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Harnessing Artificial Intelligence in Public Finance Management: Balancing Opportunities and Risks Across Diverse Governance Contexts

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Abstract

Artificial Intelligence (AI) rapidly evolves public finance management by improving fiscal responsibility, tax collection, and expenditure tracking's accuracy, efficiency, and transparency. However, serious hazards are associated with its adoption, including algorithmic prejudice, cybersecurity flaws, and governance issues. This study examines the potential benefits and hazards of artificial intelligence in public finance systems using a qualitative, exploratory research design. The research methodology combines a thematic analysis of secondary expert insights, a systematic literature review, and a comparative assessment of three nations: Estonia, Singapore, and India. In contrast to India, which is an emerging nation experimenting with AI in tax compliance, Estonia and Singapore are examples of advanced economies having sophisticated AI-enabled fiscal tools. This comparison method offers detailed insights into how contextual elements influence the risks and opportunities associated with adopting AI. The results indicate that while AI can greatly improve budget forecasts, tax compliance, and fraud detection, it also runs the risk of eroding public confidence and equity in the absence of strong ethical and regulatory controls. By putting forth a Responsible AI Framework for Public Finance, it advances research and practice by providing decision-makers with a well-rounded approach to maximise AI's promise while reducing related dangers.

Keywords: Artificial Intelligence, Public Finance Management, Comparative Study, Taxation, Governance, Fiscal Transparency, Algorithmic Bias

1. Introduction

Artificial Intelligence (AI) has become a defining force in contemporary governance, offering transformative potential for the design, execution, and monitoring of public finance systems. Public finance management (PFM), which traditionally revolves around revenue mobilization, expenditure control, budgeting, and auditing, is increasingly adopting AI-enabled technologies to enhance efficiency, accuracy, and accountability. AI-driven tools are being deployed to detect tax evasion, forecast fiscal revenues, and monitor procurement irregularities, enabling governments to optimize resource use and reduce leakages (Mikhaylov, Esteve, & Campion, 2018). As the Fourth Industrial Revolution deepens, the integration of AI into fiscal governance is no longer a peripheral reform but a strategic necessity (OECD, 2021).

The opportunities of AI in PFM are evident across diverse contexts. In developed economies, AI is driving predictive analytics that enhance budget forecasting accuracy, automated auditing processes that reduce compliance costs, and real-time fraud detection systems that safeguard public resources (Wirtz, Weyerer, & Geyer, 2019). Estonia, often referred to as a digital governance pioneer, has successfully institutionalized AI into its e-tax and e-budgeting platforms, achieving remarkable efficiency and transparency in fiscal operations (OECD, 2021). Similarly, Singapore has integrated AI into public procurement monitoring and fiscal planning, improving both compliance and accountability (World Bank, 2022). These examples underscore the opportunities of AI in strengthening fiscal governance.

In contrast, emerging economies face unique challenges and risks in AI adoption. India's implementation of AI in Goods and Services Tax (GST) compliance demonstrates how machine learning systems can improve taxpayer profiling and reduce evasion (World Bank, 2022). However, reliance on such systems raises concerns over data protection, cybersecurity vulnerabilities, and algorithmic biases that may disproportionately target small businesses or marginalized groups (Mehrabi et al., 2021). These risks reveal that while AI adoption in PFM can be transformative, its outcomes are deeply shaped by institutional capacity, governance frameworks, and socio-economic contexts (Gupta & Keen, 2020).

Beyond efficiency and revenue gains, AI adoption in fiscal governance raises broader normative questions about transparency, accountability, and public trust. Scholars caution that AI systems often operate as “black boxes,” where decision-making processes are opaque to both policymakers and citizens (Zhang, Yang, & Wang, 2021). If left unregulated, such opacity may undermine fiscal accountability and weaken democratic oversight. Moreover, concerns over privacy breaches and cyberattacks targeting sensitive fiscal databases highlight the vulnerability of governments to technological over-dependence (Wirtz et al., 2019). Therefore, understanding AI’s risks is as critical as appreciating its benefits.

