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RESEARCH ARTICLE

Achieving Sustainable Procurement in Construction Projects: The Pivotal Role of a Project Management Office

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Abstract

Environmental and ecological impacts associated with construction activities have become an ever-increasing concern, especially the considerable amount of waste generated on construction sites. Regulations and growing client pressure on meeting environmental standards have led contractors to adopt sustainable practices and try to embed this concept in their processes. Sustainable procurement management (SPM) as a potential solution takes the environmental consequences of procurement decisions into account and integrates sustainable practices into project procurement to bring positive environmental outcomes. Previous research has mainly focused on the public sector in achieving green procurement, yet this study attempts to highlight internal capacities that help private organisations manage the requirements associated with practicing sustainability. It is theorised that robust management structures, specifically project management offices (PMOs), would enhance the oversight capabilities of contractors in implementing the SPM process. The objectives of the current study are to (1) identify the requirements of a sustainable project procurement process in construction sites based on a literature review, and (2) explore the facilitative role of PMO units in achieving these requirements in the private sector. A literature review was conducted followed by a qualitative survey to solicit the viewpoints of construction professionals in principle

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contracting firms. As a result of the study, we identified 17 sustainability requirements and found that PMOs boost collaboration and improve the quality of decision making towards sustainable procurement. The findings (1) explain how PMOs support sustainability, (2) provide insights on implementing sustainable practices in project purchases, and (3) improve theoretical understanding of the SPM principles.

Keywords

Construction Projects; Project Management Office; Sustainable Procurement

Introduction

Sustainable procurement management (SPM) incorporates the environmental consequences of project purchases. Sustainability can only be achieved by the commitment and close collaboration of various businesses operating in a supply chain. In a circular industry, all parties involved in a supply chain should take responsibility for the environmental impact of their activities. It is debated that enterprises in a supply chain cannot be more sustainable than their suppliers as their business benefits are interrelated ([Krause, Vachon and Klassen, 2009](#)). SPM brings noticeable benefits to construction businesses in terms of increasing productivity, reducing overhead, controlling operational costs, enhancing compliance with environmental regulations, minimising construction waste, and tackling environmental risks. Forward-thinking companies invest more in technological advances necessary for achieving a sustainable supply chain to maximise their business values in the long run.

Studies conducted so far revealed that the purchase of materials, equipment, machinery, and services constitutes a significant portion of operations (more than half of the total activities) in a construction project. Traditional procedures are no longer adequate for the efficient procurement of such large-scale projects considering emerging complexities in dealing with sustainability risks ([Ann and Shen, 2013](#)). [Brammer and Walker \(2011\)](#) found that sustainable procurement practices are more evident in the public sector. However, the extent of application varies across different regions and is more prevalent in developed counties. Previous studies contributed to the extant body of knowledge by analysing certain aspects of sustainability such as social sustainability ([Worthington, et al., 2008](#)), waste reduction ([Holt and Ghobadian, 2009](#)), and safety ([Nawaz, Linke and Koç, 2019](#)).

From a procurement perspective, the main reason for the insufficient application of sustainability principles in the private sector is the limited efforts to introduce management capacities essential to boosting contractors' potentials in embedding sustainability. In this regard, it is necessary to analyse this concept from a broader view concerning key players that affect outcomes in the construction supply chain. Although the concept of sustainability has been well introduced into the procurement management domain, the findings need further elaboration to provide more consistent guidance to practitioners. Adopting a theoretical view based on existing theories would constitute a solid basis for introducing interventions that help contractors incorporate all necessary aspects to achieve greater levels of sustainability in construction activities ([Obicci, 2017](#)).

Supplying construction material and equipment from sources outside of an organisation in a sustainable way requires a clear overview of the procurement process. The literature gives an account of major stages in the procurement process, which encompasses activities such as identifying sourcing opportunities, information search, requisition requests, negotiation, contract approval, purchase order, delivery tracking, and payment ([Vaidya, 2005](#)). However, practitioners commonly refer to the stages introduced by international professional standards such as PMBOK ([Project Management Institute, 2017](#)) and PRINCE2 ([Axelos, 2017](#)), which present detailed tasks and responsibilities associated with the implementation of the procurement process. The PMBOK guide emphasises the procurement steps while PRINCE2 focuses on

the corresponding roles and responsibilities. These two common sources are used in this paper to base the sustainability analysis on a globally recognised procurement process.

Thus, theoretical concepts of procurement management and sustainability principles are borrowed to map out a framework relating these domains together. We also theorise that the project management office (PMO) structures can facilitate the SPM process by playing a coordinative role among senior management, procurement team, and suppliers. PMO refers to an organisational entity for centralised coordination of the parties involved in project activities and arrangements (Qi, et al., 2014). Employing this oversight structure enables contractors to embed SPM practice in multiple projects in a standard manner. Therefore, in the course of a qualitative-descriptive study, we introduce sustainability into project procurement practice in light of the mediating role of PMO. The sustainability requirements are explained and then discussed through the lenses of the procurement approach to be consolidated in the context of a theoretical framework.

Literature review

THE PROJECT PROCUREMENT MANAGEMENT PROCESS

Construction projects are characterised by temporary activities, uniqueness, and resource limitation, requiring their arrangements to be delivered on target. The first step in the study of sustainable procurement is to highlight essential elements of the procurement process in construction organisations. The PRINCE2 guide provides a methodology for the management of projects regardless of their size, type, and geographical distribution. The project management body of knowledge (PMBOK) is another standard that provides valuable insights into the process and requirements of procurement management. The concepts in this standard allow for the application of proper knowledge, processes, tools, and techniques, influencing the successful delivery of projects. This standard comprises ten knowledge areas described based on initiating, planning, monitoring and control, executing, and closing. This standard includes procedures and processes that direct activities for optimal project procurement management (Project Management Institute, 2017).

