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Effects of Digital Innovations on Sustainable Development in West African Economic and Monetary Union (WAEMU)

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Abstract

Technological innovations are widely regarded as key drivers in advancing the Sustainable Development Goals (SDGs). While substantial research has explored the relationship between technological innovations and sustainable development, few studies have specifically examined the impact of digital innovations on the triadic nature of sustainable development. This article aims to fill this gap by analysing the influence of digital innovations on the three pillars of sustainable development (economic, ecological, and social) in the countries of the West African Economic and Monetary Union (WAEMU). Using advanced econometric techniques, the study investigates the relationship between digital innovations and sustainable development across its three dimensions from 2006 to 2022. The findings reveal that digital innovations have significant effects on sustainable development in WAEMU countries, with varying impacts depending on the specific dimension. The study offers insights into how digital innovations can be leveraged to accelerate the achievement of the SDGs.

Keywords: digital innovations, sustainable development, sustainable development goals (SDGs), WAEMU.

JEL Classification: O33; Q56; O55.

Introduction

The use of digital technologies in a dynamic process to develop or enhance products, services, or business models, with the goal of increasing value for both businesses and consumers, is known as digital innovation. Henfridsson et al, (2018) explain this phenomenon by defining digital innovation as the outcome of activities where digital resources are recombined in their design and application through links between value spaces. They specifically introduce the value spaces framework as a means to enhance comprehension of how customer value is created and captured through digital innovation. This impacts consumer behaviour throughout the purchasing process, spanning from information search before the sale to post-sale activities, and potentially including participation in the product or service's co-production.

The notion of sustainable development was first introduced in a report published in 1987 by the World Commission on Environment and Development of the United Nations entitled "Our Common Future" also called the Brundtland Report. This report indicates that sustainable development means, providing for current needs, in a way that does not deplete the resources that future generation will also need. However, it should be noted that this same report proposes six other definitions of this same concept, thus reinforcing its ambiguous nature. Since then, several studies such as those of the OECD, the UNDP, the World Bank and NGOs have multiplied on sustainable development. Overall, there are two main classifications of the concept of sustainable development: firstly anthropocentrism, which emphasizes the maintenance of human well-being through:

(i) the economist approach which calls for implementing the economic means of sustainability (Solow, 1986; Turner, 1988; OCDE, 2007);

(ii) the ecological approach which emphasizes the preservation of natural resources (Norgaard, 1984; Redclift, 1987) and

(iii) the social approach, which emphasizes socio-ecological conditions of well-being (Lele, 1991).

In second place comes eco-centrism which aims at the protection of life. In 2015, the United Nations General Assembly convened the "United Nations Summit for the adoption of the Post-2015 Development Agenda in New York from September 25th to 27th. One of its key outcomes was the formal adoption of 17 Sustainable Development Goals, serving as a comprehensive global framework for achieving a better and more sustainable future. All United Nations member states committed to working toward these goals within the defined timeline of 2015 to 2030, reinforcing a universal commitment to sustainable progress. To provide a more detailed roadmap for implementation, the 17 SDGs were further broken down into 169 specific targets, addressing a wide array of interconnected development challenges. The summit positioned the SDG framework as an urgent call to action, urging immediate and coordinated efforts from all nations. These goals were specifically designed to tackle pressing global issues such as poverty, inequality, education, climate change, environmental degradation, economic growth, innovation, and the promotion of peace and justice. Importantly, the SDGs emphasize universality, recognizing that sustainable development is a shared responsibility requiring engagement and implementation across all countries, regardless of their level of development.

However, to achieve the Sustainable Development Goals, several levers need to be activated, such as exploring and maximizing the potential of digital innovation (Cancino, et al., 2018). This implies understanding how technological changes ripple through various systems and sectors. It requires analysing the broader implications and feedback loops that might arise from the introduction and adoption of new technologies. Digital technologies drive efficiency gains, create new business models, and facilitate access to global markets. This enhanced competitiveness is vital for economic growth and prosperity, which is a key dimension of sustainable development (Klewitz & Hansen, 2014)

Countries that do not have access to emerging technologies risk falling behind, as these innovations can promote sustainable development in a rapidly changing world, according to the United Nations Industrial Development Organization (UNIDO) 2024 report, particularly in the area of frontier technologies (UNIDO, 2024). The ongoing transformations introduce fresh obstacles for nations endeavouring to recover from the multiples crisis and expedite their advancement towards realizing the SDGs. These crises, whose impacts are cumulative and mutually reinforcing, include geopolitical conflicts, the rise of extreme poverty, inflation, the housing crisis, and growing distrust in financial institutions. The report also indicates that technologies associated with Industry 4.0, like artificial intelligence, advanced robotics, the Internet of Things, additive manufacturing, big data analytics, and cloud computing, are changing how we live, what we consume, and what we produce.

