

IDENTIFYING FACTORS INFLUENCING CONSTRUCTION MATERIAL PROCUREMENT PERFORMANCE THROUGH LATENT DIRICHLET ALLOCATION ANALYSIS

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ABSTRACT

Construction material procurement plays a critical role in determining cost efficiency, schedule performance, and overall project success in construction. Although numerous studies have examined procurement practices and supply chain management, the factors influencing procurement performance remain fragmented across the literature. This fragmentation limits a comprehensive understanding of procurement performance and its key dimensions. To address this issue, this study conducts a Latent Dirichlet Allocation (LDA) based literature review to identify major themes and derive procurement performance factors. A dataset of 983 peer-reviewed journal articles was analysed to explore thematic patterns in construction material procurement research. The analysis identified four dominant domains: procurement risk and cost performance, environmental impact of construction materials, supply chain and logistics, and sustainable procurement and circular economy. Based on these themes, procurement-related factors were derived and organised to provide a structured understanding of procurement performance. The findings highlight the multidimensional nature of procurement systems and emphasise the importance of integrating cost management, logistics coordination, supplier performance, and sustainability considerations to improve construction project outcomes.

Keywords: Construction Material Procurement; Construction Supply Chain; Latent Dirichlet Allocation; Procurement Performance; Topic Modelling.

1. INTRODUCTION

The construction industry is a major contributor to economic development, supporting infrastructure growth and employment generation across both developed and developing economies (Momani et al., 2016). Within this sector, construction materials represent one of the most significant cost components, typically accounting for a substantial proportion of total project expenditure (Yunna & Ping, 2012). The availability, quality, and timely delivery of materials are therefore critical factors influencing project cost efficiency,

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schedule adherence, and overall project success (Wawak et al., 2020). Despite their importance, construction projects frequently experience problems related to material procurement. Issues such as delayed deliveries, price fluctuations, poor coordination, and inaccurate quantity planning often lead to cost overruns, schedule delays, and productivity losses (Ajayi & Oyedele, 2018; Opoku et al., 2022). These challenges are further intensified by the fragmented nature of construction supply chains and the involvement of multiple stakeholders, including contractors, suppliers, and logistics providers (Hussain et al., 2023). As a result, material procurement has become a critical function that directly influences project performance and organisational competitiveness (Jusoh & Kasim, 2017).

Construction material procurement performance refers to the ability of an organisation to acquire required materials in the right quantity, quality, cost, and time while ensuring effective coordination across the supply chain (Alsamarraie & Ghazali, 2022). Traditionally, procurement performance has been evaluated based on key dimensions such as cost, time, and quality. However, recent studies highlight that procurement performance extends beyond these basic measures and includes additional dimensions such as supplier performance and process efficiency (Ibrahim et al., 2024). These dimensions collectively reflect the effectiveness of procurement systems in supporting project delivery and achieving desired outcomes. Given the high proportion of material-related costs and the direct impact of procurement activities on project outcomes, improving construction material procurement performance is essential. Effective procurement contributes to cost control, timely project completion, improved quality, and enhanced coordination among stakeholders. Conversely, poor procurement practices can disrupt project execution and reduce overall efficiency. Therefore, understanding and improving procurement performance is critical for achieving successful construction project outcomes.

Previous studies have examined various aspects of construction material procurement, including supplier selection, procurement planning, logistics coordination, and supply chain integration (Kamil & Mulyono, 2025; Parisi & Donyavi, 2025; Sivasubramaniam et al., 2024). These studies have identified several factors influencing procurement performance, such as supplier reliability, cost management practices, logistics efficiency, and information sharing. However, these factors are often studied separately across different research areas, resulting in a fragmented understanding of procurement performance (Zhao et al., 2022). In addition, the growing volume of research in this field makes it increasingly difficult to obtain a comprehensive and integrated view of the factors influencing construction material procurement performance. This lack of integration limits the ability of researchers and practitioners to fully understand how different factors interact and influence procurement outcomes. Addressing this issue is important for developing a more structured and holistic understanding of procurement performance, which can support better decision-making and improved project outcomes.

Therefore, this study conducts a LDA based review of construction material procurement literature using a structured search protocol. By analysing a large corpus of academic publications, the study aims to identify the key factors influencing construction material procurement performance. To achieve this aim, the following objectives are addressed:

1. To identify major themes related to construction material procurement performance.

2. To examine how these themes have developed over time.
3. To derive construction material procurement performance factors from the identified themes.

