

Algorithmic Governance and Public Value Creation: Reimagining Fiscal Systems in Emerging African Economies

Obiamaka Linda P. Egbo¹

¹Professor of Finance and Economic Development, Faculty of Business Administration, University of Nigeria, Nsukka

¹Special Adviser to the Governor on Public Financial Management, Government of Enugu State, Nigeria

ABSTRACT

This study examined the effect of green financial management on the firm value of manufacturing firms in Nigeria, with specific focus on how green investment ratio, environmental expenditure, and energy efficiency cost influence market capitalization. The study adopted an ex-post facto research design, utilizing panel least squares regression analysis based on secondary data extracted from the published financial statements of Nestlé Nigeria Plc, Nigerian Breweries Plc, and Guinness Nigeria Plc for the period 2015 to 2024, yielding 30 balanced observations. Descriptive statistics, normality tests, and regression diagnostics were performed using EViews 10.0 to ensure model robustness. The results revealed that green investment ratio (Coef. = 49.13960, $p = 0.0000$), environmental expenditure (Coef. = 50.18141, $p = 0.0176$), and energy efficiency cost (Coef. = 92.61867, $p = 0.0000$) all have positive and statistically significant effects on market capitalization. The model recorded an Adjusted R-squared of 0.7867, indicating that 78.67% of the variation in firm value is explained by the explanatory variables. The Durbin-Watson statistic of 2.03 confirmed the absence of autocorrelation, while the F-statistic (720.61, $p = 0.0000$) demonstrated the overall significance of the model. The study concludes that effective implementation of green financial management practices significantly enhances firm value by improving environmental efficiency, sustainability reporting, and investor confidence. It recommends that manufacturing firms in Nigeria should increase their commitment to green investment, environmental spending, and energy-efficient initiatives to strengthen firm value and achieve sustainable growth.

Keywords: Algorithmic Governance, Public Financial Management, Public Value, Digital State Capacity, Africa, Fiscal Reform, Artificial Intelligence

How to Cite

Egbo, O. L. P. (2025). Algorithmic Governance and Public Value Creation: Reimagining Fiscal Systems in Emerging African Economies. *Global Journal of Finance and Business Review*, 8(2), 1-16. DOI: <https://doi.org/10.5281/zenodo.19696818>

I. Introduction

Across the African continent, governments face a persistent and structurally embedded paradox: rising demands for public services amid chronic fiscal stress, institutional fragility, and eroding public trust. Tax compliance remains low, payroll fraud consumes significant proportions of public spending, procurement corruption redirects resources away from intended beneficiaries, and budget execution gaps undermine even well-designed expenditure plans. These are not merely administrative deficiencies, they reflect deeper institutional pathologies rooted in weak accountability systems, information asymmetries, and the political economy of discretion.

Into this landscape, algorithmic governance arrives with considerable promise. The rapid diffusion of digital infrastructure, mobile connectivity, and data systems across Africa has created new technical possibilities for transforming public financial management. Machine learning models can now detect anomalous patterns in payroll data; predictive analytics can flag high-risk procurement transactions; automated revenue systems can broaden tax bases without expanding bureaucratic headcount. These are not merely efficiency gains; they represent a qualitative shift in the nature of state decision-making, from rule-based administrative judgment to data-driven inference, from retrospective auditing to real-time monitoring, from manual discretion to automated control.

Yet the enthusiasm for algorithmic solutions in public finance has frequently outpaced critical engagement with their implications. Questions of who designs and governs these systems, whose data they use, whose interests they serve, and what risks they generate have often been subordinated to narratives of technological modernisation. This paper seeks to restore analytical balance. It argues that algorithmic governance in African fiscal systems is simultaneously a technical and political transformation, one that holds genuine potential for public value creation but also carries substantial risks of reproducing, and in some cases amplifying, existing structural inequalities.

The paper proceeds as follows. Section 2 reviews the relevant literature on algorithmic governance, public value, and digital transformation of the state. Section 3 develops the theoretical framework. Section 4 analyses the algorithmic transformation of specific PFM functions. Section 5 examines public value and governance outcomes. Section 6 explores the political economy of algorithmic reform. Section 7 presents illustrative case material from selected African countries. Section 8 offers a broader discussion, and Section 9 concludes.

2. Literature Review

2.1 Algorithmic Governance: Emergence and Concept

The concept of algorithmic governance has attracted growing scholarly attention across political science, public administration, and legal theory. Danaher et al. (2017) define it broadly as the use of computational algorithms to regulate, monitor, and manage social behaviour, encompassing both private-sector applications and state regulatory functions. In the public administration literature, Janssen and Kuk (2016) distinguish algorithmic governance from earlier e-government paradigms by emphasising its capacity for autonomous decision inference rather than mere process digitisation. Whereas e-government initiatives primarily sought to replicate existing administrative procedures online, algorithmic governance reconfigures the logic of decision-making itself.

Algorithmic systems in government operate across a spectrum from simple rule-based automation to sophisticated machine learning models capable of pattern recognition and probabilistic inference. Bannister and Connolly (2012) situate this within a broader trajectory of technological rationalism in public administration, tracing the progressive displacement of human judgment by computational systems. More critically, Dencik et al. (2019) argue that algorithmic governance must be understood as a political technology, one that encodes particular values, distributes power asymmetrically, and is susceptible to capture by dominant interests.

