

Article

Social Media and Macroeconomic Factors as Drivers of Innovation: Evidence from Africa

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Abstract

Africa's expanding youth population and rapid digitalization present opportunities for innovation and, ultimately, entrepreneurship and economic growth relevant for Sustainable Development Goal (SDG) 8—Decent Work and Economic Growth. However, the role of social media in shaping these outcomes remains underexplored empirically. This study examines how platform-specific social media use influences innovation, operationalized through external search breadth and depth, while considering macroeconomic moderators. Using panel data from 52 African countries from 2009 to 2022 and fixed effects regressions, the study links activities on Facebook, X (formerly Twitter), YouTube, LinkedIn, and Google to innovation indicators such as R&D expenditure, patent applications, and scientific publications. The findings suggest that YouTube use is consistently and positively associated with all innovation indicators, highlighting its role in knowledge diffusion and creative expression. By contrast, X and LinkedIn display neutral or negative effects. High internet penetration alone is not sufficient enough to spur innovation, underscoring the need for enabling macroeconomics factors such as GDP per capita and ease of doing business. This study concludes that visual open-access platforms, supported by education and institutional capacity, are vital for inclusive and sustained economic growth.

Keywords: social media; macroeconomics; innovation; sustainability; Africa

JEL Classification: O00

1. Introduction

Innovation (both technological and social¹) has long been recognized as a critical driver of productivity, income generation, and empowerment. All socioeconomic indicators are critical for Sustainable Development Goal (SDG) 8—in attaining decent work and economic growth across Africa (Wolf, 2006; Adekunle et al., 2013; Dos Santos, 2024). In the African agriculture and mining sectors, youths² were observed to not only simplify complex technologies but implement innovative solutions (Reij & Waters-Bayer, 2014; Žmija et al., 2020; Arthur-Holmes et al., 2023; Ayanwale et al., 2023; Das & Pal, 2023; Consentino et al., 2023). For instance, Beaudry et al. (2018) observe that a substantial number of academic researchers on the continent obtain their doctoral degrees before the age of 40, meaning that research and development (R&D) activities are often youth-driven. Colussi et al. (2022) emphasize that young people, regardless of education level, can generate novel ideas and adopt new practices when exposed to relevant knowledge through suitable channels. A number of studies (see Adekunle et al., 2013; Benjamin et al., 2024; Dos Santos, 2024;



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(Glaser, 2024) have investigated the impacts of technical, socioeconomic and institutional factors on innovation adoption in Africa. Yet, limited attention has been devoted to the effectiveness of information channels and the interplay of these channels with macroeconomic conditions in fostering innovation (Lugamara et al., 2019). In a continent where 70% of the population is under the age of 30 (United Nations, 2024) and are drivers of innovation, not understanding their knowledge and information channels may prove fatal. The knowledge and information channels align with the external search breadth and depth framework. This framework highlights the engagement with information (breadth) and repeated, focused interaction with selected channels (depth) in fostering innovation (Cohen & Levinthal, 1990; Laursen & Salter, 2006). Consequently, scholars have called for greater attention to communication platforms that are practical, non-restrictive, and aligned with youth preferences (Pretty et al., 2018; Benjamin et al., 2021; Benjamin & Ola, 2025). In recent decades, the rapid expansion of internet access and mobile connectivity has transformed Africa's information landscape, giving rise to new channels of knowledge transfer via social media. Social media is defined as "electronic information and communication platforms that enable users to easily create and disseminate content on digital networks and engage in interactive communications" (Lohento & Ajilore, 2015, p. 121). Van Mele et al. (2018) found that information shared via social media often meets quality standards and is widely favored by the youth in the global South. Facebook, X (formerly Twitter), YouTube, LinkedIn, and emerging platforms such as Synergy Portal enable African youth to exchange practical concepts, co-create solutions, and engage in collaborative problem-solving (Asio & Khorasani, 2015). The potential of social media for youth-led innovation is amplified by rapid smartphone penetration. By 2025, two-thirds of Africa's population is projected to own a smartphone, greatly expanding the reach of these platforms (Alper & Miktus, 2019). When combined with national absorptive capacities, these inflows can translate into tangible innovation outputs that spur entrepreneurship resulting in decent jobs for the youth. Nevertheless, platform usage alone is not sufficient to explain innovation outcomes. Broader macroeconomic and institutional factors, among others, GDP per capita and ease of doing business, may moderate the extent to which digital knowledge flows yield innovative results (Adekunle et al., 2013; Igwe et al., 2020). These factors create enabling ecosystems that determine whether social media becomes a catalyst for innovation. Despite the growing importance of social media, empirical research on its relationship with innovation remains sparse. Addressing this gap is urgent, given Africa's demographic transition, digital transformation, and the need to design policies that harness youth potential for sustainable development. Drawing on the frameworks of external search breadth/depth, this study addresses this literature gap. It empirically examines the relationship between social media platform usage and national innovation indicators across 52 African countries from 2009 to 2022. Data were collected from the World Bank Development Indicators (World Bank, 2024) and StatCounter Global Statistics (StatCounter, 2024).

2. Methods

The external search breadth and depth framework is illustrated using the evolution in the agricultural sector as an example (see Figure 1). In the earliest stages, external information and knowledge exchange channels were through peer-to-peer communication. This peer-to-peer method, while effective in many ways, had its limitations. As information was passed through word of mouth (WoM), the accuracy and credibility often diminished, leading to potential misinformation among those at the tail end of the communication chain (Kawakami & Parry, 2013). Despite its shortcomings, this traditional channel of information exchange continues to hold relevance today, as personal interactions and community-

based knowledge sharing still play a crucial role in various sectors (Benjamin et al., 2016; Kawakami & Parry, 2013). A major shift in information and knowledge exchange channels in developing countries³ occurred during the Green Revolution with the introduction of extension officers as optimal means for disseminating and showcasing innovations developed by experts (Raidimi & Kabiti, 2017; Khan et al., 2025). This conventional method was further complemented by the expansion of media channels such as television, radio, and the printing press, i.e., electronic word-of-mouth (eWoM). These media outlets played a crucial role in amplifying the outreach of extension services. The newest addition to the eWoM across Africa is social media platforms. Social media platforms such as Facebook, Twitter (X), YouTube, Instagram, TikTok, and LinkedIn have become essential channels for digital communication and information sharing among youths (Alper & Miktus, 2019; Ovhal, 2025). Their engagement is driven by increased access to mobile technologies, improved internet connectivity, and a growing culture of online consumerism.