The link between technological innovation and macroeconomic performance has been well-established in prior research (Datta, & Hatekar, 2024), exploring diverse areas such as the societal impact of technology (Yao & Kouakou, 2025)., the relationship between information and communication technology (ICT) and sustainable growth, the role of technology in fostering sustainable development, advancements in education and e-learning (Nicola-Gavrilă, 2023) globalization's impact on technology forecasting, the connection between social entrepreneurship and technology, and the role of green energy technology in promoting sustainability. Focusing on Malaysia, Bekhet & Abdul Latif (2018) analysed the impact of institutional quality and technological innovation on sustainable growth. They concluded that the convergence of governance and technological innovation has a beneficial impact on that growth, which aligns with broader research highlighting the importance of technological innovation in achieving macroeconomic goals. Omri (2018) posits that technological innovations in wealthy nations encourage environmentally friendly production by prompting investors to employ innovative technologies for a more sustainable environment, a finding that is consistent with the general understanding of technological innovations' importance in achieving macroeconomic performance.

A large literature has been devoted to examining the relationship between sustainable development and technological innovations. However, very few studies have analysed the effect of technological or digital innovations on the three dimensions of sustainable development. Our article intends to contribute to the literature by aiming to analyse the effects of digital innovations on the three dimensions of sustainable development (economic, ecological and social) in the countries of the West African Economic and Monetary Union (WAEMU).

1. Literature Review

The determinants of economic growth, including capital, labour, trade openness, foreign direct investment, energy consumption, and financial development, have traditionally been the main concern of researchers and policymakers, a perspective that has evolved with the growing recognition of technological innovations importance. Very recently, the importance of technological and digital innovations is increasingly highlighted as determining sustainable growth, and by extension sustainable development (Fagerberg, Srholec, & Verspagen, 2010).

Where earlier investigations prioritized the determinants of economic growth, several other studies have inquired into the social impact of technology, the effects of information and communication technologies (ICTs) on sustainable growth, technologies for sustainable development, education and e-learning, globalization and forecasting technologies, the relationship between social entrepreneurship and technology, green energy technology and sustainability. Technological innovations are generally measured by the share of research and development expenditure in GDP, financial development indicators or foreign direct investment.

In today's economy, it is ever more crucial to develop and provide products and services that foster sustainability. Digital technology and infrastructure-driven services can substantially advance sustainable development, as shown by digitally enabled car-sharing, were greater asset use decreases greenhouse gas emissions from production. However, there remains a need for deeper understanding of how digital service innovation can be intentionally used to enhance sustainability. To fill this knowledge gap, Heinz et al. (2025) present a systematic review of the literature, along with a qualitative inductive analysis of 50 articles examining the impact of digital service innovation on social, environmental, and economic sustainability. They offer a broad survey of practical examples and pinpoint five fundamental mechanisms through which digital service innovation can facilitate sustainable development. Ultimately, our goal is to provide a foundation for the intentional creation, design, and implementation of digital services that promote sustainability.

The digital revolution, marked by rapid technological advancements, offers a significant opportunity to accelerate progress toward the United Nations Sustainable Development Goals (SDGs) (Bocean, 2025). Bocean's research investigates the transformative potential of emerging digital technologies including artificial intelligence, big data analytics, cloud computing, and the Internet of Things in promoting sustainable development across economic, social, and environmental dimensions. Employing a rigorous empirical methodology, the study quantifies the impact of digital innovation on SDG achievement within the European Union. The Digital Economy and Society Index (DESI) is used as a comprehensive indicator of technological progress, and structural equation modeling is applied to capture the intricate relationships between digital advancement and sustainable development outcomes. A central focus of the analysis is the mediating role of economic performance, proxied by GDP per capita, in the link between digital technology adoption and progress toward the SDGs. This nuanced investigation reveals how economic conditions shape the efficacy of digital interventions in addressing global challenges. The findings highlight the importance of adaptive policy frameworks that leverage digital technologies while mitigating associated risks and promoting inclusive, equitable growth.

