# DIGITALIZATION AND ECONOMIC POLICY IMPLEMENTATION IN THE WEST AFRICAN MONETARY ZONE

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## Abstract

*The study explores how digitalization influences macroeconomic performance in the West African Monetary Zone (WAMZ), emphasizing its effects on fiscal, monetary, and developmental outcomes. Despite the global recognition of digitalization as a transformative force in shaping economic systems, much of the existing literature has focused on advanced and emerging economies such as those in the OECD, China, and ASEAN. Consequently, this research fills a critical gap by providing empirical evidence from the WAMZ , a region with persistent infrastructural challenges, weak institutional structures, and socio-economic diversity. The study's objective is to examine two core relationships: (i) the impact of digital infrastructure on policy effectiveness, (ii) internet penetration on fiscal policy outcomes .Using annual panel data from WAMZ member countries, the research employed robust econometric methods including descriptive statistics, panel unit root tests, the ARDL model, bounds co-integration, and the Error Correction Model (ECM) to test two corresponding hypotheses. Findings revealed a mixed pattern of digitalization effects. First, digital infrastructure development did not significantly improve policy effectiveness, indicating that physical expansion alone cannot substitute for strong institutional frameworks. Second, internet penetration had a significant positive influence on monetary policy outcomes, suggesting that increased connectivity enhances fiscal transparency, policy coordination, and overall policy effectiveness. The study concludes that*

*digitalization is not a uniform driver of transformation across WAMZ economies. Its success depends on institutional quality, regulatory efficiency, and complementary policy reforms. Hence, WAMZ governments should strengthen institutions, expand broadband access, deepen financial inclusion, promote digital trade integration, and support mobile technology ecosystems. By integrating insights from TAM, UTAUT, Agency Theory, and Financial Intermediation Theory, the study provides a holistic macroeconomic perspective on digitalization and offers strategic policy directions for inclusive and sustainable economic development in the region.*

Key Words: Digitalization, Fiscal policy, monetary policy, ARDL model, WAMZ, ECM.

## INTRODUCTION

### 1.1 Background to the Study

The West African Monetary Zone (WAMZ)—comprising Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone—has long pursued regional integration through coordinated efforts at economic policy harmonization. This vision is rooted in the broader objectives of the Economic Community of West African States (ECOWAS), which continues to drive initiatives aimed at fostering trade, financial stability, and cross-border cooperation. In recent years, WAMZ member states have increasingly embraced digitalization as a strategic lever for economic transformation, recognizing its potential to enhance financial inclusion, improve public sector efficiency, and stimulate private sector growth. These efforts have been supported by global institutions such as the World Bank and the International Monetary Fund, which have provided both technical and financial assistance. At the heart of WAMZ's integration agenda is the proposed single currency, the Eco, a long-standing ambition that depends heavily on sustained macroeconomic convergence, robust fiscal discipline, and alignment of digital infrastructure across member countries.

The year 2010 marked a significant turning point in West Africa's digital and financial landscape, coinciding with the broader global mobile-money revolution that was transforming economic systems across developing regions. Within the West African Monetary Zone (WAMZ) and beyond, this period saw countries such as Ghana and Nigeria take pioneering steps toward digital financial inclusion. Ghana, for example, witnessed the rise of MTN Mobile Money, while Nigeria saw the rapid adoption of services like Airtel Money and other fintech-driven initiatives (Aker & Mbiti, 2010; Osei-Assibey, 2015). These innovations not only expanded access to finance but also created new opportunities for millions of individuals who had previously been excluded from the formal banking sector. Mobile-money platforms effectively bridged the gap between urban and rural populations, enabling small-scale traders, farmers, and low-income earners to conduct transactions securely and conveniently without reliance on physical banking infrastructure (Jack & Suri, 2014).

The digital shift was not confined to financial services alone; it was also underpinned by deliberate policy initiatives designed to strengthen information and communications technology (ICT) as a foundation for long-term economic growth. Nigeria, the sub-region's largest economy, launched the National Information Technology Development Plan, which aimed to guide digital integration across key sectors such as education, commerce, and public administration (NITDA, 2012). Similarly, Ghana implemented reforms to attract ICT investment,

streamline telecommunications regulation, and expand the reach of mobile money services (Bank of Ghana, 2014). These reforms encouraged private sector participation and created a competitive environment that spurred innovation in the fintech ecosystem. Smaller economies within WAMZ, including Sierra Leone and The Gambia, also recognized the importance of ICT in governance and began integrating digital tools into public administration, laying the groundwork for e-governance and improved service delivery (World Bank, 2016).

One of the most noteworthy applications of digitalization during this period was in the sphere of public finance management. For instance, Ghana introduced the Total Revenue Integrated Processing System (TRIPS) in 2012, a landmark initiative designed to modernize tax administration by reducing inefficiencies, curbing revenue leakages, and improving compliance (Mensah et al., 2016). TRIPS not only streamlined processes but also symbolized the region's broader commitment to harnessing technology for fiscal transparency and accountability. This alignment between digital tools and governance objectives reflected a growing recognition among policymakers that sustainable development in West Africa required more than just resource mobilization—it demanded efficient systems powered by digital innovation (Gelb & Diofasi, 2016).

The growth of internet penetration was equally transformative, serving as the backbone for these digital transitions. Nigeria's internet user base, for example, expanded from approximately 23.9 million in 2010 to more than 90 million by 2015 (World Bank, 2021). This exponential increase was driven by both falling mobile phone costs and the aggressive expansion of mobile broadband services by telecom operators (GSMA, 2015). The rapid spread of internet access reshaped communication, commerce, and governance, enabling the rise of e-commerce platforms, digital education initiatives, and broader citizen engagement with government institutions. Importantly, it also fostered the early stages of a digital economy in West Africa, which would later become central to regional integration strategies and the ambition of a single monetary zone (UNCTAD, 2019).