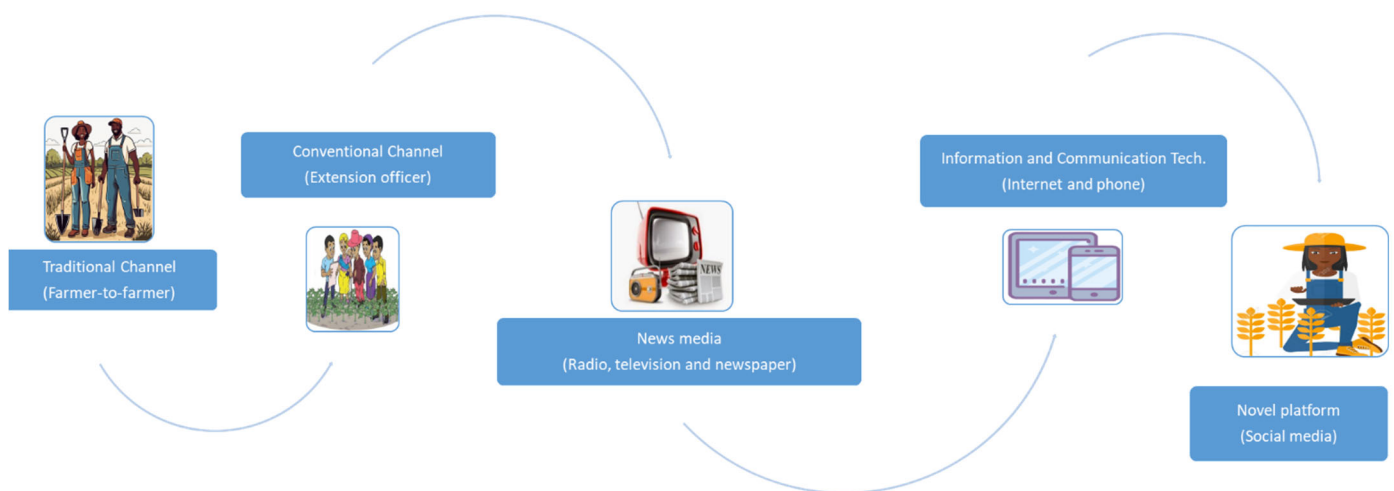


Figure 1. Evolution of information channel for (agri-)innovation in Africa. Source: Author.

The expansion of information and communications technology in the last 20 years, especially the internet (see Figure 2 below) and mobile (smart) phone technologies, has further led to an outreach and knowledge exchange via social media across Africa. The number of internet users in Africa, estimated at 40% in 2024 (StatCounter, 2024), presents a novel opportunity for youths to access information that can support their innovative ambitions and create decent jobs on the continent.

However, there are stark differences across the African sub-regions regarding internet penetration (see Figure 3 below). For instance, Southern Africa has the highest rate of internet penetration at 70% followed by Northern and Western Africa at 65% and 48%, respectively (StatCounter, 2024). Central and Eastern Africa had an internet penetration of less than 30% in 2024 (StatCounter, 2024).

Youths in Africa use the internet and social media platforms in acquiring information and knowledge to achieve inclusive human development (Asongu & Odhiambo, 2019). Figure 4 illustrates the percentage of users across Africa with Southern Africa having the highest number of users followed by Northern and Western Africa. This study introduces the dimension of social media platform heterogeneity into the analysis of social media and innovation. Social media platforms are not uniform in their design or purpose; rather, they embody distinct affordances that shape how users search for information, acquire knowledge, and participate in exchange activities. For example, YouTube, as a video-based medium, emphasizes visual and often highly detailed demonstrations, making it a particularly effective conduit for tacit and practice-oriented knowledge transfer. In contrast,

X (formerly Twitter) and TikTok are structured around microblogging, privileging brevity and immediacy in the dissemination of news, events, and topical discussions. LinkedIn occupies yet another niche, functioning primarily as a professional networking platform. It facilitates employment opportunities, reputational signaling, and the dissemination of research outputs. By recognizing these heterogeneities, the study highlights that not all platforms contribute equally to innovation, and their effects must be empirically assessed in differentiated ways.

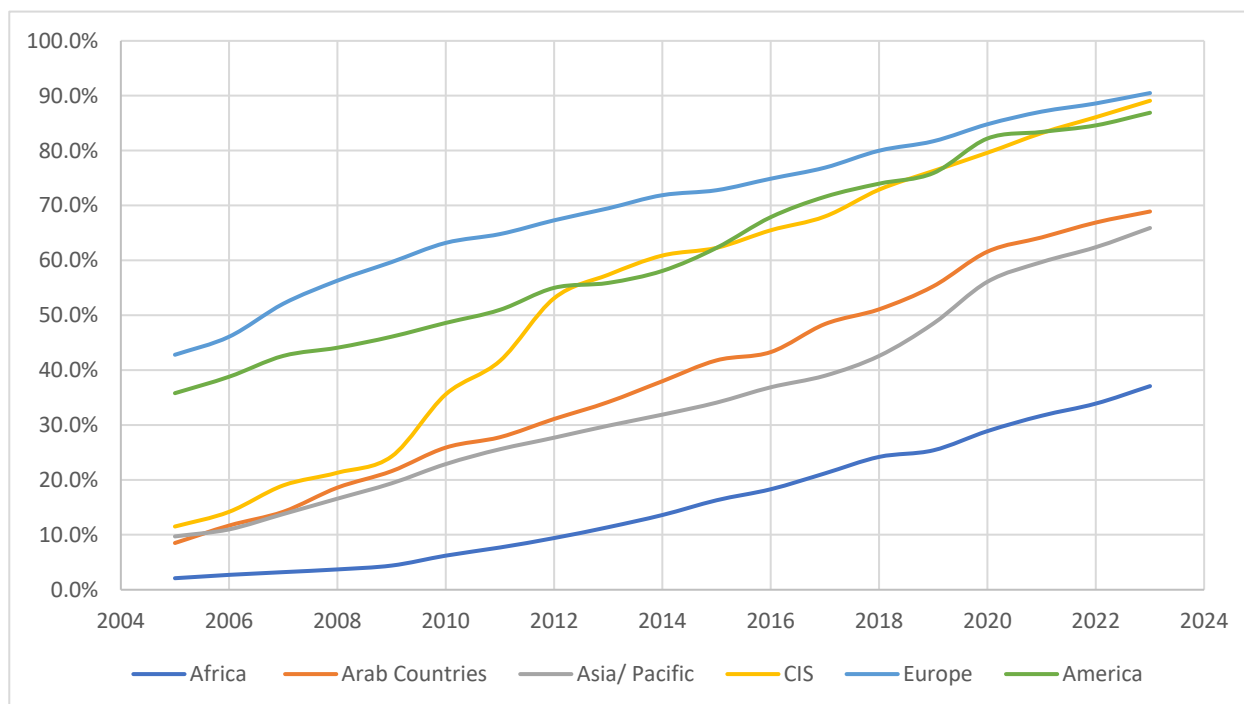


Figure 2. Estimate of the percentage of internet users by world region from 2005 to 2023. Source: StatCounter (2024). Notes: CIS: Commonwealth of Independent States.