2. METHODOLOGY

This study is designed as a literature-based investigation to identify and organise factors influencing construction material procurement performance. The research focuses on systematically analysing existing academic publications to develop a comprehensive understanding of procurement-related factors within the construction domain. To achieve this, the study adopts a topic modelling approach using LDA to analyse the collected literature. The use of LDA allows the study to extract hidden structures within the literature that may not be readily observable through conventional analysis.

Figure 1 illustrates the overall workflow pipeline followed in this study, including literature retrieval, screening, and the subsequent analysis of the literature corpus using the LDA-based approach.

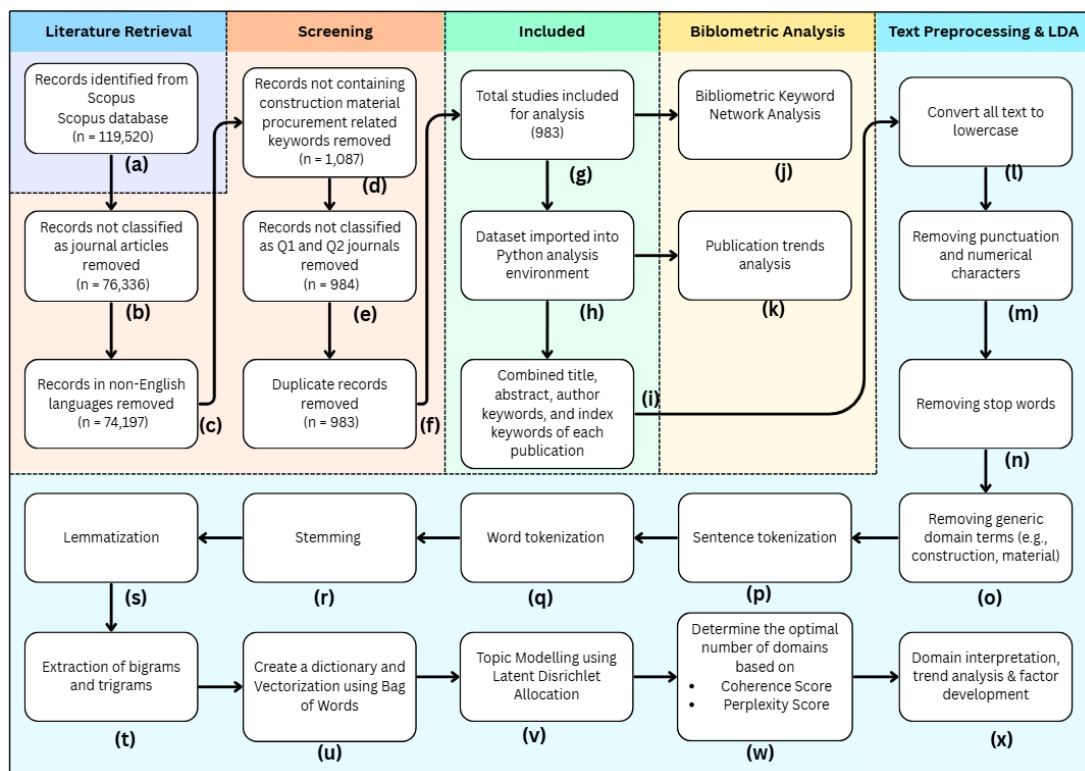


Figure 1: Detailed workflow of the LDA-based literature review, illustrating the sequential stages of literature retrieval and screening (a–f), dataset preparation (g–i), bibliometric analysis (j–k), text preprocessing and normalization (l–t), corpus representation and topic modelling (u–v), model evaluation (w), and factor derivation and interpretation (x).

The workflow is divided into a series of labelled stages (a–x), where each label represents a specific process within the research framework and is referenced throughout the methodology to describe the corresponding analytical procedures.

2.1 MATERIALS AND METHODS

The first stage of the research involved retrieving and screening relevant literature related to construction material procurement. The literature retrieval process began with the identification of publications indexed in the Scopus database as illustrated in Figure 1(a). Although both Scopus and Dimensions databases were initially explored, a comparison of search results indicated that nearly all relevant publications retrieved from Dimensions were already indexed in Scopus. Therefore, Scopus was selected as the primary data source due to its comprehensive coverage and structured bibliographic metadata suitable for bibliometric and LDA based analysis. A structured search query was then developed to retrieve publications related to construction materials, procurement processes, and performance-related factors. The search query combined three groups of keywords representing the research context, procurement domain, and performance attributes. Boolean operators were used to combine these keyword groups to ensure comprehensive retrieval of relevant studies. The search query used for retrieving the literature dataset is illustrated in Figure 2. The application of this query to the Scopus database resulted in 119,520 initial records, as shown in Figure 1(a).

```
TITLE-ABS-KEY (("construction" OR "building")
               AND material*
               AND ("procurement" OR "sourcing" OR "supply chain" OR
                   "logistics")
               AND ("factor*" OR "driver*" OR "attribute*" OR "indicator*")
               AND ("performance" OR "success"))
               AND (LIMIT-TO (DOCTYPE, "ar"))
               AND (LIMIT-TO (LANGUAGE, "English"))
```

