

The Effect of Public Expenditure on Sustainable Economic Development in Sub-Saharan African: System, Generalized Method of Moments (GMM)” Estimation Technique

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Abstract

In Sub-Saharan Africa, failure in achieving sustainable economic development and ineffective public expenditure management have become a serious problem. This study was undertaken to address a gap in previous research, which examined the economic effects of public expenditure without considering the sustainability dimension. It examines the effects of public expenditure on sustainable economic development (SECD) in sub-Saharan Africa using the annual data of 35 states during the period of 2008-2022. The research used the “Dynamic Panel, System-Generalized method of Moments (GMM)” estimation technique to examine the effect of predictor variables on the out-come variable.

The results revealed that increase in public expenditure in the military, and agriculture sectors negatively and significantly affected sustainable economic development in SSA, whereas expenditures in health and education expenditure have a positive and significant effect. In sub-Saharan Africa, for military, health and education expenditures, sustainable development theory is supported, whereas for public expenditure in agriculture the theory sustainable development does not hold true. Thus, based on the study findings governments in the study area are suggested to shrink and redirect military and agricultural expenditure and intensity spending in human capital development (health and education spending)

Keywords: Development, Economy, Public Expenditure, System GMM, Sustainability

JEL: H41, H51, H52, H53

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1. INTRODUCTION

1.1. Backgrounds of the study

In 1987, the World Commission for the Environment and Development [WCED] stated that environmental and long-run socioeconomic impacts overlooked unsustainable production and that the distribution of goods instigated global socioeconomic and environmental crises. The report pointed out that the problem needs sustainable economic, social, and environmental solutions (WCED 1987; Ozili, 2022). Sustainable economic development is a vital constituent of general SD and is the process of improving the long-lasting economic welfare of the people in a way that satisfies current desires without compromising the potential of generation to come to satisfy their own needs through reducing inequality and promoting job, economic growth, industry, innovation, and infrastructure (UNDP, 2023). Despite the fact that Africa's economy by 2063 was expected to be "structurally transformed through industrialization, manufacturing and value addition to create shared growth through private sector development, entrepreneurship and decent jobs for all", in the past two decades, countries in sub-Saharan Africa have failed to realize a dominant share of sustainable economic development (SECD) goals, viz., decent work and economic growth (SDG8), industry, innovation and infrastructure (SDG9) and reduced inequalities (SDG10) (Sachs et al., 2023). In this context, scholars claim that achieving SECD entails the coordination of institutional objectives and robust fiscal spending (Ghani & Yusoff, 2021). Public spending is an outlay of financial resources by the government on public goods and services, and it gives an insight into the size of governments across states (OECD.,

2023). Although governments in the world claim that they are using public resources for the general welfare of citizens, theorists and academicians have multifaceted arguments on their public resource utilizations. For instance, Becker and Barro, (1988), argue that public expenditure on education, health and infrastructure positively contributes to long-term economic growth and development. In addition, the modern growth theorist Barro (1990) also believes that the productive class of public spending impacts development.

From the reviewed theoretical literature, we understand that traditional economic theories fail to consider the complexities and dynamism that exist among economic, social, and environmental sustainability. Moreover, they emphasize on increasing short-term economic output using resources up to the maximum possible level. The theories ignore its long-run adverse effects on the environment and society. In general, economic theories lack sufficient thought for sustainable development. These make old economic theories powerless in addressing how fiscal policies interact with the complex environments of SECD, leading to disorganized analysis. Thus, a comprehensive theory (theory of sustainable development) is vital in examining the effects of public spending on economic welfare. According to the theory of sustainable development, public spending is a means for sustainable economic development (WCED., 1987). However, in SSA, public expenditures, particularly pro-poorer sectors such as agricultural, health, and education spending, as a percentage of national output, have been fluctuating over the past 3 decades, while states are required to increase these expenditures to achieve the SDGs. Additionally, African development agenda 2063 states that African countries

are required to upsurge their spending in agriculture, human resources development, and social capital to achieve the economic ambition of the continent, "A prosperous Africa grounded in inclusive growth and sustainable development". Despite the fact that the agenda is ambitious, the region is suffering not only from budget fluctuation but also multifaceted public expenditure allocation and management gaps (United Nations, 2020), (Pearson, 2022). These problems stem from a lack of robust empirical information on the impact of military, agricultural, health, and education resource allocation on sustainable economic development. Moreover, collective stewardship theory of sustainable development states that funds (resources) in this planet must be safeguarded, and managed collectively, and the appropriate use of all existing resources (i.e., physical and financial capitals) brings sustainable social, economic and environmental welfare (McAfee, 2019). In contrast, Rogue agent theory of sustainable development states that the agents (resource guardians) use the resources for their self-interest rather than for socio-economic and environmental development, and it will hamper sustainable development because the resource can be used for good and bad purposes (Mazzolini and Celani, 2020). In previous studies, the sustainable development theory of WCED, collective stewardship theory of sustainable development, as well as Rogue agent theory of sustainable development failed to be examined in terms of the effect of public financial resources on socio-economic and environment development sustainability.

Additionally, in SSA, military spending accounts for significant share of government expenditure and considerably increased over past three decades in the absence

of conclusive empirical knowledge. In this regard, global studies on military expenditure conclude that the economic effect of military expenditure happens to be negative in the largest weapon importer worldwide (Desli & Gkoulgkoutsika, 2019). In addition, according to Wang et al. (2012) it is also a burden for the economy in the short run in seven developed economies (G-7), but in Asia, Oceania and Europe, the researchers have concluded that military expenditure improved the performance of national economy. Also, the study by (Chary, 2023) on the largest weapon importer states worldwide revealed that military expenditure is a burden for economic growth in the short-run where it induces economic growth in the long-run. Nevertheless, Saleem and Qadri (2022) claim that irrespective of the volume of military import, total expenditure in this sector promotes economic growth. Furthermore, the research results in the G7 nations revealed that sustainable development is materially reduced due to high defense spending (Ahmed, 2024). Similarly, the research output of Karadam et al., (2021) shows that military expenditure hampers economic growth in low, middle- and high-income countries with varied magnitude. In contrast, Wang et al. (2012) concluded that proper distribution of military spending can boost regional economic output (SDG8) across Asia, Europe and Oceania. The above empirical results reveal that economic effect is positive in one state and negative in the other, positive in the short-run and negative in the long-run and vice versa in the findings of the other research, and also the effect is significant in some studies and insignificant in the others. In simple terms, there is no binding empirical result.

