



Procurement Fraud Research Landscape: A Bibliometric Analysis

Panorama da Pesquisa sobre Fraude em Compras Públicas: Uma Análise Bibliométrica e de Mapeamento Científico

Roland Moyo

Botswana Accountancy College (BAC), Botswana.
Email: rolandm@bac.ac.bw

Thato Kebaetse

Botswana Accountancy College (BAC), Botswana.
Email: thato@bac.ac.bw

Andrew Matlhabaphiri

Botswana Accountancy College (BAC), Botswana.
Email: andrew@bac.ac.bw

ABSTRACT | Purpose: This study aims to map the intellectual structure and global research landscape of procurement fraud, identifying key themes, journals, authors, countries, and research gaps that shape this emerging field. **Method:** A bibliometric approach with a science mapping focus was adopted. A total of 336 documents indexed in the Scopus database up to March 2024 were analyzed. Citation, co-citation, bibliographic coupling, keyword co-occurrence, and co-authorship analyses were conducted using VOSviewer (version 1.6.20), enabling visualization of thematic and intellectual networks in procurement fraud research. **Findings:** The findings show that procurement fraud spans all stages of the procurement life cycle and lacks a universally accepted definition. Research is predominantly focused on the public sector, with limited attention to the private sector. Key emerging themes include public procurement fraud, corruption, construction project fraud, collusion, bribery, forgery, lack of auditability, and the application of artificial intelligence in fraud detection. The *Journal of Public Procurement* and *Critical Perspectives on Accounting* emerge as the most influential journals. The United States and Australia dominate scholarly output, while African contributions remain scarce. **Originality/Value:** The study advances the literature by providing a comprehensive and structured overview of the knowledge base on procurement fraud, offering a foundation for future empirical research and evidence-based policy formulation.

Keywords | Procurement fraud; Bibliometric analysis; Science mapping; Corruption; Governance.



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RESUMO | Objetivo: O estudo tem como objetivo mapear a estrutura intelectual e o panorama global da pesquisa sobre fraude em compras públicas, identificando os principais temas, periódicos, autores, países e lacunas de pesquisa que caracterizam esse campo científico emergente. **Metodologia:** Adotou-se uma abordagem bibliométrica com ênfase em *science mapping*. Foram analisados 336 documentos indexados na base Scopus até março de 2024. Utilizaram-se técnicas de análise de citações, cocitação, acoplamento bibliográfico, coocorrência de palavras-chave e coautoria, com apoio do software VOSviewer (versão 1.6.20), permitindo a visualização das redes intelectuais e temáticas da literatura sobre fraude em compras públicas. **Resultados:** Os resultados indicam que a fraude em compras públicas permeia todas as fases do ciclo de contratação e carece de uma definição conceitual universal. A produção científica concentra-se majoritariamente no setor público, com escassez de estudos voltados ao setor privado. Os principais temas emergentes incluem fraude e corrupção em compras públicas, projetos de construção, conluio, suborno, falsificação, baixa auditabilidade dos processos e uso de inteligência artificial para detecção de fraudes. O *Journal of Public Procurement* e *Critical Perspectives on Accounting* destacam-se como os periódicos mais influentes. Os Estados Unidos e a Austrália lideram a produção científica, enquanto a África apresenta participação limitada. **Contribuições:** O estudo contribui ao oferecer uma visão integrada da base de conhecimento sobre fraude em compras públicas, servindo como referência para pesquisas futuras e para o desenvolvimento de políticas e frameworks de prevenção e detecção de fraudes.

Palavras-chave | Fraude em compras públicas; Análise bibliométrica; Mapeamento científico; Corrupção; Governança.

INTRODUCTION

Fraud has been designated the preferred crime in the twenty-first century (Wells et al., 2012). Fraud is causing significant losses to societies. Fraud has become a problem in several domains such as finance, education, telecommunications, insurance, healthcare and procurement. Procurement fraud is a pandemic that causes catastrophic economic losses for society and adds to avoidable deaths. Organizations worldwide are predicted to lose roughly US\$3.7 trillion due to fraud, with procurement fraud accounting for a large portion of this loss (ACFE, 2017, Lyra, Pinheiro, & Bacao, 2022). According to the ACFE, organizations lose around 5% of their revenue to fraud each year, with a median loss of US\$125,000 and an average loss of US\$1,509,000 (ACFE, 2020). According to PricewaterhouseCoopers LLP's 2016 Global Economic Crime Survey, 22% of organizations have suffered procurement fraud. The literature on procurement fraud is limited and requires extensive attention. Most procurement functions necessitate sophisticated information management systems.

