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The Role of Education and Human Capital on Economic Growth in Sub-Saharan African Countries (2020-2025): A Systematic Review

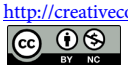
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Abstract

This systematic review captures empirical evidence from 2020 to 2025 regarding the education-human capital nexus to economic growth in sub-Saharan Africa (SSA). Four thematic objectives guide this review: What is the nature and direction of human capital impact on SSA growth; to what extent does governance/institutional quality condition human capital impact; what are the complementary and attenuating factors influencing human capital effectiveness; and what country-specific policy lessons can be gleaned. This review applied PRISMA methodology by deploying a systematic search across major academic databases and African-based journals, pre-defined study selection protocols, inclusion/exclusion criteria, and quality appraisal. Eighteen studies were retained for this synthesis. The results revealed that education, as an indicator of human capital development and human capital formation, showed a positive and significant effect on economic growth in most SSA panel studies. However, its effectiveness may be undermined or reinforced by the quality of governance & institutions, tax structure, efficiency in public expenditure, and migration. Time-series evidence from Ethiopia, Rwanda, and South Africa proves a long-run co-integration relationship between public expenditure on education and output, while higher education financing and digital transformation are emergent areas with limited in-depth research. It concludes that education as a driver of SSA growth produces the desired long-run benefits only under conditions of institutional quality, prudent public resource management, and appropriate strategies for the retention of human capital.

Keywords

Education, Human Capital, Economic Growth, Sub-Saharan Africa, Systematic Review, PRISMA

1. Introduction

The accumulation of human capital (knowledge, skills, attributes embodied in individuals) in the population takes a central role in current growth theory. Starting from Becker's conceptualization of human capital (Becker, 1964) as an asset to be invested in, theoretical approaches have consistently provided different versions of how human capital influences growth in the long run. This includes Lucas's endogenous model (Lucas, 1988) of growth, where human capital is an input and a driver of productivity growth, Romer's model (Romer, 1990), where technological progress is knowledge-based, and so on. These theories provided the basis for Mankiw, Romer, and Weil's cross-country empirical study (Mankiw et al., 1992), which demonstrates the importance of schooling in improving the predictive power of growth regressions using an augmented Solow model.

In the particular case of Sub-Saharan Africa (SSA), the concern with human capital seems to be even more paramount. It is the most under-educated region in the world, with shortages of technical and specialised skills, a renowned brain drain, and yet tight public budgets for education (Agasisti, 2014; Idrees & Siddiqi, 2013; Dissou, Didic, & Yakautsava, 2016). This, nevertheless, sparks serious concerns about the efficiency of education expenditure (Awaworyi Churchill, Ugur, & Yew, 2017; Benos & Zotou, 2014; Cui & Martins, 2021). Moreover, some argue that even if it is not always obvious what the causality chain looks like, a higher education expenditure-GDP growth nexus exists (Hamdan et al., 2020). All in all, the meta-evidence shows an overall positive effect of education on social returns but with some heterogeneity across regions and measures of the variables (Benos & Zotou, 2014; Cui & Martins, 2021).

An effect of spending on growth has also been evidenced to depend on the composition of expenditure and other institutions in the economy (Diakodimitriou, Tsioutsios, & Papageorgiou, 2025; Çetin, 2023; Tomić, 2015; Murova & Khan, 2017). The period from 2020 to 2025 seems particularly interesting. First, it takes place after the adoption of the African Union's Continental Education Strategy. Second, it coincides with the post-pandemic context of fiscal compression and digital acceleration. Third, the role of governance re-growth is coming back to the fore. Why a comprehensive synthesis of the latest evidence seems relevant.

This systematic review aims to provide an account of all the relevant studies published in the past five years (2020-2025) regarding the education-growth nexus in SSA. It differs from a narrative review as it has explicit eligibility criteria, a reproducible search strategy, rigorous appraisal, and an objective synthesis of findings, thus providing both an evidence map and a hands-on interpretation of findings of the current literature.

1.1. Research Gap

This research review fills three main gaps identified within the literature. Firstly, meta-literature reviews on the broad economics of education-which discuss global impacts of investment on growth-largely predate 2020 and lack a primary focus

on SSA (Benos & Zotou, 2014; Cui & Martins, 2021; Awaworyi Churchill et al., 2017). Secondly, this review highlights the need to synthesize nascent and specific evidence from within SSA across 2020-2025, which focuses on the moderating impact of governance, the economic effects of brain drain, and the impact of the financing of tertiary education and digitalization-all of which remain largely fragmented in current regional literature.

Thirdly, none of the extant reviews examine the specific methodological quality of recent research in this area, necessitating a rigorous review that assesses the current state of policy-ready evidence through PRISMA systematic literature review techniques.

Accordingly, this systematic review is conducted based on eighteen selected articles relevant to these factors, guided by four distinct research objectives.

1.2. Objectives of the Review

To avoid the duplication and overlap that characterize broad descriptive reviews, the review was organized around one focused question and four non-overlapping objectives:

Focused review question: *What does empirical evidence published between* 2020 *and* 2025 *reveal about the effect of education and human capital on economic growth in Sub-Saharan African countries*, *and under what conditions is this effect strengthened or weakened*?

The specific objectives were:

1) To synthesize the overall direction, significance, and magnitude of the effect of education and human capital on economic growth in SSA countries.

2) To assess how governance quality and institutional conditions moderate the education-growth relationship.

3) To identify complementary and attenuating factors, including public education expenditure, tax structure, remittances, brain drain and human capital flight, higher education financing, and digitalization, that condition the effectiveness of human capital investment.

4) To draw country-specific and policy-relevant lessons from single-country evidence (Ethiopia, Rwanda, and South Africa) and to evaluate the methodological rigor of the recent evidence base.

2. Literature Review

2.1. Human Capital Theory and the Economics of Growth

The origins of contemporary interest in the economics of education lie largely in the work of Becker (1964), who conceptualized education as a type of capital investment with returns akin to those of physical capital, flowing over the life cycle. Lucas (1988) explicitly formalized the role of human capital in endogenous growth by suggesting that the growth of productivity could be fueled by the accumulation of skills. Similar emphasis was echoed by Romer (1990), who argued that fundamental growth, in the long run, is underpinned by ideas and knowledge creation

produced by educated workers.

