Review Article

The Beneficial Opportunities of Climate Change for Enhanced Socio-Economic Development: A Review

Abstract

Many studies on adaptation to the impact of climate change have been undertaken globally since the passing of the United Nations Framework Convention for Climate Change (UNFCCC) in 1992. This is because the UNFCCC recognizes that climate change is one of the main challenges to sustainable development. However, many of the studies have focused on the negative impact of climate change and the adaptation strategies thereto. Despite the fact that climate change is known to have both negative and positive impact, the positive impact of climate change and the strategies for benefiting from them have not been given sufficient attention by researchers. This paper reviews the literature produced by researchers focusing on adaptation to the impact of climate change. The review in question has shown that a myriad of studies focus on the negative impact of climate change and adaptation strategies thereto in various socio-economic sectors. It has also shown that only a few studies have investigated the positive impact of climate change. This paper argues for a need to change viewpoint from studying adaptation to the negative impacts of climate change alone to the inclusive approach in which both adaptation to negative and positive impacts of climate change will receive equal consideration. The approach will improve the capacity of various socio-economic systems to sustainably adapt to the current and future impact of climate change.

Keywords: Climate change, beneficial opportunities, perspectives, a review

1. Introduction

The fact that the earth's climate is changing and that it detrimentally impacts other components of the earth's system is no longer debatable (IPCC, 2007; Christopherson, 2012; Walsh et al., 2014). The concentration of greenhouse gasses has been increasing, mostly as a result of human activities (IPCC, 2013). The concentration of carbon dioxide gas (CO_2), for instance, increased

from 280 parts per million (ppm) in 1750 to 369.7 ppm in 2001, and can increase to over 1000 ppm if the current trend will proceed (Christopherson, 2012; Ackerman and Stanton, 2013). This increase has increased the global mean temperature, which has increased by over 0.6^0C since the industrial revolution (IPCC, 2013). This causes changes in the statistical distribution of weather patterns over a long time (climate change) and seasonal or annual variations in the elements of weather, which are referred to as climate variability (Parmesan and Yohe, 2003; USAID, 2007).

Climate change and variability have a myriad effects on natural and human systems (Warren, et al., 2013; Walsh, et al., 2014). The effects include the melting of ice and glaciers with the potential depletion of fresh water sources, the destruction of habitats for polar bears and the rise in sea level, people's displacement, the loss of historical sites, the destruction of infrastructure, and the loss of native habitation for plants and animals (Zwally et al., 2011; Christopherson, 2012; Warren et al., 2013; Marzeion and Levermann, 2014). Besides, climate change has been causing increase in climate-related disasters, including droughts, hurricanes, floods, pests and diseases, heat waves, and wildfires (Walsh et al., 2014). The earth's systems should adapt to the effects of climate change to moderate their harm (Rizvi et al., 2015).

The aforementioned effects are negative and have been the focus of many studies on strategies for adapting to climate change (Bryan et al., 2009; Deressa et al., 2009; Gbetibouo, 2009; Mbilinyi et al., 2013). However, a critical evaluation of the definitions of adaptation to climate change reveals that the impact of climate change may also be positive (Rizvi et al., 2015). This means that climate change also has certain beneficial opportunities that should be exploited for socio-economic development purposes. An increase in temperature results in milder climates, which encourage the development of settlements with less need for energy to warm cold places, especially in high latitudes. Furthermore, an increase in temperature and precipitations in high latitudes and altitudes increases crop yields, timber production, and the shift of species to the poles (Christopherson, 2012). In Africa, only a few studies on the opportunities resulting from climate change have shown the introduction of new agricultural practices and agribusiness, energy production, the growing of early-maturing and drought-tolerant crops, greenhouse farming, and extended cropping seasons (Chikodzi et al., 2013).

