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BIG DATA ANALYTICS IN PUBLIC SECTOR AUDIT: TRANSFORMING RISK ASSESSMENT AND FRAUD DETECTION

Ferry Hendro Basuki*[1]
Jurusan Akuntansi, Universitas Pattimura, Indonesia
Email: ferrybasuki2015@gmail.com

Rita J. D. Atarwaman
Jurusan Akuntansi, Universitas Pattimura, Indonesia
Email: rita.atarwaman72@gmail.com

Yuyun Yuniarti Layn
Jurusan Akuntansi, Universitas Pattimura, Indonesia
Email: yuniarti112@gmail.com

Abstract

The development of big data technology has brought about significant transformations in public sector audit practices, particularly in the areas of risk assessment and fraud detection. This study aims to comprehensively examine how big data analytics (BDA) is used in public sector audits through a literature review approach. By analyzing various previous studies, this article identifies the role of BDA in expanding the scope of audit analysis, improving the accuracy of risk assessments, and accelerating the fraud detection process through the use of intelligent algorithms and predictive analytics techniques. The study also highlights the challenges faced, including limited data quality, privacy issues, auditor skills, and the readiness of public institutions to adopt such technology. The results indicate that the application of BDA has the potential to improve the effectiveness and efficiency of public sector audits, while strengthening the accountability and transparency of state financial management. These findings provide academic contributions to modern auditing literature and offer practical implications for auditors and policymakers in formulating digital transformation strategies for public sector audits.

Keywords: Big Data Analytics, Public Sector Audit, Risk Assessment, Fraud Detection

INTRODUCTION

In the digital era marked by a data explosion, the use of big data analytics has become one of the most significant transformations in various sectors,

[1] Correspondence author

including public sector audits. Massive amounts of data sourced from financial transactions, administrative records, procurement reports, and the digital activities of the public present both significant opportunities and challenges for auditors (Oluwatosin Ilori et al., 2024). Public sector audits have traditionally been conducted using sample testing methods and limited data-based analysis techniques. These limitations often create gaps in identifying complex risks and potential fraud, especially when faced with increasingly sophisticated and structured fraud phenomena. Therefore, the advent of big data analytics is seen as an innovation that can shift the audit paradigm by providing in-depth, real-time, pattern-based analysis capabilities that are more accurate in assessing risk and detecting fraud.

The urgency of implementing big data analytics in public sector audits is growing given the growing demand for transparency, accountability, and efficiency in state financial management. The public places high expectations on audit institutions, such as the Supreme Audit Agency (BPK) or similar audit institutions in various countries, to not only assess administrative compliance but also ensure the absence of budget misuse (Otia & Bracci, n.d.). In this context, traditional audit approaches are beginning to be deemed inadequate, capable of examining only a small portion of the vast transaction data. In contrast, big data analytics enables auditors to quickly analyze entire data populations, identify anomalies invisible to manual methods, and connect multiple data sources across systems, resulting in a more comprehensive risk picture.

Furthermore, the complexity of public financial management in the digital era demands more adaptive oversight strategies. Increasingly, government programs are becoming electronically based, from e-procurement and e-budgeting to e-taxation, generating vast amounts of data (Tanvir Rahman & Leila, 2025). While digitalization offers opportunities to increase efficiency and transparency, it also increases vulnerability to data manipulation, transaction manipulation, and multi-layered fraud. Thus, big data analytics is not merely a tool, but a crucial foundation for strengthening forensic audit mechanisms, assessing systemic risk, and accelerating early detection of irregularities.

Furthermore, the transformation of auditing through big data analytics implies a shift in the auditor's role from mere compliance checker to insight provider. Auditors are required to possess technological capabilities, statistical understanding, and the skills to interpret complex data patterns to provide evidence-based recommendations that are more strategically valuable to public policymakers (Putra et al., 2022a). The application of advanced analytics such as

predictive analytics and machine learning in audits enables auditors to not only identify fraud that has already occurred but also predict potential risks before losses occur. This proactive approach is believed to increase public trust in audit institutions and strengthen state financial governance.

However, the implementation of big data analytics in public sector audits is not without challenges. Issues of data integration between agencies, data quality and reliability, and limited human resources in mastering analytical technology remain significant obstacles. Furthermore, ethical challenges related to data privacy and the protection of sensitive information must be addressed to prevent negative consequences from being used (Özbaltan, 2024). Therefore, research on the transformation of public sector audits through big data analytics is highly relevant to explore how this technology can be optimized in risk assessment and fraud detection, while identifying the obstacles and prerequisites for its success.