Figure 2: Search query used for literature retrieval

The retrieved records were subsequently filtered to ensure the relevance and quality of the dataset. In the first filtering stage, records that were not classified as journal articles were removed from the dataset as shown in Figure 1(b). This filtering step reduced the dataset to 76,336 records. In the next stage, publications written in languages other than English were excluded to ensure consistency in textual analysis. After removing non-English publications, 74,197 records remained for further screening as illustrated in Figure 1(c). The screening process then focused on identifying studies related specifically to construction material procurement. Records that did not contain construction material procurement related keywords were excluded from the dataset as shown in Figure 1(d). This filtering stage reduced the dataset to 1,087 potentially relevant articles. In the next step, the quality of the journals in which these articles were published was evaluated. Articles published in journals that were not classified as Q1 or Q2 according to the SCImago Journal Ranking were removed from the dataset as illustrated in Figure 1(e). This stage resulted in 984 articles being retained for further analysis.

Finally, duplicate publications were identified using Digital Object Identifier (DOI) cross-referencing and removed from the dataset. This process ensured that each publication was represented only once in the literature corpus. After removing duplicate records, the final dataset consisted of 983 journal articles, as shown in Figure 1(f). These articles formed the literature corpus used for the subsequent analytical procedures.

2.2 MATERIAL ANALYSIS

2.2.1 Bibliometric and Descriptive Analysis

An initial bibliometric analysis was conducted to obtain an overview of the research landscape. Keyword co-occurrence analysis was performed using extracted author and index keywords to identify relationships among frequently occurring concepts and to reveal dominant thematic clusters within construction material procurement research. In addition, a publication trend analysis was carried out to examine the temporal evolution of research activity within the dataset, as illustrated in Figure 1(j)–(k).

2.2.2 Text Preprocessing

Following bibliometric analysis, the textual dataset was prepared for topic modelling through a series of preprocessing steps. All textual data were first converted to lowercase to ensure consistency in word representation. Subsequently, punctuation marks and numerical characters were removed to eliminate non-informative elements from the corpus. Common stop words were then removed to reduce noise and improve the quality of the textual data. In addition, domain-specific generic terms such as “construction” and “material” were excluded, as these frequently occurring words do not contribute to meaningful topic differentiation. These preprocessing steps are illustrated in Figure 1(l)–(o).

2.2.3 Text Normalisation and Tokenization

After preprocessing, sentence segmentation was applied to structure the text into manageable units. The text was then tokenised into individual word tokens, forming the basis for further analysis. Subsequently, stemming and lemmatisation were applied to standardise word forms and reduce them to their base representations, ensuring consistency across the corpus. This tokenisation and normalisation process is presented in Figure 1(p)–(s).

2.2.4 Feature Extraction

To capture meaningful contextual information within the corpus, bigram and trigram extraction techniques were applied. These methods identify frequently co-occurring word combinations such as “supply chain”, “risk management”, and “waste management”, which represent important domain-specific concepts. This step enhances the semantic representation of the dataset by incorporating multi-word expressions, as shown in Figure 1(t).

2.2.5 Corpus Representation and Vectorization

A dictionary representing the vocabulary of the corpus was constructed based on the processed tokens. Subsequently, the textual data were transformed into a numerical representation using a bag-of-words approach. Each document was converted into a sparse document-term matrix, where the frequency of each term within a document is recorded. This vectorised representation serves as the input for the topic modelling process, as illustrated in Figure 1(u).

2.2.6 Topic Modelling Using LDA

Topic modelling was performed using LDA, a probabilistic method that identifies latent thematic structures by analysing word co-occurrence patterns across documents. The model assumes that each document is composed of a mixture of topics, while each topic

is represented by a distribution of words. The LDA model was implemented in Python using Gensim, NLTK, and pyLDAvis libraries, as illustrated in Figure 1(v).

