

ENTREPRENEURSHIP, CLIMATE CHANGE AND ECONOMIC GROWTH IN AFRICA

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ABSTRACT

Over the years, Africa Countries have been exploiting other areas for the needed economic growth, such areas include; Foreign Direct Investment, external loan, foreign partnership etc. However, entrepreneurship is an area that had not been fully focused. This study carries out an in-depth qualitative analysis into the place of entrepreneurship on economic growth of the continent amidst the challenges of climate change. Africa had been adjudged as the continent most vulnerable to climate change. The climate change curtails economic growth which in turn adversely affects the state of entrepreneurship. Rapid entrepreneurship growth also influences high economic growth and the economic growth in turn brings about factors that increase climate change with its effect on entrepreneurship. Therefore, there is need for appropriate policy intervention to balance the state of entrepreneurship growth with climate change decline and sustainable economic growth in Africa. Towards this, the study recommends among others; appropriate rules and regulations coupled with stringent compliance measures on climate change issues, encouragement of entrepreneurship growth by governments at all levels and the private sectors, development of climate change resilient seeds for farmers etc.

Keywords: *Climate Change, Entrepreneurship, Economic growth, Institutions*

INTRODUCTION

Economic growth is a major concern of the Africa continent. The need for economic freedom and come up as a developed economy push the continent on the race for the desired economic growth. However, the continent economy continues to suffer different shocks including the effects of covid-19 pandemic, disruptions to global supply chains due to Russian prolong invasion of Ukraine, military coups, high debt burden, tightening of global financial conditions among others. These shocks according the 2023 African Economic Outlook have reduced the continent's real GDP growth from 4.8 percent in 2021 to 3.8 percent in 2022. Nevertheless African economies remain resilient as the growth rate had estimated to stabilize at 4.1 percent by the year 2024.

This projected growth rate is attributed to among other things the recent drive in entrepreneurship activities in the countries. Entrepreneurship does not only enables individual to create and own personal jobs; it de-emphasis concentration on public employment and increase productivity. Accordingly, Audretch, Keilbach& Lehman, (2006), argued that entrepreneurship boost economic activities through innovative technologies, that inturn increases products and services. New Job opportunities are created both in the short and long run. Globally, Entrepreneurship has become a key driver of economic growth and development. By creating new business and jobs, it brings about an increase in Gross National Product as well as per capital income. This is what Africa needs in order to compete favorably with developed continents.

However, entrepreneurship is constrained by climate change. Laurence Charly (2023), stated that climate change radically alter the speed of how poor countries pursue economic development. Temperature has been found to affect income via agricultural yields, the physical and cognitive performances of workers, demand for energy as well as the incidence of crime, unrest and conflict. Burke, Hsiang &Mignuel (2015), found that the relationship between changes in temperature and income is non – linear. While global warning could spell greater economic productivity for countries whose average annual temperature are low, rising temperatures leadto increasingly dramatic falls in productivity in countries with already warn climates. This study carried out a qualitative analysis of the nexus between entrepreneurship, climate change and economic growth in order to determine the relationship among them in Africa and bring out recommendations for the purpose of growth and development in the continent.

STRIVE FOR ECONOMIC GROWTH IN AFRICA

The need to eradicate poverty and improve on generally on people's welfare in order to compete favourably with advance countries of the world had over the years motivated the African countries to continue to strive for economic growth. However, fluctuating economic growth continued to be noticed in Africa.(WDI) 2016. GDP per capital growth between 1995 and 2015 rose from 2% in 1995 to 2.8% in 1996. A decline of per capital GDP was recorded in 1997, this followed with a steady decline between 1998 and the year 2000. A sharp increase was then witnessed from the year 2002 to 2004 where the GDP per capital grow rate was put at 3%. The growth rate was about 3.4% in 2007 before another decline was recorded from 2008 to 2009.