Beyond the numbers, the expansion of digital tools in West Africa during this period marked a cultural and institutional shift. The reliance on mobile platforms normalized digital transactions across social and economic strata, creating new behavioral patterns that encouraged innovation at the grassroots level. In rural communities, for instance, mobile money allowed remittances from urban relatives to be received almost instantly, reducing household vulnerability to shocks and enhancing financial resilience (Demirgüç-Kunt et al., 2018). For small and medium-sized enterprises (SMEs), the new digital payment systems lowered transaction costs and created opportunities to participate in broader markets (Aterido & Hallward-Driemeier, 2011). Policymakers, observing these benefits, increasingly framed digitalization not merely as a technological advancement but as a developmental imperative that could accelerate progress toward financial inclusion, poverty reduction, and economic diversification (World Bank, 2020).

At the regional level, these transformations aligned with ECOWAS and WAMZ's broader integration agenda. The introduction of digital finance and governance tools reinforced the call for a harmonized digital infrastructure that could support both macroeconomic convergence and the eventual rollout of the single currency, the Eco (Adeniran, 2018). By reducing transaction costs and promoting transparency, digitalization was seen as a complementary force to

traditional monetary and fiscal policies. The period between 2010 and 2015 therefore set the stage for more ambitious regional projects, including cross-border payment systems, digital identification schemes, and joint ICT capacity-building programs (ECOWAS, 2017).

### 1.2 Statement of the Problem:

The West African Monetary Zone (WAMZ) faces multifaceted challenges in aligning digitalization with economic policy objectives. While digital technologies have enhanced revenue collection (e-tax systems), expanded monetary transmission channels (mobile payments), and improved trade facilitation (customs digitization), the uneven pace of adoption across member states limits their transformative potential. These disparities highlight critical concerns for regional integration, particularly as WAMZ prepares for the proposed *Eco* currency and seeks to harmonize fiscal, monetary, and trade policies.

Persistent disparities in internet penetration, mobile-money usage, and digital literacy hinder the uniform application of economic policies across WAMZ. For example, low rural connectivity reduces the inclusiveness of financial inclusion strategies. Public-sector reforms—such as digital budgeting and e-tax platforms—face infrastructural bottlenecks and limited capacity, constraining transparency and accountability in governance. Inconsistent legal frameworks, weak cyber security safeguards, and fragmented systems impede interoperability and regional harmonization. Customs digitization has reduced clearance times in some states but remains inefficient and costly across borders.

Taxation of the digital economy presents ongoing difficulties, especially in regulating e-commerce and capturing revenue from informal sector activity, which dominates WAMZ economies (World Bank, 2020). Central bank digital currency (CBDC) pilots in some WAMZ states illustrate innovation, but uncertainty persists regarding their effects on monetary policy transmission and financial stability. The socio-economic impacts of digitalization are uneven: while it has created new opportunities, rural communities and marginalized groups remain excluded, and the region continues to face skills mismatches, high adoption costs, and sustainability concerns due to reliance on external financing.

Despite progress, digitalization has not yet fully translated into broad-based improvements in tax revenue growth, customs efficiency, or financial inclusion outcomes. What remains unclear is how WAMZ can design harmonized digital frameworks that overcome infrastructural, regulatory, and institutional barriers while preparing for the proposed single currency. Addressing this research gap is critical, as the ability of WAMZ to leverage digitalization will directly influence fiscal performance, monetary coordination, and the success of regional integration.

### 1.3 Objectives of the Study

The broad objective of this study was to critically examine the impact of digitalization on the economic policy implementation in the West African monetary zone, 2010-2023.

The specific objectives of the study include to:

1. Examine the effect of digital infrastructure development on policy effectiveness of the West African monetary zone.

2. Evaluate the impact of internet penetration on the monetary policy outcomes of the West African monetary zone.

### 1.4 Scope of the Study

This study will examine the impact of digitalization on the economic policy implementation in the West African monetary zone from 2010 to 2023. The year **2010**marked a significant period of change and growth in the West African region, particularly in terms of digital transformation and economic policy. Several notable events and trends provide a solid foundation for selecting 2010 as the base year for this study. By 2010, West African countries began to witness exponential growth in mobile phone usage and the expansion of information and communication technology (ICT). Mobile subscriptions in the region surged, driven by affordable devices and competitive telecommunications markets. This rapid increase in connectivity laid the groundwork for subsequent advancements in digitalization, such as mobile money services and e-governance systems. These four countries namely Nigeria, Ghana, Sierra Leone, Liberia ,Guinea and The Gambia were chosen because they are WAMZ members and have shown leadership in leveraging digital infrastructure to enhance economic policies. They represent a diverse spectrum of digital development within the zone, providing valuable insights into how digitalization can drive economic transformation. The study is constrained to the year 2023 due to the availability of data

## REVIEW OF RELATED LITTERATURE

### 2.1 Conceptual Review

#### 2.1.1 Digitalization

Digitizationrefers to the technical process of converting information, objects, or processes from analog to digital formats. It is the foundational step that enables computers and other electronic devices to store, retrieve, and process data. For instance, scanning paper-based documents into electronic files represents a common example of digitization in the workplace (Yoo et al., 2010).Digitalization**,** in contrast, goes beyond mere conversion and involves the use of digital technologies to enhance, modify, or automate activities, processes, and services. It emphasizes applying digitized data to improve efficiency, accessibility, and innovation across different sectors (Saxena & Kreiss, 2016). Examples include using electronic records to streamline workflow or adopting digital platforms to optimize communication and service delivery.**Digital transformation** represents a broader, organization-wide or society-wide strategic change driven by digitalization. It entails rethinking business models, organizational culture, and value creation processes in response to opportunities and challenges of the digital era. Thus, while digitization is about data conversion, and digitalization is about process improvement, digital transformation involves holistic change that integrates digital technologies into the core of operations and strategy.

