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An Analysis of Climate Change Effects on Bangladesh's Agriculture and Economy

Chapter 1 Introduction

As the intensity and frequency of climatic events are changing, global apprehensions on the effects of climate change are rising rapidly. Due to human activities, the level of greenhouse gas emissions has reached a historical peak, and it is presumed that even if the emission were eliminated now, another 1000 years would be required to reverse the climate change. ^[2] The world is now experiencing erratic climate volatilities which have severe implications on agriculture, and will still have to confront unprecedented hazards in the future. Most importantly, developing countries are more vulnerable in such situations, among which Bangladesh is a typical example. As a developing country, agriculture plays an essential role in its development, Bangladesh is recognized to be one of the most vulnerable countries to climate change. Thus, there is a vigorous need to find effective strategies and measures in order to cope with climatic threat. Also, the methods practiced and tested in Bangladesh may be instructive to the whole world, especially poor countries when confronting common challenge of climate change. ^[2]

Chapter 2 Agriculture in Bangladesh: current role and situation analysis

Agriculture remains the most essential sector in Bangladesh's economy, and the added value of agriculture accounted for 13.82% of GDP as of 2018. Around 70% of land in this country is used for agriculture. ^[1] A plurality in the country earn their living from it. As the largest employment sector in Bangladesh, agriculture has an overwhelming impact on macroeconomic objectives such as employment generation, poverty alleviation, food security, etc.

2.1 Pattern of Agriculture and Agricultural Sector

The main agriculture pattern in Bangladesh is the rice planting industry (monsoon paddy field agriculture), owing to the tropical monsoon climate, fertile soil, and the cultivable landscape. Crop farming is the main source of food for people in the country, providing food and nutrition security both across urban and rural area. Rice and jute are the primary crops in Bangladesh, which is one of the largest rice producers in the world. Rice, which is divided into three

categories (Aus, Aman and Boro), can be grown and harvested two or three times a year, and is grown on 10.5 million hectares across the country.^[8] Unfavorable weather conditions are responsible for the fluctuations of the rice production, while labor-intensive agriculture is beneficial to food grain production. Most of the cultivable land in Bangladesh is used to grow rice, but jute, wheat, mango, vegetables are also significant to its agricultural economy.

2.2 Irrigation source

The source of irrigation is derived mainly from canals and rivers. Bangladesh is located at the confluence of three mighty rivers ---- the Ganges, the Brahmaputra and the Meghna (GMB). The surface water resources are contained within the GMB basins which are also the physiographic characteristics of the hydraulic civilization. ^[7] While the country owns more than 200 rivers, these characteristics are associated with moisture availability, rainfall, and climate, ultimately making the country, which has no control of water flows and volume, sensitive to climate risks, including recurrent droughts and drastic flooding. ^[1]

2.3 Mechanization Level

Generally speaking, the country's machinery industry is relatively behind. The population in Bangladesh is around 147 million, increasing by 2 million people each year, while crop acreage is contracting by 0.49% each year. ^[9] The growing population also places an acute burden on food requirements and leads to food deficiency. Also, more and more labor force is shifting from agriculture to other industries, thus, making mechanization and modernization even more important. Through years of endeavor, the mechanical rate of Bangladesh's agriculture has reached 90%. However, the rate is lower than 1% in mechanization of harvesting and transporting. ^[9] Plus, most of its agricultural machineries are imported, and most of its producers at home are small workshop enterprises.

2.4 Vulnerabilities to Climate Change

However, because of the geographic settings, along with low level of preventing and fighting natural calamities, widespread poverty, increasing population density, and the lack of fund, Bangladesh is regarded as being highly vulnerable to natural disasters and climate change, including annual flooding, cyclones, sea level rise and so on. In the 2017 edition of Germanwatch's Climate Risk Index, Bangladesh was suspected as the sixth country hardest hit by climate calamities of 180 nations during the period from 1996 to 2015. ^[7] All these circumstances make it a necessity for Bangladesh to deal with climate change and improve agriculture production efficiency as well. Also, as a least developed country (LDC), Bangladesh's response and experience, could mean a lot to other nations, especially other

LDCs, on the way to coping with the universal challenge.

Chapter 3 Effects of Climate Change

The impacts of climate change in Bangladesh are giving rise to more and more attention. Increasing crop yield owing to the increased raised carbon dioxide levels in the atmosphere would slightly neutralize the negative effects but only in the short term. And it is suggested by climatic predictions that Bangladesh will have to confront more acute and frequent climatic events as a result of climate change in the future. Thus, challenges brought by climate volatilities are still vigorous. Concrete representations are as follows.

3.1 Rainfall and Temperature

Fluctuating rainfall patterns and devastating temperature rise have been reported in Bangladesh. Over the last four decades, the mean daily temperature has increased by 0.103°C per decade. The increasing temperatures enhance evapotranspiration which changes the annual and seasonal variability of rainfall along with its spatial distributions. Predictions point out a potentially continuous increase in temperature by 1.4°C by 2050, and 2.4°C by 2100.^[3] The maximum temperature is found to affect the yield and cropping area of both rice and wheat negatively, and only the Aman variety of rice is affected by rainfall. In fact, effects on the three rice varieties differ. Maximum temperature affects Aus and Aman rice positively while Boro rice negatively. ^[3] Although development has been achieved in farm production technology, temperature and rainfall still play a crucial part in influencing crop production, along with the rural income and food security.

