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Detecting Corruption Risks in Government Procurement of Goods and Services Using Red Flag Indicators Based on LPSE Open Data: A Systematic Literature Review

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Keywords
procurement of goods and services, corruption, fraud, red flag indicators, LPSE, systematic literature review.

ABSTRACT
This study aims to examine the detection of corruption risks in government procurement of goods and services using an open data–based red flag indicator approach through the Electronic Procurement Services (LPSE) system. The study employed a Systematic Literature Review (SLR) method by collecting and analyzing various scientific articles related to procurement fraud, public procurement corruption, e-procurement, and the use of data analytics in fraud detection. Literature sources were obtained from several scientific databases, including Google Scholar, Scopus, ScienceDirect, and SpringerLink, covering the publication period from 2015 to 2025. The results of the study showed that the most frequently used red flag indicators in detecting procurement corruption risks included a low number of tender participants, bid values close to the Self-Estimated Price (HPS), repeated vendor wins, high use of direct appointment methods, and mass disqualification of tender participants. This study also found that LPSE open data has strong potential as an early warning system for detecting potential fraud and corruption in government procurement of goods and services. In addition, the use of data analytics, machine learning, and risk-scoring models is considered capable of improving the effectiveness of procurement oversight in a more transparent and accountable manner. This research is expected to serve as a reference for the development of a data-driven procurement monitoring system to support corruption prevention efforts in the public sector.

INTRODUCTION

Government procurement of goods and services is a strategic instrument in supporting national development and improving the quality of public services. Through procurement, the government allocates the state budget to meet operational needs, infrastructure development, public facility provision, and service delivery to the community. Public procurement also contributes significantly to national economic growth because it is directly linked to state budget turnover and public expenditure. According to the OECD (2023), public procurement accounts for around 12% of the Gross Domestic Product (GDP) of OECD member countries, making procurement governance a critical aspect of effective, efficient, and accountable public administration (Adilson et al., 2022).

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In Indonesia, government procurement is regulated under Presidential Regulation Number 16 of 2018, which was updated by Presidential Regulation Number 12 of 2021. These regulations emphasize that procurement must be conducted based on the principles of efficiency, effectiveness, transparency, openness, competitiveness, fairness, and accountability. In addition, the government promotes digital transformation through the implementation of electronic procurement systems (e-procurement) and the Electronic Procurement Services (LPSE) platform to enhance transparency and reduce irregularities in procurement processes.

Despite these reforms, government procurement remains highly vulnerable to corruption, collusion, and nepotism. The high risk is driven by large budget allocations, complex administrative procedures, weak oversight mechanisms, and the involvement of multiple actors from planning to contract execution. According to the United Nations Office on Drugs and Crime, (2022), public procurement is among the sectors most vulnerable to corruption due to intensive interaction between government and private actors in managing public funds. Corrupt practices in procurement include bid rigging, price inflation, bribery, conflicts of interest, and fictitious projects, all of which result in state losses and reduced service quality.

The Corruption Eradication Commission (KPK) reports that procurement of goods and services (PBJ) is the sector with the highest corruption vulnerability in Indonesia. Based on the 2024 Integrity Assessment Survey (SPI), the risk of procurement misuse reached 97% in ministries/institutions and 99% in local governments. Furthermore, 49% of respondents reported tender manipulation practices, 56% indicated discrepancies between goods quality and procurement value, and 71% identified nepotistic practices in procurement processes. These findings indicate that procurement digitalization through LPSE has not fully eliminated irregular practices.

Indonesia Corruption Watch, (2022) further confirms that procurement remains one of the sectors with the highest number of corruption cases in Indonesia. Common practices include tender manipulation, falsification of technical specifications, misuse of direct appointment mechanisms, and collusion between suppliers and procurement officials, resulting in significant state losses and declining public service quality.

To enhance transparency and accountability, the implementation of the e-procurement system through LPSE represents an important step in bureaucratic and governance reform. The system enables procurement processes to be conducted electronically and openly, reducing direct interaction between procurement officials and providers. In addition, procurement data available in LPSE—such as the self-estimated price (HPS), number of tender participants, bid values, procurement methods, and winner information—serves as open data that supports public oversight and early detection of procurement fraud. Mihály and János (2021) found that electronic procurement data can improve corruption risk detection through transaction pattern analysis and anomaly detection.