Furthermore, the economic impacts of government agricultural, health, and education expenditures are open to global

and regional empirical debates. In this context, for instance the study by Chugunov et al. (2021) established that in low-income countries, agricultural expenditure improves economic growth, whereas Dkhar and De (2018) argue that in Northeast India it reduces milk and milk production and irrigation output. Also, in SSA, Mustapha and Enilolobo (2019) in their study confirmed that agricultural expenditure improved agricultural sector output. Divergently, the study result of (Wang et al., 2022) in China reported that agricultural public spending has adverse impact on the efficiencies of labor, capital, energy, and material used in the agricultural sector while considering its environmental impacts. Also, a similar result reported in Syria by Nabay et al. (2022) determined that the agricultural spending has significantly improved in the economic growth in the long-run. Additional research in Asia, for instance, in India, scholar Sinha (2022) stated that public spending on the agriculture has immaterial effect both in the long and short run on state economic growth.

Regarding the economic effect of health expenditure, research in EU member states has shown that it has significantly affected SD (Sentürk et al., 2023). Similarly, the same conclusion has been made by (Brollo et al., 2021) in Pakistan who noted that health expenditure has a positive impact on SD. On the other hand, the cross-national survey portrayed that increase in health expenditure substantially reduces the economic growth of states. But, in Indonesia it has weak power to improve sustainable economic growth (SDG8) (Sir et al., 2023). Also, the other study in Pakistan claims, health expenditure has long-term adverse effects on economic growth (Qureshi, 2009). Sub-Saharan Africa has unique socioeconomic and environmental

settings. The studies in this region have shown that, the effect of government health expenditure has a positive impact on economic growth (Abille & Obiero, 2021) whereas in Nigeria a specific study revealed that it hampered the EG (Oladosu et al., 2022). Like other government expenditures economic effects of expenditure on education are not yet conclusive. With respect to this, Churchill et al. (2015), in their cross-national analysis, exhibited that government education expenditure (GEE) boosts economic growth. Also, research in SSA has discovered that the economic growth of a region is positively and significantly explained by GEE (Abille & Obiero, 2021). On the other hand, in western Africa (parcel of SSA), GEE had a negative effect on economic growth (Odetayo & Adeyemi, 2017). Also, Kpegba et al. (2024) in their study reported that public consumption expenditure positively affected economic development sustainability in SSA. Nevertheless, in their study economic development sustainability is proxied by Genuine Savings which can never alone represent sustainability of economic development Furthermore, Sama et al., (2024) reported that public expenditure affected sustainable economic development in SSA. However, in their study, sustainable economic development was measured using GDP per capita, which is not significantly different from the measure of economic growth rather than a comprehensive measure of sustainable development.

In the context of sustainable development, the positive effect of government expenditures on a single SDG can never be a guarantee for its same effect on general development sustainability. Previous studies have examined the effect of public expenditure on small segments of sustainable economic development goals (i.e. GDP, Saving, FDI,

agricultural output, employment etc.) at the absence of theoretical linear relationship among sustainable economic development goals and without clear justification for exclusion and inclusion of one or more sustainable development indicators. Consequently, the results of these studies are also largely heterogeneous, and the failure of studies to consider all sustainable economic development goals weakened the width and depth of their analysis, impeding the preparation of informed decision on fiscal policy for SECD. To fill this gap, conducting comprehensive SECD analysis using the United Nations' SDGs is at the top of the urgent list for empirical studies on the impact of public spending on sustainable economic development in Sub-Saharan Africa. Hence, this study examined the effect of empirically debatable government expenditure viz. military, agricultural, health and education expenditure on sustainable economic development measured by the composite index of decent work and economic growth (SDG8), industry, innovation and infrastructure (SDG9), reduced inequalities (SDG10), and responsible consumption and production (SDG12) in SSA.

1.3. Objectives of the study.

The overall objective of the study was to examine the effects of public expenditures on sustainable economic development in SSA. To achieve a major objective, the specific objectives of this study was as follows:

- To explore the effect of public military expenditure on sustainable economic development in SSA.
- To examine the effect of public agricultural expenditure on sustainable economic development in SSA.
- To investigate the effect of public health expenditure on sustainable economic development in SSA.
- To explore the effect of public education expenditure on sustainable economic development in SSA.

2. Data and Methods.

The required number of observations for dynamic panel data analysis, as suggested by Roodman (2006), is that the cross-section (N) should be >20 and the time series (T) should be a continuous observation >4 . In 2009, Roodman, in his article entitled "An introduction to difference and system GMM," stated that the typical required time period for dynamic panel data is $5 < T \leq 15$. In this context, sub-Saharan Africa consists of 48 countries; however, according to a World Bank research group Sachs et al. (2023), SDGs data were not maintained by five states (i.e., Eritrea, Equatorial Guinea, Guinea-Bissau, São Tomé and Príncipe, and Seychelles). Hence, these states were excluded from the study. Moreover, due to the absence of sufficient public expenditure data on reliable data sources, 8 (eight) states were not considered in the study. According to various sources, countries in SSA share the common features of infrastructure deficits; excessive reliance on foreign aid; conflicts; food insecurity; disease; high rates of maternal mortality; weak institutional quality; and climate-related challenges (UNDP 2023). Since there is no systematic socioeconomic, environmental or governance difference among the included and excluded countries, the states considered in the study fairly represent the population of the study. Consequently, 35 (thirty-five) "N >20 " states in the study area having adequate data in the period from 2008—2022 were considered in the study. The rationale

behind the upper bound (2022) is that the World Bank Research Group (Sachs et al., 2023) computed sustainable development data for the period covering 2000-2022 only. In addition, the lower cutoff point (2008) was chosen because of a lack of public expenditure data for many states before 2008.

2.1. Methods of Data Analysis

To analyze SECD and government expenditures across countries in a given period, descriptive statistics were used. In addition, in the regression model of this study the lagged values of economic development are included as a regressor variable. When the lagged value of dependent variable is used as a predictor variable, it creates the problem of error correlation with country-specific fixed effects, leading to incorrect parameter estimates (Nickell, 1981). With respect to this, econometricists claim that the fixed-effect estimate cannot address such problems (Roodman, 2009). In this research to examine the impacts of government expenditures on SECD, the past observations (lagged values) of SECD is used as a predictor variable in a model. To alleviate the effects of time and country specific fixed effects, the generalized method of moments (GMM) method of data analysis in a dynamic panel data model is a robust measure (Blundell & Bond, 1998). Moreover, as indicated in table 5 endogeneity was found to be a serious problem of the regression model. In other words, the lagged value of sustainable economic development serially correlated with the error terms. This led us to employ the dynamic generalized method of moment estimation method which is super-efficient in removing endogeneity via using instrument variables.