On the other hand, the PRINCE2 guide has introduced both the procurement process and relevant roles, which are used in this study to highlight key responsibilities for procurement management in construction projects. The process aspect deals with procedures and steps necessary for accomplishing procurement tasks from planning to contract closure (Axelos, 2017). We borrowed concepts from both PMBOK and PRINCE2 to define the following steps as a basis for analysing relevant sustainability requirements:

- 1) Pre-procurement decisions: Once an outsourcing idea is raised, project leaders evaluate its positive and negative aspects of possible scenarios. Risks and benefits of outsourcing scenarios are specifically analysed, and different concerns associated with supplying specific equipment or material from a third party are considered. Potential sellers are evaluated against a set of given criteria, and the decision-making board decides the best outsourcing scenario. Responsibilities should be assigned to the procurement team so that the selected scenario is implemented.
- 2) Plan procurement: In this step, the details of the project purchase should be specified and planned properly in collaboration with stakeholders. This process is intended to clarify the extent and scope of the work required for the delivery of supplies. This process identifies the requirements and corresponding arrangements essential for supplying project items from outside of the project organisation. The preparation of documents, their submission to potential sellers, and specifying the source selection criteria need to be determined.
- 3) Conduct procurement: This stage ensures that the actions of the involved parties comply with the predetermined specifications. This process includes receiving proposals, price declaration, and selecting

the best sellers. Supplier selection which is often referred to as source selection, includes an assessment of plans proposed by sellers and choosing the best case. After negotiations and agreement over contract terms, the contract is awarded to the selected seller. The contract becomes an important document for ensuring whether the supplier adheres to all their responsibilities concerning the on-target delivery of supplies.

4) Control procurement: At this stage, it is necessary to evaluate the work performed by the supplier, manage the interfaces of the procurement team with suppliers' representatives, and take corrective actions. The procurement team should provide project leaders with sufficient information and timely status reports to make informed decisions on corrective actions. The process of supervising contract performance and the incorporation of amendments help the procurement team to control deviation from the performance baseline before the occurrence of any delay or error. They administer the procurement contract based on predefined objectives to ensure that each party adheres to their contractual obligations. Any kind of issue arising in relation to procurement contracts is to be negotiated through conflict resolution and arbitration mechanisms.

5) Close procurement: This step includes the approval of procured products/services, carrying out documentation, and formal closure of the contract if all obligations have been fulfilled properly as per terms and conditions. The procurement team must assure that claims are finalized, and lessons learned are documented for future use and implementation. Once the supplies are delivered, and project leaders are satisfied with the output, final documentation is collated and archived.

As well as these five steps, several principles should be considered to ensure that the project procurement process runs smoothly without major barriers. Important necessities to be considered for a more effective procurement include ([Axelos, 2017](#)): (1) Tailoring the project procurement procedure based on the scale and nature of projects allows adjustments in response to particular specifications and standards. (2) Roles and responsibilities of the procurement team in planning, supervising, and controlling the activities should be clarified. (3) Technical specifications and quality matters should be clarified in advance. (4) Potential risks and uncertainties should be acknowledged in contract documents to account for any variation and unexpected outcomes. (5) Controls are critical elements to support the execution of the procurement process by identifying the deviations and taking timely actions to realign activities.

THE IMPORTANCE OF SUSTAINABILITY IN PROJECT PROCUREMENT

Construction enterprises need to integrate sustainability across all their functions towards achieving sustainable growth in response to volatile economic variables ([McMurray, et al., 2014](#)). Creating a sustainable industry requires close consideration of the long-term consequences associated with construction procurement activities and deliverables. Total Cost of Ownership (TCO) supports this view since contractors responsible for the delivery of multiple projects, construction enterprises need to incorporate parameters related to the long-term operation of a facility to ensure optimal energy consumption, minimum noise/air pollution, and high performance of the equipment. TCO incorporates all the costs from idea inception to maintenance, which can be significantly optimised by adopting sustainable methods. Embedding this concept in construction processes is still immature and needs more empirical elaboration. Sustainable procurement seeks Sustainable Development Goals (SDGs) in the domain of project procurement ([Walker, et al., 2012](#)) and aims to address procurement needs in a way that value is generated not only for a company but also for the whole industry and economy ([Benčekroun, Benmamoun and Hachimi, 2019](#)).

The interest of suppliers is essential in practicing sustainable procurement since the sustainability level of an enterprise is dependent upon the sustainability commitment of its suppliers in a supply chain ([Krause, Vachon and Klassen, 2009](#)). Achieving higher maturity levels in sustainability hinges upon the work/items delivered by suppliers, which implies the significance of procurement decisions in creating a sustainable

organisation. Principal contractors and project owners can minimise the environmental risk posed by the involvement of third parties via encouraging their commitment to responsible project procurement ([Benchekroun, Benmamoun and Hachimi, 2019](#)). Introducing sustainability in project purchasing requires consideration of environmental, social, and economic aspects. The environmental perspective integrates considerations such as minimising waste and pollutants. Social sustainability refers to the fact that firms' performance and reputation are influenced by the services provided by their suppliers. This aspect also focuses on equity, human rights, safety and wellbeing, and labour; while the economic dimension is more concerned with financial outcomes such as the supply of the highest quality product/services with the minimum price and considering the total cost of ownership ([Benchekroun, Benmamoun and Hachimi, 2019](#)). This paper takes these three aspects of sustainability into account to study SPM.

