The effects of institutional quality and biocapacity on inclusive human development in Sub-Saharan Africa

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Abstract

The purpose of this study is to investigate the effect of biocapacity and institutional quality on inclusive human development in Sub-Saharan Africa. Using system-GMM on a sample of 39 countries, it is found that institutional quality increases inclusive human development and all its components. It is also established that biocapacity positively affects inclusive human development and the underlying positive effect is driven by the inclusive health component of inclusive human development and not by the inclusive education and inclusive income components of inclusive human development. A keen follow-up of environmental laws is a safe path for inclusive human development in Sub-Saharan Africa.

Keywords: biocapacity, institutional quality, inclusive human development

JEL Classification: G20; I10; I32; O40; P37

1.Introduction

The prerequisite for inclusive and sustainable development lies in a country's ability to sustain high levels of economic growth and development over a long period of time while ensuring that everyone contributes to and benefits from the fruits of economic growth and development (Ndikumana, 2013). The trend of economic growth and development in Sub-Saharan Africa over the past years has been disappointing. Instead of growing rapidly to catch up with the developed countries, growth has been inadequate to generate a meaningful reduction in poverty (Acheampong *et al.*, 2021). Seeing that the adoption of technology is cheaper/easier than the invention of technology, African countries are supposed to grow speedily. This is because Africa's economic growth largely depends on technology adoption thereby aiding them to evade the high costs associated with developing and testing new technology (Juma, 2011).

The effect of institutional quality on economic growth has been well explored in extant literature. Various researchers have yielded varying results using different estimation techniques and from different empirical settings (Zakaria & Bibi, 2019; Zall'e, 2019). Despite the sustained increase in Africa's economic growth, Kamah *et al.* (2021) suggest that there is an unequal distribution of the fruits of economic growth in the continent, which remains a challenge among various African countries. This is in line with Ravallion's (2014) argument that growth has significantly reduced the incidents of poverty but in a more unequal manner.

A critical problem in less developed countries is the issue of widening and persistent inequality and poverty where economic growth is associated only with the actions of a few. The distributions of the benefits of economic growth have also been limited to a small proportion of the society (Raji, 2021) which makes development not to be inclusive. Development is said to be inclusive when the growth process is accompanied by an even distribution of the fruits of economic development including benefits by the most marginalised segment of the society (Berg & Ostry, 2011). Inclusive development suggests that the poor should not only benefit from the fruits of economic growth but they should as well participate in the economic growth process as it traces the importance of equal access to economic opportunities by everyone and the absence of gender inequality (Gable, 2012; Werner, 2012).

The question of why some countries are developing faster than others has remained an important question in the economic development literature to date. Among other factors, the reason for development differentials between nations are differences in the quality of institutional factors as well as the manner in which the fruits of the economic growth process are distributed (Olanrewaju *et al*., 2019; Fonchamnyo *et al*., 2023). It has been argued that the economic development differentials between the less developed and the developed countries are due to differences in institutional quality as it affects the growth process as well as the inclusiveness in the distribution of the fruits of economic development (Olanrewaju *et al*., 2019).

Traditionally, institutional roles are aimed at formulating and implementing sound policies for broad-based (inclusive) employment, productivity and economic development. The effectiveness of every economy in successfully achieving its growth process depends on the quality of its institutions. Therefore, prioritising the quality of institutions is a pivot upon which other drivers of inclusive development rely in order to attain socio-economic prosperity, targets like poverty reduction, among others (Olanrewaju *et al.*, 2019). Nevertheless, improving the quality of institutions still remains a critical issue for inclusive growth in Sub-Saharan Africa (Saez *et al.*, 2016).

Despite the growing empirical research on the effect of institutional quality on economic growth and development, the literature fails to substantially focus on the effect of institutional quality on inclusive human development. In this study, the inequality-adjusted human development index is used to measure inclusive human development (IHD). IHD is a multidimensional concept, which cannot be holistically measured. According to UNDP (1990), human development is concerned with improvement in the well-being of people and not just the wealth of the economy in which they live. It focuses on people, their opportunity and choices.

Over the recent decades, global warming and climate change have risen as some global challenges are widely attributed to greenhouse gas emissions. Despite the remarkable significant economic growth expedition in Africa over the past years, the continent has also been trapped in a high level of environmental degradation (Asongu & Odhiambo, 2020). Environmental degradation has become a severe threat to the natural habitat of humanity and other species on earth (Hunjra *et al.*, 2020). Environmental degradation therefore remains a threat to humanity in the Sub-Sahara African region like other regions of the world.

Even though the effect of environmental degradation on well-being has been exploited by many authors, the main measure of environmental degradation used in the literature is inappropriate as it focuses mainly on-air pollution. Air pollution is not the only indicator of environmental degradation (Abid, 2016; Gani, 2012; Sarkodie & Adams, 2018; Hunjra *et al.*, 2020; Ali *et al.*, 2019; Adebayo, 2023).

In the light of the above, air pollution is a determinant of environmental degradation and not a measure of environmental degradation. There are other causes of environmental degradation like deforestation and land and water pollution. Therefore, considering just air pollution as a measure of environmental degradation is inappropriate (Al-Mulali *et al.*, 2015). This explains why authors have been using a more comprehensive measure of environmental quality, namely: the ecological footprint and biocapacity (Ozcan *et al.*, 2019). The ecological footprint created by Rees (1992) and Wackernagel and Rees (1996) measures the pressure humans are exerting on the environment to satisfy their wants. According to the Global Footprint Network (2017), it measures the ecological assets that a given population requires to produce the natural resources it consumes and to absorb its waste, especially carbon emissions. Environmental biocapacity of an ecosystem on the other hand is an estimate of the total productivity of the natural resources as well as its absorption and filtering capacity of other materials like carbon dioxide (Yue *et al.*, 2013).

Based on the foregoing studies, the present study seeks to empirically examine the possibility of improving inclusive human development in Sub-Saharan Africa through increased biocapacity and institutional quality. The novelty of this study is twofold. Firstly, the use of the inequality-adjusted human development as a measure of inclusive human development. Most of the existing studies on inclusive development have considered only the income dimension of well-being (Ali *et al.*, 2021; Shahbaz *et al.*, 2021; Adedoyin *et al.*, 2020) while those that considered the multidimensional aspect of well-being do not take into consideration the issue of inequality among the members of the society (Sayer & Campbell, 2002; Omri & Belaid, 2021). This, therefore, explains the reason for using the inequality-adjusted human development as a measure of inclusive human development. Secondly, the study uses the novel biocapacity which is a more comprehensive measure of environmental sustainability. Accordingly, to the best of knowledge, the nexus between biocapacity and inclusive development is sparse in the extant literature.