2.2 Public Value Theory

Public value theory, originally developed by Moore (1995), provides a normative framework for evaluating state action beyond narrow efficiency metrics. Moore argues that public managers must simultaneously deliver services that are operationally excellent, politically legitimate, and substantively valuable to citizens. The concept of public value encompasses not only the direct outputs of government programmes but also the broader effects on trust, democratic legitimacy, and social welfare. Bozeman (2002) extends this framework by distinguishing between value created by market actors and value that only the state can create, particularly in addressing market failures and protecting rights.

In the digital governance context, Cordella and Bonina (2012) argue that the introduction of information technology into public organisations does not automatically generate public value; outcomes depend critically on how technologies are designed, for whom, and within what governance structures. Bannister and Connolly (2015) further complicate the relationship between digital technology and public value, noting that efficiency gains in service delivery can coexist with deteriorating trust if citizens perceive systems as opaque or unaccountable. This tension between technical efficiency and democratic legitimacy is central to the present analysis.

2.3 Public Financial Management and Reform

Public financial management encompasses the full cycle of government budgeting, revenue administration, expenditure control, and financial reporting. The World Bank (2012) identifies PFM reform as foundational to development effectiveness, arguing that weak fiscal systems undermine the capacity of governments to translate resources into services. In sub-Saharan Africa, PFM deficiencies have been extensively documented: the African Development Bank (2020) estimates that illicit financial flows, tax evasion, and procurement corruption collectively deprive African governments of hundreds of billions of dollars annually, resources that could otherwise finance health, education, and infrastructure.

Recent scholarship has examined the potential of digital tools to address these deficiencies. Fjeldstad and Moore (2008) analyse the political economy of tax reform in Africa, emphasising that technological solutions must be embedded in credible institutional contexts to generate sustained compliance improvements. Prichard (2015) similarly cautions against technocratic approaches to revenue reform that ignore the political bargaining processes through which tax systems acquire legitimacy. These insights are directly relevant to evaluating algorithmic PFM innovations.

2.4 Digital Transformation and State Capacity in Africa

The literature on digital transformation in African governance has expanded rapidly alongside the continent's mobile revolution. Ndemo and Weiss (2017) document the emergence of digital governance initiatives across East Africa, noting that countries like Kenya and Rwanda have achieved remarkable gains

in public service delivery through mobile platforms and data infrastructure. However, Mwangi and Wamuyu (2019) caution that digital state capacity, defined as the ability of governments to deploy and govern digital systems effectively - is unevenly distributed and often dependent on foreign technical assistance, raising questions of sustainability and sovereignty.

Cinnamon (2020) introduces the concept of data inequality to African digital governance debates, arguing that the uneven distribution of data infrastructure and analytical capacity across socioeconomic groups means that data-driven systems may systematically disadvantage already marginalised populations. This concern is directly relevant to algorithmic PFM, where data gaps and infrastructure limitations can introduce biases that undermine both efficiency and equity objectives.

3. Theoretical Framework

3.1 Integrating Perspectives

This paper develops an integrative theoretical framework drawing on four traditions: public value theory, digital governance theory, institutional economics, and the political economy of technology. Together, these frameworks illuminate distinct dimensions of algorithmic governance in fiscal systems, from the normative question of what outcomes the state should pursue, to the organisational question of how digital systems reshape bureaucratic behaviour, to the structural question of how political and economic interests shape technological choices.

The framework's central proposition is that algorithmic governance in PFM creates pathways to public value through two primary mechanisms: 1.) information transformation, whereby algorithmic systems reduce information asymmetries between governments and taxpayers, vendors, and employees; and 2.) decision restructuring, whereby automated systems displace discretionary human judgment with rule-consistent, data-driven determinations. Both mechanisms have the potential to reduce corruption, improve allocation efficiency, and enhance accountability. However, both mechanisms are also subject to political contestation, technical failure, and value distortion.

3.2 Algorithmic Governance as Institutional Transformation

From an institutional economics perspective (North, 1990), algorithmic governance represents a shift in the formal rules and enforcement mechanisms that govern public resource allocation. Traditional PFM systems depend on hierarchical oversight, procedural compliance, and periodic audit, mechanisms that are resource-intensive, retrospective, and susceptible to capture. Algorithmic systems, by contrast, embed compliance requirements into automated workflows, making deviation technically difficult rather than merely legally prohibited. This represents what Williamson (1985) might term a shift in governance structure, from relational contracting to technological constraint.

However, institutional economics also highlights the importance of complementarity between formal rules and informal norms (North, 1990). Algorithmic systems imposed on institutional environments characterised by low trust, political interference, and weak rule of law may be subverted through manipulation of underlying data, circumvention of automated controls, or simple non-adoption. The effectiveness of algorithmic governance is therefore deeply conditioned by the institutional ecology into which it is introduced.

3.3 Political Economy of Algorithmic Reform

The political economy literature on technology (Winner, 1980; Lessig, 1999) emphasises that technical systems are never politically neutral, they embody particular values, serve particular interests, and distribute power in particular ways. In the context of African PFM reform, this means asking who designs algorithmic systems, who controls the data they consume, who benefits from their outputs, and who bears the costs of their failures. Bureaucratic actors with established rent-seeking opportunities, political elites who benefit from procurement opacity, and technical elites who gain from monopoly control of data systems may all have strong incentives to resist or capture algorithmic reforms.