THE REQUIREMENTS OF SUSTAINABLE PROCUREMENT MANAGEMENT

This study reviewed the findings of both qualitative and quantitative studies on sustainable procurement. Early research on sustainable procurement dates back to the late 1990s when [Carter \(1998\)](#) carried out a hypothesis testing and developed an environmental purchasing model in which the influence of six factors on environmental purchasing decisions was corroborated. These factors and their associated path coefficient include regulatory sector (H1, 0.076), output sector (H2, 0.296), quality (H3, 0.045), vertical coordination (H4, 0.606), supply uncertainty (H5, 0.023), and resource dependence (H6, 0.711). Carter and Jennings (2004) identified the facets of purchasing's involvement in corporate social responsibility (CSR) and found that the scales of purchasing social responsibilities and their factor coefficients include the environment (0.736), diversity (0.528), human rights (0.853), philanthropy (0.663), safety (0.793), ethics – deceitful practices (0.12), and ethics – subtle practices (0.143). Preuss (2007) conducted a case study analysis to explore the extent to which the local government in the United Kingdom utilises its procurement function to foster sustainable development. It was found that “*the local government has addressed environmental sustainability standards by phasing out hazardous materials in procured products and services, requiring a minimum recycled content for some goods, and insisting on lower energy or fuel consumption*”.

Another quantitative study was conducted in the UK to obtain the viewpoints of 106 procurement officers in the public sector based on an established questionnaire entitled “purchasing social responsibility”. A cross-sector analysis based on a five-point Likert scale revealed that purchases from small suppliers (3.99), purchases from local suppliers (3.81), the safe incoming movement of product to facilities (3.44), are the top three influential sustainability procurement practices. Besides, the cost was found to be the leading barrier to sustainable procurement ([Lindgreen, et al., 2009](#)). Two external and internal aspects of sustainability can be highlighted in organisations; the external goals focus on equity, economy, and environment, while the internal goals point to efficiency, business benefits, cost-effectiveness, fairness, and transparency ([Nijaki and Worrel, 2012](#)).

[Brammer and Walker \(2011\)](#) examined the application of sustainable procurement practices within a sample of over 280 public procurement practitioners from 20 countries. Their analysis indicated variation in the adoption of such practices in the public sector. The findings also revealed the most prevalent practices among sample organisations according to a five-point Likert scale as follows: buying from Small and Medium-Sized (SME) companies (3.73), purchasing from local suppliers (3.62), ensuring the safe incoming movement of product to an organisation's facilities (3.40), aiming to reduce packaging materials (3.21) and asking suppliers to commit to waste reduction goals (3.06). [McMurray, et al. \(2014\)](#) explored the extent of sustainable procurement practices amongst procurement managers in public and private sector organisations in Malaysia. It was found that lack of awareness was the most significant barrier to SPM whereas improved working conditions, public image, organisational efficiency, and transparency were found as facilitators. A recent study also explored the barriers to sustainable procurement in a Brazilian context and, as a result of factor analysis, it was found that organisational culture stands out as a particular barrier to sustainable

public procurement ([Delmonico, et al., 2018](#)). Overall, the findings of such studies were reviewed to provide an overview of SPM concerning three areas of environmental, social, and economic sustainability ([Benchebkroun, Benmamoun and Hachimi, 2019](#)) ([Table 1](#)).

Table 1. The sustainability requirements from a procurement perspective

Stages of the procurement process	Sustainability requirement in the literature	Aspects of sustainability		
		Environmental	Economic	Social
Pre-procurement decisions	Allocate adequate budget and resources to implement SPM principles (Preuss, 2007).	✓	✓	✓
	Social responsibility and the commitment of senior managers to incorporating sustainability in the procurement process (Lindgreen, et al., 2009).			✓
Plan procurement	Follow a life-cycle analysis to evaluate the environmental friendliness of products and packaging supplied by available suppliers in the market (Carter and Carter, 1998).	✓		
	Ensure endurance, stability, safety, and optimal performance of the equipment to be installed towards delivering a resilient facility/infrastructure (Bocchini, et al., 2014)		✓	✓
	Consideration of optimal energy/water consumption and minimum greenhouse gas/toxic emissions in supplying project equipment and material (Nijaki and Worrel, 2012)	✓		
	Avoid noise pollution by supplying the equipment that has minimum noise and vibration (Shen, et al., 2007).	✓		
	Give preference to local suppliers (support the local economy) (Brammer and Walker, 2011).		✓	
	Give precedence to small suppliers (Lindgreen, et al., 2009)		✓	
Conduct procurement	Close consideration of design features in procurement to minimise waste (McMurray, et al., 2014).	✓		
	Ensure shortlisted suppliers comply with labour laws and regulations (Carter and Jennings, 2004).			✓

Table 1. continued

Stages of the procurement process	Sustainability requirement in the literature	Aspects of sustainability		
		Environmental	Economic	Social
	Oblige suppliers to adhere to waste reduction policies (Carter and Jennings, 2004).	✓		
	Ensure safe operation and transfer of product to project facilities (Carter and Jennings, 2004).			✓
Control procurement	Reduce packaging material (McMurray, et al., 2014).	✓		
	Waste recycling and reuse on the construction site (Carter and Jennings, 2004).	✓		
	Awareness of sustainability objectives among people (Delmonico, et al., 2018).			✓
Close procurement	Ensure meeting sustainability goals upon completion of the work package (Carter and Jennings, 2004).	✓	✓	✓
	Site decontamination and waste removal after contract closure (Cappuyns, 2016)	✓		

THE BENEFITS OF PMO STRUCTURES TO ACHIEVE SPM OBJECTIVES

Principal contractors establish long-term relations with original equipment manufacturers (OEM) to benefit from their high-quality equipment and improve their brand recognition. Collaborating with capable suppliers reduces the risk of capital investments in new markets. To take control of procurement activities and arrange batch purchase orders, organisations have turned to centralised oversight mechanisms ([Ward, 2016](#)). In this regard, procurement teams are assigned to undertake tasks such as placing and handling purchase orders, ensuring timely procurement, inspecting the quality of supplied goods, and following up on the shipment of products from the manufacturing site to the project site. Such oversight functions improve the capability of a company to select the best suppliers, negotiate the type and price of the contract, and rigorously assess the risks of outsourcing specific parts of a project. However, undertaking these tasks requires intensive planning and technical support.