The rest of the study is structured as follows. A literature review follows this introduction after which, the data and methodology are discussed. Prior to concluding in the last section, the empirical results and corresponding robustness checks are presented and discussed.

2.Literature review

The literature has documented many definitions of institutional quality (Tusalem, 2015; Fukuyama, 2013; Dixit, 2009). Institutional quality which is used synonymously with governance in this study is the structure and functionality of the social and legal roles that regulate economic activity in a way that enforces contracts and protects property rights (Dixit, 2009). According to Nurkse (1953), it is the vicious cycle of poverty that is accountable for the backwardness of least developed countries (LDCs). According to him, there is a circular pattern of forces tending to act and react in such a manner that keeps the LDCs in a state of poverty as the process of capital formation remains restricted and obstructed. For a country to get out of this poverty trap, the country needs radical policies, which can be best done through institutional arrangement. Moreso, the public choice theory developed by Stigler (1971) and Peltzman (1976), which focuses on the aggregation of an individual interest's welfare to be more inclusive is cantered on achieving inclusive development through good and quality institutions (Buchanan, 1990; Tullock, 2008).

Tella (2019) found from a Toda-Yamamoto Granger non-causality test in a VAR (vector autoregressive) framework that, institutional quality is a key determinant of inclusive growth in Nigeria over the period 1998 to 2017. Yinusa *et al.* (2020) established from an asymmetric cointegration approach that, institutional quality improves inclusive growth in Nigeria over the period 1984 to 2017**.**

Diler (2021) analysed the effect of information and communication technology (ICT) on inclusive human development in Turkey's economy. The study employed annual data over the period 1990 to 2019. The autoregressive distributed lag (ARDL) model was used after investigating the stationarity of variables and cointegration between variables. The Toda-Yamamoto causality test was also used to find the causal direction between variables. The result revealed that information and communication technologies, foreign direct investment, foreign aid and domestic credit impact the inclusive human development in Turkey.

Yinusa *et al.* (2020) studied nexuses between financial development, institutional quality, and inclusive growth in Nigeria over the period 1984 to 2017. The study made use of an asymmetric cointegration approach to investigate the long-run relationship between institutional quality, financial development, and inclusive growth in Nigeria. Their results revealed that there is a long-run relationship between financial development, institutional quality and inclusive growth in Nigeria. It was also found that adjustments processes to equilibrium for institutional quality, financial development, and inclusive growth were asymmetric in Nigeria and therefore, financial development and institutional quality are important variables that influence inclusive growth in Nigeria.

Munir and Fatima (2020) investigated the effectiveness of foreign direct investment as a means of financing inclusive growth. The study also investigated how the effectiveness of foreign direct investment varies across countries with differing levels of institutional quality. An indicator for inclusive growth was also constructed using the social opportunity function while that of institutional quality was constructed using Principal Component Analysis (PCA) with data from the World Development Indicators (WDI) and World Governance Indicators (WGI), respectively. The study employed a panel of 86 countries and divided them into three clusters based on the ranking of their institutional quality. Using the Hausman specification test, the fixed effects estimates were preferred over the random effects estimates. Their results showed that foreign direct investment plays a vital role in improving inclusive growth, particularly in countries with low and medium levels of institutional quality.

Asongu *et al.* (2017) investigated the effect of ICT in complementing carbon dioxide (CO_2) emissions to affect inclusive human development in 44 Sub-Saharan African countries from the year 2000 to 2012. ICT was measured by mobile phone penetration and internet penetration. Based on a system-GMM, the results revealed that ICT reduces the potentially negative effect of environmental pollution on inclusive human development.

Ntow-Gyamfi *et al.* (2020) examined the influence of financial development on inclusive growth taking into consideration the moderation effect of institutions and the regulatory effect in redistributing the gains of financial development to also benefit the poor. Inclusive growth was measured using a social mobility function and an inclusive growth index was also constructed using the Asian Development Bank's framework of inclusive growth for robustness. Based on a panel of 48 African countries, the findings revealed that there is a non-linear relationship between finance and inclusive growth. Their results also reveal that for financial development to improve inclusive growth, there is a need for an effective institutional setup to regulate financial market participants.

Based on the existing studies, the relationship between inclusive human development and institutional quality has not been well exploited. While most of the studies have focused on the relationship between institutional quality and inclusive growth (Ntow-Gyamfi *et al.*, 2020;

Munir & Fatima; 2020; Yinusa *et al.*, 2020; Tella, 2019), the effect of institutional quality is sparse. Though some authors like Asongu *et al.* (2017) have examined the role of institutional quality in complementing the effect of ICT on inclusive human development, the direct effect of institutional quality has not been well exploited. Due to lack of data on environmental quality, air polution has been the main indicator of environment quality. In this context, biocapacity, which is a more comprehensive indicator of environmental sustainability (Hassan *et al.*, 2019; Galli *et al.*, 2020; Wackernagel & Beyers, 2019), will be used in the present study. Biocapacity is the amount of natural resources available at a specific moment in a particular place. Therefore, biocapacity is an important indicator of environmental sustainability.

As articulated in the introduction, this study therefore contributes to the literature by assessing the effect of institutional quality and biocapacity on inclusive human development. It also employs the novel biocapacity indicator to measure environmental sustainability.

3.Data and Model Specification

3.1 Data

The scope of this study is limited to 39 Sub-Saharan African countries from 2010 to 2017. The list countries is presented in Appendix 1. The sample size of the study is limited by data availability. The reasons for choosing Sub-Saharan Africa are because: (i) the region happens to be the least in the global human development index rankings and (ii) the region also has the highest prevalence of inequality and poverty (Raheem *et al.*, 2016).

To investigate the effect of biocapacity and institutional quality on inclusive human development, the dependent variable, inclusive human development is measured using the inequality-adjusted human development index which is being controlled for by its three dimensions: the inequality-adjusted income (standards of living) index, long life expectancy (health) inequality-adjusted index and the knowledge (educational) inequality-adjusted index in conformity with the recent literature on inclusive human development. Environmental degradation has been confirmed by the resent literature as a determinant of inclusive human development (Nchofoung *et al.*, 2022; Asongu & Nwachukwu, 2017). Biocapacity is measured using the novel ecological biocapacity, measured in global hectares per capita in line with recent literature (Hassan *et al.*, 2019). The six dimensions of institutional quality of the World Governance Indicators (WGI) of the World Bank were used as indicators of institutional quality. The inclusion of institutional quality as a determinant of inclusive human development is based on the apparent literature which found that institutional quality increases inclusive human development (Asongu & Nwachukwu, 2016; Asongu & Nwachukwu, 2016; Asongu & Odhiambo, 2020). The institutional quality index is contracted using the principal component analysis method based on the six dimensions of governance. The variable trade openness is measured by the sum of imports and exports of goods and services as percentage of GDP and foreign direct investment is the net inflows of investment into an economy measured as percentage of GDP. The choice of these variables to proxy for trade openness and financial openness and their inclusion as a determinant of inclusive human development is in line with contemporary literature (Asongu & Nwachukwu, 2018; Stylianou *et al.*, 2023). Official development assistant are loans and grants given to a country measured as a percentage of GDP. Its inclusion is justified by the apparent development literature as development assistance has been found to affect inclusive human development (Asongu & Nwachukwu, 2018; Asongu & Odhiambo, 2019; Asongu & Nnanna, 2019).

