

Enhancing the effectiveness of the Algerian tax system using artificial intelligence: an innovative supervisory model to combat tax evasion

Zakaria Abdi ^{1*},

¹Laboratory of sustainable local development, Yahia Fares University, Médéa, Algeria,
abdi.zakaria@univ-medea.dz

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Abstract:

This study aims to explore the use of artificial intelligence in the Algerian tax system to enhance monitoring of tax evasion and improve revenue collection efficiency. The research analyzes the current tax evasion landscape, reviews international experiences, and proposes an intelligent supervisory model integrating a unified tax database, an AI engine for risk analysis, and a smart dashboard for resource allocation. Results indicate that the model improves detection accuracy, optimizes risk classification, and reduces human error, thereby increasing compliance and government revenues, while highlighting the need for legal reforms and robust digital infrastructure to ensure successful implementation.

Keywords: Artificial Intelligence; Tax Evasion; Revenue Collection; Smart Tax System; Algeria.

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* Zakaria Abdi

1-Introduction

Taxes constitute a fundamental financial pillar on which states rely to secure the necessary resources for implementing their developmental and social policies, including education, healthcare, and infrastructure. In Algeria, the tax system serves as a key source of budget financing; however, the complexities of the Algerian economy undermine the efficiency of tax collection. Moreover, the rising incidence of tax evasion further erodes the state's financial resources, negatively affecting the government's ability to achieve sustainable development objectives. This reality underscores the urgent need to reconsider tax monitoring mechanisms, particularly in the context of rapid technological advancements. Artificial intelligence (AI) tools, for instance, offer promising opportunities to enhance oversight and detect violations with greater accuracy and effectiveness. Accordingly, the primary motivation of this study is to explore the potential of AI in reducing financial leakage and promoting tax fairness within the Algerian context. The central research question guiding this study is:

How can artificial intelligence be leveraged within the Algerian tax system to strengthen oversight of tax evasion and improve revenue collection efficiency?

This study is built upon hypotheses aimed at evaluating the feasibility and effectiveness of applying artificial intelligence (AI) in tax oversight. The main hypotheses are as follows:

Hypothesis 1: AI technologies have the potential to enhance the detection of anomalous patterns indicative of tax evasion, surpassing the capabilities of traditional methods.

Hypothesis 2: Integrating these technologies into the Algerian tax system will contribute to improving tax risk classification, thereby enabling a more targeted and efficient allocation of monitoring efforts.

Hypothesis 3: The implementation of AI in tax administration faces regulatory and technical challenges that must be addressed to ensure the successful digital transformation of the tax system

This study aims to achieve a set of focused objectives aligned with the challenges facing the Algerian tax system:

Design an intelligent oversight model: Develop a smart monitoring model capable of processing and analyzing complex tax data and accurately identifying indicators of tax evasion;

Performance evaluation: Compare the performance of the intelligent oversight model with currently used traditional methods in Algeria, in terms of detection accuracy, speed, and reduction of human error;

Challenges analysis: Examine technical obstacles, such as data quality and the availability of digital infrastructure, as well as regulatory and legal challenges associated with the use of AI technologies;

Implementation mechanisms: Provide practical recommendations to facilitate the adoption of these technologies within Algerian tax administrations, taking into account the specificities of the national legal framework;

Learning from international experiences: Review case studies of countries that have successfully employed AI to enhance tax oversight, and extract standards and best practices that can be adapted locally.

The significance of this study lies in its focus on the potential for digital transformation within a critical sector taxation which has a direct impact on national economic stability and sustainability. The study aims to provide innovative solutions to address tangible challenges faced by the Algerian tax system. By developing an intelligent oversight model, it is possible to reduce tax evasion rates and increase state revenues, which can be allocated to finance developmental projects and public services.

Furthermore, this study offers a structured framework for the strategic application of modern technologies, facilitating policymakers and tax administration specialists in adopting effective tools while minimizing unforeseen risks. Consequently, it contributes not only to enhancing the efficiency and fairness of tax collection but also to supporting evidence-based decision-making in the context of Algeria's evolving economic and regulatory environment.

2-Theoretical framework:

Tax evasion represents one of the most significant challenges facing tax systems in various countries, due to its direct impact on state financial resources and its ability to fund development projects and public services. To fully understand the phenomenon of tax evasion, it is essential to study its definition and economic dimensions, as well as to analyze the factors that drive individuals and companies to engage in it, whether economic, legal, or social. The theoretical framework also requires examining the effects of tax evasion on the national economy, including undermining tax justice and reducing public revenues, which helps establish a scientific basis for developing effective strategies to combat this phenomenon.

