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Leveraging Accounting Analytics to Enhance Payroll Accuracy and Fraud Detection in U.S. Public Sector Institutions: A Case Study Approach

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Abstract: This study explores how accounting analytics can be leveraged to enhance payroll accuracy and improve fraud detection in U.S. public-sector institutions, addressing persistent irregularities amid rising demands for fiscal transparency. The research employs a qualitative design with secondary sources including academic literature, reports, and case studies. The literature identifies successful analytics implementation, such as Treasury OPI's machine learning for data integration for unemployment claims. These precedents demonstrate direct transferability to payroll's high volume and rules-based structure. Findings show that analytics significantly reduce improper payments through real-time screening, data integration, and risk prioritization when embedded in workflows. The findings also show that the effectiveness of analytics depends on institutional conditions such as data quality, legacy systems, technical capacity, governance, and resources. Payroll shares core risks: ghost employees, overtime abuse, and disbursement systems, therefore positioning it as well-suited for similar accounting analytical interactions. The research proposes a set of practical recommendations for public sector institutions, including data integration, prepayment screening, and capacity building in analytical skills. The study concludes that accounting analytics offers a credible opportunity for proactive oversight, but requires a phased, institution-ready implementation strategy supported by strong governance.

Keywords: Accounting Analytics, Machine Learning, Artificial Intelligence, Data Quality.

INTRODUCTION

The United States public sector is responsible for managing significant payroll expenditures; however, it continues to face substantial challenges from financial fraud, which threatens both fiscal transparency and public trust (Bullock *et al*. 2023).

Digital technologies in financial services have facilitated the rise of increasingly complex fraud schemes, including payroll fraud, which traditional fraud detection systems often struggle to detect and prevent effectively (Udeh *et al*., 2024). As a result, one of the promising solutions is the increased use of accounting analytics. This analytical approach has been pivotal in improving financial management, especially in public sector payroll administration (Huda & Jatmiko, 2025). A payroll accounting system is a tool for managing different resources that are reflective of employee activities, e.g., calculating salaries, wages, and other incentives, through a set of procedures that not only regulate these activities but do so effectively (Martins *et al*., 2024). This is an area that is particularly complex and sensitive in public sector institutions due to the large size of the workforce and increased need for accountability and transparency. In U.S. public sector institutions, efficient payroll processing plays a vital role in guaranteeing that public funds are disbursed properly, that relevant policies are complied with, and that public trust is upheld (Kalufya & Nyello, 2021).

Leveraging accounting analytics such as machine Learning (ML), artificial intelligence (AI), and blockchain technology, is a game-changing strategy that can help the U.S. government agencies to augment payroll accuracy and detect fraud by facilitating the authentication process through automation as well as spotting the payroll fraud-related activity patterns, e.g., ghost employees, unauthorized payments, or salary manipulation (Udeh *et al*., 2024). It has been found that these technologies can bring about improvement in the precision and promptness of fraud detection through the utilization of data mining and anomaly detection that are more advanced than the traditional ones (He *et al*., 2022). Moreover, it is possible to identify the workforce trends more profoundly by the integration of human resource and payroll data, which can also help to manage the finances and efficiently assign the resources, as exemplified by forensic models of payroll analytics that combine integrated payroll and personnel information systems (Uddin, 2025). Computerized accounting systems play an important role in the successful implementation of these analytics frameworks in the public sector for the purpose of preventing and detecting payroll fraud (Onowu & Oludi, 2024).

While there is a growing body of literature on the use of data analytics and machine learning in public administration and auditing, there is comparatively less research specifically addressing

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accounting analytics applied to payroll accuracy and fraud detection in U.S. public sector institutions. Current studies primarily focus on developing predictive models and business intelligence frameworks for detecting financial fraud in private corporations (Cao *et al*., 2021). This study aims to address this gap by providing an overview of the deployment and effectiveness of accounting analytics in improving payroll accuracy and detecting fraud in the U.S. public sector.

