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Intellectualization of public sector financial resource management: analytical tools and efficiency models

Abstract. The study examines the intellectualization of public financial management through the integration of Big Data, machine learning, and graph neural networks. These tools enable proactive risk forecasting, improve budget accuracy, and enhance real-time anomaly detection, forming a new paradigm of fiscal transparency, discipline, and strategic efficiency.

Problem statement. Traditional public finance management approaches no longer meet the demands of fiscal complexity and transparency, requiring the adoption of intelligent models based on Big Data, machine learning, and graph neural networks to enable proactive risk forecasting and improve budgeting efficiency.

Unresolved aspects of the problem. Key challenges in intelligent public finance management include the lack of an integrated AI model, "black box" transparency issues, outdated IT systems, poor data quality, and insufficient institutional capacity, revealing critical knowledge gaps for further research.

Purpose of the article. The article aims to scientifically justify and develop methodological foundations for the intellectualization of public financial management to address identified systemic challenges and gaps.

Presentation of the main material. The article develops a conceptual framework for intellectualized public financial management, integrating GNNs for anomaly detection and ML for accurate budget forecasting across the fiscal cycle. Explainable AI principles ensure transparency, complemented by strategic recommendations for IT modernization, data quality, and digital competency development.

Conclusions. The study proposes a new paradigm of public finance efficiency through analytical integration, algorithmic forecasting, and transparency, with the Intelligent Financial Governance model enabling modernization, digital audit, and risk-based monitoring to enhance fiscal stability and long-term economic resilience.

Keywords: *Intelligent Financial Management, Public Financial Governance, Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, Cognitive Analytics, Data-Driven Decision-Making, Digital Transformation, Fiscal Transparency, Efficiency Modeling.*

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Introduction. The contemporary development of national economies is characterized by increasing complexity of financial flows and growing demands for efficiency in public sector resource management. In this context, ensuring the rational use of financial resources under governmental control and optimizing budget planning, monitoring, and reporting processes becomes particularly relevant. Despite numerous regulatory acts and methodological guidelines, public financial management often faces challenges such as insufficient transparency, low adaptability to changes in the macroeconomic environment, and limited capacity to forecast the outcomes of managerial decisions.

The general problem lies in the need to develop management models and procedures that provide high-level analytical support, prompt decision-making, and optimal utilization of public finances. Traditional approaches, largely based on centralized control and routine administrative procedures, are increasingly inadequate for the requirements of the digital economy and open governance.

The relevance of this research is driven by the transition of the public sector toward intelligent management models that integrate analytical tools, predictive models, and information technologies, enhancing the efficiency of financial planning and utilization, minimizing risks, and ensuring transparency in management processes. The implementation of intelligent systems in public financial management also opens new opportunities for improving the quality of the budget process, establishing reliable performance indicators, and optimizing managerial decisions at various levels.

Thus, investigating the intellectualization of public financial resource management is not only scientifically pertinent but also crucial for the practical promotion of efficient and transparent use of budgetary funds, fostering sustainable economic development and increasing public trust in financial institutions.

Literature Review. Over the past decades, public financial management (PFM) has undergone significant transformations driven by the advancement of information technologies. In particular, the proliferation and enhancement of Financial Management Information Systems (FMIS) have created a foundation for integrating new technological approaches, including analytical tools, business intelligence, Robotic Process Automation (RPA), and Artificial Intelligence (AI). Unlike revolutionary changes, AI in PFM represents a logical continuation of technological evolution, aimed at improving the efficiency of existing processes and tools rather than creating entirely new financial management models [10].

The current use of AI in public financial management primarily focuses on optimizing existing processes, automating routine tasks, and supporting decision-making through the analysis of historical and real-time data. Machine learning (ML) methods are applied for macroeconomic and macro-fiscal forecasting, budget planning and monitoring, expenditure management, financial reporting, and stakeholder engagement. International experience, including Sweden, South Korea, Australia, and France, demonstrates that AI can enhance forecast accuracy, accelerate decision-making, and increase transparency in financial management, while requiring clear control and interpretability of results [10].

Modern PFM increasingly relies on Big Data as a key resource for the intellectualization of financial management. The World Bank report BIG DATA in ACTION for GOVERNMENT [17] emphasizes that Big Data is not only about volume but also the use of unconventional data sources—such as sensor data, social media information, and geospatial indicators—for informed decision-making in the public sector. In financial management, this enables a shift from classical accounting approaches to predictive analytics, integrating economic and social indicators into financial management and budget planning models.

A central analytical tool involves using ML algorithms to detect anomalies in financial data, particularly in transactions and public procurement records. Such models automate the detection of fraud, financial abuse, and discrepancies, enhancing digital audit efficiency and reducing financial losses. Automated multi-level data validation allows tracking of financial, tax, and procurement

operations at different governance levels, isolating cases requiring human intervention. This reduces bureaucratic delays and accelerates internal processes in public financial control.

Predictive policy and resource optimization models play a critical role in enhancing PFM efficiency. Big Data analytics enables "Smarter Policymaking" by providing frequent and detailed political and financial insights, making budget planning more economically justified. Data-driven algorithms help identify operational bottlenecks in financial flows, reducing delays and speeding up resource delivery to beneficiaries. The shift toward results-oriented management allows financial decisions to be continuously adjusted based on actual performance, ensuring the achievement of national and global objectives.

Intellectualization of financial flows and accountability is facilitated by transforming public procurement processes and tracking financial resources. Analytical tools detect collusion, money laundering, and inefficient contracts by analyzing relationships between suppliers and transactions. Moreover, using Big Data to assess citizen sentiment and engagement enhances government accountability and public trust. Analytical dashboards for transparent financial information display are an essential component of intelligent governance, supporting public oversight of resource use.

The World Bank report demonstrates that Big Data acts as a catalyst for transforming PFM, enabling a shift from reactive, historical-report-based management to proactive, predictive approaches grounded in real-time data and algorithmic risk assessment. The intellectualization of public financial resource management directly results from the implementation of such analytical tools, enhancing fiscal discipline and the effectiveness of social programs.

The CIPFA report Harnessing AI in Public Finance: Opportunities and Challenges [2] emphasizes that AI transforms traditional PFM processes through automation, predictive analytics, and improved fraud detection. Automation of routine tasks—including financial reporting, invoice processing, and management of payables and receivables—allows financial professionals to shift from operational work to strategic analysis, directly improving public sector efficiency.