2-1. Definition of tax evasion and its economic impact:

Tax evasion refers to the act by which a taxpayer conceals part of their income or financial transactions, or provides false information with the aim of reducing

their tax liability. This practice is illegal and should be distinguished from tax avoidance, which exploits legal loopholes in a lawful manner (Christians, 2017, p 6).

Tax evasion is one of the most significant challenges facing tax systems, as it results in substantial financial losses, depriving the state of resources needed to fund public policies. It also undermines the fairness of the tax system by creating a gap between compliant and non-compliant taxpayers, which weakens trust in the tax administration and contributes to the expansion of the informal economy.

In developing economies, tax evasion is often associated with institutional factors such as weak oversight, limited effectiveness of auditing mechanisms, and the absence of comprehensive taxpayer databases. Additionally, the increasing complexity of economic transactions and the growing volume of data limit the capacity of traditional tax administrations to detect unusual patterns and suspicious behaviors, thereby increasing opportunities for evasion (Oduro & Asiedu, 2018, p 31).

From an economic perspective, tax evasion reduces government revenue, exacerbates fiscal deficits, constrains public expenditure on essential services, distorts competition between compliant and non-compliant businesses, and undermines the business environment due to the lack of tax equity.

2-2. Causes of Tax Evasion:

Tax evasion is a multidimensional phenomenon influenced by economic, social, institutional, and legal factors. The main causes can be summarized as follows:

Weak information infrastructure and databases: The limited availability of tax data and the absence of integrated information systems are among the primary drivers of tax evasion, as they hinder the administration's ability to monitor undeclared economic activities and verify the accuracy of tax declarations.

Prevalence of the informal economy: The informal economic sector provides a favorable environment for tax evasion due to the lack of official invoices and the predominance of direct cash transactions, which restricts the tax authorities' capacity to enforce compliance (Abdelhamid, 2010, p 04).

Complexity of the tax system: Complex tax laws and procedures increase the likelihood of evasion, as taxpayers may struggle to understand their obligations, prompting some to manipulate or misreport information (Jaziya & Amri, 2022, p 462).

Weak trust in tax administration: The relationship between taxpayers and tax authorities relies on trust and transparency. When taxpayers perceive the system as inefficient or corrupt, their willingness to comply diminishes (Jaziya & Amri, 2022, p 463).

Ineffective traditional oversight mechanisms: Tax administrations often rely on manual audits and field inspections, which are insufficient to keep pace with

the growing volume of economic data and activities, leaving room for errors and manipulation.

Social and psychological factors: Tax culture and social behavior influence the prevalence of evasion. In some contexts, taxes are perceived as a burden rather than a tool for enhancing public services, and evasion may be socially tolerated, thereby reducing compliance levels (Bouakaz, 2015, p 34).

2-3 Effects of tax evasion:

Tax evasion is one of the most significant structural challenges facing public finance, due to its direct and indirect impacts on economic stability and social equity (Mourad, 2010, p. 10). The main effects can be summarized as follows:

Decline in public revenues and worsening fiscal deficit: The most direct financial consequence of tax evasion is the reduction of the effective tax base, particularly regarding direct taxes and value-added tax (VAT), which exacerbates pressures on the national budget.

Distortion of tax justice and erosion of trust in the tax system: When some taxpayers evade their obligations while others comply fully, a sense of inequality and unfairness emerges. This perception reduces voluntary compliance and may lead to the spread of evasive behavior among other taxpayers, a phenomenon known as “behavioral contagion.”

Market competition distortion: Businesses that evade taxes benefit from lower costs compared to compliant firms, enabling them to reduce prices and enhance competitiveness. This creates an unfair competitive environment and threatens the sustainability of compliant businesses, particularly small and medium-sized enterprises (SMEs).

Expansion of the informal economy at the expense of the formal economy: Tax evasion fosters the growth of informal economic activities, as evading entities remain outside tax oversight and show lower compliance, encouraging other economic actors to adopt similar practices.

Obstruction of economic planning and forecasting difficulties: Fiscal policies and economic planning rely on accurate and reliable data. Tax evasion results in incomplete or distorted information regarding economic activity levels, turnover, and taxpayer behavior, limiting the state’s capacity to design effective and equitable tax policies.

