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## Artificial Intelligence for Public Expenditure Analysis in Low-Income Countries: Opportunities and Challenges

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### Abstract

Artificial intelligence (AI) has increasingly become a pivotal instrument in reshaping public financial management across the globe. Nevertheless, its integration within low-income countries (LICs) remains sporadic and underdeveloped. This study conducts a short review of recent academic literature to explore how AI is being utilized in the analysis of public expenditure, placing particular emphasis on LICs. Through a comparative assessment of recent advancements and applied research, the study investigates the primary objectives, methodological frameworks, outcomes, challenges, and limitations associated with AI-driven approaches in areas such as budget prediction, anomaly identification, financial auditing, and expenditure efficiency. The results suggest that AI possesses considerable potential to improve transparency, operational efficiency, and fiscal accountability in the public sector. However, numerous challenges continue to hinder its full deployment, including technological limitations, institutional barriers, and infrastructural deficits. The paper highlights some of the most promising AI methodologies, including machine learning, natural language processing, and robotic process automation, while also pinpointing key implementation and validation gaps. This work contributes to a clearer understanding of the current landscape of AI-driven public expenditure analysis in low-income countries, identifies gaps in existing approaches, and outlines strategic pathways for future research in data-driven fiscal governance.

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## 1. Introduction

Effective management of public expenditure serves as a crucial driver of economic growth, social equity, and institutional development, particularly in low-income countries (LICs), where fiscal resources are often limited and demands on public services are high [1, 2]. When handled with transparency and efficiency, public spending can catalyze poverty alleviation, infrastructure improvements, and access to essential health, education, and welfare programs. However, when mismanaged, the consequences can be severe and far-reaching: macroeconomic instability, mounting public debt, erosion of trust in public institutions, weakened service delivery, and deterrence of both domestic and foreign investment. These systemic inefficiencies hinder development outcomes, deepen socio-economic inequalities, and undermine efforts to build resilient governance structures.

Public expenditure constitutes a fundamental pillar for fostering economic development, alleviating poverty, and delivering essential public services in many low-income countries [2]. Yet, the effective management of these expenditures is frequently hindered by deep-rooted structural inefficiencies, insufficient transparency, fragile institutional frameworks, and underdeveloped digital infrastructure. These issues are compounded by limited access to reliable data and the inherent complexity of financial systems, both of which constrain governments' ability to allocate resources efficiently and ensure their effective utilization.

In recent years, the rapid evolution of Artificial Intelligence (AI) has opened up novel possibilities to transform public financial management systems [3, 4, 5, 6]. Techniques such as machine learning (ML), natural language processing (NLP), and robotic process automation (RPA) have demonstrated considerable potential in improving the accuracy of budget forecasts, automating financial audits, detecting irregularities in transactions, and promoting fiscal transparency [7, 8]. While these technologies have begun to reshape public finance operations in high-income and some emerging economies, their adoption within low-income countries (LICs) remains fragmented, largely experimental, and insufficiently documented [9, 10, 11, 12]. It is therefore important to examine the specific pathways, barriers, and opportunities surrounding the use of artificial intelligence in LIC contexts. Understanding the technical applications, institutional dynamics, and socio-economic constraints is essential for informing policy and designing AI solutions that are both effective and equitable.

The objective of this study is to provide a comprehensive and critical review of recent developments in the use of artificial intelligence (AI) for public expenditure analysis in LICs. Specifically, the paper aims to:

- Explore how AI technologies are being applied in fiscal governance domains such as budget forecasting, anomaly detection, financial auditing, and expenditure efficiency.
- Synthesize recent academic and institutional research to identify the analytical techniques, data sources, and outcomes associated with AI-driven public finance initiatives.
- Examine the institutional, technical, and contextual challenges that hinder the effective implementation of AI systems in LIC environments.
- Highlight emerging methodologies and tools that show promise in addressing public finance constraints despite limited resources and capacity.
- Contribute to bridging the documentation gap by offering a structured overview of the evolving role of AI in strengthening transparency, efficiency, and accountability in public financial management systems.