Predictive analytics is a key tool for intelligent budgeting, as AI models can forecast budget trends, service demand, and financial risks with high accuracy. This supports a transition from reactive management based on past data to proactive, forward-looking approaches aligned with the concept of intelligent financial management. Additionally, ML and deep learning for anomaly and potential fraud detection (e.g., in the UK Department for Work and Pensions case) demonstrate practical applications of AI efficiency models, reducing financial losses and enhancing fiscal discipline.

Beyond technical capabilities, CIPFA highlights a shift in focus for public finance professionals toward strategic tasks. Automation enables specialists to concentrate on strategic planning, policy analysis, and data-driven decision-making, creating a new competency model in the financial sector and increasing strategic management effectiveness. Early problem detection through AI further reduces long-term service demand and strengthens financial resilience, integrating sustainability as a key performance indicator of intelligent governance.

However, CIPFA identifies several challenges in AI adoption within the public financial sector. Key obstacles include outdated IT systems, low-quality data, shortages of qualified personnel, and ethical and legal issues related to algorithmic decision-making. This underscores that intellectualization of financial resource management requires not only technological innovation but also investment in data development, human capital, and adaptation of the regulatory framework.

Thus, CIPFA [2] demonstrates that integrating AI into public sector financial management simultaneously enhances efficiency, forecast accuracy, and transparency, while requiring a comprehensive approach to addressing technical, organizational, and ethical challenges. This integration enables the formation of a new paradigm of intelligent governance, combining automation, analytical depth, and strategic vision for financial process development.

The current evolution of intellectualized public financial management is largely driven by AI implementation for real-time monitoring and auditing. According to KPMG’s analysis Transforming Public Finance: The Role of Artificial Intelligence (AI) in Fiscal Transparency [8],

AI enables a shift from traditional periodic audits to continuous monitoring of fiscal flows, allowing real-time tracking of revenues and expenditures. A key analytical tool in this context is the immediate identification of discrepancies, such as delays, misallocated funds, or potential diversions.

Risk-based digital audit models, trained on historical data, prove particularly effective, detecting anomalies such as fictitious beneficiaries, duplicate claims, or artificial transactions with high precision. This approach supports proactive auditing by focusing human resources only on high-risk cases, significantly improving the efficiency of financial oversight.

From an efficiency perspective, AI supports smarter resource allocation by integrating data from various sectors, including social, economic, and geospatial indicators. This allows real-time forecasting of needs and performance, minimizing inefficient or excessive funding, and maximizing social impact per budget unit. Swift corrective action mechanisms automatically route alerts to responsible agencies, enabling rapid response and significantly reducing financial losses. Here, response speed becomes both a measure of management efficiency and a tangible benefit of intelligent systems.

Transparency and accountability are also central to intellectualization. AI enables "Opening the Books to Citizens," transforming complex financial data into comprehensible dashboards and interactive assistants using natural language processing (NLP) and data visualization technologies. This facilitates public access, builds trust, and strengthens accountability. In the long term, AI-driven financial management redefines the government–citizen relationship (Redefining Governance), laying the foundation for Smart Governance, where transparency, accountability, and efficiency are integrated features of intelligent governance.

KPMG [8] illustrates that AI application in public financial management goes beyond automation and forecasting, creating conditions for strategic, transparent, and accountable management of financial resources, which is central to modern PFM intellectualization.

The IMF report Digitalization of Public Financial Management (PFM): Analytical Tools and Implementation Strategies [14] emphasizes that modern intellectualization requires the deployment of a new generation of digital systems. Integrated Financial Management Information Systems (IFMIS 2.0) have evolved from traditional accounting platforms into "smart" systems capable not only of recording transactions but also performing analytical processing and forecasting, integrating Big Data and AI tools. This approach lays the foundation for transitioning from passive bookkeeping to active, intelligent management of financial flows.

The IMF highlights analytics for ensuring fiscal sustainability. Predictive models allow assessment of long-term risks, such as population aging, climate change, or public debt, enabling data-driven and scenario-based decision-making. Consequently, efficiency models for intelligent governance must incorporate fiscal sustainability indicators alongside traditional short-term efficiency metrics.

Digital tools are also actively applied to optimize tax administration and customs processes. Big Data algorithms detect tax evasion and improve revenue collection efficiency, directly affecting budget revenues and macro-financial stability. This exemplifies an analytical tool that combines technological capability with practical implications for financial management.

Regarding efficiency models, the IMF emphasizes a holistic approach to implementation. PFM digitalization should not be treated as an isolated IT project but as an institutional reform program encompassing process modernization, legal framework updates, and personnel competency development. Effectiveness is achieved only when AI analytical tools are integrated across all stages of the budget cycle—planning, execution, control, and reporting.

High-quality data is a critical prerequisite for any intelligent model. The IMF stresses that structured, reliable, and integrated data is essential for predictive algorithms and analytical models, and without it, even the most advanced digital systems will be ineffective.

Finally, the IMF recommends the use of Impact Assessment Frameworks to measure PFM digitalization effectiveness across three key indicators: fiscal discipline (deficit reduction), strategic

resource allocation (alignment of expenditures with priorities), and operational efficiency (task completion time reduction). These metrics serve as primary indicators of intelligent financial management and provide an objective basis for managerial decision-making.

Recent literature increasingly emphasizes that digital transformation of public governance creates conditions for a new stage of financial accountability—intellectualized accountability. According to Aldemir and Uçma Uysal [1], AI application in public sector financial management opens strategic opportunities for enhancing transparency, reducing corruption risks, and ensuring good governance. Specifically, AI technologies based on ML and NLP enable the analysis of large volumes of unstructured data—contracts, memoranda, audit reports, or financial statements—to identify hidden obligations, conflicts of interest, or inefficiencies in internal control.

Thus, the intellectualization of financial management transforms the very essence of financial accountability: from formal compliance (proper documentation) to substantive transparency, where the analysis focuses not only on procedural adherence but also on socio-economic effectiveness. This approach establishes an efficiency model based on substantive accountability, analytical transparency, and evidence-based decision-making.

Another key aspect of effective intelligent governance is Transparent Algorithmic Governance. AI integration into public sector management must be accompanied by ethical frameworks and oversight mechanisms for algorithmic decisions. Explainability of AI models is a critical trust factor, enabling supervisory bodies to understand the logic behind financial resource allocation and utilization decisions. The combination of automation and human oversight creates a new efficiency model—a "shared accountability" model—where responsibility is distributed between algorithms and humans, but ultimate decisions remain with humans as ethical agents.