From an academic perspective, research on big data analytics in public sector audits remains relatively limited compared to that in the private sector. However, the complexity and risks of public fund management demand greater attention due to their broad implications for public welfare (Ezekiel Onyekachukwu Udeh et al., 2024). Therefore, an in-depth literature review of how big data analytics can transform traditional audit methods into more evidence-based, responsive, and proactive ones would make a significant contribution to both the development of public sector accounting science and professional audit practice. This research is also expected to fill the knowledge gap regarding implementation models, adaptation strategies, and the impact of using big data analytics in strengthening public financial accountability (Elumilade et al., 2021a).

Based on this explanation, the background of this research confirms that the integration of big data analytics in public sector audits is not merely a technical necessity but also part of a governance reform agenda that promotes transparency and freedom from fraud. This transformation is believed to improve the quality of decision-making, accelerate risk response, and strengthen the integrity of audit institutions. Therefore, research focusing on the role of big data analytics in transforming risk assessment and fraud detection in the public sector is essential to support the creation of a more modern, accountable, and relevant audit system to meet the demands of the digital era.

RESEARCH METHOD

The research method used in this study is a literature review with a descriptive qualitative approach. This literature review was chosen because it focuses on a theoretical and conceptual understanding of the role of big data analytics in public sector audits, particularly in improving the quality of risk assessment and fraud detection. The research process began with identifying relevant academic sources such as international journals, conference proceedings, books, and reports from audit institutions and public oversight bodies. The selected literature sources were limited to publications from a specific year to maintain relevance with the latest developments in big data technology. Next, the literature was critically analyzed to explore trends, challenges, opportunities, and implications of implementing big data analytics in public sector audits.

The literature analysis was conducted through a synthesis stage that integrated various previous research findings to obtain a comprehensive picture of the role of big data analytics in the audit process. Using an interpretive approach, this study highlights the relationship between big data concepts, modern audit methodologies, and risk assessment and fraud prevention practices in the public sector. This literature review also identified existing research gaps and offered new perspectives on how big data analytics can function as a transformational tool in public sector audits. The results of this study are expected to provide both theoretical and practical contributions, strengthening academics' and auditors' understanding of big data-based audit innovation.

RESULT AND DISCUSSION

The Role of Big Data in Transforming Risk Assessment

The role of big data in transforming risk assessment in the public sector is becoming increasingly important with the increasing complexity of governance, public demands for transparency, and the ever-expanding scale of data from various sources (W. Wu, n.d.). Risks in the public sector can no longer be identified solely through manual or traditional approaches that rely heavily on limited sampling, auditor judgment, and retrospective administrative reports. With the advent of big data, supervisory agencies, auditors, and decision-makers can access large volumes, high speed, and a wider variety of data, ranging from financial transaction data, tax records, and procurement records to non-structural data such as social media and public reports. This

transformation paves the way for a new approach to risk assessment that is more accurate, faster, and capable of detecting previously hidden patterns.

One of the key roles of big data is in improving the accuracy of risk identification (Araz et al., n.d.). Conventional oversight systems generally rely only on information from formal documents or audit reports limited to a specific period. This often makes the risk identification process reactive and lags behind the actual dynamics on the ground (Okonkwo, 2024). With big data analytics, risks can be identified in real time by monitoring the continuous flow of incoming data. For example, in the context of government expenditure audits, transactions that deviate from common patterns can be detected more quickly because algorithms can compare millions of records simultaneously and correlate them with other variables, such as market prices, vendor records, or historical trends. This process not only accelerates risk identification but also increases precision by minimizing false positives that often occur with manual methods. This provides auditors or public supervisors with a more robust database to prioritize high-risk areas.

Furthermore, big data enables the implementation of data-driven predictive models, which are highly relevant for public sector risk mapping. Predictive models work by utilizing machine learning algorithms that learn from historical patterns to then predict the likelihood of future risks. In the public sector context, this can be applied to detect potential fraud in the procurement of goods and services, predict the likelihood of tax non-compliance, or even anticipate spikes in fiscal risk due to budget data discrepancies (Singh et al., 2023). For example, procurement data combined with market price records, vendor reputation, and past performance records can be analyzed to assign a risk score to each contract or provider. With this predictive capability, public regulators can be more proactive in intervening before significant losses occur. This clearly demonstrates a paradigm shift from a post-event audit approach to a predictive, preventative approach.

