

REVIEW ON THE LINK BETWEEN TECHNOLOGICAL CHANGE, CLIMATE FINANCE, AND MARKET IN MITIGATING CLIMATE CHANGE

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ABSTRACT: *Global Climate change has a negative impact on all sectors of the economy, eco-regions, and social groups. Identifying the risk, the international community is working to reverse the movement. By considering the climate change impacts, the global community is driving an effort of their capacity to prevent the trend. To reduce the impacts of climate change through measures such as reduction of GHG emissions. Linking technological change, climate finance, and the market is a key element for reducing greenhouse gas emissions in climate-smart agriculture. The purpose of this review is to highlight that technological change is closely linked to climate finance and the market in mitigating climate change, the role of technological change in mitigating climate change, the role of climate finance and financing mechanisms in mitigating climate change, and the market perspectives in mitigating climate change.*

KEYWORDS: climate change, climate finance, and market, technological change, mitigating.

INTRODUCTION

Climate change alters the world's climate in both natural and anthropogenic causes by increasing the concentration of greenhouse gases in the atmosphere (IPCC, 2014). Climate change is projected to have a negative impact on all sectors of the economy, eco-regions, and social groups (Singh and Purohit, 2014). Recognizing the risk, the international community is working to reverse the trend. The United Nations formed the Intergovernmental Panel on Climate Change (IPCC) and the Kyoto Protocol, the first international agreement on GHG mitigation (IPCC, 2014). The protocol's goal is for committed countries to reduce their GHG emissions by at least 5%.

Mitigation entails lowering GHG emissions and improving CO₂ sinks in order to lessen the severity of global warming. Mitigation solutions are needed to minimize GHG emissions and improve sinks in order to reduce global warming impacts. Activities aimed at mitigating the effects of climate change, such as reducing GHG emissions, will also help to lessen the consequences and, as a result, the economic costs of climate change.

Technological change is an essential component of a comprehensive climate change strategy that includes global efforts to limit and reduce GHG emissions (mitigation). In addition, new technologies will likely emerge because of focused research, development and international cooperative partnership initiatives. Technological change, innovation and utilization are expected

to play crucial roles in meeting the environmental and climate change challenges of the future (IPCC, 2007).

Climate financing is needed for mitigation because large-scale expenditures are necessary to considerably reduce emissions. The overview under the Kyoto Protocol of market-based mechanisms presents opportunities for the cost-effective reduction of GHG emissions, but also significant risks. Therefore, it is important to link between technological change, climate finance, and marketing in order to reduce or mitigate climate change. The purpose of this review is to highlight that technological change is closely linked to climate finance and the market in mitigating climate change.

Objectives

- a) Review literature on the role of technological change in mitigating climate change
- b) Review on climate finance and financing mechanisms in mitigating climate change
- c) Review on the market perspectives in mitigating climate change
- d) Linkage between technological change, climate finance and market in reducing climate change

MAIN BODY OF THE REVIEW

The Role of Technological Change in Mitigating Climate Change

One of the main drivers of GHG emissions is technology. It is one of the most important factors influencing economic growth, consumption patterns, and thus human well-being. Simultaneously, technology and technological change present the most promising avenues for reducing future emissions and eventually stabilizing GHG concentrations in the atmosphere. This report examines the role of technology in climate change mitigation, including long-term emissions and stabilization scenarios (IPCC, 2007). The success of worldwide efforts to control GHG emissions and the transition to a low-carbon economy has been attributed to recent technological advancements in renewable energy technology (Schmidt & Sewerin, 2017).

However, most of these innovations are concentrated in a few developed countries. For example, in the case of environmentally sound technologies. Hence, it is imperative to promote technology transfer from developed countries to developing and under-developed countries to mitigate climate change, which is a global concern. The ways in which technology reduces future GHG emissions in long-term emission scenarios include:

- Improving technology efficiencies and thereby reducing emissions per unit service (output).
- Replacing carbon-intensive sources of energy by less intensive ones.
- Introducing carbon capture and storage to abate uncontrolled emissions.
- Introducing carbon-free renewable energy sources ranging from a larger role for hydro and wind power, solar thermal power plants, modern biomass and other advanced renewable technologies.
- Reducing GHG and CO₂ emissions from agriculture and land use.

Climate Financing Mechanisms and the existing Climate Finance

The available climate finance to mitigate the impact of climate change includes; financing mechanisms directly under the UNFCCC, United Nations (UN) organizations or programmes, multilateral development banks (MDBs), bilateral public financing channels, Compliance and voluntary carbon markets, and Private sector actors and philanthropy. Climate finance has a critical role to play in enabling a transition to a low-carbon, climate-resilient economy. The Paris Agreement itself commits to aligning financial flows ‘with a pathway towards low greenhouse gas emissions and climate-resilient development. Several studies have established that a substantial financial gap exists to meet these goals (Buchner *et al.*, 2019; Masson-Delmotte *et al.*, 2018). To fix these financial gaps, more effectively mobilizing and steering public and private finance to climate-related purposes is of critical importance.