2.2.7 Model Evaluation and Topic Interpretation

To determine the optimal number of topics, multiple LDA models were trained with different topic configurations. Model performance was evaluated using coherence and perplexity metrics. The coherence score assesses the semantic consistency of keywords within each topic, while perplexity measures the model's predictive performance. The optimal topic structure was selected based on a balance between interpretability and statistical reliability, as shown in Figure 1(w).

2.2.8 Factor Derivation and Integration

Once the optimal topic model was identified, the resulting topics were interpreted by analysing the most representative keywords associated with each topic as per Figure 1(x). These keywords were used to identify meaningful thematic domains within the literature. The factor derivation process consisted of three stages. First, the highest-weighted keywords associated with each topic were extracted from the LDA output and examined within their thematic context. Second, semantically related keywords were grouped based on conceptual similarity and their relevance to construction material procurement. Third, the preliminary factors were refined by eliminating overlapping concepts, improving terminology consistency, and converting keyword clusters into clearly defined procurement performance factors. The resulting factors were reviewed against the construction procurement literature to ensure conceptual relevance and practical applicability. Finally, the results were synthesised into a structured representation of procurement performance dimensions.

3. RESULTS AND DISCUSSION

3.1 BIBLIOMETRIC KEYWORD NETWORK ANALYSIS

Bibliometric keyword network analysis was conducted to identify relationships among frequently occurring keywords and reveal dominant thematic clusters within the literature. This step provides an overview of the intellectual structure of construction material procurement research and supports the analysis of the research landscape. The analysis was performed using VOSviewer based on three keyword datasets extracted from Scopus records: author keywords, index keywords, and the combined keyword set.

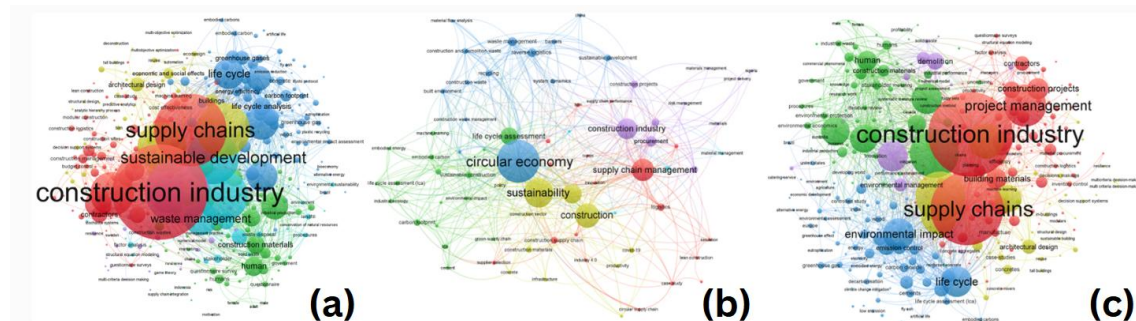


Figure 3: Keyword co-occurrence networks generated from (a) author keywords, (b) index keywords, and (c) combined keywords.

Figure 3 presents the keyword co-occurrence networks generated from these datasets, where Figure 4(a) corresponds to author keywords, Figure 3(b) to index keywords, and Figure 4(c) to the combined network. Each dataset offers a distinct perspective, enabling a more comprehensive understanding of thematic relationships within the literature.

The author keyword network as per Figure 3(a) highlights themes emphasized by researchers, with prominent nodes such as construction industry, supply chains, sustainable development, and waste management forming dense clusters. These clusters indicate strong research focus on procurement logistics, supply chain coordination, and sustainability in construction projects.

The index keyword network as per Figure 3(b) provides a broader conceptual representation, capturing themes such as circular economy, life cycle analysis, sustainability, and construction management. These patterns reflect the increasing importance of environmental performance, lifecycle assessment, and resource efficiency in construction material research.

The combined keyword network as per Figure 3(c) integrates both keyword sources to provide a comprehensive representation of the domain. Central nodes such as construction industry, supply chains, and project management highlight key research areas, while interconnected clusters reflect themes related to procurement practices, logistics management, and environmental sustainability.

Overall, the keyword network analysis reveals that construction material procurement research is strongly connected with supply chain management, sustainability, environmental impact assessment, and project management. These insights establish a foundation for the subsequent LDA-based analysis, which focuses on identifying latent thematic structures within the literature.

3.2 PUBLICATION TREND ANALYSIS

Following bibliometric keyword network analysis, publication trend analysis was conducted to examine the temporal evolution of research activity related to construction material procurement. Understanding publication trends provides insights into how research attention toward procurement performance has developed over time and helps contextualise the subsequent thematic analyses.