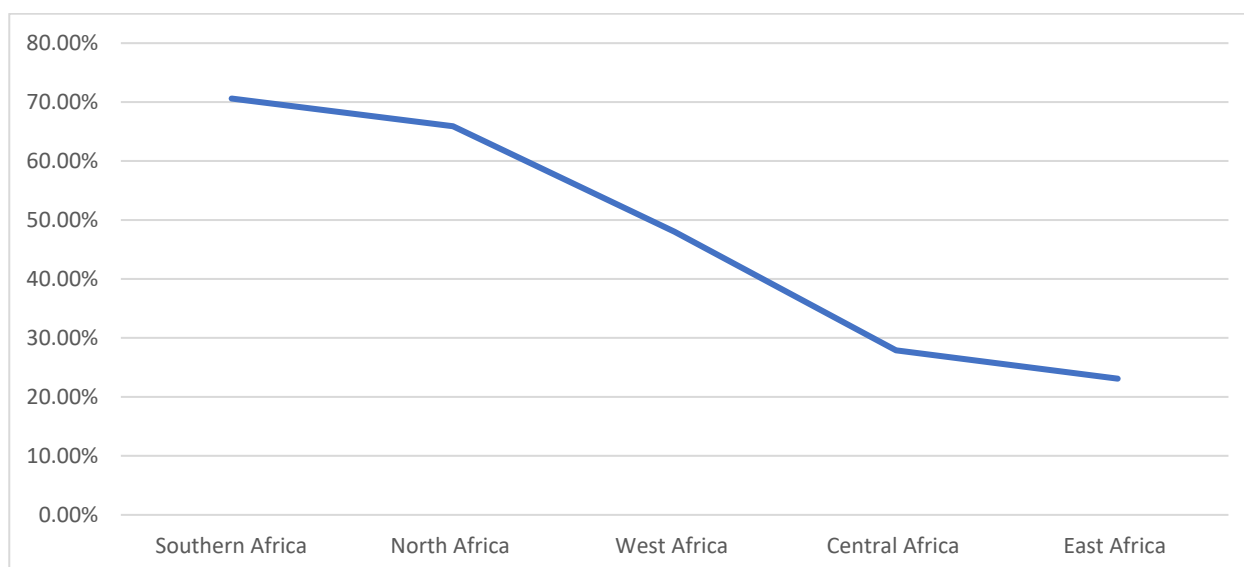


Figure 3. Percentage internet penetration by region in Africa in January 2023. Source: StatCounter (2024).

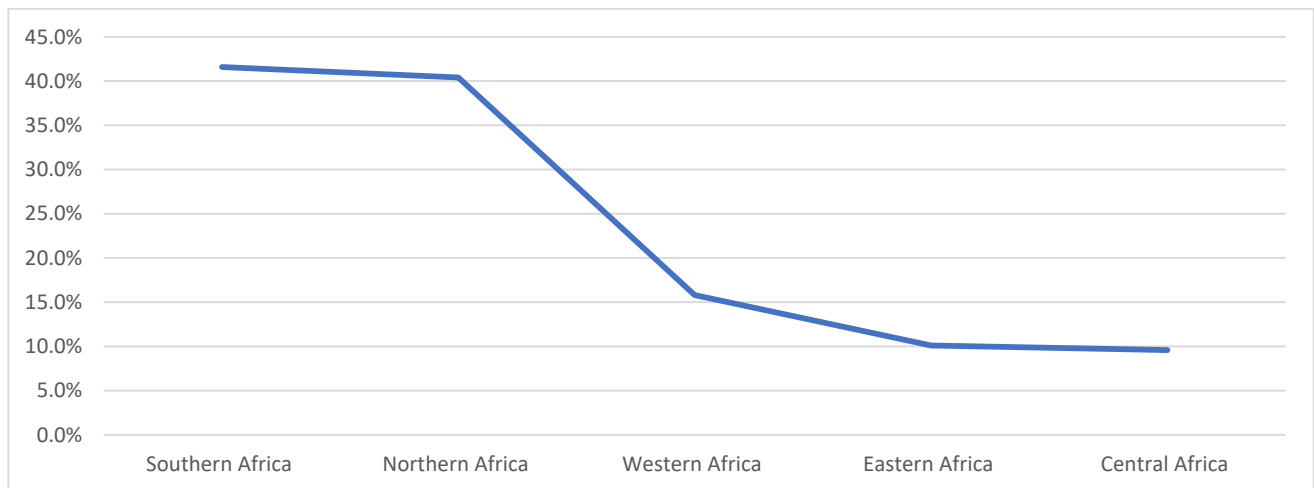


Figure 4. Share of active social network users by region with respect to population in 2024. Source: StatCounter (2024).

Adequate levels of macroeconomic and institutional development serve as critical moderators of innovation performance across African countries (Mugabe, 2009; Adekunle et al., 2013; Benjamin et al., 2024; Ndicu et al., 2024). Indicators such as GDP per capita, ease of doing business, and the quality of physical and digital infrastructure provide the foundational conditions under which knowledge can be effectively transformed into innovative outcomes (Ndicu et al., 2024; Mugabe, 2009; Dutta, 2009). When these macroeconomic fundamentals are robust, states are better positioned to channel resources toward strengthening institutions and enacting policies that foster experimentation, collaboration, and technological upgrading. This perspective aligns with Robinson and Acemoglu's (2012) argument that inclusive institutions drive long-run growth providing enabling environments for African innovation.