Multilateral institutions such as the GEF and the World Bank as well as regional banks, bilateral sources, mechanisms created through UNFCCC and carbon markets have been major institutions and mechanisms through which climate finance has been channeled. The establishment of the Green Climate Fund may be a starting point for consolidation of climate funds. However, there are also design challenges for institutions such as the green climate fund (Bird *et al.*, 2011). Special Climate Change Fund (SCCF) to finance projects relating to: capacity building, technology transfer, climate change mitigation and economic variation for countries highly dependent on income from fossil fuels.

Clean Development Mechanism (CDM) allows a developed country with an emission-reduction or emission limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn marketable certified emission reduction (CER) credits, each equivalent to one tone of CO₂, which can be counted towards meeting Kyoto targets. Climate Investment Fund (CIF) established with the objectives to influence climate investments in such like areas: Clean Technology Fund; Finances demonstration, deployment, and transfer of low carbon technologies, and Strategic Climate Fund: Targeted programs to pilot new approaches and improvements.

Market and Carbon offset Markets in Mitigating Climate Change

Market perspectives consider how to achieve sustainable markets for technologies to mitigate climate change and thus harness the power of market-based incentives to accomplish environmental goals. In recent years, market mechanisms have emerged to facilitate the global reduction of GHG emissions. Carbon offsetting is a process whereby emitters pay to offset their emissions by funding projects that result in carbon sequestration or reduced GHG emissions elsewhere. Carbon offsetting aims to achieve a net GHG emission reduction by supporting actions to reduce carbon in one place, offsetting emissions that are difficult or more expensive to curtail in another place (Tefera, M. *et al.*, 2015).

Broadly speaking, there are two types of carbon market: compliance markets and voluntary offset markets. Compliance markets allow entities to meet regulatory emission reductions commitments: most notably, those compelled by the Kyoto Protocol, the largest binding climate treaty, adopted under the UNFCCC. The Protocol’s Clean Development Mechanism (CDM) provides a cap-and-

trade approach, where limits are set on emissions, and the rights to emit excess emissions are bought and sold through the sale or purchase of carbon credits, which are generated by projects that mitigate emissions (Ibid). The CDM allows developing countries such as Ethiopia to create Certified Emissions Reduction (CER) credits, by establishing quantifiable mitigation activities to be purchased by industrialized countries to meet their regulatory commitments. Voluntary offset markets refer to measures to reduce emissions at the discretion of emitters, rather than for regulatory compliance. Such actions may be motivated by personal conscience, corporate social responsibility, or other reasons.

Linking Climate Finance and Market Mechanisms in Mitigating Climate Change

Linking carbon markets and climate finance in developing countries and harnessing synergies between market mechanisms and climate finance very important. The project establishes links between UNFCCC market mechanisms and climate finance institutions of the UNFCCC financial mechanism, such as the Green Climate Fund. In all partner countries, the project cooperates with governments and the private sector to develop climate-financing applications that leverage the potential of existing activities and bring about significant development impacts for local communities.

Sub-optimal levels of environmentally friendly technological change is caused by the interaction of market failures related to environmental externalities and in technology development, where knowledge and adoption externalities work in concert with information problems to depress levels of technological innovation (Jaffe *et al.*, 2005).

CONCLUSION

By understanding the climate change impacts, the global community is putting effort of their capacity to avert the trend. Actions taken to reduce the impacts of climate change through measures such as reduction of GHG emissions would also contribute towards reducing the impacts and hence the economic costs of climate change. Linking technological change, climate finance and market is a key element for reducing greenhouse gas emissions in CSA. Technological change have been the driver of economic and social development worldwide, so it is important for achieving climate change stabilization. It reduces future GHG emissions in long-term emission scenarios through improving technology efficiencies and thereby reducing emissions per unit service, replacing carbon-intensive sources of energy by less intensive, introducing carbon capture and storage to abate uncontrolled emissions, introducing carbon-free renewable energy sources ranging from a larger role for hydro and wind power, and solar thermal power plants, modern biomass and other advanced renewable technologies.

The available climate finance to mitigate the impact of climate change includes; financing mechanisms directly under the UNFCCC, United Nations organizations or programmes, multilateral development banks, bilateral public financing channels, Compliance and voluntary carbon markets, and Private sector actors and philanthropy. Therefore, relating carbon markets and climate finance in developing countries and harnessing synergies between technological change,

market mechanisms and climate finance is very imperative. Market mechanisms generally, and emissions trading in particular, have the potential to enable nations and economic actors to meet legally binding targets for greenhouse gas (GHG) limitation and reduction cost-effectively.

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