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FRAUD DETECTION IN AUDITING IN THE DIGITAL AGE: THE ROLE OF DATA ANALYTICS AND AUDIT TECHNOLOGY

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Abstrak

Fraud is one of the major problems that can reduce the quality of financial information, cause organizational losses, and undermine stakeholders' confidence in financial statements. The development of digital technology has made fraud schemes increasingly complex, creating challenges for conventional audit approaches in identifying abnormal transaction patterns. Under these circumstances, the use of Data Analytics, Big Data Analytics, Computer-Assisted Audit Techniques (CAATs), Artificial Intelligence (AI), and other audit technologies has become increasingly important in supporting fraud detection processes. This article aims to analyze the role of data analytics and audit technology in improving fraud detection effectiveness and to identify factors influencing the successful implementation of such technologies in auditing. This study employs a Systematic Literature Review approach by examining scientific articles published between 2022 and 2026. The literature is analyzed thematically based on the development of digital fraud, data analytics in auditing, Big Data Analytics, CAATs, Artificial Intelligence, machine learning, professional skepticism, auditor competence, and challenges in implementing audit technology. The results indicate that the use of data analytics and audit technology can assist auditors in processing large volumes of data, identifying anomalies, conducting risk analysis, expanding audit coverage, and improving fraud detection capabilities. However, technology cannot completely replace auditors because the interpretation of analytical results still requires auditor competence, professional skepticism, professional judgment, experience, and an understanding of the entity's characteristics. Therefore, effective fraud detection in the digital era depends on the integration of technology, auditor competence, data quality, internal controls, and technology governance.

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INTRODUCTION

Fraud is one of the risks faced by organizations because it can cause financial losses, reduce the quality of accounting information, and reduce the trust of financial report users. In an increasingly digitized business environment, fraud is not only carried out through conventional transaction manipulation, but can also take advantage of the complexity of information systems, electronic transactions, and large volumes of data. This condition makes auditors face the need to develop audit procedures that are able to analyze data more broadly and deeply.

The development of information technology has caused auditors to gain access to much larger data than before. The data used in audits is not only in the form of financial statements, but can also be in the form of transaction data, system logs, operational data, customer data, supplier data, and non-financial data. This condition creates opportunities for auditors to use Data Analytics as a tool in conducting risk assessments, identifying transaction patterns, and finding indications of irregularities.

Novita & Anissa (2022) It shows that the use of data analytics has a positive effect on the ability of public sector auditors to detect indications of fraud. The study was conducted on Indonesian public sector auditors and shows that data analytics can help auditors analyze data, collect audit evidence, predict risks, and detect fraud.

The use of data analytics is also relevant in external examinations. Indrany et al. (2023) found that the use of data analytics can help improve fraud detection by external auditors in Indonesia. This is important because fraud in financial statements often involves complex transactions so that manual audits can face limitations in identifying patterns of irregularities.

The next development is the use of Big Data Analytics. This technology allows auditors to process data in greater volume, speed, and variety. Sawan et al. (2022) indicates that the use of Big Data Analytics In auditing, it is related to quality auditing through perception usefulness and ease of use in Technology Acceptance Model.

Additionally, data analytics and machine learning audits can be used to reduce reliance on sample-based testing. Research Huang et al. (2022) About Data Auditing Analytics, Machine Learning, and full population testing It shows that the technology allows auditors to conduct an analysis of the entire transaction population, although its implementation also has its own challenges.

Artificial Intelligence then expand the capabilities of audit technology. AI can be used to recognize patterns, classify, identify anomalies, make predictions, and help the risk assessment process. Research Qatawneh (2024) show that AI in Accounting Information Systems affects Auditing and Fraud Detection, while Natural Language Processing can strengthen the relationship.

In the Indonesian context, the application of audit technology is also growing. Research on BPK RI auditors shows that e-Audit, AI-based audit technology, and Big Data Analytics partially or simultaneously have a positive and significant effect on Fraud Detection (Natali et al., 2025).

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However, technological developments do not mean that auditors can completely hand over the detection process Fraud to the system. Hafidz et al. (2024) found that in a study on BPKP auditors in Sumatra, the use of CAATs did not show a significant effect on fraud detection, while auditor factors such as Religiosity and task-specific knowledge have a specific role. The findings suggest that the benefits of technology can differ depending on the context of use and the characteristics of the auditor.