Data for this study are from four sources: (i) the inequality-adjusted human development index which is the dependent variable is from the United Nations Development Programme (UNDP), (ii) ecological biocapacity is from the Ecological Footprint Network (iii) the institutional quality variables are from Kaufmann *et al.* (2010) and (iv) the remaining variables are from the World Development Indicators (WDI) of the World Bank. Table 1 presents the descriptive statistics of and correlation among the variables used in the study. The panel is unbalanced as some observations are less than 312.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Inequality-adjusted human development	298	.343	.083	.208	.69
Inequality-adjusted income index	298	2.595	7.031	.233	37.3
Inequality-adjusted educational index	298	3.293	8.329	.123	41.4
Inequality-adjusted life expectancy index	298	2.422	6.473	.211	35.1
Biocapacity	304	2.487	4.028	.31	25.93
Control of corruption	312	-.677	.518	-1.559	.763
Government effectiveness	312	-.788	.556	-1.849	1.057
Political stability	312	-.584	.759	-2.699	1.013
Regulatory quality	312	-.647	.521	-2.071	1.127
Role of law	312	-.696	.541	-1.823	.975
Voice and accountability	312	-.507	.626	-1.576	.941
Trade	295	70.08	27.337	20.723	150.209
Foreign direct investment	312	5.666	11.111	-6.057	103.337
Official development assistance	312	.1	.103	0	1

Obs= number of observations and Std. Dev.= standard deviation

Source: constructed by authors from secondary data (2023)

Table 2 presents the pairwise correlation between the variables. The dependent variable inequality-adjusted human development index and its three dimensions are highly correlated. It is also found that the different dimensions of institutional quality which are highly correlated among themselves cannot be used in the same regression as it will cause multicollinearity. The institutional quality variables will therefore be used to construct and institutional quality index. Nevertheless, the other independent variables are not highly correlated among themselves and therefore there is a low chance of multicollinearity.

Table 2: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Inequality-adjusted human development	1.00													
(2) Inequality-adjusted income index	0.06	1.00												
(3) Inequality-adjusted educational index	0.11	0.83	1.00											
(4) Inequality-adjusted life expectancy index	0.02	0.96	0.70	1.00										
(5) Biocapacity	0.27	-0.09	-0.10	-0.12	1.00									
(6) Control of corruption	0.38	0.02	0.00	-0.14	-0.10	1.00								
(7) Government effectiveness	0.60	0.01	0.00	-0.07	-0.11	0.79	1.00							
(8) Political stability	0.51	0.20	0.23	0.03	0.11	0.62	0.57	1.00						
(9) Regulatory quality	0.49	0.06	0.00	-0.01	-0.13	0.75	0.89	0.53	1.00					
(10) Role of law	0.56	0.12	0.09	0.02	-0.08	0.85	0.91	0.67	0.89	1.00				
(11) Voice and accountability	0.36	0.06	0.05	-0.07	-0.20	0.63	0.63	0.60	0.70	0.73	1.00			
(12) Trade	0.21	0.03	0.00	-0.02	0.22	0.21	0.10	0.41	0.08	0.15	0.17	1.00		
(13) Foreign direct investment	-0.07	-0.02	-0.02	-0.03	0.06	0.02	-0.09	0.10	-0.08	-0.04	0.08	0.37	1.00	
(14) Official development assistance	-0.38	-0.10	-0.11	-0.09	-0.13	-0.05	-0.29	-0.15	-0.25	-0.23	-0.05	0.04	0.48	1.00

Source: constructed by authors from secondary data (2023)

3.2 Model Specification

The present study investigates the effect of institutional quality on inclusive human development. Tobin's (1955) dynamic aggregative production function highlights the role of resources in the growth process. Moreso, the public choice theory highlights' the importance of regulating economic activities. The Nurkses' (1953) theory of the vicious circle of poverty is well traced on the importance of good institutions so as to remove a society from the vicious circle of poverty. The analytical framework of this study is based on a model in which inclusive human development is the dependent variable while institutional quality is the main independent variable among a series of control variables in line with the work of Asongu and Odhiambo (2020) as specified in equation 1 below.

IHDI=f (BC, IQ, TD, FI, DA)…………..(1)

Where IHDI=inclusive human development, BC= biocapacity (environmental sustainability), IQ= institutional quality index, TD=trade openness, FI=foreign direct investment and DA= official development assistance. Econometrically, the model can be specified as follows:

$$IHDI_{it} = \alpha_1 + \alpha_2 ES_{it} + \alpha_3 IQ_{it} + \alpha_4 TD_{it} + \alpha_5 FI_{it} + \alpha_6 DA_{it} + \varepsilon_{it} \dots \dots (2)$$

Where ε_{it} is the error term and α_i are parameters to be estimated i=1, 2…..N and t=1,2, ..T.

To estimate the above-mentioned model, system-GMM estimation technique was employed. The motivation for using a system-GMM is found in Arellano and Bond (1991), Blundell and Bond (1998) and later in Levine *et al.* (2000) who provided the rationality for using the GMM to study the relationship between variables. GMM adjusts simultaneity not only at the level of the other explanatory variables but also of the dependent variable by the use of a series of instrumental variables generated by the lag of the endogenous variables. As estimated results under the static panel models such as fixed effects, pooled OLS, and random effects may lead to biased results in the presence of potential simultaneity of explanatory variables (Ibrahim, 2014).

From the model specified above, let us consider an autoregressive panel data model of the form,

$$IHDI_{it} = \alpha_1 + \partial_1 IHDI_{it-1} + \alpha_2 BC_{it} + \partial_2 ES_{it-1} + \alpha_3 IQ_{it} + \partial_3 IQ_{it-1} + \alpha_4 TD_{it} + \partial_4 TD_{it} + \alpha_5 FI_{it} + \partial_5 FI_{it-1} + \alpha_6 DA_{it} + \partial_6 DA_{it} + \varepsilon_{it} \dots \dots \dots \dots \dots (3)$$

where ε_{it}=$\eta_i + \nu_{it}$ is the usual 'fixed effects' decomposition of the error term; N is large, T small as in our case. When we estimate the above model using the fixed effects and random effects estimators, the explanatory variables will be correlated with the error term which violets the assumption of exogeneity of the estimates.

