Driving the Circular Transition in Practice through Public Procurement: An Exploration of Calls for Tender Documents

Introduction

Public Procurement (PP) is the activity of a public organization to purchase goods and services in order to carry out its functions (Gyori, 2022). The size of PP spending, estimated to be 12.9% of Gross Domestic Product (GDP) in OECD nations (Patrucco et al., 2024), gives it potential to produce radical and transformative change in the market of companies providing goods and services to public sector organisations (Harland et al., 2019). PP is also relevant to the UN Sustainable Development Goals, notably 12 – Responsible Consumption and Production, with the specific target 12.7 'to promote public procurement practices that are sustainable in accordance with national policies and priorities' (United Nations, 2015).

Public Procurement has the potential to broaden the deployment of circular economy practices, by diffusing circular practices throughout the supply chains of companies engaging in public sector projects, and ultimately become mainstream practices in the regions in which they operate. This can help authorities to contribute to achieving the stated aim of the European Union's (EU) Circular Economy Action plan, which is to deliver "sustainable activity in key sectors and new business opportunities..[which] will help to unlock the growth and jobs potential of the circular economy" (European Commission, 2015). Implementing CE practices in cities and regions is important given the population density of cities and the concentration of resource consumption (Dąbrowski et al., 2024). Public procurement, especially those conducted by city and regional authorities has a strong role to play in shifting business models towards circularity, for example through integrating circular criteria in calls for tender and contracts which encourage or mandate circular practices for suppliers serving public procurers (Fuentes-Bargues et al., 2019; Kristensen et al., 2021), and especially by contracting local firms. This is an example of practical applications of CE principles for a local strategy, which goes beyond using circularity as a 'buzzword', setting strategies that can deliver shifts towards transitions towards circular businesses within cities and regions (Dąbrowski et al., 2024). To explore this further, this research addresses the questions:

- What evidence is there of CE principles in current calls for tender in Public Procurement issued by local or regional authorities?

- How can PP be utilized to drive increased CE activity in the private sector for the benefit of city and regional economies?

Methodology

This research explores indicators and criteria providing opportunities to integrate the CE into PP projects, through the use of automated content analysis (ACA) (Hase, 2022) using a large language model, specifically Generative Pretrained Transformer (GPT-4), to examine tender documents. ACA relies on deep learning and advanced natural language processing (NLP) for machine learning and large text data-mining analysis (Hase, 2022). ACA, which has not yet been widely applied in the sustainability management literature, is an innovative methodology for deriving insights into this equally new topic. The approach integrates a structured framework for analysis derived from a review of relevant literature that was translated into customized prompts, which are presented below, designed with instructions to generate desired responses for all the dimensions in the framework (Gu et al., 2023).

Data Collection

To collect tender documents, the Tenders Electronic Daily (TED) database was used, which is connected to the EU's 'Supplement to the Official Journal' for PP. The search was conducted on 18th November 2024. Active notices published between 01.01.2023 and 31.12.2023 were searched with the keyword "circular economy", with criteria that they were for activities taking place in a single country and were an open procedure. The browsing language was set to English, though no restrictions were set for the language of tender submission. 269 documents were extracted of which 89 involve local or regional authorities.

Analysis Framework and Prompt Development

A review of existing literature on PP further helped to identify key thematic areas, criteria, and indicators of interest, building on previous work conducted by Saidani et al. (2019). These insights were synthesized into an analysis framework (see *Table 1*). Second, the framework was operationalized into a series of prompts to facilitate ACA usJuing GPT-4. These prompts were

designed to guide and fine-tune the model's focus and ensure its outputs aligned with the analysis framework.