In such a condition, adopting PMO structures benefit organisations to coordinate technical and procurement teams and ensure that all deliverables will be completed based on the deadlines in the project master schedule as promised with clients. These entities govern project activities and support executives in managing interfaces with external partners. They are well aware of project needs and have access to the knowledge base of projects, which capacitate them to suggest the best sourcing strategies. The underlying benefit of PMO structures in SPM includes (1) insisting adherence of suppliers to sustainability requirements and (2) minimising procurement risks emanating from a variety of technical and quality matters ([Mori, et al., 2013](#)). These risks are closely interrelated and are likely to leave negative impacts on sustainability objectives. Regarding the fact that PMOs govern project processes, they can address those

operational risks threatening sustainability through effective risk management to safeguard the environment, society, and economy against the consequences of procurement decisions. PMOs can enhance both internal and external communications to provide a nurturing environment in which all procurement parties collaborate in an integrated manner. To ensure their commitment to sustainability objectives, a common understanding of SPM principles should be developed within and outside of organisations.

Research Method

This qualitative-descriptive study reflects the perspective of principle contractors on SPM and is conducted through three stages of (1) literature review, (2) the qualitative survey, and (3) group consensus. The first step addresses the first research objective, and steps 2 to 3 are conducted to achieve the second research objective:

1) The literature review: First, a literature review was conducted to provide a theoretical understanding concerning (1) the steps of the procurement process in construction projects, (2) potential sustainability requirements from a procurement perspective. The purpose of this stage was to synthesise a rapidly growing field of knowledge and specify the requirements of SPM from a theoretical viewpoint. The research methodology in this stage was inspired by [Tranfield, et al. \(2003\)](#) on conducting reviews in the field of management. One of the difficulties in conducting a review study in a field related to management is the range of research design adopted by researchers ([Johnsen, Miemczyk and Macquet, 2012](#)).

Both qualitative and quantitative studies were included in the span of the review. The Scopus, Web of Science, and Google Scholar are the three main databases, and the keywords of “sustainability”, “supply chains”, “procurement management”, and “project procurement” were considered simultaneously to retrieve representative studies. As a result of the first step, the requirements of project procurement management were identified by reviewing the findings of representative studies. Key aspects and elements for achieving sustainable procurement management in construction projects were determined accordingly.

2) The qualitative survey: The second stage of the research involves a qualitative survey. This stage was conducted in New South Wales, Australia, and a thematic analysis approach was adopted for drawing conclusions based on empirical data by following a six-phase step-by-step guide introduced by Braun and Clarke (2006). This stage aims to solicit expert opinion on the role of PMO as a centralised project oversight mechanism towards embedding SPM. The participants were sourced from a group of principal contractors in the private sector, and an online survey tool was used for obtaining their viewpoints. Qualitative surveys provide a less structured way of gaining information about experts’ reasoning ([Giles and Yates, 2014](#)).

This strategy involves soliciting individual feedback through open-ended questions because the role of PMO in embedding SPM should be described from an expert viewpoint. The questionnaire of the study includes two sections (attachment 1); in the first section, demographic questions about qualification, experience, and job position were asked. The second section incorporates five subsections related to the stages of SRM. In each subsection, respondents were asked to explain the role of PMOs in embedding respective SPM requirements. Seventy eligible staff received the invitations and twenty completed responses were received (response rate of 28.5%). The sample size is acceptable since it ranges from 15 to 25 for qualitative surveys ([Trotter II, 2012](#)).

The target population includes project management professionals in principle contracting organisations. To ensure that the most suitable experts are selected, purposive sampling was adopted based on two criteria: (1) the relevance of their expertise to the topic and (2) work experience in the principal contracting sector. Forty per cent of professionals had a job tenure of more than 15 years, 40% with 11 to 15 years, and 20% with 5 to 10 years. Thirty per cent had a postgraduate degree and the rest of them had a bachelor’s degree. Fifty per cent of respondents were PMO leaders, 20% per cent project managers, 20% PMO analysts, and 10% per cent project planner.

3) Thematic Analysis: An integrative approach based on the thematic analysis was adopted to analyse, consolidate, and interpret their suggestions. Adopting this approach is beneficial in searching across a data set and putting similar ideas together to find repeated patterns of meaning. According to [Braun and Clarke \(2006\)](#), the type of thematic analysis should be determined. In this paper, an inductive (bottom-up) thematic analysis was conducted. This type of data-driven analysis ensures that themes are strongly linked to the data without trying to fit it into a pre-existing theory. The six phases that were followed to thematically analyse the data set include:

3.1. Phase 1. Familiarising with data: In this phase, the descriptive responses obtained from participants were reviewed so that we can identify the depth and breadth of the data set before beginning the formal coding process. As a result of this process, the main quotes in experts' suggestions were extracted.

3.2. Phase 2. Generating initial codes: Codes represent short and most essential segments of raw data, which initially group relevant ideas. Since each of the five questions refers to a separate domain of the procurement process, the coding was conducted separately for all responses related to a specific question. The coding was conducted using the NVivo software for facilitating this process. Working systematically through the data set, codes were generated to collate similar suggestions together.

3.3. Phase 3. Searching for themes: Themes are broader than codes and are elicited as a result of further interpretation of the data set. In this phase, we collated the codes to identify how they combine to form overarching themes. After sorting the codes and analysing the relation between them, themes were identified to represent the groups of relevant codes.

3.4. Phase 4. Reviewing themes: After devising the set of candidate themes, they were reviewed from a systematic perspective to ensure their internal homogeneity and external heterogeneity. Further refinements were made in the grouping of codes into clear themes.