There are numerous methods of dynamic panel estimation among which we have GMM. The GMM estimator has several advantages because it is robust to model misspecification since its derivation does not require any particular distributional assumptions on the residuals. It is closer to the theoretical relation because this estimator is chosen so as to minimise the weighted distance between the theoretical values and the observed values. Consistent with Arrelano and Bond (1991), the first difference-GMM involves taking for each period, the first difference of the equation to remove the individuals specific effects. .

$$\Delta IHDI_{it} = \alpha_1 + \alpha_7 \Delta IHDI_{it-1} + \alpha_2 \Delta BC_{it} + \alpha_3 \Delta IQ_{it} + \alpha_4 \Delta TD_{it} + \alpha_5 \Delta FI_{it} + \alpha_6 \Delta DA_{it} + \varepsilon_{it} (4)$$

The system GMM estimator by Blundell and Bond (1998) combines the first difference equations with the level equations. The system GMM has been found to be more robust than the difference GMM.

The instruments in the equation in first differences are expressed in level, and vice versa. We are going to apply the two GMMs to better understanding result of our study since the result of an estimation can change with respect to estimation method used. The GMM estimator has several advantages because it is robust to model misspecification since its derivation does not require any particular distributional assumptions on the residuals. It is closer to the theoretical relation because this estimator is chosen so as to minimise the weighted distance between the theoretical values and the observed values. The over identifying restriction test does not check the validity of instruments but rather it checks whether all instruments identify the same set of parameters. If the probability is not significant, it implies the instruments are valid, where (null hypothesis) H0 supports the perspective that instruments are valid while H1 (alternative hypothesis) supports the view that instruments are not valid. To proceed to the interpretation of the result of GMM estimation, the instrument used needs to be valid.

After taking into consideration the advantages of panel data as outlined by Baltagi (2013), it will be important to look at the nature of the panel whether it is homogenous or heterogenous before running the regression results. Standard panel linear regression models like random effects and fixed effects models are based on the assumptions that the parameters of interest are homogenous across panel. This therefore ignores the slope heterogeneity that usually exists across panels which might bias the results. Even if there exist slope homogeneity across the panel, it is important to verify this empirical question before any panel analysis to avoid any biased results. A probability to the test for slope homogeneity across the panel is to apply the F test on the differences of a squared residual from a cross-sectional unit-specific OLS regression and a pooled OLS (Baltagi, 2013)

4. Results and Discussion

4.1 Descriptive statistics

Before the analysis proper, it is important to investigate the specification of our panel model, that is, if the model employed portrays homogenous or heterogeneity slopes across panels.

Table 3: Testing for slope heterogeneity

H0: slope coefficients are homogenous	
Delta (p-value)	1.010 (0.312)
adj. (p-value)	3.566 (0.000)

Source: constructed by authors from secondary data (2023)

From Table 3 above, we can conclude that the slope coefficients are not homogenous across the panel as they vary across the different countries included in the panel. Therefore, it is important to do a panel analysis.

4.2. Trend Analysis

Furthermore, Figure 1 below shows the relationship between institutional quality and inclusive human developemt in Sub-Saharan Africa. The figure is divided into four trends for the whole sample, lower income countries, lower middle income countries, and finally, for the upper middle income countries. For the whole sample, trends suggest that there is a positive relationship between institutional quality and inclusive human development. This shows that at higher levels of instituinal quality, the level of inclusive human development is also high. This relationship is found to be consistent in the low-income countries and the upper middle-income countries while in the lower middle-income countries, there seem to be no relationship. Nevertheless, it can be said that, countries with high institutional quality have higher levels of inclusive human development in Sub-Saharan Africa. Therefore, for a country to improve inclusive human development, it should maintain a higher level of institutional quality.

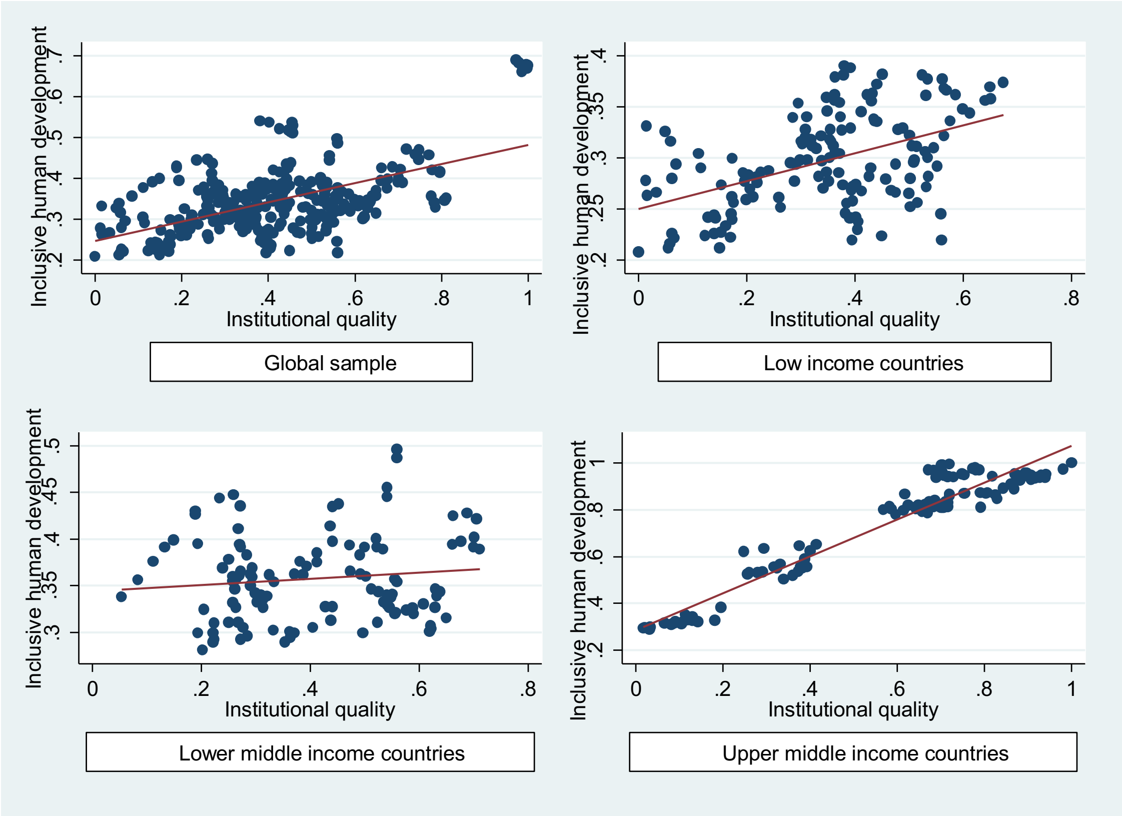

Figure 1: The link between institutional quality and inclusive human development

Source: constructed by authors from secondary data (2023)

In addition, Figure 2 also shows the relationship between environmental sustainability and inclusive human development in Sub-Saharan Africa. The trend is also divided into four components, for the whole sample, low-income countries, lower middle-income countries and finally, for the middle upper income countries. For the whole sample, the trend suggests that there is a positive relationship between environmental sustainability and inclusive human development. This shows that at higher levels of environmental sustainability, the level of inclusive human development is also high.