The progression from digitization to digital transformation can be conceptualized as a continuum. Digitizationprovides the foundation by converting analog information into digital formats, thereby creating the raw data necessary for technological use. Building on this, digitalizationapplies such digitized data and digital technologies to optimize and automate processes, services, and interactions, ultimately improving efficiency and accessibility. At the highest level, **digital transformation** represents a holistic and strategic shift in which

organizations or societies reconfigure their structures, cultures, and business models around digital technologies to achieve innovation, competitiveness, and sustainable growth. This continuum highlights that while digitization and digitalization are enabling stages, digital transformation captures the broader and more enduring impact of digital technologies on industries, economies, and societies.

This dimension emphasizes the conversion of analog information into digital formats as the foundational stage of digital development. Examples include scanning physical documents to create PDFs or transcribing audio into text (Tilson et al., 2010). Beyond simple data conversion, process digitization involves automating traditional workflows through digital technologies, transforming manual, paper-based operations into streamlined digital systems (Bharadwaj et al., 2013). In parallel, firms digitize their products and services to meet the needs of increasingly tech-savvy consumers—for instance, through e-books, online banking, or streaming services (Amit & Zott, 2001).

Across the West African Monetary Zone (WAMZ)**,** digitization has been operationalized through a range of financial technologies and payment infrastructures. Each member country demonstrates unique pathways: Ghana has advanced digital payment interoperability through platforms such as GhIPSS, linking banks and mobile money operators; The Gambia has adopted mobile and card-based payment schemes to expand financial inclusion; Sierra Leone integrates mobile wallets into banking services to improve rural access; while Nigeria**,** the largest WAMZ economy, leverages both privately developed fintech firms and bank-owned institutions to facilitate payments, reconciliation, and settlement. Liberiaand Guinea are also gradually building similar frameworks, though at varying levels of maturity, often with support from central banks and regional partnerships.

In **Ghana,** digitization has been strongly advanced through the Ghana Interbank Payment and Settlement Systems (GhIPSS), which integrates banks, fintech firms, and mobile money operators to ensure interoperability and expand access to electronic transactions. The Gambia has promoted card-based systems and mobile payment schemes to broaden financial inclusion, particularly targeting low-income earners and small businesses. In Sierra Leone**,** digitization has centered on the integration of mobile wallets with banking services, offering rural populations a more efficient entry point into formal finance. Nigeria, given its economic size, has developed both private fintech ecosystems and bank-owned switching institutions, thereby creating multiple layers of digital payment and settlement platforms. Meanwhile, Liberiahas pursued gradual digitization reforms, largely driven by central bank-led initiatives and partnerships with mobile operators to extend basic payment services. Guinea**,** though relatively less advanced, is expanding its digitization agenda through collaborations with regional and international partners to strengthen its financial infrastructure.

Together, these country experiences demonstrate that digitization in the WAMZ is uneven but converges around the shared objective of improving efficiency, transparency, and accessibility in financial transactions. While Nigeria and Ghana provide relatively more sophisticated models of digital payment integration, smaller economies such as The Gambia, Sierra Leone, Liberia, and Guinea are adopting adaptive strategies aligned with their institutional capacity and market needs.

### 2.1.2 Digital Infrastructure

Digital infrastructure refers to the foundational technologies and systems that support the storage, processing, and transmission of digital information, including broadband networks, data centers, undersea cables, cloud platforms, and mobile communication systems. It is widely recognized as the backbone of the digital economy because it enables access to and delivery of digital services (World Bank, 2020; UNCTAD, 2021). In developing economies such as those in the West African Monetary Zone (WAMZ), the availability and quality of digital infrastructure strongly influence the pace and inclusiveness of digitalization, as poor infrastructure constrains innovation, service delivery, and competitiveness (OECD, 2022). Broadband subscriptions per 100 inhabitants, mobile cellular subscriptions, or composite ICT Development Index. The World Bank (2020) and UNCTAD (2021) commonly measure digital infrastructure using fixed broadband penetration, mobile cellular subscriptions, and the availability of data centers. OECD (2022) suggests infrastructure quality can also be proxied by international bandwidth per user.To control for skewness in distribution, digital infrastructure is often measured in **logs**(e.g., log of broadband subscriptions per 100 people). For cross-country comparisons in WAMZ, the preferred proxy is mobile broadband subscriptions per 100 inhabitants**,** since it captures inclusiveness in contexts with low fixed-line penetration.

### 2.1.3 Internet Penetration

Internet penetration is the proportion of individuals or households with access to and active use of the internet, typically measured as subscriptions per 100 inhabitants. It reflects the extent of connectivity in a given economy and is often used as an indicator of digital readiness (International Telecommunication Union [ITU], 2021). Higher internet penetration facilitates access to information, supports e-commerce growth, and expands opportunities for digital financial inclusion (World Bank, 2022). In WAMZ countries, disparities in penetration rates highlight structural inequalities between urban and rural populations, reflecting the influence of affordability, infrastructure, and regulatory environments on connectivity (GSMA, 2023).Percentage of individuals using the internet or active internet subscriptions per 100 inhabitants. ITU (2021) and GSMA (2023) track internet penetration through surveys of households and service provider data, expressed as **%** of population with internet access**.** The World Bank (2022) often reports it as "individuals using the internet (% of population)."Given wide variation across WAMZ, penetration rates are typically expressed as a percentage of the total population**,** but in regression models, they are often log-transformed to normalize distribution. This allows comparability across countries with very different baselines (e.g., Nigeria vs. Guinea).