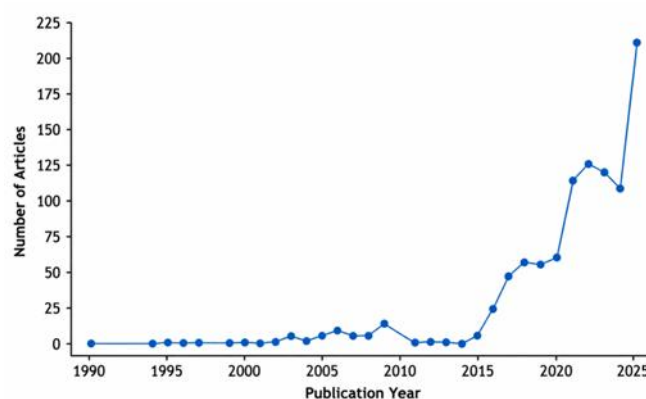


Figure 4: Annual publication trend

Figure 4 illustrates the annual publication trend of the articles included in the dataset. The earliest publications related to construction material procurement appear in the early 1990s, although research activity remained relatively limited during the following two decades. Between 1990 and 2014, the number of studies published each year remained relatively low, indicating that procurement performance had not yet emerged as a central research theme within construction management research. A noticeable increase in research activity can be observed after 2015. The number of studies rose steadily from fewer than ten publications per year before 2015 to more than one hundred publications annually after 2021. The peak in 2025 indicates that research on construction material procurement continues to expand rapidly. This growth reflects increasing attention to supply chain management, procurement performance, and sustainability within the construction industry. The increasing complexity of global supply chains, fluctuations in material prices, and growing environmental concerns have likely contributed to the rising research interest in procurement performance.

3.3 TOPIC MODEL SELECTION AND VALIDATION

Following the Bibliometric analysis, LDA was performed to identify latent thematic patterns within the literature corpus. Before interpreting the resulting topics, it is necessary to determine the optimal number of topics for the LDA model. This step corresponds to the model selection stage illustrated in Figure 1(u). This analysis is to ensure that the topic model produces themes that are both statistically reliable and semantically interpretable. To determine the optimal topic configuration, multiple LDA models were trained with different numbers of topics and evaluated using coherence and perplexity metrics. The coherence score measures the semantic consistency among the keywords within each topic, while the perplexity score evaluates the statistical performance of the model in predicting unseen data.

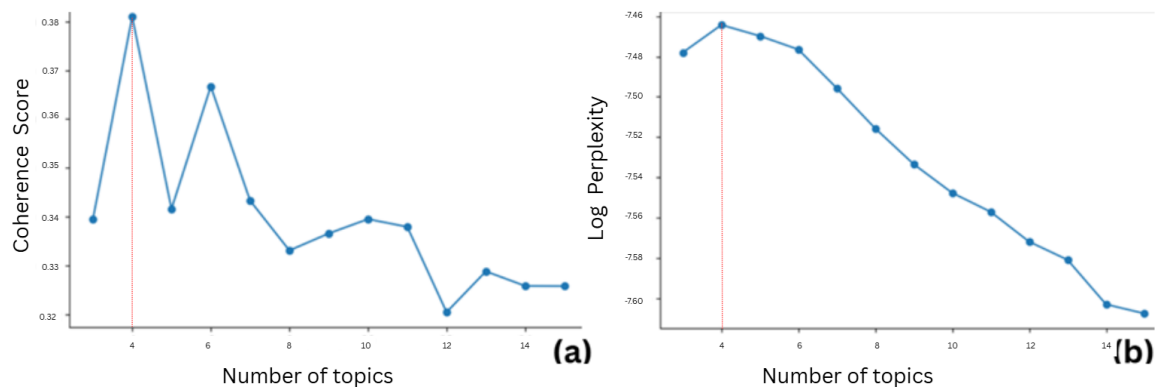


Figure 5: Top coherence, perplexity vs number of topics

As illustrated in Figure 5(a) and Figure 5(b), both the coherence score and perplexity values indicate that the optimal number of topics is 4. The coherence score reaches its maximum value at four topics, indicating strong semantic consistency among the keywords within each topic. Similarly, the perplexity analysis shows improved model performance at the four-topic configuration. Based on these results, the 4 topic model was selected as the optimal configuration because it provides the best balance between statistical reliability and semantic interpretability of the extracted topics.