To test these hypotheses, data was retrieved for 52 African countries covering the period from 2009 to 2022 from the World Bank Development Indicators (WBDIs) (World Bank, 2024) and the Statcounter Global Statistics database (StatCounter, 2024). For external search breadth and depth and platform heterogeneity, data on usage and market shares for diverse social media platforms, namely Facebook, X, YouTube, Google, and LinkedIn, were sourced from Statcounter Global Statistics. Furthermore, data on macroeconomic and other variables such as demographic, industry, and institutional that act as moderators were obtained from the WBDI. Table 1 summarizes the descriptive statistics for the variables used in this study, covering innovation proxies, social media platforms, and macroeconomic, demographic, institutional, trade, globalization, industry, and education indicators across 52 African countries between 2009 and 2022. Innovation activity remains relatively modest. On average, research and development (R&D) expenditure accounted for just 0.34% of GDP, far below global benchmarks. Annual scientific output averaged 928 journal articles, while patenting activity was 95 applications per year. The high standard deviation of patent applications (211) highlights striking disparities, with a few countries accounting for a disproportionate share of patent filings. Social media usage is uneven across platforms. Facebook dominates with an average usage rate of 80.4%, peaking at 99.5%. By contrast, X (formerly Twitter), YouTube, LinkedIn, and Google remain marginal, with mean usage rates of 5.3%, 3.7%, 0.59%, and 0.27%, respectively, underscoring the fragmented digital landscape. Control variables illustrate substantial heterogeneity across African economies. GDP per capita averages USD 2495, but spans from below USD 200 to USD 19,142. Internet penetration averages 22.5% of the population, yet ranges from 0.3% to 89.9%. Educational investment is similarly diverse. While the mean allocation is 4% of GDP,

some countries exceed 10.8%. Institutional measures also vary, with ease of doing business scores ranging from 19.9 to 81.5 (mean = 51), while the procedural burden of starting a business ranges from 3 to 18 steps. Demographic and structural factors mirror these disparities. Urban population growth averages 3.5% annually. Adult literacy rates vary widely (22–96.2%, mean = 65.4%). Researcher density averages 217 per country, spanning from 6 to 1943. Trade and manufacturing indicators vary widely. Import growth rates range from −94.7% to 328.7%, while manufacturing value added fluctuates between −43.8% and 72.6%. Collectively, these statistics underscore the highly uneven development landscape across Africa.

Table 1. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
R&D expenditure (%)	448	0.34	0.22	0.011	1.02
Scientific journals	686	928	2382	0.76	18,469
Patent applications	420	95	211	1	1804
Facebook (%)	686	80.4	17.7	13.6	99.5
X (formerly Twitter) (%)	686	5.3	6.6	0.20	74.1
YouTube (%)	686	3.7	5.5	0.01	48.1
LinkedIn (%)	686	0.59	3.7	0	88.8
Google (%)	686	0.27	0.58	0.01	11.5
Internet (% of population)	686	22.5	20.7	0.3	89.9
GDP per capita (current US\$)	686	2495	3146	199	19,142
Value added manufacturing industry (% annual growth)	644	3.4	8.2	−43.8	72.6
Government expenditure on education (% GDP)	644	4	1.9	0.35	10.8
Ease of doing business (score)	686	51	11.7	19.9	81.5
Procedures to register start-ups (number)	686	9	3	3	18
Imports of goods and services (%)	644	6.4	19.9	−94.7	328.7
Adult literacy level (%)	672	65.4	18.9	22	96.2
Annual urban population growth (%)	686	3.5	1.4	−1.9	7.6
Number of researchers in R&D	448	217	354	6	1943

A baseline econometric model (Wooldridge, 2016) assessing the impact of using social media platforms on innovation is specified as

$$(Y) Innovation_{it} = \alpha + \beta_1 Facebook_{it} + \beta_2 X(formerly twitter)_{it} + \beta_3 YouTube_{it} + \beta_4 Google_{it} + \beta_5 LinkedIn_{it} + \gamma X_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

where $(Y) Innovation_{it}$ is represented by one of the three innovation proxies (scientific journals, patent applications, or R&D expenditure as a fraction of GDP) for country i in year t . $Facebook_{it}$, $X(formerly Twitter)_{it}$, $YouTube_{it}$, $Google_{it}$, and $LinkedIn_{it}$ represent the usage rates of the respective social media platforms in country i at time t and their coefficients β . X_{it} is a vector of control variables (time-variant) that captures potential confounding effects and their coefficients γ . μ_i captures the unobserved country-specific effect (time-invariant), and ε_{it} is the error term.

The model employed in this study is specified as a fixed effects (FE) estimator⁴, based on the assumption that unobserved, country-specific, time-invariant characteristics (μ_i) are correlated with the explanatory variables. The FE approach is chosen to control for these effects, as it effectively eliminates time-invariant heterogeneity at the country level, thus ensuring consistent and unbiased coefficient estimates (Wooldridge, 2016, pp. 435–437). A Hausman test was conducted to confirm the appropriateness of the FE model over a random effects (RE). To address the possibility of unobserved time-varying confounders—such as global shocks like the Ebola outbreak (2013–2016) or the COVID-19 pandemic (2020)—the model includes a time variable (τ_t) to capture time fixed effects. This addition

controls for macro-level disturbances affecting all countries. A subsequent test confirmed the necessity of including time fixed effects, validating the presence of such unobserved temporal influences.

$$\text{Innovation}_{it} = \alpha + \beta_1 \text{Facebook}_{it} + \beta_2 X(\text{formerly Twitter})_{it} + \beta_3 \text{YouTube}_{it} + \beta_4 \text{Google}_{it} + \beta_5 \text{LinkedIn}_{it} + \gamma X_{it} + \mu_i + \tau_t + \varepsilon_{it} \quad (2)$$

As part of the robustness checks, this study conducted tests for heteroskedasticity, autocorrelation, and cross-sectional dependence using the Wald, Wooldridge, and Pesaran CD tests, respectively (Wooldridge, 2016, p. 395; Pesaran, 2021, pp. 9–12). The Wald test indicated the presence of heteroskedasticity, while the Wooldridge test revealed serial correlation in the residuals, confirming autocorrelation. The Pesaran CD test found no evidence of cross-sectional dependence. The detection of heteroskedasticity and autocorrelation violates the classical assumptions of homoskedasticity and serial independence, which can lead to biased standard errors and unreliable statistical inference (Wooldridge, 2016, pp. 389–395). To correct for these issues, the study employed robust standard errors to ensure valid inference (Wooldridge, 2016, pp. 389–391)⁵. To further ensure the robustness of the standard errors, the Driscoll–Kraay nonparametric matrix estimator was employed (Driscoll & Kraay, 1998). This method provides standard errors that are robust to heteroskedasticity, autocorrelation, and cross-sectional dependence (Hoechle, 2007). The coefficient estimates from the fixed effects model with robust standard errors and the Driscoll–Kraay specification were similar. Therefore, the results are based on Driscoll–Kraay standard errors as the primary findings. Additionally, to assess the robustness of the models, the study examined coefficient stability by including and excluding various time-varying control variables. The direction and magnitude of the coefficients remained consistent across different model specifications, indicating strong robustness. The study interprets the coefficients in terms of association, rather than causation (see Discussion section for more details).