Mahjabeen, Nasir, & Omri (2024) studied the relationship between digital innovations, transport infrastructure, ICT and sustainable development and quality of governance over the period 1996 to 2021 in 17 developed countries. In line with the research that has examined the wider impacts of technology, their study establishes a clear link between ICT, digital innovation, environmental policies, and sustainable development, with the moderating role of quality of governance and transport infrastructure. The results showed that information and communication technologies and technological innovation have a positive and significant impact on the SDGs, especially when associated with high quality of governance and transport. On the other hand, governance has a negative impact on the SDGs, this effect decreases in the presence of higher levels of ICT, transport infrastructure. They test the robustness of their estimates using DOLS and PCSE methods, which validate their basic results. Other authors such as Wahab, Imran, & Safi (2022) establish contrary results.

Expanding on research into the impact of technology on various aspects of sustainability, Wahab, Imran, & Safi (2022) examine the relationship between financial stability, technological innovation, and renewable energy and the SDGs in the BRICS countries. They analyse how financial stability affects consumption-based carbon emissions in these nations between 1995 and 2018, factoring in the influence of renewable energy, technological innovation, industrial value added, and international trade. Employing a spatial Durbin model to address cross-border spillover effects, they conclude that financial stability, technological innovation, economic growth, and imports positively correlate with consumption-based carbon emissions, while renewable energy and exports exhibit a negative correlation.

Consistent with the focus on technology's contribution to sustainable development, Bekhet & Abdul Latif (2018) investigate the impact of institutional quality and technological innovation on sustainable growth. Their findings indicate that the combination of governance and technological innovation positively influences sustainable growth in Malaysia. Omri (2018) also observes that technological innovation in high-income countries encourages environmentally friendly production by motivating investors to utilize advanced technologies for a more sustainable environment. Additionally, Omri's research suggests that low- and middle-income economies should dedicate significant resources to the production and utilization of innovative technologies to reconcile environmental preservation and economic expansion, characterizing this reconciliation as a public good.

In a comprehensive study, Omri (2020) assessed the capacity of technological innovation to simultaneously foster economic growth and enhance social and environmental outcomes across a sample of 75 countries at varying income levels. The findings, derived from long-term estimations and causality analyses, indicate that the impact of technological innovation on sustainable development is highly context-dependent. Specifically, the results show that in high-income countries, technological innovation positively influences all three pillars of sustainable development - economic, social, and environmental. In contrast, for middle-income countries, the effects are limited to the economic and environmental dimensions, while no significant impact is observed in low-income countries. These findings underscore the importance of tailoring innovation policies to the specific developmental context of each country.

West African Economic and Monetary Union (WAEMU) region presents a unique context for the adoption of digital innovations for sustainable development. Although it faces significant challenges, the region also harbours considerable potential:

- Limited access to digital infrastructure, including internet connectivity and access to devices, remains a major barrier. This divide is particularly pronounced between urban and rural areas, hampering the spread and adoption of digital innovations.
- A significant proportion of the WAEMU population does not have the digital skills needed to use digital technologies effectively. This limits their ability to reap the potential benefits of digital innovations.
- The lack of clear and supportive policies and regulations can discourage investment in digital innovations and hamper their widespread deployment.
- The high cost of digital technologies and lack of access to finance, particularly for small and medium-sized enterprises (SMEs), can limit the adoption of digital innovations.

- Inadequate basic infrastructure, such as electricity supply and transport systems, can hinder the adoption of digital innovations.

The effects of technological innovations on sustainable development goals are documented and contradictory. However, few studies have taken on the task of examining the specific case of digital innovations on sustainable development. Our study intends to fill this gap by examining this issue in the countries of the West African Economic and Monetary Union.

2. Research Methodology

Our article aims to contribute to the literature by setting itself the objective of analysing the effects of digital innovations on the three dimensions of sustainable development (economic, ecological and social) in the countries of the West African Economic and Monetary Union (WAEMU) over the period 2006 to 2022. Drawing inspiration from previous work (McCartney, 2017; Bekhet & Abdul Latif, 2018; Shahbaz, Hye, Tiwari, & Leitão, 2013; Fan, Md Ismail, & Md Reza, 2018), we specify the following econometric model:

$$\mathrm{SDIit} = \alpha + \beta1\mathrm{INOVit} + \beta i\mathrm{Xit} + \mu\mathrm{it} \quad (1)$$

where: SDIit is the indicator used to measure sustainable development. It is a synthetic indicator that measures sustainable development in countries around the world. INOVit is used to measure digital innovations; *Xit* is a vector of control variables; *t* and I *ɛ it* represents respectively the time dimension (year), the individual dimension and the error term, α represents the constant.