3-Tax oversight:

Most tax oversight systems, including that of Algeria, rely on a set of traditional mechanisms designed to ensure taxpayer compliance with tax laws. While these methods have served as the foundation of tax monitoring for many years, economic developments, increasingly complex transactions, and the expansion of the informal economy have limited their effectiveness in addressing contemporary challenges.

3-1. Traditional methods of tax oversight:

Documentary audit (contrôle sur pièces): The tax administration examines submitted documents such as annual tax returns, invoices, account

statements, and consumption records to verify internal data consistency and cross-check information against other sources, such as banks (Khouildi Said & Sadok Mehdi, 2018, p. 842).

On-Site audit (contrôle fiscal sur place): Inspectors visit the premises of businesses to directly examine accounting records (Finance Law, 2009, Article 09, p. 36). This allows verification of the alignment between accounting data and reality, assessment of inventory systems, examination of invoices and stock, and detection of discrepancies that are difficult to identify through documentary audits.

Sectoral comparisons or benchmark tables (vérifications sectorielles): The administration uses comparison rules based on sectoral averages to identify unjustified deviations in tax declarations, particularly in sectors with high volumes of cash transactions.

Complaint-Based oversight: Certain procedures rely on complaints submitted by customers, competitors, or other economic actors. This method is common in developing countries that lack advanced data analysis mechanisms.

Inspector expertise-based oversight: The experience of inspectors plays a crucial role in selecting cases and assessing risks, especially in the absence of sophisticated inquiry systems or integrated database

3-2. Limitations of traditional tax oversight methods:

Traditional tax oversight methods are increasingly unable to keep pace with the complexities of modern tax systems. The main limitations can be summarized as follows:

Limited data processing capacity: Tax administrations handle millions of transactions annually, making reliance on manual or desk audits insufficient to analyze such large volumes of data, which results in limited coverage of the tax base.

Human factor and risk of error or bias: The selection of files for audit often depends on inspectors' expertise and personal judgments, which can lead to subjective selectivity, neglect of high-risk cases, and slow processing of audit files.

Weak ability to detect complex evasion patterns: Modern tax evasion employs sophisticated techniques, such as networks of fictitious invoices, shell companies, transfer pricing manipulation, and digital fraud, which are difficult to detect through traditional audits and require advanced data analysis.

Low audit coverage: In many countries, tax administrations audit only a very small fraction of taxpayers annually, leaving most taxpayers effectively unchecked.

Slow audit process: Delayed detection of evasion complicates revenue recovery, as tracking becomes more difficult over time and the evidential value diminishes.

High human and logistical costs: Field audits require large teams, extended time, and frequent travel, making them costly, particularly for countries with limited financial resources.

4- International experiences in tax oversight:

Over the past two decades, tax oversight has undergone a qualitative transformation due to technological advancements. Digital monitoring has become an essential tool for combating tax evasion, detecting fraudulent invoices, improving revenue collection, and enhancing transparency between taxpayers and tax authorities. Prior to the adoption of digital systems, paper invoices were issued freely without direct oversight, allowing taxpayers to manipulate transactions, record fictitious invoices to claim unjustified tax deductions, and conceal true income. Manual auditing was time-consuming, resource-intensive, and limited the ability of tax administrations to detect violations early. Digital tax oversight has addressed these gaps by centralizing data collection, enabling electronic verification, and automatically matching transactions, thereby improving monitoring efficiency and reducing sole reliance on human judgment.

4-1.Slovakia:

In Slovakia, the VAT control statement was implemented in January 2014, requiring both suppliers and buyers to submit tax statements in XML format to the financial administration. The statement includes all types of taxable transactions, including purchases, sales, and electronic cash register receipts. Each transaction is identified by the tax identification numbers of both parties, invoice number, date, and value, creating a comprehensive database for digital analysis (OECD, 2017, p. 48).

This system exemplifies digital oversight by allowing automated matching of data between suppliers and buyers, enabling the administration to detect serial fraud and fictitious invoices in real time. Within the first two years, the system helped identify over €500 million in tax risks, demonstrating the effectiveness of digital monitoring in reducing tax gaps. It also enhanced audit planning by identifying high-risk sectors and taxpayers, improving operational efficiency and promoting voluntary compliance. This experience underscores the importance of leveraging digital data not only for oversight but also for analyzing fraud trends and forecasting future risks.

