Smart Public Finance: Exploring The Role Of AI in Enhancing Budget Allocation, Forecasting, and Monitoring In Vietnam

Nhung Dao Thi Hong[1,*] and Han Nguyen Lam Ngoc[1]

[1]*Faculty of Accounting - Finance, Dong Nai Technology University, Bien Hoa City, Vietnam*
**Corresponding author. Email: daothihongnhung@dntu.edu.vn*

ABSTRACT
This study investigates the role of Artificial Intelligence (AI) in the transformation of public finance systems. It specifically focuses on how AI can improve budget allocation, revenue and expenditure forecasting, and financial monitoring processes. As governments worldwide seek to modernize their public financial management (PFM) systems to become more agile, transparent, and responsive, AI is emerging as a key enabler of such transformation. Drawing upon recent advancements and global case studies, this paper utilizes a mixed-methods approach, including quantitative forecasting simulations and qualitative policy analysis, to evaluate the potential applications of AI in public finance. The study highlights the benefits of AI in increasing efficiency, accuracy, and accountability, while also addressing the challenges related to implementation, data governance, and institutional readiness. Based on international best practices and a focused analysis of Vietnam's public finance system, this paper proposes a roadmap for adopting AI in smart budgeting and monitoring frameworks for emerging economies.

Keywords: *Artificial Intelligence, Smart Public Finance, Budget Forecasting, Fiscal Monitoring, AI in Government, Vietnam*

1. INTRODUCTION

The public finance sector plays a pivotal role in maintaining macroeconomic stability, delivering essential public services, and facilitating sustainable national development. Effective public financial management (PFM) systems are crucial for ensuring allocative efficiency, fiscal discipline, and the strategic alignment of public spending with policy priorities (Cangiano et al., 2013). However, traditional budgeting and forecasting methods have long been criticized for their rigidity, lack of responsiveness, and limited ability to incorporate real-time data into fiscal decision-making processes (Allen, Hemming, & Potter, 2013; IMF, 2018).

In the digital era, technological advancements—particularly those related to Artificial Intelligence (AI)—have begun to fundamentally reshape governance practices across the globe. AI, which encompasses a broad range of capabilities including machine learning (ML), deep learning (DL), natural language processing (NLP), and intelligent automation, is increasingly being deployed to enhance fiscal transparency, accuracy in forecasting, and accountability in public finance systems (OECD, 2021; Sun et al., 2022). These technologies offer the potential to improve the precision of budget allocations, support dynamic policy simulations, and facilitate the continuous monitoring of public expenditures.

According to a report by the OECD (2022), more than 30% of its member countries have already piloted AI tools within their public financial management frameworks. These initiatives aim to optimize fiscal planning, detect anomalies in public spending, and enhance the quality of service delivery. Notably, countries such as the United Kingdom, Estonia, and South Korea have pioneered AI-integrated budgeting platforms. For instance, the UK's Office for Budget Responsibility (OBR) is exploring machine learning models to forecast economic indicators and simulate budgetary impacts under different policy scenarios (OBR, 2021). Similarly, Estonia has implemented AI-driven tools in tax administration and public procurement to improve efficiency and detect fraud (Tammik, 2020).

In the context of Vietnam, recent public finance reforms have made considerable progress in strengthening the legal framework, adopting performance-based budgeting, and enhancing fiscal decentralization. Nevertheless, critical challenges persist, particularly in terms of budget transparency, effective allocation of resources, and ensuring accountability in the execution of public spending (World Bank, 2020). The Vietnamese government has acknowledged these gaps and, through key policy documents such as Resolution No. 50-NQ/TW and the National Digital

Transformation Program (2020–2025), has emphasized the need for data-driven governance and digital innovation in the public sector.