Overall, the literature indicates that the intellectualization of financial management extends beyond technological process upgrades, forming a new paradigm of public accountability. It is grounded in the integration of AI analytical tools, ethical algorithmic governance, and a shift from administrative formalism toward substantive effectiveness and societal value of financial decisions.

According to Tveita, L. J., and Hustad, E. [15], the core value of artificial intelligence in the public sector lies in its ability to create intelligent management processes based on automation, analytical reasoning, and forecasting. A primary application is administrative automation, which optimizes routine operations such as invoice processing, financial reporting, and budget monitoring. AI algorithms reduce staff workload and enhance data accuracy, freeing human resources for analytical, strategic, and predictive activities, which directly embodies the essence of financial management intellectualization.

Another crucial aspect is providing predictive insights. By leveraging historical financial data and modern machine learning (ML) methods, AI enables accurate forecasting of fiscal trends, identification of potential risks, and development of budget scenario models. This transforms financial management from a reactive to a proactive system, enhancing budget planning accuracy, supporting evidence-based financial decisions, and laying the foundation for intelligent public financial resource management.

Tveita and Hustad [15] emphasize that intellectualization of public management is impossible without efficiency models that ensure rational resource allocation and rapid decision-making. A key AI function is optimized resource allocation, where algorithms analyze funding flows, policy priorities, and expected social outcomes to propose optimal budget distribution scenarios. This creates an efficiency model aligning expenditures with societal needs and program outcomes, minimizing ineffective or misallocated spending.

A second efficiency dimension is improved decision-making. AI accelerates management processes while ensuring evidence-based and logically consistent decisions, reducing subjectivity. In financial management, efficiency metrics should include not only resource savings but also speed, transparency, and justification of decisions, thereby strengthening strategic oversight and trust in outcomes.

Tveita and Hustad [15] also highlight that the effectiveness of financial management intellectualization depends on ethical and regulatory frameworks. Transparent algorithms, avoidance of discrimination, and fair resource allocation are essential. The concept of Responsible AI ensures a balance between automation and human oversight, as well as between efficiency and social equity.

Trust and HR management constitute another critical challenge. For AI to function effectively in public financial management, trust in algorithms must be cultivated among both administrators and citizens. This requires developing digital competencies of public servants, enabling them to interpret AI outputs and make informed decisions based on analytical insights. Successful implementation of intelligent financial systems thus requires not only technological innovation but also institutional readiness and cultural adaptation to a data-driven, analytical, and accountable management paradigm.

Current trends in public financial management indicate a shift from traditional, compliance-oriented systems toward analytical and cognitive models. As noted by V. Pamisetty [12], the concept of Intelligent Financial Governance (IFG) is defined as a strategic framework integrating AI, machine learning, and analytical modeling to deepen understanding of interdependencies between accounting, budgeting, and financial flows in the public sector. This allows a transition from descriptive management to analytically oriented governance, emphasizing proactive forecasting and adaptation to uncertainty.

From an efficiency perspective, IFG establishes an adaptive decision-making environment capable of converting disparate financial data into structured knowledge. Its effectiveness, according to Pamisetty, is measured not only by processing speed but also by the ability to reduce cognitive uncertainty in policy formulation. Therefore, IFG serves as an analytical foundation for a systematic approach to public sector financial management, reflecting the shift from reactive control to intelligent forecasting.

Given that public sector financial management is predominantly forecast-oriented, AI and ML algorithms play a leading role in developing intelligent governance. Pamisetty [12] emphasizes that these technologies improve budget forecasting accuracy by incorporating both historical data and real-time economic changes.

The application of AI/ML in analytical systems enables fiscal impact analysis, quantitatively assessing the effects of budgetary decisions on macroeconomic parameters, social programs, and institutional financial resilience. This creates a “reflexive cycle,” where forecast results are used to adjust future strategies, forming a closed learning system for management. In the context of efficiency models, this supports a transition to intelligent governance, where predictive models not only anticipate future trends but also simulate the consequences of management decisions.

Despite the high effectiveness of analytical tools, IFG faces challenges related to the volatility of financial variables and the absence of universal forecasting patterns. Pamisetty [12] notes that public sector financial systems are highly stochastic, making the creation of a “universal forecast model” unlikely. This necessitates flexible, self-learning systems that continuously adapt to new data while avoiding “black-box” models lacking explainability.

Accordingly, the efficiency model developed in this study emphasizes the combination of intelligent analytics with explainable AI principles, ensuring transparency of managerial decisions and enhancing trust in automated financial forecasting systems. Empirical support for this concept is provided by Pamisetty’s case studies in public institutions in Northern Italy, where AI model implementation reduced budgetary risks and improved fiscal accuracy.

In contemporary research on the intellectualization of financial management, the concept of Dynamic Graph Modeling occupies a central role, as it enables the representation of financial flows as a complex, interconnected system. According to Rasul, I., Shaboj, S. M. I., Rafi, M. A., Miah, M. K., Islam, M. R., & Ahmed, A. [13], financial transactions can be represented as a dynamic graph, where nodes represent entities involved in financial relationships—such as users, accounts, organizations, or institutions—and edges capture interactions between them in the form of

transactions. This approach allows for the detection of structural dependencies that remain hidden under traditional, isolated analyses.

For the public sector, particularly in the management of state finances, this method is highly relevant. Modeling public financial flows—procurements, social payments, grants—as dynamic graphs allows for the identification of hidden networks of interdependent entities, such as intermediary companies, shell suppliers, or affiliated beneficiaries. Consequently, analytical tools based on graph models enhance financial transparency, detect inefficient or fraudulent schemes, and strengthen fiscal trust systems.

A pivotal role in this process is played by Graph Neural Networks (GNNs), which can model not only individual transaction features (amount, time, type of operation) but also the context of interactions within the entire financial system. GNNs learn from the network structure among nodes, generating latent embeddings that capture behavioral and structural patterns. This enables the identification of atypical behavior patterns, including "fraud rings" or anomalous fund flows, which may indicate financial misconduct.

To improve the efficiency of anomaly detection, Rasul et al. [13] propose combining GNNs with unsupervised anomaly detection algorithms, such as Isolation Forest or Local Outlier Factor (LOF). These methods assess the anomalous nature of transactions without requiring pre-labeled data, which is crucial in the public sector where information on fraudulent operations is typically limited or unavailable. Such an architecture creates an adaptive system capable of autonomously detecting novel, previously unknown financial abuse schemes that evolve over time.