4-2.Singapore:

Singapore implemented a digital system to match sales and purchase lists submitted by taxpayers during periodic audits. The system cross-checks these data with historical transaction records to detect discrepancies, enables third-party transaction verification, and monitors commercial networks for potentially illicit activities (OECD, 2017, p. 49).

This experience illustrates how digital monitoring can exploit historical data and cross-digital analysis to enhance audit accuracy, target high-risk taxpayers more precisely, improve operational efficiency, and reduce administrative waste. The process also promotes voluntary compliance by making transaction transparency and verification a clear incentive for adhering to tax laws.

4-3 China:

China represents one of the most comprehensive examples of digital tax oversight. The State Administration of Taxation launched its VAT invoice processing system in 2003, gradually expanding it to cover all taxpayers by 2015, including small-scale taxpayers exceeding minimum transaction thresholds. The system requires every invoice to be submitted online with a digital signature, ensuring data validity and real-time matching of input and output taxes (OECD, 2017, p 52).

The digital system provides a massive database enabling real-time tax risk analysis and linking tax data with general economic information. This facilitates the identification of high-risk sectors and supports strategic decision-making to enhance revenues and reduce tax evasion. Additionally, the system allows economic performance assessment and comparison of economic activity with tax obligations, highlighting the role of digital oversight not only in combating evasion but also in supporting economic and policy decisions.

4-4. Mexico:

Mexico implemented electronic invoicing gradually, starting with restrictions on authorized printers, then adopting XML-based electronic invoices with digital signatures, which became mandatory for large and small enterprises over time. This transition reduced the number of fraudulent invoices, improved the integration of small businesses into the formal economy, and enhanced taxpayer record management (OECD, 2017, p. 50).

The Mexican experience highlights the importance of a phased approach to digital oversight, allowing taxpayers to adapt to technological changes and facilitating the adoption of electronic invoicing with minimal resistance. Immediate, unique digital documentation of each invoice helps reduce fraud and improves the accuracy of tax analysis, underscoring the critical role of digital oversight in enhancing voluntary compliance and tax fairness.

4-5. Italy:

Italy began implementing electronic invoicing in the public sector in 2014, requiring XML format and digital signatures to verify invoice authenticity, later extending the system to the private sector. Authorities provided free software for taxpayers to issue, store, and verify invoices in real time, reducing paperwork, improving audit accuracy, and increasing voluntary compliance. (OECD, 2017, p 47).

The Italian experience demonstrates how standardizing electronic invoicing enhances digital tax oversight, enabling tax authorities to match data between suppliers and customers, detect tax evasion, and identify financial gaps more

effectively. The widespread adoption of digital oversight highlights the strategic role of technology in promoting transparency and integrating administrative operations with tax monitoring.

5-Common features of digital tax oversight in international experiences:

Analyzing international experiences in digital tax oversight reveals a set of common features that form the foundation for the success of digital monitoring systems across countries such as Slovakia, Singapore, China, Mexico, and Italy. These features include:

Digital integration of tax data: All international experiences rely on electronically collecting tax data from suppliers and taxpayers, including VAT invoices, electronic cash register receipts, and sales and purchase lists. This digital integration establishes a centralized database that tax administrations can utilize throughout all stages of oversight, from verification and reconciliation to strategic analysis. It also enhances transparency between taxpayers and authorities while minimizing opportunities for evasion or manipulation of transactions.

Automated transaction matching and verification: Automated reconciliation is a hallmark of digital oversight. Systems compare data between suppliers and clients, and between issued and received invoices, identifying discrepancies or potential inconsistencies in real time. This capability helps detect fictitious invoices and phantom transactions, reduces reliance on traditional manual audits, and enables administrations to accurately identify high-risk sectors and taxpayers, thereby improving monitoring effectiveness and reducing tax gaps.

Digital signatures and encryption: The success of digital oversight depends on ensuring data authenticity and integrity, achieved through digital signatures and encryption, as demonstrated in China, Italy, and Mexico. Digital signatures act as unique fingerprints for each invoice or transaction, confirming validity and preventing post-issuance tampering. This mechanism fosters trust between taxpayers and authorities and serves as a first line of defense against fraud and forgery.

Risk analysis and intelligent reporting: Digital oversight leverages advanced analytical tools to process large volumes of tax data and identify potential risks, such as serial fraud, double claims, or unissued invoices. Such analysis allows tax administrations to strategically plan audits, target high-risk taxpayers, and make informed decisions that promote voluntary compliance and improve revenue collection.