This relationship is found to vary across different income groups. In the low-income countries, the relationship between environmental sustainability and inclusive human development is negative. In the lower middle-income countries, there is no relationship between environmental sustainability and inclusive human development. On the other hand, in the upper middle-income countries, the relationship between environmental sustainability and inclusive human development turns to be positive. This therefore mean that the relationship between environmental sustainability and inclusive human development is no linear and turns to vary across income levels. It follows, inclusive human development increases with a decrease in environmental sustainability until a certain threshold where this relationship turns to be positive. This is in line with the EK curve which focuses on the demand side of the environment and explains that an increase in economic growth is positively associated with environmental degradation until a certain threshold of development where an increase in economic growth turns to reduce environmental degradation.

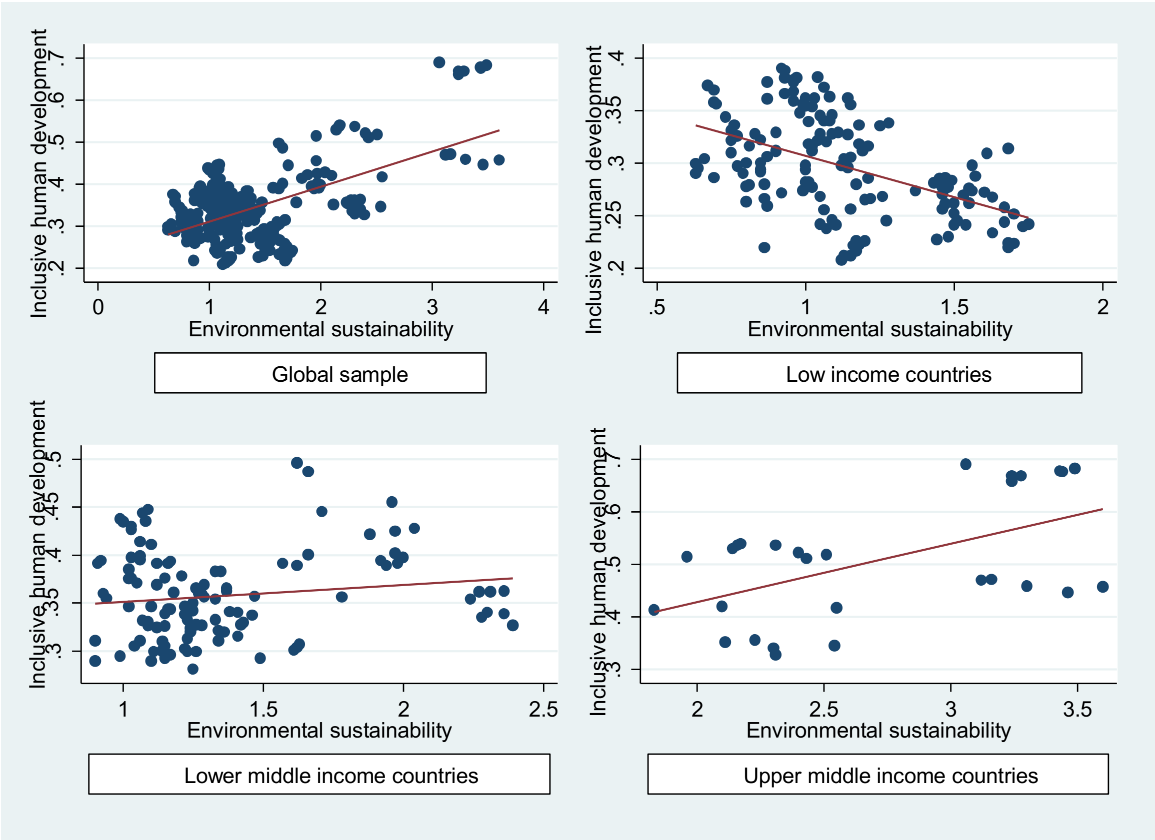

Figure 2: The relationship between environmental sustainability and inclusive human development

Source: constructed by authors from secondary data (2023)

4.3 Baseline results

Table 4 below presents the empirical results of the effect of institutional quality and biocapacity on inclusive human development. Column 1 of Table 3 presents the baseline model of the effect of institutional quality and biocapacity on inclusive human development after which the different dimensions that were used to construct the institutional quality index are added alternatively to see the robustness of our results. These variables are alternatively added to also get more insights into the effect of institutional quality on inclusive human development and to avoid multicollinearity since they are highly correlated among themselves.

Table 4: The effects of institutional quality and biocapacity on inclusive human development in SSA

