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MAINSTREAMING ADAPTATION TO CLIMATE CHANGE INTO POLICY AND DEVELOPMENT: CASE STUDY ON AGRICULTURE AND SUSTAINABLE FOOD SECURITY IN BANGLADESH

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ABSTRACT: *Our proposed study set up a long-term national climate adaptation framework for Bangladeshi policy makers. Outcomes of this research absolutely lead to measure the public perception, attitudes and understanding of the level of knowledge and the aspirations and expectations of publics with regard to how they adapted to a changing climate. This study also identify if there are significant relationship between public perceptions and attitudes of climate change and efficient adaptation framework and plans to introduce some ideas. and concepts on the challenges toward the perceptions and policies as tools for achieving long-term solutions to climate change for the national policy framework. More specific outcomes are* ***a)*** *understanding of public perceptions, attitudes towards climate change and their adaptation capacity in agriculture, industry and service sectors* ***b)*** *achievement of efficient national adaptation framework* ***c)*** *enhanced knowledge on future climate change impacts and better capacity building on the long run integrated economic development and finally and* ***d)*** *recommendations and policy tools for achieving long-term solutions to climate change for the national policy framework.*

KEYWORDS: Climate Change, Policy, Development, Agriculture, Food Security, Bangladesh

INTRODUCTION

Climate change is one of the most challenging problems the world is currently facing. Among its most severe consequences are uneven and sometimes inadequate rainfalls, increases in temperature, unpredictable and extreme weather (e.g. storms, surges, etc.) that can cause catastrophes in agriculture. The impacts of climate change are now real and many countries are particularly vulnerable to its consequences, partly because of their limited capacity to adapt. Against this background, this proposed study plans to introduce some ideas and concepts regarding the challenges toward policies as tools for achieving long-term solutions to the problem and to examine some of the technical foundations on appropriate adaptation measures, which are new developments in the climate change agricultural research. The experiences from our study can be useful for Bangladesh policy makers for the operational tools to dealing climate change impacts and elsewhere with similar economic and ecological conditions.

Research Background

Climate change is one of the most challenging threats that currently Bangladesh facing. The scientific evidence is now overwhelming and climate change is accredited a solemn problem and it demands as an urgent response. Scientifically, it is clear that changing climate patterns often adversely affect many countries across the world. If we consider the background of research; a good number of works have recently made reference to the subject, including well-

known publications by Lobell, DB et al. (2011), Rowhani P. et al. (2011), Georgescu M. et al. (2011), Ahmed, SA et al. (2011), Burke, MB et al. (2010), Hertel TW et al. (2010), Burke, MB et al. (2009), Bonfils, C et al. (2008), Lobell, DB et al. (2007), Cahill, KN et al. (2007) and IPCC (2007). Therefore, from a national and international perspective, policymakers and environmentalists alike are looking for the mechanisms to tackle the issues and the operational tools for dealing with climate change impacts. Detailed analyses of long-term adaptation technique, technical foundation, institutions and operational barriers centre on integrating climate change concerns. However, appropriate long-term adaptation modelling and frameworks aiming to resolving climate change disputes are fundamentally lacking, whilst evidence suggests the impact of climate change is increasing (Lobell, DB et al. 2011). Therefore, the fundamental question that arises is: what still needs to be done? Can we state that current adaptation technology is not sound enough? We are proposing the solution of the fundamental question in Bangladesh perspective, agriculture in particular.

SUMMERY OF LITERATURE

A study published by Lobell, DB et al. (2008) analyzed that due to climate change, Southern Africa could lose more than 30% of its main crop, maize, by 2030. In Asia, especially South Asia and South East Asia such as Bangladesh will lose of many regional staples, such as rice, millet and maize could top by 10%. Assessment of the effects of global climate change on agriculture might help to properly anticipate and adapt farming to maximize agricultural production (Rosamond, L. et al. 2007). Bangladesh realizes adapt farming and the impacts of climate change issues and therefore, the awareness of climate change and policy resources for implementation are the most frequently voiced in mainstreaming adaptation development activity but specific operational guidance on how to take it into account is generally lacking. We know that bridging the gap between the climate change concerns and mainstreaming adaptation development activity is not easy. The two areas have different priorities; often operate on different time and space scales. Specific information is therefore required for the resilience of climate change for developmental activities along with operational guidance on how best to adapt to its impacts, within the contest of other pressing social priorities.