A comparison of the effectiveness of traditional methods with big data analytics further underscores the urgency of transformation. Traditional methods often rely on manual sampling, interviews, and document review (Johnson et al., 2021). While these methods offer advantages in terms of qualitative insights and a certain depth of analysis, their weaknesses lie in the limited data coverage and time required to produce reports. Manual analysis is also more susceptible to auditor subjectivity, so the potential for bias cannot be completely eliminated (Jagatheesaperumal et al., 2022). In contrast, big data analytics offers much broader coverage because the entire data population can

be analyzed without being limited to a sample. The computational process also allows for rapid analysis, even on millions of transactions simultaneously, allowing for continuous risk monitoring. This advantage provides significant advantages in the complex public sector context with a high risk of fraud and inefficiency.

However, this comparison does not necessarily negate the value of traditional methods. In many cases, human interpretation and contextual understanding by auditors remain crucial, particularly when risks involve non-technical factors such as organizational culture, political dynamics, or ethical aspects that are difficult to measure with quantitative data. Therefore, a more ideal synergy between the two approaches is one in which big data becomes the primary instrument for comprehensively collecting, processing, and mapping risks, while auditors retain their role in providing interpretation, validation, and recommendations based on their professional understanding. This synergy creates a hybrid risk assessment model that is more adaptive, intelligent, and relevant to the needs of modern public sector management.

The transformation of risk assessment with big data also has broader implications for public sector governance (W.-T. Wu et al., 2021). Accurate risk identification and predictive capabilities not only enhance oversight effectiveness but also strengthen the accountability of government institutions in the eyes of the public. When potential fraud or irregularities can be detected more quickly, public trust in budget management mechanisms increases. Furthermore, the effectiveness of big data analytics can help supervisory institutions allocate resources more efficiently, focusing energy and time on the highest risk areas, rather than on routine, often administrative audits. This ultimately contributes to a more transparent, responsive, and prevention-oriented government rather than a reactionary one.

Thus, the role of big data in transforming risk assessment in the public sector is not merely a technical innovation, but also a fundamental paradigm shift in how institutions manage risk. Increased accuracy in risk identification, data-driven predictive capabilities, and effectiveness far exceeding traditional methods demonstrate that big data is key to delivering more modern, efficient, and accountable oversight. However, the successful implementation of big data still requires a balance between human auditor skills, regulatory strengthening, and digital infrastructure readiness to optimize its benefits sustainably.

Big Data for Fraud Detection in Public Sector Audits

Big data has brought significant changes to public sector audit practices, particularly in fraud detection efforts (Junaidi et al., 2024). The complexity of government financial data, involving large volumes of transactions with diverse expenditure types and funding sources, demands a more sophisticated analytical approach than traditional methods. In this context, the application of anomaly detection algorithms is a key breakthrough that can improve audit effectiveness. These algorithms work by identifying unusual patterns in financial data, such as significant differences between transaction values and historical trends, deviations in expenditure distribution, or unusual recurring patterns in specific accounts. With big data analytics, auditors can quickly sift through hundreds of thousands of transactions and highlight indications of anomalies potentially linked to fraudulent practices, whether in the form of budget misappropriation, price markups, or report manipulation.

The application of anomaly detection algorithms in the public sector focuses not only on finding "outlier" data but also on understanding the context of the analyzed transactions (Accounting Department, Faculty of Economics and Communication, Bina Nusantara University, Jakarta, Indonesia et al., 2020). For example, clustering algorithms can be used to group transaction types based on spending categories and then detect if a single transaction deviates from the general characteristics of the group. Meanwhile, machine learning techniques such as random forests or support vector machines can predict the likelihood of fraud by comparing historical data on transactions already classified as fraudulent with newly emerging data. This provides auditors with much stronger predictive capabilities than traditional sampling-based approaches, which often miss indications of fraud due to limited data coverage. Thus, big data analytics paves the way for more proactive and prevention-oriented public sector audits.

Beyond algorithmic applications, analyzing patterns in financial transactions and public spending also plays a crucial role in fraud detection. Transaction patterns can often reveal hidden relationships that are not readily apparent (The Role of Data Analytics for Detecting Indications of Fraud in the Public Sector. | EBSCOhost, n.d.). For example, in procurement of goods and services, pattern analysis can reveal suppliers consistently winning tenders at higher-than-market prices, or repeated payments to the same vendor in small amounts repeatedly to evade oversight mechanisms. Big data analysis can uncover these patterns by combining data from various sources, such as regional financial information systems, procurement data, and internal

accounting records. Cross-system data integration allows auditors to detect inconsistencies, such as discrepancies between spending figures recorded in financial reports and actual transaction evidence, or even identify patterns in relationships between actors that could potentially lead to conflicts of interest.