Economic growth improved in 2010 and a period of decline followed until 2015 WDI (2016). Meanwhile, world Bank report 2023, indicated that economic growth across Sub-Saharan African remains sluggish, dragged down by uncertainty in global economy, with high inflation and sharp deceleration of investment growth. The report also shows that economic activities in South Africa is set to be weaken further by 0.5% annual growth rate from 2023. Also growth recovery rate was 2.8% in Nigeria, the largest economies in West Africa is still fragile as oil production remains subdued. The report also added that the real gross domestic product grow of the western and central African sub regions is set to decline to 3.4% in 2023 from 3.7% in 2022. While that of Eastern and Southern Africa are to decline to 3.0% in 2023 from 3.5% in 2022. In North Africa where economic growth has declined from 5.4% in 2021 to 4.3% in 2022 is expected to stabilize at 4.3% in 2023.

However, the African Economics Outlook 2023, report says that Africa economies remain resilient amid multiple shocks which are responsible for the continents economic downturn. These shocks include among others: Covid-19 pandemic, disruptions to global supply chains, due to

Russia – Ukraine war, and tightening of global financial conditions, significant losses and damages due to frequent extreme weather condition and climate change, political instability etc. In the midst of all these shocks the African Economics Outlook (2023) projected that African economics will stabilize at 4.1 percent in 2024 and that the continent is set to outperform the rest of the world in economic growth within the rest two years.

In order to achieve this growth goal, the role of the private sector cannot be over – emphasized. According to the reports, Africa offers the private sector trillion dollars investment opportunities in climate and green growth sectors. The report shows that private climate finance flows amounted to 4.2 billion US dollars between 2019 and 2020 and this is about six times lower than mobilized public climate finance of US \$ of 25.3 billion.

Africa is endowed with abundant renewable and non-renewable natural resources. These include; oil, gas, land, fresh water, wind sunshine and biodiversity. 30% of the world's mineral resources and 65% of uncultivated arable land are found in African. The continent has a huge stock of fertile agricultural land and the most productive forests both in timber and carbon retentive. However it is pertinent to note that the availability of these natural resources are being under-utilized in Africa (Rugumamu, 2006). Cupta (2023) identified some factors responsible for underutilization of natural resources in Africa as; absence of constant diligence, skill shortage and lack of proper tools to effectively manage resources. Ocholaetal (2022) put it forward that factors including deforestation, desertification land degradation, water scarcity and climate change had been depleting Africa natural resources over last the two decades.

The result of underutilization and depletion of natural resources in Africa as put by NuroyaByaroetal (2023) are soil erosion and deforestation which had decreased the amount of fertile soil for agricultural products and enlarger biological diversity. This in turn had hindered the ability to raise livestock's and grow foods.

In nutshell, the African economy has been projected to grow amidst the challenge of climate change and other factors. These other factors include; weak institutional strength, (Aliyu, Baba and Suleiman 2015), low Foreign Direct Investment FDI, (Matekenya, W. and Moyo 2023), and low level of higher education (David, David, Kelvin and Dara 2014).

ENTREPRENEURSHIP AS A CATALYST TO ECONOMIC GROWTH IN AFRICA

Economic growth is the direct result of increase in the volume and availability of goods and services. In other words, increase in economic and business activities paves the way for increase in the Gross Domestic Product (GDP) of a country.

Hitherto the survival of many African countries depends on importation of goods and services particularly food items. These imported food items are usually cheaper and of higher quality than those produced domestically. With large volume of importation Africa balance of payment is distorted, exchange rate, level of inflation and interest rates are significantly affected. The result of all these is reduction in continents GDP per capita. The goal is to lift up the continent from the rubbles of trade deficit to trade surplus and thereby pave the way for the desired sustainable economic growth. Entrepreneurship has been identified as a veritable tool for achieving this goal in Africa (Ann and Agu 2012, Baga, Byrem, Perumalla, Aparna and Shilipi 2023).