The purpose of this study is to explore how accounting analytics might be successfully utilized to bring about improvements in payroll accuracy and fraud detection in the public sector of the U.S. government. The research will primarily involve gathering insights from secondary qualitative studies and then evaluating their suitability and effect in the context of public sector payroll management. The key objectives of this study are understanding how analytical instruments have been utilized in solving payroll-related issues, recognizing the challenges and obstacles encountered by the public sector while trying to implement advanced accounting analytics in payroll management, and coming up with the best practice recommendations and frameworks that can assist policymakers, public finance leaders, auditors, and researchers in enhancing payroll accuracy and fraud detection. This study is significant as it deals with the urgent demand for the right and fair treatment of payroll, with special focus on fraud detection within the public sector of the U.S. through the adoption of advanced accounting analytics. Besides being a prerequisite for public trust, proper handling of payroll is also instrumental in ensuring fiscal responsibility and fostering transparency in government operations (World Bank, 2023). By leveraging analytics tools such as machine learning, artificial intelligence, and integrated data systems, public sector institutions can better detect fraudulent activities, prevent financial losses, and optimize resource allocation, which ultimately enhances service delivery to citizens (Bullock, 2023).

METHODOLOGY

This research adopts a qualitative research approach focused on secondary data analysis to explore how accounting analytics can be leveraged to improve payroll accuracy and fraud detection in U.S. public sector institutions. The research uses a case study and literature synthesis approach, using peer-reviewed journals, government reports, and authoritative sources to develop a comprehensive understanding of current practices, challenges, and technological applications.

Limitations

This research relies on secondary data, which limits primary contextual findings and may omit very recent innovations. Qualitative synthesis may be subject to interpretive bias.

Related Literature

To position this research within existing literature, this section aims to synthesize existing research on the application of accounting analytics in enhancing payroll accuracy and fraud detection. The review looks at the usage of accounting analytic tools in the public sector, the difficulties in detecting payroll fraud, and the effectiveness of these tools.

Accounting Analytics: Concepts and Scope

Accounting Analytics is the systematic application of data analytics techniques, ranging from descriptive and diagnostic to predictive analytics, to accounting data for decision-making, risk management, and operational efficiency improvement (Agostino *et al*., 2022). This field, which is rapidly evolving, brings together the use of machine learning (ML), artificial intelligence (AI), and blockchain technology for the improvement of financial reporting and fraud detection accuracy and reliability. The main feature of accounting analytics lies in its capability to change vast financial data into insightful information using algorithms and computational models. This aligns with integrated digital design and implementation frameworks, where coordination across system components and phases enhances operational efficiency and data consistency (Torres, F. N. C, 2022). Descriptive analytics is about data summarization of the past, whereas diagnostic analytics looks for the reasons for the anomalies in the accounting records (Amalia, 2023). Blockchain technology also has a few features like transparency, immutability, and decentralization. It has further changed the face of accounting by providing the means for the secure and instant confirmation of transactions, thus lessening the chances of fraudulent manipulations (World Bank, 2023). Recent studies show how accounting analytics tools have been applied successfully across various domains, including financial statement fraud detection and compliance monitoring (Agostino *et al*., 2022). However, significant barriers remain:

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the complexity of implementation, data privacy concerns, and resource constraints, particularly in the public sector, where institutional frameworks vary widely (Amalia, 2023).

Payroll Accuracy and Challenges in the Public Sector

Payroll is a critical yet challenging aspect of public sector financial management. Public payroll systems have an intricate nature involving diverse employee categories, varying compensation structures, and complex regulatory compliance frameworks. An effective payroll process ensures the employees receive the right compensation in time, a very important factor in keeping the morale workforce and the smooth running of the operations (Cordery & Hay, 2021). The complex nature of the public payroll, however, makes it extremely difficult to be accurate and properly controlled (World Bank, 2023). The problem of decentralization and fragmented payroll processes that have led to data inconsistencies makes this problem even worse (Amalia, 2023). Additionally, the World Bank (2023) brings up manual processes and technological variations as the major issues that not only slow down the reconciliation but also reduce the payroll operations' efficiency in public institutions (World Bank, 2023). Public sector payroll fraud is one of the challenges in the public domain, which includes ghost employees and salary manipulation (Amalia, 2023). Amalia (2023) points out that traditional controls frequently fail in detecting sophisticated fraud, especially in situations that have limited audit capacity and are exposed to evolving threats. This finding is in line with Cordery & Hay (2021), who emphasize that effective payroll fraud prevention requires the promotion of monitoring and verification frameworks Technological issues, such as the dependence on manual processes and scarcity of IT infrastructure, that are often cited as major reasons for the inefficiencies and inaccuracies in payroll, are also present in the public sector (Faruk & Khan, 2022).

Application of Accounting Analytics to Payroll Accuracy and Fraud Detection.