3.5. Phase 5. Defining and naming themes: Reaching a satisfactory combination of themes, a concise label was selected for each theme considering the aspects which are captured by them. The final labelled themes

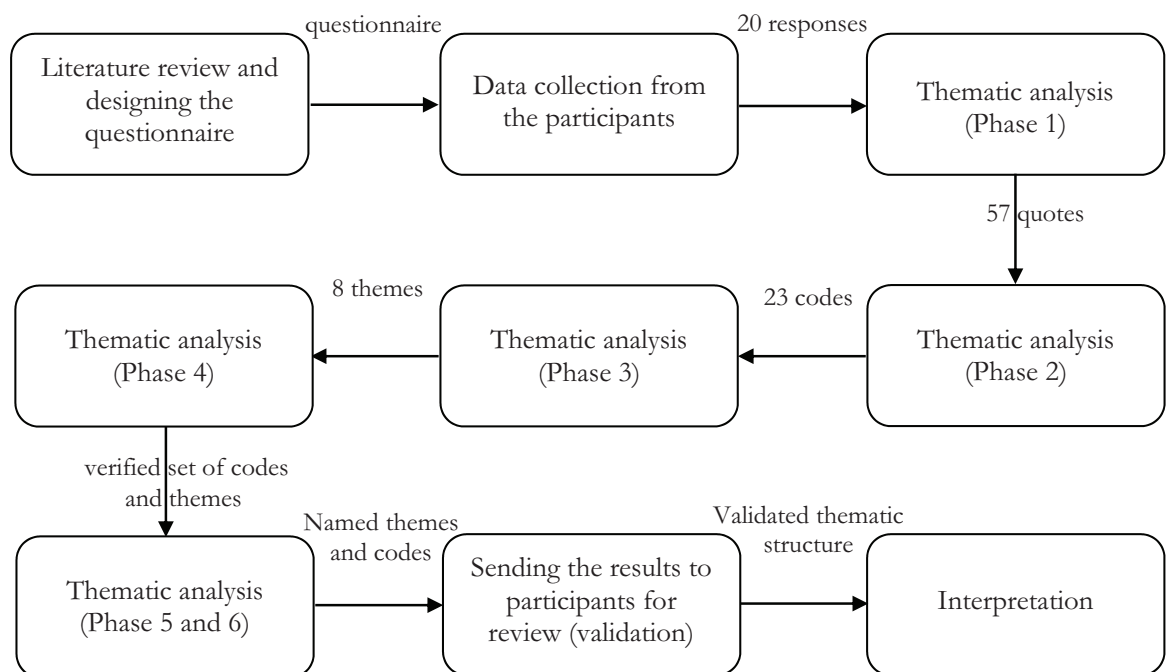


Figure 1. The research process

represent a set of consistent groups without overlap. It was checked using the 15-point checklist of criteria for good thematic analysis as introduced by [Braun and Clarke \(2006\)](#).

3.6. *Phase 6. Producing the report:* The themes were interpreted and discussed in the paper to explain the concepts that were identified in the data analysis process. We ensured that the research objectives are addressed by the findings.

4) Validation: It is suggested in the literature that after consolidating the individual expert feedback, the results can be sent to participants to review the consolidated outcomes and validate them ([Aghimien, Aigbavboa and Oke, 2020](#)). Participants were invited via email to review the elicited codes and themes representing essential roles that PMOs undertake to implement sustainability in the procurement process. The validated thematic structure includes 23 codes collapsed into eight overarching themes ([Table 3](#)).

[Figure 1](#) provides an overview of the main stages of the present research.

Results

Participants explained the role of PMOs in supporting the SPM process for private contractors. Regarding the qualitative nature of data obtained from experts, thematic analysis was conducted to capture the similarities and differences in their viewpoints and provide an overview of responsibilities. The coding process was conducted manually, and NVivo software was used to help organise data and identify codes. The text obtained from the qualitative survey was imported to NVivo, and each feedback was closely reviewed and summarised to identify the main points. The key points for each participant were elicited and then compared in terms of their semantic relationship. Finally, relevant codes were extracted to represent the role of PMO in SPM implementation. An example of the thematic analysis of expert suggestions for the conduct procurement step has been provided in [Table 2](#). This analysis was also conducted for the rest of the procurement steps.

Table 2. Example of the thematic analysis (the conduct procurement step)

Participants		Quotes	Codes	Theme
No	Position			
2	Project Manager	<i>"Screen potential suppliers based on qualification related to sustainability"</i>	Evaluate potential vendors/suppliers against sustainability-related source selection criteria.	Tendering support
9	Project Planner	<i>"Evaluate vendors in terms of their capability in meeting requirements of sustainable procurement management"</i>		
5	PMO Analyst	<i>"Screen out those suppliers that cannot meet minimum sustainability criteria"</i>		
15	Project Planner	<i>"Achieve consensus with suppliers on sustainability controls throughout the procurement process"</i>	Create a common language with selected suppliers on sustainability objectives and controls.	

Table 2. continued

Participants		Quotes	Codes	Theme
No	Position			
18	PMO Leader	<i>"Create a common language with suppliers on sustainability objectives and how to achieve them"</i>	Technical support of the procurement team in the tender evaluation and selection.	
3	PMO Leader	<i>"Support the procurement team in tender selection"</i>		
13	Project Manager	<i>"Provide technical guidance on the evaluation of tender proposals"</i>		

The sustainability requirements for each stage of the procurement process were elicited from the literature and summarised in [Table 1](#). In this section, we elaborated on the mediating role of PMO in embedding the sustainability requirements. To benefit from a steadfast and comprehensive sustainable procurement management, a framework was presented to account for the facilitative role of PMOs. In the expert consensus stage, the codes and themes were reviewed and confirmed after making minor modifications in the wording, constituting a validated framework of 23 codes and 8 themes. It can be implied from the synthesised codes that these roles reflect the ability of PMO in the clarification of objectives, the suggestion of effective strategies, the proposition of best solutions, facilitation of procurement steps, demarcation of role boundaries, training the staff, and enforcement of controls. These are beneficial in tackling the sustainability barriers previously asserted in construction research. Such obstacles include a lack of adequate coordination arrangements and a lack of a clear understanding of sustainability and its economic benefits among stakeholders ([Chang, et al., 2015](#)). [Table 3](#) provides an overview of the role of PMO in embedding the requirements of sustainable procurement management in construction projects.

