**Original Research Article**

**Big Data Analysis and Its Role in Enhancing Tax Audit Efficiency**

Abstract

**Aims:** This study aims to analysis the impact of big data on improving tax audit efficiency, focusing on the challenges facing traditional methods such as tax evasion, complex legislation, and the difficulty of taxing digital activities.

**Study design:** The research employs a descriptive-analytical approach, distributing a questionnaire to 44 employees from the Tax Audit Department at the General Tax Authority.

**Methodology:** Data were analyses using SPSS, with statistical tests such as linear regression and Pearson’s correlation coefficient applied.

**Results:** The researcher found statistically significant evidence of the effect of big data analysis on enhancing tax audit efficiency. The independent variable (big data analysis) achieved a high mean score (μ = 4.052). In contrast, the dependent variable (tax audit efficiency) reached a mean of (μ = 4.168), reflecting the sample’s awareness of the importance of this technique. **Conclusion:** Among the most important recommendations are the investment of financial resources in updating technological systems, training staff, and enhancing international cooperation to combat cross-border tax evasion, as well as simplifying legislative procedures to keep pace with digital developments.

*Keywords include Big Data, tax audits, artificial intelligence, and tax evasion.*

**Introduction**

In the contemporary technological era, big data is one of the most significant phenomena affecting various aspects of life. The term refers to enormous volumes of information accumulated from Multiple sources, including financial and accounting transactions, tax records, and others. For an advanced analytical approach to transforming this data into useful knowledge, these experiences must now show functionality. As this data continues to increase in scope and intricacy, a pressing necessity arises for advanced analytical techniques that can turn it into meaningful information on which decisions are made. In modern tax systems, a high level of operating efficiency is demanded in both examination and audit, thereby ensuring compliance with the tax code as well as minimizing taxes. Evasion. In this context, big data analysis plays a critical role; techniques such as machine learning and artificial intelligence enhance the accuracy and efficiency of tax audits. By analysing patterns and behaviours within big data, tax authorities can identify potential risks and allocate resources more effectively, which enhances the overall performance of the tax system.

**1-1: Research Problem:**   
With the tremendous technological development and the increase in the volume of data generated from various sectors, big data has become a powerful tool capable of causing a radical transformation in many fields, including tax auditing. However, the use of big data in tax auditing faces significant challenges related to data quality, privacy, cost, and the ability to analyse the data effectively. Hence, there is a need to investigate how to leverage big data to enhance the efficiency of tax audits.

Sub-research questions:   
Despite the great potential of big data in enhancing tax audits, several issues hinder its effective application, including:

1. What are the challenges facing traditional tax audit procedures?
2. How can big data be employed to address these challenges?

**1-2: Research Objectives:**

1. To analyse the role of big data in enhancing tax audit operations.
2. To identify the most important technologies and tools used in big data analysis for tax purposes.
3. To study the impact of big data on improving tax audit efficiency.

**1-3: Research Significance:**

1. **Academic Significance:** The study contributes to enriching the academic literature on the use of big data in tax auditing.
2. **Practical Significance:** The study offers practical recommendations for enhancing the use of big data in tax audits, thereby improving the efficiency of tax administration.
3. **Economic Significance:** The study helps reduce tax evasion and increase tax revenues, supporting economic development.

**1-4: Research Hypothesis:**   
The research is based on the main hypothesis:   
"There is a statistically significant effect between big data and the improvement of tax audit efficiency within the General Tax Authority."   
From this hypothesis, the following sub-hypotheses emerge:

1. There is a statistically significant correlation between big data and the improvement of tax audit efficiency within the General Tax Authority.
2. There is a statistically significant effect of big data on enhancing tax audit efficiency within the General Tax Authority.

**1-5: Research Method and Data Collection Tools:**   
To achieve the research objectives, a descriptive analytical method was adopted to present and analyse the research variables theoretically, relying on previous studies, publications, and guidelines issued by professional organisations. For obtaining research results, a questionnaire was used.

**1-6:Research Population and Sample:**   
The General Tax Authority represents the research population, while the sample consists of employees in the Tax Audit and Examination Department.