This study relies exclusively on secondary data sources through a structured literature review. Given the limited availability of real-world AI implementations in LICs and the fragmented nature of available case studies, a scoping literature review offers a valuable first step toward understanding current trends, challenges, and opportunities in this field.

The remainder of this paper is structured as follows. Section 2 outlines the methodology used to select and evaluate the literature. Section 3 presents a comparative synthesis of the analyzed studies. Section 4 provides a critical discussion of emerging trends, benefits, and limitations. Section 5 explores broader opportunities and persistent barriers to the adoption of AI in public finance systems across low-income countries. Section 6 discusses the limitations of the study. Finally, Section 7 concludes the paper by highlighting avenues for future research and offering strategic guidance for practitioners and policymakers.

## 2. Research Methodology

This study employs a structured literature review approach to systematically identify, compare, and analyze recent scholarly work on the application of artificial intelligence in public expenditure analysis, with particular attention to low-income countries. The primary objective is to consolidate current knowledge on how AI methodologies are used to improve budget forecast accuracy, improve expenditure efficiency, and promote financial transparency in resource-constrained settings [13, 14].

This study did not conduct a formal meta-analysis with effect-size aggregation or quality scoring, as the heterogeneity of the selected studies and the scarcity of standardized evaluation metrics made such analysis impractical. Instead, we adopted a narrative synthesis approach to highlight recurring themes, challenges, and proposed solutions across diverse contexts.

To ensure methodological rigor, transparency, and reproducibility, this review adheres to the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. A structured process was implemented for the identification, screening, and inclusion of relevant studies, and this process is visually summarized using a PRISMA-style flow diagram (see Figure 1).

### 2.1. Selection Criteria

To guarantee both the relevance and quality of the material, we selected peer-reviewed journal articles and authoritative institutional reports published between 2021 and 2025. Sources were retrieved from academic and institutional databases, including Google Scholar, Semantic Scholar, ResearchGate, ArXiv, and official platforms maintained by organizations such as the IMF [13], OECD [15], and the World Bank [16]. Search queries combined keywords such as "Artificial Intelligence", "Public Expenditure", "Low-Income Countries", "Budget Forecasting", "Machine Learning", and "GovTech".

### 2.2. Inclusion and Exclusion Criteria

Documents were eligible for inclusion if they satisfied the following criteria:

- Presented original empirical research or conceptual contributions involving the application of AI in public financial management;
- Included case studies, datasets, or real-world implementations relevant to LICs or comparable environments;
- Were written in English or French and accessible in full text.

Conversely, the following were excluded:

- Theoretical discussions lacking practical AI application;
- Studies focused exclusively on private-sector financial systems;
- Articles without a clearly defined methodology or discernible results.

### 2.3. PRISMA-Based Selection Flow

To enhance transparency and ensure the reproducibility of our review process, a simplified PRISMA flow diagram is used (Figure 1) to represent the step-by-step procedure from the initial identification of sources to the final inclusion of studies.

## 3. Summary of selected studies

A comparative synthesis of ten recent scholarly contributions examining the application of artificial intelligence in the analysis of public expenditure, with a particular focus on LICs is presented in this Section. The selected studies, dating from 2021 to 2025, include both peer-reviewed academic articles and reports.