This study positions itself within this debate by adopting a comparative research design that analyzes three countries—Estonia, Singapore, and India—representing diverse governance capacities and stages of AI adoption in public finance management. Through a systematic literature review, case study comparison, and thematic analysis, the paper examines how AI’s opportunities and risks manifest differently across developed and emerging economies. By doing so, it contributes to both academic discourse and policy practice, proposing a Responsible AI Framework for Public Finance that balances technological innovation with ethical safeguards. In doing so, the paper seeks to advance an evidence-based understanding of how AI can be integrated responsibly into public finance to achieve efficiency, transparency, and equity.

Literature Review

AI and the Transformation of Public Finance

Artificial Intelligence (AI) is increasingly recognized as a catalyst for modernizing public finance management (PFM). Traditional fiscal systems often suffer from inefficiencies in tax administration, delays in expenditure reporting, and weak auditing mechanisms. AI technologies, including machine learning, predictive analytics, and natural language processing, promise to address these inefficiencies by automating processes, enhancing forecasting, and improving oversight (Mikhaylov, Esteve, & Campion, 2018). According to Gupta and Keen (2020), digital innovations, particularly AI, are revolutionizing public finance in both advanced and emerging economies by enabling governments to expand their revenue base and strengthen compliance. Thus, AI is not merely a technological add-on but a structural innovation that reshapes fiscal governance.

Opportunities: Efficiency, Compliance, and Transparency

The literature highlights several opportunities AI presents in PFM. First, AI enhances tax compliance by enabling predictive risk profiling of taxpayers and detecting anomalies that indicate potential evasion (Yigitbasioglu, 2020). Second, AI contributes to efficiency gains by automating routine administrative tasks, freeing up human resources for higher-level policy analysis (Wirtz, Weyerer, & Geyer, 2019). Third, AI improves budget forecasting by analyzing vast datasets, which reduces fiscal errors and strengthens long-term planning (OECD, 2021). Finally, AI enhances transparency by making financial processes more open to citizen scrutiny through interactive dashboards and automated audit trails (World Bank, 2022). Collectively, these opportunities suggest AI has transformative potential in advancing fiscal efficiency and accountability.

Risks: Bias, Privacy, and Governance

Despite its promise, scholars have identified critical risks associated with AI adoption in public finance. The most significant concern is algorithmic bias, where models trained on skewed datasets reproduce systemic inequalities (Mehrabi et al., 2021). For example, fraud detection algorithms may disproportionately target small businesses or marginalized taxpayers. Data privacy and cybersecurity risks are also central, as public financial data is highly sensitive and vulnerable to external attacks. Additionally, AI systems often operate as opaque “black boxes,” raising governance concerns about accountability in fiscal decision-making (Zhang, Yang, & Wang, 2021). Wirtz et al. (2019) argue that without strong oversight, AI risks reducing citizen trust in fiscal institutions, particularly in contexts where transparency is already weak.

Comparative Case: Estonia and Singapore

The experience of advanced economies such as Estonia and Singapore provides valuable insights into the potential of AI in PFM. Estonia, often considered the global leader in digital governance, has embedded AI across its e-taxation and e-budgeting platforms, which has reduced administrative costs and increased compliance rates significantly (OECD, 2021). Similarly, Singapore’s Smart Nation initiative leverages AI in fiscal planning, procurement monitoring, and fraud detection. A study by the World Bank (2022) shows that

Singapore's use of AI in procurement audits has saved millions of dollars annually by reducing irregularities. These cases demonstrate that with strong institutional capacity and governance frameworks, AI can substantially enhance fiscal efficiency and accountability.

Comparative Case: India and Emerging Economies

Emerging economies, however, present a more complex picture. India's deployment of AI in its Goods and Services Tax (GST) system illustrates both opportunities and risks. On the positive side, AI-enabled tools have improved tax compliance by identifying high-risk taxpayers and automating return verification (World Bank, 2022). Yet, significant risks remain. Concerns over cybersecurity breaches, algorithmic fairness, and unequal access to digital infrastructure reveal the limitations of AI in weaker institutional settings (Gupta & Keen, 2020). These challenges are not unique to India but are shared across many developing countries experimenting with AI in fiscal management. As such, the literature emphasizes that the effectiveness of AI in PFM is context-dependent, shaped by governance capacity, institutional maturity, and technological infrastructure.