With the evolution of these theoretical underpinnings, Mankiw, Romer, and Weil (1992) extended the framework to cross-country regressions and argued that an augmented Solow growth model incorporating human capital as part of the production function predicts growth much more effectively.

Over decades of cross-country and multi-regional study, the empirical evidence has, by and large, supported this positive social return to education; however, it has also highlighted heterogeneity across regions, time periods, and estimation models (Benos & Zotou, 2014; Cui & Martins, 2021; Ogundari & Awokuse, 2018; Zhou et al., 2022). Consequently, this theoretical and empirical literature base sets an initial baseline expectation in this review: that it is highly probable to find empirical evidence that supports the idea that the increase in stocks and flows of education to growth could be contributing to increased production in Sub-Saharan Africa.

2.2. Public Education Expenditure and Growth: The Efficiency Debate

A second thematic avenue of investigation focuses on whether public education finance, per se, stimulates growth efficiently. In the empirical growth literature, the debate is equally lively and nuanced. While meta-studies indicate positive average impacts of public education spending on growth (Awaworyi Churchill, Ugur, & Yew, 2017), the cross-country variation in magnitude and significance remains high; similarly, cross-country analyses argue that the impacts are much less evident in low-income economies compared to high-income economies (Idrees & Siddiqi, 2013; Appiah, 2017).

The crux of the argument points towards the "efficiency" with which the public investment is utilized: a dividend from education on growth is dependent on how, where, and when that spending occurs (Agasisti, 2014; Dissou, Didic, & Yakautsava, 2016), as well as on what other areas complementary to the investment occur, such as in Research and Development (Diakodimitriou, Tsioutsios, & Papageorgiou, 2025; Bambi & Pea-Assounga, 2024; Çetin, 2023; Tomić, 2015).

Moreover, distribution matters, as education spending, as an engine of growth, interacts with considerations of inequality (Sylwester, 2000; Artige & Cavenaile, 2023). History and regional context matter for the analysis of outcomes, from the USA context (Carpentier, 2006; Baldwin & Borrelli, 2008; Murova & Khan, 2017; Bania, Gray, & Stone, 2007) and Europe's welfarist education context (Beraldo, Montolio, & Turati, 2009), to general-equilibrium examinations applied to countries like Tanzania and Zambia (Jung & Thorbecke, 2003). All these studies tend to indicate that spending level itself cannot be an optimal growth indicator; in the context of our investigation into these issues, this efficiency debate shapes the direction of the study through the attainment of Objective 3 of this study.

2.3. Governance, Institutions, and the Conditioning of Educational Returns

Increasingly, the literature argues that institutions are not just an alternative chan-

nel for growth, but a modulating variable, in that institutional efficacy matters in conditioning the growth from educational access. This is especially due to the fact that dysfunctional or poor governance through variables like corruption, fiscal misspending, and policy ineffectiveness is hypothesized to stifle the schooling-to-growth transformation, whereas good institutional quality can accelerate this relationship (Odhiambo, 2024; Abu Alfoul et al., 2024). Placed into structural growth comparisons, this has the ability to provide explanations-both through good institutions and by showing that good governance in tandem with digital transformation can actually contribute to some of the observed wealth inequality between Sub-Saharan Africa and other parts of the world, like the Middle East (Correa & Esquivias, 2025).

Relevant to our focus, research such as that by Karambakuwa, Ncwadi, and Phiri (2020), which examined what influences human capital impacts on growth within SSA, emphasized that factors which act as complements, for example, institutions and macro-environment stability, are imperative and vital components of growth. These factors are important given our interest in Objective 2 of this review.

2.4. Human Capital Flight, Brain Drain, and Remittances

As pertains to the specificity of Sub-Saharan Africa, the literature also brings in an issue regarding human capital leakage, where a significant portion of educated personnel exit from the region. According to studies such as Usman, Ozdeser, Cavusoglu, and Aliyu (2022), remittances can contribute to sustainable economic growth in this region, but overall human capital loss, essentially brain drain, on the other hand, leads to largely offsetting or cancelling the gain from that human capital gain. Furthermore, evidence by Temilade Akinola et al. (2024) indicates a negative growth influence, as the net outflow leads towards brain drain and related output decline in growth. Therefore, where public systems form the basis of the supply side, the eventual loss is really the export of the state return from investments, a fact not usually captured under the standard Human Capital Theory (Becker, 1964).

2.5. Higher Education, Digitalization, and Structural Transformation

There is still another subset of scholarly studies that examines what comprises the quality of this human capital in the SSA context. Research (Amin & Ntembe, 2021) outlines how a lack of sufficient funding in higher education institutions hinders growth from its potential role in helping foster productive and modern workforce development across various sectors in SSA countries. A review of single-country empirical evidence in the sub-Saharan African context provides a different picture. Studies specifically concerned with the linkages between economic growth and educational outcomes, like Rwigema (2020) and Gu (2025), both provide some evidence of long-run co-integration of education expansion and growth in GDP for Rwanda, while studies like Cyiza et al. (2025) look at attainment along-

side demography and fertility as a dependent variable, as opposed to macroeconomic outcome variables which require explicit output measures for growth.

3. Methodology

This systematic review was performed and recorded following the PRISMA 2020 guidelines (Page et al., 2021). It should be noted that the information available indicates that the review protocol was not registered before starting the review and is not available on an open platform (limitations). The review protocol, search, eligibility criteria, data extraction sheets and quality assessment tools are in supplementary material S1-S4 respectively. The final PRISMA 2020 27-item checklist used in this review is available as Supplementary Material S5. All deviations from the planned method are outlined in Supplementary Material S6. Screening and data extraction were independently carried out by two authors, with inter-rater reliability noted as a limitation.

3.1. Search Strategy

A systematic search for primary research published from January 2020 to August 2025 was conducted. The relevant literature was identified using databases, namely: Scopus, Web of Science, Google Scholar, and the African Journals Online (AJOL) platform. The searches were carried out in real time, and relevant reference lists of the identified studies were also hand-searched to ensure inclusivity.

