

Developing a Data Analytics Framework Using Python for Internal Audit Functions of the Accountant General's Department of Malaysia

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Abstract

Purpose: This study aims to develop a data analytics framework that incorporates Python for continuous auditing purposes. This initiative involves revisiting the existing audit framework to incorporate data analytics with Python capabilities. This comprehensive audit framework will be the foundation for a robust and continuous auditing system, maximising Python's potential due to its versatility, efficiency, and powerful data analysis capabilities. The proposed framework is designed to significantly enhance the effectiveness and efficiency of continuous auditing practices, specifically within the BPAD of the Accountant General's Department of Malaysia (AGD).

Design/ Methodology/ Approach: This study employs a qualitative methodology to develop a comprehensive audit framework integrating Python for continuous auditing. The approach consists of focus group interviews, in-depth discussions with key stakeholders from the BPAD, and a thorough examination of the current audit procedures and guidelines within existing audit documents. This method facilitates the understanding and identification of current practices and opportunities for improvement tailored to the BPAD's (Bahagian Pengurusan Audit Dalam [BPAD]) requirements while leveraging Python's robust capabilities in data analysis and process automation.

Findings: This study discovers several challenges and limitations in the existing audit framework that warrant the development of an analytical data

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framework using Python for internal audit functions in the public sector. The proposed framework is expected to reduce manual data processing and analysis through automation, increase accuracy in audit results, and provide continuous real-time monitoring, potentially significantly enhancing the division's continuous auditing capabilities, leading to more efficient, effective, and comprehensive audit processes.

Originality/ Value: This study proposes an analytical data framework that incorporates Python for continuous auditing purposes tailored to government agencies' unique requirements and challenges. The framework focuses on integrating data analytics in audit processes, providing a novel approach to enhance internal audit effectiveness in the public sector. The traditional audit fieldwork is divided into two (2) sub-stages: Pre-Audit Analytics and Audit Analytics Fieldwork, following the Extract, Transform, Load (ETL) process for data preparation and analysis. This approach allows for real-time insights, proactive risk management, and improved decision-making. By automating data analysis with Python, the framework also enables the identification of anomalies, fraud detection, and more effective compliance than traditional methods.

Keywords: Data analytics, continuous audit, public sector, Python, government

1.0 Introduction

Public sector auditing is essential for upholding prudence and integrity, ensuring value for money, and overseeing the stewardship of public assets. It enhances the quality of information used for decision-making, supports an effective corporate governance system, and boosts citizens' confidence in the government's management of economic resources (Dawuda et al., 2017). Within the framework of public sector audits, internal audits serve purposes similar to internal audits in the private sector. However, they are tailored to the unique needs and objectives of governmental entities. According to Goodwin (2004), internal audits have evolved from their traditional emphasis on financial and compliance audits to encompass a broader, value-enhancing role, incorporating assurance and advisory functions to enhance efficiency and effectiveness. In the context of the internal audit function in the public sector, its significance is highlighted by the accountability of public entities to a diverse array of stakeholders, in contrast to the accountability of private entities. The role of the internal audit function is crucial to providing unbiased assessments and recommendations that contribute to effective governance and prompting corrective actions when necessary (Ahmad et al., 2009). It acts as the first line of defence by assessing internal controls, ensuring the reliability of financial information, and enhancing accountability within government agencies (Kamara, 2023).

In Malaysia, the requirement for implementing internal auditing in federal government agencies was first documented in Treasury Circular No. 2 (1979). This Circular was replaced by Treasury Circular No. 9 (2004), which took effect on October 12, 2004 (Ali et al., 2012; Treasury Circular, 2004). Subsequently, it was replaced by Treasury Circular (PP) PS 3.1 – Implementation of Internal Auditing in Federal Ministries/ Departments and State Governments (Ministry of Finance, 2024). It states that the Internal Audit Unit is responsible for conducting financial

management audits and performance audits. Financial management audits involve examining financial systems, internal controls, and financial records to ensure that expenditures, revenues, assets, and inventories are managed according to relevant laws, regulations, and directives. Performance audits evaluate an organization's activities to determine if its objectives have been achieved and resources have been used prudently, efficiently, and effectively.