3.4 LDA RESULTS

Once the optimal topic configuration was identified, the LDA model was applied to extract the dominant thematic domains within the literature corpus. Figure 8 illustrates the most representative keywords associated with each topic identified by the LDA model.

Figures 6(a)–6(d) show the highest weighted keywords for Topics 1–4 respectively.

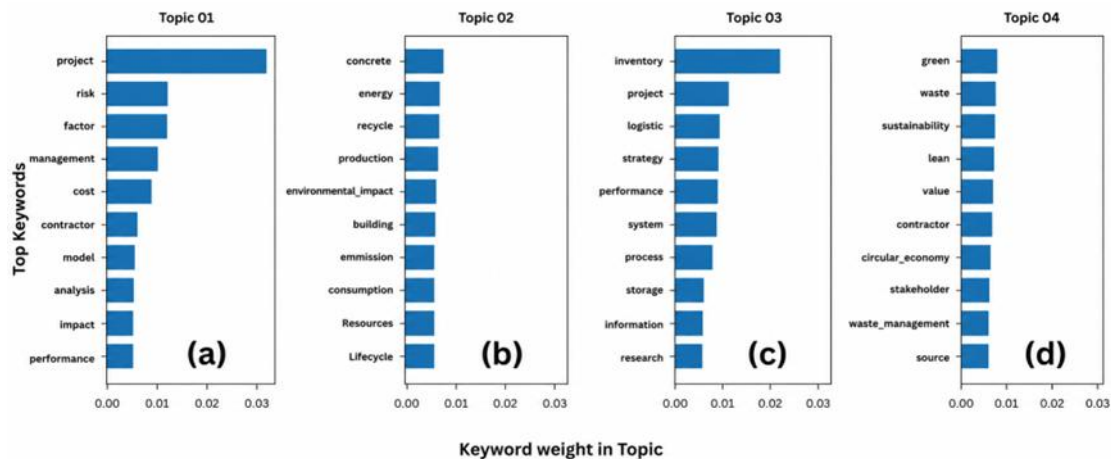


Figure 6: Top keywords associated with each LDA topic. Figures (a)–(d) illustrate the most representative keywords and their corresponding weights for Topics 1–4 identified through the topic LDA analysis.

Since LDA generates probabilistic distributions of words rather than explicit labels, the interpretation and naming of topics were performed by examining the semantic relationships among the highest probability keywords and their contextual relevance within procurement research. Identified four dominant thematic domains were named based on the keywords behaviour.

Topic 1 – Procurement Risk and Cost Performance

As illustrated in Figure 6(a), Topic 1 is characterised by high-weight keywords such as project, risk, factor, management, cost, and contractor. The clustering of these terms indicates that a significant body of the analysed literature is dedicated to identifying and mitigating procurement-related risks while maintaining cost efficiency.

Topic 2 – Environmental Impact of Construction Materials

The keyword distribution for Topic 2, shown in Figure 6(b), prominently features concrete, energy, production, environmental impact, and emission. This suggests a research concentration on the ecological footprint of the construction sector, specifically regarding material manufacturing and usage. This theme reflects a critical shift toward assessing carbon emissions and energy intensity through a lifecycle lens.

Topic 3 – Supply Chain and Logistics

As depicted in Figure 6(c), Topic 3 encompasses keywords such as inventory, project, logistic, strategy, performance, and system. These terms highlight the operational core of construction procurement, focusing on the seamless movement of resources. The research emphasizes the necessity of integrated logistics management and sophisticated information systems to coordinate complex supply chain networks.

Topic 4 – Sustainable Procurement and Circular Economy

Topic 4, illustrated in Figure 6(d), is defined by keywords including Green, waste, sustainability, circular economy, and stakeholder. This theme represents the modern evolution of procurement from a purely transactional function to a value-driven strategic pillar. Overall, these themes provide a structured foundation for linking LDA derived insights with procurement performance factors identified in the literature.

Collectively, the four topics demonstrate that construction material procurement performance is a multidimensional concept that extends beyond traditional cost and schedule considerations. Topic 1 highlights the continued importance of risk management and cost control in ensuring procurement effectiveness. Topic 2 reflects the growing emphasis on environmental performance and lifecycle impacts, indicating that procurement decisions are increasingly influenced by sustainability objectives. Topic 3 emphasises the critical role of logistics coordination, inventory management, and information integration in supporting uninterrupted material flows. Topic 4 demonstrates the increasing adoption of sustainable procurement principles, including circular economy practices and stakeholder-driven value creation. Together, these findings suggest that contemporary procurement performance requires a balanced consideration of economic, operational, environmental, and strategic dimensions.