To facilitate the search, the Boolean operators (AND, OR) were used to join three specific conceptual categories: i) population ("Sub-Saharan Africa" OR "Africa" OR country names like "Ethiopia", "Rwanda", "South Africa"); ii) exposure ("human capital" OR "education" OR "educational attainment" OR "schooling" OR "education expenditure"); and iii) outcome ("economic growth" OR "GDP growth" OR "inclusive growth" OR "economic development").

Truncation and wildcards were used appropriately as per database function. Only peer-reviewed academic journal articles published in the English language were included in the search. A total of 312 records were retrieved. After 41 duplicates were removed, 271 unique articles remained for screening.

List of acronyms used in this review: ARDL = autoregressive distributed lag, ECM = error correction model, GMM = generalized method of moments, AMG = augmented mean group; AJOL = African Journals Online.

3.2. Inclusion and Exclusion Criteria

To make an assessment on eligibility, the Population, Interest, Context, Study design (PICoS) was applied. Eligible studies had to meet the following criteria: a) published during the review period 2020-2025; b) the population of interest to include Sub-Saharan African countries, including studies of specific individual SSA countries; c) the study should examine education or human capital formation or education expenditure as an explanatory variable in the growth models; d) the study reported the growth outcome in terms of GDP growth or GDP per capita

or inclusive growth or economic sustainability; and e) quantitative study with empirical model (including panel estimation models and time-series method like ARDL/ECM or robust case study econometrics). Studies were excluded if: the studies were published before 2020; the study focus is on non-African countries or non-SSA countries without specifically highlighting results for an SSA country; the study does not cover the outcome (growth); the study relies on a data sample used already in the analysis in this current review without any variation in specification/model to contribute newer findings; and conference abstract/opinion papers/studies evaluated as having weak methodology in full-text review were excluded.

3.3. Study Selection Process

Two authors (E.N.B. and J.N.) Independently screened studies, including duplicate screening, blinded via the software Rayyan QCRI. A first round of screening of titles/abstracts of the 271 non-duplicated items was performed by applying the pre-specified inclusion/exclusion criteria. The inter-rater agreement measured by Cohen's kappa coefficient (κ), before consensus, was $\kappa = 0.84$ (95% CI: 0.78 - 0.90), showing strong agreement. Both authors independently assessed the full-text reports of the 52 eligible studies for eligibility. In case of disagreement about the eligibility of an article at the title/abstract level or at the full-text level, the conflict was adjudicated by one author (L.N.), who scrutinized the article independently and made the final decision.

3.4. Data Extraction and Quality Assessment

For every study that met the inclusion criteria, we extracted information and summarized it in a table consisting of the following headings: authors/year, title of the study, context/time, econometric method, variables (both in terms of human capital/education measurement and output variables), and results/recommendations. A critical appraisal checklist was modified to evaluate whether the methodology adopted was sufficiently robust or if bias was likely (Higgins & Green, 2011). Our tool covers 8 criteria, including clearly stated research questions, appropriate sampling methods/representativeness of data, use of relevant econometric techniques with adequate diagnostic testing, robustness and sensitivity checks, corrections for endogeneity bias (e.g., via IV or GMM models), data availability, consistency between findings and conclusion, and the identification of study limitations.

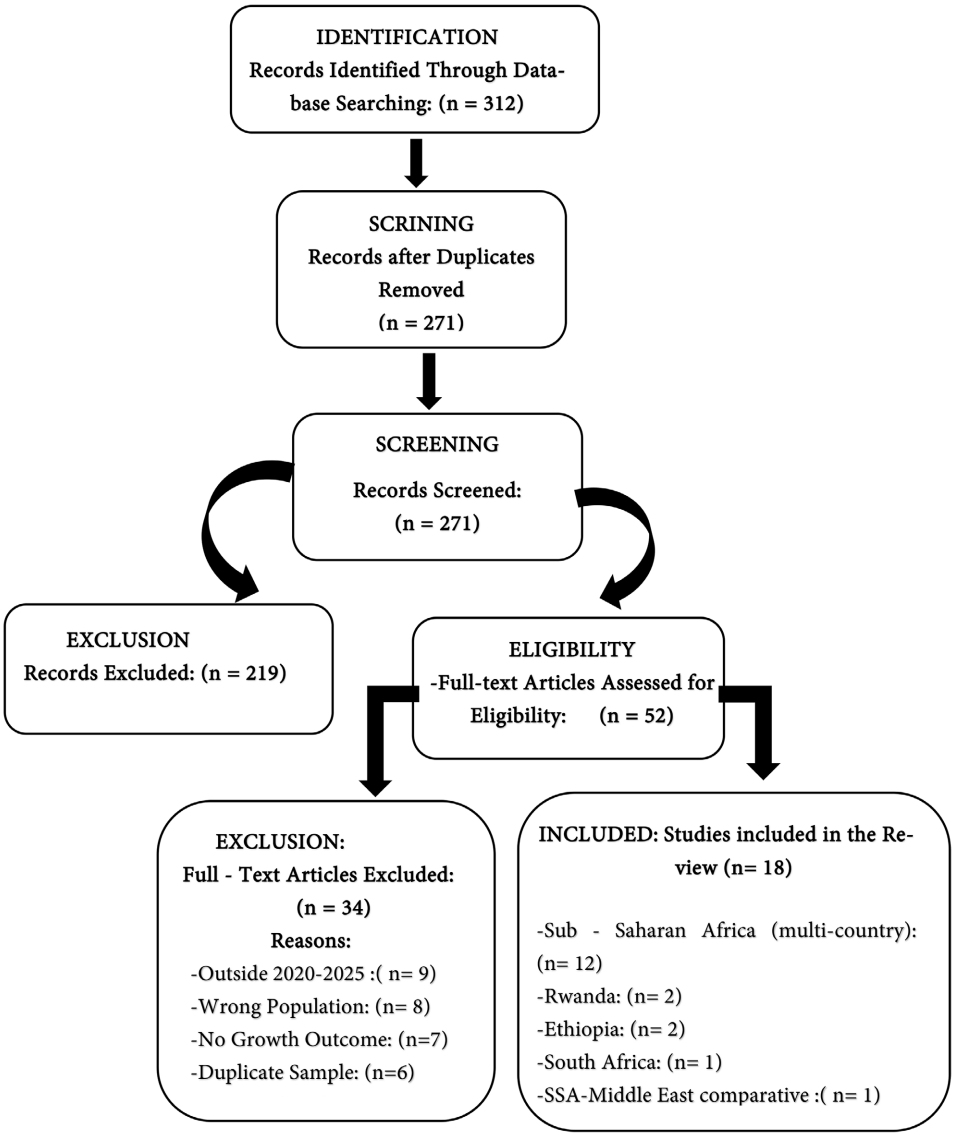
For every study that met the inclusion criteria, we extracted study details into an extraction matrix (**Table 1**). Quality was scored, where studies with scores 7 - 8 were high, 5 - 6 were moderate, and 4 were rated as low (the 4 low-quality papers identified at the appraisal stage of full-text review were rejected). **Table 2** provides the quality profile for the 18 studies.

