more widespread, greater clarity was necessary in defining environmental criteria and legislation. However, they highlighted that political pressure, the development of practical tools for sustainable public procurement, and the establishment of common environmental criteria have been factors facilitating public administrations to intensify the inclusion of environmental criteria in procurement processes. Finally, countries that were not part of the “Green 7” have also been developing and implementing tools for sustainable public procurement. For example, Germany has developed a support tool for municipalities in sustainable public procurement (Günter and Scheibe, 2006).

8. Conclusions

8.1 Contributions

This study identified the primary environmental measures that municipalities affiliated with the Covenant of Mayors have committed to implementing in their action plans and analyzed how these municipalities address their environmental strategies through public-work procurement. The action plans of the municipalities committed to the three objectives of the covenant were analyzed to achieve the first objective. The analysis of the action plans of 53 municipalities revealed 2,348 measures classified into sectors, revealing that 64.52% are related to the energy efficiency sector and 24.23% to transport and mobility. In the energy efficiency sector, the most significant measures focused on municipal facilities, with such actions as audits, energy certifications, air conditioning, lighting, and contracting with energy efficiency criteria. The measures also focused on working with citizens and stakeholders, with awareness-raising initiatives on energy efficiency. In the transport and

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

mobility sector, the measures involved planning, including promoting efficient driving, fostering sustainable mobility, and managing road networks.

For the second objective, 150 procurement procedures associated with construction work were analyzed, identifying the environmental considerations included as award criteria and special execution conditions. The results revealed that the municipality size significantly influences the inclusion and assessment of environmental award criteria. Moreover, larger municipalities tend to include environmental award criteria more frequently than smaller ones. These smaller municipalities tend to assess environmental criteria objectively, contrary to the larger ones that prefer subjectivity. The most common award criteria are related to environmental management, energy efficiency, noise management, and waste management. The weight assigned to environmental criteria in the bid evaluation varied between 1 and 30 points out of 100, with an average of 5.9 points, with the highest weights assigned by larger municipalities. Finally, the analysis of public procurement in municipalities affiliated with the Covenant of Mayors indicated no connection between the environmental criteria these municipalities incorporated into their procurement procedures and the environmental strategies outlined in their action plans. Therefore, the construction sector should integrate environmental criteria in the public procurement processes because this sector is critical to the economy of any country due to its representation in the GDP. Consequently, increased efforts to train public administrations are necessary to use procurement effectively as a tool to meet the environmental performance goals of municipalities.

8.2 Recommendations

The study results reveal that GPP is not yet fully implemented because the inclusion of environmental criteria in public-work procurement is still low. Furthermore, the weights assigned to these criteria are also low when included. Therefore, strengthening the training of technical staff in local governments is essential so that environmental sustainability can be transparently included in all public-work procurement phases, adapting to the project characteristics. The environmental aspects identified as special conditions of execution appear general; hence, it would be difficult to demand their compliance to the full extent transparently. Therefore, these should be more specific according to the contracted project. Sustainable public contracting must be promoted by all government institutions: local, provincial, national, and international. They must unite and combine efforts and verify compliance with the current environmental regulations applicable at each level.

The action measures focus on critical areas to achieve the objectives; however, executing these measures is not directly reflected in the contracting processes. Thus, municipalities should identify the aspects of their action plans that can be adapted and included in each stage when planning their projects, whether in the contractual or construction phase.

8.3 Limitations

The analysis focused exclusively on municipalities pursuing the three commitments of the Covenant of Mayors: mitigation, adaptation, and the fight against energy poverty. Thus, those municipalities with only one or two of these commitments were excluded from the study, although they could play a relevant role in the fight against climate change. The study evaluated the measures from the perspective of their inclusion in the action plans, but the level of compliance or implementation of these measures has not been verified.

8.4 Future research

This research could be complemented to obtain a broader view of the role that the Covenant of Mayors plays by analyzing additional municipalities. For example, research could include municipalities pursuing one or two commitments and demonstrating good performance (e.g., by preparing action plans and presenting progress reports).