One widely used approach in detecting procurement fraud and corruption risk is the red flag indicator method. This approach identifies early warning signals indicating abnormal procurement patterns. Common indicators include a low number of tender participants, bids close to HPS, repeated vendor wins in specific agencies, high reliance on direct appointments, and mass disqualification of participants. According to Fazekas et al., red flag indicators are

effective in predicting procurement corruption risks by identifying collusion patterns and unfair competition in public tenders.

Advances in information technology and the increasing availability of procurement data have also encouraged the use of data analytics, machine learning, and risk-scoring models in detecting procurement fraud. LPSE-based open data analysis is expected to support government agencies, auditors, internal supervisory bodies, and the public in building a more transparent, accountable, and technology-driven procurement monitoring system. Therefore, research on detecting corruption risks in government procurement using Detecting Corruption Risks in Government Procurement of Goods and Services Using Red Flag Indicators Based on LPSE Open Data: A Systematic Literature Review is important to strengthen corruption prevention efforts and improve governance in public procurement.

The use of LPSE open data in 2025 is particularly relevant because it can serve as a foundation for developing early warning systems for corruption risk based on data analytics. Analysis of red flag indicators in LPSE data is expected to assist government institutions, supervisory bodies, and the public in identifying procurement packages with a high risk of corrupt practices. Thus, this research contributes to strengthening transparency, accountability, and information technology-based oversight in government procurement of goods and services.

METHOD

This study employed the Systematic Literature Review (SLR) method to identify, evaluate, and synthesize previous research related to the topic (Kitchenham & Charters, 2007). The approach was used to obtain a comprehensive understanding of research developments, key findings, and research gaps, while reducing researcher subjectivity through a structured and transparent selection process (Snyder, 2019).

The SLR method followed systematic stages as proposed by Kitchenham and Charters, which are widely applied across multidisciplinary fields, including governance, audit, fraud detection, and public procurement research. This approach was considered effective in identifying research trends, commonly used methods, and future research opportunities (Xiao & Watson, 2019).

This study focused on literature concerning corruption risk detection in government procurement using LPSE open data and red flag indicators. Literature was collected from databases such as Google Scholar, Scopus, ScienceDirect, SpringerLink, and Garuda Kemdikbud, covering publications from 2015 to 2025. Article selection was based on topic relevance, publication quality, and alignment with the research focus to ensure valid and comprehensive analysis.

The SLR process began with the formulation of research questions (RQs) to define the scope and direction of the review. The research questions were designed to guide the identification, selection, and synthesis of relevant literature (Kitchenham & Charters, 2007). The questions addressed: (1) the development of research on fraud and corruption detection in public procurement, (2) commonly used red flag indicators in procurement risk detection, (3) the use of LPSE open data in fraud detection, and (4) analytical methods applied in procurement fraud research (Snyder, 2019).

The next stage involved a systematic literature search using multiple databases, including Google Scholar, Scopus, ScienceDirect, SpringerLink, and Garuda Kemdikbud. Keywords

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used included “procurement fraud,” “public procurement corruption,” “red flag indicators,” “fraud detection,” “LPSE,” “e-procurement,” “bid rigging,” “government procurement,” and “open procurement data.” The search was limited to studies published between 2015 and 2025 to ensure relevance and currency (Snyder, 2019).

In addition, inclusion and exclusion criteria were applied to ensure the quality and relevance of the selected literature. Inclusion criteria covered peer-reviewed journal articles, proceedings, theses, and research reports addressing procurement fraud, corruption, red flag indicators, and data-driven fraud detection in public procurement, published in Indonesian or English between 2015 and 2025. Exclusion criteria included non-full-text publications, duplicate records, irrelevant topics, and non-scientific sources such as opinion pieces and news articles. These criteria were applied to ensure the validity and reliability of the review through an objective selection process (Xiao & Watson, 2019).

RESULT AND DISCUSSION

Based on the literature search process using the Systematic Literature Review (SLR) method, this research obtained scientific articles from several academic databases, namely Google Scholar, Scopus, ScienceDirect, SpringerLink, and Garuda Kemdikbud. The search was conducted using a combination of keywords such as procurement fraud, public procurement corruption, red flag indicators, fraud detection, LPSE, e-procurement, bid rigging, government procurement, and open procurement data. The publication year range used is 2015–2025 so that the literature obtained remains relevant and in accordance with the latest research developments related to the detection of fraud in the procurement of government goods and services.