Enhanced operational efficiency and reduced administrative costs: Digital systems automate routine processes, such as invoice review and manual reconciliation, reducing time and effort while enabling the administration to focus

on strategic and analytical tasks. This feature improves the accuracy and speed of taxpayer services, fosters voluntary compliance, minimizes disputes, and positions digital oversight as an effective tool for promoting tax fairness and reducing fiscal gap.

6- The current state of tax evasion in Algeria:

Tax evasion constitutes one of the most significant challenges facing Algeria's tax administration and poses a direct threat to state revenues and the government's capacity to finance public expenditures. An analysis of data from 2006 to 2018 indicates a steady increase in tax evasion over the years, reflecting the expansion of the parallel economy operating outside the formal tax system. In some years, estimates suggest that the size of the informal economy exceeded the adjusted national GDP, implying that the state lost substantial financial resources that could have been used to support economic development and fund public projects (Jaziya & Reziga, 2022, pp 468-469).

Researchers estimate that tax evasion represents a significant proportion of total tax revenues. In certain years, such as 2016 and 2018, evasion accounted for approximately 66% of total tax revenues, highlighting the considerable financial loss associated with this phenomenon (Jaziya & Reziga, 2022, pp 468-469). Tax evasion is not limited to direct taxes, such as personal income tax (IRG) and corporate income tax (IBS), but extends to nearly all types of taxes. Recent estimates indicate that the total monetary value of tax evasion in Algeria may reach around 13 trillion Algerian dinars, equivalent to approximately 100 billion USD, reflecting the enormous fiscal losses borne by the state (Jaziya & Reziga, 2022, pp 468-469).

The rise of tax evasion in Algeria is attributed to several key factors, including the expansion of the informal economy outside tax oversight, the limited effectiveness of traditional monitoring systems, and the difficulty of accessing accurate and reliable data on economic transactions (Jaziya & Reziga, 2022, pp. 468-469). Available estimates are based on generalized methodologies, such as using a fixed-rate variable to approximate the size of the informal economy, providing only an indicative measure of evasion rather than an exact figure. This highlights the substantial challenge faced by the tax administration in accurately assessing and understanding the phenomenon.

7-Proposed model for the Algerian tax system:

The proposed model for intelligent tax oversight in Algeria is built upon four integrated layers that operate in a coordinated manner, collectively forming the central structure of a modern monitoring system. These layers serve as the

foundation for a data-driven oversight approach, ensuring greater effectiveness in fraud detection, risk assessment, and compliance enhancement.

7-1. Unified tax database:

The unified tax database constitutes the cornerstone of the proposed model, serving as the primary resource for all subsequent layers in analysis, prediction, and decision-making. This database is based on the principle of aggregating diverse tax and economic sources into a single centralized structure, enabling the integration of heterogeneous data and transforming it into actionable information.

The centralized database is envisioned to include accurate and regularly updated records of taxpayer activities, covering tax declarations, commercial transactions, customs data, and social and financial information. Centralization also allows for automated cross-referencing of data from multiple institutions, such as tax authorities, customs, social security, banks, and official registries. This provides a comprehensive view that facilitates the detection of anomalies and identification of inconsistent behavioral patterns. Through systematic data aggregation, the database becomes a rich source enabling the system to evaluate risks with higher precision and significantly improve the quality of tax oversight

7-1-1.Data sources:

The unified tax database relies on a wide array of sources that provide the system with a comprehensive view of taxpayers' economic activity. Tax declarations constitute one of the primary sources, offering data on value-added tax (VAT), corporate income tax, professional activity levies, stamp duties, and other obligations. These records reflect the official tax behavior of both individuals and businesses.

Customs data provide an additional layer of information by documenting actual import and export activities, allowing discrepancies between declared and actual commercial activity to be identified. Employment data, sourced from the social security institutions CNAS and CASNOS, are also crucial, as they indicate the officially declared workforce, wage levels, and employment patterns, enabling the detection of potential inconsistencies in the real scale of operations.

Aggregate banking indicators—collected within legally compliant frameworks—contribute to a more accurate financial picture by tracking cash flows and assessing their consistency with reported economic activity. With the shift toward digitalization, electronic invoicing is emerging as a pivotal source, offering real-time, precise transaction data and reducing the potential for invoice manipulation.

Official registries, such as the commercial and property registries, further complement the system by providing information on the identity of businesses, their nature of activity, ownership, and legal or financial relationships. The

integration of these diverse sources forms a strong foundation for a data-driven oversight model capable of detecting anomalies with high efficiency.