**Table (1): Number and Percentage Distribution of Sample Members by Age**

|  |  |  |
| --- | --- | --- |
| Age Group | Frequency | Percentage |
| Less than 30 | 5 | 11% |
| 30 - Less than 40 | 14 | 32% |
| 40 - Less than 50 | 24 | 55% |
| 50 or above | 1 | 2% |
| Total | **44** | **100%** |

**Table 2: Number and Percentage Distribution of Sample Members by Educational Qualification**

|  |  |  |
| --- | --- | --- |
| Educational Qualification | Frequency | Percentage |
| Diploma | 9 | 20% |
| Bachelor’s Degree | 24 | 55% |
| Master’s Degree | 6 | 14% |
| Doctorate | 5 | 11% |
| Total | **44** | **100%** |

**Table (3): Number and Percentage Distribution of Sample Members by Years of Experience**

|  |  |  |
| --- | --- | --- |
| Years of Experience | Frequency | Percentage |
| Less than 10 years | 10 | 23% |
| 11 – 20 years | 25 | 56% |
| 21 – 30 years | 8 | 18% |
| 31 or more | 1 | 3% |
| Total | **44** | **100%** |

**2-1: Concept of Big Data:**   
The term "Big Data" first appeared in the early 2000s but has recently gained widespread popularity, emerging as one of the Some of the world's most important signs of future trends in technology suggest that as we move into the new century, there will be an increasing emphasis on this concept. Research powerhouses of international renown like Gartner, McKinsey, and IBM all write in their documents that this is certainly a concept that cannot be ignored. It is widely assumed within high-level political circles that big data will be an important strategic resource for the economy and society. It is even looked upon very much as something akin to traditional resources. Such as human, financial, and natural resources. Esteemed scientific institutions, such as the U.S. National Science Foundation (NSF) and Canada’s Natural Sciences and Engineering Research Council (NSERC), have focused their research on this field (Al-Tayyib & Al-Rubaie, 2018: 5). A brief overview of the evolution of digital data processing systems, which has led to the era of big data, distinguishes three main stages:

**Stage of Primary Data:**   
Data was collected and stored, with limited processing and analytical capabilities.

**Stage of Organized Data:**   
This stage witnessed the development of relational database systems, allowing data to be stored in an organized and easily accessible manner.

**Stage of Big Data:**   
With technological advancements and the increasing volume of data generated from diverse sources, a need arose for advanced tools to process and analyses this data, leading to the emergence of the big data concept.

In the information revolution and rapid technological development in data collection and processing, the world has witnessed a massive and continuous increase in data volumes, resulting in what is known as "Big Data," measured in trillions of bytes or more. This data has been likened to a "tsunami" due to its enormous size and power, with quantities automatically increasing over time (Younis, 2019: 8).

Big data refers to extremely large or highly complex datasets that require rapid and efficient processing. It is not only about the volume of data, but also about the variety of its forms (structured, unstructured, and semi-structured) and the velocity of its generation from multiple sources, necessitating advanced storage and processing techniques that differ from traditional methods (Balios et al., 2020: 215).

In the business sector, the use of big data is no longer confined to large corporations; many small and medium-sized enterprises are also benefiting from it. This is achieved through intermediary services that help these organisations improve their sales by understanding customer behaviour and analysing browsing data on their online platforms, especially in cloud environments where big data is continuously generated through various applications such as mobile phones, websites, and social media. Although big data is not a technology in itself, it requires modern techniques for analysis and storage, as it cannot be handled with traditional tools. These technologies have made the use of big data more effective, enabling institutions—including academic ones—to discover new insights and achieve greater benefits in daily operations. The term "big data" refers to the enormous volumes of information, where structured data constitutes only a small portion (about 10%) compared to the unstructured data generated daily through human activities, such as emails, videos, tweets, Facebook posts, and WhatsApp messages. This unstructured data is difficult to collect and analyse using traditional techniques, requiring advanced processing to extract common patterns and understand behavioural trends in communities (Abdelghaffar, 2021: 488-489).

**2-2: Characteristics of Big Data:**   
Big data offers a competitive advantage to organisations that manage to develop practical solutions for deconstructing their complexity and analysing their content, thereby achieving added value and returns. The importance of big data becomes significant after it is structured and processed using advanced analytical tools. The concept of big data (Big Data) gained tremendous momentum in the early first decade of the 21st century, as industry analyst Doug Laney defined big data by its characteristic "3 V’s" (Al-Tayyib & Al-Rubaie, 2018: 4):

**Volume:**  
Organisations gather data from a variety of sources, including business transactions, smart devices, industrial equipment, videos, and social media. In the past, storage was a significant challenge, but today, storage capabilities have advanced through technological innovations and artificial intelligence (Sun & Strang, 2018, pp. 166-167).