Table 3. The role of PMOs in SPM

Stages of the SPM process	The role of PMO in SPM	
	Codes	Themes
Pre-procurement decisions (obtain the required budget and management commitment to sustainability objectives)	<ul style="list-style-type: none"> • Conduct a strategic cost-benefit analysis of SPM. • Propose effective SPM strategies (delivery method, source selection criteria, etc.) • Incorporate sustainability into strategic partnership decisions. 	<ul style="list-style-type: none"> • Strategic analysis
	<ul style="list-style-type: none"> • Set SPM objectives • Cascade SPM objectives into measurable metrics and controls • Reach consensus on the SPM objectives 	<ul style="list-style-type: none"> • Goal setting

Table 3. continued

Stages of the SPM process	The role of PMO in SPM	
	Codes	Themes
Plan procurement (compliance with environmental laws, evaluate the environmental friendliness of products/ packaging, and give preference to local/small suppliers)	<ul style="list-style-type: none"> Assign the tasks of each party in implementing the SPM process. Document project-specific SPM tasks to be tracked during the execution of a contract. 	<ul style="list-style-type: none"> Task assignment
	<ul style="list-style-type: none"> Draw on lessons learned from previous projects to improve procurement planning outcomes Technical support of the procurement team in analysing equipment/items that are planned to be supplied considering the sustainability criteria 	<ul style="list-style-type: none"> Planning support
Conduct procurement (incorporate sustainability in design features, supplier's commitment, and safe operations)	<ul style="list-style-type: none"> Evaluate potential suppliers against sustainability source selection criteria. Create a common language with selected vendors/suppliers on sustainability objectives and controls. Technical support of the procurement team in tender evaluation and selection. 	<ul style="list-style-type: none"> Tendering support
Control procurement (reduce packaging material, waste recycling and reuse, and sustainability training)	<ul style="list-style-type: none"> Monitor interphase dependencies to ensure the incorporation of sustainability from design to delivery in an integrated manner. Track the realisation of SPM requirements to detect deviations and non-compliance. Enforce sustainability controls and determine corrective actions Apply industry best practices to optimise sustainability controls and outcomes 	<ul style="list-style-type: none"> Maintain consistency
	<ul style="list-style-type: none"> Apply conflict resolution techniques in the procurement process. Offer the best solution to tackle sustainability barriers Coordinate the SPM tasks among involved parties Arrange necessary training of project staff on SPM to improve their effectiveness in operations. 	<ul style="list-style-type: none"> Operational support
Close procurement (ensure meeting sustainability goals and site decontamination)	<ul style="list-style-type: none"> Procurement post-review to ensure the achievement of sustainability objectives. Capture lessons learned obtained from implementing the SPM process. 	<ul style="list-style-type: none"> Post-review

The eight themes elicited as a result of the six-phase thematic analysis present a consistent set of roles that should be undertaken by PMOs in support of SPM objectives.

1. *Strategic analysis:* The critical role of PMO in incorporating sustainability becomes more evident early in the procurement process when strategic decisions are made. The analysis revealed that this contribution is made by demonstrating the benefits of sustainability to project leaders and investors through cost-benefit analysis. SPM scenarios are to be analysed and the best strategies should be proposed to ensure an effective project management approach.
2. *Goal setting:* Another major role to be undertaken by PMO is to set measurable SPM objectives and translate them into metrics and controls. Stakeholders' buy-in over such objectives and metrics pave the way for a smoother implementation of the SPM requirements.
3. *Task assignment:* The evidence from the analysis indicates that PMO assigns and keeps track of the tasks assumed by each party contributing to the sustainable procurement process. Role boundaries of each team member are to be clarified to avoid any miscommunication, rework, and overlap.
4. *Planning support:* Achieving sustainability is not possible without proper planning and anticipating the arrangements as set early in the SPM process. Regarding access to lessons learned from previous projects, PMO decides on optimal planning arrangements and puts them into practice.
5. *Tendering support:* The results revealed that during the tendering process, further support is needed to ensure that sustainability principles are properly integrated into the evaluation of potential suppliers and tender selection. Those suppliers that cannot demonstrate their commitment to sustainability (e.g., practising waste control systems) should be screened out, which is considered as a risk-avoidance strategy for principal contractors.
6. *Maintain consistency:* Performing quality assurance (QA) from the perspective of sustainability standards guarantee the achievement of SPM requirements throughout the procurement process. The thematic analysis showed that PMO has information dominance on different phases of construction projects and can handle interphase interfaces, manage transitions, detect noncompliance, and realign activities with baseline performance targets.
7. *Operational support:* Effective execution of SPM plans requires a high level of coordination among the teams involved in the process. Challenges and conflicts are likely to occur, which call for operational support of the PMO team in terms of applying problem-solving techniques facilitating and give consultation to the team in tackling operational issues and risks.
8. *Post-review:* Delivery of the supplies does not mean that the procurement process is completed since the accomplishment of certain requirements such as site decontamination must be checked. The procurement post-review helps to identify environmental concerns that have not been still addressed and further actions that need to be taken by contractors.