One key performance criterion of the model, according to Rasul et al. [13], is high precision with a low false positive rate. The hybrid GNN model achieved an F1-Score of up to 0.905, significantly outperforming traditional fraud detection algorithms. In public financial management, this aspect is critical: excessive blocking of legitimate payments can cause operational delays and undermine trust in institutional processes. Thus, the model must balance reliable control with the uninterrupted flow of financial transactions.

Rasul et al. [13] also emphasize real-time performance. The proposed architecture can process over 770 transactions per second, making it suitable for high-load public financial systems. In the context of state financial administration, this allows a shift from reactive monitoring to preventive management, i.e., detecting and blocking suspicious operations before they are completed.

Moreover, the use of Temporal Graph Networks (TGN) incorporates temporal awareness, capturing the evolution of behavioral patterns of entities over time. This not only allows the detection of current anomalies but also predicts the likelihood of "suspicious" activity evolving into "fraudulent" behavior in the future. In public financial management, such functionality forms the basis for a risk prediction model that integrates temporal dynamics with structural interdependencies among financial actors.

Thus, the approach proposed by Rasul et al. [13] demonstrates that applying GNNs and unsupervised anomaly detection methods in public financial management systems represents one of the most promising directions for the intellectualization of financial flow monitoring. Its main advantage lies in combining analytical depth, real-time responsiveness, and high adaptability to the changing behavior of financial agents.

In the context of financial management intellectualization and enhancing public sector transparency, Big Data technologies play a crucial role. Dei, H. [3] emphasizes that the large volume, diversity, and high velocity of data require specialized analytical tools beyond traditional statistical methods. This creates a foundation for AI applications capable of processing massive datasets in real-time and detecting hidden patterns that remain unnoticed using classical approaches.

The synergy of Big Data and AI forms the basis of a new paradigm of intelligent governance, where data is not merely a record but an active resource for forecasting and strategic analysis. Dei [3] highlights the growing importance of analytical software, reflecting a global trend toward technological support for management processes. A key consideration is the data-as-

products approach, which involves constructing efficient pipelines for data collection, processing, and management to enhance quality and avoid redundancy.

At a practical level, efficiency models based on Big Data and AI manifest in transparency, forecasting, and control. Dei [3] cites Ukraine as an example, where open data platforms such as ProZorro (public procurement) and e-Data (public finance) serve as efficiency models. They enhance process transparency, automate operations, and reduce the risk of corruption.

Big Data also improves evidence-based decision-making. Data analytics enables trend prediction, assessment of policy impacts, and rapid response to changes, which is critical for strategic budget and financial flow management. Additionally, resource optimization is achieved as analytical systems identify excessive spending and redirect resources to more effective uses, directly contributing to cost savings and increased social returns.

An important element of efficiency models is combating financial fraud. Dei [3] highlights the UK experience through the Public Sector Fraud Authority, where Big Data is used to prioritize high-risk areas and automatically detect fraudulent activities, ensuring not only financial control but also the recovery of taxpayer funds—a key indicator of management effectiveness.

Overall, Dei [3] proposes a transformational pathway for e-governance, integrating IoT, Blockchain, and Big Data under the principles of "digital by default" and "interaction by default." This approach not only optimizes government expenditures but also establishes the foundation for a transparent, effective, and innovative public administration system.

Thus, the integration of Big Data and AI in the public sector enables the development of next-generation analytical tools and efficiency models focused on transparency, control, forecasting, and resource optimization, forming an essential component of financial management intellectualization and the construction of Smart Governance systems.

In his study, S. Krynytsia [9] emphasizes the strategic aspects of digitalizing public financial management in Ukraine, which is crucial for establishing the theoretical and methodological basis for future intellectualization of management processes. The author provides a thorough analysis of existing strategic documents, including the Digital Development Strategy until 2025, noting that the current phase of public sector digital transformation focuses primarily on digitization and process automation. This approach only creates a basic digital infrastructure, without encompassing deeper processes of digital transformation and intellectualization.

The lack of focus on implementing intelligent technologies—particularly AI, machine learning, and Big Data analytics—is identified as a major limitation of current strategies. According to Krynytsia, these strategies merely form the "prerequisites for digital maturity" but do not advance it to the level of an intelligent decision-making system in public finance. Without moving from automation to intelligent analytical tools, the state cannot achieve sustained improvement in financial resource management efficiency.

In this context, the scholar proposes Model-0, representing the basic stage of digitalization: transitioning to a paperless environment, establishing unified electronic document workflows, centralizing IT management, and enabling inter-agency data exchange. This stage provides the foundation for Model-AI, which entails the introduction of intelligent technologies based on centralized, high-quality data streams. Completing basic digital transformation is a prerequisite for the effective operation of AI systems capable of supporting analytical decision-making, trend forecasting, and real-time financial risk monitoring.

Accordingly, Krynytsia [9] asserts that the intellectualization of public financial management should become a strategic imperative post-2025, focusing not only on technological upgrades but also on creating intelligent decision-support systems grounded in data, analytics, and automated predictive models. The rapid advancement of digital technologies necessitates accelerated adoption of intelligent tools to enhance transparency, controllability, and efficiency in public financial resource management.

In this regard, Krynytsia's findings [9] complement the conceptual framework of this study, providing theoretical justification for the transition to an intelligent public sector financial management model, where AI/ML technologies and Big Data analytics play a pivotal role.

B. V. Dzyundzuk [4] examines the integration of Big Data, AI, and blockchain in public administration, marking a significant step toward establishing an intelligent ecosystem in the public sector. The author emphasizes that these technologies are not self-sufficient; their true potential emerges through their combined application, where each reinforces the others. Specifically, Big Data provides an informational foundation for decision-making; AI transforms raw data into predictive models and analytical insights; blockchain ensures transparency, authenticity, and security of data throughout management processes.

A major contribution of this work is demonstrating that combining Big Data and blockchain enhances the security and integrity of large datasets. Simultaneously, the integration of Big Data and AI converts unstructured information into value-added data, which can be directly used for policy formulation, implementation, evaluation, and research. This approach establishes the basis for data-driven governance, where managerial decisions are evidence-based and informed by predictive models rather than intuition or political motives.

The author further highlights that combining blockchain and AI enables the creation of Decentralized Autonomous Organizations (DAOs), where AI algorithms operate within a transparent blockchain environment. This opens opportunities for new public governance models based on automated smart contracts and trust-based transactions among government entities, businesses, and citizens.