Entrepreneurship is the process of creating, managing and running a new business venture for the purposes of making profit. Ogundele (2022) identified the economic function of an entrepreneur as; marshalling the financial resources necessary for the enterprise, bearing the utilimate risk of uncertainty, providing avenue for dispersal and diversification of economic activities, utilization of local raw materials and human resources, stimulation of indigenous technology to level environment and developing technological competence in self and work group.

Entrepreneurship involves creativity and innovation. By the entrepreneur creative activities, new product are discovered, produced and brought into the market for consumption. With the volume of goods had services in the economy is increased. By the entrepreneur innovative skill the existing products are improved and this can eventually replace the old products in the market and reduce importation that may pave the way for correction of balance of trade deficit.

Entrepreneurship contributes to economic growth and development in numbers of ways. First, it is a

significant way of job creation. The entrepreneur create job for himself as well as others. As a result, unemployment rate is reduced and the economic wellbeing as well as the financial situation of people is generally improved. Secondly, Entrepreneurship enhances employability which inturn drives competition in the business and economic sectors. The result of this is better quality products and services and eventually happier consumers. Also, entrepreneurship pave the way for the establishment of new industries and thereby brings about increase and diversification of industries in the economy. This no doubt hasten the pace of economic growth and development.

By production utilization of the national resources, entrepreneurs contributes significantly to the rate of capital formation which inturn leads to rapid economic growth. Similarly, through entrepreneurship, latent and idle resources such as land, labour and capital are mobilized for wealth creation in from of goods and services. This leads to increase in the net national product and income per capital of a nation. Through entrepreneurship, industries are set up in the rural or backward areas and by this the nation's Gross Domestic product do not only increase, but balanced economic development is achieved for both rural and urban regions.

Furthermore, entrepreneurship serves a catalyst to economic growth in developing countries by mobilizing capital and technology from advanced countries to produce locally the goods that had been hitherto imported. By this the balance of trade deficit is corrected and the home countries become exporters rather than importers. Large scale of goods are exported and the entrepreneur's country earn the scarce foreign exchange to speed up the countries economic growth. In addition, through entrepreneurship, diverse new products are produced for consumption by this the standard of living is increased and the national welfare improves. This leads to more agile and creative people that can add to the team of the entrepreneur to produce more goods for increase in Gross Domestic product.

It should be noted, however, that as entrepreneurship serves as catalyst to Africa economic growth, in the same way, the economy also affects the growth of entrepreneurship in the continent. Ajide (2022), found that economic growth has a positive impact on entrepreneurship development. Manuel, Antonio and Juan (2022) analyzed 74 economies in a period of 6 years, identifying those factors simultaneously related with entrepreneurship development and economic growth. The study found out that entrepreneurial activities play different roles depending on the economic stage of the countries in question and that less developed countries should not base their economic policy on generic entrepreneurship if they desire to stimulate economic growth. This no doubt implies that other factors such as strong institutional quality, education, good infrastructural development among others are germane to the growth of economic visavis entrepreneurship development in Africa.

However, it is observed that some of these social, political and economic factors had been on the increase over the years in Africa. For example, the population of the continent had been put as 1.46 billion in the year 2023, this represent an increase of 2.37% over that of 2022. It was put at 1.43 in 2022 and this is an increase of 2.38 over that of 2021 which was 1.4 billion. The 2021 population increased by 2.43% over that of 2020 which was 1.7 billion (<https://www.statista.com>). In the same way level of literacy has been growing though not steadily in Africa. In Sub-Sahara Africa countries, the rate of literacy has been put as; 64.31% in 2016, 64.69% in 2017, 66.14% in 2018, 67.06% in 2019 and 67.27% in 2020. (World Bank Development Indicator).