Consequently, in order to yield the expected benefits, we need to take into account how the mainstreaming adaptation technology is developed and how it can be transferred between the climate change concerns and development. As a way forward on this issue, long-term security options are being increasingly explored, along with adaptation mechanisms. However, the use of systems for enforcing the effects of adaptation (or mitigation) issue is still being debated, especially with regard to market mechanisms, is subject to dispute. Hence, overcoming the gap between adaptation options (i.e. in agriculture) and environmental development is among the most difficult elements of modelling system. Therefore, the new challenge in addressing climate change issues for adaptation option is how to involve dimensions of physical and social science in a new technique. This must take the demands of environmental development into account on the one hand, and requirements for effective climate change adaptation on the other. Here, the coordination of multidisciplinary (i.e. dimensions of physical and social science together) adaptive modeling is important to structuring long-term climate change scenarios. This multidisciplinary adaptive approach must enable new effective adaptation techniques taking account of national agendas, current policy options, future national agricultural road-maps, market preferences, green growth and technology changes for the green technology, which is our initiative in the proposed study.

The rationality of the multidisciplinary adaptive approach such as science and non-science based techniques is quite noble as we are looking for long-term government policy planning for climate change issues. Here, it is also important to look at the issue not only in theoretical, but also in realistic terms. We also must consider all societal subsystems related to national needs such as future option on green growth, green technology, market mechanisms and preferences, social utility, national growth plans and agendas, taxation policy, industrial development, and other social institutions contributing in one way or another, directly or indirectly. Our argument here is that scientists and social-scientists may work together on developing adaptation modeling (i.e. agriculture), thus bringing together efficient technological innovation and long-term applicable adaptive frameworks. The implementation of the expected agreement should be ensured on the base of sound scientific knowledge. The specific budget line should therefore: identify research needs and gaps that need to be addressed in view of establishing scenarios for a socially, economically and environmentally suitable. Finally, there should be justified mix of adaptation and development options to climate change long-run pathways.

Here, we widen the scope to deliver new approaches of a technique to provide good amounts of information that can augment traditional forecasting systems by using long-term adaptation scenarios (i.e. in agriculture). The analogy of effective techniques is very straightforward. It must monitor through changes with various strategies using mathematical algorithms and to locate direct benefits. Although the ultimate target groups are principally Bangladeshn policymakers, however, a wider range of beneficiaries may be expected that would have enormous scientific value. Finally, to augment an intelligent solution on the adaptive long-run pathways, a responsive and integrated Environmental Dynamic General Equilibrium Modeling (TECH-ENERGY-DYSCGE) approach will used.

Objectives of the Study

The overall goal of the proposed research is to develop a mainstreaming adaptation technique for the long-term national policy, but the specific objectives of this proposed proposal are mentioned below:

1. To develop a scenario-based long-term applicable adaptation modelling for agriculture and food security based on TECH-ENERGY-DYSCGE Modeling approach;

2. To evaluate suitable adaptation policies and technology options to support sustainable future strategies based on the scenario developed in objective (1);

3. To identify the capacity building options and gaps in the local policy community/network to support the adaptation policies and technology options identified in objective (2)

Research Question

a. What is the scientific, technological, economic and socio-cultural trade-offs between climate change and sustainable food security?

b. How to appraise the socioeconomic impacts and adaptation preferences to avoid the gap between environmental sustainability and socioeconomic development?

c. How to find the balance between environmental and development policy for sustainable food security?

d. What are the gaps in the capacity building of the local policy community/network to support long-run and integrative policy development (e.g. futures research and policy analysis) for climate change adaptation?