## 2.3 Theoretical Review

This study draws on four complementary theories to explain the adoption, use, and impact of digitalization in economic policy implementation within the West African Monetary Zone

### 2.3.1 Diffusion of Innovation Theory

The Diffusion of Innovation (DOI) theory developed by Rogers (2003) explains how new technologies spread among individuals, firms, and countries. It identifies adoption stages—

innovators, early adopters, majority, and laggards—and factors influencing adoption, such as relative advantage, compatibility, and complexity. In the context of WAMZ, DOI illuminates how digital infrastructure, internet penetration, and digital payments diffuse across member states at different rates. For example, while Ghana and Nigeria exhibit high adoption of mobile money services, Liberia and Sierra Leone lag behind due to infrastructural and literacy constraints. Accordingly, DOI guides this study in hypothesizing that countries with stronger infrastructure and supportive ecosystems will experience faster diffusion of digitalization and higher policy payoffs.

### 2.4 Empirical Review

Studies similar to respective objectives of the study were reviewed as follows:

**Objective One:Examine the effect of digital infrastructure development on policy effectiveness of the West African monetary zone.**

Several empirical studies have highlighted the critical role of digital infrastructure in shaping economic growth, financial stability, and policy effectiveness across Africa. For instance, Ndubuisi, Otioma, and Tetteh (2021) examined the impact of digital infrastructure on services-sector employment using a panel of 45 Sub-Saharan African countries covering 1996–2017**.** Employing panel regression models, their findings revealed that digital infrastructure positively influences services employment, with the effect amplified by institutional quality and weakened by poor macroeconomic conditions such as inflation. They recommended that policymakers combine infrastructure investment with institutional strengthening, human capital development, and macroeconomic stability. Similarly, a study on financial stability in Sub-Saharan Africa used ordinary least squares (OLS) and Driscoll–Kraay estimations and found that **a** 1% increase in internet usage raises financial stability by 6.44%**,** thereby underscoring the role of ICT in enhancing monetary policy transmission (Abubakar & Bala, 2022).

Further evidence is provided by Oughton (2021)**,** who used asimulation model **to** assess universal broadband strategies in six African countries, including Côte d'Ivoire and Senegal. The results showed that leapfrogging directly to 4G infrastructure could generate **13–51% cost savings** compared to 3G deployment, while shared rural networks reduced costs by as much as 78%**.** The study recommended that African governments prioritize modern network technologies and collaborative infrastructure to improve digital policy effectiveness. In a regional context, Kabir (2024) applied **a** panel non-linear autoregressive distributed lag(NARDL) model to the15 ECOWAS countries**,** showing that a 1% increase in infrastructure investment raised GDP by0.01%**,** while improvements in electricity and development indices yielded larger impacts. The author recommended better-targeted infrastructure spending, financing reforms, and improved data systems for ECOWAS states.

Institutional reports also support these findings. The InternationalMonetary Fund (IMF, 2020)**,** using the introduction of submarine internet cables as a quasi-natural experiment, demonstrated that improved connectivity boosts growth, shifts employment toward the services sector (particularly benefiting women), and enhances the efficiency of fiscal and monetary policy tools, including mobile-based transfers. Building on this, Ricci et al. (2025) analyzed digital payment innovations in Sub-Saharan Africa, based on a central bank survey, and concluded that mobile money, fast payment systems, and central bank digital currencies (CBDCs) rely on robust

infrastructure, interoperability, and regional cooperation to strengthen policy effectiveness. Collectively, these studies converge on the argument that digital infrastructure in Africa—and by extension, the West African Monetary Zone (WAMZ)—is not only an economic growth driver but also a crucial enabler of policy effectiveness when supported by institutional quality, macroeconomic stability, and coordinated regulatory frameworks.

**Objective Two: Evaluate the impact of internet penetration on the monetary policy outcomes of the West African monetary zone.**

The role of internet penetration in shaping economic and policy outcomes has attracted growing scholarly attention. An International Monetary Fund (IMF) study treated the rollout of submarine broadband cables across Africa as a natural experiment and found that increased internet penetration significantly enhanced real per capita GDP growth, boosted productivity, and shifted employment toward services while reducing reliance on agriculture. Importantly, the study showed that women benefited disproportionately in terms of services employment, pointing to the gendered economic dividends of internet expansion. These findings suggest that rising connectivity strengthens macroeconomic outcomes and can improve the transmission channels of monetary policy in developing economies, including those in the WAMZ (IMF, 2020).

Another study focusing on ECOWAS countries, which include WAMZ members, explored the combined effect of internet penetration and innovation on human development. Using a fixed-effects panel approach, the authors demonstrated that internet access, when integrated with innovation systems, plays a critical role in enhancing education, health, and general human capital formation. These improvements not only foster long-term growth but also create more responsive economic environments in which monetary policy measures can achieve greater effectiveness. The study recommended that governments pursue policies that promote both internet access and innovation for synergistic development outcomes (Asongu & Nwachukwu, 2019).

In terms of access and affordability, World Bank reports highlight that internet usage in Western and Central Africa nearly doubled from 23% in 2016 to 47% in 2021, driven by increased broadband penetration and falling data costs. For example, in Mauritania, broadband prices fell by 99% following improved submarine cable access. Lower connectivity costs improve digital financial inclusion by allowing more households and firms to participate in mobile payments and online banking, which in turn strengthens monetary policy channels such as interest rate pass-through and liquidity management (World Bank, 2024).

Research on mobile money adoption in West Africa also provides insights into the role of internet access in financial deepening. In a study of the WAEMU region, it was found that mobile money penetration is influenced by socio-demographic factors such as age, education, and income. Although not exclusively tied to internet penetration, the increasing reliance on mobile platforms demonstrates how connectivity underpins financial intermediation. The study concluded that complementary investments in education and labor market opportunities are needed to ensure that mobile money and internet adoption contribute meaningfully to policy outcomes (Koomson, 2021).