Synthesis and Gaps in the Literature

The comparative evidence underscores the dual nature of AI in PFM: while advanced economies highlight its efficiency and accountability gains, emerging economies reveal its vulnerabilities and governance challenges. However, the literature also shows a gap in comparative, cross-country studies that systematically assess both opportunities and risks within diverse fiscal contexts. Most research focuses either on technological potential (Mikhaylov et al., 2018; Wirtz et al., 2019) or on risks such as bias and privacy (Mehrabi et al., 2021; Zhang et al., 2021), with limited integration of both perspectives. This study seeks to address this gap by combining a comparative case analysis of Estonia, Singapore, and India with a thematic synthesis of AI's opportunities and risks, ultimately proposing a balanced Responsible AI Framework for Public Finance.

Research Questions

This paper investigates how AI reshapes PFM by analyzing both its opportunities and risks. The research questions are:

1. What are the main opportunities offered by AI in public finance management?
2. What are the risks and limitations associated with its adoption?
3. How can policymakers design governance frameworks that maximize benefits while mitigating risks?

Research Methodology

This study adopts a qualitative, exploratory research design to examine the opportunities and risks of Artificial Intelligence (AI) in public finance management. Given that AI in fiscal governance remains an emergent field with limited quantitative datasets, a qualitative approach allows for a richer and more context-sensitive understanding of institutional practices and governance dynamics. The research is guided by the need to explore how AI is integrated into diverse fiscal systems, and how its benefits and risks vary across different administrative and developmental contexts.

The research employs a comparative *case study approach*, focusing on three countries: Estonia, Singapore, and India. These cases were deliberately chosen for their diversity. Estonia represents one of the most advanced pioneers of e-governance, with AI embedded in taxation and budgeting processes. Singapore illustrates an advanced Asian economy with a sophisticated digital infrastructure and strong governance traditions. India, on the other hand, exemplifies an emerging economy that has introduced AI into its Goods and Services Tax (GST) framework, reflecting large-scale experimentation under conditions of administrative complexity. This comparative design allows for examining variation in institutional capacity, technological maturity, and governance contexts, thereby generating insights that are both specific to each case and globally relevant.

The data used in this study were drawn from a combination of academic literature, policy and institutional reports, and secondary expert insights. Peer-reviewed journal articles indexed in Scopus and Web of Science from 2015 to 2024 were systematically reviewed to identify scholarly discussions on AI in taxation, fiscal forecasting, and digital governance. Policy documents published by the OECD, IMF, World Bank, and government portals of the selected countries were consulted to provide empirical and policy-level evidence of AI adoption. These were complemented by practitioner reports, interviews, and expert

commentaries that offered real-world perspectives on challenges such as algorithmic fairness, cybersecurity, and transparency.

A systematic literature review was conducted using structured search protocols to ensure methodological rigor, and the selected case material was coded and triangulated across sources. Cross-verification between policy reports and expert commentaries was applied to strengthen the validity of evidence and avoid overreliance on single narratives. By employing this triangulation, the study reduces the risk of bias and ensures that the findings reflect a balanced understanding of both opportunities and risks associated with AI adoption.

The collected data was analyzed thematically. Opportunities such as improvements in tax compliance, fraud detection, efficiency, and transparency were coded and compared against risks such as algorithmic bias, data privacy concerns, governance challenges, and cybersecurity vulnerabilities. These themes were then mapped across the three cases, allowing the study to highlight not only cross-country differences but also recurring global patterns. While Estonia and Singapore provide evidence of how strong governance frameworks and digital capacity amplify the positive effects of AI in fiscal systems, India demonstrates how weaker institutional safeguards may intensify risks. The methodological contribution of this study lies in situating the analysis of AI within the realities of governance and development, thereby moving beyond abstract theorization to evidence-based policy implications.