Model Specification

In this study, in examining the impacts of public expenditure on sustainable economic development, SECD is explained by its own lagged value and by the percentage change in public spending. The dynamic panel estimator is designed to solve this shortcoming of conventional estimates. Hence, this research employed the dynamic panel data generalized method of moments (GMM) technique. Roodman (2006) suggests that the GMM is the right choice for panels with small time series relative to the cross section. In this study, ($T=15 < N=35$), and the past values of the dependent variable are included as an explanatory variable. **The linear dynamic panel model**

$$Y_{i,t} = \alpha \sum_{i=1}^n Y_{i,t-1} + \sum_{i=1}^n X_i \beta + \lambda_i + u_{it} + \epsilon_{it} \quad (1)$$

where:

- Y_{it} is the outcome variable (SECD) for a specific country at time t
- α is the coefficient of the past observations (lagged) outcome variable (SECD),
- $y_{i,t-1}$ is the lagged dependent variable (i.e., SECD for country i at time $t-1$),
- X_{it} is a vector of public expenditure for country i at time t
- λ_i is the unobserved country-specific random or fixed effects, u_{it} is time invariant effect
- ϵ_{it} is the error term, ($i = 1, 2, \dots, 35$ cross-section groups (countries in SSA) and ($t = 1, 2, \dots, 15$) time periods (yearly observations on SECD)).

In short,

$$E(y_t | X=x_t), E(\epsilon_t, x_t) = 0 \quad (2)$$

"E", denotes expectation, y_t (SECD at time t) is the mean value of the outcome variable at time t , "I" denotes, subject to change, "X"

is the observed value of predictor x_i (i.e., public military expenditure (PMEX), public agricultural expenditure (PAEX), public health expenditure (PHEX), and public education expenditure (PEEX), $[E(\epsilon_i, x_i) = 0]$, denoting that explanatory variables in a system are not correlated with disturbance ϵ_{it} . When this is not the case the estimated effect of public spending on SECD is possibly biased, but the GMM model is designed to solve the problem of explanatory variables' correlation with error terms (endogeneity problem), $[E(\epsilon_i, x_i) \neq 0]$. Therefore, this research employs the GMM model to estimate parameters. Hereunder, system and difference GMM equation are presented in equation 3 and equation 4 respectively.

$$1) \text{SECD}_{i,t} = \lambda_0 + \lambda_1 \text{SECD}_{i,t-p} + \lambda_2 \text{GMILEX}_{it} + \lambda_3 \text{GAGREX}_{it} + \lambda_4 \text{GHEEX}_{it} + \lambda_5 \text{GEDUEX}_{it} + \eta_i + u_t + \epsilon_{it} \quad (3)$$

$$2) \text{SECD}_{i,t} = \lambda_0 + \lambda_1 (\text{SECD}_{i,t-p} - \text{SECD}_{i,t-2p}) + \lambda_2 (\text{GMILEX}_{it} - \text{GMILEX}_{it-p}) + \lambda_3 (\text{GAGREX}_{it} - \text{GAGREX}_{it-p}) + \lambda_4 (\text{GHEEX}_{it} - \text{GHEEX}_{it-p}) + \lambda_5 (\text{GEDUEX}_{it} - \text{GEDUEX}_{it-p}) + (u_t - u_{t-p}) + (\epsilon_{it} - \epsilon_{it-p}) \quad (4)$$

The SECD denotes sustainable economic development index, λ_0 is constant, p , is the degrees of AR (autoregression), $\lambda_1, \lambda_2, \lambda_3, \lambda_4$, & λ_5 denotes the coefficients of explanatory variables in a model. η_i is the cross section-specific effect, u_t is the time-specific fixed effect, and ϵ_{it} is the disturbance terms.

Variable Measurement

In this study, public expenditures are measured by the percentage of GDP. Measuring this percentage of GDP gives useful information for multinational comparisons, as it controls for differences in

the size of economies, reflects government size relative to national GDP, shows resource mobilization potential and provides evidence for policy makers to make informed decisions on taxing and spending (Alqadi & Ismail, 2019). In addition, SECD is measured by a composite index from SDG8, SDG9, SDG10, and SDG12. The SECD performance results have numerical values for diverse indicators, and good achievement in one SECD goal may compensate for poor performance in the other goals. Hence, standardizing and normalizing SECD goals is imperative for achieving accurate economic development performances in countries (Sharm & Bandyopadhyay, 2023). In this context, Petkovová et al. (2020) reported that several methods of data normalization exist, but min-max standardization is the most appropriate method and is largely recognized in CI building.

$$N(X_{ij}) = \frac{(X_{ij}) - \text{Min}((X_{ij}))}{\text{Max}((X_{ij})) - \text{Min}((X_{ij}))} \quad (4)$$

$N(X_{ij})$ = Standardized Value of SECD goal for country i at period j

(X_{ij}) = Observed Value of SECD goal of country i at period j

$\text{Min}(X_{ij})$ is the smallest value of SECD goal of country i in period between 2008 – 2022

2.2. Data aggregation techniques

In this study, sustainable economic development was characterized by a composite index of sustainable economic development goal (i.e., SDG8, SDG9, SDG10, and SDG12) scores computed by Sachs et al. (2023) for all states since 2000 by considering seventeen United Nations' sustainable development goals. For instance, in 2016 for the index score of Goal-2, 52.5% means that a country has performed 52.5% of SDG2 (no

hunger), which is measured by the targets under the given SDGs.

2.3. GMM Mode Assumption Tests

In any time, series analysis including GMM data must always be stationary to avoid spurious regression results (See table-3). The results presented in Table 3 indicate that both the dependent (outcome) variables and the explanatory (independent) variables are stationary at level $I(0)$, at the 5% significance level. While the first difference also rejects the null hypothesis of a unit root, the level results confirm the series is integrated of order zero. Furthermore, GMM is an instrumental variable approach in which instruments must be valid as a group (Hansen., 1982). The large J-figures or the p-values for the test statistic > 0.05 in six (5) alternative models suggest that instruments uncorrelated with the error term (Hansen., 1982; Arellano, 1991)- (See Table 8 and Table 9). In addition, econometrists claim that there must be a significant association between the endogenous predictor and instrument variable (Andrews et al., 2018). This was examined by taking F- statistics from

least square regression. An F- ratio > 10 and a p-value < 0.05 suggest that the instrument is robust (Stock & Watson, 2020); as shown in Table 7, the instruments are strong up to the 5th lag. Furthermore, the GMM technique assumes that the dynamic panel model residual is not serially correlated with the explanatory variables to obtain a consistent GMM estimator (Arellano & Bond., 1991). In Table 8, the sig-values of AR (2) for " ρ " (rho) > 0.05 show that the endogeneity problem in the dynamic panel data mode is removed by using instrument variables. Furthermore, in Table 8 and Table 9, the signs of the coefficients of the explanatory variables are found to be the same under both the difference GMM and system GMM for the given instrument. This finding indicates that the model is stable when the instrument variables are changed.