The framework therefore posits that the pathway from algorithmic governance to public value creation is mediated by political economy factors, particularly the distribution of power over system design, the strength of accountability mechanisms, and the presence or absence of civil society capacity to scrutinise algorithmic systems. Where these mediating conditions are favourable, algorithmic governance can generate genuine public value. Where they are absent or adverse, algorithmic systems risk becoming instruments of new forms of digital authoritarianism or elite capture.

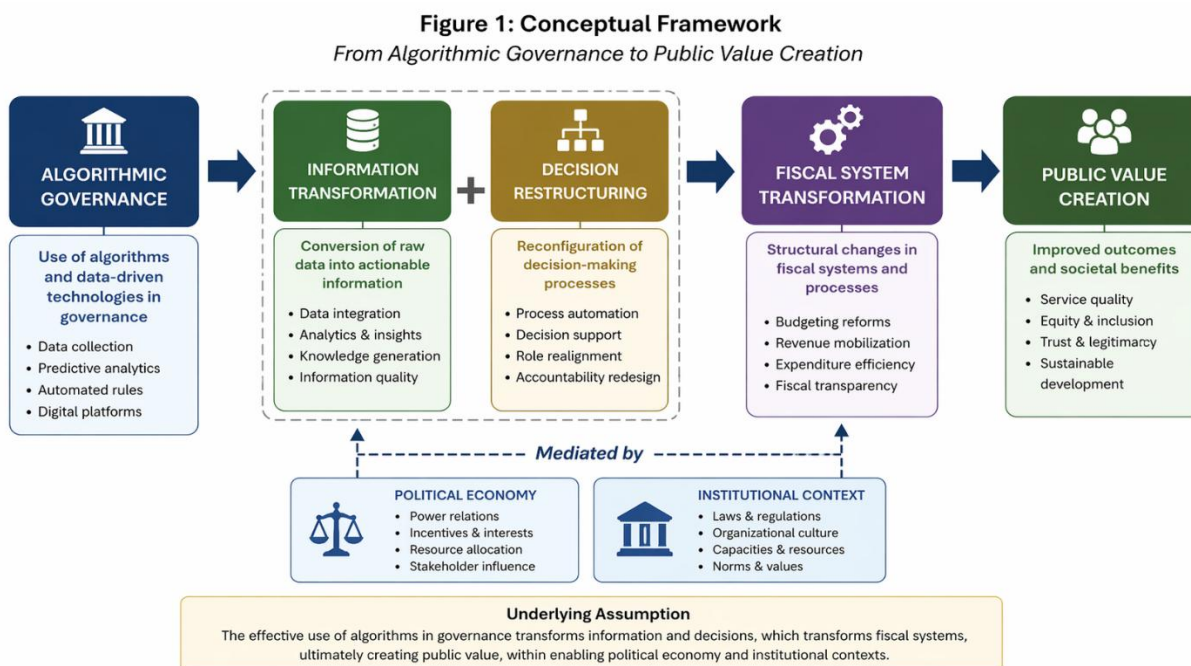


Figure 1: The Conceptual framework

This causal chain structures the analysis that follows.

4. Algorithmic Transformation of Fiscal Systems

4.1 Revenue Administration: From Compliance to Prediction

Revenue administration is perhaps the domain in which algorithmic tools have been most systematically applied within African fiscal systems. Traditional approaches to tax compliance rely on taxpayer self-declaration, periodic audits, and penalty enforcement, mechanisms that are labour-intensive, retrospective, and vulnerable to collusion between taxpayers and revenue officers. Machine learning and predictive analytics offer a fundamentally different paradigm: rather than waiting for non-compliance to be discovered through audit, algorithmic systems can continuously analyse taxpayer data to identify anomalies, predict evasion risk, and direct enforcement resources toward high-risk cases.

Predictive tax analytics can integrate multiple data streams, corporate financial statements, VAT transaction records, import and export data, mobile money flows, and third-party income reports, to construct probabilistic risk profiles for individual and corporate taxpayers. Studies from developed economies suggest that machine learning approaches to audit selection can double compliance yields compared to random or heuristic-based selection (Kleven et al., 2011). The extension of such approaches to African contexts requires careful attention to data quality and coverage, but the potential gains are substantial given current revenue mobilisation gaps.

Beyond audit selection, algorithmic tools can support integrated tax administration through automated registration systems, electronic filing and payment platforms, and real-time cross-matching of VAT invoice chains. The Uganda Revenue Authority and Kenya Revenue Authority have both deployed electronic fiscal device systems that automatically relay transaction data to central servers, enabling real-time VAT compliance monitoring. These systems reduce the scope for human discretion, and therefore corruption, at the point of revenue collection, while generating data assets that support deeper analytical applications.

4.2 Expenditure Management: Automating Fiscal Discipline

Expenditure management presents a different set of challenges and opportunities for algorithmic governance. The core problem in many African fiscal systems is not the absence of budget rules but the inconsistent application of those rules, often reflecting political pressures, institutional weaknesses, or deliberate manipulation. Algorithmic tools can address this through automated pre-payment controls that check expenditure requests against budget allocations, commitment registers, and procurement records before authorising payment.