Discussions

Embedding sustainability principles in the procurement process adds to its complexities and is more challenging for contracting organisations that are coping with variations in today's global economy. Although contractors are extremely concerned with the timely delivery of their projects with a tight budget and schedule, they should not neglect the importance of sustainability principles in their routine business activities since it can become a competitive advantage over competitors. We conducted this study to highlight the importance of sustainability in the procurement process through a research design including three stages of (1) literature review, (2) opinion survey, and (3) expert consensus. As a result of the first stage, it was found that although there are evident benefits for contractors both in the public and private sectors in practicing sustainability, evidence from previous research shows that it has not still become a permanent part of construction projects ([Charmaz, 2014](#); [Giles and Yates, 2014](#); [Aghimien, Aigbavboa and Oke, 2020](#)).

This study focuses on principle contractors as a key player in construction projects that are in a proper position to encourage subcontractors, vendors, and suppliers in practicing sustainability. The social responsibility of such contractors necessitates adhering to standards related to three aspects of (1) environmental, (2) economic, and (3) social sustainability. As a link connecting clients' requirements to subcontractors' work, they are responsible not only for the realisation of the technical specifications but also for the enforcement of sustainability requirements in the procurement process.

While previous research sheds light on the importance of environmental, social, and economic sustainability in the construction industry ([Benchekroun, Benmamoun and Hachimi, 2019](#)), we consolidated the findings of independent studies and elaborated on the sustainability requirements from a procurement perspective. It was found that prior research on environmental sustainability is more concerned with construction waste, recyclability of construction materials, noise pollution, and natural resource depletion. The social aspect is more related to social responsibility, safety and wellbeing of human resources, public awareness, and labour laws. The economic aspect also concentrates on budget allocation to sustainability, infrastructure resilience, and supporting local and small suppliers. Commitment to all these requirements is quite challenging for private construction organisations due to posing further constraints. However, it is their social responsibility to contribute to building a sustainable industry. The findings revealed that employing centralised oversight structures (the most common name for which is PMO) would significantly improve their capability in achieving business targets while adhering to sustainability principles.

To provide a theoretical basis for the analysis of sustainability through the lenses of project procurement, five main stages of the project procurement management were adopted from standards ([Axelos, 2017](#); [Project Management Institute, 2017](#)) and experts were asked to explain the role of PMO in embedding the sustainability requirements associated with each stage of the procurement process. The procurement process starts with strategic supply chain decisions that are made by senior managers. Such decisions are a critical part of a company's strategic direction since they determine long-term partnerships with original equipment manufacturers (OEM), local businesses, and industry leaders.

The literature asserts the importance of business partnership instead of price and other operational concerns at the stage of design and pre-procurement ([Pesämaa, Eriksson and Hair, 2009](#)). In line with this tenet, this study found that PMO units support executives in making strategic partnership decisions to ensure the achievement of business targets without compromising sustainability values. It was found that undertaking a cost-benefit analysis of investments in sustainability would highlight long-term advantages that can be gained in terms of brand image, tax incentives, positive social impact, and contribution to a more resilient economy. Such an analysis provides a basis for defining SPM objectives and optimal outsourcing strategies early in the procurement process.

The pre-procurement stage is followed by procurement planning which is debated to be underemphasised at the initial stages of construction projects ([Aliza, Stephen and Bambang, 2011](#)). To cover this gap, we asserted that PMOs must take action to ensure the incorporation of sustainability requirements by adopting a collaborative implementation approach in which the role of each party/team in the sustainability practice is determined, controls are in place, and the procurement team is technically supported to analyse the potential equipment/services against the sustainability criteria.

At the third stage, conduct procurement involves tender preparation, receiving proposals, price declaration, and tender evaluation, and selection. Previous research asserts that the tendering process is of crucial significance in achieving green procurement ([Leger, Oueslati and Salanié, 2013](#)) and this study confirms this finding since PMOs support the procurement team to evaluate and screen suppliers against sustainability criteria. This is a key stage of the SPM process because those suppliers that cannot meet the minimum sustainability requirements are disqualified, which means that a major sustainability risk is being

avoided. It was also found that PMO plays a facilitative role in creating a common language with suppliers on sustainability targets and requires them to comply with relevant requirements.

The fourth stage is control procurement which reflects the key role of compliance with predefined sustainability criteria in construction projects ([Kasim, et al., 2013](#)), which was confirmed in this study by indicating that PMOs systematise the sustainability compliance and maintain the integration of sustainability controls from design to delivery. SPM is a collaborative process that requires close intensive interactions and coordination. This study highlighted the coordination role of PMOs to speed up SPM tasks and keep track of their progress. These units take actions to train human resources on how to practice sustainability in pursuit of green procurement goals.

The procurement process ends at the stage of close procurement when all supplies are delivered by the supplier. Although the procurement team is responsible for finalising the project purchase documentations and closing suppliers' contracts, PMOs undertake post-delivery reviews to ensure that all necessary steps have been completed and there are no outstanding payments or open claims. It should be confirmed that all sustainability tasks have been accomplished as planned and SPM objectives are met with satisfactory performance. The capability of PMO in knowledge management has been well discussed in previous research ([Martinez Sanz and Ortiz-Marcos, 2019](#)), and the current research confirms this capacity in the form of collating and archiving lessons learned in the organisation's knowledge base.

This paper contributes to examining one of the applications of PMO units in sustainable procurement. We extended the literature on what was already known on the sustainability requirements of the project procurement process and explained how PMOs could be employed to enhance effectiveness and coordination among stakeholders of an integrated supply chain towards meeting the SPM requirements.

Conclusion

The purpose of this study was to identify the sustainability requirements that need to be considered at different stages of the project procurement process and to elucidate the role of PMO in achieving these requirements. A qualitative survey was conducted among experts in Australian principal construction companies and twenty individuals participated that shows a response rate of 28.5%. A majority of participants were PMO leaders with over 15 years of job tenure in the construction industry. The results of the survey revealed a significant contribution of PMO to the sustainable project procurement process in the private sector. The most important contribution is made at the pre-procurement and planning stages since sustainability begins with strategic business decisions such as long-term partnerships with those suppliers that are committed to sustainability and social responsibility. Incorporation of sustainability in the source selection criteria helps to avoid the involvement of suppliers that cannot meet minimum sustainability requirements and are unlikely to address sustainability risks. We found that PMOs team up with consultants and procurement teams to undertake market analysis in terms of potential suppliers and their products/services, which is helpful to identify available environmentally friendly materials, goods, and equipment.