3. Results and Discussions

The mean value for sustainable economic development goals in the descriptive statistics given in Table 1 above showed that except in SDG12 sub-Saharan African countries

Table 1. Sustainable Economic Development

	SDG8	SDG9	SDG10	SDG12	SECD	Standardized-SECD
Mean	63.79018	19.34460	39.27649	93.00514	53.85410	0.493442
Median	65.03186	15.38329	39.43550	95.34940	53.86496	0.500337
Maximum	78.71914	70.80171	84.30350	98.99833	68.88142	1.000000
Minimum	39.99175	1.027667	0.000000	74.42667	39.40975	0.000000
Std. Dev.	7.953367	12.66138	22.65888	5.618792	6.945053	0.368780
Skewness	-0.865748	1.475154	0.101929	-1.483177	-0.083253	0.019861
Kurtosis	3.569778	5.387058	1.979198	4.046758	2.241782	1.450578
Jarque-Bera	72.68454	315.0519	23.70365	216.4523	13.18228	52.55004
Probability	0.000000	0.000000	0.000007	0.000000	0.001372	0.000000
Observations	525	525	525	525	525	525

Source: SDG Transformation Center(2024)

Table 2. Public Expenditures as A Percentage of GDP

	Military Expenditure (% of GDP)	Agriculture Expenditure (% of GDP)	Health Expenditure (% of GDP)	Education Expenditure (% of GDP)
Mean	1.542961	0.939228	1.795990	4.062103
Median	1.251701	0.736232	1.390592	3.555050
Maximum	7.955662	4.823639	6.384695	12.32952
Minimum	0.142302	0.047000	0.141208	0.796046
Std. Dev.	1.035805	0.756598	1.266244	1.948422
Skewness	1.663644	1.732197	1.279607	1.100794
Kurtosis	7.441927	6.576978	4.029581	4.255476
Jarque-Bera	673.7841	542.4300	166.4604	140.5078
Probability	0.000000	0.000000	0.000000	0.000000
Observations	525	525	525	525

Sources: World Bank, IMF and MOF (2024)

were unable to achieve sustainable economic development goals.

The mean value for government expenditure in descriptive statistics result in Table 2 above exhibited that expenditure in education accounts the largest share (4.06 % of GDP) while the lowest investment made by agriculture is 0.93 percent of total GDP.

In an attempt to avoid a spurious regression result, the stationarity data have been tested. In this study for the data in which the residuals are independent and identically distributed (i.i.d.) overtime periods and across cross-sectional units Levin, Lin, and Chu (LLC) was employed. On the other hand, for data exhibited cross sectional dependence, cross-sectional dependence Im, Pesaran, and Shin (CIPS) test was used. When cross-sections (N) is larger than time periods (T) the LLC test is a strong instrument in detecting unit roots in panel data (Levin, Lin, & Chu, 2002). In addition, literatures claim that when the panel data is under solid cross-sectional dependence the (CIPS) test is a very suitable unit testing

method for large panel data and offers strong power and dependability in identifying unit roots (Pesaran, 2007).

The unit root result obtained from Levin, Lin, and Chu (LLC) and cross-sectional dependence Im, Pesaran, and Shin (CIPS) tests for the variables cross-sectionally dependent residual and those free from cross-sectional dependence presented in table 3. Based on cross sectional dependence result LLC unit root test was conducted for government military and educational expenditures. The result of the unit root test for military expenditure shows that the test statistic = -3.92518 and Prob.*=0.000 is less than the critical values at 1%, 5% and 10% significance levels and the test in its first difference revealed that the test statistic = -11.6241 and Prob.*=0.000. In addition, the same unit root test tool was used for educational expenditures. The test statistic in $I(0)$ = -4.29318 and Prob.*=0.000 and in its first difference test statistic = -13.7071 and Prob.*=0.000. Therefore, based on the LLC test results, it can be concluded

Table 3. Cross Sectional Dependence Test and Stationarity Test

Variable	Cross Sectional Dependence Test				Stationarity Test				
	Test	Statistic	d.f.	Prob.	Method	Level		1 st Differences	
						Statistic	Prob.**	Statistic	Prob.**
GMILEX	Breusch-Pagan LM	1738.231	595	0.0000	LLC	-3.92518	0.0000***	-11.6241	0.0000***
	Pesaran scaled LM	33.14060		0.0000	IPS	-1.38085	0.0837*	-9.22529	0.0000**
	Bias-corrected scaled LM	31.89060		0.0000	ADF	97.3803	0.0169**	217.506	0.0000***
	Pesaran CD	-0.177102		0.8594	PP	111.753	0.0011**	358.240	0.0000***
GAGREX	Breusch-Pagan LM	1295.688	595	0.0000	CIPS	t-stat=-2.86085 P-value<0.01***		t-stat=-2.86772 P-value<0.01***	
	Pesaran scaled LM	20.31193		0.0000					
	Bias-corrected scaled LM	19.06193		0.0000	Truncated CIPS	t-stat=-2.74394 P-value<0.01***		t-stat=-2.77342 P-value<0.01***	
	Pesaran CD	6.840055		0.0000					
GHEEX	Breusch-Pagan LM	1921.363	595	0.0000	CIPS	t-stat=-2.21530 P-value<0.05**		t-stat=-2.28150 P-value<0.05**	
	Pesaran scaled LM	38.44935		0.0000					
	Bias-corrected scaled LM	37.19935		0.0000	Truncated CIPS	t-stat=-2.21530 P-value<0.05**		t-stat=-2.28150 P-value<0.05**	
	Pesaran CD	14.50655		0.0000					
GEDUEX	Breusch-Pagan LM	1512.772	595	0.0000	LLC	-4.29318	0.0000***	-13.7071	0.0000***
	Pesaran scaled LM	26.60487		0.0000	IPS	-2.84139	0.0022***	-11.4398	0.0000***
	Bias-corrected scaled LM	25.35487		0.0000	ADF	108.524	0.0022***	248.215	0.0000***
	Pesaran CD	0.862013		0.3887	PP	147.213	0.0000***	423.523	0.0000***
	Pesaran CD	73.98254		0.0000					
SECD	Breusch-Pagan LM	4007.369	595	0.0000	CIPS	t-stat=-2.37913 P-value<0.01***		t-stat=-3.29499 P-value<0.01***	
	Pesaran scaled LM	98.91963		0.0000					
	Bias-corrected scaled LM	97.66963		0.0000	Truncated CIPS	t-stat=-2.30579 P-value<0.05***		t-stat=-2.87976 P-value<0.01***	
	Pesaran CD	30.37653		0.0000					

Sources: Sources: Authors' own computation (EViews 12)

that government military and educational expenditures are stationary either at level (I(0)) or after first differencing (I(1)). Furthermore, for other cross-sectional dependent outcome and explanatory variables cross-sectional dependence Im, Pesaran, and Shin (CIPS) was employed. The result (t-stat and prob.) in the table for sustainable economic

development, agricultural expenditure, and health expenditures show that the variables are stationary in level (I (0) and in their first difference (I (1). In this context, Dickey and Fuller (1979) claim that when the moment conditions (mean and variance) are constant, data can be stationary at level (I (0).