Accounting analytics is a vital instrument to a public sector institution that is in dire need of accurate payroll records and a fraud detection mechanism. The recent breakthroughs in accounting analytics in U.S. public institutions demonstrate the great importance of data analytics in the situation of sensitively and proactively identifying payroll anomalies. The analytic firm, Accru, provides evidence for the same by demonstrating how payroll data analytics can expose the typical anomalies responsively and swiftly such as duplicate employee details, unreasonable and excessive overtime, employees without tax file numbers, and unusual pay rates, all of which are indications that lessen the chances of payroll fraud by means of its early detection (Ravichandran *et al*., 2023).

Artificial Intelligence (AI) and Machine Learning (ML) have made much progress in fraud prediction within payroll and Enterprise Resource Planning (ERP) systems. AI tools analyze vast historical payroll data to find suspicious activity by combining supervised and unsupervised learning techniques for classification and anomaly detection (Saha & Goel, 2023). Machine Learning models, such as classifications and clustering algorithms, have been particularly successful in finding hidden fraud patterns and anomalies in complicated payroll datasets. These models provide ways to safeguard public funds by identifying subtle, odd patterns that are frequently overlooked by manual review (Saha & Goel, 2023). Again, by combining several ML algorithms and neural networks to produce employee fraud risk scores, machine learning techniques enhance payroll fraud detection and increase audit and investigative effectiveness (Singireddy, 2024). Blockchain technology is also gaining traction as a secure and transparent ledger system that can enhance payroll integrity by ensuring immutability of transaction records and enhancing auditability. Blockchain's decentralized nature reduces the risks associated with data tampering and fosters trust among stakeholders (World Bank, 2023). These technologies help with continuous fraud detection in complex public sector payroll systems. Such integration reflects broader digital coordination models that synchronize analytical systems with operational processes across different implementation stages (Torres, F. N. C, 2022).

Challenges and Limitations in Implementing Analytics

While accounting analytics has numerous advantages; it still faces some challenges. The negative sides of such a large-scale implementation are present. The public sector payroll systems have challenges and limitations that prevent them from reaping the full benefits of the implementation (Agnostino *et al*.,

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2020). One primary challenge is data quality and availability (Agostino *et al*., 2022). Data concerning public sector payroll is usually kept separately in various departments, thus resulting in incoherent, incomplete, or even obsolete data. They debilitate the effectiveness of datasets in fraud detection as well as accuracy improvement (Amalia, 2023). Besides that, the absence of standard data formats and protocol integrations for unifying payroll and human resource data for in-depth analysis only adds to the difficulties (Saha, 2024).

Technical infrastructure limitations also play a pivotal role in hindering the adoption of accounting analytics. Most government agencies operate legacy systems with limited interoperability and insufficient computational capabilities, hindering their ability to implement accounting analytics tools such as machine learning or AI effectively (Irani *et al*., 2023).

Another major barrier is organizational culture and resistance to change. Public institutions often exhibit hierarchical structures and a risk-averse culture, which may resist the adoption of some technologies and data-driven processes (Amalia, 2023). The employees could be deficient in the required analytics skills, and if there is no adequate change in management training, the new technologies might be scarcely employed or wrongly applied. This socio-technical friction calls for strategic capacity-building efforts to integrate analytics into payroll workflows effectively (Hund *et al*., 2021). Privacy and ethical concerns also hinder the use of accounting analytics in payroll fraud detection. Handling sensitive employee information demands data protection policies and compliance with regulations. Public entities must balance transparency, accountability, and employee privacy, which sometimes limits the depth of accounting analytics applications (World Bank, 2023). There is also the issue of algorithm bias, which makes it difficult to explain their decisions. Public support for AI is mostly contingent on knowledge and the assurance of human oversight (Lerusse & Van de Walle, 2023). A deliberate poll experiment showed that people become more supportive of new technologies, especially AI, in public sector decision-making, after being educated on its use and understanding that AI would act as a tool to assist, not replace human judgment (Arnesen *et al*., 2025). Finally, financial constraints and competing priorities in public budgeting may limit investment in technology upgrades and hiring accounting analytics specialists (Mergel *et al*, 2021).

RESEARCH GAP

Existing

literature mainly concentrates on the application of accounting analytics within auditing and forensic accounting, emphasizing financial statement fraud detection and post-fraud investigations (Bockel-Rickermann *et al*., 2023). This focus has dominated the specific nuances of proactive payroll fraud detection and prevention, especially in the complex and highly regulated U.S. public sector. Most analytics tools have been implemented in auditing processes with limited adaptability to the uniqueness of the payroll systems (Eilifsen *et al*., 2020). The gap highlights the need for further research that bridges the existing divide between auditing-focused analytics and payroll analytics literature for the public sector (Agostino *et al*., 2022). Bridging this gap will provide policymakers, auditors, and public finance leaders with the necessary insights to enhance payroll accounting and effectively reduce fraud risks in the U.S. public institutions.