Similarly, Fredrick, Nicholas, Joseph Sunday and Romanus (2023) found that institutional qualities such as corruption perception, government effectiveness, regulatory quality, political stability and rule of law had been on the increase in Sub-Sahara South Africa from the period 2005 and 2019. The general submission is that all these factors had not able to influence economic growth as expected. Fredrick e-tal (2023) explained that, inadequate investment, civil wars poor weather as well as worse trade terms had been impeded the growth of economic in Africa over the years. Based on all these findings, entrepreneurship has now become a factor to be properly exploited by African countries for the needed economic growth.

EFFECTS OF CLIMATE CHANGE ON AFRICAN ECONOMIC GROWTH

The continent of Africa has been located as the epicenter of global climate crisis. This implies that extreme weather condition is more frequent and severe in the continent compared with others. Africa countries had become the most vulnerable to climate impacts due to their higher rate of poverty, food insecurity, population growth, as well as low level of technological development, and adaptive capacity among other factors. The Intergovernmental Panel on Climate Change (IPCC) (2021) had projected that Africa temperature will rise faster than the global average between 0.2°C to 0.5°C per decade. The implication of this is that the IPCC prediction that Africa will be warmed by 2°C to 0.5°C by 2050 and over 4°C by 2100 is becoming increasingly realistic. Africa's wet regions along the equator will experience a 30 percent increase in rainfall while already dry region will experience a 20 percent decrease. By this, wet region will get wetter while dry regions get drier. As these changes intensify IPCC asserted that Africa will experience prolonged periods of both drought and flooding depending on the region.

The experience in East Africa is that before 1999, a drought caused by a poor or failed rainy season occurred every two to three years. With this, it has been predicted that drought in East Africa will increase by up to 54 percent by the end of this century. It has also been noted that since 1970s, Sub-Sahara Africa has experienced flood occurrences. IPCC revealed that in 2020 1.2 million Africans were displaced by floods and practical storms. And as a result more than twice the number were displaced by violent conflict. In the same vein, the rapid increase in continental temperature combined with a growing population, has led experts to predict that by the end of this century, 118 million across Africa shall be exposed to extreme and extended heat period. Weber et al (2018).

The climate in Africa impacted on the economy directly and indirectly. The damaging effect of changes in temperature on growth rate of GDP is evidenced through the destruction of ecosystems, flood and drought. The extinction of endangered species and deaths occasioned by extreme weather conditions causes permanent damages to economic growth. Coupled with this resources required to combat the negative effect of warming, reduces investment in physical structure, research and development as well as human capital. All these curtail the economic growth in Africa. (Pindy 2011). Similarly Abidoye and Odusola, 2015, examined the linkage between economic growth and climate change in Africa and found that a 1°C increase in temperature reduces GDP growth of the continent by 0.67 percent. Indeed the vulnerability of the overall economy sectors such as agricultures, forestry, energy, coastal and water resources to climate change is a major concern in the continent of Africa.

The location of many Africa countries on the lower latitudes put the continent at a disadvantage as about 80 percent damages from climate change occur in these countries (Mendelsohn R. (2009) showed that any further warming would seriously impact negatively on productivity with its attendant effect on the GDP.

Babatunde and Ayodele (2015) revealed that within the period of 1960 and 2009, many Africa countries such as Uganda, Chad, Sudan, Botswana, and Tunisia experienced substantial rise in temperature between 1°C and 3°C . This rise contributed significantly to; loses in agricultural productivity, increased morbidity, mortality and social instabilities.

The state of climate in Africa (2019) report issued by the World Meteorological Organization (WMO) shows increase in climate change factors is a great threats to human health, food, water security and socio-economic development in Africa. The report reveals that the continent temperatures have been rising somewhat faster than the global mean and predicts that the temperature will exceed 2°C of warming above pre – industrial levels by the last two decades of this century. The report also shows that sea level increase had reached 5mm per year (which is above the global average of 3 – 4 mms). In many countries and even above in countries like Madagascar and Mauritius. Similarly about 56% of the coastlines in Benin, Cote d'ivore, Senegal and Togo are being eroding fast and the level of erosion is expected to be faster in future.