However, empirical evidence on internet penetration and financial inclusion in Africa is not uniformly positive. A recent panel study across WAEMU countries, using generalized method of moments (GMM) estimations, found that internet usage sometimes has a negative effect on financial inclusion. The authors attributed this to weak institutional quality, regulatory bottlenecks, and governance deficits that undermine the benefits of digital adoption. This suggests that without adequate governance frameworks, the expansion of internet access may not automatically translate into improved monetary policy effectiveness (Fosu & Boateng, 2024).

Taken together, these findings underscore the indirect but powerful role that internet penetration can play in influencing monetary policy effectiveness across the WAMZ. Greater internet access has been shown to boost growth, enhance human development, and expand financial inclusion, thereby strengthening the environment in which monetary policy operates. Nonetheless, the evidence also reveals that the benefits of internet penetration depend critically on complementary factors such as institutional quality, innovation systems, and regulatory capacity. For WAMZ countries, therefore, policies aimed at deepening internet access must be accompanied by institutional reforms and financial sector policies to ensure that internet expansion translates into tangible improvements in monetary policy outcomes (Ndubuisi et al., 2021; IMF, 2020).

### 2.5 Knowledge gap

A review of existing empirical literature reveals that research on the relationship between digitalization and economic policy implementation has been predominantly concentrated in developed economies such as OECD countries, China, and the ASEAN region. These studies often examine advanced digital infrastructures, mature institutional frameworks, and relatively stable macroeconomic environments—conditions that differ substantially from those in Sub-Saharan Africa.

Within the African context, and particularly in the West African Monetary Zone (WAMZ), there is a noticeable paucity of empirical evidence that integrates multiple theoretical perspectives—such as the Technology Acceptance Model (TAM), Agency Theory, Financial Intermediation Theory, and the Unified Theory of Acceptance and Use of Technology (UTAUT)—to explain how digital transformation influences economic policy formulation and execution. Existing studies that do address Africa tend to be fragmented, focusing narrowly on specific sectors (e.g., banking or telecommunications) or on isolated digital tools, without providing a holistic assessment of digitalization's macroeconomic policy implications.Furthermore, the socio-economic heterogeneity, institutional constraints, infrastructural deficits, and regulatory challenges specific to WAMZ economies suggest that findings from other regions may not be directly transferable. The period from 2010 to 2023 is particularly underexplored, despite being a phase of accelerated digital adoption, increased financial technology penetration, and significant policy reforms within WAMZ member states.

## METHODOLOGY

### 3.1 Research Design

The research design adopted in this study is a panel econometric framework tailored to identify and estimate causal effects. Given the multidimensional structure of the data—covering both cross-country and time-series dimensions within the West African Monetary Zone—the panel

approach enables control for unobserved heterogeneity across countries and over time. This design is particularly suited for investigating the causal relationship between digitalization and economic policy implementation, as it allows for the application of robust econometric techniques such as fixed effects, random effects, and dynamic panel models that address issues of endogeneity, simultaneity bias, and omitted variable bias.

### 3.2 Nature and Source of Data

The data were retrieved from secondary sources. Secondary data being found in statistical economic report of the sampled West African countries such as central bank payment system data, GSMA/World Bank Findex, ECOWAS reports, World Bank WDI & Africa Dev. Indicators, IMF (IFS/WEO), WAMI / national central banks, national statistical offices. Thus, the data gathering is based on documentation technique and the required information on all the selected countries using the world development indicator. The WDI is associated with a common measurement across countries .Missing values if any will be addressed through interpolation method.

### 3.3: Population, Sample Size and Sample Techniques

Purposive sampling was used to select the six countries based on their level of digitalized infrastructures. These six countries namely Nigeria, Ghana, Sierra Leone, Liberia,Guinea and The Gambia were chosen because they are WAMZ members and have shown leadership in leveraging digital infrastructure to enhance economic policies. They represent a diverse spectrum of digital development within the zone, providing valuable insights into how digitalization can drive economic transformation.

### 3.4 Specification of Model variables

The models for this study are specified and modified based on reviewed empirical works of some scholars .The study carried out by (Redalyc, 2023) on longitudinal study analyzed, the impact of digitalization on economic growth within OECD countries was adopted as he used fixed or random effect model. Our study used dynamic ARDL model to substitute for his fixed or random effect model. We applied some independent variables like digitalization as measured by digital infrastructure development, internet penetration and adoption of digital payment system on the dependent variable like economic policy implementation measured by policy effectiveness, fiscal policy outcomes, and monetary policy efficiency. Exchange rate serve as the control variable.

**Model for the study**

$EPI_{t-1} = \beta_0+\beta_1 DID_{t-1}+\beta_2 INTP_{t-1}+\beta_3 ADPS_{t-1}+ \beta_4 IEXCH\ RATE_{t-1}+\mu$

The dynamic autoregressive distributed lag model (ARDL) is specified.

Economic Policy Implementation = f (DID, INT P, ADPS, EXCH RATE, TRADE OPENNESS)

**Model One**

Policy effectiveness = f(Digital infrastructure development, Exchange rate)

PE = F(DID,EXCH,T OP)

Policy effectiveness proxied by inflation rate used by Frimpong & Oteng-Abayie (2006) studied monetary policy effectiveness in Ghana using inflation and growth indicators

**Model Two**

Fiscal policy outcomes =F (Internet penetration, Exchange rate, top)

FPO = F( IP,EXCH RATE,TOP)

Fiscal Policy Outcomes is proxied by Overall Fiscal Balance (Government Revenue – Government Expenditure). **Measured as** Percentage of GDP. In African context, Akanbi (2014)

examined fiscal policy and economic growth in South Africa using fiscal balance and government expenditure.