	Dependent variable: inclusive human development						
VARIABLES	(1)	(2)	(3)	(4)	5)	(6)	7)
Lag of Inclusive human development	**0.894*** (0.009)**	**0.985*** (0.005)**	**0.973*** (0.010)**	**0.939*** (0.011)**	**0.986*** (0.007)**	**0.973*** (0.009)**	**0.979*** (0.008)**
Biocapacity	**0.008** (0.004)**	**0.006*** (0.001)**	**0.012*** (0.003)**	**0.008** (0.003)**	**0.007** (0.003)**	**0.009*** (0.003)**	**0.009*** (0.003)**
Trade	**-0.028*** (0.003)**	**-0.015*** (0.005)**	**-0.015*** (0.005)**	**-0.023***** (0.007)	**-0.013** (0.006)**	**-0.012* (0.006)**	**-0.019*** (0.005)**
Foreign direct investment	-0.004 (0.004)	**0.017*** (0.004)**	**0.011*** (0.002)**	0.006 (0.004)	**0.016*** (0.003)**	**0.015*** (0.004)**	**0.019*** (0.004)**
Development assistant	**-0.079*** (0.005)**	-0.007 (0.011)	0.005 (0.010)	**-0.032** (0.013)**	-0.005 (0.011)	0.004 (0.009)	-0.011 (0.012)
Institutional quality	**0.032*** (0.001)**						
Control of corruption		0.003 (0.003)					
Government effectiveness			**0.024*** (0.006)**				
Political stability				**0.028*** (0.006)**			
Regulatory quality					**0.012** (0.006)**		
Role of law						**0.022*** (0.005)**	
Voice and accountability							**0.008** (0.003)**
Constant	**0.047*** (0.002)**	**0.014*** (0.003)**	**0.010** (0.004)**	**0.022*** (0.004)**	**0.009** (0.004)**	**0.009** (0.004)**	**0.016*** (0.004)**
Observations	234	234	234	234	234	234	234
Number of Countries	36	36	36	36	36	36	36
P-value of AR(1)	[0.00171]	[0.00348]	[0.00314]	[0.00277]	[0.00340]	[0.00345]	[0.00308]
P-value of AR(2)	**[0.440]**	**[0.393]**	**[0.377]**	**[0.395]**	**[0.383]**	**[0.391]**	**[0.392]**
P-value of Sargan OIR	**[0.167]**	[0.0195]	[0.0235]	[0.0216]	[0.0236]	[0.0286]	[0.0218]
P-value of Hansen OIR	**[0.370]**	**[0.494]**	**[0.465]**	**[0.284]**	**[0.465]**	**[0.419]**	**[0.385]**
Fisher Statistics	**1.061e+06 *** **	**1.710e+07 *** **	**9.268e+06 *** **	**1.500e+07 *** **	**5.250e+08 *** **	**8.384e+06 *** **	**3.975e+06 *** **
Fisher P-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**
Number of instruments	35	35	35	35	35	35	35

Standard errors of the estimated coefficients in parentheses, the p-values of all the tests are in square brackets, *, **, ***: significance levels of 10%, 5% and 1% respectively, OIR: Over-identifying Restrictions, AR (1) = autocorrelation of order 1 and AR(2): autocorrelation of order 2. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR (1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.

Source: constructed by authors from secondary data (2023)

From the results of the Arellano-Bond test for Autocorrelation of residuals and the Hansen and Sargan tests of over-identification restrictions above, we found that; there is an absence of autocorrelation of order one since corresponding p-values were significant at least 10% and presence of autocorrelation of other two since corresponding p-values were insignificant at least 10%. As concerns the Hansen and Sargan tests of over-identification restrictions, the instruments were valid. Therefore, the Hansen test failed to reject the over-identification, suggesting that we have valid instruments and the serial correlation test failed to reject the null of the no AR (2) while rejecting the null of the no AR (1).

From the Table 4 above, the coefficient of the lagged of inclusive human development is 0.8942 and significant at 1%. This means that the past values of inclusive human development have a positive and significant effect on the present inclusive human development. Therefore, an increase in the past values of inclusive human development by 1 point will increase the present value of inclusive human development by 0.8942 point. These results are stable even after mining with the different institutional quality variables.

As expected, the coefficient of biocapacity is positive and significant at 1% with a coefficient of 0.0083. This means that, if biocapacity increases by 1 point, inclusive human development will increase by 0.0083 point. These results remained stable even after adding a combination of other control variables. This result is significant at 1% level which makes it relevant for policy recommendation towards improving inclusive human development. The outcome of this result is in line with the findings of Asongu *et al.* (2017) who established that carbon dioxide degradation has a negative effect on inclusive human development in Sub-Sahara African countries. It is also in line with the findings of Asongu and Odhiambo (2019), who found similar results in 44 Sub-Saharan Africa countries. More so, the result is in line with that of Ntow-Gyamfi *et al.* (2019) who have established that, institutional quality regulates financial market participants to be inclusive in their operations.

Trade openness on the other hand was found to have a negative effect on inclusive human development with coefficient -0.0281. This means that if trade openness increases by one-point, inclusive human development will decrease by 0.0281 point. These results are also stable even after mining with the different institutional quality variables though at different levels of significance.

The results also reveal that foreign direct investment has a negative and significant effect on inclusive human development with coefficient -0.0036. This means that if foreign direct investment increases by 1 point, inclusive human development will decrease by 0.0036. This result remains stable when the other dimensions of institutional quality are alternatively used in the place of institutional quality index except regulatory quality which becomes insignificant.

The results also revealed that foreign aid has a negative and significant effect on inclusive human development with a coefficient -0.0789. This means that if foreign aid increases by 1 point, inclusive human development will decrease by 0.0789 point. This result is significant at 1 % though becomes insignificant with the different dimensions of institutional quality with the exception of regulatory quality.

Regarding the effect of institutional quality on inclusive human development, it was found that institutional quality has a positive and significant effect on inclusive human development with coefficient 0.0316. This means that if institutional quality increases by 1 point, inclusive human development will increase by 0.0316 point. In addition, all indicators of institutional quality were found to improve inclusive human development, however, control of corruption was not significant.

Accordingly, the results from the system GMM reveal that institutional quality exerts a positive and statistically significant effect on the inclusive human development in Sub-Saharan African countries. This result is in conformity with our a priori expectation. It therefore permits the researcher to accept the second hypothesis of the study which states that, institutional quality has a statistically significant effect on inclusive human development in Sub-Saharan Africa. This result simply reveals that the benefits from institutional quality to these countries equitably improves their well-being. Therefore, institutional quality provides a conducive environment for less developed economies like Sub-Saharan African countries with opportunities such as faster economic growth, good health, high educational attainment, more employment opportunities, equitable distribution of resources, among others.

This finding is in line with the finding of Woldegiorgis (2020) who claimed that institutional quality increases inclusive human development in 21 African countries. It is also in line with the findings of Olanrewaju *et al.* (2019), and Yinusa *et al.* (2020) who found that institutional quality is a dominant driver of inclusive growth in Nigeria. Moreso, the result is in line with that of Ntow-Gyamfi *et al.* (2019) who have established that, institutional quality regulates financial market participants to be inclusive in their operations.

4.4. Sensitivity analysis by change of dependent variable

For an in-depth understanding of the effect of institutional quality on inclusive human development, the dependent variable, inclusive human development, was divided into three dimensions, the inclusive income index, inclusive educational index and inclusive life expectancy index. Table 5 presents the results of the effect of institutional quality on inclusive income in SSA. Just like the baseline results presented in Table 3, this is a series of mining with the different institutional quality variables since all of them cannot be added to the regression equation at the same time due to multicollinearity.