Integrated Financial Management Information Systems (IFMIS) represent the most widespread application of this logic. When properly implemented, IFMIS platforms automate budget releases, commitment recording, payment processing, and financial reporting, reducing the scope for manual intervention and off-system transactions. However, the African experience with IFMIS has been mixed: while platforms such as Ghana's Ghana Integrated Financial Management Information System (GIFMIS) and Kenya's Integrated Financial Management Information System (IFMIS) have achieved notable successes in standardising financial processes, they have also been associated with implementation challenges, data integrity concerns, and resistance from line ministries accustomed to greater discretion (Andrews, 2013).

More recent applications apply machine learning to expenditure monitoring, using anomaly detection algorithms to flag unusual patterns in spending data, such as year-end expenditure spikes, unusual payment

amounts, or repeat transactions to single vendors, that may indicate poor planning or fraud. The transition from rule-based IFMIS controls to adaptive, learning-based expenditure monitoring represents a qualitative upgrade in the intelligence of fiscal oversight.

4.3 Payroll Management: Eliminating Ghost Workers

Payroll fraud, including the payment of salaries to non-existent employees ("ghost workers") and duplicate payments to real employees, represents a significant drain on public resources in many African countries. A 2017 survey by the Nigerian government revealed that a payroll audit exercise identified over 60,000 ghost workers, saving an estimated NGN 200 billion in annual salary payments (Transparency International, 2019). Similar exercises in Ghana, Uganda, and Tanzania have yielded comparable results, highlighting the scale of the problem.

Algorithmic approaches to payroll integrity combine biometric identification, database cross-matching, and anomaly detection to systematically identify and remove fraudulent entries. Biometric registration links payroll records to unique physiological identifiers, making the creation of fictitious employees technically difficult. Automated cross-matching algorithms compare payroll databases against tax records, pension registers, and death registries to identify implausible entries. Machine learning models can further identify statistical anomalies, such as unusually large numbers of employees in a single department or systematic patterns of year-end salary adjustments, that may indicate systematic manipulation.

The implementation of the Integrated Payroll and Personnel Information System (IPPIS) in Nigeria, while politically contested, illustrates both the potential and the limitations of algorithmic payroll management. The system achieved significant savings through ghost worker elimination but generated substantial resistance from university staff and other professional groups who objected to the loss of institutional autonomy in payroll management, highlighting the political economy dimensions of algorithmic reform.

4.4 Public Procurement: Algorithmic Fraud Detection

Public procurement is the fiscal domain most extensively studied in corruption research, and it is one where algorithmic tools offer particularly significant analytical leverage. Procurement data, bid submissions, contract awards, payment records, vendor registrations, is structured, time-stamped, and rich in patterns that distinguish competitive from collusive bidding. Machine learning models trained on historical procurement data can identify collusive bidding patterns (such as bid rotation, complementary bidding, and cover pricing), detect conflicts of interest between procurement officers and vendors, and flag anomalies in contract pricing relative to market benchmarks.

The Open Contracting Data Standard (OCDS), adopted by a growing number of African governments, provides the data infrastructure for such applications by standardising the publication of procurement information. Rwanda's e-procurement system, which publishes comprehensive procurement data in OCDS format, has enabled civil society and government analysts to apply algorithmic tools to procurement monitoring, achieving measurable improvements in procurement competition and pricing efficiency (Andrews et al., 2017). Similar initiatives in Ghana and Kenya have demonstrated the potential of data-driven procurement oversight, though implementation challenges around data completeness and timeliness remain.

5. Public Value and Governance Outcomes

5.1 Efficiency and Resource Mobilisation

The most direct pathway from algorithmic PFM to public value creation runs through efficiency improvements. By automating routine compliance processes, directing enforcement resources toward high-risk cases, and eliminating fraudulent claims on the public purse, algorithmic systems can generate significant fiscal gains that can be redirected toward public services. The International Monetary Fund (2021) estimates that improved revenue mobilisation, including through digital taxation tools, could increase tax-to-GDP ratios in sub-Saharan Africa by three to five percentage points over a decade, a transformation that would substantially expand the fiscal space available for public investment.

These efficiency gains have direct implications for public value creation. Additional fiscal resources, if properly allocated, can finance expanded health coverage, improved educational infrastructure, and more resilient social protection systems, outcomes that constitute core elements of public value as defined by Moore (1995) and Bozeman (2002). However, the translation of fiscal efficiency into public value is not automatic; it depends on the quality of expenditure allocation and the political will to prioritise public welfare over elite benefit.

5.2 Transparency and Accountability

Algorithmic governance can also create public value through enhanced transparency and accountability. When procurement data is published in standardised formats, when tax administration decisions are made through transparent algorithmic rules rather than arbitrary official discretion, and when payroll systems are auditable through biometric verification, the informational foundations for accountability are strengthened. Civil society organisations, parliamentary oversight bodies, and investigative journalists can engage with public financial data in more systematic and rigorous ways.

However, transparency and accountability are not synonymous. Publishing data does not automatically generate accountability if civil society capacity to analyse and act on that data is limited, if judicial and parliamentary institutions lack the independence to hold executives to account, or if whistleblower protections are inadequate. Cordella and Bonina (2012) make the important distinction between transparency as a technical condition, the availability of information—and accountability as a political condition, the capacity to use that information to constrain power. Algorithmic governance can substantially improve the former; whether it improves the latter depends on the broader governance environment.