In the rapidly evolving landscape of financial auditing, the BPAD must augment the efficiency and efficacy of its audit processes. While traditional audit methods are robust, their shortfall lies in keeping abreast of the dynamic intricacies inherent in contemporary business environments. Moreover, traditional auditing methods are constrained by data scale and processing speed, often relying on sampling, which limits the auditors' ability to conduct comprehensive analyses across all available data (Sun et al., 2024).

In the context of the BPAD, the absence of a systematic and automated approach to continuous audit will expose potential vulnerabilities associated with a delayed anomaly or red flag and compliance issues. This delay could result in problems not identified promptly, potentially allowing the continuation or escalation of fraudulent or irregular activities. There is a need for the BPAD to explore automated processes to provide real-time monitoring and help identify and address issues as they arise. In this regard, a systematic and automated continuous audit framework that is aligned with the specific needs and requirements of the BPAD must first be established. This framework should leverage technology, such as Python-based analytical tools, to enhance the efficiency, accuracy, and timeliness of the audit process. A framework that focuses on a systematic and ongoing auditing approach is vital, instead of relying solely on periodic or manual interventions. This approach can ensure continuous oversight and timely identification of issues, leading to more effective and proactive risks and compliance management.

Given the constraints of traditional auditing and the urgent need for continuous auditing in the BPAD, this study aims to develop a Python-based data analytics framework for continuous auditing. It is essential to provide the division with a systematic approach to integrating data analytics into ongoing internal auditing processes to overcome current limitations and bolster the effectiveness and efficiency of audits.

2.0 Literature Review

2.1 Audit Tools

Extant literature has highlighted the need to shift from traditional auditing due to its limitations, such as being labour-intensive and time-consuming (Chan & Vasarhelyi, 2011). This shift can be facilitated using audit tools for automation, enabling continuous auditing. Audit tools have become increasingly integral to modern auditing practices, leveraging technology to enhance efficiency, accuracy, and overall audit quality. They encompass various technologies, such as Computer-Assisted Audit Tools and Techniques (CAATs), electronic audit working papers, database applications, and business intelligence audit software (Siew et al., 2020). These tools automate audit tasks, enabling auditors to analyse extensive datasets, detect anomalies, and perform complex calculations swiftly and precisely. For instance, CAATs streamline data analysis, providing auditors with a greater volume of evidence in less time (Aksoy & Gurol, 2021).

Incorporating audit tools into auditing processes yields manifold benefits. They reduce audit costs by automating routine tasks, enabling auditors to focus on the analytical aspects. Moreover, they enhance audit quality by minimising human error and facilitating thorough examination of financial data, enhancing assurance validation to financial reporting users (Sanusi et al., 2023). These tools are crucial for keeping pace with evolving business landscapes and complex financial transactions, extracting insights from vast datasets, and employing data analytics to uncover patterns, trends, and risks that traditional methods may overlook. Despite these advantages, challenges persist in the broad adoption of audit tools, particularly regarding technological infrastructure, specialised training needs, and data security and privacy concerns. Addressing these challenges is essential to maximise efficiency and effectiveness in audit performance, thereby improving the overall audit quality (Sanusi et al., 2023).

Python, a versatile programming language, is increasingly integrated into auditing and data analysis. Renowned for its readability, simplicity, and extensive libraries, Python supports tasks, like data extraction, transformation, and analysis. Auditors use Python scripts to automate repetitive tasks, analyse large datasets, and conduct intricate calculations. Its data manipulation and analysis capabilities make Python particularly valuable for auditors engaged in financial data analysis and data-driven audits. It also facilitates data visualisation, aiding auditors in presenting findings more clearly. Its flexibility allows the customisation of scripts based on audit needs, contributing to its recognition as a pivotal tool in data-centric audit approaches and CAATs (Siew et al., 2020).