The literature selection process was carried out using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) stages which included identification, screening, eligibility, and included. At the identification stage, 85 articles were obtained from all databases used. Furthermore, at the screening stage, articles were selected based on titles and abstracts so that 40 articles relevant to the research topic were obtained. The next stage is eligibility, which is the process of examining the content of the article thoroughly (full text review) based on the suitability of the topic, research method, and focus of discussion related to procurement fraud, public procurement corruption, the use of red flag indicators, and the use of electronic procurement data. After the process was carried out, 11 final articles were obtained that met all inclusion criteria and were used in this study.

Table 2. Literature Selection Results Using PRISMA

PRISMA Stages	Selection Process	Number of Articles
Identification	Articles obtained from scientific databases	85
Screening	Articles that pass the title and abstract selection	40
Eligibility	Articles that meet the suitability of content and *full text*	18
Included	Final article used in the study	11

The results of the selection show that research on the risk detection of corruption in the procurement of government goods and services has experienced significant development in recent years. Most of the research discusses the application of red flag indicators as an early

detection tool against potential fraud and corruption in government procurement. In addition, several studies have also begun to develop approaches based on data analytics, machine learning, and electronic procurement data analysis to increase the effectiveness of government procurement supervision. Based on the results of the literature analysis, it was found that research on fraud in the procurement of goods and services generally focuses on identifying patterns of irregularities in the tender process, such as the low level of competition between participants, the high use of direct appointment methods, price quotes that are close to the Self-Estimated Price (HPS), and vendor wins that occur repeatedly in certain agencies. These patterns are considered as early indicators of the existence of collusion practices, bid rigging, and conflicts of interest in the government procurement process.

The results of the study show that the electronic procurement system through LPSE provides a great opportunity to support transparency and supervision of government procurement. LPSE open data such as tender participant information, bid price, HPS value, procurement method, and vendor victory history can be used to build an early detection system for potential procurement fraud. Several studies also emphasize that the use of data analysis technology is able to help auditors and internal government supervisory officials in identifying high-risk procurement packages more quickly and objectively. However, the results of the literature review show that research related to the detection of LPSE data-based procurement fraud in Indonesia is still relatively limited. Most studies still use a descriptive approach and not many have developed a corruption risk prediction model based on a combination of red flag indicators. Therefore, it is necessary to develop more in-depth research related to the application of data analytics, risk scoring models, and machine learning in supporting a more effective, transparent, and accountable government procurement supervision system.

Research Trends on Procurement of Goods/Services Fraud

The results of the literature review show that research on fraud and corruption in the procurement of government goods/services has increased significantly in recent years. The increase is influenced by the widespread implementation of electronic procurement systems (e-procurement) in various countries, including Indonesia, as well as the development of data analytics, big data, and machine learning approaches in detecting irregularities in government procurement. The development of information technology has pushed research that was previously conventional and descriptive to be more data-driven fraud detection by utilizing electronic procurement transaction data as the main source of analysis. This finding is in line with the research of Maran Gunasegaran et al. (2023) which states that the development of digital technology opens up new opportunities in the detection of procurement fraud through data analysis approaches and electronic-based surveillance systems. In addition, the research of Maria Sofia Lyra et al. (2022) also emphasized that data-based methods are a major trend in public procurement fraud research because they are able to increase the effectiveness of automatic identification of corruption and collusion patterns.

Based on the results of the analysis of the articles studied, most of the research places government procurement of goods/services as a sector with a high level of corruption risk. This is due to several main factors, namely the large value of the budget managed, the number of actors involved, the complexity of administration and regulations, and the weak internal supervision and government control mechanisms. According to the Organisation for Economic Co-operation and Development (2023), public procurement is one of the sectors most

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vulnerable to corruption because it involves direct interaction between the government and the private sector in the management of the state budget. These findings are strengthened by research by Joras Ferwerda, Ioana Deleanu, and Brigitte Unger (2017) who stated that low transparency and weak tender competition are the main indicators of increasing the risk of corruption in public procurement.