Control Variables Acting as Confounders

The control variables capture the potential confounding effects of the relationship between innovation and social media platforms. The confounders encompass economic, demographic, institutional, trade, globalization, industry, and education factors. Table 2 below briefly summarizes these variables and their confounding effects. These variables are commonly employed in innovation and research analysis and serve as neutral control factors. While they do not introduce additional bias, they may enhance the precision of the results or, at worst, have no significant impact on the study.

Table 2. Description of confounding variables.

Confounding Variables	Effect of Confounding Variable on the Relationship Between Innovation and Social Media Platforms
GDP per capita (current US\$)	Captures a country's wealth and economic capacity. Wealthier countries are likelier to invest more in R&D, education infrastructure, digital infrastructure, and broader digital connectivity that simultaneously raise innovation, the prevalence of digital platforms (Robinson & Acemoglu, 2012; Muninger et al., 2022), and the growth of social media (Song et al., 2024). Failing to control for these confounding effects risks an upward bias in the coefficients.
Government education spending	Better-funded education systems affect human capital formation, which in turn influences R&D spending, patent applications, scientific output, and the pool of skilled users engaged in social media engagement and interaction (Yu et al., 2023; Ahmad, 2023).

Table 2. *Cont.*

Confounding Variables	Effect of Confounding Variable on the Relationship Between Innovation and Social Media Platforms
Adult literacy levels	Higher literacy rates expand the pool of highly educated and skilled users who consume knowledge via social media and translate it to scientific output (Ahmad, 2023).
Researchers in R&D	The number of researchers involved in R&D is crucial for innovation (Whelan et al., 2013). Similarly, the number of researchers involved in R&D is a proxy for a country's research culture and digital sophistication as social media tools enhance research visibility and facilitate academic collaborations (Asmi, 2018). For example, higher researcher density often coincides with heavier online engagement in professional networks, which confounds the relationship between innovation and social media use.
Internet penetration	Represents and operationalizes access to the social media platforms, but also captures greater knowledge diffusion that affects innovation creation and adoption (Muninger et al., 2022; Zondo & Ndoro, 2023), making the variable a suitable confounder.
Urban population growth	This variable signals the agglomeration and knowledge spillover effects of people moving into larger cities, sharing ideas and using digital tools that elevate both innovation intensity and the adoption of digital communication tools (Huang et al., 2022; Anttiroiko et al., 2020). Omitting this effect could exaggerate the role of social media.
Ease of doing business	Reflects the regulatory and business climate in a country, e.g., streamlined registration for business start-ups, protecting investors, etc. This variable allows businesses to focus on innovative activities and attract international investments (Morano et al., 2023) while making online channels more attractive for entrepreneurs and enhancing networking opportunities (Mbeni et al., 2025), thus creating a back-door pathway between social media platform use and innovative activities.
Value added growth from manufacturing industry	The value added growth from the manufacturing industry in a country represents another back-door path between social media platform use and the three innovation proxies. This path works via industrial activities that stimulate technological upgrading and innovations, while simultaneously increasing demand for digital networks and a digital economy (Ding et al., 2021).

3. Results

Table 3 presents the regression results, with patent applications as the dependent variable. In three of the four models (Models 1–3), YouTube usage, a preferred channel among youths, consistently shows a positive and statistically significant relationship with patent activity, with coefficients ranging from 0.004 to 0.005. This suggests that a one-percentage-point increase in YouTube usage is associated with a 0.004 to 0.005 increase in patent applications. In contrast, the effects of Facebook, X, LinkedIn, and Google are not statistically significant, indicating a limited or inconclusive direct impact of these platforms on patenting activity. Internet penetration rates, however, exhibit a consistently negative and statistically significant effect across the same three models, with coefficients ranging from -0.003 to -0.004 . This suggests that higher internet access may be negatively associated with patenting.

The results also suggest that both the ease of doing business index and the volume of imports of goods and services have a positive and statistically significant association with patent applications. This implies that greater trade openness and a more favorable business environment may contribute to increased patenting activity. Other variables such as GDP per capita, government education expenditure, and adult literacy show positive but statisti-

cally insignificant effects, suggesting limited direct influence on patenting in this context. Annual trends reveal strong year-specific effects, especially from 2015 onward. Notably, the period from 2018 to 2022 consistently shows highly significant positive coefficients, indicating a marked increase in patent applications relative to the base year, 2009.

Table 3. Patent applications.

VARIABLES	(1) PATENT	(2) PATENT 1	(3) PATENT 2	(4) PATENT 3
Facebook (%)	0.00169 (0.00203)	0.00190 (0.00204)	0.000820 (0.00193)	0.00182 (0.00238)
X (formerly Twitter) (%)	0.00341 (0.00473)	0.00297 (0.00463)	0.00186 (0.00294)	0.00249 (0.00390)
YouTube (%)	0.00405 * (0.00212)	0.00431 * (0.00214)	0.00435 * (0.00231)	0.00489 (0.00407)
LinkedIn (%)	−0.00158 (0.00823)	−0.000148 (0.00840)	7.60×10^{-6} (0.00710)	0.000433 (0.00878)
Google (%)	−0.0196 (0.0230)	−0.0188 (0.0231)	0.00672 (0.0250)	0.0293 (0.0372)
GDP per capita (log)	0.0203 (0.0775)	0.0277 (0.0796)	0.112 (0.104)	0.0823 (0.111)
Value added manufacturing industry (% annual growth)	−0.000349 (0.00199)	−0.000632 (0.00218)	0.000204 (0.00159)	0.00351 (0.00268)
Internet (% of population)	−0.00384 ** (0.00139)	−0.00372 ** (0.00136)	−0.00293 ** (0.00117)	−0.00383 (0.00225)
Government expenditure on education (% GDP)	0.0194 (0.0237)	0.0218 (0.0236)	0.0265 (0.0217)	0.0355 (0.0330)
Ease of doing business (score)	0.0243 * (0.0121)	0.0311 (0.0187)	0.0203 * (0.0112)	0.0533 *** (0.0169)
Procedures to register start-ups (number)	−0.00754 (0.0105)	−0.00666 (0.0102)	−0.0138 (0.00918)	−0.00359 (0.0109)
Imports of goods and services (%)			0.00644 ** (0.00222)	0.00368 (0.00256)
Adult literacy level (%)		0.00174 (0.00535)	0.00399 (0.00494)	
Number of researchers in R&D (log)				−0.0166 (0.132)
Annual urban population growth (%)			−0.0699 ** (0.0293)	−0.0670 (0.0576)
2010.Year	0.0229 (0.0746)	0.0203 (0.0754)	0.0559 (0.0809)	0.0520 (0.0952)
2011.Year	−0.131 (0.0869)	−0.144 (0.0878)	−0.140 (0.0938)	−0.121 (0.109)
2012.Year	0.121 (0.0858)	0.117 (0.0847)	0.143 (0.0899)	0.189 * (0.102)
2013.Year	−0.0128 (0.0963)	0.00282 (0.0947)	0.0241 (0.0989)	0.00768 (0.110)
2014.Year	0.0494 (0.0990)	0.0413 (0.0973)	0.0563 (0.103)	0.0434 (0.116)
2015.Year	0.193 * (0.0956)	0.198 ** (0.0890)	0.192 * (0.0890)	0.218 * (0.104)
2016.Year	0.164 * (0.0879)	0.166 * (0.0817)	0.192 * (0.0892)	0.190 (0.109)
2017.Year	0.226 ** (0.0825)	0.220 ** (0.0779)	0.241 ** (0.0903)	0.263 ** (0.101)
2018.Year	0.365 *** (0.0766)	0.360 *** (0.0760)	0.327 *** (0.0874)	0.341 *** (0.0972)
2019.Year	0.0555 (0.0802)	0.0369 (0.0858)	−0.00608 (0.0881)	0.0306 (0.0976)
2020.Year	0.303 *** (0.0684)	0.299 *** (0.0555)	0.265 *** (0.0589)	0.328 *** (0.0914)