2.2 The Use of Audit Tools in the Public Sector

Internal audits, especially within the public sector, are critical because they evaluate the efficiency and effectiveness of management controls. These audits support management by optimising these control mechanisms, thus aiding in achieving relevant objectives and tasks (Postula et al., 2020). The importance of internal audits in the public sector is further underscored by their crucial role in assessing the quality of internal controls, thereby improving public sector management (Uneqbu & Kida, 2011).

In 2000, the public sector accounting system underwent significant changes, notably transitioning towards e-business (Mahzan & Veerankutty, 2011). This shift required auditors to adapt to new technologies for conducting information technology-related (IT) audits. Consequently, auditors improved their technological skills to navigate and assess the evolving IT landscape within the public sector. This transformation has profoundly impacted the accounting systems of the federal government, state governments, and statutory bodies (Mahzan & Veerankutty, 2011).

Besides their crucial role, internal audits in the public sector face evolving challenges that necessitate using advanced tools like CAATs. Adopting CAATs is essential for internal audit teams to effectively identify red flags and discrepancies, thereby increasing their capacity for continuous auditing. As highlighted by Malaescu and Sutton (2014), the application of audit technology increases auditors' confidence in creating audit reports and ensures the reliability of financial statements. Using CAATs in the public sector is well-established for enhancing audit efficiency, improving the accuracy of data analysis, and ensuring thorough scrutiny of financial records. Technological advancements and data analytics have further facilitated the use of

CAATs, enabling auditors to stay abreast of evolving methodologies and to fully leverage these tools in the auditing process.

2.3 Audit and Python

Integrating Python in financial auditing has garnered significant interest in recent academic research. Oladipupo et al. (2023) demonstrated the effectiveness of a Python-based machine-learning technique for enhancing audit data performance. Several studies have examined the use of Python in various contexts. For example, Hung et al. (2023) utilised Python web crawlers to collect data and examine the impact of auditing industry specialisation on using derivatives for earnings management in Chinese public companies. In another study, Liu et al. (2022) investigated the application of Python's Random Forest algorithm in the digital systems of power grid enterprises to enhance internal audit functions. Bellinga et al. (2021) presented an open-source Python algorithm for extracting data from annual reports, significantly improving the efficiency of the audit process in a Dutch asset management firm.

Python is also used in financial auditing. For instance, Eguando (2023) highlighted technological advancements in forensic auditing, emphasising the strategic use of software applications, including Python, for data analytics and robotic process automation. According to Eguando, such an approach is recommended for forensic audit firms and banks to enhance the credibility of forensic auditors' reports.

Li (2023) studied improving internal tax audit management for China's private enterprises by leveraging network IT, data mining, and computer application technology. The author utilised data processing libraries, like Numpy and Pandas, within the Python environment to develop a web-based internal tax audit system for these enterprises. Such development has significantly enhanced the efficiency of internal tax audits for private enterprises and fostered the informatisation and intelligent evolution of their internal management processes (Li, 2023).

In a case study at University W, Xia (2023) uncovered that the university had insufficient risk controls within its finance department through process testing and risk assessment. The auditors integrated Python automation tools with optical character recognition (OCR) technology to overcome this issue, linking it to an intelligent cloud OCR financial document image recognition interface. This approach automated the reading of files, recognition of invoice images, data collection, and entry into Microsoft Excel. Subsequent data analysis identified audit suspicions for further verification, enhancing audit efficiency and accuracy (Xia, 2023).

It can be concluded that Python is increasingly recognised for its importance in auditing due to its numerous benefits, such as its versatility, extensive libraries, and ability to automate repetitive tasks. These advantages enable auditors to efficiently analyse large datasets, identify irregularities, and detect red flags. Nevertheless, before integrating Python into the auditing process, it is crucial to revisit and update the existing audit framework to incorporate Python's capabilities. By doing so, a comprehensive audit framework can be developed, laying the groundwork for a robust auditing system that fully leverages Python's potential.