4. Results

Results are organized by review objective in the following subsections. The evi-

dence base is described in Sections 4.1 to 4.5; findings aligned with Objectives 1 to 4 are presented in Sections 4.6 to 4.9, respectively.

The PRISMA 2020 flow diagram is presented as Figure 1.



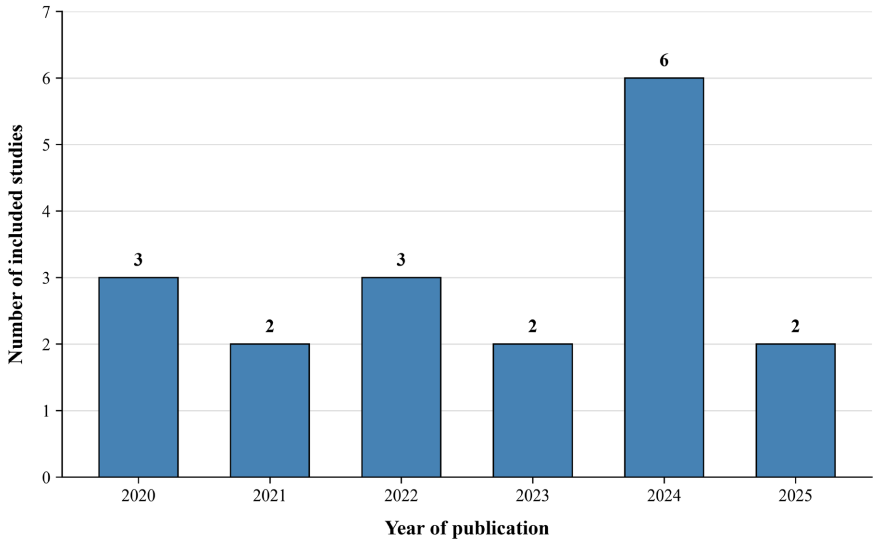
Source: Author's compilation, based on Page et al. (2021) and PRISMA 2020 guidelines.

Figure 1. PRISMA 2020 flow diagram.

4.1. Characteristics of the Included Studies

The selected 18 studies for the analysis were published between 2020 and 2025 (Figure 2), with the year 2024 seeing the most publications (six studies). This growth in the literature is indicative of a growing academic focus on human capital and economic growth. Geographically (Figure 3), 12 out of the selected studies used multi-country SSA panels. In contrast, 3 studies used panel studies in specific countries (2 each for Ethiopia and Rwanda, and 1 for South Africa).

One study also compared SSA with the Middle East. Methodologically (Figure 4), eight studies used a similar empirical regression but with additional/extension or interaction variable analyses in their approach to the human capital-economic growth nexus. Six studies used various panel econometric tools, such as dynamic GMM, augmented mean group, and static panel estimation methods. Three studies employed time-series ARDL/ECM econometric approaches. Only one study was written in the form of a country case study. Most of the sample periods covered data from the mid-80s or 2000 up to 2018-2020, implying that 2020-2025 was the period within which analysis of the latest data was reported in journals.



Note: Publications were most prevalent in 2024 (6 studies), 3 in 2020 and 2022, and 2 in 2021, 2023, and 2025.

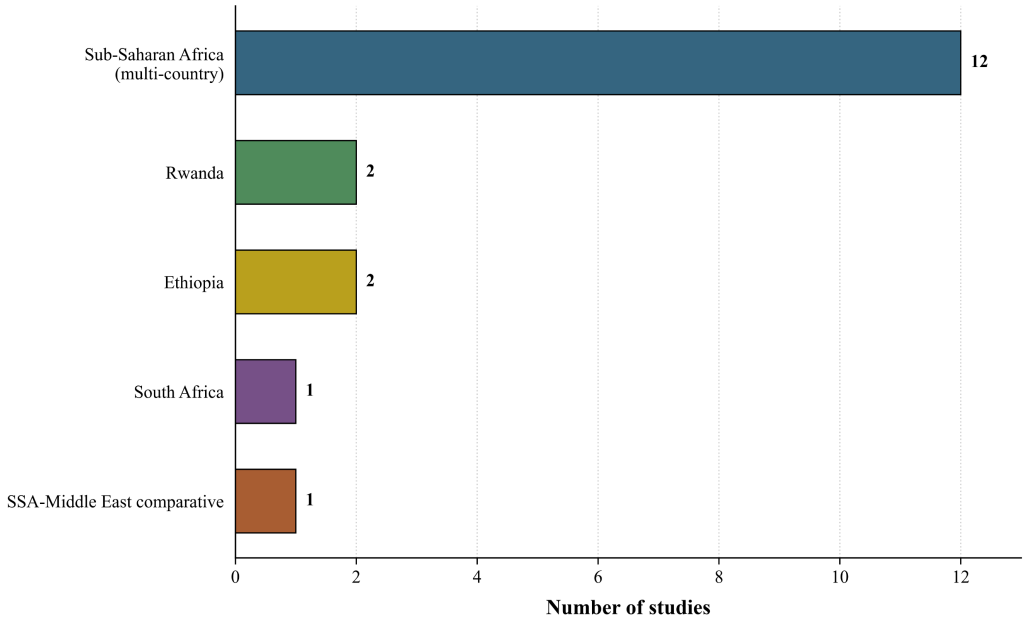
Figure 2. Distribution of included studies by year of publication (n = 18).