Table 4. Heteroscedasticity

Panel Cross-section Heteroskedasticity LR Test				
Null hypothesis: Residuals are homoscedastic				
	Value	df	Probability	
Likelihood ratio	160.9665	35	0.0000	
LR test summary:				
	Value	df		
Restricted LogL	111.5895	484		
Unrestricted LogL.	192.0727	484		

Sources: Authors' own computation (EViews 10)

Table 5. Endogeneity Test

Covariance Analysis: Ordinary: Sample: 2009 2022: Included observations: 490: Balanced sample (listwise missing value deletion)						
Correlation t-Statistic Probability	ϵ_{it}	L_SECD	PMIEX	PAGEX	PHEEX	PEDEX
ϵ_{it}	1.000000					
L_SECD	-0.193151 -4.348734 0.0000***	1.000000 ----- -----				
PMIEX	-7.31E-16 -1.61E-14 1.0000	0.072821 1.612949 0.1074	1.000000 ----- -----			
PAGEX	6.77E-16 1.50E-14 1.0000	-0.057926 -1.281780 0.2005	0.102986 2.287189 0.0226	1.000000 ----- -----		
PHEEX	8.21E-16 1.81E-14 1.0000	0.057076 1.262898 0.2072	0.178011 3.996221 0.0001	0.107355 2.385340 0.0174	1.000000 ----- -----	
PEDEX	-1.17E-14 -2.58E-13 1.0000	0.020278 0.448058 0.6543	0.299639 6.938026 0.0000	0.212500 4.803999 0.0000	0.720416 22.94669 0.0000	1.000000 ----- -----

Sources: Authors' own computation: Note: Balanced sample (listwise missing value deletion)

Table 6. Model Comparison: OLS, fixed and difference GMM estimates

Regressor Variables	OLS-Estimate	Fixed Effect-Estimate	Difference GMM-Estimate
	Coefficient (Std. Error) Prob.	(Coefficient (Std. Error) Prob.	Coefficient (Std. Error) Prob.
L1. SECD	0.853081 (0.020563) 0.0000***	0.834896 (0.026217) 0.0000***	0.686784 (0.054464) 0.0000***
PMIEX	-0.005234 (0.006826) 0.4436	-0.009091 (0.017411) 0.6018	-0.048577 (0.027019) 0.0729*
PAGEX	-0.012531 (0.012550) 0.3185	-0.055538 (0.024900) 0.0262**	-0.037718 (0.027019) 0.0001***
PHEEX	0.010923 (0.006459) 0.0915*	0.027730 (0.022617) 0.2208	0.050458 (0.013750) 0.0003***
PEDEX	0.000884 (0.005950) 0.8819	-0.020110 (0.009759) 0.0399**	0.026312 (0.006968) 0.0002***
R-squared	0.720979	0.734944	*****
Adjusted R-squared	0.718096	0.711972	*****
F-statistic	250.1271	31.99368	*****
Prob(F-statistic)	0.000000***	0.0000***	*****

Sources: Authors' own computation. Note: Dependent Variable: SECD, *** & **, denote statistically significant variables at the 1% and 5% levels of significance, respectively.

In Table 4 above the p-values for Panel Cross-section Heteroskedasticity LR Test=0.0000<0.05 shows that there exists serious heteroscedastic distribution of variance which can not easily be handled by the traditional fixed and random effect model. This indicates the need for alternative dynamic panel models.

Table 5 above shows that the lagged value of the dependent variable which was included as the explanatory variable in the model serially correlated with disturbances.

This indicates that the model exposed an endogeneity problem.

On the bases of the coefficient of L1, SECD from the three-alternative model OLS-Estimate, Fixed Effect-Estimate and Difference GMM-Estimate in Table 7 above revealed the coefficient of L1, SECD from Fixed Effect-Estimate= 0.834896> the coefficient of L1. SECD from Difference GMM-Estimate = 0.686784. The result indicated that the system GMM estimation technique is preferred over the difference GMM model.

Table 7. Instrument Variable Relevance Test

Endogenous and exogenic variables to be replaced	Candidate Instrument variable Correlation Coefficient (Std. Error) Prob. F-statistics Prob(F-statistic)			
	L2.SECD	L3. SECD	L4.SECD	L5.SED
L1.SED	0.843809 (0.026727) 0.0000*** 996.7430 0.0000***	0.665730 (0.038424) 0.0000*** 300.1912 0.0000***	0.453845 (0.047920) 0.0000*** 89.69731 0.0000***	0.211762 (0.054696) 0.0001*** 14.98934 0.000129***
GMILEX.	L1_GMILEX	L2_GMILEX	L3_GMILEX	L4_GMILEX
	0.919383 (0.017186) 0.0000*** 2861.796 0.0000***	0.817800 (0.021828) 0.0000*** 1403.678 0.0000***	0.765576 (0.024190) 0.0000*** 1001.612 0.0000***	0.703142 (0.028094) 0.0000*** 626.4056 0.0000***
GAGREX.	L1_GAGREX	L2_GAGREX	L3_GAGREX	L4_GAGREX
	0.843990 (0.023154) 0.0000*** 1328.636 0.0000***	0.788124 (0.027159) 0.0000*** 842.0755 0.0000***	0.715153 (0.030700) 0.0000*** 542.6511 0.0000***	0.712375 (0.030661) 0.0000*** 539.8145 0.0000***
GHEEX.	L1_GHEEX.	L2_GHEEX	L3_GHEEX	L4_GHEEX
	0.976038 (0.012894) 0.0000*** 5729.721 0.0000***	0.975781 (0.016239) 0.0000*** 3610.688 0.0000***	0.986997 (0.018604) 0.0000*** 2814.684 0.0000***	0.988775 (0.021437) 0.0000*** 2127.570 0.0000***
GEDUEX	L1_GEDUEX	L2_GEDUEX	L3_GEDUEX	L4_GEDUEX
	0.936635 (0.014065) 0.0000*** 4434.752 0.0000***	0.889949 (0.018975) 0.0000*** 2199.728 0.0000***	0.868526 (0.020004) 0.0000*** 1885.092 0.0000***	0.843616 (0.022530) 0.0000*** 1402.027 0.0000***

Sources: Authors' own computation Note: L1=first lag, L2= second lag.