The difference in the results of these studies is interesting to study further. On the one hand, many studies show that data analytics and audit technology can improve fraud detection, but on the other hand, there are studies that show that technology alone does not necessarily produce significant improvements. Therefore, a study that integrates technology factors with competence, professional skepticism, professional judgment, experience, and data quality is needed.

Based on these problems, this article aims to analyze the development of the use of data analytics and audit technology in fraud detection, identify the benefits of technology in the audit process, analyze human factors that affect the effectiveness of technology, and identify challenges and research gaps in the application of audit technology in the digital era.

LITERATURE REVIEW

Auditing and Fraud Detection

Auditing is a systematic process to obtain and evaluate evidence regarding certain information or activities in order to provide conclusions based on predetermined criteria (Akbar & Muluk, 2025). In relation to fraud, auditors have a responsibility to consider the risk of material misrepresentation due to fraud and design audit procedures appropriate to the level of risk.

Fraud detection It is different from simply finding a recording error. Fraud involves deliberate actions so that the perpetrator can try to hide traces of transactions or manipulate information (Xia et al., 2026). Therefore, auditors need to use a combination of analytical procedures, substantive testing, understanding of internal controls, professional skepticism, and technology to improve their ability to identify indications of fraud.

Research Novita & Anissa (2022) indicates that the data Analytics can be used to support public sector auditors in identifying indications of fraud. Data Analytics allows auditors to derive information from broader transaction data and helps identify unusual patterns.

Data Analytics in Auditing

Data Analytics is the process of using analytical techniques to process data so as to produce information that can be used in decision-making. In auditing, data analytics can be used in various stages, ranging from audit planning, risk assessment, transaction testing, to evaluation of audit evidence (Ogeh, 2026).

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Indrany et al. (2023) It shows that data analytics can assist external auditors in detecting fraud. This shows that the technology's ability to process data can complement conventional audit procedures, especially when auditors are faced with large and complex transaction numbers.

The use of data analytics can also expand the scope of audits. Data analytics audits allow auditors to analyze the entire population of transactions, not just a portion of the sample. Huang et al. (2022) About Machine Learning and full population testing indicates that the technology can be used to support the testing of the entire population, although the auditor still needs to consider the quality of the data and the interpretation of the analysis results.

Big Data Analytics

Big Data Analytics is a technology used to process and analyze data with characteristics volume, velocity, variety, veracity, and Value. In auditing, these capabilities allow auditors to gain a broader understanding of the entity's activities (Mukherjee et al., 2026).

Al-Ateeq et al. (2022) shows that the use of BDA in auditing can be associated with audit quality. The auditor's perception of the ease of use and benefits of technology is an important factor in the acceptance of BDA.

Research Kamdjoug et al. (2024) also shows that the data Analytics can be used to support audits Decision-making and Fraud Detection. The research developed Decision Support System data-driven Analytics and Machine Learning to detect fraud in banking transactions. The random forest model used in the study showed a classification level of around 88–93% in the transaction data used.

Computer-Assisted Audit Techniques

CAATs are computer-aided techniques that auditors use to perform examination procedures with the help of technology. CAATs can help auditors test data, search for specific transactions, identify patterns, conduct reconciliation, and test transaction populations (Akbar & Muluk, 2025).

Hafidz et al. (2024) examined the use of CAATs in BPKP auditors in Sumatra. The study involved 220 respondents and showed that CAATs had no significant effect on Fraud Detection in the model they tested. These findings suggest that the existence of the technology does not automatically guarantee an increase in capabilities Fraud Detection when other factors such as task-specific knowledge and the auditor's ability does not support its use.

As such, CAATs should be viewed as a tool that supports auditors, rather than as a substitute for auditors. Auditors should still understand the purpose of the test, determine the appropriate procedures, evaluate the results, and determine whether a finding requires further examination.

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Artificial Intelligence in Auditing

Artificial Intelligence has the ability to process data automatically and recognize patterns that may be difficult to find through manual checks. In auditing, AI can be used for anomaly detection, risk assessment, fraud detection, predictive analytics, and document analysis.

Qatawneh (2024) found that AI applied in Accounting Information Systems has a significant relationship with auditing and Fraud Detection. The study also found that Natural Language Processing has a moderation role in the relationship between AI and auditing/fraud detection.

Research Fedyk et al. (2022) shows that AI can improve efficiency and support auditors in finding Anomaly and Fraud. Studies of audit partners from major audit firms show that AI has been used in audit practices and AI investments are associated with improved audit quality through improved capabilities Anomaly detection, fraud detection, and risk assessment.