The advantage of big data-based transaction pattern analysis is its ability to handle large and diverse data volumes in a short time. Auditors can use natural language processing (NLP) to extract information from procurement contract documents and then link it to payment and delivery records. With this approach, auditors not only look at the numbers in the reports but also understand the broader transaction narrative (Lazarevska et al., 2022). Furthermore, through social network analysis, relationships between parties involved in transactions can be analyzed to identify potential collusion. This approach is nearly impossible with manual methods, so big data provides a new dimension in understanding the dynamics of fraud in the public sector.

Case studies on successful fraud detection using big data approaches further reinforce the relevance of its use in public sector audits. One concrete example can be seen in financial supervisory agencies in various countries that have utilized big data analytics to uncover irregularities in infrastructure development budgets. (Pamisetty et al., 2022) Through procurement data analysis, auditors discovered a pattern of systematic price inflation perpetrated by a group of contractors in collaboration with regional officials. Using an anomaly detection algorithm, transactions priced above market standards were automatically identified and then further investigated to uncover hidden ownership relationships between contractors and public officials. This case demonstrates how the integration of big data and intelligent analytics can transform audits from mere administrative verification to robust, evidence-based investigations.

Another example comes from the government's efforts to monitor the distribution of social assistance funds. During the pandemic, the large amount of aid disbursed was vulnerable to misuse. Through big data analysis, auditors were able to identify fictitious recipients by matching their data with the national population database. Anomaly detection revealed thousands of recipients using multiple identities or even being unregistered in the population system. This case was successfully uncovered and prevented a financial leak worth billions of rupiah (Elumilade et al., 2021b). This demonstrates that by leveraging big data, the government can strengthen accountability while reducing potential state losses due to fraud.

The success of this case study confirms that big data serves not only as a technical tool but also as a strategic instrument in building more transparent and accountable public financial governance. With the support of big data, auditors have the ability to act more quickly in detecting anomalies, analyzing transaction patterns, and following up on indications of fraud before they cause greater losses. This transformation not only improves audit effectiveness but also strengthens public trust in public institutions (Putra et al., 2022b). Therefore, implementing big data analytics in fraud detection in the public sector is an inevitable step in facing the increasingly complex and high-risk challenges of state financial management.

Challenges of Implementing Big Data Analytics in Public Audits

The challenges of implementing Big Data Analytics in public audits have become an increasingly important topic of discussion, as demands for transparency, accountability, and efficiency in state financial management increase (Ellul & Buttigieg, 2021a). Utilizing advanced analytical technology enables public sector auditors to identify risks, detect fraud, and provide more accurate, data-driven policy recommendations. However, implementing Big Data Analytics in public audits is not simple. Several fundamental barriers exist, ranging from technical and human resources issues to ethical, privacy, and government data regulations, that must be overcome to ensure digital transformation in audits truly adds value.

Technical constraints are often the primary obstacle to implementing Big Data Analytics. Public sector audits require a robust technological infrastructure to manage large amounts of diverse data at high speed. Challenges arise because data from various government agencies is typically stored in different formats and systems, complicating the integration process (Hezam et al., 2023a). For example, regional financial data may be stored in different applications than central government spending data, while data on taxation, procurement of goods and services, or social assistance programs have different recording standards. This kind of data integration requires significant investment in system interoperability and the implementation of data warehouse or data lake technology that can unify various information sources. Furthermore, security is also a crucial issue. Public data, especially concerning state finances and citizens' personal information, is highly vulnerable to leaks and misuse. The analytical systems used by auditors must be equipped with adequate security layers, including encryption, strict access controls, and transparent audit trails. Without robust security systems, the

implementation of Big Data can actually create new risks in the form of data breaches that threaten public trust.