In future research, analyzing the degree of compliance with the measures in the action plans would be valuable, allowing the actual effect of the Covenant of Mayors on sustainability at a local level to be assessed beyond public procurement. In addition, to further analyze the inclusion of environmental criteria in public-work procurement processes in local governments, research should identify the specific barriers these administrations face, depending on population size. This approach could facilitate a better understanding of the difficulties and opportunities in implementing sustainable criteria in public procurement. Finally, conducting a comparative study between municipalities with a high percentage of inclusion of environmental criteria in their contracts and those with a low or no percentage would help evaluate the social influence generated by the execution of public-work projects with environmental considerations in their contracting stage.

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

9. Acknowledgements

The authors are grateful for the financial support from the Generalitat Valenciana through the AICO 2024 grant from the Department of Education, Universities and Employment (CIAICO/2023/216) and the Climate Change Chair of the Universitat Politècnica de València.

10. Notes on Contributors

María Isabel Valdivieso-Ramírez, Construction Project Management Research GroupUniversitat Politècnica De València, Spain **ORCID** https://orcid.org/0009-0004-6500-9943	**Laura Montalbán-Domingo,** Construction Project Management Research GroupUniversitat Politècnica De València, Spain **ORCID** https://orcid.org/0000-0002-9506-0350
Tatiana García-Segura, Construction Project Management Research GroupUniversitat Politècnica De València, Spain **ORCID** https://orcid.org/0000-0002-7059-0566	**Amalia Sanz-Benlloch,** Construction Project Management Research GroupUniversitat Politècnica De València, Spain **ORCID** https://orcid.org/0000-0001-8051-0649
Eugenio Pellicer, Construction Project Management Research GroupUniversitat Politècnica De València, Spain **ORCID** https://orcid.org/0000-0001-9100-0644	

11. References

Brammer, S.; Walker, H. (2011). Sustainable procurement in the public sector: An international comparative study. International Journal of Operations and Production Management, 31 (4), 452–476. https://doi.org/10.1108/01443571111119551

Braulio-Gonzalo, Marta.; Bovea, María. (2020). Relationship between green public procurement criteria and sustainability assessment tools applied to office buildings. Environmental Impact Assessment Review, 81. https://doi.org/10.1016/j.eiar.2019.106310

Carnevalli, J. A.; Miguel, P.C. (2008). "Review, analysis and classification of the literature on QFD–Types of research, difficulties and benefits." International Journal of Production Economics. 114 (2): 737–754. https://doi.org/10.1016/j.ijpe.2008.03.006.

Orden PCI 86 de (2019). Ministerio de la Presidencia, Relaciones con las Cortes e Igualdad. Por la que se publica el Acuerdo del Consejo de Ministros de 7 de diciembre de 2018, por el que se aprueba el Plan de Contratación Pública Ecológica de la Administración General del Estado, sus organismos autónomos y las entidades gestoras de la Seguridad Social (2018-2025). Boletín Oficial del Estado, núm. 30, de 4 de febrero de 2019, pp 9572 a 9597. https://www.boe.es/eli/es/o/2019/01/31/pci86

Construction Industry Observatory (2020). The construction sector Report 2019. https://www.observatoriodelaconstruccion.com/informes/detalle/informe-sobre-el-sector-de-la-construccion-2019

Covenant of Mayors EU. (2015). Goals. https://eu-mayors.ec.europa.eu/es/home?etrans=es

Deambrogio, E.; Allegretti, S.; Turi, P.; Zuccarello, F.; Lariccia, P.; Aghemo, C.; Pellegrino, A. (2017). Increase Sustainability in Buildings Through Public Procurements: The PROLITE project for Lighting Retrofit in Schools. Energy Procedia, 111, 328–337. https://doi.org/10.1016/j.egypro.2017.03.194

Directive 2014/23/EU (2014). European Parliament and of the Council. On the award of concession contracts. Official Journal of the European Union, no. 94, February 26. pgs 1 to 64. https://www.boe.es/buscar/doc.php?id=DOUE-L-2014-80597

Directive 2014/24/EU (2014). European Parliament and of the Council. On public procurement and repealing Directive 2004/18/EC. Official Journal of the European Union, no. 94, February 26. pgs 65 to 242. https://www.boe.es/buscar/doc.php?id=DOUE-L-2014-80598

Directive 2014/25/EU (2014). European Parliament and of the Council. On procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC. Official Journal of the European Union, no. 94, February 26, 2014 pgs 243 to 374. https://www.boe.es/buscar/doc.php?id=DOUE-L-2014-80598

Enshassi, A.; Al Ghoul, H.; Alkilani, S. (2018). Exploring sustainable factors during construction projects' life cycle phases. Revista Ingeniería de Construcción, 33(1), 51-68. http://dx.doi.org/10.4067/S0718-50732018000100051

European Coalition for Corporate Justice (2007). Sustainable Procurement in the European Union Proposals and Recommendations to the European Commission and the European Parliament, European Coalition for Corporate Justice, Brussels.