Table 1: Analysis framework

	Dimension	Indicator	Prompts
Award criteria	**1. Award criteria**		• What are the award criteria? Are criteria other than price considered? And what are they? • Are specific CE-related criteria included in the award criteria?
Quantitative	**1. Resource Efficiency**	Resource Utilization Rate	• What percentage of recycled materials is required? • What percentage of renewable materials is required?
		Waste Reduction Targets	• Are there specific waste reduction goals? • If yes, what targets are set?
		Circular Material Use Rate	• Are there specific use rates of circular material incorporated?
	2. Longevity	Product Lifecycle Duration	• Is there an expected lifespan specified for the product/service? • Is there a minimum lifespan specified for the product/service?
		Maintenance and Repair Rates	• Are there specific goals for the maintenance or repair to extend the product's/service's lifespan?
	3. Circularity	Recyclability of Components	• Does the tender require a fixed percentage of recyclable components? • Does the tender require a fixed percentage of reusable components?
	4. Environmental and Social Considerations	Carbon Footprint	• Is there a mandatory requirement to report on the carbon footprint of the product/service? • Is there a carbon footprint target set associated with the product/service?
		Water and Energy Consumption	• Is it mandatory to report water consumption across the product lifecycle? • Is it mandatory to report energy consumption across the product lifecycle?
Qualitative	**1. Resource Efficiency**	Waste Minimization	• Does the tender specify modular or repair-friendly designs to minimize waste?
	2. Product Longevity	Design for Durability	• Are materials or components required to meet specific durability standards?
	3. Circularity	Circularity	• Does the tender encourage the use of secondary materials? • Does the tender encourage the use of locally-sourced materials?
	4. Environmental and Social Considerations	Social Sustainability	• Are awarded companies required to meet social sustainability standards?
		Environmental Sustainability	• Are awarded companies required to avoid/minimize/offset GHG emissions? • Are awarded companies required to avoid/minimize/offset negative biodiversity effects? • Are awarded companies required to avoid/minimize/offset water stress?
	5. Innovation and Market Development	Market Development	• Does the tender prioritize suppliers with CE-aligned business models?

			• Does the tender prioritize suppliers with CE-aligned innovations?
		Transformative action	• Is there evidence in the tender of cross-scale integration (e.g., coordination between regional and city-level goals)?
		Capacity development	• Are there provisions in the tender for shared resources or collaboration to bolster project capacity?

Source: own representation, categories based on Saidani et al., (2019), Wolfram (2016), Wurster & Ladu (2022).

Pilot Testing and Prompt Refinement

A pilot study was conducted on a subset of tender documents (n = 20) to assess the initial prompts' effectiveness. The outputs generated during this trial were manually analyzed to detect any inconsistencies or ambiguities in the responses. Insights from this analysis informed iterative refinements to the prompts, improving their clarity and alignment with the analysis framework.

Data Analysis and Validation

The refined prompts were applied to the complete dataset of tender documents. Each document was processed individually by feeding its content into GPT-4 and generating responses based solely on the information within that specific document. This controlled approach ensured that the analysis remained document-specific and avoided introducing external data or bias. We validated the ACA's results by using reliability measures, which take into account stability, reproducibility, and accuracy reflecting precision and recall (Harwood & Garry, 2003; Krippendorff, 1980).

Preliminary Findings

This study reveals an urgent need for an increased inclusion of CE criteria in PP to drive sustainability transitions. From the conducting of the pilot study it is revealed that there is a lack of CE integration into PP call for tender documents, with price dominating the award criteria. Where quality criteria are included, this often referred to vague environmental references that lacked clear operationalisation. Linear economic factors such as cost efficiency dominated, and only two calls for tender explicitly incorporate CE practices. This signals an emerging interest in circular approaches but only accounted for 15% of the overall weighting in decision-making,

underscoring a marginal role at present in decision-making. Therefore, there is a systemic challenge which needs to be faced to implement CE practices, and to leverage PP as a strategic tool for promoting sustainable transitions in the private sector. While national laws play a crucial role in defining how PP can be utilized, achieving meaningful sustainability action requires commitment from local and regional authorities. Without such commitment, broader policy objectives are at risk.

Future Work

Future work will further refine the framework and explore the patterns that emerge from analysing the full dataset. This will provide opportunity to refine the framework and translated prompts to improve the ACA's efficacy based on the findings. Deeper insights will be developed into how PP at different scales can effectively drive increased CE activity in the private sector, and how this drives circular transitions in city and regional economies. Following refinement, the methodology will be rolled out to a wider sample of calls for tender documents and explore differences between the spatial scales of procuring authorities.

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