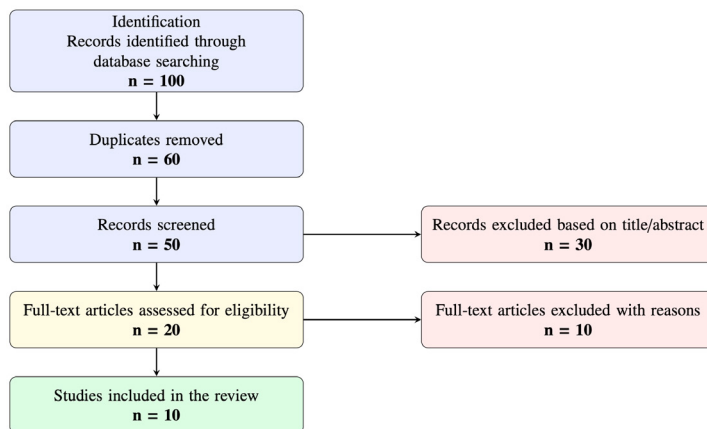


Fig. 1. Simplified PRISMA Flow Diagram of the Literature Selection Process

Table 1 presents a detailed comparative overview of the reviewed literature. For each entry, we record the objective, methodology, key findings, limitations, type of AI, country, and references. This structured comparison enables a clearer understanding of the prevailing methodological approaches, thematic variations, and evolving trends within the emerging field of AI-driven public financial analysis.

Table 1. Structured Literature Review: AI in Public Expenditure Analysis for LICs (2022–2025)

Objective	Methodology	Key Findings	Limitations	Type of AI	Country/ Area	Refs.
Optimize government expenditures using AI	Exploratory analysis	Identifies key optimization areas	Lacks empirical validation	ML, Analytics	Nigeria	[17]
Framework for AI adoption in LICs	Conceptual	Strategic roadmap for LIC governance	No technical implementation	Conceptual AI	Global LICs	[10]
Address investment bottlenecks in LICs	Policy /Institutional report	Highlights structural constraints to efficiency	Not AI-focused but policy-critical	Governance tech	LICs (IMF)	[18]
Link public spending, governance, and growth	Panel econometrics	Governance improves impact of spending	No AI integration	Non-AI empirical	Sub-Saharan Africa	[19]
Role of AI investment in poverty reduction	Econometric analysis	AI boosts macroeconomic performance	Limited generalization	LIC-wide ML applications	South Africa	[20]
AI diffusion analysis	Theoretical review	AI can reduce cost or widen gaps	Risks of dependence on foreign tech	General AI	LMICs	[21]
GovTech transformation of finance	Institutional cases	Fraud reduction, efficiency gains	Uneven adoption in LICs	Hybrid AI (ML + RPA)	Multinational	[13]
Analyze impact of expenditure allocation on health	ML regression models	Identifies high-impact allocation areas	Requires more datasets	LIC ML (regression)	Brazil (LIC context)	[14]
Assess AI integration challenges	Systematic review	Identifies infrastructure and policy gaps	No budget-focused evidence	ML, NLP	Africa	[12]
Modernization of public financial systems	Case study	Shows importance of digital transformation	Limited detail	AI-specific Digital + AI elements	Morocco	[22]

## 4. Critical Discussion and Analysis

The comparative review of the selected literature reveals an expanding, yet still fragmented, landscape regarding the adoption of AI in public expenditure management, particularly within LICs. Three key dimensions emerge from the analysis and merit closer examination: variation in methodological approaches, disparities in data accessibility and quality, and limitations in empirical validation and institutional preparedness.

### 4.1. Variation in AI Methodologies

The reviewed studies apply a diverse array of AI methods, including supervised and unsupervised machine learning algorithms, deep learning techniques, notably convolutional neural networks, natural language processing (NLP), and robotic process automation (RPA) [23, 16, 13]. This methodological diversity underscores the versatility of AI in addressing a broad spectrum of public finance challenges, such as anomaly detection, budget forecasting, resource allocation, and policy auditing. However, the choice of technique is frequently dictated by the type, structure, and availability of the data, which introduces significant constraints.

### 4.2. Challenges in Data Availability and Quality

One of the most persistent obstacles highlighted in the studies is the limited availability and poor quality of public financial data in LIC contexts [24, 25]. Unlike high-income countries, where financial information systems are largely digitized and standardized, LICs often contend with fragmented, outdated, or non-digitized data sources. These limitations significantly hinder the feasibility and scalability of advanced AI models. In particular, some researchers (e.g., [26, 20, 21]) have addressed these constraints by using nontraditional data sources, such as satellite imagery and mobile phone metadata, to estimate socio-economic variables. However, direct applications of such approaches to public expenditure datasets remain scarce.