All these coupled with extensive drought and heavy rainfall, the report said, has increased malnutrition, heat, damaging pests, ill health among others which continue to have negative impact on economic activities in Africa.

However climate change in Africa does not have a total negative effect on economic growth. Shuguang (2023) found that in climate zones near the equator temperature tends to have an inverted U- shaped impact on economic growth, on the contrary, in climate zones far from the equator, temperature tends to have U-shaped impact on economic growth while temperature has no significant impact in the STD, STM and TDS regions.

The general implication of this finding is that climate change, though a challenge to the Africa economic growth but potent some opportunities for growth of economic activities in the continent. This area had not been explored in the literature. Just for instance, a high level of rainfall in a particular season may hinder the natural growth of some farm product but may pave the way for rapid growth of certain useful plants that have not been even planted. Similarly, unexpected high temperature may course long draught, but at the same time hasten the dogness of certain seeds that are useful for consumption or production. Also in certain regions of African climate change may lead to longer growing seasons. As a result, agricultural productivity and output may increase and this inturn contributes to economic growth in the regions concern. Also as a result of long drought, melting ice in Artic could create new shipping routes, thereby shortened the distance between some major parts. The result of this is the reduction in transportation costs and enhancement and global trade efficiency. Countries with access to these routes experience economic with increase activity in the shipping industry.

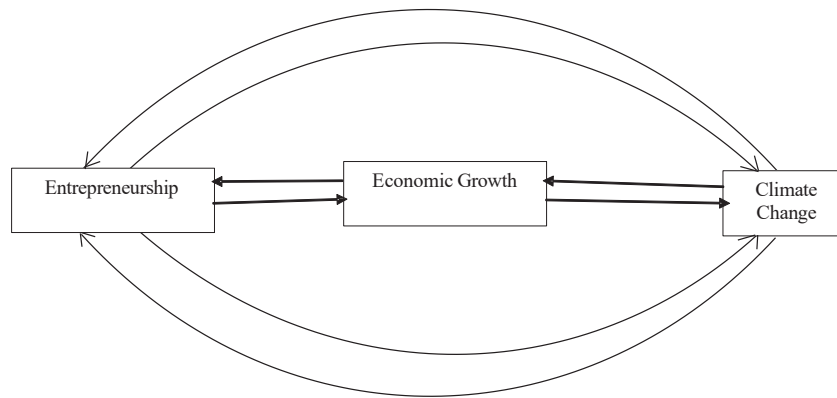
Excessive rainfall or high temperature may open up the path way for accessing previously untapped natural resources such as minerals and fossil fuels. This no doubt boost the economics of the countries with this opportunity. In the same way, warmer temperatures and extreme rainfall in certain regions may boost the activities of tourist industry by attracting more tourists to these region. Tourism, Oladokun, Adedara and Adedamola (2015) is said to be one of the biggest growing sector of the world,as it generates 11% of Gross Domestic Product (GDP) and employed 200 million people. Advancement in renewable energy Technology is another positive effect of climate change. Concerns about climate change is accelerating research and development in renewable energy technologies. The results from these researches can be a shift toward cleaner energy which can inturn stimulate the economic growth of the continent through the creation of new jobs and industries. As put by AhmandShamoon, Abid Haleem, Shashi Bahl, MohdJavaid and SonuBala (2022), renewable energy technologies could be increased by up grading the required equipment infrastructure. Ensuring a mix of reliable energy production methods and ensuring minimal impact on the environment would lead us in future to resilient and efficient energy production will sustain our future energy demand at a low cost. These are possible through researches influenced by the climate challenge being faced in Africa and the rest of the world.

In the same vein excessive and unpredictable rainfall and temperature, though, potent risks to production farm products, it is important to realise that this challenge ends up promoting innovative farming techniques and development of more resilient seeds that boost production of farm products in the long run. Climate change result in changes in ocean temperatures and currents and this affects the distribution of fisheries in certain region. However, this also can be a blessing in waiting for other regions and it can lead to expansion of fisheries in these other regions, thus providing economic opportunities to these regions.