4.2. Geographic Focus of Included Studies (n = 18)

Figure 3 illustrates the geographic distribution of the 18 included studies. The majority (12 studies) focus on Sub-Saharan Africa as a multi-country region, followed by Rwanda and Ethiopia with two studies each, while South Africa and a comparative SSA-Middle East analysis account for one study each.

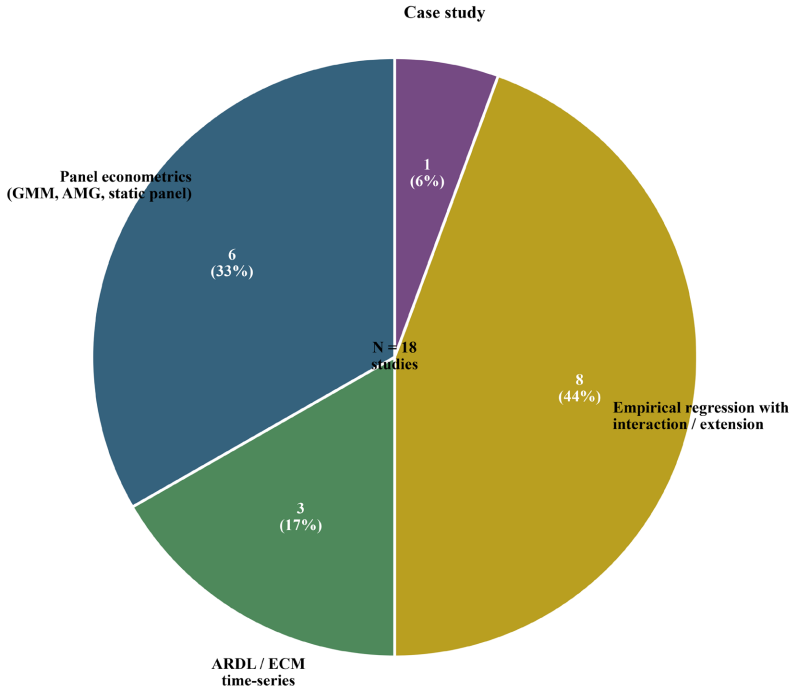
4.3. Methodology Types of Included Studies (n = 18)

Figure 4 presents the types of methodologies employed by the 18 selected studies. As the graph shows, empirical regression with interaction/extension was the most common type used, applied by 8 studies, or 44% of the total studies. Panel econometrics models, *i.e.*, GMM, AMG, and static panel, were used by 6 studies, or 33% of the total studies. Additionally, the ARDL/ECM time-series approaches were applied by 3 studies (17%), whereas the case study approach was used in 1 study (6%).



Note: SSA = Sub-Saharan Africa.

Figure 3. Geographic focus of the included studies (n = 18).



Note: GMM = generalized method of moments, AMG = augmented mean group, ARDL = autoregressive distributed lag, ECM = error correction model.

Figure 4. Methodological approaches used in the included studies (n = 18).

4.4. Summary of Characteristics of Included Studies (n = 18)

Table 1 presents the characteristics of the 18 studies in terms of authors, year, title, methods used, and geographical coverage. The majority of the studies make use

of panel data estimation methods such as dynamic GMM, ARDL bounds testing, and the augmented mean group estimator. Further, the majority of the countries of focus in the studies are from the Sub-Saharan African region, with case studies concentrating on Rwanda, Ethiopia, and South Africa.

Table 1. Extraction matrix of included empirical studies (n = 18).

ID	Author(s) & Year	Sample Period & Geographic Scope	Econometric Methodology/ Estimator	Human Capital/ Education Measure(s)	Economic Growth/ Output Measure(s)	Key Empirical Results & Effect Direction
1	Akinlo & Oyeleke (2020)	1986-2018 (36 SSA Countries)	Dynamic System GMM & Static Panel (FE/RE)	Primary/secondary school enrollment rates; Penn World Table Human Capital Index	Real GDP per capita growth rate	Positive & Significant: Human capital accumulation significantly drives long-run output growth; dynamic system GMM confirms output persistence across Sub-Saharan Africa.
2	Matashu & Skhephe (2022)	2000-2018 (37 SSA Countries)	Panel ARDL Bounds Testing & Error Correction Model (ECM)	Public education expenditure (% of GDP); secondary school enrollment ratios	Real GDP growth rate	Positive & Significant: Confirms long-run co-integration between educational investment and growth; reveals a statistically significant short-run error correction mechanism toward equilibrium.
3	Bekele et al. (2024)	2000-2020 (Sub-Saharan Africa Panel)	Augmented Mean Group (AMG) Estimator	Human Capital Index (PWT); adult literacy rates; gross primary completion	Economic Sustainability Index/Real GDP per capita	Positive & Significant: Human capital development fosters long-term economic sustainability and output growth while accounting for cross-sectional dependence and unobserved heterogeneity.
4	Bashir Elsharif et al. (2024)	2005-2022 (Sub-Saharan Africa Panel)	Fixed Effects (FE) & Random Effects (RE) Panel Regression	Primary, secondary, and tertiary school enrollment rates	Real GDP per capita	Positive & Significant: Educational stock positively influences per capita output; primary education exhibits the largest marginal coefficient in low-income sub-panels.
5	Odhiambo (2024)	2000-2021 (Sub-Saharan Africa Panel)	Panel Interaction Regression with Moderation Terms	Public education spending; secondary attainment; WGI Governance Index	Real GDP growth per capita	Conditional/Moderated: Education yields a negligible or negative direct effect under weak governance, but turns strongly positive when institutional quality exceeds a critical threshold.
6	Usman et al. (2022)	1995-2020 (Sub-Saharan Africa Panel)	Dynamic Panel GMM & Fully Modified OLS (FMOLS)	Brain drain index; skilled human capital flight; worker remittance inflows	Real GDP growth rate	Negative/Attenuating: Human capital flight and brain drain exert a statistically significant structural drain on growth; worker remittances only partially cushion the productive loss.