This complexity in itself exposes organization to procurement fraud risk. Moreso, majority of fraud incidences are on the rise due to lack of auditability power in institutional processes (Rendon & Rendon, 2022). Auditability theory posits that fraud is difficult to be flagged by auditors in institutions due to lack of educated and experienced personnel, processes that are not measurable and not institutionalised and ineffective internal control that are reviewed regularly (Alsamarraie and Ghazali, 2023). There is no universal accepted definition of procurement fraud. There is a huge scholarly description of what procurement fraud is. Most scholars have attempted to define procurement fraud through different aspects of procurement, particularly the various stages of the contracting processes. The UK National Fraud Authority defines procurement fraud as “a deliberate deception intended to influence any stage of the procurement lifecycle to make a financial gain or cause a loss. It can be perpetrated by contractors or sub-contractors external to the organization, as well as staff



within the organization.” While the Procurement Integrity Consulting Services (PICS) (2014) describe procurement fraud as the misrepresentation of the truth in any stage of the acquisition process by an individual who has an operational knowledge of your process. It is evident that the complexity of procurement fraud is that it is embedded in all the stages of the procurement cycle.

Procurement is particularly vulnerable to fraud and corruption (Dhurandhar *et al.*, 2015). This vulnerability is primarily due to the large amounts of money involved and the difficulties, at times, to effectively supervise a large number of contracts (Murray, 2014) coupled with auditability bankruptcy. Procurement fraud can be separated into two separate categories: The period of time before any contract is awarded, and after a contract has been awarded as shown in the Table 1 below. Precontract stage fraud is fraud that occurs during the issuance of the bid to the public. Post contract stage fraud occurs after the bid has been awarded which includes inflating invoices and creative accounting to deliberate conceal information.

Table 1. Manifestations of Procurement Fraud

Pre-contract stage fraud	Post-contract fraud scheme
<i>Bid Rigging schemes</i>	<i>Accounting Mischarge schemes</i>
<i>Bid Suppression schemes</i>	<i>Labor mischarge scheme</i>
<i>Bid rotation schemes</i>	<i>Product Substitution Scheme</i>
<i>Phantom bids scheme</i>	<i>False invoicing</i>
<i>Bid tailoring schemes</i>	<i>Conflict of interest</i>

Source: Deloitte (2014)

Majority of procurement fraud incidents occurs due to collision between the internal employees of the principal and the contractor. While other scholars argue that procurement fraud occurs at the source selection and contract administration phase of the contract management process. There is acute information on procurement fraud, although implied in many scholarships that there is procurement fraud, there are few studies that explicitly explain what it is and how does it come about. The studies are scanty and they focus on different manifestations of procurement fraud and corruption. This bibliometric study seeks to analyse the intellectual structure on procurement fraud globally.

This bibliometric study is a pioneering effort to investigate the contentious field of fraud in procurement, and it has the potential of mapping the intellectual structure around fraudulent activities acts in procurement. Moreso this bibliometric study seeks to contribute knowledge on the increasingly important fields of fraud management and procurement. The study has the potential of being an anchor to further studies on how procurement fraud can be detected after a thorough identification and understanding of this phenomenon. This investigation requires a methodical approach that allows for an assessment of the extent and nature of academic contributions while highlighting emerging trends in scholarly discourse. The study intends to map the evolution of these domains by thoroughly examining publication trends and thus drawing a development trajectory in the fields of procurement and fraud.

This research is driven by a central question: What is the intellectual structure of the knowledge base in procurement fraud? The study employs bibliometric analysis to provide a lens through



which the progression, current dynamics, and potential future directions of fraud management in procurement research can be viewed. This method is invaluable for identifying critical research pathways, gaps, and influences, ultimately serving as a compass for academics and practitioners in the procurement and supply chain management field. It will enhance the efforts of practitioners in combating procurement fraud.