3.5 TOPIC TREND ANALYSIS

After identifying the dominant thematic domains, a topic trend analysis was conducted as illustrated in Figure 7 to examine how these themes have evolved over time.

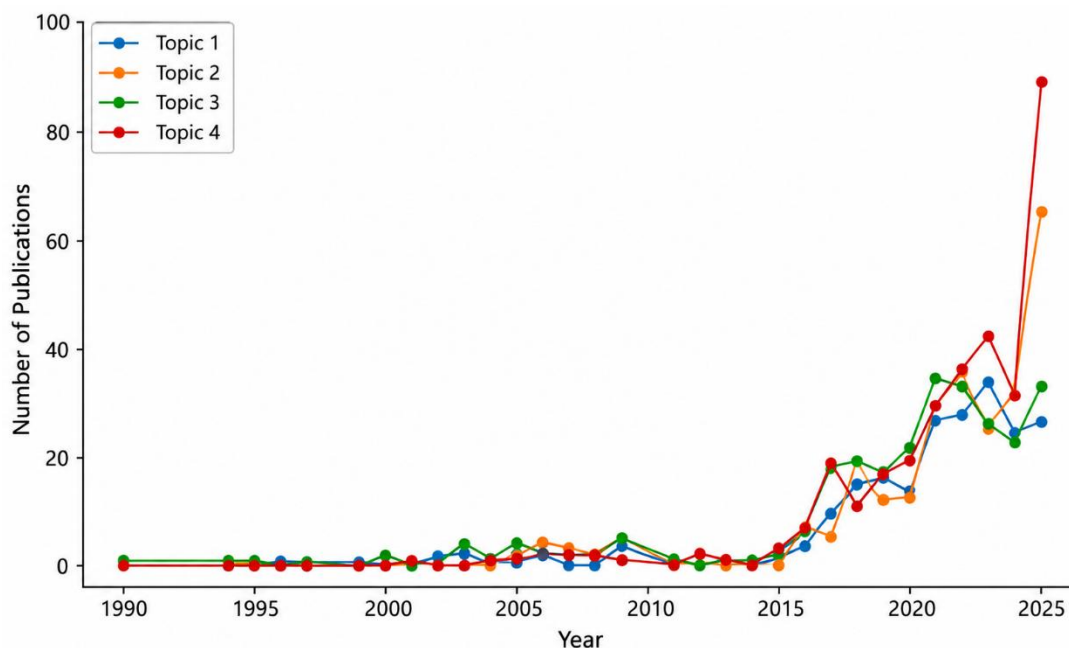


Figure 7: Topic trends in construction material procurement research

This analysis contributes to Objective 3, which aims to interpret the identified themes in relation to the development of procurement performance research. The results indicate that earlier studies primarily focused on procurement management and project-related issues. However, more recent publications demonstrate increasing attention toward sustainability, logistics management, and procurement performance evaluation. In

particular, the growth of Topic 4 in recent years highlights the rising importance of sustainable procurement practices and circular economy principles within the construction sector. This trend reflects the increasing emphasis on environmental responsibility and supply chain resilience in construction projects.

3.6 FACTOR DERIVATION FROM LDA TOPICS

Following the identification of dominant thematic domains through LDA, the extracted keywords were processed to derive procurement-related factors. Since the LDA model generates clusters of co-occurring terms rather than directly measurable constructs, an interpretation step was required to translate these keyword groups into meaningful factors within the context of construction material procurement. The derivation process involved analysing semantic relationships among high-weight keywords within each topic and grouping related terms to define distinct procurement performance factors. These factors were refined to ensure clarity, consistency, and applicability. An impact level was assigned to each factor based on keyword prominence and contextual relevance within the topic. Through this process, a total of thirty-five factors were derived and organised under four thematic domains: Procurement Risk and Cost Performance, Environmental Impact and Lifecycle, Supply Chain Operations and Logistics, and Sustainable Procurement and Circular Economy. These factors represent a data-driven interpretation of latent thematic structures identified from the literature corpus.

Compared with traditional literature reviews, the LDA-based approach adopted in this study enables the analysis of a substantially larger body of literature while reducing dependence on manual thematic classification. Rather than relying solely on researcher judgement, the identified themes emerged from statistically derived patterns of word co-occurrence across the literature corpus. This approach enhances transparency and provides a data-driven basis for identifying procurement performance factors. The findings therefore complement existing review studies by offering a systematic and reproducible framework for exploring construction material procurement research.