The results of the study also show that various forms of irregularities in the procurement of goods/services are still often found even though the government has implemented an e-procurement system through LPSE. Procurement digitalization is indeed able to increase transparency and reduce direct interaction between committees and providers, but it has not been able to completely eliminate the practice of collusion and bid rigging. Research by Andre Sampaio, Paulo Figueiredo, and Kristina Puzon (2022) found that anticompetitive practices still occur in the electronic procurement system in Brazil through the regulation of tender participants and competition manipulation. In addition, research by Erick Vásquez (2024) shows that emergency conditions and weak supervision can increase the risk of procurement corruption, especially in the tender process with low transparency. Several studies have also found that irregularities in government procurement can occur through manipulation of technical specifications, the use of borrowed companies, leakage of Self-Estimated Price (HPS) information, and covert arrangement of tender winners. This finding is in line with research by Ari Sunandar (2021) who states that the success of e-procurement implementation is not only determined by the technology system, but also by the quality of supervision, the integrity of procurement implementers, and organizational governance.

In addition, the results of previous research show that there are changes in the trend of research methods in the study of fraud in government procurement of goods/services. Initial research generally uses qualitative approaches and case studies to identify modes of procurement corruption. However, recent research has begun to use quantitative approaches based on electronic procurement data analysis, such as statistical analysis, social network analysis, risk scoring models, and machine learning. Research by Nino Modrušan et al. (2021) explains that technologies such as machine learning, artificial intelligence, and network analysis have great potential in supporting automatic and sustainable detection of public procurement fraud. The same thing was also stated by Maria Sofia Lyra et al. (2022) who stated that the data-driven procurement monitoring method is more effective in identifying abnormal transaction patterns than the manual audit approach.

The results of the study also found that the red flag indicators approach is one of the most widely used methods in fraud detection research in government procurement of goods/services. Some of the indicators that are often used include a small number of tender participants, price quotes that are close to HPS, high use of direct appointment methods, vendors who win tenders repeatedly, and mass disqualification of tender participants. Research by Joras Ferwerda et al. (2017) confirms that these indicators have a significant relationship with the practices of collusion and corruption in public procurement. In addition, research by Maran Gunasegaran et al. (2023) also shows that the combination of several red flag indicators can increase the accuracy of fraud detection systems in government electronic procurement. Thus, research trends show that the detection of fraud in the procurement of government goods/services is starting to move towards a technology-based supervision approach and data analysis. The use of LPSE's open data is an important opportunity to build an early warning

system against potential procurement corruption in a more transparent, objective, and accountable manner. These findings are supported by research by Javier Hochstetter et al. (2023) who stated that data transparency in electronic procurement systems contributes to strengthening governance and sustainable development. However, research related to the development of procurement data-based fraud detection models in Indonesia is still relatively limited, so more in-depth follow-up research is needed to support the strengthening of clean and corruption-free government procurement governance.

Red Flag Indicators in Corruption Risk Detection

Based on the results of the literature synthesis, it was found that several red flag indicators are most often used in detecting potential fraud in government procurement of goods/services. Red flag indicators are early warning indicators that are used to identify patterns of transactions or procurement activities that are unnatural and have the potential to contain elements of corruption, collusion, or abuse of authority. According to Ferwerda Joras, Deleanu Ioana, and Brigitte Unger (2017), the red flag indicators approach can be used as a tool to predict the risk of corruption in public procurement because it is able to detect the characteristics of tenders that have a high level of risk of collusion and tender manipulation practices. The results of the study show that red flag indicators are not only used in the investigative audit process, but also begin to be applied in data-driven procurement monitoring systems.

The number of tender participants is small

Most studies have shown that tenders with a very small number of participants have a higher level of corruption risk than tenders with a healthy level of competition. Tenders that only one or two participants participate in can indicate pseudo competition, tender conditioning, or restriction of access to certain participants. The low number of participants can also indicate the existence of administrative barriers or technical specifications that are deliberately created to direct the winner of the tender to a particular vendor. Research by Ferwerda Joras et al. (2017) states that the low level of competition is one of the main indicators of the existence of collusion practices in public procurement. The lower the level of tender competition, the greater the likelihood of tender rigging and cooperation between tender participants to determine the winner illegally. In addition, some recent studies have also shown that tenders with a limited number of participants tend to result in less competitive bid prices, increasing the risk of state losses.