Generally, climate change may impact positively on infrastructure development. Due to the need to adapt to climate change, governances and business men are investing on infrastructural projects in terms of, resilient buildings, flood defenses renewable energy installations etc. These projects no doubt, create jobs and increase economic growth in Africa.

Entrepreneurship, Climate Change and Economic Growth: The Interactions

Figure 1 summarises the interactions among entrepreneurship, climate change and economic growth in Africa. This interaction is important for policy.



- (i) In the first scenario (figure 1), from left to right, entrepreneurship cause increase in economic growth. Increase in the economic growth increase the rate of climate change. Increase in the rate of climate change all things being equal curtails economic growth and the curtailment of economic growth leads to decline in entrepreneurship.
- (ii) Growth in entrepreneurship directly leads to increase in the rate of climate change and this results in to decline of entrepreneurship. The decline in entrepreneurship all things being equal, leads to decrease in climate change.

CONCLUSION AND POLICY RECOMMENDATIONS

Entrepreneurship is vital to desired economic growth in Africa. However, the rate of climate change over the years has become a major challenge both to entrepreneurship and economic growth. Climate change curtails economic growth directly and via entrepreneurship. In all the regions of the continent.

The concern about the negative impact of climate change on entrepreneurship and economic growth had led to various movements by agencies, governments, public and private enterprises in Africa and the world at large. However, these movements are yet to yield the desired adequate solutions. There is need for continuous efforts by all stake holders to curtail climate change increase in Africa in order to pave the way for greater zeal in entrepreneurship that will eventually lead to the desired economic growth in Africa. Entrepreneurship is considered crucial to foster economic growth, particularly in developing economies. Entrepreneurs create employment opportunities not only for themselves but for the teeming population. It further improves a country's economic performance through introduction of new products that helps enhance labour productivity.

For the purpose of accelerating the rate of economic growth in Africa through entrepreneurship, in the light of climate change challenges; the following recommendations are hereby made.

- (i) African governments should embark on a comprehensive and all-inclusive entrepreneurship education both at and out of formal school setting. Government should be sincerely opened up and sensitise all about the need to own and run personal business instead of waiting and seeking for government and private organizations salary jobs which are gross inadequate to cater for the teeming young school leavers.
- (ii) Special finance institutions in addition to the existing ones to be established for the purpose of providing funds for the certified entrepreneurs. For example, an entrepreneurship bank could be established in all local government areas or regions in Africa to facilitate easy access to fund by individuals or groups who are genuinely ready to own and run business. Such banks should provide long term loans of at least five years with no interest or low interest rate.
- (iii) Government at all levels in all Africa nations should heavily embark on investing and developing appropriate infrastructures which hitherto not adequate in many of the countries. This includes; good

transportation system, water supply, electricity supply, information network, internet connectivity etc.

- (iv) Laws that are attractive to both the existing and new entrepreneurs are to be enacted to include; tax holiday or freedom, and financial, material or equipment incentives.
- (v) African entrepreneurs to be well assured of markets for their products and services both at local and international levels. For example the government can assure the entrepreneurs of 50% to 60% of purchase of their goods or services per annum for a period of five years. Also through government persuasions and other strategies certain private organisations can be completed to take up the responsibilities of purchasing between 60% to 100% of the goods and services of some enterprises.
- (vi) Countries in partnership with advanced countries should embark on the provision of adequate supply of renewable energy sources such as solar, wind and hydroelectric power at a low cost for the entrepreneurs.
- (vii) Both the new and the existing entrepreneur should be educated and encouraged through free workshops to adopt clean energy particularly solar energy. The use of fossil fuel should be strongly discouraged.
- (viii) Government at all levels should gear and concentrate effort on investing in infrastructure and strategies that will make the entrepreneurs adopt appropriately to the impacts of climate change, such as extreme cold or hot weather condition, sea level rise, low or high rainfall, and changes in agricultural pattern.
- (ix) Rules and regulations that will make all entrepreneurs to make use of machine, and equipment with low or no environmental pollution should be put in place.
- (x) There should be an annual increase allocation of funds by each Africa government for research and development of clean energy technologies. Fund for this purpose can be sourced from the well- established private business and non – business organizations as well as international agencies.
- (xi) Start-up subsidies should be considered to foster entrepreneurial activities. These will help to curtail the risk of failure of businesses.