METHOD

Bibliometric Approach

The study employed a bibliometric analysis approach in uncovering the intellectual structure, foundational themes, existing or future relationships on procurement fraud. Reviews of the literature and bibliometric research are linked to quantitative analysis and enable the identification of patterns in the creation and dissemination of scientific information (Araújo, Pereira Carneiro and Palha, 2020). Bibliometric analysis has over the years gained traction as a befitting methodology in business research due to its objective analysis rigor as compared to meta analysis (Shi *et al.*, 2021). Although meta analysis tend to summarise the linkages of concepts, the literature considered tend to be less varied which can have negative effects on the validity of results.

The Bibliometric analysis was chosen due to its ability to handle a vast amount of literature and provide detail summary of scope and intellectual debates in procurement fraud (Rejeb, Rejeb, Abdollahi, *et al.*, 2022). In contrast to conventional systematic literature review which is confined to research areas and heavy reliance on qualitative analysis. Bibliometric analysis is quantitative in nature. It maps the intellectual structure rather than summarizing empirical evidence onl (Arora and Chakraborty, 2021). This approach mitigates interpretation bias (Rejeb, Rejeb, Zailani, *et al.*, 2022). Using bibliometrics provides an objective, fast, and visual method to monitor the development and evaluate the intellectual framework of a particular scientific field.

Moreso, the approach employed has the benefit of analysing the social and structural relationships between authors, countries, institutions and topics (Abdollahi, Sadeghvaziri and Rejeb, 2023). The employment of bibliometric analysis has been instrumental in the discovery of key growth trends in any research field. Moreover, the primary advantage of bibliometrics over conventional review techniques is that it makes it possible to create complete, unbiased, detailed, and trustworthy scientific maps. Based on the connections between these things, these maps provide analytical representations of the interconnections between scientific phenomena (Piwowar-Sulej, Krzywonos and Kwil, 2021).

Bibliometric analysis can be conducted via two approaches, ie performance analysis and science mapping (Zainuldin and Lui, 2022). In this paper we utilised science mapping analysis only to examine fundamental knowledge interactions in procurement fraud (Jain *et al.*, 2022). The table below details the techniques for science mapping and their usage, unit of analysis and data requirements.



Table 2. Techniques for science mapping utilised

Research question	Technique	Uses	Unit of analysis	Data Requirements
What is the intellectual structure of the knowledge base on fraud in procurement?	Citation analysis	Uncover the most influential publications in procurement fraud	Documents	Author name Citations received. Journals
What areas in procurement fraud have been studied with greatest frequency and are attracting the greatest attention?	Co-citation analysis	To uncover the major/pivotal/ landmark studies on procurement fraud. To discover the intellectual structure.	Cited References	References
What are the key growth trends in research on fraud in procurement?	Bibliographic coupling	To discover key growth trends and present themes in procurement fraud	Research papers	Authors Title Journals
What areas in procurement fraud have been studied with greatest frequency and are attracting the greatest attention?	Co-word analysis	Examination of the actual content of publications	Words	Title Abstract Key words Fulltext
What authors and documents in the literature on fraud in procurement have had the greatest impact on citations over the past decade?	Co-authorship analysis	To assess the interactions between authors and their affiliations	Authors Affiliation	Author Affiliation Country

Source: Authors Conceptualization

The study was conducted through successive steps. We first gathered data from Scopus database. Scopus was chosen due to quality and the comprehensive nature of the database. Bibliometric analysis credibility is founded on large volumes of publications which are present in the Scopus database. The other databases such as Web of Science, Dimensions and Google Scholar could have been used but the enriching technique, VOSviewer that was employed can only receive input from a single database. However from the search that was done in Web of Science only 28 publications were retrieved which is too small for bibliometric analysis. This could have been a potential limitation that was present in conducting this study. However the breadth of quality content found in Scopus was a significant factor that the authors took into consideration in selecting this database for science mapping.

Data Collection Procedure

The table below details how data was collected in the scopus database.

Table 3.Data Collection-Search String

Database	Scopus
Search within	Article title,Abstract,key words
Search terms	TITLE-ABS-KEY (procurement AND fraud* OR " Fraud AND procurement*" OR procurement AND fraud)
Time Period	Up to 20 March 2024

This comprehensive procedure produced 336 articles for further examination. Including all document types which were written in English language ensures a comprehensive collection of research

outputs, which may include articles, reviews, conference papers, and other documents. This approach acknowledges the importance of various forms of scholarly communication in comprehending the full scope of the research landscape. Furthermore, taking into account all documents allow for a global perspective on the subject, recognizing that significant contributions to these fields come from a variety of regions.