Conceptual Framework

The conceptual framework positions accounting analytics as a transformative technology for improving payroll accuracy and enhancing fraud detection in U.S. public sector institutions. The framework assumes that public sector payroll systems are characterized by fragmented legacy infrastructure, large transaction volumes, and stringent regulatory compliance, creating inherent vulnerabilities to errors and fraud (Irani *et al*., 2023). Within this context, accounting analytics technologies such as Artificial Intelligence, Machine Learning, and Blockchain act as enablers that can strengthen internal controls by recognizing patterns in payroll data, identifying anomalies, improving data integrity, and supporting continuous monitoring (World Bank, 2023).

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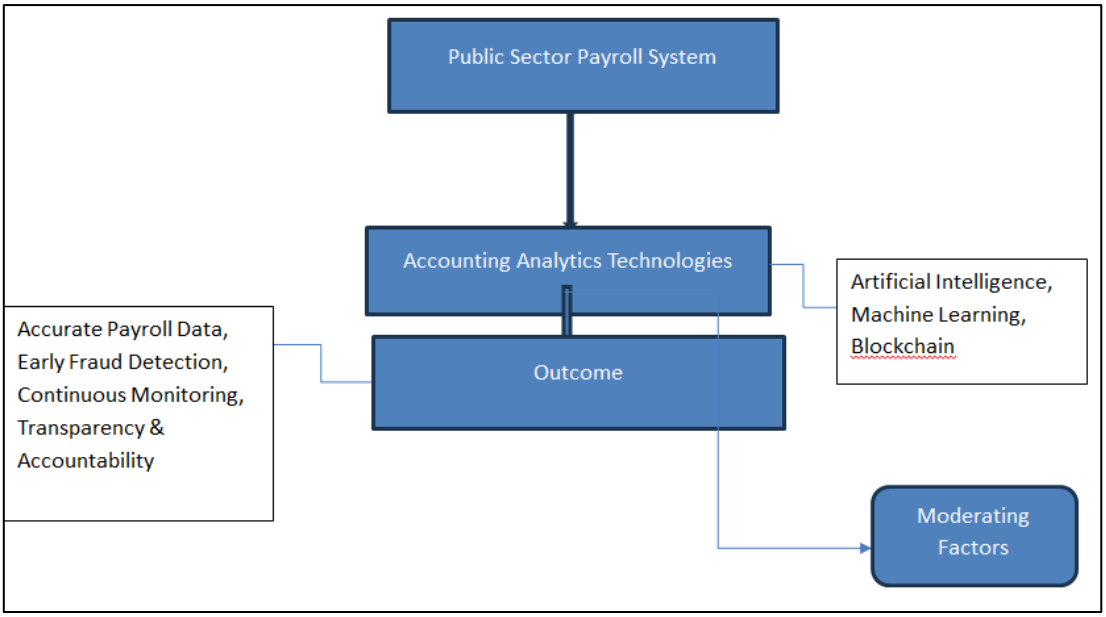

Figure 1: The Conceptual Framework integrates insights from existing literature on accounting analytics, public-sector payroll systems, and fraud detection.

The effectiveness of accounting analytics, however, depends on some organizational and technical factors that influence the quality of data and integration, technical capacity or expertise, legacy infrastructure, organizational culture, or cultural resistance to technological change (Amalia, 2023). Such factors may slow down the scalability for ML deployment and consequently lessen the benefits of analytics. Therefore, the conceptual framework acknowledges that analytics results depend on some technological factors and organizational readiness (Agostino *et al*., 2022). Bullock (2023) argued that the consequences of public payroll system accounting analytics adoption might be increased payroll accuracy, better fraud detection and prevention, and transparency promotion, which is the basis of public accountability.

The conceptual framework shows the relationship between the public sector payroll system, accounting analytics technologies, mediating organizational factors, and payroll governance outcomes. understand how accounting analytics can be leveraged to improve payroll accuracy and fraud detection in U.S. public sector institutions. The research uses a case study and literature synthesis approach, using peer-reviewed journals, government reports, and authoritative sources to develop a comprehensive understanding of current practices, challenges, and technological applications.