The data on sustainable development are extracted from the SDGs Database (2022). The method for constructing this indicator is developed by the work of (Hickel, 2020). The final econometric model looks like this:

$$\mathrm{SDIit} = \alpha + \beta1\mathrm{INOVit} + \beta2\mathrm{INSTit} + \beta3\mathrm{FDIit} + \beta4\mathrm{TRADit} + \beta5\mathrm{HUMit} + \beta6\mathrm{INFit} + \mu\mathrm{it} \quad (2)$$

where: INOVit measures digital innovations, INSTit measures institutional quality, TRADit measures the degree of trade openness, HUMit measures human capital, INFit measures the level of inflation.

Justification for the choice of variables

Digital Innovations (INOV)

Technological advancement, particularly in the form of digital innovations, is increasingly recognized as a key driver of sustainable development. Wang & Kafouros (2015) highlight the central role that digital technologies play in fostering inclusive and efficient growth. In this study, digital innovation is operationalized through the overall usage rate of financial services, measured as the proportion of the adult population holding active accounts at formal financial institutions, including banks, post offices, national savings banks, the Treasury, microfinance institutions (MFIs), and electronic money establishments (EMEs). This indicator, adjusted for multibanking, is derived from Kinda (2024). Given the potential of digital tools to enhance financial inclusion and access to essential services, a positive relationship is hypothesized between digital innovation and sustainable development.

Institutional Quality (INST)

The role of institutions in shaping economic outcomes and sustainable development is well documented. Studies such as those by Akcomak & Weel (2009) and Demetriades (2006) emphasize the importance of governance structures in promoting long-term societal progress. Institutional quality in this study is captured using the six governance indicators proposed by Kaufmann et al. (1999): (i) *Voice and Accountability*, (ii) *Political Stability*, (iii) *Government Effectiveness*, (iv) *Regulatory Quality*, (v) *Rule of Law*, and (vi) *Control of Corruption*. These dimensions respectively assess electoral processes, the stability of governance, the efficiency of public service delivery, the quality of regulatory frameworks, adherence to the rule of law, and the extent of corruption. A synthetic index of institutional quality is constructed as the unweighted average of these six indicators. A positive association with sustainable development is expected.

Foreign Direct Investment (FDI)

FDI is widely recognized as a critical factor in economic development, particularly in emerging and developing economies. Empirical evidence from both developed countries and Sub-Saharan Africa indicates a significant positive impact of FDI on growth and development outcomes (Law, Kutan, & Naseem, 2018). In this context, FDI is expected to support the achievement of sustainable development goals (SDGs) by facilitating technology transfer, capital inflows, and job creation.

Trade Openness (TRAD)

Trade openness is often cited as a catalyst for economic growth and development. According to BCEAO (2021), the trade openness rate in the WAEMU region increased from 24.8% in 2020 to 26.2% in 2021, following a 14.8% rise in trade in goods and services. This aligns with findings from Pradhan et al. (2017) and Hsu and Tian (2014), who argue that trade liberalization enables countries to capitalize on their comparative advantages, thereby enhancing welfare and promoting sustainable development. A positive relationship is therefore expected between trade openness and sustainable development.

Human Capital (HUM)

Human capital is a cornerstone of sustainable development, influencing both productivity and social outcomes. For this study, human capital is measured using the Human Capital Index (HCI) developed by the United Nations Conference on Trade and Development (UNCTAD). The index comprises two sub-indices:

- The *health sub-index* includes indicators such as under-five mortality, maternal mortality, and the prevalence of stunting.
- The *education sub-index* includes lower secondary education completion rates, adult literacy rates, and the gender parity index for lower secondary education.

Building on the foundational work of Becker (1964) and subsequent empirical research (Jores & Law, 2016), we expect a positive impact of human capital on sustainable development.

Inflation (INF)

Inflation control remains a core macroeconomic objective, given its capacity to erode purchasing power, reduce investment, and destabilize economic systems. Persistent inflationary pressures can hinder progress towards sustainable development by compromising economic stability and public welfare. As such, a negative relationship is anticipated between inflation and sustainable development outcomes.

Table 1: Presentation of variables

Variables	Definition	Expected sign	Source
INOV	Digital innovations	+	BCEAO
INST	Institutional quality	+	WGI
FDI	Foreign direct investment	+	WDI
TRAD	Trade openness	+	WDI
HUM	Human capital	+	UNCTAD
INF	Inflation	-	WDI

Source: Author based on theory

3. Results and Discussion

Panel data has two dimensions: one for individuals (or any observation unit) and one for time. They are generally indicated by the index i and t respectively. It is often interesting to identify the effect associated with each individual, i.e., an effect which does not vary over time, but which varies from one individual to another. This effect may be fixed or random. In addition to the question of individual effects, the issue of correlation and heteroscedasticity in panel data is addressed.