**Velocity:**  
With the growth of the Internet of Things (IoT), data flows into companies at unprecedented speeds. Sensors and smart meters drive the need to handle these torrents of data in real time to study consumer behaviour and effectively utilise all available information.

**Variety:**  
Data comes in various formats—from structured digital data in traditional databases to unstructured textual documents, emails, videos, audio recordings, stock market data, financial transactions, and other types of data.

Additionally, another study added the following characteristics (Gepp et al., 2018: 7):

**Variability:**  
Refers to the inconsistency of data at times, which causes difficulties in processing and managing it effectively.

**Veracity:**  
Relates to the quality of the data obtained, requiring precise analysis regarding its usefulness, source, and accuracy.

**2-3: Sources of Big Data:**   
There are many sources of big data (Dagiliene, 2019: 756), including:

Sensors and meteorological devices used in the Internet of Things.

Databases and Enterprise Resource Planning (ERP) systems.

Social media platforms.

Structured data: Data stored in database fields, which is searchable, analyzable, and manageable.

Unstructured data: Data that, despite having its structure, is considered unorganised because it cannot be formatted like database tables.

Semi-structured data: A type of data that is somewhat structured but not designed in tables or databases.

Some scholars argue that the sources of big data vary and include (Yaqoob et al., 2016: 1235):

**Administrative sources related to program management:**   
Includes electronic records from governmental or non-governmental programs, such as beneficiary records, publishers, employees, cooperative libraries, as well as records of beneficiary visits, insurance, taxes, and patients’ medical records.

**Commercial or transactional sources:**   
Encompasses data resulting from interactions between two parties, such as credit card transactions or online transactions using mobile devices or other digital means.

**Data from sensor networks:**   
Includes data captured by various sensors, such as satellite images, road sensors, climate monitoring devices, and air pollution measuring instruments.

**GPS tracking data:**   
Consists of data extracted from tracking systems like mobile phones or devices that rely on the Global Positioning System (GPS).

**Behavioural data:**   
Includes information resulting from user interactions on the internet, such as the number of times a product or service is searched, or the number of visits to a particular webpage.

**Opinion-related data:**   
Encompasses comments, reviews, and opinions shared on social media platforms or other digital channels.

**2-4: Importance of Using Big Data in the Tax Field:**   
Big data is considered "the new oil that needs refining," as described by online information expert Andreas Vaigand. This description encapsulates the enormous value of the concept, which has become an integral part of the operations of companies and institutions. Big data has become a pivotal tool for development, marketing, industry, media, and politics. It provides a high competitive advantage to communities that can effectively exploit and process their vast volumes, thereby facilitating a deeper understanding, more precise decision-making, and the provision of better services based on insights drawn from databases (Katal et al., 2013: 404).

In our current era, big data is of utmost importance, offering unparalleled transparency and extensive usability of information. The accumulation of such massive amounts of data in various forms represents a significant stage in the evolution of information and communication systems. Big data provides a competitive edge to economic units that can develop practical solutions to deconstruct, classify, and analyse it, resulting in added value and substantial returns. The benefits of big data, once structured and processed with advanced analytical tools, include:

Making better decisions based on insights extracted from big data analysis applied to all facets of tax administration.

Discovering untapped opportunities and potential weaknesses in the functions of tax administration through data analysis results.

Finding solutions to problems by enabling stakeholders to address issues revealed by data analysis in the tax field.

Improving services and offering better services to taxpayers and clients of the General Tax Authority.

Enhancing processes by identifying weaknesses and improving operations across all units of tax administration.

Facilitating clear decision-making and increasing the chances of accurate and correct decisions.

Enhancing forecasting ability, enabling planners in tax administration to predict more effectively.

In summary, the researcher argues that big data is a strategic tool for achieving excellence and competitiveness in the information era, as it can transform challenges into opportunities through its effective analysis and exploitation.