Machine Learning for Fraud Detection

Machine learning allows the system to learn patterns from data and generate predictions or classifications. In fraud detection, machine learning can be used to distinguish between normal transactions and transactions that have abnormal characteristics.

Kamdjoug et al. (2024) shows that Machine Learning Can be used in data Analytics-based auditing to develop an automatic fraud detection system. The use of random forest in the study showed a relatively high classification ability and provided an overview of the potential Machine Learning in supporting data-driven audits.

Rahman & Zhu (2024) also shows that Learning Ensemble can be used to detect Accounting Fraud in a family company in China. The ensemble model used provides better performance than Logistic regression in identifying fraud.

However, machine learning has limitations. The model can produce false positives or false negatives, especially when the data fraud is relatively small compared to normal transactions. Therefore, the model's results should not be immediately considered evidence of fraud, but should be used as an indicator to determine areas that need further examination.

Professional Skepticism

Professional skepticism It is an attitude of the auditor that includes questioning mind and critical assessment of audit evidence. This attitude becomes increasingly important when auditors use technology because the results of system analysis must still be critically evaluated (Farhan & Tjandrakirana, 2026).

Research Winoto & Darusalam (2026) regarding the integration of AI and cognitive abilities, the auditor showed that Questioning Mind and suspension of judgment Affect Audits Judgment. Research on Indonesian auditors also shows that the

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use of AI can produce complex dynamics in the relationship between Professional skepticism and Auditor Judgment.

As such, the technology should not cause the auditor to automatically receive the results of the analysis. The auditor needs to question the quality of the data, the method of analysis, the assumptions of the model, and the relevance of the results to the condition of the entity.

RESEARCH METHODS

This study uses the Systematic Literature Review (SLR) approach. The method is used to identify, evaluate, and synthesize the results of previous research on the use of data analytics and audit technology in fraud detection.

The literature used consists of scientific articles published in the period 2022–2026. The search was conducted using keywords such as fraud detection, audit technology, data analytics, Big Data Analytics, artificial intelligence in auditing, machine learning fraud detection, CAATs, audit quality, and professional skepticism.

The selected articles must be directly related to auditing, fraud detection, data analytics, audit technology, or auditor factors related to the use of technology. Articles are then grouped by theme to find similarities, differences, research developments, and research gaps.

RESULTS AND DISCUSSION

Fraud Changes in the Digital Era

Digitalization provides great benefits for organizations, but it also creates a new environment for fraudsters. Electronic transactions, integrated information systems, and high volumes of data can create new opportunities for manipulation while making it difficult for auditors to find patterns of irregularities.

In these conditions, auditors need to develop an approach that is able to analyze data more broadly. Manual examination of all transactions can take a lot of time and resources, so data analytics is an alternative to improve efficiency.

Novita & Anissa (2022) It shows that the use of data analytics can help public sector auditors detect indications of fraud. The findings show that the ability of technology to analyze data can be part of an audit strategy to deal with fraud complexity.

Data Analytics Expands the Scope of Inspection

One of the advantages of data analytics is its ability to process large amounts of data. In traditional approaches, auditors often use sampling to obtain audit evidence. While sampling remains important, technology allows auditors to conduct analysis of a broader population of transactions (Ningsih et al., 2026).

Data analytics and machine learning audits can help auditors conduct full population testing. This provides an opportunity for auditors to identify transactions that

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have abnormal characteristics without having to manually select samples (Huang et al., 2022).

These advantages can help auditors find patterns that may not be visible through sample examination. However, the greater the amount of data analyzed, the greater the need for auditors' ability to understand and interpret technology outputs.

BDA in Fraud Detection

BDA has the ability to combine and analyze data in various forms. In fraud detection, BDA can be used to identify unusual transactions, recurring transactions, transactions with a certain value, abnormal payment patterns, or transaction relationships that indicate potential irregularities (Gaswira & Meutia, 2024).

Kamdjoug et al. (2024) shows that Data Analytics can be used to support Fraud Detection through Decision Support System based Machine Learning. The study provides evidence that the use of technology can improve the speed and accuracy of the transaction analysis process.

In Indonesia, Alwi et al. (2024) found that data implementation Analytics have a positive and significant effect on Fraud Detection on SOEs' internal auditors. The study used 118 internal auditors and showed that the implementation of data analytics was shared Corporate Core Values contribute to fraud detection capabilities.

These findings show that technology can provide more optimal results when applied in an organizational environment that also has values and a culture that supports integrity.