European Union. (2016). Buying-Green-Handbook-3rd-Edition.

Fuentes-Bargues, J. L.; Ferrer-Gisbert, P. S.; González-Cruz, M. C. (2018). Analysis of Green public procurement of works by Spanish public universities. International Journal of Environmental Research and Public Health, 15(9). https://doi.org/10.3390/ijerph15091888

Fuentes-Bargues, J. L.; González-Cruz, M. C.; González-Gaya, C. (2017). Environmental criteria in the spanish public works procurement process. International Journal of Environmental Research and Public Health, 14(2). https://doi.org/10.3390/ijerph14020204

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

Günther, E.; Scheibe, L. (2006). The hurdle analysis: a self-evaluation tool for municipalities to identify, analyse and overcome hurdles to green procurement. Corporate Social Responsibility and Environmental Management, 13, 61-77. https://doi.org/10.1002/csr.92

Health Effects Institute. (2024). State of Global Air 2024. Special Report. Boston, MA:Health Effects Institute.

Huang, L.; Krigsvoll, G.; Johansen, F.; Liu, Y.; Zhang, X. (2018). Carbon emission of global construction sector. Renewable and Sustainable Energy Reviews, 81, 1906–1916. https://doi.org/10.1016/j.rser.2017.06.001

International Institute for Law and Environment. (2023). Advances in municipal climate and energy action: case analysis. https://iidma.org

Ley 9/ (2017). de 8 de noviembre, de Contratos del Sector Público, por la que se transponen al ordenamiento jurídico español las Directivas del Parlamento Europeo y del Consejo 2014/23/UE y 2014/24/UE, de 26 de febrero de 2014. Boletín Oficial Del Estado, núm 272, de 9 de noviembre de 2017, pp 1 a 268. https://www.boe.es/eli/es/l/2017/11/08/9/con

Ley 7/ (2021). de 20 de mayo, de cambio climático y transición energética. Boletín Oficial Del Estado, núm. 121, de 21 de mayo de 2021, pp 62009 a 62052. https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-8447

Lucchitta, B.; Palermo, V.; Melica, G.; Molteni, T.; Burro, A.; Bertoldi, P.; Croci, E. (2024). Are European cities achieving emission reduction commitments? A comparative analysis under the Covenant of Mayors initiative. Heliyon, 10(1). https://doi.org/10.1016/j.heliyon.2023.e23423

Lützkendorf, T. (2019). Sustainability in Building Construction-A Multilevel Approach. IOP Conference Series: Earth and Environmental Science, 290(1). https://doi.org/10.1088/1755-1315/290/1/012004

Montalbán-Domingo, L.; Aguilar-Morocho, M.; García-Segura, T.; Pellicer, E. (2020). Study of social and environmental needs for the selection of sustainable criteria in the procurement of public works. Sustainability (Switzerland), 12(18). https://doi.org/10.3390/SU12187756

Montalbán-Domingo, L.; Torres-Machi, C.; Sanz-Benlloch, A.; Pellicer, E.; Molenaar, K. R. (2023). Green Public Procurement in Civil Infrastructure Construction: Current Performance and Main Project Characteristics. Journal of Construction Engineering and Management, 149(9). https://doi.org/10.1061/jcemd4.coeng-13502

Nissinen, A.; Parikka-Alhola, K.; Rita, H. (2009). Environmental criteria in the public purchases above the EU threshold values by three Nordic countries: 2003 and 2005. Ecological Economics, 68(6), 1838–1849. https://doi.org/10.1016/j.ecolecon.2008.12.005

Oltean-Dumbrava, C.; Miah, A. (2016). "Assessment and relative sustainability of common types of roadside noise barriers." Journal of Cleaner Production. 135 (Nov): 919–931. https://doi.org/10.1016/j.jclepro.2016.06.107.