We then summarised bibliometric structure and knowledge structure through scientific mapping analysis. Within the scientific mapping step, version 1.6.20 of the bibliometric software VOSviewer was utilized. VOSviewer is an open-source tool that offers sufficient functions for visualizing bibliometric networks and scientifically depicting literature. Citation analysis, co-citation analysis, bibliographic coupling, co-word analysis and co-authorship analysis was done.

RESULTS AND DISCUSSION

Citation analysis

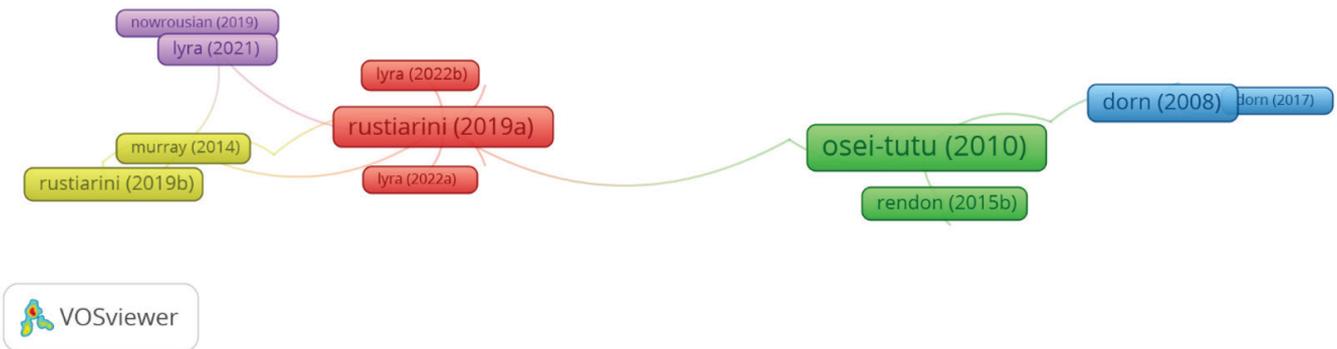


Figure 1. Citation Analysis

The seminal work by (Osei-Tutu, Badu and Owusu-Manu, 2010) has received the most citations in many scholarly outputs on procurement fraud. There are the most cited paper in procurement fraud discourse as shown in **Table 3** below. According to the authors, conflict of interest, bribery, embezzlement, kickbacks, tender manipulation and fraud are observed corruption practices in the Ghanaian infrastructure projects delivery system. The most cited paper in the studies included in **Table 3** have made significant contributions to the advancement of procurement fraud research. Since their research was a review-and explanatory in nature it lacked empirical analysis to back up the arguments, the findings cannot be applied to a larger context of the public procurement practices.

(Rustiarini *et al.*, 2019) conducted a systematic literature review study to discuss the factors that cause procurement fraud. This article aimed at educating regulators, auditors, and other staff members on how to identify the traits and origins of fraud. This knowledge can aid in the prevention of several types of procurement fraud that take place at organisational level. However, the review was not comprehensive in explaining procurement fraud rather it mainly focused on fraud identification.

In another most influential publication, (Lyra, Pinheiro and Bacao, 2022), the authors posited that even though public procurement fraud is a major problem that costs states and societies a great deal of



money, there are less empirical studies that extend the procurement fraud concept and management of it. The authors reviewed the most recent literature on public procurement in order to pinpoint methods for Network Science-based fraud detection. Using the Scopus and Web of Science repositories along with the PRISMA approach, the authors chose scholarly papers and compared their outcomes between 2011 and 2021. The study was largely biased towards fraud detection. The discussion on what procurement fraud was and why it is important to combat it was not adequately addressed.

Table 4. Most Influential publication in procurement fraud

Article Title	Authors	Links	Citations	Cluster	Publication Year
Exploring corruption practices in public procurement of infrastructural projects in Ghana	Osei-tutu	3	84	2	2010
Why people commit public procurement fraud: The Fraud Diamond View	Rustiarini N.W.; T S.; Nurkholis N.; Andayani W.	5	43	1	2019
Fraud triangle in public procurement: Evidence from Indonesia	Rustiarini, N. W.; Sutrisno, S; Nurkholis, N; Andayani, W	1	13	3	2019
Characterization of the firm–firm public procurement co-bidding network from the State of Ceará (Brazil) municipalities	Lyra M.S.; Curado A.; Damásio B.; Bação F.; Pinheiro F.L.	3	8	2	2021