Before moving on to model estimation, it is important to specify and perform preliminary tests on the model variables. Preliminary tests allow us to determine certain sources of bias related to the panel data in order to correct them for a better estimation.

Hsiao 's homogeneity test

The choice of specification (homogeneity, heterogeneity) is very important. In order to determine the structure of the panel, Hsiao (1986) proposes a sequential procedure of tests allowing to define the case in which we are situated. Hsiao statistic is based on Fisher's F and is calculated as follows:

$$F = \frac{(Rnc^2 - Rc^2)/(n-1)}{(1-Rnc^2)/(nT-k-1)} \sim F^{\alpha}_{(n-1,\, nt-k-1)}$$

Hypothesis tests are constructed from Fisher statistics (Wald test of restrictions on the coefficients).

H_0: Homogeneity ($F_{cal} < F_{tab}$; prob >5%): $\beta_1 = \beta_2 = \beta_3 = \ldots\ldots = 0$ (model constrained) → Rejection of the panel structure;

H_1: Heterogeneity ($F_{cal} > F_{tab}$; prob <5%): $\beta_1 \neq \beta_2 \neq \beta_3 \neq \ldots\ldots \neq 0$ (model not constrained) → The panel structure is accepted.

In our case, prob =0.000 <5%). Conclusion: Rejection of H_0 the unconstrained model is adequate to the data structure under study.

Hausman test

The Hausman test helps to choose the appropriate specification between the fixed effects model and the random effects model. The test statistic is:

$$W = (\beta_F - \beta_A)'var[(\beta_F - \beta_A)^{-1}(\beta_F - \beta_A)] \sim x^2_{dl=2}$$

where: $\beta_F = \beta_{MCO}$: Matrix of estimated parameters of the fixed effects model, $\beta_A = \beta_{MCO}$: Matrix of estimated parameters of the random effects model, var β_A and var β_F: The variance-covariance matrices of the random effects model and the fixed effects model respectively.

The hypotheses of the test are:

H_0: $\beta_F - \beta_A = 0$ (No differences between the two models);

H_1: $\beta_F - \beta_A \neq 0$ (Difference between the two models);

Decision: For our case, Hausman test = 0,000, there are no differences between the two models in this case, the random effects model is appropriate

To estimate the model, we will first use the fixed effects method and the random effects method. Since panel data are data on several individuals and evolve over time, it is possible to encounter autocorrelation problems in this analysis. To correct this bias, it uses the generalized least squares method and the panel corrected standard errors method.

To address the problems of multicollinearity, autocorrelation and heteroscedasticity of errors, the study uses the PCSE (Panel Corrected Standard Errors) estimator, corrected standard errors for panel to estimate the study model. The use of this estimator is justified in situations where the sample size is small and the individual dimension of the data is less than the time dimension (Beck & Katz, 1995). For the present study, the sample size can be considered small (eight countries) and the individual dimension (eight) is less than the time dimension (2006-2022).

The Hasuman test allows us to retain the random effects model. The results of the first estimation are reported in Table 3**.** Before presenting the econometric results, it is appropriate to present the descriptive statistics to identify the trends.

Table 2: Descriptive statistics

Variables	Observations	Average	Standard deviation	Minimum	Maximum
Sustainable development	136	0.4816176	0.0627997	0.327	0.589
Digital innovations	136	0.2390114	0.0854956	0.12	0.556
Institutional quality	136	-0.6847703	0.673822	-2.479409	0.5478926
Foreign direct investment	136	2,532225	2,518134	-2.574548	13,43879
Trade openness	136	54.98659	10,0912	31,33251	80,99059
Human capital	136	31,57537	15,11491	0.9973889	61.7
Inflation	136	2,651871	3,262977	-4.243386	14,51966

Source: Author's estimate

Table 2 shows that the WAEMU countries display relatively low scores in terms of sustainable development, i.e., an average of 0.48 out of 1 over the study period, namely 2006 to 2022. The minimum score displayed is 0.327 for a maximum score of 0.58. The same findings are established for digital innovations captured by the use of financial services, which display low levels. Institutional quality is relatively poor in this zone. On a scale of -2 to 2, the countries of the zone display an average score of -0.68 over the period for a maximum value of 0.57.

Human capital is poorly developed, as shown by the figures in Table 2. Inflation is relatively under control in all countries of the Union.