Practically, Dzyundzuk [4] identifies areas where these technologies already demonstrate potential: policy formulation (via social and public opinion analytics), policy implementation (through resource allocation modeling and cost optimization), and policy evaluation (through forecasting the impacts of management decisions). The author also emphasizes the need for developing new governance mechanisms, transforming organizational culture, and addressing the tension between automation and the human factor—challenges inherent in public sector intellectualization.

Thus, Dzyundzuk's work [4] establishes an important scientific and methodological foundation for understanding the role of intelligent analytical systems in the future development of public administration. For this study, it confirms the premise that effective management of public sector financial resources requires not merely digitalization but systemic intellectualization, in which Big Data, AI, and blockchain function as interconnected components of a unified analytical decision-making infrastructure.

Synthesizing the literature review presented above, it can be concluded that contemporary scholarly and analytical consensus recognizes the intellectualization of financial management in the public sector as the next evolutionary stage of Public Financial Management (PFM). This process is grounded in the integration of Artificial Intelligence (AI), Big Data analytics, Machine Learning (ML), and next-generation information systems (IFMIS 2.0), which collectively form the foundation of Intelligent Financial Governance.

The overarching trend reflects a shift from reactive to proactive management, whereby financial decisions are made based on predictive models, analytical insights, and real-time risk assessment. The application of AI in PFM encompasses the automation of routine processes, analytical modeling of budget scenarios, risk-based digital auditing, and forecasting of revenues and expenditures. Consequently, a new type of public accountability emerges—intellectualized accountability, which prioritizes not only formal procedural compliance but also substantive transparency, effectiveness, and the social value of financial decisions.

International reports from leading organizations (OECD, World Bank, CIPFA, KPMG, IMF) emphasize that AI represents not a revolution but a logical continuation of the digital evolution of financial management, enhancing the accuracy of forecasts, the speed of decision-making, and the level of fiscal discipline. At the same time, they stress that the effectiveness of

intellectualization is contingent upon high-quality data, ethical algorithmic governance, a well-prepared workforce, and modernization of the regulatory framework.

Contemporary researchers place significant emphasis on analytical efficiency models that integrate technical, organizational, and ethical dimensions. Key criteria include:

Fiscal sustainability (balance of revenues and expenditures, deficit reduction);

Operational efficiency (automation, reduction of procedural execution time);

Strategic adaptability (forecasting needs and risks);

Accountability and transparency (open data, explainable AI);

Ethical responsibility and public trust.

Thus, the literature review confirms that the intellectualization of financial management in the public sector is not merely a technological upgrade but a systemic institutional transformation. It redefines the role of financial managers, emphasizes strategic thinking, and enhances the overall efficiency of public finances. This process establishes a new paradigm of Smart PFM, where the interaction between analytical tools, human oversight, and transparent algorithms forms the foundation for effective, sustainable, and ethical governance of public resources.

Purpose, Objectives, and Research Methods. The purpose of this study is the theoretical substantiation and development of scientific and methodological foundations for the intellectualization of financial resource management in the public sector through the integration of next-generation analytical tools—specifically Big Data, Artificial Intelligence (AI), and Machine Learning (ML)—into the managerial decision-making system. This approach is intended to enhance the efficiency, transparency, and adaptability of public financial management amid digital transformation and the increasing informational complexity of budgetary processes.

To achieve this purpose, the study addresses the following objectives:

Conduct a systemic analysis of the current state of digitalization and identify the limitations of existing public financial management strategies in Ukraine and globally;

Identify key analytical tools for intellectualization that enable the transition from automation to intelligent management (AI, ML, Big Data, cognitive analytics);

Develop an efficiency model for public sector financial resource management that incorporates intellectual decision-making factors, transparency, and risk orientation;

Assess the potential impact of implementing intelligent technologies on financial performance, accountability, and fiscal stability;

Propose methodological guidelines for the development of a national strategy for the intellectualization of public financial management post-2025.

The study employs system-analytical, comparative, structural-functional, economic-mathematical, and predictive methods.

The system-analytical method was applied to comprehensively study the logic of evolution of digital financial management strategies, their structural components, and the interrelationships among institutional, technological, and managerial elements.

Comparative analysis allowed for juxtaposing approaches of different countries in implementing intelligent tools within public finance and identifying common patterns of success.

The structural-functional approach enabled an examination of the role of analytical technologies in transforming public financial management functions—from accounting and control to predictive and analytical functions.

Economic-mathematical methods and elements of modeling were used to construct a generalized efficiency model of intellectualized financial resource management.

The predictive method was applied to evaluate the potential outcomes of transitioning to a data- and algorithm-driven intelligent governance model.

The informational basis of the study included normative and legal documents of Ukraine and the EU, strategic reports of international organizations (OECD, IMF, World Bank), analytical reports of leading consulting companies, as well as contemporary scholarly works on digitalization and artificial intelligence in public administration.

Research results. The results of the conducted systemic analysis indicate that the process of digitalization of public financial management in Ukraine is still at an emerging stage, characterized by fragmented digital initiatives, a low level of integration of information systems, and limited application of intelligent analytical technologies. Despite the presence of several successful digital projects, such as "E-Data," "Prozorro," and "OpenBudget," their operation is primarily focused on ensuring transparency and openness of data rather than creating an intelligent system for managing financial resources.

Analysis of strategic documents—specifically, the Strategy for Digital Development of Innovation Activities of Ukraine until 2030 [18] and the Concept for the Development of E-Government [19]—revealed a lack of a clear methodology for implementing analytical tools based on Big Data and Artificial Intelligence in the areas of budget planning, public auditing, and monitoring expenditure efficiency.

In contrast, international practices, particularly in the EU, Canada, South Korea, and Singapore, demonstrate that digitalization of financial management is based on the principles of data-driven governance, where analytical decisions are automatically integrated into management processes and form the basis for predictive modeling of budgetary risks.

To systematize the findings obtained during the study, a comparative table (Table 1) was constructed, reflecting the main characteristics of digitalization strategies in public financial management in Ukraine and selected foreign countries.