3.0 Research Methodology

This research employed a qualitative approach to investigate the integration of Python-based analytics in continuous audit practices within the BPAD. The qualitative design was chosen to provide deep insights into the perceptions, experiences, and challenges related to adopting new audit technologies in the public sector context. A focus group of face-to-face interviews with key stakeholders within the BPAD was conducted to gather insights into the current internal audit practices. This group comprised the deputy director, chief assistant director of the accounting compliance section and their two (2) staff members, and two (2) staff members each from the special auditing section and internal control section. The discussion centred on audit tools, challenges, implications, issues, potential tools, and expectations from a data analytics framework for detecting red flags.

Additionally, existing documents, such as the auditing manual, reports, and audit findings, were reviewed to understand the internal audit process of the BPAD in detail. This document review is crucial for understanding current practices and identifying opportunities for improvement using Python-based tools. It helps pinpoint gaps, issues, and areas for enhancement within internal audit procedures while providing insights into integrating Python-based tools to boost audit efficiency and effectiveness. The data from the document review and the focus group interview transcriptions were triangulated to produce a data analytics framework for continuous auditing in the BPAD.

4.0 Data Analytics Framework Using Python for Internal Audit Functions in the Internal Audit Management Division

This study proposes a comprehensive, continuous internal auditing data analytics framework tailored to the unique requirements and challenges faced by government institutions. The framework integrates data analytics into audit processes, especially audit planning, pre-audit, audit fieldwork, audit documentation, and reporting.

4.1 Current Traditional Framework for Internal Audit in the Internal Audit Management Division

Based on the document review and the findings from the focus group interview, the traditional framework for internal audit in the government sector was structured into three (3) main stages: (1) Audit Planning, (2) Audit Fieldwork, and (3) Post-Audit and Monitoring (Figure 1).

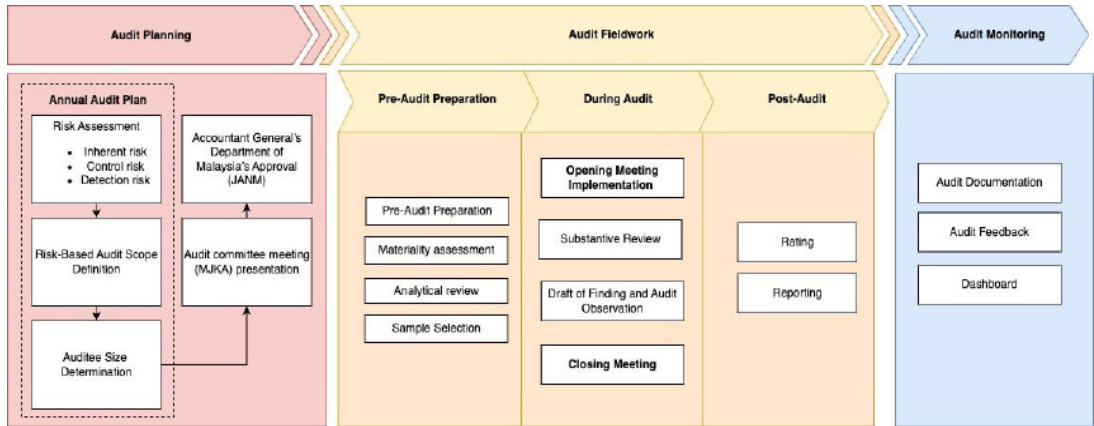


Figure 1: Traditional Framework for Internal Audit in the BPAD

The Audit Planning phase begins with a comprehensive risk assessment, including evaluating inherent, control, and detection risks to identify areas susceptible to material misstatement due to error or fraud. Based on this assessment, a risk-based audit scope is developed to focus on high-risk areas, ensuring efficient use of audit resources. The size and complexity of the auditees are also considered when tailoring the audit procedures accordingly. The audit plan is then presented to the Audit Committee Meeting (Mesyuarat Jawatankuasa Audit, MJKA) for review and approval before obtaining approval from the Accountant General to commence the audit.