Table 3. Cont.

	(1)	(2)	(3)	(4)
VARIABLES	PATENT	PATENT 1	PATENT 2	PATENT 3
2021.Year	0.347 *** (0.0903)	0.336 *** (0.0844)	0.335 *** (0.0816)	0.380 *** (0.118)
2022.Year	0.206 ** (0.0834)	0.195 ** (0.0675)	0.143 * (0.0738)	0.186 (0.124)
Constant	0.947 (1.148)	0.420 (1.321)	0.273 (1.022)	−1.176 (1.228)
Observations	420	406	378	322
Number of groups	30	29	27	23

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 2009 = reference year.

The findings for R&D expenditure as the second innovation proxy are displayed in Table 4. Similar to Table 3, YouTube consistently shows positive and statistically significant coefficients across all four models, indicating a strong positive association between YouTube usage, often high among youths, and innovation, as measured by R&D spending. In contrast, usage of X demonstrates a consistently negative and statistically significant relationship in most models (Models 1–3, Table 4), with coefficients of 0.001. This suggests that greater penetration of X may be negatively associated with innovation. Other social media platforms did not exhibit any statistically significant effects on innovation.

Table 4. R&D expenditures.

	(1)	(2)	(3)	(4)
VARIABLES	RD	RD 1	RD 2	RD 3
Facebook (%)	0.000175 (0.000266)	0.000173 (0.000267)	0.000209 (0.000271)	0.000300 (0.000306)
X (formerly Twitter) (%)	−0.000874 ** (0.000292)	−0.000870 ** (0.000294)	−0.000883 ** (0.000300)	−0.000601 (0.000399)
YouTube (%)	0.00167 *** (0.000489)	0.00166 *** (0.000486)	0.00174 *** (0.000555)	0.00173 *** (0.000514)
LinkedIn (%)	0.00167 (0.00107)	0.00166 (0.00107)	0.00183 (0.00108)	0.00150 (0.00103)
Google (%)	0.000107 (0.00128)	7.23×10^{-5} (0.00131)	−0.00217 (0.00421)	−0.00832 (0.00573)
GDP per capita (log)	0.0129 (0.0152)	0.0129 (0.0152)	0.0130 (0.0151)	0.0118 (0.0177)
Value added manufacturing industry (% annual growth)	0.000130 (0.000369)	0.000134 (0.000369)	0.000169 (0.000376)	0.000200 (0.000500)
Internet (% of population)	0.000409 (0.000298)	0.000409 (0.000299)	0.000406 (0.000302)	0.000516 (0.000307)
Government expenditure on education (% GDP)	0.00514 (0.00350)	0.00514 (0.00351)	0.00567 (0.00393)	0.00638 (0.00407)
Ease of doing business (score)	0.00266 ** (0.000906)	0.00273 ** (0.000973)	0.00266 ** (0.00100)	0.00131 (0.00132)
Procedures to register start-ups (number)	−0.000947 (0.00197)	−0.000946 (0.00197)	−0.000908 (0.00207)	−0.00287 (0.00207)
Imports of goods and services (%)			−0.000238 (0.000258)	−0.000361 (0.000331)
Adult literacy level (%)		−0.000105 (0.000256)	-6.04×10^{-5} (0.000262)	
Number of researchers in R&D (log)				0.0504 * (0.0254)
Annual urban population growth (%)			−0.000385 (0.00480)	0.000496 (0.00779)

Table 4. Cont.

	(1)	(2)	(3)	(4)
VARIABLES	RD	RD 1	RD 2	RD 3
2010.Year	−0.00917 (0.0106)	−0.00917 (0.0107)	−0.0110 (0.0114)	−0.0159 (0.0127)
2011.Year	−0.0132 (0.0115)	−0.0131 (0.0116)	−0.0151 (0.0119)	−0.0157 (0.0131)
2012.Year	−0.0283 ** (0.0117)	−0.0282 ** (0.0117)	−0.0300 ** (0.0122)	−0.0356 ** (0.0125)
2013.Year	0.00824 (0.0131)	0.00823 (0.0132)	0.00731 (0.0138)	0.00330 (0.0156)
2014.Year	−0.0122 (0.0134)	−0.0122 (0.0135)	−0.0139 (0.0142)	−0.0223 (0.0160)
2015.Year	0.00582 (0.0142)	0.00607 (0.0143)	0.00436 (0.0153)	−0.00633 (0.0175)
2016.Year	−0.0103 (0.0154)	−0.0102 (0.0155)	−0.0127 (0.0166)	−0.0209 (0.0187)
2017.Year	−0.00284 (0.0141)	−0.00275 (0.0142)	−0.00475 (0.0152)	−0.0137 (0.0170)
2018.Year	−0.0203 (0.0149)	−0.0202 (0.0150)	−0.0223 (0.0162)	−0.0279 (0.0170)
2019.Year	−0.0280 * (0.0142)	−0.0280 * (0.0142)	−0.0308 * (0.0152)	−0.0445 ** (0.0167)
2020.Year	−0.00718 (0.0134)	−0.00700 (0.0135)	−0.00969 (0.0147)	−0.0171 (0.0149)
2021.Year	−0.0162 (0.0167)	−0.0161 (0.0167)	−0.0186 (0.0175)	−0.0293 (0.0188)
2022.Year	−0.0199 (0.0185)	−0.0195 (0.0187)	−0.0215 (0.0190)	−0.0312 (0.0197)
Constant	0.0664 (0.134)	0.0697 (0.134)	0.0779 (0.134)	−0.0536 (0.184)
Observations	448	448	434	392
Number of groups	32	32	31	28

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 2009 = reference year.