REFERENCES

- Abidoye B. and Olusola A. (2015): Climate Change and Economic Growth in Africa; An Econometric Analysis. *Journal of Africa Economics*, 4, (2), 1 – 25.
- Adedamola, O. J., Adedara, T. M. & Adedamola, J. O. (2015). Tourism and climate change, combating climate change effect on Tourism Participation in Nigeria. *Journal of Tourism, Hospitality and sports*, 5,1-5
- Ajide F.M. (2022) Economic Complexity and Entrepreneurship: Insights from Africa, *International Journal of Development*: 21, (3), 367–388.
- Aliyu H.I. & Suleiman Z.A. (2016): Flood menace in Kaduna Metropolis; Remedial and management strategies. *Science World Journal*; 11, (2).
- Asogwa, F. O., Attamah H., Amuka J., Agu, S. V, . Ngewuanyi R. O. (2023) Institutional Quality Indicators and Economic Growth in Selected Sub-Sahara Africa countries. *Journal of African Studies and Sustainable Development*, 6, (4),
- Bloom, D., Canning D., Chan K & Lee D. N. (2014). Higher Education and Economic Growth in Africa: *International Journal of African Higher Education*, 1, (1); <https://doi.org/10.6017/Ijahe v1.1>. 5643.
- Byano, M., Nkonoki J., Mafwolo G. (2023): Exploring the nexus between the natural resources depletion, renewable energy use and environmental degradation in Sub-Sahara Africa. *Journal of Environmental Science and Pollution* 30; 19931 – 19945.
- Cupta,O., Narayana, P. & Kamaladasaa S. (2023): Soft computing applications in modern power energy systems; Selected proceedings of EPREC, 4, .
- Materkenyu W. and Moyo C. (2023): Foreign Direct Investment, Economic Growth and Development in South Africa; An empirical analysis; *Journal of Chinese Economic and Foreign Trade Studies*. 16, (1), 4 – 21.
- Mendelson R. (2009): The Impact of Climate Change on Agriculture in Developing Countries *Journal of National Resources Policy Research*. 1. 5 – 19.
- Ochola, B. Nankabriwa, J. Buwembo, W. Kaddumukesa M. and Harriet MayanjaKizza H. (2022): *Rheumatol* 14, 75 – 86.
- Ogbo, A. and Agu, C. N. (2012). The Role of Entrepreneurship in Economic Development; the Nigerian perspective: *European Journal of Business and Management*, 4, (8).
- Ogundele, O. J. K. Ajonbadi H.A, Mustapha O. R, and Abdulraheem I (2015). *The Entrepreneurs Book of Reading in Honour of Late Professor Oyewole Otokiti*. 1, Decision Management Consult Ltd.
- Pindy R.S. (2011): Fat Tails, Thin Tails and climate change policy; Review of Environmental Economics and policy. Volume 5 (2): 258 – 274.
- World Meteorological Organization (2019): state of climate in Africa: WMO – No 1253, Geneva.
- Zhao Y. & Liu S. (2023): Effect of Climate Change on Economic Growth. A Perspective of Heterogenous Climate Regions in Africa. Special Issue. *Environmental and Sustainable Economic Growth*. 15 (9) 1 – 22, 7 <https://doi.org/10.3390/su15097136.09713>.