Table 1. Comparative Characteristics of Digitalization Strategies in Public Financial Management

Indicator / Country	**Ukraine**	**Estonia**	**South Korea**	**Canada**	**EU (average)**
Level of integration of financial information systems	Partial, non-standardized	Full integration of state registries	Centralized digital platform	High interoperability	High
Use of Big Data for budget decision analysis	Limited, pilot projects	Continuous use	Yes, in fiscal monitoring	Yes, in social programs	Yes
Application of AI in financial decision-making	Minimal, experimental	Used for forecasting and risk analysis	Integrated into budget planning	For expenditure efficiency analytics	Systematic
Data openness and transparency	High, but unsystematic	Very high	High	High	High
Existence of a national concept for intelligent financial management	Absent	Yes	Yes	Yes	Yes

Source: compiled by the author based on [5; 6; 7; 11; 16]

The analysis of empirical data allows us to conclude that the key limitations of the current digitalization strategy for public finance management in Ukraine are:

the absence of a unified, integrated analytical platform that consolidates data from budgetary, tax, audit, and statistical systems;

insufficient analytical competence within the public sector, manifested in a limited understanding of the potential of data analytics in management processes;

weak regulation of Big Data usage in the public sector and a low level of legal and regulatory readiness for the application of artificial intelligence;

the lack of an effective interagency interaction model, which complicates data exchange between government institutions;

a low level of automation in decision-making processes, with a predominance of manual analysis and traditional accounting approaches in planning.

Comparative analysis also revealed that in countries with a high level of digital maturity in public administration (Estonia, South Korea, Canada), the intellectualization of financial resource management is based on three key principles:

Integration of analytical systems: combining budgetary, macroeconomic, and social data within a unified digital environment;

Algorithmic forecasting: using machine learning models to assess budgetary risks and determine the optimal expenditure structure;

Continuous system learning: adapting algorithms based on new data and evolving behavioral scenarios of economic agents.

The study systematically identified the key analytical tools that enable the transition from traditional process automation to intelligent management in public finance and corporate systems. The results confirm that contemporary transformation of management practices increasingly focuses on integrating intelligent technologies, predominantly artificial intelligence (AI), machine learning (ML), Big Data processing technologies, and cognitive analytics.

According to the data obtained, AI implementation in financial processes allows for highly accurate budget forecasting, automated risk monitoring, and performance analysis of public expenditures. Machine learning, in turn, enables adaptive data processing and the generation of management decision scenarios based on historical and real-time data, significantly improving the speed and quality of analytical processes.

Big Data technologies serve as a fundamental tool for integrating disparate information sources, including budgetary, tax, audit, and statistical data, enabling comprehensive analysis and the identification of hidden patterns in financial flows. Cognitive analytics expands decision-making capabilities by modeling the behavior of the management system, identifying risks, and proposing optimal management strategies based on knowledge and rules embedded in analytical models.

For clarity and structured presentation of the research findings, Table 2 was developed to demonstrate the functional capabilities of key intellectualization tools in the context of public finance management.

Table 2. Key Intellectualization Tools and Their Applications

Tool	Core Functions	Practical Applications
AI (Artificial Intelligence)	Forecasting, automated monitoring, performance analysis	Budget indicator forecasting, automated expenditure audit
ML (Machine Learning)	Adaptive data processing, scenario modeling	Financial scenario development, anomaly detection
Big Data	Integration of disparate sources, large-scale analysis	Consolidation of data from various systems, analysis of large datasets
Cognitive Analytics	System behavior modeling, recommendation mechanisms	Decision-making based on embedded knowledge and rules, strategic planning

Source: compiled by the author based on [2, 10, 17].

During the study, a model for evaluating the effectiveness of financial resource management in the public sector was developed, integrating intelligent decision-making factors, transparency principles, and risk-oriented management approaches. The proposed model is based on a systemic analysis of current practices in public financial management and on the study of the impact of digital technologies, analytical platforms, and intelligent tools (AI, ML, Big Data, cognitive analytics) on decision-making processes.

Within the model, three interrelated components were identified:

Analytical Component – encompasses tools for the collection, integration, and processing of financial data, enabling budget forecasting, expenditure efficiency analysis, and risk identification. A key element is the use of machine learning algorithms for scenario modeling and cognitive analytics for generating recommendations to optimize managerial decisions.

Transparency Component – ensures the openness of data and accessibility of financial information for the public, state supervisory authorities, and analytical centers. This component includes integration with open government registries, enhancing accountability and reducing the risk of corruption.

Risk-Oriented Component – is responsible for identifying, assessing, and managing financial risks. By leveraging Big Data analytics and AI tools, it becomes possible to forecast potential discrepancies in budgetary processes and to adjust managerial decisions in a timely manner.

The developed model allows for evaluating financial management effectiveness across three interconnected indicators: intelligent decision-making efficiency, process transparency, and risk-oriented management actions. Empirical testing of the model in Ukrainian public institutions and the examination of international experience demonstrated that integrating intelligent tools into financial management increases forecast accuracy, reduces the time required for data analysis, and mitigates the risks of inefficient resource utilization.

Overall, the findings confirm the feasibility of transitioning from traditional automation to intelligent financial management, which incorporates not only process digitization but also the integration of analytical and cognitive approaches to enhance the quality of managerial decisions in the public sector.

The study also assessed the potential impact of implementing intelligent technologies on key performance indicators of financial management in the public sector, particularly financial performance, accountability, and fiscal stability. The analysis was based on a systematic comparison of traditional public finance management approaches with modern practices integrating artificial intelligence (AI), machine learning (ML), cognitive analytics, and Big Data.

The results indicate that the application of intelligent technologies enables:

Improved financial performance through the automation of budget planning processes, optimized resource allocation, and forecasting of inefficient fund usage risks. AI and ML for scenario modeling allow public authorities to respond promptly to changes in the economic environment and reduce losses due to inconsistent decisions.

Enhanced accountability through the integration of data from various government registries, automated reporting, and the use of cognitive analytics to monitor compliance with established standards. Process digitization ensures transparency in financial flows and reduces opportunities for corruption.

Increased fiscal stability by applying Big Data for assessing budget deficit risks, forecasting tax revenues, and analyzing the impact of external and internal factors on the financial system. Intelligent management allows not only the anticipation of potential financial threats but also the development of preventive measures to minimize them.

The study further proposed methodological guidelines for developing a national strategy for intelligent public financial management post-2025. The development of these guidelines was based on a systemic analysis of the current state of digitalization in the public financial sector, a comparative study of international experience, and an evaluation of the effectiveness of intelligent management tools, such as AI, ML, cognitive analytics, and Big Data.

The results highlighted that the formation of a national strategy should consider the following key components:

Integrated financial management platform – consolidates data from budgetary, tax, statistical, and auditing systems, creating a unified information environment for decision-making at all levels of public administration.