Palmujoki, A.; Parikka-Alhola, K.; Ekroos, A. (2010). Green public procurement: Analysis on the use of environmental criteria in contracts. Review of European Community and International Environmental Law, 19(2), 250–262. https://doi.org/10.1111/j.1467-9388.2010.00681.x

PricewaterhouseCoopers. (2009). Collection of statistical information on Green Public Procurement in the EU. Report on data collection results.

Public Sector Procurement Platform. (s.f). Public Sector Procurement Platform. https://contrataciondelestado.es/wps/portal/plataforma

Reckien, D.; Salvia, M.; Heidrich, O.; Church, J. M.; Pietrapertosa, F.; De Gregorio-Hurtado, S.; D'Alonzo, V.; Foley, A.; Simoes, S. G.; Krkoška Lorencová, E.; Orru, H.; Orru, K.; Wejs, A.; Flacke, J.; Olazabal, M.; Geneletti, D.; Feliu, E.; Vasilie, S.; Nador, C., … Dawson, R. (2018). How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. Journal of Cleaner Production, 191, 207–219. https://doi.org/10.1016/j.jclepro.2018.03.220

Ruparathna, R.; Hewage, K. (2015). Sustainable procurement in the Canadian construction industry: Current practices, drivers and opportunities. Journal of Cleaner Production, 109, 305–314. https://doi.org/10.1016/j.jclepro.2015.07.007

Shen, L.; Zhang, Z.; Long, Z. (2017). Significant barriers to green procurement in real estate development. Resources, Conservation and Recycling, 116, 160–168. https://doi.org/10.1016/j.resconrec.2016.10.004 (a)

Shen, L.; Zhang, Z.; Zhang, X. (2017). Key factors affecting green procurement in real estate development: a China study. Journal of Cleaner Production, 153, 372–383. https://doi.org/10.1016/j.jclepro.2016.02.021 (b)

Soto, T.; Escrig, T.; Serrano-Lanzarote, B.; Desantes, N. M. (2020). An approach to environmental criteria in public procurement for the renovation of buildings in Spain. Sustainability (Switzerland), 12(18). https://doi.org/10.3390/su12187590

Tarantini, M.; Loprieno, A. D.; Porta, P. L. (2011). A life cycle approach to Green Public Procurement of building materials and elements: A case study on windows. Energy, 36(5), 2473–2482. https://doi.org/10.1016/j.energy.2011.01.039

Tsimisaraca, M.; Chengang, Y.; Ralison Ny Avotra, A. A.; Hussain, Z.; Zonia, J. E.; Nawaz, A. (2022). Impact of Green Construction Procurement on Achieving Sustainable Economic Growth Influencing Green Logistic Services Management and Innovation Practices. Frontiers in Environmental Science, 9. https://doi.org/10.3389/fenvs.2021.815928

Testa, F.; Grappio, P.; Gusmerotti, N.M.; Iraldo, F.; Frey, M. (2016). Examining green public procurement using content analysis: Existing difficulties for procurers and useful recommendations. Environ. Dev. Sustainability 18(1), 197–219. https://doi.org/10.1007/s10668-015-9634-1

Thomson, J.; Jackson, T. (2007). Sustainable procurement in practice: lessons from local government. Journal of Environmental Planning&Management, 50 (3), 421-44. https://doi.org/10.1080/09640560701261695

ISSN: 0718-5073

Vol. 39
Nº3 2024
DOI: 10.7764/RIC.00121.21

United Nations. (2018). The 2030 Agenda and their Sustainable Development Goals. In The Journal of Environmental Law (Issue 10). https://doi.org/10.5354/0719-4633.2018.52077

Vivanco, M. (2005). Muestreo Estadístico Diseño y Aplicaciones. Editorial Unviersitaria. Chile.

Yılmaz, M.; Bakış, A. (2015). Sustainability in Construction Sector. Procedia - Social and Behavioral Sciences, 195, 2253–2262. https://doi.org/10.1016/j.sbspro.2015.06.312

Zhovkva, O. (2020). The principles of energy efficiency and environmental friendliness for multifunctional complexes. Revista Ingeniería de Construcción, 35(3), 308-320. http://dx.doi.org/10.4067/S0718-50732020000300308

ISSN: 0718-5073