Table 1

CMS Fraud Prevention System (FPS)	Predictive Analytics, Anomaly Detection, Prepayment Review	Medicare provider payments (payroll-like disbursements)	AI/ML Intervention	$1.5B prevented in improper payments (2011-2015); 25% of prepayment savings from FPS (West, 2021)
Treasury Office of Payment Integrity (OPI)/ FinCEN FAIS	Real-time Machine Learning, pattern detection	Check fraud (SARs doubled to 680K 2021-2022); money laundering	AI/ML & Anomaly Detection	$375M recovered pre-payment; multiple investigations

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				(Treasury, 2024)
NASWA Integrity Data Hub	Data Mining, Cross-state data integration, duplicate detection	Unemployment insurance payments	Data Mining & Integration	$5B fraud prevented through payroll verification (Cognyte, 2025)
IRS Return Review Program (RRP)	Fraud risk scoring, automation, and AI classification	Tax refund fraud risk assessment	Data Mining	$400M invested; prioritizes high-risk referrals. (West, 2021)
Security and Exchanges Commission - CIRA/ARTEMIS/ATLAS/Form ADV	Algorithmic risk categorization, relational trading analysis	Accounting fraud and insider trading detection	AI/ML	High/medium/low risk classification; investigation prioritization (West, 2021)

Implications for Public Payroll System

The case studies show how accounting analytics can be successfully adopted and integrated to prevent improper payments across high-volume disbursement systems, offering a clear road map for improving accuracy and detecting payroll fraud in the public sector. Centers for Medicare & Medicaid Services(CMS) Fraud Prevention System (FPS), Treasury Office of Payment Integrity (OPI), National Association of State Workforce Agencies (NASWA) Hub, Internal Revenue Service Return Review Program (RRP) and Securities and Exchanges Commission Corporate Issuer Risk Assessment (CIRA) collectively show the effectiveness of accounting analytics intervention; AI/ML, anomaly detection and data mining in addressing challenges identical to public sector payroll systems: large transaction volumes eligibility verification, repetitive cycles and manual review limitation (West, 2021).

Treasury Office of Payment Integrity (OPI)'s real-time machine learning exemplifies the continuous monitoring outcome. In 2023, OPI recovered over $375 million in check-fraud losses using machine learning models and enhanced risk-based evaluation of disbursements (Treasury, 2024). The operational logic is directly transferable, even though the focus is on benefits and refund checks rather than employee compensation: transactions are screened before disbursement to find anomalies that cannot be found through manual review. This approach directly aligns with payroll accuracy objectives by moving oversight from retrospective audits to proactive prevention (Treasury, 2024).

Similarly, the NASWA Integrity Data Hub is a good example of how valuable data integration is in detecting fraud. The hub, through the consolidation of state-level wage, identity, and employment data, can detect duplicate records, fabricated employers, and other indicators of unemployment insurance fraud, with the participating states having saved over $5 billion in improper payments as of September 2025 (Cognyte, 2025). This approach, which combines several data sources with automated anomaly detection, addresses common payroll issues, such as fragmented record-keeping, disjointed HR payroll systems, and limited scalability for identity or eligibility validation, even though it focuses on benefit distribution rather than government payroll. The hub's findings show that when backed by consolidated datasets, even simple analytics produce significant gains (Cognyte, 2025).

Across these cases, institutional and operational factors determine how effective analytics are, rather than just algorithmic details. Governance frameworks that integrated tools into core

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workflows were necessary for real-time screening, and cooperative multi-agency data infrastructure ensured Data integrity. Payroll analytics adoption necessitates simultaneous improvements in data quality, system interoperability, and capacity. These prerequisites highlight the constraints previously discussed: legacy systems, data fragmentation, workforce limitation, and regulatory obstacles (World Bank, 2023). Together, these examples support the central idea of the conceptual framework that analytics interventions, when accompanied by enabling conditions, lead to enhanced public financial transaction integrity.

In summary, though direct payroll evidence remains limited publicly, these cases prove that digital oversight has the capacity to boost accuracy, efficiency, and accountability in high-volume public disbursements.