Continued

7	Oyinlola & Adedeji (2022)	1996-2019 (Sub-Saharan Africa Panel)	Two-Step System GMM Dynamic Panel Estimator	Human Capital Index; tax revenue structure (% of GDP)	Inclusive Economic Growth Index	Positive & Conditional: Human capital interacts positively with direct tax revenue structures to drive inclusive economic growth and reduce income inequality.
8	Abu Alfoul et al. (2024)	2002-2022 (Sub-Saharan Africa Panel)	Panel System GMM with Interaction Terms	Secondary school enrollment; composite Institutional Quality Index	Real GDP growth per capita	Positive & Moderated: Institutional quality acts as a complementary input; superior governance accelerates output returns from secondary schooling.
9	Karambakuwa et al. (2020)	1990-2018 (Sub-Saharan Africa Panel)	Pooled Mean Group (PMG)/ Panel ARDL	Mean years of schooling; macroeconomic stability proxies (inflation, debt)	Real GDP growth rate	Positive & Conditional: Macroeconomic stability and sound fiscal management function as essential policy complements that strengthen the growth returns to schooling.
10	Rwigema (2020)	2000-2018 (Rwanda)	Time-Series OLS & Descriptive Econometric Analysis	Primary/secondary school enrollment; public expenditure on education	Real GDP growth rate	Positive & Significant: Educational expansion and targeted public investment contributed significantly to Rwanda's post-2000 economic transformation.
11	Gu (2025)	2005-2023 (Rwanda)	Multiple Linear Regression & Time-Series Analysis	Secondary and tertiary completion rates; labor force skill composition	Real GDP total output	Positive & Significant: Human capital accumulation is identified as a primary structural driver of economic output and industrial diversification in Rwanda.
12	Temilade Akinola et al. (2024)	1990-2022 (SSA/Nigeria Focus)	Dynamic Panel GMM & Time-Series ARDL	Skilled labor emigration rate; human capital flight index	Real GDP growth rate	Negative/Attenuating: High rates of skilled human capital flight lead to severe macroeconomic output losses and depletion of domestic technological capacity.
13	Owopetu et al. (2024)	2000-2021 (Sub-Saharan Africa Panel)	Two-Step System GMM Estimator	Average years of schooling; government capital spending on education	Inclusive GDP Growth Index	Positive & Significant: Targeted investment in education significantly promotes inclusive growth and reduces macroeconomic growth volatility across SSA economies.
14	Dirir (2023)	1990-2021 (Ethiopia)	ARDL Bounds Testing Approach to Co-integration	Public expenditure on human capital; gross enrollment ratios	Real GDP per capita	Positive & Significant: Establishes a robust, co-integrating long-run relationship between human capital expenditure and per capita economic growth in Ethiopia.
15	Amin & Ntembe (2021)	2000-2019 (Sub-Saharan Africa Panel)	Fixed Effects & Panel Econometric Regression	Tertiary education expenditure; university enrollment rates	Real GDP growth & youth employment	Positive but Constrained: Tertiary education promotes employment and growth, but severe underfunding and structural skill mismatches constrain the potential dividend.

Continued

16	Odhiambo (2021)	1980-2018 (South Africa)	ARDL Co-integration Approach & ECM	Primary, secondary, and tertiary school enrollment ratios	Real GDP per capita growth	Positive & Significant: Confirms long-run co-integration; reveals that secondary and tertiary education yield significantly larger growth elasticities than primary schooling.
17	Ferede et al. (2023)	1990-2020 (Ethiopia)	ARDL Bounds Testing & Error Correction Model	Public education expenditure (% of GDP); government efficiency metrics	Real GDP growth rate	Positive & Significant: Public education spending co-integrates with real GDP growth; institutional budget execution efficiency conditions long-run output returns.
18	Correa & Esquivias (2025)	2002-2022 (SSA vs. MENA Comparison)	Dynamic Panel System GMM Comparative Estimator	Penn World Table Human Capital Index; Digitalization Index; Institutional Quality	Real GDP per capita growth	Positive & Moderated: Human capital positively affects growth; the growth performance gap between SSA and MENA is explained by digitalization and governance differentials.

Note: Table content reproduced from the supplied extraction matrix; bibliographic details and empirical findings have not been independently verified.

4.5. Critical Appraisal of Studies Included (n = 18)

Table 2 summarizes the critical appraisal of the 18 studies included. Each study was appraised against seven methodological criteria: Research Question, Data and Sample, Specification and Diagnostics, Control of Endogeneity, Robustness Checks, and Results consistent with Conclusion. The total score ranges from 5 to 8 (Table 2). Accordingly, studies are likely to be of "high" (score of 7 - 8) or "moderate" (score of 5 - 6) quality.

Table 2. Critical appraisal of the included studies (n = 18).

ID	Study	C1	C2	C3	C4	C5	C6	Total	Rating
1	Akinlo & Oyeleke (2020)	2	2	2	2	1	2	**7/8**	High
2	Matashu & Skhephe (2022)	2	1	2	1	2	2	**6/8**	Moderate
3	Bekele, Sassi, Jemal, & Ahmed (2024)	2	2	2	2	2	2	**8/8**	High
4	Bashir Elsharif et al. (2024)	2	2	2	1	2	2	**7/8**	High
5	Odhiambo (2024)	2	2	2	2	1	2	**7/8**	High
6	Usman, Ozdeser, Cavusoglu, & Aliyu (2022)	2	2	2	2	2	2	**8/8**	High
7	Oyinlola & Adedeji (2022)	2	2	2	1	2	2	**7/8**	High
8	Abu Alfoul, Bazhair, Khatatbeh, & Ariana (2024)	2	2	2	2	1	2	**7/8**	High
9	Karambakuwa, Ncwadi, & Phiri (2020)	2	2	1	1	2	2	**6/8**	Moderate
10	Rwigema (2020)	2	1	1	1	1	2	**5/8**	Moderate
11	Gu (2025)	2	2	1	1	1	2	**5/8**	Moderate
12	Temilade Akinola, Awolaja, & Onakoya (2024)	2	2	2	2	1	2	**7/8**	High
13	Owopetu, Oyedele, & Tella (2024)	2	2	2	1	2	2	**7/8**	High

Continued

14	Dirir (2023)	2	2	2	1	2	2	**7/8**	High
15	Amin & Ntembe (2021)	2	2	1	1	2	2	**6/8**	Moderate
16	Odhiambo (2021)	2	2	2	2	1	2	**7/8**	High
17	Ferede, Mersha, & Teshager (2023)	2	2	2	1	2	2	**7/8**	High
18	Correa & Esquivias (2025)	2	2	2	2	2	2	**8/8**	High

Note: Scoring Key: 2 = fully met, 1 = partially met. Quality thresholds: Total 7 - 8 = High Quality; 5 - 6 = Moderate Quality.