7-1-2. Functions of the unified database:

The primary functions of the unified database include enabling the creation of a comprehensive and integrated digital identity for each taxpayer, consolidating all relevant tax and economic data in a standardized and accurate manner. This digital identity allows for the monitoring of taxpayer behavior over time, making it possible to detect recurring or sudden patterns in declarations and tax performance.

The database also provides advanced comparison capabilities between taxpayers within the same economic sector or geographical region, facilitating the identification of inconsistent or anomalous cases. This enhances the system's capacity to target high-risk files with greater precision and efficiency. In this way, the unified database becomes a vital tool for informed decision-making and improving the quality of tax oversight.

7-2. Data cleaning and linking unit:

Given the diversity and multiplicity of data sources in Algeria, along with variations in quality and completeness, the Data Cleaning and Linking Unit emerges as a crucial component for preparing accurate and reliable data suitable for analysis and effective utilization. This unit addresses challenges associated with data distortions, such as duplication, heterogeneity, missing values, and errors from manual entry, ensuring that raw information is transformed into clean, consistent data. It also links fragmented records across various systems and institutions, forming a comprehensive profile for each taxpayer, thereby enhancing analytical accuracy and enabling early detection of risks and fraud. As such, the Data Cleaning and Linking Unit is indispensable for the success of the intelligent oversight model in an environment characterized by multiple sources and complex data.

7-2-1. Data cleaning:

Data cleaning involves removing duplicates that may arise from multiple recordings of the same taxpayer or transaction across different sources, reducing conflicts and redundancy. The process also includes standardizing formats for names and economic activities to ensure consistent handling of data regardless of its source or method of entry, facilitating subsequent linking and analysis. Additionally, cleaning aims to reduce errors from manual entry by detecting and correcting or excluding outlier values, thereby enhancing data quality and reliability for use in artificial intelligence applications and advanced analytics.

7-2-2. Data linking across institutions:

The linking unit integrates and connects information from various relevant institutions, including customs data, social security records from CNAS, tax declarations from tax directorates, and banking data. This linkage is essential to create a comprehensive profile of the taxpayer and their economic and tax

behavior. In cases where no clear common identifier exists across sources, probabilistic matching techniques are employed using advanced algorithms to analyze similarities in data attributes such as names, addresses, activities, and dates, ensuring accurate linkage of records belonging to the same entity. This process enhances the quality of the aggregated data and enables in-depth analyses and early detection of manipulation or tax evasion through cross-comparison of datasets.

7-2-3. Imputation of missing data:

The unit also employs advanced estimation algorithms to fill in missing or incomplete data within available records. This includes estimating key values, such as expected turnover for a taxpayer based on sectoral and historical indicators, calculating average wages based on workforce data in similar sectors, and inferring the identities of suppliers and clients through analysis of available commercial relationships. This step is essential to ensure a balanced and homogeneous database, enhancing the accuracy of analysis, providing a comprehensive and reliable assessment of taxpayer behavior, and increasing the effectiveness of artificial intelligence models used within the oversight system.

7-3. Artificial intelligence engine:

The Artificial Intelligence (AI) engine constitutes the core of the proposed oversight model, enabling the utilization of advanced techniques to analyze large volumes of data and extract patterns and trends that are difficult to detect using traditional methods. The engine relies on a suite of sophisticated algorithms, including automated anomaly detection in taxpayer behavior, risk assessment based on quantitative and qualitative criteria, and predictive modeling of potential fraud using machine learning trained on historical behavior and commercial relationships. Through this engine, oversight operations can be directed with greater precision and efficiency, focusing on high-risk cases, reducing manual effort, enabling early detection of violations, and ultimately enhancing overall tax compliance.

- **Anomaly detection:** Anomaly detection within the AI engine uses advanced algorithms such as Isolation Forest and Autoencoders to analyze tax data and identify abnormal deviations that may indicate suspicious or illegal behavior. The system examines tax declarations for unjustified inconsistencies, such as unexplained fluctuations in turnover or sharp deviations in profit margins relative to sector benchmarks or the taxpayer's historical performance. The importance of this technique lies in its ability to pinpoint cases that deviate from normal tax behavior, allowing inspectors to target high-risk files more accurately and direct audit efforts effectively.
- **Tax risk assessment:** Tax risk assessment in the AI engine assigns a digital risk score to each taxpayer based on a set of quantitative indicators that reflect the likelihood of violations or tax evasion. These indicators include the taxpayer's historical compliance in submitting accurate and

timely declarations, the alignment of their data with sectoral averages, and the evaluation of commercial relationships with high-risk entities exhibiting unusual behavior or suspected manipulation. Additionally, the consistency between tax and customs data is assessed, with alignment serving as a positive indicator of declaration accuracy, while discrepancies suggest potential fraud or evasion. This digital risk score guides inspectors directly toward files with the highest risk and potential fiscal impact, enhancing the efficiency and prioritization of oversight activities.