Beyond technical challenges, limited human resources are also a crucial issue. Many public sector auditors are still accustomed to traditional audit methods based on physical documents and simple applications. A paradigm shift toward Big Data-based audits requires adequate digital literacy, including the ability to understand complex data structures, use anomaly detection algorithms, predictive modeling, and interpret the resulting data visualizations. Unfortunately, not all auditors possess these skills (De Santis & D'Onza, 2021a). Existing training programs often do not keep pace with the rapid pace of technological development, creating a gap between auditor capacity and the technical needs of the field. Furthermore, resistance to change often arises because some auditors are comfortable with old methods or fear that their role will be replaced by technology. In this context, digital transformation in public auditing requires a comprehensive capacity-building strategy, ranging from ongoing training and collaboration with information technology experts to the formation of multidisciplinary audit teams that combine accounting, technology, and data analytics expertise.

Another equally significant challenge relates to the ethics, privacy, and regulation of government data. Big Data Analytics in public audits requires auditors to access and analyze large amounts of data, often including sensitive information about individuals, community groups, and government entities themselves (ALRASHIDI et al., 2022). This raises an ethical dilemma regarding the extent to which auditors can use this data without violating citizens' privacy rights. In practice, regulations on data protection in the public sector often do not align with the needs of modern analytics. Strict regulations, on the one hand, can hinder auditors' flexibility in accessing data across agencies, while lax regulations risk opening up opportunities for data misuse (Eilifsen et al., n.d.). Therefore, a regulatory framework is needed that balances privacy protection with the need for transparency and accountability. Furthermore, public auditors must also adhere to professional ethical principles, including maintaining data confidentiality, avoiding conflicts of interest, and ensuring that analysis results are used objectively for the public interest. These ethical issues become even more complex when analysis is conducted with the help of algorithms or artificial intelligence, which sometimes lack complete transparency in the decision-making process. The risk of algorithmic bias must also be anticipated, as it can result in unfair or misleading audit recommendations (Hamdam et al., 2022).

Overall, the challenges of implementing Big Data Analytics in public auditing demonstrate that digital transformation in this sector requires not only advanced technology but also adequate human, policy, and governance readiness. Robust infrastructure, reliable data integration, and multi-layered security systems are non-negotiable technical foundations. Furthermore, auditors' digital literacy must be enhanced to enable them to optimally utilize the potential of data. Furthermore, a regulatory and ethical framework for the use of public data must be developed to prevent the implementation of Big Data Analytics from creating new problems in the form of privacy violations or unfairness. If these challenges can be overcome, Big Data Analytics has great potential to revolutionize public auditing, making it more responsive, predictive, and oriented towards fraud prevention and improving public financial governance. However, if these obstacles are ignored, Big Data implementation risks failing to deliver optimal benefits and becoming merely an unsustainable technology project.

The Future of Public Sector Auditing with Big Data

The future of public sector auditing with Big Data represents a fundamental transformation in how auditors conduct audits, assess risks, and detect fraud in bureaucracies and government institutions (Ellul & Buttigieg, 2021b). As the volume, velocity, and variety of data generated by public administration activities increase, traditional audit methods are increasingly perceived as inadequate. Big Data Analytics offers the solution to overcome these limitations by enabling auditors to leverage a vast array of data sources, from financial reports, transaction records, procurement contracts, tax data, to digital records of public service activities. Through advanced analytical technology, auditors can gain a more comprehensive understanding of public institution performance and identify potential irregularities previously difficult to detect using conventional methods.

The current trend in the development of analytical technology in public sector auditing is moving toward the use of real-time data and automated systems that can accelerate the audit process while improving the accuracy of decision-making. While previously audits were often retrospective, where auditors assessed financial statements after a specific period had ended, with Big Data, the audit process can be conducted continuously. The concept of continuous auditing allows auditors to monitor transactions in near-real time, making early detection of irregularities or anomalies more likely (Hezam et al., 2023b). This undoubtedly has a significant impact on public sector risk

management, as the government can take corrective action more quickly before problems escalate into major scandals. Another trend is the use of interactive data visualization, which makes it easier for auditors to communicate findings to stakeholders. With more intuitive graphical displays, the complexity of vast amounts of data can be processed into easily understood information, thereby increasing both transparency and accountability in public audits.

The future of public auditing with Big Data is also inseparable from integration with artificial intelligence (AI), machine learning (ML), and blockchain technologies. AI and machine learning can strengthen Big Data's capabilities in predictive analysis and complex pattern detection. For example, machine learning algorithms can learn normal transaction patterns in the government financial system and then automatically flag deviant activity as potential indications of fraud (De Santis & D'Onza, 2021b). Thus, the audit process becomes more adaptive and intelligent as the system continuously learns from incoming new data. On the other hand, blockchain technology offers significant opportunities for public audits due to its decentralized, transparent, and difficult-to-manipulate nature. Implementing blockchain in recording government financial transactions can create a more reliable audit trail, where every change is permanently recorded and can be verified by multiple parties without intermediaries.