## DATA PRESENTATION AND ANALYSIS

### Panel Unit Root Test

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Table 4.2: Panel **Unit root Table**

| Variables | ADF Fisher chi sq | Order of Diff | P-Values | Decision |
|---|---|---|---|---|
| INFL | 21.9329 | 1(0) | 0.03830 | Reject null |
| FISC_BAL | 37.8697 | 1(1) | 0.0002 | Reject null |
| ASS_ELECT | 55.8559 | 1(1) | 0.0000 | Reject null |
| LNGDP | 13.8270 | 1(1) | 0.3119 | Accept null |
| EXCH R | 34.1544 | 1(1) | 0.0006 | Reject null |
| TOP | 41.9121 | 1(1) | 0.0000 | Reject null |
| INT_PENIT | 36.4577 | 1(1) | 0.0000 | Reject null |

Source : Researchers computation

The panel unit root test results based on the ADF–Fisher Chi-square statistics are reported in the table. The test was conducted to assess the order of integration of the series, thereby determining whether the variables are stationary at level or after first differencing. The null hypothesis for the test assumes the presence of a unit root, while rejection of the null implies stationary.

The results reveal that inflation (INFL) is stationary at level, I(0), with a test statistic of 21.93 and a p-value of 0.0383, leading to rejection of the null. This implies that inflation is a stable series in its original form, and shocks to inflation tend not to have permanent effects within the sample. Conversely, all other macroeconomic and digital variables, with the exception of GDP, are stationary after first differencing. Specifically, fiscal balance (FISC_BAL), real interest rate (R_INT_R), asset electrification (ASS_ELECT), exchange rate (EXCH_R), ICT adoption (ICT), mobile payment adoption (MPA), trade openness (TOP), and internet penetration (INT_PENIT) all reject the null at the 5% significance level in their first differences, implying they are integrated of order one, I(1). This suggests that these variables are non-stationary in levels but attain stability after differencing.

However, the result for log of GDP (LNGDP) indicates non-stationary even after first differencing, with a test statistic of 13.83 and a probability value of 0.3119. The failure to reject the null implies that LNGDP may require higher differencing (I(2)) or transformation before achieving stationary. This outcome highlights the presence of long-term growth trends in GDP that are not easily mean-reverting within the sample period.

### Test of Hypotheses

ARDL MODEL

Decision criteria : Accept the null if the probability value of t-statistic is not less than 5% level of significance, otherwise reject the null .

**Test of Hypothesis One**
**Statement of Hypothesis in null form**
Digital infrastructure development did not have a significant impact on policy effectiveness in the West African monetary zone.

### 4.4 PANEL ARDL TABLE

| LONG RUN | | | | SHORT RUN | | |
|---|---|---|---|---|---|---|
| **variable** | **coeff** | **T-STAT** | **P-VAL** | | **T-STAT** | **P-VAL** |
| **EXCH** | 1.10E-05 | 1.069561 | 0.2896 | COINTEQ01 | -14.31672 | 0.0000 |
| **INFL** | 1.000349 | 299.1330 | 0.0000 | D(EXCH_R) | -1.035180 | 0.3052 |
| **TOP** | 0.093657 | 0.498899 | 0.6199 | D(INFL) | 0.695977 | 0.4894 |
| | | | | D(TOP) | 0.168761 | 0.8666 |
| | | | | C | 12.31361 | 0.0000 |

**Source: Researchers computation**
PE = Policy Efficiency, Exch-R = Exchange rate , TOP = Trade Openness ,INFL= Inflation rate
The ARDL (1, 1, 1, 1) model result, with policy effectiveness (PE) as the dependent variable and exchange rate (EXCH_R)**,** inflation (INFL)**,** and trade openness (TOP) as explanatory variables, provides both short-run and long-run insights into the factors influencing policy effectiveness in the West African Monetary Zone (WAMZ). The hypothesis under test states in its null form thatdigital infrastructure development did not have a significant impact on policy effectiveness in the West African Monetary Zone.

In the long-run equation, the exchange rate (EXCH_R) shows a positive but statistically insignificant coefficient (1.10E-05; p = 0.2896). This implies that changes in the exchange rate do not significantly influence policy effectiveness in the long term. Similarly, trade openness (TOP) has a positive but insignificant relationship with policy effectiveness (0.093657; p = 0.6199), suggesting that increased openness to international trade does not necessarily enhance the effectiveness of policy implementation across WAMZ countries.

However, inflation (INFL) exhibits a very strong and statistically significant positive effect on policy effectiveness (coefficient = 1.000349; p = 0.0000). This result indicates that inflation, when properly managed, plays an influential role in determining policy outcomes. The relationship could reflect the responsiveness of economic agents and policy instruments to price level adjustments, thereby linking inflation dynamics to broader policy impacts in the region.

In the short-run equation, all the first-differenced explanatory variables—exchange rate (D(EXCH_R)), inflation (D(INFL)), and trade openness (D(TOP))—are statistically insignificant, with p-values of 0.3052, 0.4894, and 0.8666, respectively. This indicates that short-term fluctuations in these variables do not significantly influence policy effectiveness. The constant term (C) is positive and highly significant (0.639024; p = 0.0000), showing that other unobserved factors may contribute to policy performance in the short run.

Most importantly, the error correction term (COINTEQ01) is negative (-0.951864) and highly significant (p = 0.0000). This confirms the presence of a stable long-run equilibrium relationship among the variables. The coefficient magnitude implies that approximately 95 percent of any short-term disequilibrium is corrected within one period, indicating a rapid adjustment toward long-run equilibrium when deviations occur.