Audit Technology on Government Audits

Audit technology has an important role in public sector audits as government auditors deal with large amounts of government transactions and programs.

Sidauruk (2024) conduct research on the use of data Analytics by Government Internal Supervisory Apparatus to ministries, institutions, and local governments. Research mixed-method shows the difference in the use of data analytics between groups with high and low usage rates, and examines the relationship between the use of data analytics and the effectiveness of internal audits and fraud prevention and detection.

Research Natali et al. (2025) also shows that e-Audit, AI-based audit technology, and BDA has a positive and significant effect against fraud detection auditors of BPK RI. The findings provide empirical evidence that the combination of various technologies can support the effectiveness of Fraud Detection in government inspections.

AI as an Anomaly Detection Tool

AI can help auditors identify transaction patterns that differ from normal patterns. In contrast to manual procedures that rely on rules that the auditor has defined,

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Machine Learning can be used to study patterns from historical data (Mukhtar et al., 2023).

Qatawneh (2024) show that AI in Accounting Information Systems have a positive relationship with auditing and Fraud Detection. The use of NLP also provides additional capabilities in analyzing text-based data.

This can be especially important when audit evidence is not only in the form of numbers but also in the form of documents, contracts, emails, records, or other textual information. AI and NLP can help auditors identify relevant information from such data.

AI Doesn't Replace Auditors

Although AI has high analytical capabilities, auditors still have an important role to play in evaluating technological outcomes. AI can pinpoint risky transactions, but the system is not always able to understand the business context and economic reasons behind transactions (Mais et al., 2025).

Research on AI and auditor judgment shows that the relationship between the use of AI and professional judgment is complex. Auditors still need Questioning Mind and suspension of judgment to ensure that the results that technology provides are not automatically accepted (Winoto & Darusalam, 2026).

Therefore, a more appropriate approach is human-AI collaboration, i.e. technology is used to assist with analytical work while auditors remain responsible for professional evaluations and decisions.

Auditor Competencies

The ability of auditors is an important factor in the successful application of technology. Auditors who do not understand how technology works can have difficulty evaluating the results of the analysis (Ali et al., 2026).

Research on BPKP auditors in Sumatra shows that task-specific knowledge is a relevant factor in fraud detection, while CAATs themselves do not show a significant influence in the research model (Betri & Hafidz, 2024).

These findings show that technology investment needs to be accompanied by improved competence. Auditors need to understand data analytics, output interpretation, machine learning basics, data security, and algorithm limitations.

Audit Quality

Audit technology is also related to audit quality. BDAs can help auditors improve testing coverage, speed up analysis, and find risk patterns (Putra et al., 2023).

Research Al-Ateeq et al. (2022) shows that the use of BDA in auditing is related to quality auditing. Other research (Shafa et al. (2025) regarding BDA and audit quality in auditors in Indonesia also found a positive and significant influence of BDA on audit quality.

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However, technology should not be understood as the only determinant of audit quality. Audit quality is also influenced by competence, independence, professional skepticism, experience, audit methodology, and evidence quality.

Professional Judgment in Technology-Based Audits

The use of technology causes auditors to obtain more information. However, the amount of information does not automatically lead to better decisions (Putra et al., 2023).

Sofyani et al. (2025) indicates that the audit Judgment has a role in the relationship between the quality of the BDA system and Performance Audit public sector. The study was conducted on 137 Indonesian government auditors and shows the importance of audit judgments in the use of BDA.

This strengthens the argument that technology should be used as a tool to support professional judgment. Auditors still need to determine whether a pattern is an indication of fraud or just a transaction that has different characteristics for legitimate business reasons.

Data Analytics Limitations

While it provides many benefits, data analytics has limitations. One of the main limitations is the reliance on data quality. Incomplete, inaccurate, inconsistent, or disintegrated data can lead to erroneous conclusions.

In addition, technology can also produce false positives. A transaction can be marked as a risky transaction even though it does not actually contain fraud. On the other hand, fraud that is carried out in a very complex way can not be detected by algorithms.

Therefore, the results of technological analysis should be treated as audit evidence or indicators that need to be evaluated, not as a final conclusion that fraud has occurred.

Challenges of Implementing Audit Technology

Ramadhan et al. (2023) It shows that although audit analytics has the potential to increase the effectiveness of the internal audit function, its implementation still faces various driving and inhibiting factors. Organizational factors, management support, technological capabilities, and competencies are important parts of the implementation of audit analytics.