The ease of doing business also shows a positive impact on innovation, as reflected in R&D expenditure, with coefficients significant at the 5% level in most of the models (Models 1–3, Table 4). As anticipated, the number of R&D researchers demonstrates a positive and statistically significant influence in Model 4, indicating that R&D spending tends to rise with an increase in research personnel. Additionally, the time effects reveal notable trends throughout the sample period, with several year dummies, particularly for 2012 and 2019, showing consistently significant declines in R&D expenditure.

Table 5 reports the results for the number of academic journal publications, i.e., the third innovation proxy. In all models, YouTube usage (youth preferential channel) shows a consistently positive and statistically significant association with the number of journal publications, echoing the patterns found in the patent and R&D expenditure. Conversely, LinkedIn usage is associated with consistently negative and statistically significant coefficients (Models 1–3, Table 5), suggesting that higher LinkedIn engagement may be linked to a reduction in academic publication output. The effect of Google and Facebook on journal publication numbers appears to be inconsistent across different models, indicating that their impact is not reliably significant in most cases. Nonetheless, in Model 4, there is evidence of a statistically significant negative relationship, suggesting that higher engagement or presence on these platforms may be associated with a decrease in journal publication output.

Table 5. Number of academic journal publications.

VARIABLES	(1) JOURNALS	(2) JOURNALS 1	(3) JOURNALS 2	(4) JOURNALS 3
Facebook (%)	−0.000713 (0.00112)	−0.000214 (0.000916)	−0.000486 (0.000983)	−0.00116 * (0.000612)
X (formerly Twitter) (%)	0.00131 (0.00132)	0.00243 (0.00138)	0.00268 (0.00153)	0.000536 (0.00181)
YouTube (%)	0.00506 ** (0.00171)	0.00537 *** (0.00173)	0.00514 ** (0.00179)	0.00402 ** (0.00139)
LinkedIn (%)	−0.00407 *** (0.00111)	−0.00401 *** (0.00110)	−0.00390 ** (0.00131)	−0.00506 (0.00352)
Google (%)	−0.0119 (0.00894)	−0.00980 (0.00875)	−0.0287 (0.0174)	−0.0281 * (0.0156)
GDP per capita (log)	0.142 * (0.0772)	0.215 ** (0.0927)	0.230 ** (0.0926)	0.218 *** (0.0616)
Value added manufacturing industry (% annual growth)	−0.000423 (0.00109)	−0.000899 (0.00100)	−0.00114 (0.00103)	−0.00232 ** (0.000920)
Internet (% of population)	−0.00347 ** (0.00116)	−0.00159 * (0.000829)	−0.00114 (0.000808)	−0.000537 (0.000916)
Government expenditure on education (% GDP)	−0.000713 (0.00580)	−0.00480 (0.00594)	−0.00665 (0.00668)	−0.0540 ** (0.0193)
Ease of doing business (score)	0.00644 (0.00666)	0.00970 ** (0.00334)	0.00802 ** (0.00337)	0.00736 (0.00508)
Procedures to register start-ups (number)	0.0230 *** (0.00643)	0.0166 ** (0.00565)	0.0169 ** (0.00610)	0.0203 * (0.0108)
Imports of goods and services (%)			0.00145 (0.00135)	0.000820 (0.00108)
Adult literacy level (%)		−9.94 × 10 ^{−5} (0.00269)	−0.000307 (0.00276)	
Number of researchers in R&D (log)				0.0194 (0.0285)
Annual urban population growth (%)			0.0283 (0.0195)	0.114 ** (0.0451)
2010.Year	0.0893 * (0.0430)	0.0689 * (0.0387)	0.0744 * (0.0413)	0.0912 *** (0.0204)
2011.Year	0.167 *** (0.0539)	0.147 ** (0.0497)	0.155 ** (0.0528)	0.177 *** (0.0276)
2012.Year	0.274 *** (0.0513)	0.237 *** (0.0474)	0.246 *** (0.0502)	0.295 *** (0.0268)
2013.Year	0.380 *** (0.0514)	0.339 *** (0.0477)	0.357 *** (0.0511)	0.405 *** (0.0291)
2014.Year	0.525 *** (0.0540)	0.477 *** (0.0505)	0.493 *** (0.0533)	0.548 *** (0.0316)
2015.Year	0.632 *** (0.0533)	0.598 *** (0.0479)	0.618 *** (0.0502)	0.666 *** (0.0291)
2016.Year	0.743 *** (0.0487)	0.712 *** (0.0414)	0.732 *** (0.0442)	0.766 *** (0.0310)
2017.Year	0.830 *** (0.0491)	0.780 *** (0.0420)	0.797 *** (0.0443)	0.843 *** (0.0278)
2018.Year	0.862 *** (0.0472)	0.797 *** (0.0417)	0.813 *** (0.0444)	0.855 *** (0.0256)
2019.Year	0.967 *** (0.0438)	0.896 *** (0.0350)	0.911 *** (0.0366)	0.978 *** (0.0320)
2020.Year	1.136 *** (0.0471)	1.065 *** (0.0400)	1.082 *** (0.0440)	1.145 *** (0.0323)
2021.Year	0.649 *** (0.0485)	0.563 *** (0.0453)	0.572 *** (0.0484)	0.640 *** (0.0393)
2022.Year	0.659 *** (0.0593)	0.569 *** (0.0582)	0.575 *** (0.0592)	0.627 *** (0.0367)
Constant	2.982 *** (0.537)	2.384 *** (0.726)	2.152 *** (0.674)	2.394 *** (0.540)
Observations	616	602	574	420
Number of groups	44	43	41	30

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 2009 = reference year.