From Table 5, the effect of institutional quality variables remained all positive like in the baseline result in Table 3 and control of corruption becomes insignificant. This explains the importance of institutional quality in achieving inclusive income. This shows that for a country to achieve economic growth it must increase its institutional quality. However, given that the AR(2) test is consistently significant in Table 5, the findings are nonetheless reported in order to avoid the file drawer problem or publication bias in scientific scholarly reporting in which, strong/expected/significant results are preferred over weak/unexpected/insignificant results. In the same light, Table 6 presents the results of the effect of institutional quality on inclusive education in sub-Saharan Africa.

Table 5: The effects of institutional quality and biocapacity on inclusive income in SSA

	Dependent variable: inclusive income						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag of inclusive income	**0.687*** **	**0.702*** **	**0.698*** **	**0.699*** **	**0.690*** **	**0.692*** **	**0.648*** **
index	**(0.005)**	**(0.008)**	**(0.011)**	**(0.006)**	**(0.008)**	**(0.006)**	**(0.009)**
Biocapacity	**-1.334*** **	**-1.002** **	**-2.872*** **	**-0.898*** **	**-1.319*** **	**-1.217*** **	**-1.093*** **
	(0.250)	**(0.403)**	**(0.486)**	**(0.316)**	**(0.281)**	**(0.284)**	**(0.239)**
Trade	**1.908*** **	**0.121**	**1.270*** **	0.471	0.146	0.459	0.245
	(0.389)	**(0.386)**	**(0.348)**	(0.449)	(0.682)	(0.361)	(0.192)
Foreign direct investment	**1.878*** **	**3.447*** **	**4.045*** **	**4.481*** **	**5.270*** **	**4.653*** **	**4.723*** **
	(0.258)	**(0.411)**	**(0.653)**	**(0.427)**	**(0.382)**	**(0.397)**	**(0.487)**
Development assistant	**4.741** **	**4.608*** **	**3.428*** **	**4.322*** **	**3.271*** **	1.797	2.380
	(1.770)	**(0.697)**	**(1.038)**	**(0.450)**	**(1.141)**	(1.100)	(1.409)
Institutional quality	**1.379*** **						
	(0.414)						
Control of corruption		0.216					
		(0.534)					
Government effectiveness			**4.828*** **				
			(0.950)				
Political stability				**1.016*** **			
				(0.181)			
Regulatory quality					**1.777** **		
					(0.822)		
Role of law						**0.671** **	
						(0.250)	
Voice and accountability							**1.595*** **
							(0.429)
Constant	0.230	**0.361** **	**2.085*** **	**0.810*** **	-0.633	0.056	-0.264
	(0.187)	**(0.152)**	**(0.286)**	**(0.185)**	(0.558)	(0.154)	(0.178)
Observations	252	252	252	252	252	252	252
Number of Countries	36	36	36	36	36	36	36
P-value of AR(1)	[0.0270]	[0.0270]	[0.0279]	[0.0279]	[0.0274]	[0.0304]	[0.0311]
P-value of AR(2)	[0.0561]	[0.0634]	[0.0714]	[0.0654]	[0.0633]	[0.0646]	[0.0631]
P-value of Sargan OIR	**[1]**	**[0.995]**	**[0.996]**	**[0.995]**	**[0.995]**	**[0.995]**	**[0.994]**
P-value of Hansen OIR	**[0.917]**	**[0.868]**	**[0.440]**	**[0.929]**	**[0.837]**	**[0.985]**	**[0.925]**
Fisher Statistics	**26746**	**34253**	**17827**	**5160**	**385702**	**4389**	**4954**
Fisher P-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**
Number of instruments	25	25	25	25	25	27	25

Standard errors in parentheses, the p-values of all the tests are in square brackets, *,**,***: significance levels of 10%, 5% and 1% respectively OIR: Over-identifying Restrictions, AR(1)= probability of autocorrelation of order 1 and AR(2): probability of autocorrelation of order 2. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR (1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.

Source: constructed by authors from secondary data (2023)

Table 6: The effects of institutional quality and biocapacity on inclusive education in SSA

	Dependent variable: inclusive education						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag of inclusive education index	**0.694***** **(0.041)**	**0.667***** **(0.018)**	**0.746***** **(0.009)**	**0.713***** **(0.024)**	**0.740***** **(0.012)**	**0.746***** **(0.009)**	**0.735***** **(0.011)**
Biocapacity	-0.758 (0.641)	**-4.054***** **(1.206)**	**-3.918***** **(0.568)**	**-5.441***** **(0.872)**	**-3.947***** **(0.543)**	**-4.781***** **(0.661)**	**-4.008***** **(0.617)**
Trade	0.935 (1.428)	2.137 (1.870)	**7.015***** **(0.811)**	**4.532***** **(1.529)**	**6.923***** **(0.829)**	**7.083***** **(0.799)**	**6.736***** **(0.837)**
Foreign direct investment	**6.272***** **(1.970)**	**10.352***** **(1.793)**	**8.039***** **(1.260)**	**7.435***** **(1.177)**	**8.687***** **(1.133)**	**6.591***** **(1.152)**	**8.669***** **(1.270)**
Development assistant	1.853 (3.125)	**4.586**** **(2.194)**	**7.302**** **(2.736)**	**6.466***** **(1.497)**	**8.561***** **(1.792)**	4.769 (3.069)	**7.339**** **(2.724)**
Institutional quality	**0.551***** **(0.023)**						
Control of corruption		0.534 (0.837)					
Government effectiveness			0.931 (0.759)				
Political stability				**5.111***** **(0.794)**			
Regulatory quality					0.628 (0.546)		
Role of law						**-1.536***** **(0.108)**	
Voice and accountability							**0.361**** **(0.133)**
Constant	0.041 (0.685)	0.083 (0.829)	**-3.084***** **(0.542)**	**-4.266***** **(0.617)**	**-3.133***** **(0.519)**	**-1.723***** **(0.524)**	**-2.834***** **(0.470)**
Observations	252	252	252	252	252	252	252
Number of Countries	36	36	36	36	36	36	36
P-value of AR(1)	**[0.626]**	**[0.591]**	**[0.636]**	**[0.540]**	**[0.611]**	**[0.656]**	**[0.622]**
P-value of AR(2)	**[0.297]**	**[0.332]**	**[0.398]**	**[0.433]**	**[0.390]**	**[0.406]**	**[0.384]**
P-value of Sargan OIR	**[0.160]**	**[0.272]**	**[0.903]**	**[0.897]**	**[0.899]**	**[0.919]**	**[0.895]**
P-value of Hansen OIR	**[0.818]**	**[0.623]**	**[0.643]**	**[0.584]**	**[0.645]**	**[0.527]**	**[0.688]**
Fisher Statistics	**555.4**	**1150**	**87299**	**725.9**	**14018**	**3856**	**15249**
Fisher P-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**
Number of instruments	27	26	26	27	27	27	27

Standard errors in parentheses, the p-values of all the tests are in square brackets, *, **, ***: significance levels of 10%, 5% and 1% respectively OIR: Over-identifying Restrictions, AR(1)= probability of autocorrelation of order 1 and AR(2): probability of autocorrelation of order 2. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR (1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.