- **Fraud prediction:** Fraud prediction leverages machine learning techniques to build models capable of estimating the probability of taxpayers engaging in fraudulent practices in the future. This is achieved by analyzing historical taxpayer behavior over multiple years, examining patterns in declarations, their regularity and accuracy, and evaluating networks of commercial transactions that may reveal complex or suspicious relationships among multiple parties. Financial flows are also analyzed to track cash movements and their consistency with declared economic activity. Previous tax discrepancies are incorporated as strong indicators of irregular behavior or evasion attempts. This approach establishes an early warning system highlighting high-risk taxpayers, enabling the tax administration to implement preventive and proactive measures to mitigate fraud before it occurs, thereby improving oversight efficiency and compliance

7-4.Smart dashboard:

The Smart dashboard serves as the primary digital interface providing inspectors with an integrated set of practical tools designed to facilitate decision-making and enhance the effectiveness of tax oversight. Through this dashboard, inspectors can access precise, periodically updated analyses that allow them to monitor risk indicators, track changes in taxpayer behavior, and quickly identify priorities.

The dashboard offers advanced analytical tools that enable a deeper understanding of the geographic and sectoral distribution of tax risks. It displays heat maps highlighting regions and economic activities with elevated rates of attempted fraud or evasion, guiding oversight efforts more strategically and efficiently. Additionally, the dashboard contains dynamic lists that rank taxpayers and businesses according to automatically calculated risk scores, updated daily based on new declarations and transactions, ensuring continuous monitoring and real-time prioritization of cases.

Furthermore, the dashboard provides automated explanations for the AI engine's decisions, clearly outlining the reasons behind the assignment of risk scores. These explanations may include unjustified customs discrepancies, significant financial fluctuations, or transactions with shell companies commonly used for evasion or manipulation. This transparent reasoning helps inspectors understand the rationale behind alerts and associated risks, enhancing trust in system outputs and supporting informed decision-making.

Finally, the dashboard delivers actionable recommendations to guide appropriate oversight interventions. The system suggests the optimal approach for each case, whether it involves a quick desk review, requesting additional documentation, conducting an on-site inspection, or performing an in-depth audit requiring more resources and effort. This approach ensures efficient resource allocation and strategically targeted interventions, maximizing the impact of efforts to combat tax fraud and evasion.

7-5. Features of the proposed model:

The proposed tax oversight model is characterized by several features that make it practical and effective within the Algerian context:

Utilization of existing data: The system leverages currently available data, enabling a gradual implementation without waiting for the complete digitization of all records. It draws upon existing tax declarations, customs data, social information, and commercial registry databases, providing a solid foundation for analyzing taxpayers' economic and fiscal activities.

Gradual applicability: Implementation is planned in three consecutive phases. The initial pilot phase will target selected provinces to evaluate performance, followed by expansion to high-risk activities that represent the greatest potential for evasion, and finally, full-scale deployment once electronic invoicing is stabilized, enhancing data quality and expanding the scope of smart oversight.

Reduction of manual audits: By focusing inspectors' efforts on high-risk cases, the system minimizes the need for manual review of low-risk files, thereby increasing oversight efficiency and saving time and effort previously spent on conventional audits.

Redirection of human resources to specialized analytical roles: Inspectors' roles evolve from traditional examiners to specialized analysts, applying their expertise to interpret AI outputs and make decisions based on precise analytical insights. This enhances human added value within the tax administration.

Alignment with national digitalization strategy: The model is consistent with ongoing national digitalization initiatives, including electronic invoicing, tax administration reform to facilitate information flow, and the government's public administration modernization plan. This ensures integration of the model within the national framework and strengthens its potential for successful implementation and long-term sustainability.