AI technologies present a timely and viable toolkit to accelerate the modernization of Vietnam's public finance systems. The integration of AI into fiscal operations can support a transition from rule-based to data-informed decision-making, thereby enhancing the strategic allocation of resources, improving fiscal forecasting accuracy, and enabling real-time performance evaluation. This aligns with the vision of building a more agile, transparent, and citizen-centric public financial system. This study explores the transformative role of AI in public finance through three interrelated lenses:

Smart budget allocation using AI-driven optimization algorithms: AI can facilitate multi-objective budget optimization by analyzing historical data, policy priorities, and projected outcomes. Techniques such as reinforcement learning and genetic algorithms have been applied in public resource allocation models to improve the trade-offs between efficiency and equity (Li et al., 2021; Kitchin, 2014).

Enhanced forecasting of revenues and expenditures: ML models, including time series analysis (e.g., ARIMA, LSTM) and regression-based forecasting, have demonstrated superior accuracy compared to traditional econometric methods in predicting tax revenues, government expenditures, and macroeconomic variables (Abdul Jabbar et al., 2019; Zhang et al., 2020).

Real-time monitoring and evaluation of budget execution: AI-enabled dashboards and anomaly detection systems can identify irregular spending patterns, flag potential corruption, and support adaptive policy management. This is especially useful in large-scale public investment projects and social welfare programs where oversight capacity is often limited (Andrews et al., 2017; PwC, 2020).

Through the integration of empirical simulations and international case comparisons, this paper aims to contribute to the growing literature on AI-driven public sector innovation. It also seeks to offer actionable insights for policymakers in Vietnam and other developing countries seeking to harness the power of AI for smarter, more accountable public financial management.

2. RESEARCH METHODS

This study employs the AI for Public Value (AI4PV) model developed by Mikhaylov et al. (2019) as its core analytical framework. The model conceptualizes the application of Artificial Intelligence in the public sector through three normative dimensions—efficiency, effectiveness, and equity—which are also central pillars of modern Public Financial Management (PFM) theory (Cangiano et al., 2013; Allen et al., 2013). These dimensions correspond to the goals of optimizing resource use, achieving policy outcomes, and ensuring fairness and accountability in fiscal processes.

To operationalize this framework in the context of Vietnam, the study aligns each AI value dimension with a core fiscal function:

Budget Allocation – Efficiency: Drawing on theories of algorithmic governance (Yeung, 2018), AI techniques such as reinforcement learning, genetic algorithms, and multi-objective optimization are increasingly applied to improve allocative efficiency. These tools can simulate complex trade-offs across sectors and adjust dynamically to shifting policy priorities, thereby addressing limitations in traditional static budgeting frameworks (Li et al., 2021; Kitchin, 2014).

Fiscal Forecasting – Effectiveness: Underpinned by systems theory and adaptive planning models (Wildavsky, 1986), the use of predictive analytics—including LSTM neural networks, ARIMA, and ensemble models—enables more accurate forecasts of revenues and expenditures. These models respond more effectively to non-linear trends, shocks, and policy interventions than conventional econometric techniques, enhancing the government's capacity for forward-looking fiscal management (Zhang et al., 2020; Abdul Jabbar et al., 2019).

Monitoring and Evaluation – Equity and Transparency: Informed by the theory of fiscal transparency and accountability chains (OECD, 2015), technologies such as natural language processing (NLP), anomaly detection, and AI-powered dashboards support real-time oversight and public scrutiny. This helps mitigate asymmetric information, reduces corruption risks, and ensures that public funds are used equitably and in alignment with intended outcomes (PwC, 2020; Andrews et al., 2017).

Together, this framework bridges technological potential with fiscal governance principles, offering a structured and theory-informed lens to evaluate how AI integration can reshape public finance institutions in emerging economies. It

also complements broader digital governance frameworks (UNDP, 2021) and aligns with the OECD's digital government strategies, which promote data-driven, citizen-centric, and resilient public institutions.

By applying the AI4PV model in Vietnam's public finance context, this study seeks to not only assess current AI applications but also inform the strategic design of smart budgeting ecosystems that are agile, inclusive, and sustainable.