Research Methods

Nowadays, climate change is a well-established visible danger for the long-run; therefore, we have taken consideration of a science and non science-based strategy to manage long-term climate change transformation (i.e. scenarios) for policy actions. In particular, we widen a potential framework by focusing on the application of science-based technology on optimized adaptation modeling, experiments and non-science-based changed management keys for environmental adaptation. The parameters of the science and social-science domain taken into account are as follows:

Science domain:

This domain addresses the issues of science based technology and what innovative systems can be developed by utilising a set of tools in order to prioritise adaptation options such as:

- Pathways of efficient green technology within existing environment
- Alternative technological innovation
- Applicable climate change adaptation scenarios for national planning

Social-science domain:

This domain addresses the issues of a non-science system and what innovative ideas can be facilitated by the science domain for forward-looking approaches within the policymaking scheme. It also addresses how to strike the right balance of sustaining economic growth with careful planning by means of a forward-looking approach and agenda. A set of tools that can help to prioritise options, potential effectiveness which is taken care by the social-science domain such as:

- Development and application of the country-specific TECH-ENERGY-DYSCGE framework which must be facilitated by the efficient core of science and technology.
- Improved ability of current and future climate change challenges by resource-efficient and sustainable management system, while policy must take stock of maintaining the region's high growth potential and competitiveness.

Research Approach

To fulfill the objectives, the scope of framework is addressed into two modules as research approaches: science and social-science module (Fig. 1). Here, the science-based module works using optimized modeling techniques and experiments. In contrast, the social science-based module takes the essence of science innovation, data and information and mobilizes the innovative techniques efficiently to the policymakers with the state-of-art modelling (i.e. quantitative) and planning framework. The social-science-based module sets short-term and long-term goals that are based on the long-term sustainability visions, scenario studies (dynamic CGE modelling), trend analyses, and short-term possibilities (i.e. statistical analysis). Here we term this process "back-casting forecasting approach" for the long-run pathways (Al-Amin and

Leal, 2012). This module considers all societal subsystems, actors, and institutions contributing in one way or the other, directly or indirectly to the emergence or production of innovation. Finally, this module attempts to determine the trade-offs between climate change adaptation and sustainable environmental development. The brief approaches of applicable techniques are stated below:

Approaches

(i) Science module:

This module principally considers research appraisal and evaluation of data generation for long-term optimized scenarios. Explicitly, the research appraisal will be involved to assess possible green growth systems for applicable mainstreaming adaptation and the evaluation system will be involved on experiments to locate the climate change transformation components and applicable scenario data generation. Eventually, the science module will be approached for country-specific assessment and data invention (i.e. environmental and technological co-efficient) on scenario green growth, scenario technology options, possible (i.e. sustainable) future strategies and scenario climatic parameters (i.e. temperature, rainfall, production loss etc...) The specific guidelines are as follows:

- Appraisal: country-specific assessment of an optimized adaptation-system by new and latest green or alternative technology options
- Innovation: building technology options to support sustainable future strategies and scenario evaluation on climatic parameters
- Assessment: country-specific green-growth co-efficient based on mathematical (or may be by laboratory) experiments.

(ii) Social-science module:

This module considers applicable solution points by examining the parameters from the science domain and Bangladeshn national accounts. Explicitly, this module will be involved in building of environmental Social Accounting Matrix (SAM) by utilizing the dataset of science module to economic analysis for long–run planning and policy. The specific guidelines are as follows:

- Database: building essential Social Accounting Matrix (SAM) for Bangladesh. This database will be involved by national economic parameters, agricultural production, and finally simulated data by science module on future scenario and preferences
- Method: utilize the TECH-ENERGY-DYSCGE framework for analysis on agricultural sustainability for future demand and preferences
- Economic analysis: short-term and long-term goals based on long-term sustainability visions, scenario studies, trend analyses and impacts
- Planning: back-casting forecasting approach and applicable solution points