5.3 Service Delivery and Citizen Trust

Beyond fiscal efficiency, algorithmic PFM can contribute to public value through improved service delivery. When public resources are more effectively mobilised and less subject to diversion through corruption, the resources available for service provision expand. Additionally, algorithmic systems can directly improve service delivery by reducing bureaucratic friction, through automated eligibility determination for social transfers, digital public service platforms, and predictive demand modelling for infrastructure planning.

The relationship between algorithmic governance and citizen trust is more complex and theoretically contested. On one hand, improved service delivery and reduced corruption may enhance citizen

satisfaction with government and increase trust in public institutions. On the other hand, algorithmic systems that are opaque, error-prone, or perceived as unfair may erode trust, particularly among populations who have reason to distrust state institutions. Bannister and Connolly (2015) argue that trust in digital government depends not only on technical performance but on perceived legitimacy, fairness, and responsiveness. These are normative dimensions of public value that technical efficiency metrics cannot fully capture.

6. Political Economy of Algorithmic Reform

6.1 Who Designs and Controls the Algorithm?

The question of who designs algorithmic systems in African PFM is not merely technical; it is profoundly political. The majority of large-scale algorithmic governance initiatives in Africa have been implemented through partnerships with international technology vendors, large multinational corporations, development finance institution-funded consultants, and bilateral development partners. This creates a structural dependency in which the analytical logic embedded in algorithmic systems reflects the values, assumptions, and commercial interests of external actors rather than those of the governments and citizens they purport to serve.

Mwangi and Wamuyu (2019) document this dynamic in the context of East African digital governance initiatives, noting that the technical architectures of deployed systems frequently include provisions for data sharing with vendor servers outside the jurisdiction, creating data sovereignty risks that are rarely discussed in reform narratives. The asymmetry of technical capacity between African governments and international vendors also creates conditions for vendor lock-in, in which governments become dependent on external support for the maintenance and modification of systems they nominally own.

6.2 Bureaucratic Resistance and Political Capture

Algorithmic reforms in PFM generate resistance from multiple directions. Bureaucratic actors whose informal authority and in some cases income, derives from discretionary control over financial decisions have strong incentives to resist systems that automate and constrain that discretion. This resistance may take active forms (sabotage, manipulation of input data, deliberate system misuse) or passive forms (non-adoption, workaround practices, under-resourcing of technical teams). Andrews (2013) documents extensively how PFM reforms in Africa have been undermined by implementation gaps, arguing that the political will to sustain reform often decays once initial attention fades.

Political capture presents a different but equally serious risk. Algorithmic systems that concentrate fiscal data and decision authority can become instruments of political control if they are not subject to robust institutional oversight. A government that controls a comprehensive digital database of taxpayer financial behaviour, procurement transactions, and payroll records possesses extraordinary informational power. Without appropriate accountability structures - independent data protection authorities, judicial oversight, and free press scrutiny, such power can be deployed for political surveillance, selective enforcement, or the targeting of political opponents.

6.3 Algorithmic Opacity and the Black Box Problem

A distinctive feature of machine learning-based algorithmic systems is their opacity: the internal logic of complex models, particularly deep neural networks, is frequently unintelligible even to their designers. This creates what Pasquale (2015) terms the "black box" problem: consequential decisions affecting citizens' tax liabilities, contract awards, or employment status are made by systems whose reasoning cannot be explained or challenged. In the context of African PFM, where legal and institutional mechanisms for challenging government decisions are often weak, algorithmic opacity represents a particularly acute threat to accountability and due process.

The opacity problem is compounded by the uneven distribution of algorithmic literacy. When technical systems make decisions that citizens or civil society organisations wish to contest, the ability to do so requires not only legal standing but technical capacity to understand and interrogate algorithmic logic. In environments where such capacity is concentrated in a small technical elite, algorithmic governance may create new forms of exclusion that are structurally more durable than the arbitrary human discretion they replace.

6.4 Data Inequality and Systematic Exclusion

Algorithmic systems are only as good as the data on which they are trained and which they consume. In African contexts, significant populations, particularly rural communities, informal sector workers, and women, remain outside formal data systems. When algorithmic revenue systems are trained on historical tax data that predominantly reflects the formal urban economy, they may generate risk models that systematically underweight evasion in the informal sector while over-scrutinising formal sector actors who are already relatively compliant. Similarly, algorithmic expenditure systems that rely on electronic payment records may disadvantage beneficiary populations in areas without reliable digital infrastructure.

Cinnamon (2020) conceptualises these dynamics under the rubric of "data inequality," arguing that the unequal distribution of data infrastructure creates a structural bias in algorithmic systems toward already-advantaged populations. This is not merely an efficiency problem, it is an equity problem with direct implications for the distributive dimensions of public value. Algorithmic PFM that improves fiscal outcomes for the formal sector while leaving the informal economy unaffected or disadvantaged may generate aggregate efficiency gains while worsening distributional outcomes.

7. African Case Illustrations

7.1 Kenya: Digital Revenue Mobilisation and Integrated Financial Management

Kenya represents one of the more advanced cases of algorithmic governance in African PFM. The Kenya Revenue Authority (KRA) has progressively deployed data-driven tools across its operational functions, including the iTax platform for electronic filing and payment, the Electronic Cargo Tracking System for customs monitoring, and predictive analytics tools for audit case selection. The KRA's use of third-party data matching, cross-referencing taxpayer declarations against banking transaction records, land registry data, and import/export records, has enabled a significant expansion of the effective tax base without proportionate increases in enforcement staff (KRA, 2022).