Analysis and Discussion

Estonia: AI as a Pillar of Digital Governance

Estonia exemplifies how Artificial Intelligence can be embedded successfully into public finance when supported by a strong tradition of digital governance. AI-driven applications in taxation and budgeting have dramatically improved efficiency, reducing administrative burdens on both citizens and government officials. Predictive analytics deployed within the Estonian Tax and Customs Board have enhanced revenue forecasting, while e-budgeting platforms have minimized fiscal errors and strengthened discipline in expenditure planning. These advancements are not technological achievements alone but are deeply embedded within Estonia's governance framework, where transparency,

accountability, and citizen-centric services have been institutionalized. The Estonian case demonstrates that opportunities presented by AI are maximized when political commitment, institutional maturity, and digital infrastructure converge.

Singapore: Smart Nation and Fiscal Accountability

Singapore's integration of AI into public finance has been closely tied to its broader Smart Nation initiative. AI-based systems have been applied to fiscal planning, tax monitoring, and procurement audits, resulting in both efficiency gains and significant cost savings. Automated anomaly detection in procurement contracts has allowed authorities to identify fraud, saving millions of dollars annually. Importantly, Singapore has matched these technological innovations with robust oversight and regulatory mechanisms, ensuring that risks such as algorithmic opacity or misuse of fiscal data are minimized. Its experience shows that AI can function not merely as a technical instrument but as part of a holistic governance model that enhances accountability and builds citizen trust.

India: Promise and Vulnerabilities in an Emerging Economy

India illustrates a more complex reality in which the adoption of AI brings clear benefits but also amplifies systemic vulnerabilities. The incorporation of AI analytics into the Goods and Services Tax (GST) system has helped detect tax evasion, identify high-risk taxpayers, and streamline compliance processes. These outcomes point to AI's transformative potential even in contexts with vast administrative challenges. However, India's experience has also highlighted the risks of algorithmic bias, as small businesses have often been disproportionately flagged for compliance irregularities. Furthermore, concerns over cybersecurity breaches and the uneven development of digital infrastructure reveal the difficulties of implementing advanced AI systems in weaker institutional contexts. India's case therefore underscores that while AI adoption in public finance can improve efficiency, without adequate regulatory frameworks and safeguards it may undermine equity and public trust.

Cross-Country Insights: Context as a Determinant of Outcomes

The comparative analysis of Estonia, Singapore, and India reveals that the impact of AI on public finance cannot be understood independently of institutional and governance contexts. Estonia and Singapore show that strong institutions and robust oversight mechanisms allow governments to harness AI for efficiency, accountability, and transparency. By contrast, India demonstrates how weak data protection, governance gaps, and infrastructural limitations amplify risks and constrain the realization of AI’s potential. These contrasts reinforce the conclusion that AI is not a value-neutral tool: its outcomes are shaped by how effectively governments design regulatory frameworks, secure sensitive fiscal data, and promote transparency in decision-making.

Towards a Responsible AI Framework

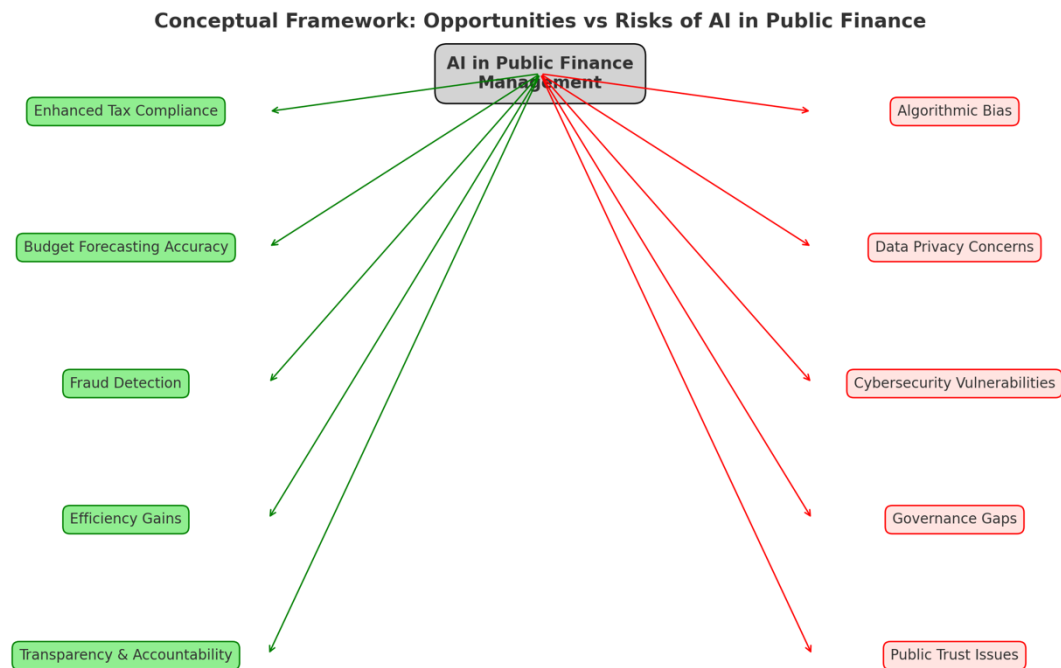
The discussion highlights the urgent need for a responsible AI framework in public finance management. Such a framework should incorporate transparency and explainability in algorithmic processes, robust data protection and cybersecurity policies, fairness mechanisms to address algorithmic bias, and oversight institutions capable of ensuring accountability. Capacity-building for public officials is equally essential, as technology must be accompanied by human expertise to interpret, monitor, and refine AI systems. A responsible AI framework would allow governments to maximize opportunities while mitigating risks, ensuring that technological innovation strengthens rather than undermines fiscal governance.