Discussion & Findings

The analyzed literature and case studies prove that accounting analytics can greatly improve accuracy in payroll and fraud detection in public sector institutions in the United States. Artificial Intelligence (AI), Machine Learning (ML), and blockchain provide the opportunity to detect anomalies, integrate data, and evaluate risks in advance, changing the oversight to the active monitoring of real-time (Udeh *et al*., 2024; World Bank, 2023). Studies of cases like the Treasury Office of Payment Integrity (OPI), CMS Fraud Prevention System (FPS), and NASWA Integrity Data Hub verify the abilities of analytics to manage improper payments through the detection of anomalies that happen before refunds are issued (West, 2021; Treasury, 2024; Cognyte, 2025). Nonetheless, fragmentation of data, old systems, and technical shortages hinder adoption (Amalia, 2023; Agostino *et al*., 2022). These results support the assumption that the efficacy of analytics can be determined by institutional preparedness and data governance. Analytics has provided practical advances to payroll transparency, fraud management, and fiscal accountability when made part of working processes, packaging the concept of public sector payroll as being well-suited to data-driven accountability (Huda & Jatmiko, 2025).

Recommendations

The findings of the study suggest that accounting analytics can be leveraged to strengthen payroll oversight within public sector institutions.

Prioritize Payroll Data Integration Across HR and Finance Systems

The NASWA Integrity Data Hub is a perfect example of how important it is to integrate data as the basic enabler of analytics. Decision-makers and finance executives should put into action a phased plan for payroll data integration, which should end with the formation of unified and analyzable databases. These databases should allow the cross-matching of employee identity, employment history, attendance, position classification, and payment details. As a result, this will facilitate duplicate detection, stop ghost employees, flag the improper overtime allocation, and make pattern analysis possible, which directly deals with the data quality and system integration challenge.

Develop Risk-Scoring Models for Payroll Audit Prioritization

IRS RRP and SEC CIRA are good examples of how risk-based prioritization can make the best use of limited audit resources by exposing fraud cases with high probabilities. The suggestion is to develop matrices for employees or department-level risk scores that would include these sorts of indicators, like typical overtime trends, quick changes in pay scale, irregular grade progression, sectors with high staff turnover, or the presence of long-term stagnant salaries. Such a system will allow exhaustive analysis of the entire population instead of just random sampling, which is a direct way of facilitating the Early fraud detection framework outcome, and at the same time, it deals with the technical capacity issue.

Strengthening Internal Analytics Capabilities by Providing Targeted Training

Human capacity is pinpointed as the most important factor by all case studies in the translation of analytical outputs into actionable oversight. Entities are advised to allocate funds for compulsory training programs that aim at enhancing the competencies of payroll and audit staff in the areas of data interpretation, anomaly analysis, and risk evaluation. Appoint analytics experts to be part of the internal and financial management teams, thus forming centers of excellence, on which NASWA governance structures can serve as a model. This move will tackle the technical capacity and skills moderator by making sure that the staff members can put the analytics into practice effectively.

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Creating Well-defined Governance Structures for Using Data, Ensuring Privacy, and Ethical Decision-Making

Payroll information is personal data about employees. To adopt analytics responsibly, public institutions need to be certain that they abide by privacy regulations, collective-bargaining agreements, and ethical standards. The examples of the Treasury and NASWA both show that they function under clearly defined governance arrangements that facilitate data sharing within regulated boundaries. It is highly recommended that institutions come up with agency-specific policies that will regulate access, retention, sharing, and ethical use of payroll data. These regulations ought to strike a balance between transparency and privacy, thereby making it possible for accounting analytics to be a tool of legitimate oversight, and at the same time, not posing any threat to the employees' rights. Institutions are encouraged to put role-based access controls, audit trails, and continuous compliance monitoring, like CMS FPS governance**.**

CONCLUSION

This research focused on the utilization of accounting analytics to increase accuracy in payroll and how the fraud detection process operates in U.S. public-sector organizations. Analogous applications in payment environments were found in the study. The review demonstrates that certain public organizations have already registered substantial gains from monitoring analytics, high-volume, and rules-based disbursement systems. These observations imply that many of the technical skills, organizational preparations, and governance mechanisms that render analytics effective in these contexts apply to payroll systems. The review identified continuing challenges to the implementation of accounting analytics in public finance.

Fragmented HR and payroll data, legacy system limitations, a lack of finance and audit capabilities, and an organization that isn't ready for change are just a few examples. The presented case studies also demonstrated that functional capacity exists, but technology cannot provide stronger controls on its own without integrated data environments, strong governance frameworks, and an institution's commitment to changing processes. The case study further indicated that accountancy analytics holds the promise to move public sector financial management from rear-view reflection of auditing to forward-leaning prevention.

Overall, the existing evidence of cases strongly supports that payroll will benefit from the use of accounting analytics.

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