Source: Authors

Co-citation analysis

Source	Citations	Total Link Strength
Journal of public procurement	85	395
Critical perspectives on accounting	33	255
Journal of purchasing and supply management	27	225
Journal of Business Ethics	45	223
International journal of production economics	36	206
International journal of public sector management	20	147
International journal of procurement management	30	136
Accounting History	20	117
Journal of financial crime	43	117
Managerial auditing journal	21	113
International journal of project management	20	84
Management Science	22	26

Source: VoSviewer



Co-occurrence analysis of keywords allowed us to identify emerging topics and or themes related to procurement fraud. It is a significant analysis that gives a full colour pictorial view of research themes which allow readers to appreciate the main focus of a research article without reading the abstract (Donthu *et al.*, 2021). This analysis identified multiple keywords. Secondly, it studies the relationship between keywords with the number of titles and abstracts. Third, it enabled us to determine the main topics researched in the journals.

Co-word linkages detect several keywords that occur together in the same articles (van Eck *et al.*, 2010). The number of articles where the keywords appear together determines the link between them (van Eck *et al.*, 2010) and this can imply similarity or strength of relationship. By using this method on the 336 documents we had chosen, VOSviewers suggested 5 keyword clusters (shown in Figure 3 as red, blue, green, amber, and purple) that allowed us to identify the major themes and trends found in research on procurement fraud. In order to strengthen our clustering and bibliographic linkage, we then carried out tally literature research on the bibliometric mapping to develop the five primary discovered clusters in relation to our 336 documents.

Cluster 1 (Red) Procurement Fraud and Detection

The cluster consists of 21 key words relating to procurement fraud. The key words relate to the manifestations of public procurement fraud and fraud detection using automated systems. The contemporary scholars recommend the application of artificial intelligence in preventing and detecting fraud in procurement (Mircea, Stoica and Ghilic-Micu, 2022). This is corroborated by (Ezeji, 2024) who argued that automation of the procurement process guarantees access to unstructured data sources like spreadsheets, digital documents and email inboxes. This points to the current interplay of procurement fraud and use of automated systems that is shaping the global landscape. This is an important transition as manual audit process are failing to cope with the complex nature of procurement fraud. The use of automated systems (Barajei *et al.*, 2023) is global story that is shaping the risk management mechanism that are responding to the leakages in the procurement life cycle.

Cluster 2 (Green) Corruption

This is a synonym that is used by many scholars in place of procurement fraud (Rustiarini *et al.*, 2019). The authors use this term interchangeably with reference to procurement fraud (Osei-Tutu, Badu and Owusu-Manu, 2010). The cluster highlights a significant prevalence of corruption in the procurement processes in differing sectors of the society (Velasco *et al.*, 2021). The cluster highlights that there is no sector that is immune to procurement corruption, pharmaceutical and health sector (Kohler and Dimancesco, 2020), municipalities (Ndlovu and Mutambara, 2023), department of Defense (Rendon and Rendon, 2016), shell companies (Nicolás-Carlock and Luna-Pla, 2023) and many other sectors.

The cluster also highlights a great need of automation of processes in deterring procurement fraud (Dhurandhar *et al.*, 2015). The cluster highlights the importance of robust systems in combating corruption in the procurement process (Taoufik and Azmani, 2022). COVID-19 era has been flagged in this cluster as one of the periods of entrenched corrupt practices in the procurement processes (Akokuwebe and Idemudia, 2023).



Cluster 3 (Blue) Fraud

This cluster highlights the prevalence of fraud in every stage of the procurement process. Forgery have been indicated as one of the most elusive elements in the procurement process. There are a lot of allegations of such practices but there is no authoritative evidences to convict the perpetrators. The perpetrators are ahead of the audit processes. (Rendon and Rendon, 2016) have argued that the lack of auditability of the procurement process will perpetuate fraud. While (N.A., 2021) have posited that the procurement process is built in a manner that it breeds fraudulent practices. By this he implies that the nature and processes involved in precontract, and post contract stage of the procurement cycle have been designed to conceal any fraudulent activities. The auditors and corruption investigators have a hard time in flagging procurement fraud due to the complexity of the procurement process.