Table 8. Model stability (Robustness) tests -Arellano-Bond Dynamic Panel Estimations (Difference GMM)

	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
L1. SECD.	0.682709 (0.053920) 0.0000***	0.631596 (0.059512) 0.0000***	0.665282 (0.055609) 0.0000***	0.662816 (0.030062) 0.0000***	0.658375 (0.032743) 0.0000***	0.612314 (0.005334) 0.0000***
PMIEX	-0.047685 (0.030211) 0.1152	-0.078651 (0.033010) 0.0176**	-0.102741 (0.022713) 0.0000***	-0.095659 (0.018914) 0.0000***	-0.104533 (0.020246) 0.0000***	-0.105741 (0.005217) 0.0000***
PAGEX	-0.021813 (0.012959) 0.0930*	-0.073383 (0.007227) 0.0000***	-0.052531 (0.006662) 0.0000***	-0.024555 (0.006759) 0.0003***	-0.020929 (0.008261) 0.0117**	-0.002851 (0.003858) 0.4603
PHEEX	0.046702 (0.016094) 0.0039**	0.058066 (0.025999) 0.0261**	0.046767 (0.024060) 0.0527*	0.103004 (0.020753) 0.0000***	0.098794 (0.027730) 0.0004***	0.101961 (0.008539) 0.0000***
PEDEX	0.034164 (0.006534) 0.0000***	0.040337 (0.009413) 0.0000***	0.047572 (0.008100) 0.0000***	0.023710 (0.008728) 0.0069***	0.029813 (0.010718) 0.0057	0.031132 0.004693 (0.0000***
Sample (adjusted): 20122022(Min.obs.)	13	12	10	12	11	11
Cross sections	35	35	35	35	35	35
Observations	455	420	350	420	385	385
Hansen's J- Test						
Model	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
IVs	L2_SECD and L1_IDVs	L2_SECD and L2_IDVs	L2_SECD and L4_IDVs	L3_SECD and L2_IDVs	L3_SECD and L3_IDVs	L4_SECD and L3_IDVs
Mean dependent var	0.041750	0.047126	0.050967	0.047126	0.050981	0.050981
S.E. of regression	0.258040	0.258508	0.267596	0.262417	0.260601	0.254800
J-statistic	30.25776	28.67509	31.67559	33.75132	33.22182	32.32293
Prob(J-statistic)	0.452510	0.534709	0.382766	0.290883	0.312997	0.352663
Arellano and Bond- Autocorrelations-Test						
AR (1) - m-Statistic (SE (rho)) Prob.	-4.255371 (3.439144) 0.0000	-0.200720 (65.631222) 0.8409	-2.675779 (4.556110) 0.0075	-4.506786 (2.969478) 0.0000	-4.828385 (2.481592) 0.0000	-3.934004 (2.816209) 0.0001***
AR (2) - m-Statistic (SE (rho)) Prob.	1.718187 (0.879617) 0.0858	0.176504 (9.147184) 0.8599	1.085584 (1.139269) 0.2777	1.338211 (0.989546) 0.1808	1.288717 (1.025340) 0.1975	1.493947 (0.831405) 0.1352

Sources: Authors' own computation Note: IVs denotes Instrument variables:
IDVs denotes Independent variables

Table 10. Model Robustness Tests -Arellano-Bond dynamic panel estimations
(Two_Step_system GMM)

	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
L1. SECD.	0.762761 (0.016656) 0.0000***	0.734014 (0.017436) 0.0000***	0.766627 (0.033657) 0.0000***	0.724391 (0.017048) 0.0000***	0.772698 (0.016633) 0.0000***	0.751431 (0.007283) 0.0000***
PMIEX	-0.076230 (0.008233) 0.0000***	-0.116759 (0.011218) 0.0000***	-0.099951 (0.010717) 0.0000***	-0.116377 (0.005323) 0.0000***	-0.103809 (0.005416) 0.0000***	-0.107179 (0.003050) 0.0000***
PAGEX	-0.063562 (0.003667) 0.0000***	-0.081798 (0.005970) 0.0000***	-0.075263 (0.010670) 0.0000***	-0.030809 (0.009206) 0.0009***	-0.025351 (0.008179) 0.0021**	-0.020835 (0.006562) 0.0016***
PHEEX	0.067157 (0.006685) 0.0000***	0.068543 (0.011170) 0.0000***	0.074748 (0.019062) 0.0001***	0.109481 (0.010079) 0.0000***	0.117264 (0.007874) 0.0000***	0.136243 (0.006336) 0.0000***
PEDEX	0.014852 (0.004377) 0.0008***	0.032702 (0.006774) 0.0000***	0.046535 (0.005811) 0.0000***	0.009683 (0.004196) 0.0215**	0.033695 (0.002957) 0.0000***	0.039171 (0.002393) 0.0000***
Sample (adjusted): 20122022(Min.obs.)	13	12	10	12	11	11
Cross sections	35	35	35	35	35	35
Observations	455	420	350	420	385	385
Hansen's J- Test						
Model	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
IVs	L2_SECD and L1_IDVs	L2_SECD and L2_IDVs	L2_SECD andL4_IDVs	L3_SECD and L2_IDVs	L3_SECD and L3_IDVs	L4_SECD andL3_IDVs
Mean dependent var	-0.189478	-0.184946	-0.162509	-0.184946	-0.175660	-0.175660
S.E. of regression	0.201315	0.208478	0.199255	0.210721	0.207801	0.210258
J-statistic	33.75967	31.50179	33.15749	32.43249	34.83370	31.78886
Prob(J-statistic)	0.290543	0.391049	0.315748	0.347691	0.290439	0.377411
Arellano and Bond- Autocorrelations-Test						
AR (1) - m-Statistic (SE (rho)) Prob.	-4.255371 (3.439144) 0.0000	-0.200720 (65.631222) 0.8409	-2.675779 (4.556110) 0.0075	-4.506786 (2.969478) 0.0000	-4.828385 (2.481592) 0.0000	-3.934004 (2.816209) 0.0001***
AR (2) - m-Statistic (SE (rho)) Prob.	1.718187 (0.879617) 0.0858	0.176504 (9.147184) 0.8599	1.085584 (1.139269) 0.2777	1.338211 (0.989546) 0.1808	1.288717 (1.025340) 0.1975	1.493947 (0.831405) 0.1352

Sources: Authors' own computation.

Table 10. Optimal Model - Arellano-Bond Dynamic Panel Estimations

(Difference GMM)		(Two-Step System GMM)
SECD (Dependent Variable)		SECD (Dependent Variable)
L1. SECD	0.662816 (0.030062) 0.0000***	0.724391 (0.017048) 0.0000***
PMIEX	-0.095659 (0.018914) 0.0000***	-0.116377 (0.005323) 0.0000***
PAGEX	-0.024555 (0.006759) 0.0003***	-0.030809 (0.009206) 0.0009***
PHEEX	0.103004 (0.020753) 0.0000***	0.109481 (0.010079) 0.0000***
PEDEX	0.023710 (0.008728) 0.0069***	0.009683 (0.004196) 0.0215**
Sample (adjusted):	12	12
Cross section (Number of countries) included	35	35
Observations	420	420

Source: (Authors' computation): Dependent Variable: SECD, *** & **, denote statistically significant variables at the 1% and 5% levels of significance, respectively.