During the Audit Fieldwork phase, auditors perform a materiality assessment to determine the significance of financial statement items and transactions, focusing on those that could influence the economic decisions of users. Analytical reviews are conducted to identify unusual trends or variances in financial data, which help in understanding the public sector’s financial performance and areas that need further investigation. Auditors will then determine the sample size from the raw data to test the effectiveness of controls and the accuracy of financial statement assertions without examining every transaction. Upon completing the Pre-Audit phase, auditing commences with an opening meeting and ends with reporting at the Post-Audit phase.

In the Post-Audit phase, findings are documented, highlighting any discrepancies, control weaknesses, or identified areas of non-compliance. A comprehensive audit documentation is prepared to support the audit findings and conclusions, ensuring the transparency and verifiability of the audit process. This structured approach ensures that the internal audit process in the BPAD is thorough, efficient, and aligned with regulatory requirements, ultimately enhancing the effectiveness and accountability of the public sector, specifically the AGD.

While the traditional framework for internal audit in the BPAD is structured, some limitations require the integration of data analytics. A significant limitation is the reliance on sampling methods, which do not capture the full scope of financial transactions, resulting in missing irregular trends, anomalies, and red flags. Additionally, although manual testing techniques are thorough, they are time-consuming and may not be as effective in identifying all instances of non-compliance or deviations. Incorporating data analytics is essential to address these concerns.

Data analytics tools, such as Python, can analyse entire datasets through big data analysis, providing a more comprehensive view and enabling the identification of unusual patterns, red flags, and potential issues that traditional methods might have overlooked. Furthermore, dashboards can enhance data visualisation, making it easier for auditors to communicate findings and insights to stakeholders. By leveraging data analytics, internal audits can become more efficient, accurate, and aligned with modern auditing standards, ultimately improving the accountability and effectiveness of public sector entities.

4.2 Proposed Framework

The Data Analytics Framework using Python for the internal audit process in the BPAD was designed to enhance the traditional internal audit process by integrating data analytics at every stage. This framework (see Figure 2) begins with automated audit planning, which involves a comprehensive risk assessment to develop a risk-based audit scope. The size and complexity of the auditees are determined automatically using rule-based audit procedures accordingly. The audit plan is then presented at the MJKA for further endorsement, followed by obtaining approval from the Accountant General to commence the audit.

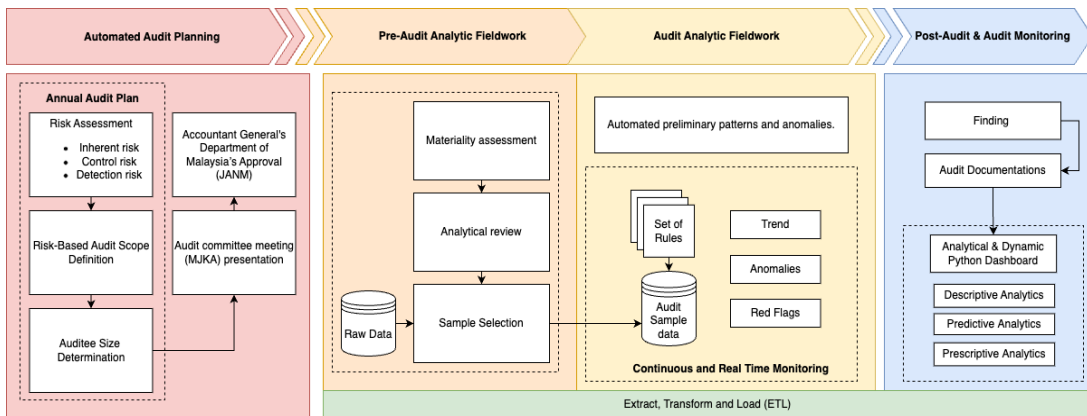


Figure 2: Data Analytics Framework using Python for the Internal Audit Process in the BPAD

Figure 2 illustrates the proposed framework. The Audit Fieldwork stage is divided into Pre-Audit Analytics and Audit Analytics Fieldwork. During the Pre-Audit Analytics phase, auditors perform a materiality assessment to determine the significance of financial statement items and transactions. Analytical reviews are conducted to identify unusual trends or variances in financial data, which help in understanding the public sector's financial performance and areas needing further investigation. Sample sizes are determined from raw data. Data security is a main priority in the AGD. Therefore, if the system is developed, it should not be directly integrated with the raw database.