Generally, adaptation to the impact of climate change has received considerable attention from researchers. However, to a large extent, such attention has focused on adaptation to the negative

impact of climate change (Deressa et al., 2009; Gbetbouo, 2009; Nabikolo et al., 2012; Mbilinyi et al., 2013; Kemal et al., 2022). Strategies for exploiting the beneficial opportunities resulting from climate change have received little attention despite their importance for contemporary socio-economic development. In view of the above, research needs to focus on both the negative and positive impacts of climate change. Therefore, this paper reviews works on adaptation to climate change and shows that there is a need for a new perspective, which includes strategies for exploiting the beneficial opportunities of climate change.

2. Adaptation to Climate Change

2.1 An Overview

Adaptation to climate change entails adjustments being made in the earth's systems (natural or human systems) in response to actual or expected climatic stimuli or their effects, in order to moderate harm or exploit the opportunities resulting from climate change (Rizvi et al., 2015). It involves changes in structures, practices or processes so as to moderate damages or exploit the opportunities (Arbuckle et al., 2013; Rizvi et al., 2015). The general aim of adaptation is to lessen vulnerability to actual or potential effects of climate change and improve the capacity to adapt to them (Regmi et al., 2010).

Adaptation strategies can be proactive or reactive, autonomous or planned, private or public, structural or non-structural, and short term or long term (Dessler, 2012; Levina and Tirpak, 2006). Proactive (anticipatory) adaptation takes place before the effects of climate change occur, for example moving people from flood plains that are more likely to be flooded in the future (Holden, 2011). By contrast, reactive adaptation takes place after the effects of climate change have occurred, for example compensating affected communities (Rizvi et al., 2015; Dessler, 2012). Autonomous (or spontaneous) adaptation is a reaction to changes in natural or human systems, but not a conscious response to climatic stimuli. Planned adaptation refers to practices which result from deliberate policy decisions (Rizvi et al., 2015; Dessler, 2012). Planned adaptation is aimed at fostering the adaptive capacity or facilitating specific adaptation strategies. Private adaptation refers to strategies initiated and implemented by individuals, households, or private companies, whereas public adaptation means strategies initiated and implemented by governments.

Moreover, adaptation can be structural or non-structural. Structural adaptation refers to the construction of structures to reduce or avoid possible effects of hazards, or the application of

engineering techniques to building structures or systems that are resilient or resistant to hazards. Non-structural adaptation does not involve constructing any structures or systems (Levina and Tirpak, 2006). Instead, it involves raising public awareness through training and education, policies, laws, and agreements aimed at reducing risks and the impact of climate change and variability. In terms of temporal dimensions, adaptation can be short term or long term (Levina and Tirpak, 2006). Ideally, adaptation needs to be proactive and planned so as to avoid the impact of climate change. However, due to the complexity in the climatic systems, some events occur unpredictably, such that reactive and autonomous adaptation strategies are frequently required.

The importance of adaptation to climate change to environmental health and socio-economic development cannot be overemphasized. Climate change-induced hazards have detrimental effects on natural, social, and economic systems. As such, adaptation helps to avoid or moderate such effects so as to realize socio-economic development (Rizvi et al., 2015). Further, adaptation facilitates exploitation of the benefits of climate change (Arbuckle et al., 2013). In addition, adaptation helps to lessen vulnerability and improve adaptation capacity. Effective adaptation reduces exposure to the impact of climate change, thus reducing vulnerability. Furthermore, efforts to adapt to climate change increases the amount of information, innovations, creativity and assets/resources, which foster adaptation capacity and reduce vulnerability (Regmi et al., 2010; Klein et al., 2014). Besides, adaptation strategies such as migration, diversification of the economy, and saving help to reduce poverty (Klein et al., 2014). In general, adaptation to climate change needs to be promoted, as it leads to sustainable development.

2.2 The Current Worldview on Adaptation to Climate Change: The Need for a Paradigm Shift

In its Article 4b, the United Nations Framework Convention for Climate Change (UNFCCC) demands that the member states undertake initiatives aimed at facilitating sustainable adaptation to climate change (UN, 1992). In response, many studies on the impact of, and adaptation to, climate change have been undertaken globally (Nhemachena and Hassan, 2007; Bryan et al., 2009; Gbetibouo, 2009; Mbilinyi et al., 2013; Oo et al., 2015; Kemal et al., 2022). However, one main characteristic of such studies is that they have been focusing on strategies for adapting to the negative impact of climate change. The positive impact of climate change and strategies for exploiting the benefits thereof have received little attention. The subsequent part of this paper

synthesizes the empirical studies on the impact of climate change as well as those on the strategies used to adapt to the impact, focusing on agriculture.