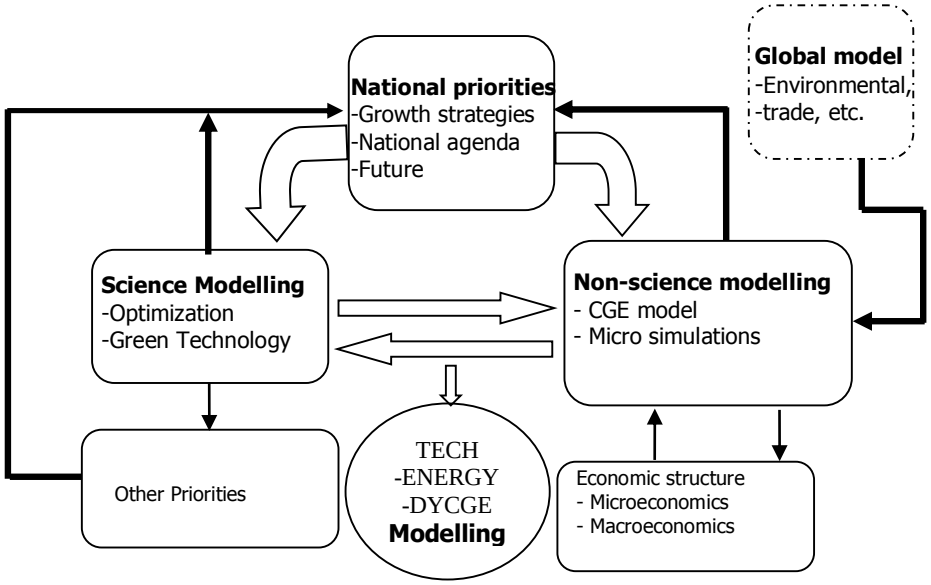

Fig. 1 Proposed module of research approach

Data and Capacity building

The benchmark model as TECH-ENERGY-DYSCGE approach is representing the baseline economy that requires a for the social-science module. In contrast, the specific assessment with an optimised system for the science module requires a non-linear simulation-based modelling with optimising experiments (i.e. laboratory test and experiments). As a long-term policy option, special consideration must be placed on capturing the changes in factors of production including re-structuring of national future thrust, agenda, structure of production in the overall economy, industry demand and preferences, green production demand, consumer demand and preferences, exports condition, household consumption, public (i.e. government) consumption, national investment, fixed capital investment, depreciation of capital, devaluation of exchange rate and other macroeconomic variables resulting from economic and environmental policy changes (Al-Amin et al, 2010).

RESULTS

The trends outlined in the TECH-ENERGY-DYSCGE approach, it should be recalled that our study is to evaluate within the scenario framework but to draw lessons at this stage of the research in matters relating to relevant technical support. Our proposed study will contribute to setting up a log-term climate change adaptation mechanism for applicable policy programmes and options, particularly on the issue of agriculture and food security. Our outcomes undoubtedly lead to granting a precautionary concern in designing climate change awareness, guiding extension subject matters and a fruitful result. More specific outcomes are mentioned below:

- Scenario-based long-term applicable adaptation model

- Proper policy alternatives toward suitable adaptation options in agriculture
- Policy implications for sustainable agriculture development, and
- Enhanced knowledge on future climate change impacts and better capacity building on the long run integrated economic development.

CONCLUSION

In order for climate change adaptation to be sustainable and applicable on a wide scale, it must be incorporated, integrated or "mainstreamed" into the policy apparatus of governments. Most climate change adaptation measures relate closely to, or directly overlap with, existing strategies, policies and programmes (e.g. agricultural development, food security, livelihood maintenance, resources management, risk management). A similar situation exists with climate change mitigation. There is an increasing demand to reduce net greenhouse gas emissions, even among developing countries who have historically not contributed to emissions and climate change. This translates into pressures and incentives to promote policies in order to reduce emissions of greenhouse gases from crop and livestock operations, to capture carbon in land use practices Within policy assistance for climate change adaptation and mitigation, the role of FAO includes assisting countries to identify potential options and to mainstream climate change responses in food and agricultural policies and programmes. Key features for integrating climate change adaptation and mitigation into agricultural development initiatives are that they fit within the development priorities and processes of the country and that they are accepted, supported and promoted by a wide spectrum of stakeholders, including government, civil society organisations. This integration process should be profiled to fit with the choices of the Government in question as well as with the degree of partner mobilisation using the following paths separately or jointly: (i) begin with policymaking as a driver; (ii) Promote local entry points to test and multiply pilot experiences which will help design adequate policies; (iii) encourage or facilitate donor initiatives to propose innovative projects; (iv) simultaneously promote mainstreaming at all levels with synergic effects of selfdynamic of local initiatives vis - à- vis public policies. An additional mechanism to scale up the integration process is to ensure that newly formulated and on going projects are promoting technical adaptation and mitigation options and tools down to farmers and beneficiary levels.

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