Analytical competence of public authorities – involves enhancing staff skills in Big Data and intelligent technologies, implementing training and certification systems in financial analytics.

Regulation and legal support for intelligent technologies – includes developing legislation on Big Data circulation, the use of AI in the public sector, and ensuring compliance of national standards with international practices.

Interagency interaction and data exchange – entails creating effective procedures for information sharing among various public institutions, using standardized protocols and digital services to ensure rapid access to data.

Risk-oriented management and transparency – ensures control over the efficiency of financial decisions, forecasting potential threats to fiscal stability, and maximizing the transparency of budget processes through open data and integrated analytics.

Discussion. The results of the conducted systemic analysis, combined with a comparison to international scholarly literature, reveal a substantial gap between global trends in Public Financial Management (PFM) and the current digitalization strategy in Ukraine. In contemporary international practice, as highlighted in reports by OECD, CIPFA, KPMG, and IMF, there is a gradual yet consistent shift toward the paradigm of Intelligent Financial Governance—an approach to financial management oriented toward proactive forecasting, algorithmic analytics, and the integration of artificial intelligence (AI) and machine learning (ML) across all stages of the budget cycle [1; 12].

A central discussion point lies in the divergence between the information-declarative model, currently dominant in Ukraine, and the analytical-intelligent model, characteristic of countries with a high level of digital maturity and considered a standard for advanced PFM systems. The gap between these management models is reflected in the following dimensions:

Fragmentation versus Integration. International studies [14] emphasize that effective intelligent governance is achieved only through a comprehensive, holistic approach in which analytical tools are fully integrated into a single platform (Holistic Implementation, IFMIS 2.0). In Ukraine, significant system fragmentation is observed: low compatibility, lack of a centralized analytical platform, and insufficient coordination among information subsystems. This fragmentation not only impedes automation but also prevents the effective application of advanced analytical technologies, such as Graph Neural Networks (GNNs) for fraud detection [13], which require a unified, structured database.

Reactivity versus Prognostics. Reviews of international literature [2; 15] unequivocally confirm that the key advantage of AI in PFM is its predictive-analytical capability, which enables evidence-based policymaking and budgeting decisions (Smarter Policymaking). Ukrainian digital initiatives, such as Є-Data and Prozorro, primarily focus on transparency and data openness, operating at an information-declarative level without sufficient predictive support. The absence of methodologically grounded implementation of Big Data and machine learning in strategic documents, such as the Digital Transformation Strategy, indicates that the focus remains on automating routine processes rather than on intelligent decision-making.

Formal versus Substantive Accountability. The use of AI in PFM transforms accountability from formal compliance with regulatory requirements to substantive transparency and social relevance of decisions [1]. In Ukraine, where manual analysis and traditional accounting methods dominate, performance indicators are largely retrospective, conflicting with the concept of continuous monitoring and risk-based digital auditing recommended by KPMG [8]. This situation creates risks for timely identification of financial imbalances and reduces the public sector's capacity to respond to dynamic economic challenges.

In summary, the discussion indicates that Ukraine's transition to an intelligent PFM model requires a comprehensive reassessment of the existing digitalization strategy. The implementation of integrated platforms, predictive-analytical tools, and AI/ML solutions is essential not only for technological modernization but also for a paradigm shift in accountability and efficiency in public

financial management. The gap between the current state and international standards defines the strategic priorities for the next stage of Ukraine's PFM development.

The discussion further confirms that the primary barriers to intelligent public financial management in Ukraine are predominantly institutional and organizational rather than purely technological. Recognizing this is critical for developing an effective national digitalization strategy that goes beyond procedural automation and envisions deep systemic transformation of management and accountability mechanisms:

Data Quality and IT Legacy. One of the key constraints is the quality, structure, and accessibility of data. As emphasized by the IMF [14], any analytical algorithm, including predictive models and resource optimization algorithms, requires high-quality data. In the current Ukrainian context, this problem is exacerbated by outdated IT systems, the absence of centralized platforms, and low compatibility of existing subsystems. CIPFA [2] identifies these factors as major institutional barriers that hinder the integration of analytical solutions and the full utilization of Big Data and AI potential. The result is a fragmented information environment and limited use of advanced analytical tools, such as cognitive analytics and graph neural networks, for risk monitoring and anomaly detection.

Human Capital and Ethics. The study also demonstrates that successful PFM intelligentization is impossible without appropriate human capital development. Insufficient understanding of analytical potential in the public sector, a shortage of qualified analysts, and a lack of AI and ML training programs create significant limitations [2; 15]. Simultaneously, international practice confirms the necessity of implementing ethical principles, such as Explainable AI (XAI), to ensure transparency in algorithmic decision-making and to build trust among citizens and officials [1]. In Ukraine, the absence of legal and regulatory frameworks governing such systems significantly complicates the legitimization of intelligent decisions and the enhancement of accountability.

Effectiveness Model. The analysis confirms that traditional performance indicators, which focus on resource savings and retrospective control, are insufficient in the context of intelligent management. The IMF [14] recommends using more comprehensive metrics encompassing fiscal discipline, strategic resource allocation, and operational efficiency. This necessitates the development of digitalization impact assessment models that integrate forecasting, risk-oriented analytics, and fiscal sustainability indicators. Such an approach enables a transition from formal to substantive accountability and from manual control to automated monitoring and prediction of financial management outcomes.

Thus, the discussion demonstrates that effective intelligent public financial management in Ukraine requires the simultaneous resolution of technological, institutional, and organizational challenges. Only a comprehensive transformation that combines IT infrastructure modernization, human capital development, implementation of ethical principles, and new performance evaluation methods can ensure the transition to an Intelligent Financial Governance model consistent with international digital maturity standards.

The discussion supports the initial research hypothesis: effective digitalization of public sector financial management in Ukraine is impossible without a fundamental shift from the traditional emphasis on accounting automation toward comprehensive intelligent management. This transition implies not only technical system modernization but also a fundamental transformation of decision-making methodology, accountability approaches, and the use of analytical data in strategic planning.

According to international practice and the recommendations of leading analytical centers (OECD, IMF, CIPFA, KPMG), the formation of an effective model for the intelligentization of public financial management is based on three interrelated and mutually reinforcing principles:

Integration of Analytical Systems. The first principle involves creating a unified digital environment that consolidates all major financial subsystems—budgetary, tax, audit, and statistical. This environment should support Dynamic Graph Modeling, enabling the tracking of complex

interconnections among budgetary flows, management entities, and risk zones. Such integration not only promotes data unification but also establishes a foundation for the application of advanced analytical tools, including algorithmic anomaly detection and scenario-based forecasting of financial processes.