The complete set of derived factors, including associated topics, keywords, refined descriptions, and impact levels, is presented in Table 1.

4. CONCLUSIONS

This study identified the factors influencing construction material procurement performance through a structured review of existing literature. A dataset of 983 journal articles was analysed to identify dominant thematic patterns in construction material procurement research. The analysis revealed four key domains: procurement risk and cost performance, environmental impact of construction materials, supply chain and logistics management, and sustainable procurement practices. These domains highlight the multidimensional nature of procurement performance in construction projects. The findings further indicate emerging areas such as lifecycle environmental assessment, digital integration in supply chains, and circular procurement practices. Based on these insights, procurement-related factors were derived and organised to provide a structured understanding of procurement performance. From a practical perspective, the results emphasise the importance of managing cost, supplier relationships, logistics, and sustainability in an integrated manner to improve procurement performance. Future research can extend this work by validating the identified factors through empirical studies and expanding the analysis using additional data sources.

Table 1: LDA-derived construction materials procurement performance factors

Factor No	Topic Name	Keywords	Factor from LDA	Refined Factor Name
F1	Procurement Risk and Cost Performance	project, risk, factor, management, cost, contractor, model, analysis, impact, performance	Contractor Risk Management Effectiveness	Effectiveness of Contractor Risk Management
F2			Project Cost Variance Analysis	Accuracy of Procurement Cost Estimation
F3			Risk Factor Impact Assessment	Impact of External Risk Factors on Procurement
F4			Contractor Cost Performance Index	Contractor Cost Efficiency in Material Procurement
F5			Procurement Management Risk Model	Effectiveness of Procurement Risk Forecasting
F6			Project Management Cost Factor	Procurement Management Cost Efficiency
F7			Contractor Analysis Performance	Effectiveness of Contractor Evaluation Process
F8			Risk-Adjusted Cost Performance	Cost Performance under Risk Conditions
F9			Project Performance Impact Factor	Impact of Procurement Delays on Project Performance
F10			Management Analysis Effectiveness	Effectiveness of Data-Driven Procurement Decisions
F11	Environmental Impact and Lifecycle	concrete, energy, recycle, production, environmental_impact, building, emissions, consumption, Resources, Lifecycle	Lifecycle Environmental Impact Score	Overall Environmental Impact of Materials
F12			Energy Consumption Efficiency	Energy Efficiency in Material Production
F13			Recycled Resource Utilization Rate	Use of Recycled Materials in Procurement
F14			Resource Consumption Impact	Resource Consumption in Material Sourcing
F15			Concrete Lifecycle Sustainability	Sustainability of Concrete over Lifecycle
F16			Production Resource Efficiency	Efficiency of Resource Use in Material Production
F17	Supply Chain Operations and Logistics	inventory, project, logistic, strategy, performance, system,	Inventory Storage Efficiency	Efficiency of Material Storage Systems
F18			Logistic System Performance	Performance of Material Logistics Systems
F19			Information Process Integration	Integration of Procurement Information Systems
F20			Strategic Logistic Performance	Effectiveness of Logistics Planning Strategy

Factor No	Topic Name	Keywords	Factor from LDA	Refined Factor Name
F21	Sustainable Procurement and Circular Economy	process, storage, information, research	Inventory Management Strategy	Effectiveness of Inventory Management Practices
F22			Supply Chain Research Application	Application of Supply Chain Innovations
F23			Project Logistic System Reliability	Reliability of Material Delivery Systems
F24			Process Performance Speed	Speed of Procurement Processes
F25			Logistic Information Accuracy	Accuracy of Logistics and Inventory Data
F26			Green Sourcing Effectiveness	Effectiveness of Green Material Sourcing
F27			Stakeholder Sustainability Alignment	Alignment of Stakeholders on Sustainability Goals
F28		green, waste, sustainability, lean, value, contractor, circular_economy, stakeholder, waste_management, source	Waste Management Performance	Effectiveness of Material Waste Management
F29			Lean Procurement Value	Implementation of Lean Procurement Practices
F30			Contractor Sustainability Compliance	Contractor Compliance with Sustainability Standards
F31			Circular Economy Waste Reduction	Waste Reduction through Circular Practices
F32			Circular Economy Integration Value	Value Creation through Circular Procurement
F33			Stakeholder Value Creation	Value Delivered to Stakeholders through Procurement
F34			Green Waste Management Strategy	Implementation of Sustainable Waste Strategies
F35			Sustainable Source Selection	Effectiveness of Sustainable Supplier Selection

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