Kenya's IFMIS implementation has achieved significant improvements in budget execution transparency, with real-time expenditure data available to oversight bodies and the public through the Integrated

Financial Management Information System portal. However, the system has also been associated with high-profile procurement fraud cases in which perpetrators manipulated payment records within the system, highlighting the limits of technical controls when institutional oversight is insufficient (Transparency International Kenya, 2018). The Kenyan case illustrates the pattern identified in the theoretical framework: algorithmic tools create the information infrastructure for improved fiscal governance, but the translation of that infrastructure into public value outcomes depends on the strength of accountability institutions and the political will to use available information for disciplinary purposes.

7.2 Rwanda: e-Procurement and Algorithmic Transparency

Rwanda's e-procurement system represents perhaps the most technically sophisticated application of algorithmic governance in African public procurement. The Rwanda Public Procurement Authority (RPPA) has implemented a comprehensive electronic system that automates procurement processes from tender publication through contract award and payment, generating a rich data trail that supports both internal audit functions and external scrutiny. The system's alignment with the Open Contracting Data Standard enables civil society and media actors to apply analytical tools to procurement data, supporting independent monitoring of competitive practices and pricing benchmarks (Andrews et al., 2017).

Rwanda's experience reflects the enabling role of a relatively strong institutional environment in realising the public value potential of algorithmic tools. The country's combination of political commitment to anti-corruption reform, relatively capable public institutions, and a governance environment that, while not without democratic limitations, maintains credible commitment to service delivery outcomes, has created conditions under which algorithmic procurement tools have generated tangible improvements in value for money. However, analysts have also noted the tension between Rwanda's digital governance achievements and its constraints on political competition and civil society independence, raising questions about the sustainability and distributive dimensions of its model (Booth & Golooba-Mutebi, 2012).

7.3 Nigeria: Scale, Politics, and Implementation Challenges

Nigeria's experience with algorithmic PFM reform illustrates the challenges of implementing large-scale digital governance initiatives in a politically fragmented and institutionally complex environment. The Treasury Single Account (TSA) initiative, implemented from 2015, represents an ambitious application of algorithmic cash management: by consolidating over 20,000 government bank accounts into a single treasury account monitored through an automated reconciliation platform, the federal government achieved significant improvements in cash visibility and reduced opportunities for float-based diversions. Independent estimates suggest the initiative recovered billions of naira in previously undetected government funds within its first year of operation.

The IPPIS payroll system, while achieving substantial ghost worker savings, encountered sustained resistance from federal universities and other institutional actors. The National Universities Commission initially refused compliance, citing concerns about institutional autonomy over staffing and remuneration, a conflict that reflects the deeper political economy tensions inherent in algorithmic governance reform. The case illustrates how algorithmic PFM initiatives that threaten established institutional prerogatives generate political conflicts that cannot be resolved through technical means alone.

Nigeria also illustrates the data quality and connectivity challenges facing large-scale algorithmic systems in countries with significant infrastructure gaps. Incomplete and inconsistent data across state and federal systems, limited broadband connectivity in many states, and the large size of Nigeria's informal economy,

estimated at over 50% of GDP - all constrain the effectiveness of data-driven fiscal tools deployed at the national level.

7.4 Ghana: Biometric Systems and the Limits of Technical Solutions

Ghana's experience with biometric payroll systems offers a nuanced case study in both the potential and the limitations of algorithmic approaches to payroll integrity. The government's Mechanised Payroll and Human Resource Management System, subsequently upgraded with biometric verification components, achieved significant reductions in ghost worker claims and payroll fraud. The 2018 payroll audit identified substantial numbers of fraudulent entries across the civil service, generating estimated savings of several hundred million cedis annually.

However, subsequent analysis revealed implementation gaps that limited the system's effectiveness: biometric registration was incomplete in rural districts with poor connectivity, data synchronisation between the payroll database and personnel records was inconsistent, and some government departments developed workaround practices that preserved informal payroll arrangements outside the formal system. The Ghana case reinforces the institutional complementarity argument: biometric and algorithmic payroll systems can significantly improve fiscal outcomes, but only when embedded in governance environments with sufficient administrative capacity and political will to enforce compliance consistently across the public service.

8. Discussion

8.1 Towards Responsible Algorithmic Governance in African PFM

The evidence from theory and practice suggests that algorithmic governance in African fiscal systems is a genuinely powerful tool for public value creation, but one whose effectiveness and equity implications are deeply conditioned by political, institutional, and technical context. This section synthesises the analysis into a set of design principles for responsible algorithmic PFM governance.

First, transparency and explainability must be embedded as design requirements rather than afterthoughts. Algorithmic systems deployed in consequential PFM functions, audit selection, procurement evaluation, payroll verification, should be built using methods that permit human-intelligible explanation of individual decisions. This does not necessarily require the deployment of simpler models; it requires investment in interpretable AI techniques and the institutional processes for making explanations available to affected parties. Citizens and firms whose tax assessments, contract bids, or salary payments are affected by algorithmic decisions should have a right to understand and contest those decisions.