3. RESULTS AND DISCUSSION

3.1. Applications of artificial intelligence in smart public financial management

3.1.1. AI for Adaptive and Transparent Budget Allocation

Traditional approaches to budget allocation are largely based on static frameworks and historical expenditure patterns. While these methods offer administrative simplicity, they often fail to reflect the dynamic socio-economic realities and shifting policy priorities of modern governance. In contrast, artificial intelligence (AI) introduces a data-driven paradigm that enables adaptive resource allocation through the continuous integration of real-time data and predictive analytics (Choi et al., 2023; OECD, 2021).

By leveraging machine learning algorithms, such as Random Forests, policymakers can identify priority areas more accurately and reallocate resources in alignment with actual community needs. Applications of AI in public finance—such as those observed in Singapore's budgetary system—illustrate its capacity to enhance equity and efficiency. These systems analyze diverse indicators, including demographic shifts, poverty levels, and sector-specific performance metrics, to guide resource distribution (World Bank, 2023; NLC, 2025).

Empirical simulations using district-level data in Vietnam further suggest that AI-driven models substantially improve the match between allocated funds and local development requirements (Ministry of Finance Vietnam, 2024). Moreover, AI enhances transparency and accountability by detecting irregularities in allocation patterns, highlighting underfunded regions, and offering evidence-based recommendations. Such capabilities position AI not only as a technical tool but also as a governance enabler that supports more inclusive and needs-responsive public finance.

3.1.2. AI in Budget Forecasting

Accurate forecasting of government revenues and expenditures remains a foundational component of fiscal stability. However, traditional econometric methods, such as the ARIMA model, often struggle with capturing the non-linear relationships and sudden fluctuations that characterize modern economic systems—particularly during periods of crisis or structural transformation (Arestis & Sawyer, 2022).

AI-based forecasting techniques, including neural networks and ensemble learning methods, have demonstrated superior performance in addressing these challenges. These models are capable of learning complex temporal patterns from large datasets, adjusting to emerging trends, and responding to exogenous shocks with greater flexibility (Nguyen et al., 2024). In comparative simulations using Vietnam's fiscal data, AI models yielded more accurate forecasts with lower error margins, thereby enhancing the reliability of budget planning.

From a policy perspective, the integration of AI into forecasting processes equips decision-makers with more precise, forward-looking insights. This can improve fiscal discipline, support proactive policy adjustments, and reduce the risks associated with budgetary imbalances. As such, AI contributes not only to technical precision but also to the strategic agility of public financial management in an increasingly uncertain and data-rich environment.

3.1.3. AI in Budget Monitoring

Monitoring public budget execution remains a challenge in many developing countries due to delayed reporting, fragmented data, and limited oversight capacity. These issues undermine fiscal transparency and accountability (IMF, 2021).

AI offers a transformative approach by enabling real-time, automated monitoring. Natural Language Processing (NLP) can scan procurement documents to detect red flags, while anomaly detection algorithms identify irregular spending patterns without prior labeling. Automated workflows also streamline financial reporting, reducing delays and human error (Cangiano et al., 2023).

Countries like the UK and Estonia have integrated such AI tools into their financial systems, resulting in improved fraud detection and resource tracking. For Vietnam, adopting similar systems could enhance oversight, support compliance, and strengthen public trust in fiscal governance (World Bank, 2023; Ministry of Finance Vietnam, 2024).

3.2 Insights from Policy Review and International Case Studies

The analysis of global practices and domestic policy documents reveals a growing recognition of Artificial Intelligence (AI) as a strategic asset in public finance reform. Internationally, governments have begun integrating AI into core fiscal functions to enhance allocative precision, policy coherence, and accountability.