### 4.3. Empirical Constraints and Institutional Readiness

Despite encouraging theoretical outcomes, such as improved forecasting accuracy and increased fiscal transparency, many of the reviewed studies remain largely conceptual or simulation-based [27, 9]. Very few have undergone testing or deployment within real-world public administration systems. Furthermore, critical institutional variables, including human resource capacity, regulatory frameworks, and political commitment, are frequently underrepresented in the models. Yet, these factors are essential for the sustainable implementation and uptake of AI innovations in the public sector [16, 15].

### 4.4. Emerging Trends and Unaddressed Research Needs

Several notable trends are emerging in this domain. First, there is increasing momentum toward integrating AI into existing public financial management frameworks via GovTech platforms [13, 18]. Second, the use of NLP and large language models (LLMs) is gaining attention for automating the interpretation of complex budgetary documents [16, 15]. However, several critical research gaps remain unresolved, particularly.

- the lack of empirical studies evaluating real-world deployments in LIC settings;
- insufficient attention to ethical implications and algorithmic transparency in public decision-making;
- the absence of comparative cross-country analyses to assess AI-readiness and policy uptake.

## 5. Opportunities and Challenges for Low-Income Countries

The integration of AI into public expenditure analysis presents a complex yet promising landscape for LICs. On one side, AI offers transformative possibilities for enhancing fiscal governance; on the other, its deployment is constrained by systemic, infrastructural, and ethical barriers that are particularly pronounced in resource-limited contexts. Figure 2 presents a taxonomy of challenges, opportunities, and applications used in public expenditure.

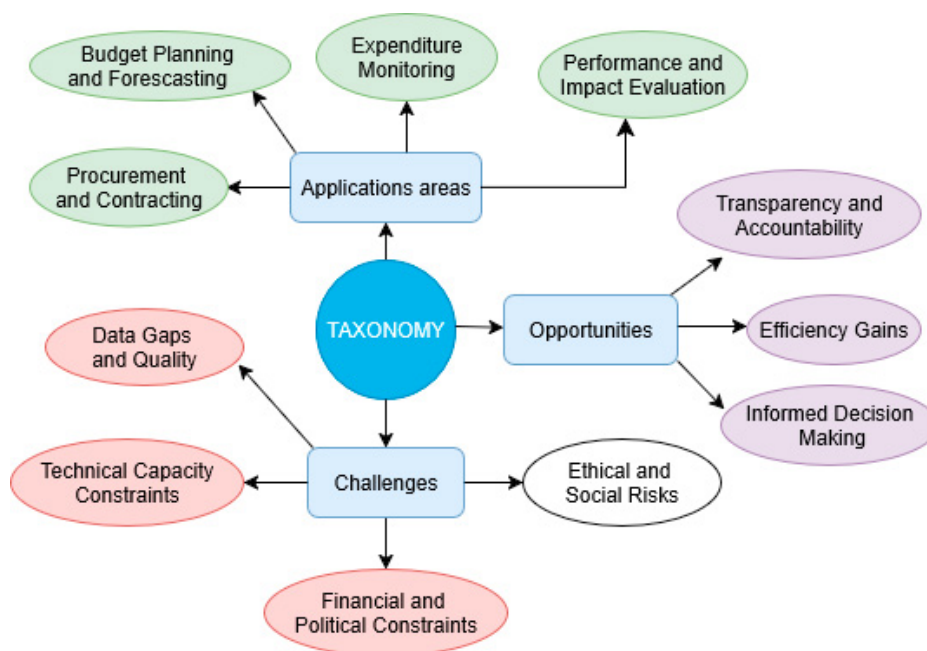


Fig. 2. Conceptual framework illustrating AI opportunities, application and challenges for public expenditure analysis in low-income countries

### 5.1. Opportunities

Several key opportunities appear for LICs that want to harness AI in their public financial management systems. AI can enhance transparency and accountability by detecting irregularities, tracking public expenditures in real time, and strengthening oversight mechanisms [13, 19]. Furthermore, machine learning models contribute to more accurate forecasting of revenues and expenditures, supporting better fiscal planning and budget reliability [27, 23]. Process automation, particularly through robotic process automation (RPA), enables the streamlining of repetitive administrative tasks, thereby reducing inefficiencies, delays, and human errors within financial workflows [13]. Moreover, natural language processing (NLP) techniques make complex budget documents more accessible to the general public, fostering greater citizen engagement and transparency in decision-making processes [16]. In contexts where official records are limited or outdated, AI can leverage alternative data sources such as satellite imagery, mobile network activity, and social media to provide valuable insights that support more informed and adaptive fiscal governance [26].