Algorithmic Forecasting. The second principle entails the systematic use of machine learning (ML) to assess budgetary risks, conduct fiscal impact analysis, and optimize resource allocation. Predictive analytics enables a shift from reactive management based on retrospective data to proactive scenario modeling, allowing decisions to be made based on quantitative forecasts and a risk-oriented approach. This, in turn, contributes to reducing uncertainty and enhancing the resilience of national financial systems.

Continuous Learning and Explainable AI (XAI). The third principle focuses on system adaptability and the enhancement of trust in algorithmic decisions. Continuous learning involves updating models based on new data and changing contexts, ensuring dynamic adjustment of forecasts and recommendations. Simultaneously, integrating XAI principles transforms formal accountability into substantive, transparent, and comprehensible accountability for all stakeholders. This is critically important for fostering social trust and legitimizing decisions made with the support of intelligent systems, particularly in public finance, where transparency and accountability are paramount.

Thus, the proposed efficiency model for managing public sector financial resources in Ukraine combines three complementary components: integration of analytical systems, algorithmic forecasting, and continuous learning with XAI. Their comprehensive implementation facilitates the transition to an intelligent financial management model that aligns with international standards of digital maturity and enhances the efficiency, transparency, and predictability of financial decision-making.

Conclusions. The conducted study on the intelligentization of public sector financial management in Ukraine has systematically identified key analytical tools, assessed the current state of digitalization, and substantiated a new efficiency paradigm oriented toward proactive governance. It has been demonstrated that the traditional information-declarative model, which focuses on accounting automation and ensuring data transparency, limits the potential of Public Financial Management (PFM) and requires replacement with an analytical-intelligent model of Intelligent Financial Governance.

Within the study, an efficiency model for managing financial resources was developed, integrating algorithmic forecasting, principles of transparency, and risk-oriented management, enabling the assessment of effectiveness through indicators of intelligent decision-making performance and substantive accountability. The scientific novelty of the research lies in the systematic application of Dynamic Graph Modeling based on Graph Neural Networks (GNNs) for the integration of fragmented financial data and proactive detection of anomalies and fraud, opening new opportunities for digital auditing and monitoring of public finances.

The theoretical significance of the research consists in deepening the conceptual foundations of PFM evolution, from basic digitalization approaches to intelligentization, particularly through the introduction of metrics for intelligent efficiency and substantive accountability as criteria for evaluating the digital maturity of public governance. The practical significance lies in the fact that the developed model and methodological guidelines can be utilized by the Ministry of Finance and other central government authorities for the modernization and integration of financial systems in the IFMIS 2.0 format, as well as by state auditors and regulatory bodies for implementing risk-based digital auditing and continuous monitoring of fiscal flows.

The implementation of the research results ensures significant socio-economic benefits, including enhanced fiscal stability through accurate budget forecasting and rapid analysis of fiscal risks, strengthened accountability and reduced corruption risks via transparent algorithmic governance and detection of hidden fraud networks, and optimization of resource utilization

through automated expenditure efficiency analysis with prioritization of socially significant programs.

Prospects for further research include empirical implementation of the proposed model within specific Ukrainian government agencies, development of organizational and legal mechanisms for the adoption of Explainable AI (XAI) principles in budget planning and public auditing, and in-depth exploration of the potential of Dynamic Graph Modeling to ensure interagency integration of financial, tax, and statistical data within a unified digital environment. Advancing these directions will enable the formation of a comprehensive, intelligent public financial management system that aligns with international standards of digital maturity and ensures improved efficiency, transparency, and predictability of state financial governance.

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Інтелектуалізація управління фінансовими ресурсами державного сектору: аналітичні інструменти та моделі ефективності

Анотація. У статті розглянуто процес інтелектуалізації управління державними фінансами через інтеграцію технологій Big Data, машинного навчання та графових нейронних мереж (GNNs). Застосування цих інструментів дає змогу здійснювати проактивне прогнозування ризиків, підвищувати точність бюджетного планування та покращувати виявлення аномалій у режимі реального часу, що формує нову парадигму фіскальної прозорості, дисципліни та стратегічної ефективності.

Постановка проблеми. Традиційні підходи до управління державними фінансами вже не відповідають зростаючій фіскальній складності та вимогам прозорості, що зумовлює необхідність упровадження інтелектуальних моделей, побудованих на основі Big Data, машинного навчання та графових нейронних мереж. Це дозволить підвищити ефективність прогнозування ризиків і результативність бюджетування.

Невирішені аспекти проблеми. Серед основних викликів у сфері інтелектуального управління державними фінансами - відсутність інтегрованої моделі на основі ШІ, проблема «чорної скриньки» у питаннях прозорості алгоритмів, застарілі ІТ-системи, низька якість даних і недостатня інституційна спроможність. Це свідчить про наявність суттєвих прогалин у знаннях, які потребують подальших досліджень.

Мета статті. Метою статті є наукове обґрунтування та розроблення методологічних засад інтелектуалізації управління державними фінансами для подолання системних проблем і підвищення ефективності фіскального управління.

Основний матеріал. У роботі сформовано концептуальну модель інтелектуалізованого управління державними фінансами, що інтегрує графові нейронні мережі для виявлення аномалій і алгоритми машинного навчання для точного прогнозування бюджетних показників на всіх етапах бюджетного циклу. Застосування принципів пояснювального штучного інтелекту (Explainable AI) забезпечує прозорість управлінських рішень, а запропоновані стратегічні рекомендації спрямовані на модернізацію ІТ-інфраструктури, підвищення якості даних та розвиток цифрових компетенцій у державному секторі.

Висновки. У дослідженні сформульовано нову парадигму ефективності управління державними фінансами, засновану на аналітичній інтеграції, алгоритмічному прогнозуванні та прозорості. Запропонована модель інтелектуального фінансового управління (Intelligent Financial Governance Model) сприятиме модернізації системи державних фінансів, цифровому аудиту та ризик-орієнтованому моніторингу, що підвищить фіскальну стабільність і економічну стійкість у довгостроковій перспективі.

Ключові слова: *інтелектуальне управління фінансами, державне фінансове управління, штучний інтелект (AI), машинне навчання (ML), аналітика великих даних, когнітивна аналітика, прийняття рішень на основі даних, цифрова трансформація, фіскальна прозорість, моделювання ефективності.*

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