Opportunities vs Risks of AI in Public Finance

Opportunities	Risks
Enhanced tax compliance through predictive analytics	Algorithmic bias disproportionately affecting small taxpayers
Improved budget forecasting accuracy	Data privacy concerns and potential misuse of fiscal data
Fraud detection in procurement and expenditure	Cybersecurity vulnerabilities in digital fiscal systems
Efficiency gains by automating routine tasks	Governance gaps leading to opaque fiscal decisions
Greater transparency and citizen accountability	Declining public trust if systems remain “black boxes”

Conceptual Framework

The following conceptual framework visualizes the dual nature of AI in public finance management:

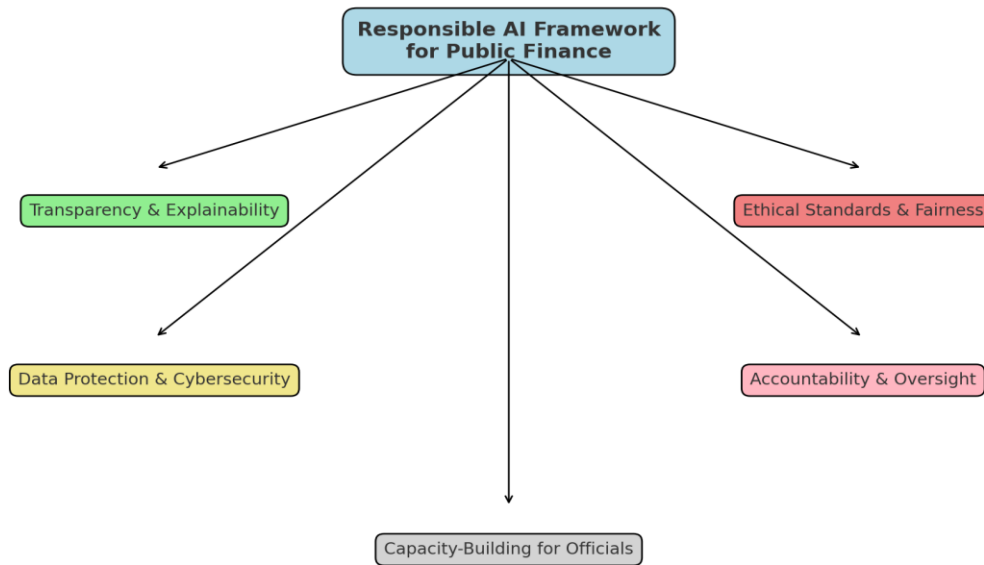


(Diagram displayed above: AI as the central hub connecting both opportunities and risks.)