Source: constructed by authors from secondary data (2023)

From Table 6, the effect of institutional quality variables on inclusive education remained all positive like in the baseline result in Table 3 except that, the rule of law, government effectiveness and regulatory quality are insignificant. The effect of biocapacity on inclusive health is found to be negative. In the same light, Table 7 presents the results of the effect of institutional quality on inclusive health in SSA.

Table 7: The effects of institutional quality and biocapacity on inclusive health in SSA (two System GMM)

	Dependent variable: inclusive health						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag of inclusive health index	**0.932***** **(0.001)**	**0.902***** **(0.003)**	**0.925***** **(0.002)**	**0.714***** **(0.006)**	**0.692***** **(0.005)**	**0.922***** **(0.002)**	**0.669***** **(0.006)**
Biocapacity	**2.878***** **(0.630)**	**2.459**** **(0.964)**	-1.558 (1.316)	**4.826***** **(0.967)**	1.141 (1.203)	**2.342**** **(1.070)**	**5.438*** **(2.737)**
Trade	**7.059***** **(0.351)**	**10.871***** **(0.477)**	**6.987***** **(0.265)**	**20.994***** **(0.409)**	**18.147***** **(0.600)**	**8.002***** **(0.302)**	**23.879***** **(0.400)**
Foreign direct investment	**-24.274***** **(0.291)**	**-31.837***** **(0.375)**	**-30.543***** **(0.300)**	**-58.136***** **(0.738)**	**-57.837***** **(0.422)**	**-32.055***** **(0.262)**	**-66.639***** **(0.595)**
Development assistant	**15.295***** **(0.434)**	**19.634***** **(0.476)**	**28.732***** **(1.086)**	**40.049***** **(1.090)**	**50.264***** **(0.908)**	**24.850***** **(0.560)**	**39.564***** **(0.954)**
Institutional quality	**5.275***** **(0.275)**						
Control of corruption		**7.438***** **(0.217)**					
Government effectiveness			**0.639*** **(0.342)**				
Political stability				**9.694***** **(0.300)**			
Regulatory quality					1.653 (1.994)		
Role of law						**4.066***** **(0.209)**	
Voice and accountability							**15.795***** **(0.515)**
Constant	**0.973***** **(0.155)**	**0.735***** **(0.115)**	**-0.971***** **(0.230)**	**0.476** **(0.294)**	**-5.069***** **(1.149)**	**0.563***** **(0.149)**	**2.637***** **(0.341)**
Observations	252	252	252	252	252	252	252
Number of Countries	36	36	36	36	36	36	36
P-value of AR(1)	**[0.170]**	**[0.169]**	**[0.163]**	**[0.232]**	**[0.222]**	**[0.165]**	**[0.304]**
P-value of AR(2)	**[0.158]**	**[0.371]**	**[0.384]**	**[0.747]**	**[0.850]**	**[0.287]**	**[0.979]**
P-value of Sargan OIR	**[0.0531]**	**[0.204]**	**[0.0150]**	**[0.990]**	**[0.979]**	**[0.0164]**	**[1]**
P-value of Hansen OIR	**[0.421]**	**[0.457]**	**[0.362]**	**[0.676]**	**[0.338]**	**[0.413]**	**[0.823]**
Fisher Statistics	**3.805e+06**	**9.772e+06**	**2.994e+06**	**77192**	**169910**	**5.650e+06**	**1.036e+06**
Fisher P-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**
Number of instruments	21	21	21	21	21	21	25

Standard errors in parentheses, the p-values of all the tests are in square brackets, *, **, ***: significance levels of 10%, 5% and 1% respectively OIR: Over-identifying Restrictions, AR(1)= probability of autocorrelation of order 1 and AR(2): probability of autocorrelation of order 2. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Fisher statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR (1) and AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Constants are included in all regressions.

Source: constructed by authors from secondary data (2023)

From Table 7, the effect of institutional quality is found to be positive and significant on inclusive human development. The results remain consistent when the different dimensions of institutional quality are used except regulatory quality which is insignificant. This explains the importance of institutional quality in achieving inclusive education.

The effect of institutional quality is consistently positive on inclusive human development and on its different dimensions; inclusive income, inclusive health, inclusive income and inclusive education. This explains the importance of institutional quality in mobilising resources to enhance inclusive human development.

Moreso, biocapacity positively affects inclusive human development and the underlying positive effect is driven by the inclusive health and not by the inclusive education and inclusive income components of inclusive human development. An increase in environmental quality maintains the functionality of the ecosystem and therefore an increase in inclusive health. More so, Sub-Saharan African countries are dependent on natural resources and hence, policies to improve environmental sustainability are accompanied by a reduction exploitation of natural resources. This reduces inclusive income and subsequently inclusive education as the minority cannot afford the cost of education.

On the other hand, an increase in environmental sustainability is mainly focused of regulating the exploitation of resources. An increase in environmental sustainability will therefore reduce the level of income and hence, the means to afford the cost of education is reduced. This ultimately reduces inclusive education in Sub-Saharan Africa.

5. Conclusion and recommendation

This study was set to investigate the effect of institutional on inclusive human development in Sub-Saharan Africa. Using system-GMM on a sample of 39 countries, it is found that institutional quality increases inclusive human development and all its components. It is also established that biocapacity positively affects inclusive human development and the underlying positive effect is driven by the inclusive health component of inclusive human development and not by the inclusive education and inclusive income components of inclusive human development, though the models related to the inclusive income component are not valid.

Sound institutions are much desired to effectively harness inclusive human development in Sub-Sahara African. Therefore, governments of Sub-Sahara African countries should use state roles in mobilising both human and natural resources for equitable socio-economic opportunities to achieve the much-desired broad-based inclusive human development and productive employment growth. Moreso, environmental sustainability should be improved through good environmental policies. From a comparative perspective, it is apparent that policy makers should prioritize the inclusive health component of human development in view of improving human development standards in the sampled countries.

The major deficiency of the present study is that it did not take into consideration the issue of cross-sectional dependence as well as slope heterogeneity in the empirical exercise. Hence, it will be interesting for future research to assess if the established results in this study are relevant to cross-sectional dependence and slope heterogeneity.

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Appendix 1: List of countries

Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Congo Republic, Ivory Coast, Eswatini, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia, Zimbabwe