This is an important theme in the academic and practical discourse of procurement fraud. The auditability of procurement processes is a trend that has to be examined as it can provide solutions to combat rampant fraudulent activities (Syamsuddin *et al.*, 2023). A critical examination is however needed on whether the procurement process has been built by different institutions to manufacture fraud? The cluster reinforces that fighting corruption should be deliberate and calculated in each and every stage of the procurement process (Lopes and Andrade, 2022).

Cluster 4 (Amber) Construction Industry/Projects

This cluster point to construction and projects as one of the areas that have received a lot of attention in relation to procurement fraud. In USA at least there has been convictions of perpetrators in the Department of Defense (Rendon and Rendon, 2016) on those who directly or indirectly benefited from procurement fraud in construction projects. The cluster highlight that large projects are prone to procurement fraud in every stage from pre-contract to post contract. Bribery and kickbacks are prevalent in projects from the small to billion dollar projects (Murray, 2014). Collusion begins from the establishment of specifications and bidding.

Collusion have been characterised in this cluster as the most common type of crime in public procurement processes that produce significant monetary losses, inefficiencies, and misuse of the public treasury (Lyra *et al.*, 2022). This cluster encourages the engineers and other construction professionals to take the lead to clarify the facts when a possible fraud in public infrastructure procurement is identified. A robust approach for producing scientific evidence to determine the presence of collusive bidding is an urgent need (Signor, Love and Ika, 2022)

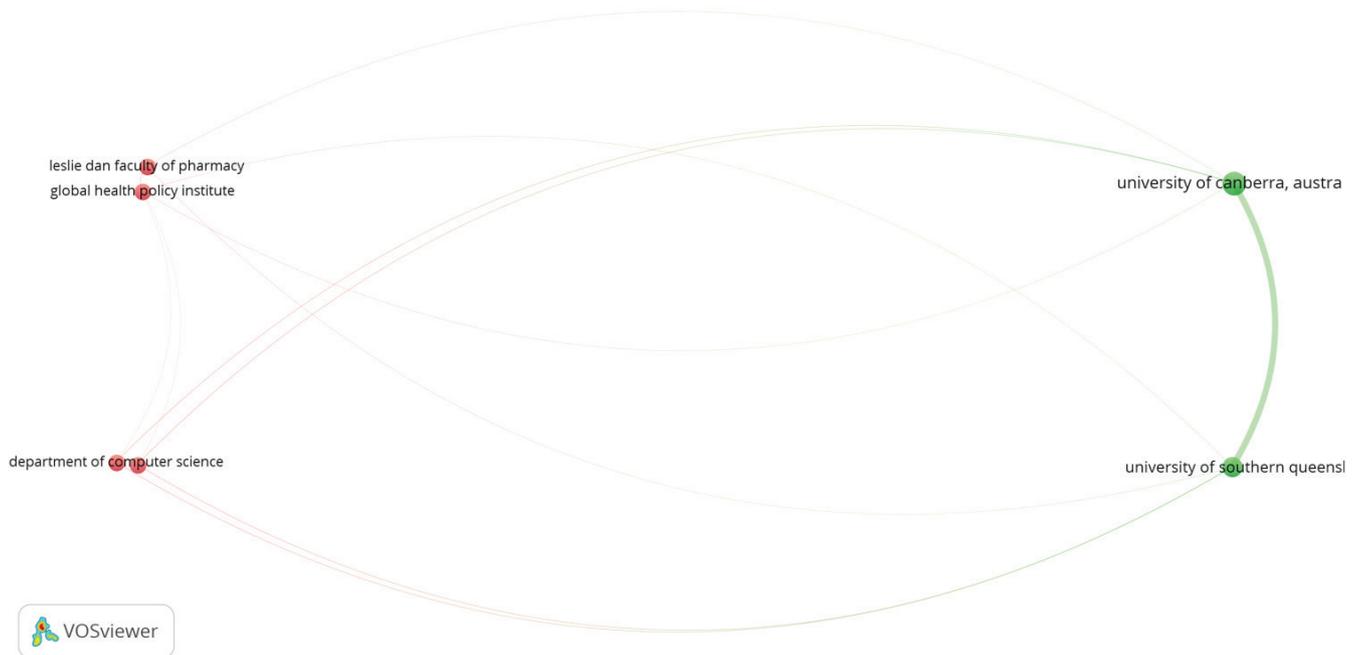
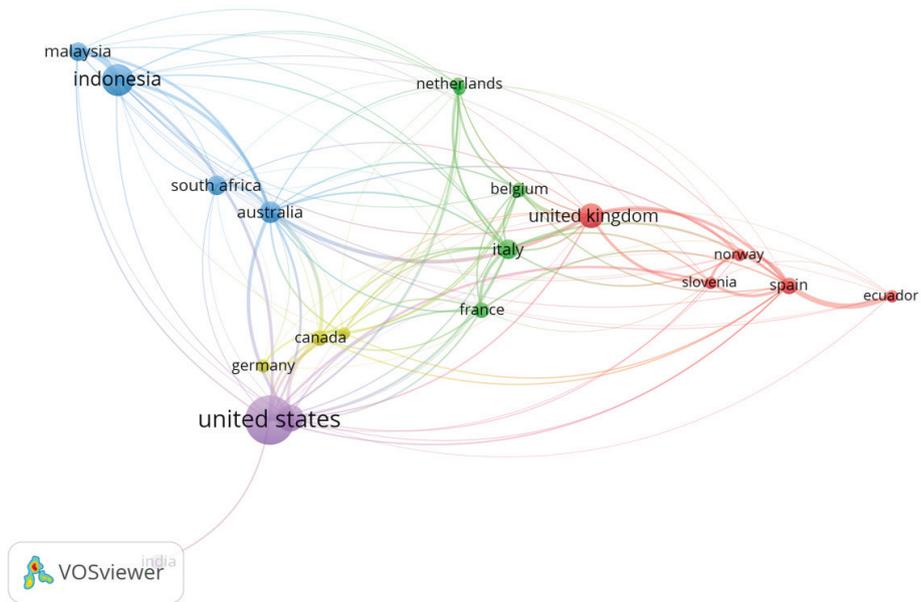
The scandals around projects particularly highlighted in this cluster have been flagged as “norm” in most of government construction projects (Smith, 2021). In recent times, contract termination cases have been reported on high-profile public construction projects in developing countries with expensive debts. A considerable number of researchers have found the major factors affecting contract termination of local projects are instances of fraud (Coleman, Mwanaumo and Rahman, 2023). Future research should focus on the financial scale and extent of procurement fraud in construction projects.