4.6. Objective 1: Overall Impact of Education/Human Capital on Growth

Across cross-country literature, findings broadly confirm that human capital has a statistically positive impact on economic growth in SSA. The multi-country panel evidence is overwhelmingly supportive: Using the dynamic Generalized Method of Moments (GMM) alongside static panel estimations for 36 SSA countries between 1986 and 2018, Akinlo and Oyeleke (2020) conclude that the accumulation of human capital could lead to an increase in economic growth, and their dynamic model further provides evidence of persistence in growth dynamics. The results in the studies by Bashir Elsharif et al. (2024) and Bekele et al. (2024) arrive at similar outcomes using panel estimation, with the former deploying standard panel analysis whilst the latter employing the Augmented Mean Group estimator, arguing this through the lens of economic sustainability, which includes growth.

Further, using Autoregressive Distributed Lag (ARDL) bounds testing, as well as an error correction model, the study by Matashu and Skhephe (2022) indicates long-run co-integration of human capital and economic growth with a significant adjustment process in the short run to the long-run equilibrium. Importantly, through examining inclusive growth in Africa, the study by Owopetu, Oyedele, and Tella (2024) indicates that human capital, particularly through education, has been a key contributor to inclusive growth within the region. Time series and case studies focused on one country are broadly consistent with the cross-country panel estimates in this set of studies. In Ethiopia, both Dirir (2023) and Ferede et al. (2023) find evidence of a positive long-run co-integrating relationship between public education spending and real GDP per capita, based on ARDL bounds tests. In South Africa, Odhiambo (2021) shows a likely positive long-run link between the level of schooling and output, though its size is somewhat model-dependent. In Rwanda, Rwigema (2020) and Gu (2025) find positive structural long-run linkages between the education stock and economic development. Since these observational and time series studies estimate long-run cointegrating relations rather than using exogenous sources of variation as in quasi-experimental designs, caution must be exercised in terms of establishing strong macroeconomic causality.

However, this study might arguably be considered supporting evidence in the face of our findings, though certainly aligned. Out of 18 included papers, 16 primary empirical studies investigated the direct effect of human capital/education on economic growth (IDs 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18). Results

demonstrated that there was either a significant positive direct coefficient or a significant positive interaction with growth, with the exception of the other 2 papers (IDs 6 and 12) focusing on human capital flight/brain drain as dampening factors for human capital. Further, for consistency and clear mapping in **Table 3**, all 16 papers focused on the primary direct impact of human capital on growth under Objective 1, sub-mapping moderation (IDs 5, 8, 18) under Objective 2, and conditioning/dampening factors (IDs 6, 7, 12, 15, 17, 18) under Objective 3.

4.7. Objective 2: Quality of Governance and Institutions as Moderating Variables

The second objective is focused on whether the impact of education/human capital is moderated by the quality of governance within countries in SSA. Two studies specifically address this, and both confirm the proposition that institutions matter for the realization of education's contribution to growth. Odhiambo (2024) argues that education may lead to growth only in countries with high levels of governance and quality institutions, given the results showing that education significantly and negatively affects growth in instances with poor governance levels.

There is, however, evidence from studies such as the one by Abu Alfoul, Bazhair, Khatatbeh, and Ariana (2024), who found consistent results with institutional quality as a moderator variable in a human capital growth model that assumes institutions behave as a complementary input to educational investments.

Similar results to this perspective were reported by Correa and Esquivias (2025) regarding the growth differentials in SSA relative to the Middle East, attributing these gaps specifically to the differences in the level of digitization and institutional quality as drivers for translating the existing education stock into realized growth. In total, based on these three pieces of evidence, it can be concluded that institutions do act as a moderator.

4.8. Objective 3: Factors Complementing/Attenuating Education's Growth Impact

Regarding the third objective on factors that affect the growth-enhancing impact of education/human capital, four such factors arise in the empirical literature:

1) Brain drain/human capital flight: Usman et al. (2022) examine sustainable growth in SSA and indicate that remittances provide support for inclusive growth, but human capital flight and brain drain impact growth significantly, as these losses are not easily recovered, while Temilade Akinola, Awolaja, and Onakoya (2024) find an attenuating direct negative effect of human capital flight on growth in Nigeria.

2) Fiscal structure/revenue policy: Oyinlola and Adedeji (2022) find that the nexus between human capital conditions and tax structure matters for inclusive growth.

3) Efficiency of expenditure: Ferede, Mersha, and Teshager (2023) reinforce findings for Ethiopia that growth is conditioned by expenditure on education and

that spending on its own (as noted in section 2.2) is not sufficient, hence supporting the "quality" versus quantity debate in expenditure.

4) Technology: The study by Amin and Ntembe (2021) indicates that financing education in terms of Higher Education can also constrain growth if not utilized efficiently and when funding mechanisms are poor, and also that when considering digitalization as a tool (Correa & Esquivias, 2025), it can complement growth where education levels exist.

4.9. Objective 4: Lessons Learned and Methodological State of Play

From the country-specific lessons, ARDL bounds evidence from Ethiopia (Dirir, 2023; Ferede et al., 2023) points toward a predictable, long-run budgeting approach to education funding to leverage the benefits of co-integration with economic output. For South Africa (Odhiambo, 2021), the lesson is that while positive effects exist, there might be diminishing marginal returns of additional years of schooling as countries advance. The studies from Rwanda (Rwigema, 2020; Cyiza et al., 2025) demonstrate that schooling impacts growth in combination with wider economic structural and demographic changes.

On methodology, although the literature is large and expanding, three of the many studies (Akinlo & Oyeleke, 2020; Usman et al., 2022; Correa & Esquivias, 2025) used state-of-the-art estimators explicitly accounting for endogeneity and cross-sectional dependency in panels.