According to Blundell and Bond (1998), the results from optimal estimators do not change with changes in methods of data transformation or are insensitive to changes in instrument variable(s). In Table 9 and Table 10, the results from the difference GMM (first difference transformation) and two-step system GMM (orthogonal transformation) are similar. However, we emphasize the results of the two-step system GMM in Model 4 or in optimal model in table 11 below, in which the signs of the coefficients and the significance of the explanatory variables are the same, endogeneity is resolved, the instruments are valid and relevant (no overidentification), and

the models are insensitive to changes in the instrument variables.

The robust panel least squares results reported in Table 11 are consistent with the findings obtained from the Difference GMM and System GMM estimations, thereby confirming the robustness of the empirical results. In other words, under robust panel least square regression, difference GMM, and System GMM the effect of military expenditure, and agricultural expenditure on sustainable economic development was found to be negative and significant where health and educational expenditures positively and significantly affect sustainable economic development in the study area.

Table 11. Robust Panel least square regression

Dependent Variable: SECD Method: Robust Least Squares Method: M-estimation Huber Type I Standard Errors & Covariance				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
L ₃ SECD	0.632278	0.000524	1207.597	0.0000
L ₂ PMIEX	-0.023588	0.000182	-129.8680	0.0000
L ₂ PAGEX	-0.035442	0.000248	-142.9329	0.0000
L ₂ PHEEX	0.029190	0.000209	139.7129	0.0000
L ₂ PEDEX	0.001645	0.000142	11.55492	0.0000
C	0.313142	0.000516	607.3753	0.0000
Robust Statistics				
Rw-squared	0.432491	Adjust Rw-squared		0.432491
Scale	0.302560	Rn-squared statistic		1543120.
Prob(Rn-squared stat.)	0.000000			
Non-robust Statistics				
Mean dependent var	0.552052	S.D. dependent var		0.356683
S.E. of regression	0.309344	Sum squared resid		39.61711

Source: (Authors' computation): Dependent Variable: SECD, *** & **, denote statistically significant variables at the 1% and 5% levels of significance, respectively.

The results from two step-system GMM in table 10 above show that the coefficient of public spending on the military is negative, indicating that military expenditure negatively and significantly affects SECD in the study area. According to several sources SSA shares common features of infrastructure deficit, excessive reliance in foreign aids, conflicts, food insecurity, disease and high rate of maternal mortality, weak institutional quality, and climate related challenges (UNDP 2023; World Bank, 2023; International Crisis Group, 2023). Moreover, decent job and economic growth, industry, innovation and infrastructure, income inequalities, and consumption and production patterns differences across a country do not change

the effect of government expenditure on SECD, due to the fact that these variables are used to measure sustainable economic development (dependent variables of this study). This indicates that the effect of the mentioned factors variation across a country will have no or insignificant effect on the coefficient's government expenditure. In other words, since homogeneity exists among the population of the study, public expenditure will have a similar effect or slight differences across a country.

The results also revealed that a 1% increase in defense spending led to a [0.116377 units] decrease in the standardized value of SECD performance in sub-Saharan Africa. In this regard, Modern growth theorists

Barro (1990), and the theory of sustainable development (WCED, 1987) claim that economic wellbeing can be achieved through reducing fiscal spending in the military sector, and by redirecting resources and converting productions of military equipment and guns into nonmilitary goods and provisions of civilian services. The finding of this study confirmed that the theory of sustainable development holds true in sub-Saharan Africa, and the findings coincide with those of previous studies. For example, Ahmed, (2024) reported that military spending significantly reduced sustainable development. In addition, Yusuf and Mohd (2023) reported that in both the short and long run, military expenditure hampers economic growth. In addition, Minini and Selem-Amachree (2021) reported that in Nigeria, recurrent defense spending intensifies joblessness. However, the findings of these previous studies deviate from our findings. Wang et al. (2012) reported that appropriate allocation of funds for military sectors can raise regional economic output (SDG8) across Asia, Europe and Oceania. Additionally, (Nugroho & Purwanti, 2021) determined that in low- to middle-income countries, economic growth (SDG8) increases with increasing military expenditure.

In addition, in the Maputo declaration of 2014, Africa's country authorities were committed to increasing and investing 10 percent of the public budget in agriculture to end hunger by 2025, and Agenda 2063 adapted Maputo's declaration and highlighted the contribution of the intensification of public investment in agriculture. The theory of sustainable development claims that public investment in sustainable agricultural practices positively contributes to the development of the nation. The results of this study revealed that the effect of public

expenditure on agriculture is negative and statistically significant. Keeping the other factors constant, the results also revealed that a 1% increase in public agricultural expenditure led to a [0.030809 units] decrease in the standardized value of SECD in the study area. This finding indicates that the theory of SD, which insists that the government has to expand its investment in agriculture, does not hold true in sub-Saharan Africa. Although this finding contradicts the results of many studies, this study which considered all sustainable economic development goals supports the findings of some previous studies that argue that public expenditure in agriculture negatively affects economic growth, economic development goals and targets. For example, Emeru (2023) reported that in both the short run and long run, public spending in agriculture negatively influenced economic growth in Ethiopia. Additionally, Wang et al., (2022) determined that in China, agricultural spending has an adverse effect on the efficiencies of labor, capital, energy, and material used in the agricultural sector.

Safeguarding health and safety are a means of ensuring sustainable development (Boar et al., 2020). This study sought to determine the effect of public health expenditure on sustainable economic development in sub-Saharan Africa. The results revealed that the effect of government investment in public health was positive and statistically significant. The results also showed that a 1% increase in public health spending led to a [0.109481units] improvement in the standardized value of SECD in SSA, keeping the other factors constant. This finding aligns with the findings of earlier studies. For example, (Olayiwola et al., 2021) reported that Nigerian government health spending and economic growth have a long-term positive relationship; in

EU member states, (Sentürk et al., 2023) reported that this relationship largely explains sustainable development. In addition, Sabina (2020) reported that in developed states, the PHEEX significantly induces economic development. However, other scholars, such as (Qureshi, 2009) in Pakistan, Kareem et al. (2017), Oladosu et al., 2022 and Jolaiya (2024) in Nigeria, have claimed that PHEEX has adverse effects on state economic development. In addition, Olayiwola et al. (2021) Nigeria and Abille & Obiero, 2021 from sub-Saharan Africa argued that, in their study area, PHEEX has no contribution to economic growth. Although the results of previous studies are inconclusive because different economic development indicators have been used to ascertain the effect of health expenditure, this study proved that the theory of sustainable development states that expanding public investment in health services positively contributes to sustainable economic development (WCED, 1987) and collective steward theory of sustainable development supported (holds true) in sub-Saharan Africa.