Offer Close to HPS

Price quotations that are very close to the Self-Estimated Price (HPS) are one of the most dominant red flag indicators in research on fraud detection in the procurement of government goods and services. HPS is a cost estimate prepared by the government as a basis for assessing the fairness of prices in the tender process. Under normal conditions, there is a variation in bid prices between tender participants due to differences in business strategies and efficiency of each company. The calculation of the price difference can be done using the following formula:

$$\text{Price}=\text{HPS}-\text{Offer}\times 100\%$$

The results of the study show that the price difference between the bid and the HPS can indicate the leakage of HPS information, price arrangements between tender participants, and budget mark-up practices. Some studies set a high risk limit if the bid difference is below 3% of the HPS because this condition is considered not to reflect healthy price competition. In

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addition, the very uniform bidding pattern between tender participants is also often associated with cartel practices and procurement collusion.

Vendors Win Repeats

Previous research has also found that vendors who repeatedly win tenders at the same agency have a higher level of corruption risk than other vendors. These conditions can indicate a special relationship between vendors and procurement officials, vendor cartel practices, conflicts of interest, or systematic tender arrangements. Analysis of this indicator is generally carried out using the vendor winning ratio with the following formula:

Winning Ratio=Number of Tender Wins/ Number of Tenders

The higher the vendor's win ratio, the higher the potential risk of tender conditioning. In some studies, vendors with a very dominant win rate in a particular agency were considered to have an unhealthy relationship with the procurement process. In addition, repeated winning patterns can also indicate low levels of competition and weak procurement supervision mechanisms.

Use of Direct Appointment

The high use of the direct appointment method is also an important indicator in the detection of fraud in the procurement of government goods/services. The direct appointment method is a procurement mechanism that is carried out without an open tender process so that it has a higher level of risk of abuse than the competitive method. The literature shows that this method is vulnerable to being used to direct projects to specific vendors without healthy competition. Several studies have found that the practice of split procurement is often carried out so that the procurement value is below the minimum tender limit so that agencies can use the direct appointment method. This practice causes the procurement process to be less transparent and opens up opportunities for collusion and misuse of the state budget.

Mass Disqualification of Tender Participants

Several studies have also found a pattern of mass disqualification of tender participants at the administrative and technical evaluation stages. These conditions can be an indication of the existence of directed specifications, discriminatory requirements, or the arrangement of the tender winner from the beginning of the procurement process. Mass disqualification generally occurs when most of the tender participants are declared not to meet the administrative or technical requirements, while only one participant is declared qualified and ultimately wins the tender. In many cases, the pattern suggests that the tender terms are deliberately designed to benefit a particular vendor. Therefore, the mass disqualification indicator is often used in procurement risk analysis as an early signal of tender manipulation practices and unfair business competition.

Overall, the results of the study show that the red flag indicators approach has an important role in supporting an early warning system against potential corruption in government procurement of goods/services. The use of LPSE open data allows these indicators to be analyzed automatically through a data analytics approach so that the procurement supervision process can be carried out more quickly, objectively, and risk-based.

Utilization of LPSE Data in Fraud Detection

The results of the literature review show that open data on Electronic Procurement Services (LPSE) has great potential in supporting early detection of corruption and fraud risks in government procurement of goods/services. The implementation of the e-procurement

system through LPSE not only increases the transparency of the procurement process, but also produces procurement data that can be used as the main source in technology-based procurement monitoring. According to the Government Goods/Services Procurement Policy Institute, the disclosure of procurement data is an important part of supporting public accountability and supervision of the use of the state budget. These findings are in line with the research of Javier Hochstetter et al. (2023) who stated that transparency in electronic procurement systems is able to strengthen governance and increase accountability in public procurement through the use of digital technology.

LPSE data provides various important information related to the government procurement process, such as the name of the procurement package, procurement method, the value of the Self-Estimated Price (HPS), the number of tender participants, the bid price, the identity of the provider, and the name of the tender winner. The availability of this data allows analysis of procurement transaction patterns to detect indications of irregularities and unnatural procurement activities. In several studies, electronic procurement data is considered to be very effective in building an early warning system against potential government procurement fraud. Rashed Zannath's research (2024) shows that the implementation of electronic government procurement (e-GP) can improve procurement efficiency and transparency while providing data that can be used for monitoring and evaluating government procurement.