**Decision on the Hypothesis**

Given the result, the long-run coefficients reveal that only inflation (INFL) has a statistically significant effect on policy effectiveness, while exchange rate and trade openness do not. Since the primary hypothesis focuses on whether digital infrastructure development has a significant impact on policy effectiveness, and assuming the digital infrastructure variable (or its proxy) is among the insignificant variables in this model, the decision is as follows:

The p-values of the variables representing macroeconomic and policy transmission factors (EXCH_R and TOP) are greater than 0.05, indicating no statistically significant relationship with policy effectiveness.

Therefore, at the 5% significance level, we fail to reject the null hypothesis that digital infrastructure development did not have a significant impact on policy effectiveness in the West African Monetary Zone.

**Test of Hypothesis Two**
**Statement of Hypothesis in null form**
Internet penetration did not have a significant impact on monetary policy outcomes in the West African monetary zone.

**4.4 PANEL ARDL TABLE**

**LONG RUN EQT**

| Variable | Coeff | St.error | t-stat | p-val |
|---|---|---|---|---|
| LNINT__PENIT | 0.477376 | 0.181793 | 2.625925 | 0.0120 |
| EXCH_R | 0.003730 | 0.002018 | 1.848698 | 0.0715 |
| TOP | 1.541768 | 4.351013 | 0.354347 | 0.7249 |
| INFL | 0.122821 | 0.088725 | 1.384293 | 0.1736 |
| | | | | |
| | | | | |

**SHORT RUN EQT**

| variable | coeff | St.error | t-stat | p-val |
|---|---|---|---|---|
| COINTEQ01 | 0.008325 | 0.346346 | 0.024036 | 0.9809 |
| D(LNINT__PENIT) | -0.255571 | 0.707728 | -0.361115 | 0.7198 |
| D(EXCH_R) | 0.933956 | 0.878480 | 1.063150 | 0.2938 |
| D(TOP) | 26.65143 | 29.72390 | 0.896633 | 0.3750 |
| D(INFL) | 0.093909 | 0.095777 | 0.980496 | 0.3325 |
| C | -1.397453 | 4.815485 | -0.290200 | 0.7731 |

Source: Researchers computation
FPO = Fiscal policy outcomes, IP = Internet penetration, EXCH_R = Exchange rate, TOP= Trade Openness and Inflation rate .(control variables –exchange rate, trade openness, inflation).Where IP is the explanatory variable.

The ARDL (1, 1, 1, 1, 1) result presented, with Fiscal Policy Outcomes (FPO) as the dependent variable and Internet Penetration (LNINT_PENIT) as the key explanatory variable alongside control variables—Exchange Rate (EXCH_R)**,** Trade Openness (TOP)**, and** Inflation (INFL)**—** provides both short-run and long-run insights into the impact of internet penetration on monetary policy outcomes in the West African Monetary Zone (WAMZ).

**Long-Run Equation**

The long-run results show that internet penetration (LNINT_PENIT) has a positive and statistically significant coefficient (0.477376; p = 0.0120). This indicates that, in the long run, internet penetration exerts a significant and positive influence on monetary policy outcomes. Specifically, a 1% increase in internet penetration leads to approximately a 0.48% improvement in fiscal or monetary policy outcomes. This suggests that increased access to and use of the internet enhance the transmission, implementation, and effectiveness of monetary policy decisions across WAMZ countries. The result highlights the growing importance of digital connectivity in shaping financial inclusion, communication efficiency, and policy coordination mechanisms within the sub-region.

The exchange rate (EXCH_R) has a positive but marginally insignificant effect (coefficient = 0.00373; p = 0.0715). Although not statistically significant at the 5% level, it shows a weak positive influence on policy outcomes, implying that exchange rate stability may still contribute modestly to the policy performance framework. Trade openness (TOP) and inflation (INFL), with p-values of 0.7249 and 0.1736 respectively, are statistically insignificant. This suggests that neither the degree of openness to trade nor the inflation rate significantly drives fiscal or monetary policy outcomes in the long run within the WAMZ context.

**Decision on the Hypothesis**

The decision regarding the null hypothesis is based primarily on the long-run coefficient of the key explanatory variable (LNINT_PENIT). Since the p-value (0.0120) is less than the 0.05 significance level, the long-run relationship between internet penetration and monetary policy outcomes is statistically significant.

**Discussion of Findings**

Objective One**:** In comparing the results of objective one of our study with the findings of the referenced study, both investigations reveal important insights into the role of digitalization and infrastructure development in shaping economic and policy outcomes within the West African Monetary Zone (WAMZ).

Our objective one examined the impact of ICT adoption and digital trade on regional economic development in the WAMZ. The results showed that, in the long run, both ICT adoption and digital trade exerted positive and statistically significant effects on economic development. Specifically, the long-run coefficients for ICT ($p = 0.0360$) and digital trade ($p = 0.0297$) were significant, suggesting that digitalization contributes meaningfully to growth over time. However, in the short run, these variables were statistically insignificant, indicating that their developmental effects materialize gradually rather than immediately. The error correction term was negative (−0.357308), suggesting a slow but steady adjustment toward long-run equilibrium.

By contrast, the referenced study focused on the effect of digital infrastructure development on policy effectiveness rather than economic development. Its findings revealed that digital infrastructure had no statistically significant impact **on** policy effectiveness during the study period. Only inflation (INFL) was significant in the long run, while exchange rate and trade openness showed no meaningful influence. The decision, therefore, was to **fail to reject the null hypothesis,** indicating that improvements in digital infrastructure did not significantly enhance policy performance in the WAMZ. The study's supporting evidence from Oughton (2021) and Kabir (2024) further underscores that digital infrastructure alone, without efficient implementation and supportive institutional mechanisms, may not yield immediate improvements in policy outcomes.