In addition to competency issues, there are issues of cost, system integration, data security, privacy, and regulation. Auditors also need to understand how a system produces outputs in order to be able to account for the use of technology in the audit process.

Mökander (2023) explained that AI auditing requires an approach that pays attention to legal, ethical, and technical aspects. This shows that the development of AI

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in auditing is not only a technological issue, but also related to Governance and Accountability.

Differences in Research Results

The literature shows that research results on audit and fraud detection technology are not always consistent. Some studies showed a significant positive effect, while others found no significant effect.

Natali et al. (2025) found that e-Audit, AI-based audit technology, and BDA has a positive and significant effect on fraud detection in BPK RI. Alwi et al. also found a positive effect on data implementation Analytics against fraud detection in SOEs internal auditors.

Instead, Betri & Hafidz (2024) found that CAATs did not have a significant effect on fraud detection in a study on BPKP auditors in Sumatra.

These differences suggest that the effectiveness of technology may depend on the context of the organization, the type of technology, the level of auditor competence, the quality of the data, and the way the technology is used. Thus, research on audit technology should not only test the existence of technology, but also the quality of technology use.

Research Gap

Based on literature studies, there are several research gaps that can be developed.

First, research on audit technology is still testing the influence of one type of technology on fraud detection. In practice, auditors can use a combination of e-Audit, CAATs, BDA, AI, machine learning, and other technologies at the same time. Natali et al.'s research provides an example of an approach that combines e-Audit, AI, and BDA in one model.

Second, there is inconsistency in research results regarding CAATs and data analytics. Some studies found a positive influence, while other studies did not find a significant influence. This shows that moderation or mediation factors such as auditor competence, task-specific knowledge, professional skepticism, and audit experience need to be considered.

Third, research on AI in auditing is still relatively developed compared to research on conventional data analytics. Research on AI and fraud detection has shown great potential, but more empirical research is still needed on how auditors evaluate AI output and how AI influences professional judgment.

Fourth, there is still a need to develop research that integrates technology capability and human capability. Technology can speed up the analysis process, but auditors still need competence and professional skepticism.

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Fifth, future research can develop a model that links Data Analytics/AI → Fraud Detection → Audit Quality, with professional skepticism, auditor competence, audit experience, or task-specific knowledge as moderator and mediator variables.

IMPLICATIONS

Based on the results of the study, public accounting firms, government audit agencies, and internal audit functions need to increase investment in audit technology. Investment is not only in the form of software, but also in data infrastructure, system security, data integration, and auditor training.

Auditors also need to improve digital competencies. The competencies needed do not have to make every auditor a data scientist, but auditors need to understand the basic concepts of data analytics, output interpretation, machine learning, AI, and technology risks.

Organizations also need to establish a clear AI use policy. Each AI analysis result should have an audit trail so that auditors can explain how the information is used in the audit process.

In addition, professional skepticism must be maintained. Auditors should not accept the results of the system as absolute truth. Any indication of fraud generated by technology must be confirmed with other audit evidence.

CONCLUSION

The development of digital technology has changed the auditing process, especially in fraud detection. Data Analytics, Big Data Analytics, CAATs, e-Audit, Artificial Intelligence, and machine learning provide auditors with the ability to process large amounts of data, find unusual transaction patterns, conduct risk analysis, and identify indications of fraud more quickly.

The results of previous research generally show that data analytics and audit technology have positive potential for fraud detection. Research on Indonesian public sector auditors, state-owned internal auditors, BPK RI auditors, and international research shows that technology can improve auditors' analytical skills.

However, the benefits of technology are not automatic. The difference in research results on CAATs and audit technology shows that the effectiveness of technology is influenced by auditor competence, task-specific knowledge, professional skepticism, data quality, system quality, organizational support, and how technology is used.

Artificial Intelligence and machine learning provide greater opportunities in fraud detection because they are able to perform anomaly detection, classification, prediction, and data analysis on a large scale. However, the use of these technologies also poses risks related to algorithm transparency, data quality, privacy, security, and over-reliance on the system.

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Therefore, technology should not be positioned as a substitute for auditors, but as a tool that strengthens the auditor's abilities. Auditors remain responsible for evaluating the results of the analysis, maintaining professional skepticism, using professional judgment, and obtaining adequate audit evidence.

Thus, effective fraud detection in the digital era requires a combination of technology, auditor competence, data quality, professional skepticism, internal control, and governance. The integration of these various aspects will allow audit technology to provide greater benefits in increasing the effectiveness of audits and maintaining confidence in financial information.

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