Cluster 5 (Purple) Purchasing

Procurement fraud on the purchasing area impacts companies all around the globe (Oliverio *et al.*, 2019). One of the possibilities to tackle this issue is through the usage of audits, however, due to the massive volume of the data available today, it is becoming impossible to manually check all the transactions of a company, hence only a small sample of the data is verified.

Bibliographic coupling





There are social linkages among authors in different institutions across the globe on procurement fraud publications. However the strongest links are between the regions that publish a lot on procurement fraud ie United States of America and Australia. The bibliographic coupling results indicate that there is acute cohesion in the procurement fraud research. This can be attributed to differing synonyms ascribed to procurement fraud across the globe.

CONCLUSION AND RESEARCH IMPLICATIONS

This pioneering study on procurement fraud presents a structured bibliometric data upto April 2024 on procurement fraud. The study examined the most influential publications and journals with the highest link strength on procurement fraud. The bibliometric study was done to carry out an in-depth understanding of procurement fraud through citation, co-occurrence, co-citation and bibliographic coupling analysis. The study contributes to the existing literature on procurement fraud and unearthed the emerging themes around this phenomenon that can be used by practitioners in identification and deterrence of fraudulent activities.

This study provides theoretical and practical implications to scholars and those in practice. The study provides a critical analysis on procurement fraud in uncovering current themes in journals, journal performance and link strength, research constituents (academic institutions, authors and countries), patterns and knowledge base that point out gaps for future. The findings of the study will assist in understanding the key growth trends in research on procurement fraud. This will also assist academics in appreciating the topics in the procurement fraud that have been studied with greatest frequency and are currently receiving greatest attention. The future work can focus on an in-depth study rather than literature reviews on the scale of procurement fraud both in public and private sector.

The Journal of public procurement has the highest number of publications and link strength and can be used by scholars in procurement fraud studies. By co-occurrence analysis the study identified five major clusters on procurement fraud on past and present trends. The major clusters are procurement fraud detection and application of Artificial intelligence, corruption, fraud in construction projects, purchasing and fraud. The co-occurrence analysis provides insight onto future research themes. Although this science mapping review provides a comprehensive understanding of procurement fraud, the study presented certain shortcomings. Searching on a single database, Scopus, could have limited the extent of findings.

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