Econometric results

Table 3: Estimation results

Variables	FE	RE	GLS	PCSE
Digital innovations	0.1025169** (0.0520841)	-0.2229699 ** (0.0935457)	-0.2229699** (0.0897481)	-0.2229699** (0.1149907)
Institutional quality	-0.0172499*** (0.0053259)	0.0064 (0.0088002)	0.0064 (0.008443)	0.0064 (0.0099693)
Foreign direct investment	0.002333 (0.0019823)	-0.0015844 (0.0029647)	-0.0015844 (0.0028443)	-0.0015844 (0.0028332)
Trade openness	-0.0001097 (0.0003994)	0.0013276** (0.0006025)	0.0013276** (0.000578)	0.0013276*** (0.0003865)
Human capital	-0.0005523*** (0.0003013)	0.0004928 (0.0005063)	0.0004928 (0.0004857)	0.0004928* (0.0003608)
Inflation	-0.002082* (0.0010843)	-0.0050514** 0.0021398	-0.0050514** (0.0020529)	-0.0050514* (0.0030581)
Constant	0.4616342 (0.0223865)	0.4656908**** (0.0395494)	0.4656908 (0.0379438)	0.4656908*** (0.035738)
Number of observations	136	136	136	136
R squared	0.2408	0.2211		0.2045

Variables	FE	RE	GLS	PCSE
F Statistics	4.02			
Prob. (F Statistic)	0.0015			
Forest χ 2		20.83	22.63	46.63
Prob > χ 2		0.0020	0.0009	0.0000
Hausman test	0.00			
Prob (Hausman test)				
Rho	0.89511378	0.02575479		
Log likelihood			136.4117	
Number of countries	8	8	8	8

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: Author's estimate

From our estimation results, it emerges that regardless of the estimation method used, digital innovations have a significant impact on sustainable development in WAEMU countries. Considering the basic results obtained by the fixed/random effects method, the Hausman test allows us to retain the estimation results of the random method. Digital innovations have a negative impact on sustainable development. Our results are contrary to those of Bekhet & Abdul Latif (2018), Cancino, et al. 2018). The results obtained by alternative estimation methods such as the GLS and the PCSE support the same idea. This counterintuitive result still has an explanation. Digital innovations are poorly implemented in the countries of this zone and are not likely to influence sustainable development goals. Also, these countries are essentially recipients of innovations produced elsewhere and which are not necessarily adapted to their context. In a word, digital innovations have not yet reached stages where they can influence sustainable development goals in the countries of the zone.

Furthermore, trade openness has a positive effect on sustainable development. Trade helps increase economic growth and boost the SDGs in countries in the region. This result is consistent with those of (Pradhan, et al., 2017; Hsu & Tian, 2014).

Finally, our results allow us to conclude that an increase in the general level of prices in the Union is likely to undermine the efforts of political decision-makers to improve sustainable development indicators. Our results are consistent with those of many authors who conclude that inflation has harmful effects on macroeconomic variables in general.

Conclusion

The objective of this research is to analyse the effects of digital innovations on sustainable development goals in the countries of the West African Economic and Monetary Union over the period 2006 to 2022. It uses modern econometric techniques to test the hypothesis that digital innovations positively influence the SDGs. The results do not confirm this hypothesis given the particularity of the countries in this zone. Inflation also undermines efforts towards sustainable human development in these countries. It calls for measures to be taken to adapt innovations to the context of these countries while combating inflation.

The findings underscore that digital transformation extends beyond simply implementing new technologies; it encompasses a holistic approach that aligns with broader societal and economic objectives. For countries within the West African Economic and Monetary Union (WAEMU) to maximize the benefits of digital technologies, substantial investments in digital infrastructure are necessary. Additionally, enhancing technological education is crucial to equip the population with the skills needed to thrive in a digital economy.

Policymaking must also pivot towards fostering sustainable and inclusive economic growth, ensuring that the benefits of digital transformation permeate all layers of society. Collaboration between governments, private sector entities, and civil society organizations is essential to create a cohesive ecosystem where digital advancements can flourish. This partnership is vital for leveraging digital technologies in a way that promotes sustainable development.

A comprehensive strategy that intertwines technological innovation, economic progress, and social equity is required. By implementing adaptive policies, initiating collaborative partnerships, and focusing on digital education, WAEMU countries can harness the power of digitalization to expedite their progress towards the Sustainable Development Goals (SDGs), all while ensuring that inclusivity remains at the forefront of this transformation. Through these efforts, WAEMU can build a future where digital advancement contributes to the well-being of all its citizens, leaving no one behind.

Credit Authorship Contribution Statement

Kinda, A. was solely responsible for the conception and design of the study, the development of the methodology, and the collection and analysis of the data. He conducted the literature review, interpreted the results, and drafted the original manuscript. He also revised the paper critically for important intellectual content, managed all stages of the writing and editing process, and approved the final version of the manuscript for submission.