Second, accountability mechanisms must be structurally independent of the executive systems that deploy algorithmic tools. This means empowering parliamentary finance committees, supreme audit institutions, and independent data protection authorities with the technical capacity and legal authority to scrutinise algorithmic systems in use. The Organisation for Economic Co-operation and Development's (OECD, 2019) principles on algorithmic accountability in government provide a useful starting framework, though adaptation to the specific institutional contexts of African countries is essential.

Third, data protection and privacy frameworks must be developed and enforced alongside algorithmic deployment. The comprehensive fiscal data assembled by algorithmic PFM systems, transaction histories, income patterns, employment records, represents a significant privacy risk if inadequately protected.

African governments have made uneven progress in enacting data protection legislation: Nigeria's Nigeria Data Protection Regulation (2019) and Kenya's Data Protection Act (2019) represent meaningful advances, but implementation capacity remains limited and enforcement is inconsistent.

Fourth, institutional capacity building must accompany rather than follow algorithmic deployment. Algorithmic systems require human expertise for their configuration, maintenance, interpretation, and contestation. Investing in technical capacity within revenue authorities, public financial management offices, and oversight bodies is not merely a support activity, it is a prerequisite for effective and accountable algorithmic governance. Dependence on external vendors for technical maintenance creates vulnerabilities that undermine long-term public value realisation.

Fifth, equity and inclusion must be explicit design criteria rather than residual concerns. This means actively auditing algorithmic systems for disparate impacts on marginalised groups, investing in data infrastructure that covers informal sector and rural populations, and designing system interfaces that are accessible to users with limited digital literacy. The goal should not be algorithmic neutrality, a fiction given the value-laden nature of all design choices, but algorithmic justice: systems whose outcomes are defensible according to publicly articulated principles of fairness.

8.2 Systemic Risks and the Path to Digital Authoritarianism

The discussion of design principles must be complemented by honest acknowledgment of systemic risks. The most concerning scenario is not algorithmic failure but algorithmic success in the service of authoritarian governance. A government that deploys sophisticated fiscal surveillance systems, comprehensive financial data integration, and algorithmic enforcement mechanisms in an environment without robust democratic accountability has acquired extraordinary capacity for political control. The fiscal data collected through algorithmic PFM systems, who earns what, who pays taxes, who receives government transfers, who wins contracts, is also the data of political life, capable of being weaponised against dissidents, opposition actors, and minority communities.

This risk is not hypothetical. The deployment of digital financial surveillance systems by governments with limited democratic accountability has been documented in multiple contexts globally (Dencik et al., 2019). African governments are not immune to these dynamics, and the enthusiasm of international donors for fiscal digitalisation sometimes obscures insufficient attention to the governance conditions under which such systems operate. Development partners who fund algorithmic PFM systems have a responsibility to condition support on demonstrable progress in accountability and civil liberties frameworks.

8.3 The Limits of the Technical Fix

Throughout this analysis, a recurring theme has been the inadequacy of purely technical approaches to fiscal governance problems that are fundamentally political. The introduction of algorithmic systems into environments characterised by predatory elites, weak institutions, and fragmented social contracts cannot, by itself, resolve the underlying political economy of fiscal dysfunction. As Andrews (2013) argues compellingly in the context of PFM reform more broadly, the problem of isomorphic mimicry, adopting the forms of modern governance while preserving the substance of patrimonial practice, is a real and pervasive risk in algorithmic reform as much as in other reform domains.

This is not an argument against algorithmic governance. It is an argument for algorithmic governance that is embedded in a broader political project of institutional reform, democratisation, and social

accountability. Technical tools can shift the information landscape, raise the costs of certain corrupt practices, and create new opportunities for accountability actors. But they cannot substitute for the political foundations on which sustainable fiscal governance ultimately rests.

9. Conclusion

This paper has developed a conceptual and analytical framework for understanding the relationship between algorithmic governance, fiscal system transformation, and public value creation in emerging African economies. Drawing on public value theory, digital governance frameworks, institutional economics, and political economy analysis, it has argued that this relationship is neither automatic nor neutral, but is deeply conditioned by the political and institutional contexts in which algorithmic systems are designed and deployed.

The analysis of specific PFM domains, revenue administration, expenditure management, payroll integrity, and public procurement, demonstrates that algorithmic tools offer genuine and substantial potential to improve fiscal outcomes: widening tax bases, reducing corruption, improving budget execution, and generating the informational foundations for accountability. Case illustrations from Kenya, Rwanda, Nigeria, and Ghana show that these possibilities are not merely theoretical; concrete improvements in fiscal performance have been achieved through algorithmic PFM initiatives across the continent.

Yet the analysis has also documented the serious risks and limitations that qualify this potential. Algorithmic opacity threatens accountability. Data inequality risks encoding and amplifying existing patterns of exclusion. Political capture of algorithmic systems can transform tools of fiscal discipline into instruments of surveillance and control. Bureaucratic and political resistance can undermine implementation or force adaptations that hollow out reform content. And the structural dependency on external technical vendors creates vulnerabilities that compromise both sovereignty and sustainability.

Can algorithmic governance genuinely enhance public value in African fiscal systems, or does it risk reproducing existing inequalities in digital form? The honest answer is: both are possible, and which outcome prevails depends not primarily on the technical properties of the algorithms deployed but on the governance architecture within which they operate. Algorithmic tools deployed within contexts of robust accountability, strong civil society, independent oversight institutions, and explicit attention to equity can generate significant public value, improving fiscal efficiency, enhancing transparency, and expanding the resource base for public services. The same tools deployed in contexts of political authoritarianism, institutional weakness, and elite capture risk becoming instruments of a new and more technically sophisticated fiscal oppression.