In the Audit Analytics Fieldwork phase, a dataset is prepared with rules. Sample data are stored in a separate database for analysis to ensure security. Continuous testing is performed to analyse trends, detect anomalies, and identify red flags. This phase also involves determining

sample sizes from raw data for further testing and investigation. Both Pre-Audit Analytics and Audit Analytics Fieldwork follow the ETL process for data preparation and analysis.

The final stage, Post-Audit and Monitoring, involves documenting findings and highlighting any discrepancies, control weaknesses, or areas of non-compliance identified during the audit. Comprehensive audit documentation is prepared to support the audit findings and conclusions and ensure transparency and verifiability of the audit process. Unlike the traditional audit process, an analytical dashboard can visualise the data, providing descriptive, predictive, and prescriptive analytics. Python is the recommended tool. Descriptive analytics summarises and visualises the audit findings; predictive analytics identifies potential future risks or issues based on historical data patterns; and prescriptive analytics recommends actions or strategies for addressing identified issues or improving processes. By leveraging data analytics, the framework ensures that internal audits in government agencies are more efficient, accurate, and aligned with modern auditing standards, ultimately improving the accountability and effectiveness of the public sector.

5.0 Conclusion

Integrating data analytics into continuous internal auditing presents a transformative opportunity for government agencies. Traditional internal auditing methods, characterised by periodic reviews and sample testing, have become increasingly inadequate in addressing the complexities and data volume of modern governance. The proposed data analytics framework aims to address these limitations by leveraging data analytics to enhance the efficiency, accuracy, and comprehensiveness of internal audits.

The framework integrates data analytics at every stage of the audit process, from planning and fieldwork to post-audit monitoring. This approach allows for real-time insights, proactive risk management, and improved decision-making. By automating data analysis and utilising advanced techniques, such as machine learning, the framework can identify anomalies, detect fraud, and ensure compliance more effectively than traditional methods.

Nevertheless, implementing continuous internal auditing in the public sector faces several challenges, including data privacy and security concerns, skill gaps among auditors, and the need for robust data quality and integration strategies. Addressing these challenges requires a comprehensive data strategy, investment in technology infrastructure, and ongoing training and capacity-building for audit teams.

Therefore, future research and development efforts to enhance the framework in government agencies should focus on developing monitoring dashboards using big data analysis language, such as Python, which can integrate analytics to improve audit accuracy and predictive capabilities while providing real-time and continuous audits with data privacy and security measures. In addition, empirical studies to validate the framework's effectiveness in improving audit outcomes and achieving objectives in the public sector are proposed for future work. These efforts will help improve the potential of continuous internal auditing, thereby enhancing accountability, transparency, and efficiency of government operations.

Given that the study is directed towards one (1) case study involving the BPAD of the AGD, generalisations on the applicability and suitability of the Python-based data analytics framework to other government agencies should be made with care.

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References

- Ahmad, N., Othman, R., Othman, R., & Jusoff, K. (2009). The effectiveness of internal audit in Malaysian public sector. *Journal of Modern Accounting and Auditing*, 5(9), 53.
- Aksoy, T., & Gurol, B. (2021). Artificial intelligence in computer-aided auditing techniques and technologies (CAATTs) and an application proposal for auditors. In *Auditing Ecosystem and Strategic Accounting in the Digital Era: Global Approaches and New Opportunities* (pp. 361–384). Cham: Springer International Publishing.
- Ali, A. M., Saidin, S. Z., Sahdan, M. H., Rasit, M. H. H., Rahim, M. S., & Gloeck, J. D. (2012). Internal audit in the federal government organisations of Malaysia: The good, the bad and the very ugly. *Asian Journal of Business and Governance*, 2(1), 68–111.
- Bellinga, J., Bosman, T., Höcük, S., Janssen, W. H., & Khzam, A. (2021). Robotic process automation for the extraction of audit information: A use case. *Current Issues in Auditing*, 16(1), A1–A8.
- Chan, D., & Vasarhelyi, M. (2011). Innovation and practice of continuous auditing. *International Journal of Accounting Information Systems*, 12(2), 152–160.
- Dawuda, A., Ataribanam, S., & Joseph, A. (2017). An exploratory study on management support services and its effects on the quality service delivery of internal auditors in the Northern Ghana. *International Journal of Accounting Research*, 5(2), 2–5.
- Eguando, T. (2023). Technological forensic auditing and financial crime detection in Nigeria: A study of selected deposit money banks. *African Journal of Accounting and Financial Research*, 6(4), 70–80.
- Goodwin, J. (2004). A comparison of internal audit in the private and public sectors. *Managerial Auditing Journal*, 19(5), 640–650.