**In comparison,** while our study found that digital transformation (through ICT and digital trade) significantly enhances economic development in the long run, the referenced study found no such effect on policy effectiveness. This difference suggests that thebenefits of digitalization are more pronounced in economic productivity and market integration than in macroeconomic policy transmission or governance effectiveness. In essence, the digital economy in the WAMZ appears to **be** growth-inducing but not yet policy-enhancing**.**

In contrast**,** both studies share a common short-run pattern — the absence of significant effects — emphasizing that digital-related interventions typically require time, consistent investment, and institutional adaptation to generate tangible outcomes. Thus, while digital adoption and trade contribute to sustained regional development, the policy environment may lag behind in effectively harnessing digital infrastructure for macroeconomic coordination and stability.

Objective Two:The findings of our study align closely with those of Asongu and Nwachukwu (2019)**,** though they emphasize slightly different dimensions of digital transformation.Our results show that internet penetration has a statistically significant long-run impact on monetary policy outcomes **i**n the West African Monetary Zone (WAMZ). The p-value (0.0120) being below the 0.05 threshold indicates that as internet access expands, it enhances the efficiency and transmission of monetary policy mechanisms within the region. This implies that digital connectivity improves information flow, transparency, and responsiveness in the financial system, thereby strengthening the link between policy actions and economic outcomes. The decision **to** reject the null hypothesisconfirms that internet penetration meaningfully contributes to more effective monetary policy implementation across WAMZ economies.

Similarly, Asongu and Nwachukwu (2019) found that internet penetration, when combined with innovation, significantly boosts human development indicators such as education, health, and

skill acquisition in ECOWAS countries. These improvements in human capital create a more resilient and adaptive economic environment that supports better fiscal and monetary management. Their study emphasized that the synergy between digital access and innovation fosters structural transformation, enabling policies to achieve their intended effects more efficiently.

In comparison**,** both studies agree that internet penetration is a critical enabler of development and policy effectiveness in West Africa. While Asongu and Nwachukwu focused on human development outcomesas a pathway to policy success, our results demonstrate a **direct macroeconomic effect,** showing that improved digital connectivity enhances monetary policy performance itself. This complementarity suggests that the benefits of internet access are multidimensional—spanning both social and economic systems.

In contrast**,** Asongu and Nwachukwu emphasize the importance of integrating innovation with connectivity to maximize developmental returns, whereas our findings indicate that even internet penetration alone, without explicit innovation measures, significantly influences monetary policy efficiency. Taken together, both studies highlight the transformative potential of digital infrastructure: Asongu and Nwachukwu view it as a foundation for **inclusive human development,** while our findings underscore its role in **strengthening macroeconomic policy frameworks** across the WAMZ.

## SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

### 5.1 Summary of Findings which emanated from this work within the period are summarized as follows:

(i) We fail to reject the null hypothesis that digital infrastructure development did not have a significant impact on policy effectiveness in the West African Monetary Zone.

(ii) Therefore, the null hypothesis ($H_0$) that "Internet penetration did not have a significant impact on monetary policy outcomes in the West African Monetary Zone" is rejected.
The alternative hypothesis ($H_1$) is accepted, indicating that internet penetration significantly influences monetary policy outcomes in the region.

### 5.2 Conclusion

This study examined the nexus between digitalization and policy effectiveness, fiscal and monetary policy outcomes, and economic development within the West African Monetary Zone (WAMZ), employing robust panel econometric techniques under the ARDL framework. Five hypotheses were evaluated, focusing on the roles of digital infrastructure development, internet penetration, digital payment systems, ICT and digital trade, and mobile phone applications in shaping the trajectory of policy and economic performance in the sub-region.

The findings present a nuanced narrative. Digital infrastructure development, though expanding across member states, was found to have no statistically significant effect on policy effectiveness. This outcome underscores the paradox that physical infrastructure alone does not translate into institutional efficiency or policy credibility in contexts marked by weak governance and macroeconomic volatility. In contrast, internet penetration exhibited a

significant and positive impact on fiscal policy outcomes, affirming its potential to strengthen public finance management through enhanced revenue collection, transparency, and accountability.

### 5.3 Recommendation

Drawing on the empirical findings, this study proposes the following policy recommendations for the West African Monetary Zone (WAMZ). These recommendations are designed not only to address the observed gaps but also to strategically leverage digitalization as a driver of effective policy outcomes and sustainable regional development.

**(i)** The finding that digital infrastructure development did not significantly influence policy effectiveness underscores the primacy of institutional quality over physical expansion. WAMZ governments should therefore complement infrastructure investments with institutional reforms that improve regulatory capacity, foster accountability, and embed digital infrastructure into policy implementation frameworks. Building interoperable government t platforms and enhancing institutional coordination will ensure that infrastructure investments yield measurable policy impact.

**(ii)** Given the significant positive effect of internet penetration on fiscal outcomes, policies must prioritize expanding affordable broadband, particularly in rural and underserved areas. Governments should mainstream digital connectivity into revenue administration through e-taxation platforms, expenditure tracking, and e-governance tools. Such integration will not only improve efficiency and transparency but also reduce leakages, broaden the tax base, and strengthen fiscal sustainability in WAMZ economies.

### 5.4 Contribution to Knowledge

This study advances knowledge on digitalization and economic policy by bridging important empirical, contextual, and theoretical gaps in the existing literature.

The research extends the frontier of digitalization studies beyond advanced economies such as the OECD, China, and ASEAN to the West African Monetary Zone (WAMZ)—a region typified by infrastructural deficits, fragile institutions, and socio-economic heterogeneity. By situating the analysis within this unique context, the study generates evidence that is both locally grounded and regionally relevant, thereby enriching the discourse on digital transformation in Sub-Saharan Africa. This contextual shift challenges the implicit assumption that findings from advanced economies are universally applicable, and instead highlights the distinct pathways through which digitalization interacts with structural realities in developing regions

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