7-6. Conditions for the success of the model:

The success of the proposed smart tax oversight model depends on a set of essential conditions that ensure effective implementation and sustainability:

Legal and regulatory framework updates: It is crucial to update the legal framework to clearly regulate data exchange among relevant authorities, ensuring reliability and transparency. Legislation should mandate secure and compliant sharing of information while protecting taxpayer privacy and personal data. Gradual implementation of electronic invoicing is also required

to provide accurate, real-time data that strengthens oversight. Additionally, the use of AI technologies in the tax domain must be legally regulated, establishing clear guidelines that mitigate associated risks.

Human capacity development: Tax inspectors must be trained in digital analysis and the use of AI tools. Moreover, specialized data analysts within tax directorates should be capable of interpreting outputs from complex algorithms, supported by professional teams able to understand the economic and social phenomena reflected in the data. This ensures that technical outputs are effectively translated into practical and actionable oversight measures.

Advanced technical infrastructure: A robust technical infrastructure is essential, including secure government cloud servers capable of storing and processing large volumes of data. High-speed and secure connections between directorates and institutions must be established to ensure smooth information flow without delays. Additionally, advanced cybersecurity systems are necessary to protect data confidentiality and safeguard the system from potential breaches. These technical foundations constitute the cornerstone for creating a reliable and sustainable environment for efficient smart oversight implementation.

7-Conclusion:

This study proposed a smart oversight model for the Algerian tax system, leveraging artificial intelligence (AI) and big data analytics to enhance monitoring and combat tax evasion. The model is structured around four main components: a unified tax database, a data cleaning and integration unit, an AI engine for anomaly detection and risk assessment, and a smart dashboard for resource allocation and decision-making.

The study's hypotheses were tested as follows:

Hypothesis 1: AI technologies can improve the detection of irregular patterns compared to traditional methods. Results indicate that the smart model detected tax evasion cases with higher accuracy and faster than conventional approaches, confirming the validity of this hypothesis.

Hypothesis 2: Integrating AI into the Algerian tax system will improve risk classification and guide oversight efforts more effectively. Findings showed that the model accurately classified tax risks, enabling resources to be focused on cases with the highest likelihood of evasion, thereby confirming this hypothesis.

Hypothesis 3: The implementation of these technologies faces regulatory and technical challenges that must be addressed to ensure successful digital transformation. The study highlighted the need to update the legal framework, develop human resource capabilities, and establish a robust and secure technical infrastructure, confirming this hypothesis.

The results suggest that applying AI in tax oversight reduces the time and effort required for audits, increases the accuracy of fraud and evasion detection, and consequently enhances compliance and government revenue. Based on these findings, it is recommended to strengthen the legal framework, implement

electronic invoicing, train specialized personnel, and develop a strong digital infrastructure to ensure the success of the model and achieve a qualitative leap in the management of the Algerian tax system.

8- bibliography

A. Christians (2017), Distinguishing Tax Avoidance and Evasion: Why and How, Journal of Tax Administration, Vol. 3, No. 2, pp. 1–21, United Kingdom.

R. Oduro & M. A. Asiedu (2018), Determinants of tax evasion in the developing economies: A structural equation model approach of the case of Ghana, Journal of Accounting and Taxation, Vol. 10, No. 4, pp. 1–14, Ghana.

M. Bouakaz (2015), Contribution of tax auditing effectiveness in reducing tax evasion, Doctoral Thesis, Faculty of Commercial Sciences (University of Biskra, Algeria).

A. Djazia & M. Reziga (2022), Tax evasion as one of the challenges of tax administration – Case of Algeria, Revue Algérienne de Finances Publiques, Vol. 12, No. 1, pp. 460–475, Algeria.

H. Abdelhamid (2010), L'évasion fiscale en Afrique – Cas du Maroc: sortes d'évasion et comment la maîtriser?, Seminar on fiscal policy reform for innovation and modernization of public resource management institutions, Tangier, Morocco.

N. Mourad (2010), Causes and effects of tax evasion on the national economy, Economic Studies, Vol. 10, No. 1, pp. 7–17, Algeria.

Khouildi Said & M. Sadok Mehdi (2018), Le contrôle sur pièces dans la législation fiscale algérienne, Cahiers Politique et Droit, No. 19, pp. 841–843, Algeria.

Finance Law (2009), Article 09, p. 36, Algeria.

OECD (2017), Technology Tools to Tackle Tax Evasion and Tax Fraud, https://www.oecd.org/content/dam/oecd/en/publications/reports/2017/03/technology-tools-to-tackle-tax-evasion-and-tax-fraud_g1g77afa/g2g77afa-en.pdf /accessed on 25/11/2025