Integrating Big Data with blockchain will improve data integrity, while integration with AI and ML will expand analytical capacity and accelerate data-driven decision-making. This combination of technologies promises to make public sector audits more efficient, transparent, and effective in preventing and detecting irregularities.

Future research and innovation in the field of public auditing using Big Data will likely lead to the development of a comprehensive digital audit framework. Research will focus on how to integrate heterogeneous data sources, from financial data to social media, to create a comprehensive picture of public institution accountability (Lois et al., 2020). Furthermore, research will examine how artificial intelligence algorithms can be applied without compromising the principles of fairness, ethics, and privacy. These ethical challenges will be a key part of the research agenda because, while technology offers significant opportunities, public auditing must still uphold public trust in the state. In the future, innovation will also encourage the use of natural language processing to analyze massive amounts of contract documents or

policy reports, as well as predictive modeling that can anticipate corruption risks based on historical trends.

Beyond technical aspects, research in Big Data-based public auditing will involve policy and regulatory aspects. A legal framework that supports the use of analytical technology in auditing is needed to ensure compliance with the principles of good governance. Research in this area will explore the balance between the need for public transparency and the protection of individual privacy. Another innovation will emerge in the form of a digital platform-based collaborative audit system, where auditors can collaborate with other oversight institutions and civil society through more open data access. In this way, auditing is no longer viewed as a closed activity, but as a collaborative ecosystem that leverages technology to strengthen democracy and public participation.

Thus, the future of public sector auditing with Big Data is not just about technical efficiency, but also about a paradigm shift in government accountability. Trends in analytical technology, integration with AI, machine learning, and blockchain, as well as future research directions, will shape the face of auditing that is more proactive, intelligent, and adaptive to digital dynamics. If technical, ethical, and regulatory challenges can be overcome, Big Data-based auditing will become a powerful instrument for maintaining the integrity of state financial management and increasing public trust in the government.

CONCLUSION

The conclusion of the study on Big Data Analytics in public sector audits indicates that the application of this technology can significantly transform the risk assessment and fraud detection processes. With its vast capacity to process and analyze data from various sources in real time, Big Data Analytics helps auditors identify anomalous patterns, estimate potential risks, and accelerate more accurate, evidence-based decision-making. This approach not only improves oversight effectiveness but also provides a stronger foundation for transparency and accountability in public sector governance.

Furthermore, the use of Big Data Analytics in public sector audits offers significant opportunities to strengthen the integrity of government institutions by reducing the likelihood of fraud that is difficult to detect using traditional audit methods. However, the implementation of this technology also presents challenges, such as the need for adequate data infrastructure, auditors' analytical skills, and the need to strictly maintain ethical and data security

aspects. Therefore, the success of audit transformation through Big Data Analytics is largely determined by the synergy between technological readiness, increased human resource capacity, and a regulatory framework that adapts to the developments in the digital era.

REFERENCES

Accounting Department, Faculty of Economics and Communication, Bina Nusantara University, Jakarta, Indonesia, Handoko*, B. L., Mulyawan, A. N., Accounting Department, Faculty of Economics and Communication, Bina Nusantara University, Jakarta, Indonesia, Tanuwijaya, J., Accounting Department, Faculty of Economics and Communication, Bina Nusantara University, Jakarta, Indonesia, Tanciady, F., & Accounting Department, Faculty of Economics and Communication, Bina Nusantara University, Jakarta, Indonesia. (2020). Big Data in Auditing for the Future of Data Driven Fraud Detection. *International Journal of Innovative Technology and Exploring Engineering*, *9*(3), 2902–2907. https://doi.org/10.35940/ijitee.B7568.019320

ALRASHIDI, M., ALMUTAIRI, A., & ZRAQAT, O. (2022). The Impact of Big Data Analytics on Audit Procedures: Evidence from the Middle East. *The Journal of Asian Finance, Economics and Business*, *9*(2), 93–102. https://doi.org/10.13106/JAFEB.2022.VOL9.NO2.0093

Araz, O. M., Choi, T.-M., Olson, D. L., & Salman, F. S. (n.d.). *Role of Analytics for Operational Risk Management in the Era of Big Data*. https://doi.org/10.1111/deci.12451