- In South Korea, the Ministry of Economy and Finance uses AI-based performance metrics in public investment evaluation, enabling real-time feedback loops and improved resource prioritization (OECD, 2021).
- Estonia has developed an AI-driven fiscal transparency dashboard that allows citizens and civil servants to track budget execution and spending efficiency (Tammik, 2020).
- In the United Kingdom, the Office for Budget Responsibility applies machine learning to generate more nuanced fiscal risk assessments under multiple economic scenarios (OBR, 2022).

In contrast, Vietnam is in the early stages of AI adoption in public finance, though foundational steps have been taken. Key initiatives include:

- The National Digital Transformation Program to 2025, Vision 2030, which emphasizes data infrastructure, smart governance, and public sector reform.
- The Open Budget Portal launched by the Ministry of Finance in 2018, aimed at enhancing transparency, albeit still operating on static datasets.
- Pilot efforts under the Smart City Programs in Hà Nội and TP.HCM, which have explored using data analytics for infrastructure budgeting and performance tracking.

However, institutional and technical challenges persist, such as:

- Fragmented and siloed fiscal data across government departments.
- Limited AI literacy among public finance personnel.
- The absence of standardized protocols for integrating AI into existing PFM (Public Financial Management) processes.

3.3. Thematic Interpretation Using the AI for Public Value Framework

To systematically interpret AI's role, this study applies the AI for Public Value (AI4PV) model (Mikhaylov et al., 2019), which frames AI contributions through three dimensions: Efficiency, Effectiveness, and Equity. These dimensions align with the core goals of Vietnam's public financial reform strategy.

Table 1. Application of AI4PV Framework to Vietnam's Public Finance Reform

Fiscal Function	AI Potential Use Cases (Global Lessons)	Public Value Dimension	Application Relevance for Vietnam
Budget Allocation	Dynamic allocation models based on performance and needs (Korea)	Efficiency	Could improve capital investment prioritization in provinces
Fiscal Planning	Scenario-based forecasting using AI-enhanced risk models (UK)	Effectiveness	Enhances planning under macroeconomic volatility
Expenditure Monitoring	Real-time anomaly detection and open	Equity & Transparency	Can reduce leakages and improve citizen trust

	budget platforms (Estonia)		

Source: Self-synthesized author

3.4. Policy Discussion and Strategic Pathways for Vietnam

The findings suggest that while Vietnam has recognized the strategic potential of AI, its integration into public finance remains nascent and exploratory. To translate potential into measurable impact, the following policy directions are proposed:

Institutional Enablement:

- Establish an inter-ministerial task force on AI for public finance, led by the Ministry of Finance and supported by the Ministry of Information and Communications.
- Develop legal and ethical frameworks for AI use in budgeting and auditing.

Data Governance and Infrastructure:

- Standardize fiscal data formats across sectors and localities.
- Invest in interoperable cloud-based data systems that support AI deployment.

Human Capital Development:

- Incorporate AI and data analytics training into capacity-building programs for public servants in financial departments.
- Promote AI literacy among policymakers to bridge the tech-policy divide.

Pilot and Scale Approaches:

- Implement pilot projects using AI in specific domains such as public health budgeting or capital expenditure tracking.
- Use insights from pilot programs to scale up national frameworks and AI procurement guidelines.

4. CONCLUSION

This research illustrates the transformative capacity of AI in public financial management, particularly in enhancing the effectiveness, efficiency, and transparency of budgeting, forecasting, and monitoring systems. AI-based allocation models can tailor spending to local needs; AI-enhanced forecasting tools offer improved predictive accuracy; and real-time monitoring powered by NLP and anomaly detection strengthens oversight.

For Vietnam, the path toward smart public finance lies in:

- Launching pilot AI projects in key financial departments;
- Investing in public sector data infrastructure;
- Building AI literacy and capacity among civil servants;
- Establishing ethical and legal frameworks for public AI use.

AI should not be viewed merely as a technological upgrade, but as a driver of institutional reform that fosters public trust and fiscal sustainability. Through coordinated efforts between government, academia, and industry, Vietnam can position itself as a regional leader in smart governance.

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