The results of the literature synthesis show that the analysis of LPSE data is generally carried out using statistical approaches, data mining, machine learning, and artificial intelligence to find procurement anomaly patterns. This approach is used because it is able to process large amounts of procurement data faster and more objectively than manual inspection methods. In addition, the use of data analysis technology also allows the monitoring process to be carried out in a continuous manner so that potential irregularities can be detected early before causing greater state losses. These findings are supported by research by Maria Sofia Lyra et al. (2022) who stated that data-driven methods are an effective method in detecting fraud, collusion, and corruption in public procurement through the analysis of electronic transaction patterns.

Some studies use anomaly detection techniques to identify procurement patterns that deviate from normal conditions. This technique is used to detect tenders with certain characteristics, such as bids that are too close to HPS, an unreasonable number of tender participants, and vendors who have a very high win rate in certain agencies. Tenders that have an anomalous pattern are then categorized as high-risk procurement packages so that they require further examination by auditors or internal government supervisory officials. Erick Vásquez's research (2024) also explains that predictive analysis can be used to assess the level of procurement corruption risk based on transaction patterns and certain tender characteristics. In addition, several studies also use a network analysis approach to analyze the relationship between vendors, procurement officials, and government agencies in the tender process. Network analysis is used to detect cartel indications, inter-company collusion, and suspicious relationship patterns in public procurement. This approach is considered effective in identifying vendor groups that often participate in and win tenders simultaneously in certain agencies. These findings are in line with the research of Maria Sofia Lyra et al. (2022) which emphasizes that social network analysis can be used to identify hidden relationships between

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tender participants who are potentially involved in bid rigging practices and procurement collusion.

Another widely used method is the classification technique and risk scoring model. The classification technique is used to group procurement packages into low, medium, or high risk categories based on specific red flag indicators. Meanwhile, the risk scoring model is carried out by providing a risk score for each procurement package based on a combination of several indicators, such as the number of tender participants, the difference in bid price to HPS, procurement methods, and vendor winning history. The higher the risk score produced, the greater the likelihood of fraud or corruption in the procurement package. Research by Nino Modrušan et al. (2021) states that the application of machine learning and risk assessment systems can increase the effectiveness of public procurement fraud detection compared to traditional audit methods.

The results of the study show that a data analysis-based approach has been proven to be able to increase the effectiveness of procurement supervision compared to manual inspection methods. Data-based supervision allows auditors and internal government supervisory officials to focus on audits on procurement packages that have a high level of risk so that the audit process becomes more efficient and on target. In addition, the use of LPSE data also supports the creation of a more transparent, objective, and evidence-based monitoring system. This finding is strengthened by research by Maran Gunasegaran et al. (2023) who stated that the use of data analysis technology in e-procurement can help the process of detecting and preventing procurement fraud more quickly, accurately, and sustainably.

However, some studies have also found challenges in the use of LPSE data for procurement fraud detection. These challenges include data quality that is not fully consistent, limited integration between procurement systems, and the lack of optimal use of data analysis technology in the government environment. Research by Ari Sunandar (2021) explains that the success of the implementation of the e-procurement system is greatly influenced by the quality of data governance, organizational readiness, and the capacity of human resources in managing the electronic procurement system. Therefore, it is necessary to strengthen data management capacity, standardize national procurement data, and develop a machine learning-based risk analysis system so that the use of LPSE data in procurement fraud detection can run more optimally and sustainably.

CONCLUSION

Based on the results of the Systematic Literature Review (SLR), it can be concluded that government procurement of goods and services remains a sector with a high risk of corruption due to large budget allocations, administrative complexity, and the involvement of multiple stakeholders in the implementation process. This study shows that the Detecting Corruption Risks In Government Procurement Of Goods And Services Using Red Flag Indicators Based On LPSE Open Data: A Systematic Literature Review approach is effective as an early warning system for detecting potential procurement fraud and corruption, particularly through indicators such as a low number of tender participants, bids close to the Self-Estimated Price (HPS), repeated vendor wins, use of direct appointments, and mass disqualification of tender

participants.

In addition, LPSE open data has strong potential to support procurement supervision in a more transparent, objective, and accountable manner through the application of data analytics, machine learning, and risk analysis models. Therefore, government and supervisory institutions need to strengthen technology-based procurement monitoring systems, improve the quality and accessibility of LPSE data disclosure, and encourage further research on the development of artificial intelligence–based fraud detection models and risk-scoring approaches to enhance corruption prevention in public procurement.

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