The imperative for African governments, development partners, and civil society is therefore not to embrace or reject algorithmic governance categorically, but to insist on the governance conditions that make it genuinely beneficial. This means demanding transparency and explainability from algorithmic systems, investing in independent oversight capacity, enacting and enforcing data protection frameworks, building technical capacity within public institutions, and maintaining the democratic foundations on which accountable fiscal governance depends. Algorithms are powerful tools. Their value, or their danger, lies not in their code but in the governance choices made by the human institutions that design, deploy, and oversee them.

The digital transformation of African fiscal systems is already underway. The critical question is not whether it will happen, but whether it will be governed in ways that expand public value for all citizens or

entrench advantage for the few. That question is ultimately political, and answering it well is among the most important governance challenges of the coming decade.

References

African Development Bank. (2020). Africa economic outlook 2020: Developing Africa's workforce for the future. African Development Bank Group.

Andrews, M. (2013). The limits of institutional reform in development: Changing rules for realistic solutions. Cambridge University Press.

Andrews, M., Pritchett, L., & Woolcock, M. (2017). Building state capability: Evidence, analysis, action. Oxford University Press.

Bannister, F., & Connolly, R. (2012). Defining e-government and its outcomes. *Public Administration Quarterly*, 35(1), 8–33.

Bannister, F., & Connolly, R. (2015). The great theory hunt: Does e-government really have a problem with theory? *Government Information Quarterly*, 32(1), 1–11.

Booth, D., & Golooba-Mutebi, F. (2012). Developmental patrimonialism? The case of Rwanda. *African Affairs*, 111(444), 379–403. <https://doi.org/10.1093/afraf/ads026>

Bozeman, B. (2002). Public-value failure: When efficient markets may not do. *Public Administration Review*, 62(2), 145–161. <https://doi.org/10.1111/0033-3352.00165>

Cinnamon, J. (2020). Data inequalities and why they matter for development. *Information Technology for Development*, 26(2), 214–233. <https://doi.org/10.1080/02681102.2019.1650244>

Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, 29(4), 512–520. <https://doi.org/10.1016/j.giq.2012.03.004>

Danaher, J., Hogan, M. J., Noone, C., Kennedy, R., Behan, A., De Paor, A., Felzmann, H., Haklay, M., Khoo, S. M., Morison, J., Murphy, M. H., O'Brolchain, N., Schafer, B., & Shankar, K. (2017). Algorithmic governance: Developing a research agenda through the power of collective intelligence. *Big Data & Society*, 4(2), 1–21. <https://doi.org/10.1177/2053951717726554>

Dencik, L., Redden, J., Hintz, A., & Warne, H. (2019). The 'golden view': Data-driven governance in the scoring society. *Internet Policy Review*, 8(2). <https://doi.org/10.14763/2019.2.1413>

Fjeldstad, O. H., & Moore, M. (2008). Revenue authorities and public authority in sub-Saharan Africa. *The Journal of Modern African Studies*, 46(2), 161–182. <https://doi.org/10.1017/S0022278X08003200>

International Monetary Fund. (2021). Digital solutions for revenue mobilisation. IMF Fiscal Affairs Department Policy Paper No. 2021/023.

Janssen, M., & Kuk, G. (2016). The challenges and limits of big data algorithms in technocratic governance. *Government Information Quarterly*, 33(3), 371–377. <https://doi.org/10.1016/j.giq.2016.08.011>

KRA (2022). Annual report and financial statements 2021/2022. Kenya Revenue Authority.

Kleven, H. J., Knudsen, M. B., Kreiner, C. T., Pedersen, S., & Saez, E. (2011). Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. *Econometrica*, 79(3), 651–692. <https://doi.org/10.3982/ECTA9113>

Lessig, L. (1999). Code and other laws of cyberspace. Basic Books.

- Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard University Press.
- Mwangi, E., & Wamuyu, P. K. (2019). Digital governance in East Africa: Challenges and opportunities. *African Journal of Information and Communication*, 24, 1–22.
- Ndemo, B., & Weiss, T. (Eds.). (2017). *Digital Kenya: An entrepreneurial revolution in the making*. Palgrave Macmillan.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- OECD (2019). *Recommendation of the Council on Artificial Intelligence*. OECD Legal Instruments, OECD/LEGAL/0449.
- Pasquale, F. (2015). *The black box society: The secret algorithms that control money and information*. Harvard University Press.
- Prichard, W. (2015). *Taxation, responsiveness and accountability in sub-Saharan Africa: The dynamics of tax bargaining*. Cambridge University Press.
- Transparency International. (2019). *Corruption perceptions index 2019*. Transparency International.
- Transparency International Kenya. (2018). *Risk assessment of Kenya's IFMIS system*. Transparency International Kenya.
- Williamson, O. E. (1985). *The economic institutions of capitalism: Firms, markets, relational contracting*. Free Press.
- Winner, L. (1980). Do artifacts have politics? *Daedalus*, 109(1), 121–136.
- World Bank. (2012). *Public financial management: Performance measurement framework*. World Bank Group.