Balancing the Equation

The study suggests a Responsible AI Framework for PFM, built on:

- Ethical standards for algorithmic transparency
- Strong data protection policies
- Independent oversight mechanisms
- Capacity-building for public officials to manage AI tools



Discussion

The comparative study of Estonia, Singapore, and India illustrates that the integration of Artificial Intelligence in public finance management produces both significant opportunities and notable risks, with outcomes highly dependent on governance structures and institutional capacity. Estonia’s pioneering use of AI in taxation and budgeting reveals that efficiency, compliance, and transparency gains are maximized when technological innovation is supported by long-term state commitment to digitalization and accountability. Singapore reinforces this point by demonstrating that AI systems embedded within a broader governance strategy—such as the Smart Nation initiative—can simultaneously enhance fiscal efficiency and maintain citizen trust through strong regulatory oversight. India, however, highlights the challenges of adopting similar technologies in emerging economies, where weak institutional safeguards, uneven infrastructure, and cybersecurity vulnerabilities make the risks of algorithmic bias, data breaches, and reduced trust more pronounced.

These findings align with existing scholarship that emphasizes AI's dual nature as both a transformative and disruptive force in public finance. On one hand, AI enhances predictive forecasting, strengthens fraud detection, and automates complex fiscal operations, thereby improving resource allocation and accountability (Mikhaylov, Esteve, & Campion, 2018; Wirtz, Weyerer, & Geyer, 2019). On the other hand, AI systems can undermine equity, privacy, and transparency when adopted in environments lacking regulatory frameworks and institutional maturity (Mehrabi et al., 2021; Zhang, Yang, & Wang, 2021). The comparative evidence suggests that AI is not a universally beneficial technology; rather, its effects are contingent upon governance contexts and the extent to which states implement safeguards for fairness, security, and accountability.

The discussion further underscores that AI adoption in public finance is not simply a technical upgrade but a governance reform. Governments must recognize that fiscal systems are not only mechanisms for revenue and expenditure but also instruments of public trust and social legitimacy. The opacity of AI-driven decisions, if unchecked, can weaken this trust and deepen skepticism about state accountability. Thus, the challenge for policymakers is to embed AI within fiscal systems in ways that are transparent, ethical, and inclusive. This requires a shift from viewing AI as a purely technical tool to considering it as part of a larger governance ecosystem.

Finally, the study contributes to debates on responsible innovation by proposing that the future of AI in public finance must be guided by a framework that balances efficiency gains with ethical safeguards. Such a framework would include algorithmic explainability, data protection standards, independent oversight mechanisms, and sustained investment in public sector capacity. Without these measures, the risks of AI may outweigh its potential benefits, particularly in contexts where governance institutions remain fragile.

Conclusion

This study has examined the role of Artificial Intelligence in public finance management by analyzing its opportunities and risks across three diverse national contexts: Estonia, Singapore, and India. The findings demonstrate that AI can transform fiscal systems by enhancing compliance, efficiency, forecasting, and transparency. However, the study also reveals that risks such as algorithmic bias, data privacy breaches, cybersecurity

vulnerabilities, and governance gaps remain critical challenges, especially in emerging economies.

The comparative approach highlights that the success of AI in public finance is not determined solely by technological capacity but by institutional readiness and regulatory robustness. Estonia and Singapore exemplify how strong governance and oversight can amplify the benefits of AI, while India illustrates how weak safeguards and infrastructural disparities can magnify its risks. These insights emphasize that context matters profoundly: AI must be embedded within accountable and transparent governance systems if it is to serve the public good.

The research contributes to both theory and practice by advancing the idea of a Responsible AI Framework for Public Finance, which integrates transparency, fairness, accountability, and security into the adoption process. Policymakers are urged to approach AI not as a quick-fix solution but as part of a long-term governance reform that requires ethical oversight, institutional capacity-building, and citizen engagement.

Future research should deepen this inquiry by incorporating empirical evidence from additional case studies, particularly in low-income countries, to broaden the understanding of how institutional weaknesses shape AI's risks. Quantitative assessments of fiscal outcomes under AI-enabled systems could also provide stronger evidence of efficiency gains and cost savings. Ultimately, ensuring that AI strengthens rather than undermines fiscal governance will depend on the willingness of governments to balance innovation with responsibility, thereby building systems that are efficient, equitable, and trusted by citizens.

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