De Santis, F., & D'Onza, G. (2021a). Big data and data analytics in auditing: In search of legitimacy. *Meditari Accountancy Research*, *29*(5), 1088–1112. https://doi.org/10.1108/MEDAR-03-2020-0838

De Santis, F., & D'Onza, G. (2021b). Big data and data analytics in auditing: In search of legitimacy. *Meditari Accountancy Research*, *29*(5), 1088–1112. https://doi.org/10.1108/MEDAR-03-2020-0838

Eilifsen, A., Kinserdal, F., Messier, W. F., & McKee, T. E. (n.d.). *An Exploratory Study into the Use of Audit Data Analytics on Audit Engagements*. Retrieved September 13, 2025, from https://dx.doi.org/10.2308/HORIZONS-19-121

Ellul, L., & Buttigieg, R. (2021a). *Benefits and challenges of applying data analytics in government auditing*. https://doi.org/10.32602/jafas.2021.017

Ellul, L., & Buttigieg, R. (2021b). *Benefits and challenges of applying data analytics in government auditing*. https://doi.org/10.32602/jafas.2021.017

Elumilade, O. O., Ogundeji, I. A., Achumie, G. O., Omokhoa, H. E., & Omowole, B. M. (2021a). Enhancing fraud detection and forensic auditing through data-driven techniques for financial integrity and security. *Journal of Advanced Education and Sciences*, *1*(2), 55–63. https://doi.org/10.54660/.JAES.2021.1.2.55-63

Elumilade, O. O., Ogundeji, I. A., Achumie, G. O., Omokhoa, H. E., & Omowole, B. M. (2021b). Enhancing fraud detection and forensic auditing through data-driven techniques for financial integrity and security. *Journal of Advanced Education and Sciences*, *1*(2), 55–63. https://doi.org/10.54660/.JAES.2021.1.2.55-63

Ezekiel Onyekachukwu Udeh, Prisca Amajuoyi, Kudirat Bukola Adeusi, & Anwulika Ogechukwu Scott. (2024). The role of big data in detecting and preventing financial fraud in digital transactions. *World Journal of Advanced Research and Reviews*, *22*(2), 1746–1760. https://doi.org/10.30574/wjarr.2024.22.2.1575

Hamdam, A., Jusoh, R., Yahya, Y., Abdul Jalil, A., & Zainal Abidin, N. H. (2022). Auditor judgment and decision-making in big data environment: A proposed research framework. *Accounting Research Journal*, *35*(1), 55–70. https://doi.org/10.1108/ARJ-04-2020-0078

Hezam, Y. A. A., Anthonysamy, L., & Suppiah, S. D. K. (2023a). Big Data Analytics and Auditing: A Review and Synthesis of Literature. *Emerging Science Journal*, *7*(2), 629–642. https://doi.org/10.28991/ESJ-2023-07-02-023

Hezam, Y. A. A., Anthonysamy, L., & Suppiah, S. D. K. (2023b). Big Data Analytics and Auditing: A Review and Synthesis of Literature. *Emerging Science Journal*, *7*(2), 629–642. https://doi.org/10.28991/ESJ-2023-07-02-023

Jagatheesaperumal, S. K., Rahouti, M., Ahmad, K., Al-Fuqaha, A., & Guizani, M. (2022). The Duo of Artificial Intelligence and Big Data for Industry 4.0: Applications, Techniques, Challenges, and Future Research Directions. *IEEE Internet of Things Journal*, *9*(15), 12861–12885. https://doi.org/10.1109/JIOT.2021.3139827

Johnson, M., Jain, R., Brennan-Tonetta, P., Swartz, E., Silver, D., Paolini, J., Mamonov, S., & Hill, C. (2021). Impact of Big Data and Artificial Intelligence on Industry: Developing a Workforce Roadmap for a Data Driven Economy. *Global Journal of Flexible Systems Management*, *22*(3), 197–217. https://doi.org/10.1007/s40171-021-00272-y

Junaidi, Hendrian, & Syahputra, B. E. (2024). Fraud detection in public sector institutions: An empirical study in Indonesia. *Cogent Business & Management*. https://www.tandfonline.com/doi/abs/10.1080/23311975.2024.2404479

Lazarevska, Z. B., Tocev, T., & Dionisijev, I. (2022). How to Improve Performance in Public Sector Auditing Through the Power of Big Data and Data Analytics? – The Case of the Republic of North Macedonia. *Journal of Accounting, Finance and Auditing Studies*, *8*(3), 187–209. https://doi.org/10.32602/jafas.2022.023