While a heavy bias exists in favor of interaction-based institutional papers (to address Objective 2), there is a shortage of quasi-experimental or truly instrumented research (to establish deeper, more exogenous causal mechanisms). **Table 3** provides the summary of findings mapped to the four objectives.

Table 3. Synthesis of reviewed studies mapped to research objectives.

Objective	Primary Evidence Base (Study IDs)	Total Studies (n)	Synthesis Narrative Finding	GRADE Certainty of Evidence
Objective 1: Overall Effect of Human Capital and Education on Growth	IDs 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18	16	Overwhelmingly positive and statistically significant impact across dynamic panel GMM and time-series ARDL estimators. Long-run co-integration is consistently confirmed across diverse educational proxies (enrollment, completion, years of schooling, and Penn World Table HCI). No studies report a direct negative effect of education stock.	Moderate (Upgraded due to large multi-country sample sizes and consistent co-integration across estimators)
Objective 2: Moderating Role of Governance and Institutions	IDs 5, 8, 18	3	Governance standards and institutional quality act as essential modulating variables. Weak institutions attenuate educational returns, whereas high governance quality accelerates output transformation.	Moderate (Consistent interaction terms across GMM panel specifications)

Continued

Objective 3: Complementary & Attenuating Conditioning Factors	IDs 6, 7, 12, 15, 17, 18	6	Human capital flight and skilled brain drain (IDs 6, 12) directly erode domestic growth capacity. Tax revenue structure (ID 7), expenditure efficiency (ID 17), higher education funding (ID 15), and digital infrastructure (ID 18) condition the magnitude of returns.	Moderate (Strong convergence across time-series and panel specifications)
Objective 4: Country-Specific Lessons & Methodological State	IDs 10, 11, 14, 16, 17	5	Ethiopia (IDs 14, 17): predictable long-run education budgeting required. South Africa (ID 16): secondary and tertiary quality yields highest elasticity. Rwanda (IDs 10, 11): schooling combined with structural economic transformation drives development.	Low to Moderate (Observational time-series and case-study design limitations)

Note: Study IDs correspond to the numbered studies in **Table 1**. Studies 6 and 12 focus specifically on human capital flight/brain drain as attenuating structural drains on the human capital stock.

5. Discussion

This review confirms the earlier forecasts of growth theory and the results of global meta-analyses (Lucas, 1988; Romer, 1990; Mankiw et al., 1992; Benos & Zotou, 2014; Cui & Martins, 2021): education and human capital are potentially strong positive drivers of growth, even in the modern context, at least from 2020 to 2025. However, these effects are qualified by three features specific to the SSA case. Firstly, there is some conditionality: the growth effect of education seems to be driven by governance (Odhiambo, 2024; Abu Alfoul et al., 2024), fiscal structure (Oyinlola & Adedeji, 2022), and technology (Correa & Esquivias, 2025). This echoes previous literature showing that the impact of education in public spending on growth depends on efficiency and complementary inputs (Dissou et al., 2016; Diakodimitriou et al., 2025; Artige & Cavenaile, 2023; Ogundari & Awokuse, 2018).

Secondly, there is leakage: brain drain and human capital flight seem to have siphoned some of the return on education away from the region (Usman et al., 2022; Temilade Akinola et al., 2024). Such effects have largely been ignored in classic human capital literature (Becker, 1964), but are at the core of SSA growth accounting, and are consistent with data showing that educational migration will have a non-negligible effect on the distribution of returns to schooling (Zhou et al., 2022, for China; Jung & Thorbecke, 2003, for Tanzania and Zambia). Thirdly, there are level effects: the financing constraint identified by Amin and Ntembe (2021) indicates that the binding margin for SSA may be shifting from access issues to quality, relevance, and financing mechanisms-a process that is well-documented to have happened in the course of economic development in some now-developed countries (Carpentier, 2006; Baldwin & Borrelli, 2008). Convergence between panel, time-series, and case-study evidence boosts the credibility of this review, although experimental or quasi-experimental identification techniques are under-represented in this literature.

6. Conclusions and Policy Recommendations

Table 3 provides a synthesis of eighteen studies (reported in detail across Table 1 and Table 2) published from 2020 onwards; it shows that the evidence from these studies, on average, is that education and human capital will likely have a positive effect on growth in SSA (the positive effect is largely conserved thanks to good governance, appropriate tax and expenditure mix, digitalization, and higher education financing, but lost thanks to brain drain, human capital flight, and inefficient expenditure). Policy recommendations directly follow from the evidence. It is recommended to stabilize and safeguard education budgets and to value expenditure efficiency rather than expenditure levels. It is recommended to combine education investments with governance and institutional reforms, so that schooling yields productivity gains. It is recommended to adopt retention and diaspora policy in order to counterbalance human capital flight. It is recommended to align tax policy with human capital accumulation and to expand higher education financing, while also exploiting digital technologies to pair skills with technology. Priority areas for researchers include quasi-experimental identification, harmonized human capital and data measures, and post-2020 period data, to fully incorporate pandemic-time changes. The main lesson from the recent literature, and in particular from this systematic review, is that education is a precursor for growth in SSA, but it only works in conjunction with a solid macroeconomic and institutional environment. This is the first systematic review to synthesize the evidence from 2020 to 2025 on the education-human capital-growth relationship in SSA. Such is the knowledge contribution of this review.

7. Limitations of This Review

This review has several limitations. Searches were limited to peer-reviewed journal articles written in English; thus, it is plausible that some relevant grey literature or papers published in other languages were missed. Heterogeneity in the human capital measures and estimators used made it unlikely that a formal meta-analysis could be conducted; hence, the evidence was synthesized in narrative format. Furthermore, many of the reviewed studies utilize data covering up to the period 2018-2020, which is not fully post-pandemic. Finally, while a structured approach to the critical appraisal was used, it remains inherently a subjective exercise; ratings in Table 2 should be interpreted as transparent expert judgements rather than as objective scores.

Author Contributions

Estimé Nobel Basabakwinshi conceived the systematic review, developed the search strategy, and performed the initial literature search and screening. Léonidas Ndayizeye participated in the screening and selection of search results, extraction of data, assessment of the quality of data, and interpretation of the study findings. Both authors contributed to the synthesis of the results, critically reviewed, revised, and approved the manuscript. Both authors have read and approved the manu-

script.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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