- Hung, W., Shu, P., Wang, Y., & Chiang, T. (2023). The relationship between auditing industry specialisation and the relative derivatives use for earnings management: Evidence from China. *International Journal of Emerging Markets*. <https://doi.org/10.1108/ijocem-06-2022-0947>
- Kamara, D. A. K. (2023). *The study on effectiveness of internal audit on the performance of the public sector in Sierra Leone: Case study of the National Social Security Insurance Trust*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4492858
- Li, H. (2023, June). *The construction of internal tax audit system of private enterprises based on Python*. In Proceedings of the 2nd International Conference on Big Data Economy and Digital Management, BDEDM 2023, January 6–8, 2023, Changsha, China.
- Liu, J., Dang, R., Di, H., & Yang, K. (2022). *Improve Python's random forest algorithm in the intelligent construction of digital system in power grid enterprises*. 2022 International Conference on Knowledge Engineering and Communication Systems (ICKES).
- Mahzan, N., & Veerankutty, F. (2011). IT auditing activities of public sector auditors in Malaysia. *African Journal of Business Management*, 5(5), 1551–1563.
- Malaescu, I., & Sutton, S. G. (2014). The reliance of external auditors on internal audit's use of continuous audit. *Journal of Information Systems*, 29(1), 95–114.
- Ministry of Finance. (2024). Retrieved from <https://ppp.treasury.gov.my/>
- Oladipupo, M. A., Obuzor, P. C., Bamgbade, B. J., Adeniyi, A. E., Olagunju, K. M., & Ajagbe, S. A. (2023). An automated Python script for data cleaning and labeling using machine learning technique. *Informatica*, 47(6), 219–232.
- Postula, M., Irodenko, O., & Dubel, P. (2020). Internal audit as a tool to improve the efficiency of public service. *European Research Studies Journal*, 23(3), 699–715.
- Sanusi, Z. M., Noor, N. F. M., Isa, Y. M., Ghazali, A. W., & Rentah, F. (2023). The implications of digital audit practice, management support and team support on auditor performance. *IPN Journal of Research and Practice in Public Sector Accounting and Management*, 13(1), 59–79.

- Siew, E. G., Rosli, K., & Yeow, P. H. (2020). Organisational and environmental influences in the adoption of computer-assisted audit tools and techniques (CAATT) by audit firms in Malaysia. *International Journal of Accounting Information Systems*, 36,100445.
- Sun, Y., Li, J., Lu, M., & Guo, Z. (2024). Study of the impact of the big data era on accounting and auditing. *Frontiers in Business, Economics and Management*, 13(3), 44–47.
- Treasury Circular. (2004). *Pekeliling Perbendaharaan Bil. 9 Tahun 2004 Pelaksanaan Audit Dalam di Kementerian/Jabatan Persekutuan dan Kerajaan Negeri*. 12 Oktober 2004 (Perbendaharaan Malaysia, Kuala Lumpur).
- Unegbu, A. O., & Kida, M. I. (2011). Effectiveness of internal audit as instrument of improving public sector management. *Journal of Emerging Trends in Economics and Management Sciences*, 2(4), 304–309.
- Xia, S. (2023). Application of Python automation tool combined with OCR technology in “Financial Checkup” of universities. *Accounting and Corporate Management*, 5(12), 130–136.