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Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Akcomak, S., & Weel, B. (2009). Social capital, innovation and growth: evidence from Europe. *European Economic Review, 53(5)*, 544-567. https://doi.org/10.1016/j.euroecorev.2008.10.001

BCEAO. (2021). *Report on foreign trade for the year 2021.* Dakar. https://www.bceao.int/en/publications/bceao-annual-report-2021

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with Time-Series Cross-Section data? *The American Political Science Review,* 89(3), 634-647. https://doi.org/10.2307/2082979

Bekhet, H., & Abdul Latif, N. (2018). The impact of technological innovation and governance institution quality on Malaysia's sustainable growth: evidence from a dynamic relationship. *Technology in Society,* 54, 27–40. https://doi.org/10.1016/j.techsoc.2018.01.014

Bocean, C. G. (2025). Sustainable Development in the Digital Age: Harnessing Emerging Digital Technologies to Catalyze Global SDG Achievement. *Applied Sciences*, 15(2), 816. https://doi.org/10.3390/app15020816

Cancino, C., La Paz, A., Ramaprasad, A., & Syn, T. (2018). Technological innovation for sustainable growth: an ontological perspective. *Journal of Cleaner Production, 179*, 31–41. https://doi.org/10.1016/j.jclepro.2018.01.059

Heinz, D., Hu, M., Benz, C., & Satzger, G. (2025). Digital Service Innovation for Sustainable Development: A Systematic Literature Review. In: Beverungen, D., Lehrer, C., Trier, M. (eds) Transforming the Digitally Sustainable Enterprise. WI 2023. *Lecture Notes in Information Systems and Organisation,* Volume 76. Springer, Cham. https://doi.org/10.1007/978-3-031-80125-9_10

Datta, S. & Hatekar, N. (2024). Modelling range volatility in currency bid - ask spreads: Implications for financial resilience and sustainable development in emerging market economies. *Journal of Global Sustainability and Development,* Volume I, Issue 1, 27 – 40. https://doi.org/10.57017/jgsd.v1.i1.02

Demetriades, S. (2006). Law, Finance, institutions and economic development. *International Journal of Finance & Economics, 11(3)*, 245-260. https://doi.org/10.1002/ijfe.296

Fagerberg, J., Srholec, M., & Verspagen, B. (2010). The role of innovation in development. *Review of Economics and Institutions, 1(2)*, 1-29. http://dx.doi.org/10.5202/rei.v1i2.15

Fan, H., Md Ismail, H., & Md Reza, S. (2018). Technological Innovation, Infrastructure and Industrial Growth in Bangladesh: Empirical Evidence from ARDL and Granger Causality Approach. *Asian Economic and Financial Review, 8(7)*, 964-985. https://doi.org/10.18488/JOURNAL.AEFR.2018.87.964.985

Henfridsson, O., Nandhakumar, J., Scarbrough, H., & Panourgias, N. (2018). Recombination in the open-ended value landscape of digital innovation. *Information and Organization, 28(2)*, 89-100. https://doi.org/10.1016/j.infoandorg.2018.03.001

Hickel, J. (2020). The sustainable development index: Measuring the ecological efficiency of human development in the anthropocene. *Ecological Economics 167*, 106-331. https://doi.org/10.1016/j.ecolecon.2019.05.011

Hsu, P.-H. X., & Tian, Y. X. (2014). Financial development and innovation: cross-country evidence. *Journal of Financial Economics,* 112(1), 116-135. https://doi.org/10.1016/j.jfineco.2013.12.002

Jores, R., & Law, S. (2016). ARDL bound test approach for cointegration between FDI, human capital and innovation activities: insights from Malaysia. *Journal of Advanced Resources in Business Management Study, 5(1)*, 57-71. https://www.akademiabaru.com/submit/index.php/arbms/article/view/121

Kaufmann, D., Kraay, A., & Zoido-Lobaton, P. (1999). Governance matters (English). *Policy, Research working paper; no. WPS 2196 Washington, D.C. World Bank Group.* http://documents.worldbank.org/curated/en/665731468739470954

Kinda, A. (2024). Digital Innovations: Threat or Opportunity for Financial Stability in WAEMU Countries? *The IUP Journal of Financial Risk Management,* 21(4), 47-55. https://iupindia.in/ViewArticleDetails.asp?ArticleID=7536

Klewitz, J., & Hansen, E. (2014). Sustainability-oriented innovation of SMEs: a systematic review. *Journal of Cleaner Production, 65*, 57–75. https://doi.org/10.1016/j.jclepro.2013.07.017