Lois, P., Drogalas, G., Karagiorgos, A., & Tsikalakis, K. (2020). Internal audits in the digital era: Opportunities risks and challenges. *EuroMed Journal of Business*, *15*(2), 205–217. https://doi.org/10.1108/EMJB-07-2019-0097

Okonkwo, N. E. (2024). TRANSFORMING RISK MANAGEMENT IN FINANCIAL INSTITUTIONS THROUGH ADVANCED BIG DATA ANALYTICS. *Research Journal of Accounting and Finance*, *12*(3), 1–18. https://doi.org/10.5281/zenodo.13778101

Oluwatosin Ilori, Nelly Tochi Nwosu, & Henry Nwapali Ndidi Naiho. (2024). Advanced data analytics in internal audits: A conceptual framework for comprehensive risk assessment and fraud detection. *Finance & Accounting Research Journal*, *6*(6), 931–952. https://doi.org/10.51594/farj.v6i6.1213

Otia, J. E., & Bracci, E. (n.d.). *Digital transformation and the public sector auditing: The SAI's perspective*. https://doi.org/10.1111/faam.12317

Özbaltan, N. (2024). APPLYING MACHINE LEARNING TO AUDIT DATA: ENHANCING FRAUD DETECTION, RISK ASSESSMENT AND AUDIT EFFICIENCY. *EDPACS*. https://www.tandfonline.com/doi/abs/10.1080/07366981.2024.2376793

Pamisetty, V., Pandiri, L., Singreddy, S., Annapareddy, V. N., & Sriram, H. K. (2022). *Leveraging AI, Machine Learning, And Big Data For Enhancing Tax Compliance, Fraud Detection, And Predictive Analytics In Government Financial Management* (SSRN Scholarly Paper No. 5210975). Social Science Research Network. https://doi.org/10.2139/ssrn.5210975

Putra, I., Sulistiyo, U., Diah, E., Rahayu, S., & Hidayat, S. (2022a). THE INFLUENCE OF INTERNAL AUDIT, RISK MANAGEMENT, WHISTLEBLOWING SYSTEM AND BIG DATA ANALYTICS ON THE FINANCIAL CRIME BEHAVIOR PREVENTION. *Cogent Economics & Finance*. https://www.tandfonline.com/doi/abs/10.1080/23322039.2022.2148363

Putra, I., Sulistiyo, U., Diah, E., Rahayu, S., & Hidayat, S. (2022b). THE INFLUENCE OF INTERNAL AUDIT, RISK MANAGEMENT, WHISTLEBLOWING SYSTEM AND BIG DATA ANALYTICS ON THE FINANCIAL CRIME BEHAVIOR PREVENTION. *Cogent Economics & Finance*. https://www.tandfonline.com/doi/abs/10.1080/23322039.2022.2148363

Singh, A. V., Bansod, G., Mahajan, M., Dietrich, P., Singh, S. P., Rav, K., Thissen, A., Bharde, A. M., Rothenstein, D., Kulkarni, S., & Bill, J. (2023). Digital Transformation in Toxicology: Improving Communication and Efficiency in Risk Assessment. *ACS Omega*. https://doi.org/10.1021/acsomega.3c00596

Tanvir Rahman, A., & Leila, E. (2025). FINANCIAL RISK ANALYSIS AND FRAUD DETECTION TRENDS IN BIG 4 CONSULTING FIRMS (2020-2025) A DATA-DRIVEN APPROACH. *Journal of Adaptive Learning Technologies*, *2*(5), 1–10.

The role of data analytics for detecting indications of fraud in the public sector. | EBSCOhost. (n.d.). Retrieved September 13, 2025, from https://openurl.ebsco.com/EPDB%3Agcd%3A2%3A5933746/detailv2?sid=

ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A160276937&crl=c&link_origin=scholar.google.com

Wu, W. (n.d.). *Credit Risk Measurement, Decision Analysis, Transformation and Upgrading for Financial Big Data*. https://doi.org/10.1155/2022/8942773

Wu, W.-T., Li, Y.-J., Feng, A.-Z., Li, L., Huang, T., Xu, A.-D., & Lyu, J. (2021). Data mining in clinical big data: The frequently used databases, steps, and methodological models. *Military Medical Research*, *8*(1), 44. https://doi.org/10.1186/s40779-021-00338-z