### 5.2. Challenges

Despite the potential benefits, LICs must navigate a series of complex obstacles that threaten the effective adoption and long-term sustainability of AI initiatives in public financial management. One major hurdle is insufficient data infrastructure; the lack of digitized and standardized financial datasets limits both the training and deployment of AI systems [24, 28]. Compounding this issue is a widespread shortage of technical capacity, as many public institutions lack the skilled professionals required to develop, implement, and maintain AI tools [15, 29]. Institutional resistance and regulatory uncertainty also play a significant role. Legacy systems, rigid bureaucratic structures, and vague legal frameworks frequently impede technological innovation and the integration of emerging AI solutions into existing workflows [16, 30]. In addition, the use of opaque AI algorithms in budgetary processes raises important ethical and governance concerns, including the risks of reduced transparency, unfair treatment, and biased decision-making in public finance [15]. Financial limitations further restrict progress, as the high upfront costs linked to infrastructure development, workforce training, and software acquisition often exceed available national resources—making external support from international donors and private-sector partners essential [24].



### 5.3. Balancing Innovation and Contextual Constraints

To unlock the potential of AI while addressing context-specific limitations, LICs must pursue a carefully calibrated strategy. This includes investing in foundational digital infrastructure, fostering international technical collaboration, adopting open data standards, and embedding ethical considerations into public sector AI frameworks [16, 15]. The successful adoption of AI also depends on multi-stakeholder engagement—spanning governments, academia, civil society, and international development partners—working collectively to ensure that AI technologies are harnessed to promote inclusive, accountable, and resilient public financial systems [13].

## 6. Limitations

While this review offers valuable insights, the limited number of included studies—only ten LIC-focused papers—may constrain the generalizability of the conclusions. Many of the selected works are conceptual or pilot-scale, reflecting the early stage of AI adoption in LIC public financial systems. Furthermore, this study did not conduct a formal meta-analysis with effect-size aggregation or quality scoring, as the heterogeneity of the selected studies and the scarcity of standardized evaluation metrics made such analysis impractical. Instead, a narrative synthesis was adopted to highlight recurring themes, challenges, and proposed solutions across diverse contexts. These limitations highlight the urgent need for more empirical, longitudinal, and quantitatively robust studies in this domain.

## 7. Concluding Remarks

This review has explored how AI is progressively shaping the field of public expenditure analysis, with particular emphasis on its application in LICs. By examining recent academic and institutional studies, we were able to identify a wide range of AI applications, including budget forecasting and anomaly detection, and critically assess both their potential benefits and inherent limitations. A key insight is that, while AI holds considerable promise in enhancing transparency, efficiency, and reliability in public financial management, its adoption in low-resource settings remains hindered by persistent challenges. These include limited digital infrastructure, shortages of skilled personnel, and institutional inertia. What is especially notable is the diversity of emerging tools and methodologies currently being tested, although many are still in the pilot or experimental stage. This signals a growing momentum and interest in the use of data-driven approaches for better governance. However, the success of AI integration will depend not only on technological innovation, but also on political commitment, inclusive policy design, and context-sensitive ethical frameworks. Our findings suggest that the future of AI in public finance hinges on the capacity to foster collaboration between researchers, policymakers, and citizens. Only through coordinated, context-aware strategies can AI truly support the development of more transparent, equitable, and accountable fiscal systems in low-income countries. Given the limited but growing body of literature in this domain, our findings should be interpreted as exploratory rather than definitive. They provide a conceptual and policy-oriented foundation for future research that integrates robust quantitative analyses, standardized evaluation metrics, and applied case studies in LIC contexts.

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