Procurement decision criteria should not be limited to price and technical specifications. However, they must also include an analysis of the Total Cost of Ownership (TCO) to consider the long-term value of a product as well as its impact on the environment and society. The literature review revealed that recent research mainly emphasises sustainable procurement in the public sector while achieving sustainability is not possible without the active engagement of the private sector. This study proposed that a cost-benefit analysis should be conducted by PMO at the beginning of a project to convince key stakeholders and sponsors about the budget allocation for the sustainability practice. Although practising sustainability imposes further costs and constraints to private contractors, they can benefit from long-term competitive advantages such as tax incentives and a stronger brand image.

The literature review indicated that some private organisations might be unwilling to practice sustainability due to this assumption that further workload and constraints may be imposed on their routine business activities. However, the empirical survey showed that adopting robust management structures (such as PMO) would enable them to resolve the paradox of making a business profit and incurring overhead costs associated with practicing sustainability. This study encouraged a long-term view of sustainability practice in private organisations. In this regard, PMO adopts a systematic approach to project procurement and puts arrangements in place to enhance intra- and inter-organisational collaboration for implementing green procurement goals. In the collaborative SPM approach that was introduced in this paper, procurement teams continuously cooperate with PMO, project leaders, and executives to build mutual trust with external stakeholders (third parties) in addressing projects' supply needs with a minimum negative impact on the environment and society. The result of this study indicated that PMOs contribute to the execution of sustainable procurement activities by cascading sustainability objectives into measurable controls to keep track of actions, identify deviations from baseline targets, and suggest corrective actions to be performed collaboratively. The findings of the opinion survey would encourage practitioners in private organisations to approach sustainability differently by considering the positive consequences of implementing SPM methods. For instance, applying lean construction techniques benefit them to utilise their resources more optimally with minimum waste and environmental damage.

From the perspective of the research implications, we extended what is already known on SPM practices by explaining the application of multi-project oversight structures in enabling private contractors to balance their current business undertaking with their new commitment to sustainability. We explained how PMO structures can be employed in response to the lack of integration and engagement which have always been a barrier towards implementing collaborative approaches such as SPM in construction projects. This paper extended the literature by providing an overview of the main sustainability requirements from a procurement perspective and suggested the application of PMO to facilitate their realisation in the private sector. The authors recognise the following limitations of the study. First, it is exploratory, which means further quantitative research is needed to validate the proposed factors using a larger sample of construction professionals. Regarding the exploratory nature of qualitative research, the generalizability of findings, especially the statistical-probabilistic generalizability, has often been highlighted as a limitation of qualitative research. This study also acknowledges this limitation and encourages a follow-up quantitative survey to examine the statistical validity of the proposed framework using a large sample size.

This research also elaborated on PMO interventions in principle contracting firms to enforce SPM principles in collaboration with several subcontractors and suppliers. However, a more comprehensive understanding of sustainability in the procurement process is required by analysing the perspectives of subcontractors and suppliers. Thus, it is recommended that future research attempts to extend the scope of the current study by incorporating and comparing their views on necessary SPM methods and strategies. This refers to an important gap in the literature yet to be addressed in future research since diverse perspectives of stakeholders in construction projects lead to adopting SPM in a different way while it requires a collaborative approach that coordinates all involved parties. The emphasis of previous research on the public sector is also a subject that needs a paradigm shift in terms of finding solutions to enhance the commitment of private sectors to sustainability objectives. The majority of construction activities are executed by private companies and the public sector acts as a supervisory body. Ultimately, it is the private sector that should adjust its practices to comply with sustainability requirements. Thus, we encourage future research to focus on suggesting solutions for improving sustainability practice in the private sector.

Attachment 1. Survey questionnaire

Section A. Demographic questions	
1	Your job tenure in the construction industry.
2	Your current job position.
3	Your highest academic qualifications.
4	Email address:
Section B. Survey questions	
Please suggest the possible role of PMO concerning the sustainability requirements for each stage of the procurement process.	
1	What is the possible role of PMO in embedding the sustainability requirements associated with the pre-procurement stage (1. allocate adequate budget and resources to implement SPM principles in practice. 2. social responsibility and commitment of senior managers to sustainability)?
2	What is the possible role of PMO in embedding the sustainability requirements associated with the plan procurement stage (1. follow a life-cycle analysis to evaluate the environmental friendliness of products and packaging supplied by available suppliers in the market. 2. deliver a resilient infrastructure, 3. consideration of optimal energy/water consumption and minimum greenhouse gas/toxic emissions 4. avoid noise pollution by supplying the equipment that has minimum noise and vibration 5. give preference to local suppliers. 6. give precedence to small suppliers)?
3	What is the possible role of PMO in embedding the sustainability requirements associated with conduct procurement stage (1. close consideration of design features in procurement to minimise waste, 2. ensure shortlisted suppliers comply with environmental laws and regulations. 3. oblige suppliers to commit to waste reduction goals, 4. ensure safe operation and transfer of product to project facilities)?
4	What is the possible role of PMO in embedding the sustainability requirements associated with the control procurement stage (1. reduce packaging material. 2. waste recycling or reuse on construction sites. 3. awareness of sustainability objectives among staff.)?
5	What is the possible role of PMO in embedding the sustainability requirements associated with the close procurement stage (1. ensure meeting sustainability goals at the end of the procurement process, 2. Site decontamination and waste removal after the contract closure)?

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