In their study on farmers' perception of climate change, adaptation measures and adaptation decisions in South Africa and Ethiopia, Bryan et al. (2009) focused on adaptation to the negative impact of climate change, particularly drought. The researchers reported that the most common adaptation strategies in the areas studied included changing planting dates, soil conservation, practicing irrigation, using different crop varieties, and tree planting.

In the same year and from the same viewpoint, Gbetibouo (2009) focused on the negative impact of climate change and adaptation to such impact at the farm level and the factors driving adaptation. The study was conducted among farmers at the Limpopo River Basin in South Africa. It reported that the farmers adapted to the negative impacts of cimate change by changing planting dates, using irrigation and changing types of crops. Two years earlier, Nhemachena and Hassan (2007) conducted a study in Zambia, Zimbabwe and South Africa. The findings of their study were akin to those of the foregoing two studies with regard to the strategies used to adapt to the negative impact of climate change in farming. They included mixed farming among the strategies used in the countries studied.

Various studies from this perspective have been undertaken in Tanzania, just as they have been in many other places in the world. Mbilinyi et al. (2013) is a case in point. The study was conducted to establish the impact of climate change and small-scale farmers' adaptation to it in Tanzania. The researchers reported that farmers adopted crop diversification, improved soil and water management, and improved the flow and use of information on weather. Kangalawe et al. (2011) is another study conducted from the same perspective. The study reported that the riparian communities practice irrigation, grow drought-tolerant crops, practice rationing of irrigation water, cultivate in wetlands, and engage in non-agricultural activities to cope with the impact of climate change. Like many other current studies, this study focused on the strategies for coping with the negative impact of climate change. Likewise, Malekela and Lusiru (2022) conducted a study on strategies for adapting to the impacts of climate change. The researchers found that the use of Matengo pits was a sustainable strategy for adapting to low production caused by climate change-induced drought.

As the foregoing discussion has shown, many studies have examined adaptation to the negative impact of climate change. Many studies have not shown that climate change can have some positive impact on the environment and socio-economic systems. Indeed, only a few studies have focused on the positive impact of climate change. Among them is a study by Chikodzi et al. (2013), which was conducted in southeast Zimbabwe. Apart from indicating various opportunities resulting from climate change, the study contended that exploiting the opportunities provided by climate change and variability provides the quickest way of embracing adaptation to the impact of climate change. Besides, some of the studies undertaken to project production (e.g. crop production) under various climate change-related scenarios have indicated both negative and positive results (Tubiello et al., 2002). This suggests that there is a need to explore both strategies for adapting to the negative impacts of climate change and those for exploiting the beneficial opportunities resulting from climate change. This paper contends that this is due time for climate change researchers to include positive impacts of climate change and strategies to exploit them for the attainment of the national and international development goals.

3. Conclusion

There is a general agreement that climate change has both negative and positive impacts on the earth's systems. The negative impacts damage natural and human systems, hence negatively impacting socio-economic development. By contrast, the positive effects are the situations or conditions under which various socio-economic systems can benefit from climate change. It is also known that systems ought to adapt to such effects so as to moderate harm and exploit the associated benefits. Thus, sustainable adaptation to climate change entails devising strategies for adapting to the negative impact and exploiting the beneficial opportunities. However, most of the current studies have focused on the negative impact of climate change and on the strategies for adapting to them in various sectors. Though studying the strategies for adapting to the negative impact of climate change is important in avoiding the attendant harm, studying ways of benefiting from the positive impact of climate change is equally important. This paper notes that researchers should focus on the positive impact of climate change as well, and on the ways through which communities can exploit the opportunities generated by climate change. This perspective is crucial because various models of climate change project that the earth's climate will continue changing, at least until the foreseeable future.

4. References

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