**3-1: Description of the Study Sample:**   
This section presents the results of the field study conducted by the researcher, analysed using descriptive statistical tools such as the mean to determine the degree of agreement of the selected sample with the questionnaire items. The study employed a five-point Likert scale (5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree), with the questionnaire divided into two axes: the first addressing "big data analysis" and the second "improving tax audit efficiency," each containing 10 statements. A total of 44 questionnaires were distributed. To assess the reliability of the instrument, Cronbach's Alpha was used. Table 4 indicates that the reliability coefficients for the study instrument were (.813, .917, .919), reflecting acceptable reliability for this research.

Table (4): Reliability Coefficients for the Research Instrument

|  |  |
| --- | --- |
| Variable | Cronbach's Alpha |
| Big Data Analysis | .813 |
| Enhancing Tax Audit Efficiency | .917 |
| Overall | .919 |

**3-2: Presentation and Interpretation of the Study Results:**

**3-2-1: The Independent Variable (Big Data Analysis):**   
Table 5 presents the descriptive analysis results (mean, standard deviation) for the independent variable (big data analysis) for each statement, indicating the degree of adoption and ranking of each item.

Table (5): Responses of the Research Sample Regarding the Variable (Big Data Analysis)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Statement | Mean | Std. Deviation | Degree of Adoption | Ranking |
| 1 | Big data provides a competitive advantage to organisations that have developed practical solutions to deconstruct its complexity and analyse its content. | 4.07 | .759 | High | 5 |
| 2 | The concept of big data has gained significant momentum due to its critical set of characteristics. | 4.23 | .642 | Very High | 2 |
| 3 | The diversity of big data sources ensures its credibility. | 4.07 | .873 | High | 4 |
| 4 | Big data is the new oil that needs refining. | 4.14 | .702 | High | 3 |
| 5 | Big data is highly important as it offers a competitive advantage by making information transparent and widely accessible. | 4.05 | .806 | High | 7 |
| 6 | The significant development in the volume, type, and speed of data is attributed to the digital processes adopted by companies. | 3.89 | .754 | Moderate | 9 |
| 7 | The challenges associated with big data lie in its availability, processing, storage, analysis, and search. | 4.05 | .834 | High | 6 |
| 8 | A positive aspect of these challenges is that they continually prove the value of exploiting big data to advance professionals and keep them at the forefront. | 3.84 | .713 | Moderate | 8 |
| 9 | Making better decisions based on the information derived from big data analysis. | 4.25 | .811 | Very High | 1 |
| 10 | Discovering untapped opportunities and potential weaknesses in various functions based on big data analysis results. | 3.93 | 0.900 | Moderate | 8 |
| Overall Mean |  | **4.052** | **0.7794** |  |  |

Table 5 shows that the overall mean for the independent variable (big data analysis) is 4.052 with a standard deviation of 0.7794, confirming the importance of employing big data analysis techniques to improve tax audit efficiency. Notably, statement (9) concerning making better decisions based on big data analysis achieved the highest mean (4.25), reflecting a strong consensus on its significance.

**3-2-2 The Dependent Variable (Enhancing Tax Audit Efficiency):**   
Table 6 presents the descriptive analysis results for the dependent variable (enhancing tax audit efficiency), including the mean, standard deviation, degree of adoption, and ranking for each statement.

***Table (6): Responses of the Research***

***Sample Regarding the Variable (Enhancing Tax Audit Efficiency)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Statement | Mean | Std. Deviation | Degree of Adoption | Ranking |
| 1 | The use of big data analysis plays a significant and major role in elevating the tax audit profession. | 4.27 | .788 | Very High | 1 |
| 2 | The use of big data analysis contributes to the development and enhancement of the auditing process for taxpayers’ accounts. | 4.23 | .711 | Very High | 2 |
| 3 | The use of big data analysis increases the efficiency and effectiveness of tax audits. | 4.36 | .750 | Very High | 1 |
| 4 | The use of big data analysis in tax audit operations enables the completion of tasks more efficiently and with greater accuracy. | 4.16 | .861 | High | 6 |
| 5 | The use of big data analysis in tax audit operations reduces the costs associated with these operations, including time, effort, and human resources. | 4.02 | .902 | High | 10 |
| 6 | The use of big data analysis in tax audit operations enables auditors to prepare flowcharts and audit maps more effectively. | 4.18 | .870 | High | 5 |
| 7 | The use of big data analysis in tax audit operations facilitates the more effective scheduling of audit timelines. | 4.23 | .743 | Very High | 3 |
| 8 | The use of big data analysis in tax audit operations aids in more effective task distribution among audit team members. | 4.09 | .772 | High | 8 |
| 9 | The use of big data analysis in tax audit operations enhances the effectiveness of the auditing process. | 4.09 | .802 | High | 7 |
| 10 | The use of big data analysis in the auditing process helps reduce errors and improve accuracy. | 4.05 | .746 | High | 9 |
| Overall Mean |  | **4.168** | **0.7945** |  |  |