Krammer, S. (2015). Do good institutions enhance the effect of technological spillovers on productivity? Comparative evidence from developed and transition economies. *Technological Forecasting and Social Change, 94*, 133-154. https://doi.org/10.1016/j.techfore.2014.09.002

Law, S., Kutan, A., & Naseem, N. (2018). The role of institutions in finance curse: evidence from international data. *Journal of Comparative Economics*, 46(1) ,174-191. https://doi.org/10.1016/j.jce.2017.04.001

Lele, S. (1991). Sustainable development: a critical review. *Word Development*. 19(6), 607-621. https://doi.org/10.1016/0305-750X(91)90197-P

Mahjabeen, U., Nasir, K., & Omri, A. (2024). Environmental policy stringency, ICT, and technological innovation for achieving sustainable development: Assessing the importance of governance and infrastructure. *Journal of Environmental Management,* Volume 365, 121581. https://doi.org/10.1016/j.jenvman.2024.121581

McCartney, M. (2017). Bangladesh 2000-2017: Sustainable growth, technology and the irrelevance of productivity. *Lahore Journal of Economics,* 22 (3): *183-198*. https://nja.pastic.gov.pk/LJE/index.php/LJE/article/view/1197

Nicola-Gavrilă, L. (2023). *Education and Technology in a Data Driven Society. Turning Data into Education Intelligence*. In L., Nicola-Gavrilă (Ed), Digital Future in Education: Paradoxes, Hopes and Realities (pp.12-33). ISBN 978-606-95516-1-5. In Book Series Socio-Economics, Research, Innovation and Technologies (SERITHA), ISSN: 3008-4237. https://doi.org/10.57017/SERITHA.2023.DFE.ch1

Norgaard, R. (1984). Co-evolutionnary development potential. *Land Economics, 60(2)*, 160-173. https://doi.org/10.2307/3145970

OCDE (2007). Institutionalising Sustainable Development, *OECD Sustainable Development Studies*, Éditions OCDE, Paris. https://www.oecd.org/content/dam/oecd/en/publications/reports/2007/03/institutionalising-sustainable-development_g1gh7d8f/9789264019096-en.pdf

Omri, A. (2018). Entrepreneurship, sectoral outputs and environmental improvement: international evidence. *Technological Forecasting and Social Change,* 128*, 45–56*. https://doi.org/10.1016/j.techfore.2017.10.016

Omri, A. (2020). Innovation and sustainable development: Does the stage of development matter? *Environmental Impact Assessment Review, 83, 106398*. https://doi.org/10.1016/j.eiar.2020.106398

Pradhan, R., Arvin, M., Bahmani, S., & Bennett, S. (2017). The innovation-growth link in OECD countries: could other macroeconomic variables matter? *Technology in Society, 51*, 113-123. https://doi.org/10.1016/j.techsoc.2017.08.003

Redclift, M. (1987). *Sustainable development: exploring the contradictions.* New York: Methuen. https://www.environmentandsociety.org/sites/default/files/key_docs/redclift_2_1.pdf

Shahbaz, M., Hye, Q., Tiwari, A., & Leitão, N. (2013). Economic growth, energy consumption, financial development, international trade and CO2 emissions in Indonesia. *Renewable and Sustainable Energy Reviews, 25(C): 109-121*. https://doi.org/10.1016/j.rser.2013.04.009

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics,* 70(1), 65-94. https://doi.org/10.2307/1884513

Turner, R. (1988). Pluralism in environmental economics: a survey of the sustainable economic development debate. *Journal of Agricultural Economics, 39(3)*. https://doi.org/10.1111/j.1477-9552.1988.tb03253.x

UNIDO. (2024). *Industrial Development Report 2024.* Vienne. https://www.unido.org/idr/idr2024#/

Wahab, S., Imran, M., & Safi, A. (2022). Role of financial stability, technological innovation, and renewable energy in achieving sustainable development goals in BRICS countries. *Environmental Science and Pollution Research*, *29, 48827–48838*. https://doi.org/10.1007/s11356-022-18798-7

Yao, K. Y. & Kouakou, A. K. (2025). Migration, Remittances and Sustainable Development in Sub-Saharan Africa. *Journal of Global Sustainability and Development,* Volume II, Issue 2, 27 – 42. https://doi.org/10.57017/jgsd.v2.i2.02

Wang, C., & Kafouros, M. (2009). What factors determine innovation performance in emerging economies? Evidence from China. *International Business Review, 18*, 606-616. https://doi.org/10.1016/j.ibusrev.2009.05.003