Finally, the study examines the effect of public educational expenditure on SECD in SSA. Wisely managed government expenditures in pro-poorer areas, especially healthcare and educational services, play pivotal roles in sustainable development (IMF., 2023; UNDESA.,2023). In this study, the results from the two-step system GMM show that the effect of public spending on education has a positive and significant effect on sustainable economic development in sub-Saharan Africa. The results also revealed that a 1% increase in public education expenditure led to a [0.009683 units] increase in the standardized value of SECD performance in SSA. Some previous studies that examined the effect of this expenditure on the economic

development goals reported the same result. For example, in Indonesia expenditure in education has improved economic growth Verazuliant (2021), and has encouraged economic growth in SSA (Abille & Obiero, 2021). However, this finding is different from the findings of Sir et al., 2023) from East Nusa (state in Indonesia), (Kocevska., 2023) from North Macedonia, (Odetayo & Adeyemi, 2017) from West Africa, and Kareem et al.(2017) from Nigeria reported that spending on education negatively affected economic growth in their study area. Nevertheless, our study, which considered all sustainable economic development goals, confirmed that the theory of sustainable development is valid in sub-Saharan Africa.

5. Conclusion and Policy Recommendations

By 2063, the desire of Africa was to be a militarily strong continent. However, building strong military power requires substantial spending in the defense sector. This will be true (possible) only when countries in SSA have a sustainably growing economy to finance the sector. Nevertheless, the study revealed that public spending in the military sector in sub-Saharan Africa becomes a challenge to achieving the goals of Agenda 2063 and the region's sustainable economic development. If public spending in sub-Saharan African countries is not reconfigured in a way that contributes positively to sustainable development, by 2063, countries in the region will neither be militarily nor economically strong. Unlike the findings of earlier studies, the adverse effect of military expenditure discovered by this study is beyond single economic goal or targets like GDP, saving, etc. This adverse effect on sustainable economic development can be further translated into

its bad effect on the constituents of SECD such as decent job and economic growth, industry, innovation and infrastructure, income inequalities, and responsible consumption and production. Thus, the study suggests that policy makers must obtain a balance between law and order and economic development sustainability. In addition, policymakers in the study area should recognize that a key driver of the escalation of military expenditure in several African countries is not the need to defend against foreign aggression, but rather the management of internal conflicts arising from political and ideological differences. Since many of these conflicts can be resolved through diplomacy, dialogue, and reconciliation, greater emphasis on peaceful conflict resolution could help reduce the need for increased military spending. Furthermore, the study suggests expenditure allocation to defense sectors should never be in a manner that significantly crowd-out the effect on economically important sectors such as innovation, employment creation, infrastructure, technology, production and consumption and so on. Moreover, defense sectors resources should be utilized in advancing defense technology, and should create a job in military sites.

Moreover, the study revealed that public expenditure in the agricultural sector hinders sustainable economic development in sub-Saharan Africa. This finding indicates that expenditures in this sector are crowding out resources away from other sectors, which might result in more sustainable and inclusive economic development, such as health, infrastructure, and education. In addition, in sub-Saharan Africa, the government is providing massive chemical fertilizer subsidies (FAO., 2021; World Bank., 2023). This might lead to the depletion of soil fertility and water

pollution, and general ecological deterioration can have long-term adverse impacts on agricultural yield and general economic sustainability. The result of this research indicates that agricultural expenditure is not limited to reducing specific GDP, FDI, and so on, rather it diminishes comprehensive economic sustainability and performance of the study area. Thus, this study recommends that economic policy makers in SSA should never focus only on increasing short-term agricultural output through massive cereal production via increased investment in agriculture, rather they must specify and use resources on sustainable agriculture activities. Also, public expenditure in agriculture should be used to expand organic fertilizers that can preserve environment-friendly nutrient and helps to increase agricultural output in a sustainable manner.

Furthermore, the study revealed that health expenditure is a positive determinant of sustainable economic development in sub-Saharan Africa. This revealed that health expenditure is a powerful variable that can increase infrastructure development, foster innovation, create employment opportunities, boost national GDP, narrow income inequalities, and stabilize consumption and production. However, the agenda of 2063 has overlooked some of the targets of SDG3 (good health and well-being), such as deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination, tobacco control, research and development of vaccines and medicines. The study recommends that to achieve the sustainable economic development of agendas 2030 and 2063, countries in SSA first must harmonize the health development agenda of 2030 and 2063 and intensify public investment in each goal and target SDG3

(good health and well-being) by redirecting resources from the military and agricultural sectors. The expenditure on health sectors must be invested in health technology, health infrastructure, healthy consumption, and public health service equitably distributed to smooth income inequality.

Finally, the study concludes that education expenditure is a significant contributor to sustainable economic development (i.e., development of decent work and economic growth (SDG8), industry, innovation and infrastructure (SDG9), reduced inequalities (SDG10), and responsible consumption and production (SDG12) in sub-Saharan Africa. This implies that improving the quality and quantity of teachers, the supply of advanced teaching aids and materials, good educational infrastructure at all levels of education, and the provision of equitable education services determine the success of sustainable economic development in the study area. The study suggests that in realizing sustainable economic development, the policy makers in the study area must dig out to improve public investments in areas that improve the quality of education, such as the expansion of primary and preprimary education, the professional quality of teachers at all levels, the expansion of e-learning in higher education, intensive vocational education and training and intensive and extensive research on improvements in educational quality.

6. Originality/Value

While earlier studies have examined the economic effects of public spending, they have often ignored the thought of sustainability. This research seeks to fill this gap by exploring how different classes of public expenditure can contribute to sustainable economic development, not just

short-term growth. In addition, this study found that military and agricultural expenditures have adverse effects not only on individual economic development indicators but also on broader development outcomes such as innovation, technology, employment, national GDP, income inequalities, consumption and production simultaneously. Furthermore, this study added values of health and educational expenditure by revealing their positive concurrent effects on infrastructure, innovation, technology, employment, national GDP, income inequalities, consumption and production. Thus, based on the study findings, governments in the study area are encouraged to reduce military expenditure and reallocate the resulting resources to productive sectors, particularly education, and healthcare, to foster sustainable economic development.

7. Recommendations for Future Research

This study examined only the economic dimension of sustainable development, whereas sustainable development covers three interconnected dimensions: economic, social, and environmental. Therefore, future research should examine the effects of military, agricultural, health, and educational expenditures on the social and environmental dimensions of sustainable development to provide a more comprehensive understanding of the role of public expenditure in achieving sustainable development. Moreover, future research should be conducted on the international economic, social, and environmental development effects of public expenditures.

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