For the control variables, the logarithm of GDP per capita exhibits a strong, positive, and statistically significant effect on the number of academic journal publications across Models 1–4 in Table 5. Likewise, the variable representing the number of procedures required to register a start-up remains consistently positive and significant, suggesting that

simplifying regulatory processes may generate spillover benefits for academic research by promoting a more innovative and efficient environment.

In Table 5, time effects are particularly pronounced. Time dummies from 2010 onwards indicate significant positive effects, with the strongest coefficients from 2018 to 2021. This reflects a consistent upward trajectory in academic publication outputs over time.

4. Discussion

This study finds that YouTube use is positively and significantly associated with all proxies of innovation in Africa. This finding is consistent with the literature. Mobile-phone video, especially YouTube, has emerged as a powerful channel for knowledge sharing and information exchange among the youth (Asio & Khorasani, 2015; Sousa et al., 2016). Its integration into formal and informal learning is expanding (Jung & Lee, 2015), prompting calls for further research on its role in sustainable development (Semington & Hall, 2019). Yang (2023) similarly shows that YouTube fosters innovation and business performance in resource-constrained developing countries by enabling low-cost knowledge exchange and collaborative creativity. Conversely, LinkedIn, a primarily professional networking site, was found to facilitate career opportunities rather than active innovation (B. Maharaj, 2014; N. Maharaj & Naicker, 2016). While Cripps et al. (2016) demonstrate that X (formerly Twitter) supports innovation in Europe, this study finds no such effect in Africa, perhaps because African youths perceive it as a microblogging and non-educational tool (Neier & Zayer, 2015). These differences underscore the importance of platform heterogeneity. Where YouTube supports tacit knowledge transfer through visual, interactive content, X and LinkedIn may not align with the innovation needs of African youth. A counterintuitive finding is the negative association between internet penetration and innovation proxies. Internet access is typically assumed to facilitate communication, knowledge sharing, and entrepreneurial activity (Asongu, 2023). However, based on our findings, connectivity may be a necessary but insufficient driver of innovation. The positive and consistent association between the ease of doing business (EoDB) and innovation aligns with World Bank findings emphasizing regulatory simplicity (Independent Evaluation Group, 2020). In parts of Africa, reforms that reduce bureaucracy and improve access to finance have boosted innovation (Asongu & Odhiambo, 2019; Adegbite et al., 2021; Bernatzki et al., 2022). However, regulatory reforms alone are insufficient without complementary structural factors such as quality education, infrastructure, and political stability (Suarez-Villa & Hasnath, 1993; Dutta, 2009). This study finds a positive relationship between GDP per capita and innovation. This is consistent with the finding of Robinson and Acemoglu (2012) that higher income levels enable greater investments in education, research, digital infrastructure and, ultimately, innovation. Ndicu et al. (2024) and Mugabe (2009) found that higher-income African countries are more likely to sustain innovation, enhance technical efficiency, and allocate fiscal resources to support research and knowledge systems. Temporal dynamics reveals that between 2015 and 2022, Africa experienced steady growth in patent applications and scientific publications compared to 2009, reflecting macroeconomic and technological progress. However, R&D expenditure shows persistent declines, with marked dips in 2012 and 2019. This analysis also has a number of limitations. Although fixed effects models account for unobserved, time-invariant differences across countries, they cannot fully control for time-varying omitted variables. Shifts in governance, infrastructure, or demographics may correlate with both social media use and innovation. To mitigate this, multiple specifications with alternative controls were estimated, ensuring coefficient stability. However, endogeneity remains a concern. Innovation may itself drive higher social media use, raising reverse causality issues. Attempts to use instrumental variables were constrained by the lack of valid instruments, such as detailed digital infrastructure

rollouts or regulatory shocks (Czernich et al., 2011; Manacorda & Tesei, 2020). The use of lagged variables was also explored but ultimately rejected due to identification challenges (Bellemare et al., 2017). Despite these caveats, the study makes several contributions. In particular, it highlights YouTube as a uniquely effective tool for stimulating youth-driven innovation, while questioning the relevance of other platforms. These findings open pathways for future research. First, disaggregated studies at national, regional, and firm levels are needed to capture heterogeneity in how social media affects innovation. Second, platform-specific mechanisms deserve closer attention, particularly the ways in which the youth use video-based platforms to absorb and apply new knowledge. Third, the role of enabling macroeconomic and institutional conditions should be further examined to identify the precise factors that allow digital engagement to translate into innovation.

5. Conclusions

This study investigates the relationship between innovation and social media platforms in Africa from 2009 to 2022, applying the external search breadth and depth framework and considering the moderating roles of macroeconomic conditions. The findings highlight that YouTube emerges as a distinctive catalyst for innovation. As YouTube has become a preferred channel for knowledge exchange among youths, its role in enabling visual, accessible, and application-oriented learning underscores its value for fostering innovation and job creation. Policymakers and educators could therefore leverage YouTube more deliberately in capacity building, supporting youth-led content creation and context-specific knowledge dissemination to stimulate inclusive innovation across the continent for decent job creation. Beyond digital platforms, the results emphasize the centrality of an enabling environment. Improvements in the ease of doing business and GDP per capita are strongly linked to higher innovation outputs. Reforms will be most effective when integrated with broader investments in digital literacy, quality education, and infrastructure as well as access to credit. Empirically, this study contributes to the literature on innovation in resource-constrained contexts by foregrounding youth-preferred digital platforms as complementary enablers. Overall, the strong association between regulatory simplicity, GDP per capita and innovation confirms that favorable governance environments, are pivotal for Africa's innovation and job creation trajectory. Future research should extend this analysis to other regions and explore how social media platforms interact with innovation dynamics in shaping sustainable economic growth.

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Notes

- ¹ According to the [Mulgan et al. \(2007, p. 9\)](#), Social innovations are “innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organizations whose primary purposes are social.”
- ² [FAO \(2024\)](#) defines youth as those between the ages of 15 and 25; there is an upper age limit of 35 in some African countries.
- ³ Effective for 2025, those countries with a per capita gross national income (GNI) of less than USD13,846 (World Bank Atlas method) in 2022.
- ⁴ This study estimated an ordinary least squares estimator (OLS) for Equation (1) as well as Variance Inflation Factor (VIF) for all independent and control variables. All the variables showed VIF values less than 5 indicating minimal to no multicollinearity (results available upon request).
- ⁵ After the test results show the presence of heteroscedasticity, the Hausman test was conducted with robust standard errors to check if the fixed effects estimator is still appropriate. The results indicated that the fixed effects estimator is still the preferred model.

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