Table 6 indicates that the overall mean for the dependent variable (enhancing tax audit efficiency) is 4.168 with a standard deviation of 0.7945. The results reveal strong agreement on the importance of utilising big data analysis techniques to enhance tax audit efficiency, which in turn impacts tax revenues —a critical source of public income.

**3-3: Testing the Research Hypotheses:**

***Table 7: Simple Linear Regression Test of the Impact of Big Data Analysis on Enhancing Tax Audit Efficiency***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | B | Standardised Beta (β) | t-value | p-value | R² | R | F-value | p-value (F) | VIF |
| Constant | 0.691 | / | 1.147 | 0.258 | .448 | .669 | 34.065 | 0.000 | / |
| Big Data Analysis | 0.858 | 0.669 | 5.836 | 0.000 | **1.00** |

**Table (8): Analysis of Variance (ANOVA)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Sum of Squares | df | Mean Square | F-value | p-value |
| Regression | 6.747 | 1 | 6.747 | 34.065 | 0.000 |
| Residual | 8.319 | 42 | 0.198 |
| Total | 15.056 | 43 | / |

The statistical analysis results in Table 7 indicate a strong correlation between the independent variable (big data analysis) and the dependent variable (enhancing tax audit efficiency) at the 1% significance level, with a correlation coefficient (R) of 0.669. This provides sufficient evidence to support the hypothesis that "there is a statistically significant correlation between big data and the improvement of tax audit efficiency within the General Tax Authority."

The F-value of 34.065 further indicates that the model is statistically significant in prediction. The results demonstrate that big data analysis has a significant impact on improving tax audit efficiency, with a direct effect coefficient (B = 0.691) that is statistically significant at the 1% level. The coefficient of determination (R² = 0.448) indicates that the independent variable accounts for 44.8% of the variation in the dependent variable, confirming a significant effect at the 1% level of significance. The t-test value (5.836, significant at p < 0.01) exceeds the critical value (1.984), affirming the significance of the direct effect on enhancing tax audit efficiency. These findings suggest that an increased reliance on big data techniques facilitates tax audit processes, thereby reducing the time, effort, and costs incurred by the tax administration. Given the statistical significance of both the direct effect coefficient and the R² value, we accept the second sub-hypothesis stating that "there is a statistically significant effect of big data analysis on enhancing tax audit efficiency."

**4-1: Conclusions:**

The study showed a statistically significant relationship between the use of big data analysis and the improvement of tax audit efficiency, with big data analysis explaining 44.8% of the variation in audit efficiency (R² = 0.448).

The results indicate that big data analysis contributes to accelerating processes, increasing accuracy, and reducing the costs associated with traditional auditing.

Traditional tax auditing faces several challenges, including increased volume of transactions, complex tax laws, and difficulties in taxing e-commerce activities.

Technological challenges, such as inadequate infrastructure and untrained personnel, are major obstacles to implementing big data techniques.

The sample’s responses reflect a high level of awareness regarding the importance of big data, as indicated by mean scores of 4.052 for the independent variable and 4.168 for the dependent variable.

The study showed that employing tools such as artificial intelligence and machine learning enhances the ability to detect tax evasion and analyse unusual patterns in financial data.

**4-2: Recommendations:**

The General Tax Authority should invest in advanced data storage and processing systems, such as cloud computing and modern databases.

Data integration platforms should be established to link information from multiple sources, including electronic transactions and social media.

Specialised training programs in big data analysis and artificial intelligence applications for tax auditors should be developed, along with partnerships with universities and research centres to prepare skilled personnel capable of addressing technological challenges.

Tax procedures should be simplified and transparency in audit operations enhanced to encourage voluntary compliance among taxpayers, supported by awareness campaigns highlighting the importance of tax compliance.

Establish partnerships with international tax organisations to combat cross-border tax evasion and exchange knowledge in data analysis.

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