3.2 Sea Level Rise and Cyclones

Bangladesh lies in low-lying coastal regions, for which it is highly vulnerable to sea level rise and cyclones caused by global warming. The World Bank recognized Bangladesh as a hotspot in the world for effects from sea level rise. ^[7] Estimates predict that by 2050, sea level rise could affect at least 3 million people. The worst scenario indicates that Bangladesh could lose up to 25% of its land. A sea level rise of 10cm by 2020, 25cm by 2050, and 1m by 2100 would respectively affect 2%, 4% and 17.5% of the total land mass in Bangladesh, according to estimates given by the World Bank. ^[3] The coastal area of Bangladesh is also affected by cyclones, which are the most dangerous natural calamity in Bangladesh among all. The cyclones of 1970 and 1991 destroyed the whole national economy and were regarded as the most devastating cyclones in the history of Bangladesh, whose consequences on lives and livelihoods have also been catastrophic. It was estimated that financial losses and damages from the cyclone Sidr in 2007 amounted to 167 billion dollars, while the cyclone in 2013

adversely affected thousands of people's lives. ^[1]

3.3 Migration and Displacement

Due to reduced water gradients, higher rainfall in the Ganges-Meghna-Brahmaputra (GMB) river basins, and the melting of glaciers in the Himalayas, a growing number of floods are identified as the main reason for migration in Bangladesh. ^[7] Drought takes responsibility for displacement while the rising sea levels and cyclones are the main cause of migration in the South. By 2013, 6.5 million people had already been displaced since arable land is eroded and other income opportunities are destroyed, and even worse, the livelihood patterns of some whole families are disrupted. Poor and other vulnerable population groups have been affected disproportionately. ^[1] Dhaka as well as local urban centers are mostly the destination of migration, which leads to an increased pressure on urban infrastructure and services, especially around health, education and creates a heightened risk of conflicts. ^[8]

Chapter 4 Adaptation and policies

4.1 Solutions to Cope with Extreme Weather Events Confronting the threat of climate volatilities, measures have been taken by both the government and grassroots in Bangladesh, dealing directly with floods and drought, achieving higher mechanization level, and improving production and efficiency.

At the governmental level, some measures have been adopted to cope with extreme weather events, including establishing specialized institutions for meteorological disaster governance, formulating climate response plans, using structural means for disaster prevention, and developing environmental education.

4.1.1 Establish Specialized Institutions

The National Disaster Relief Commission (NDRC), under the leadership of the Prime Minister, is the highest organ for formulating disaster relief policies and inspections. The Ministerial Coordinating Committee for Disaster Management (MFDM), with the support of the NDRC, is responsible for implementing the policies and decisions it has formulated. The Ministry of Environment and Forestry is also an important sector in addressing climate change challenges, which includes international negotiations. Also, it has established 34 grass-roots emergency network centers to address climate change in different government departments, research institutions and relevant organizations. ^[6]

4.1.2 Formulate Relevant Climate Response Plans

The government also actively supported the Bali Plan, which was presented by the United Nations Framework Convention on Climate Change (UNFCCC) at the 13th Conference of the Parties in December 2007. A series of action plans to safeguard future climate security have been identified. As a response to the Bali Plan, the Government of the State of Yugara promulgated the Bangladesh Strategy and Action Plan on Climate Change (BCCSAP) in 2009.^[8]

4.1.3 Use Structural Means For Disaster Prevention

Bangladesh mainly adopts structural methods in the implementation of flood control projects, which means being based on the perspective of engineering technology and emphasizing structural vulnerability. The government has invested heavily in flood control, drainage projects, and other strategies such as preventing floods by dredging and surrounding the sea with embankments.

4.1.4 Develop Environmental Education

The government of Bangladesh has carried out environmental education in relevant institutions and has established various environmental education centers, particularly universities and research institutions. They respond immediately to emergencies and mobilize people to save themselves and rebuild after disasters, control the vitality of disasters and disaster-prone areas, provide feasibility forecasts for potential disasters,

4.1.5 The Try of Organic Floating Beds

Except for actions from the government, the social level, peasants have also taken experiment of the organic floating beds in order to alleviate the negative effects of natural disasters. Owing to the severe flooding, some low-lying inland areas lose agricultural productivity in rainy season, and villagers are forced to migrate. Fortunately, with the joint efforts of experts and grassroots, soilless agriculture has gained some benefits. Local villagers make organic floating beds of straw, water hyacinth and some water plants, and then use them for planting crops, flower seedlings, etc. The yield is approximately 10 times as much as that of traditional farming. Due to the rich nutrition of organic floating bed, it can also be transformed into organic compost, thus realizing the secondary utilization of resources. At the same time, this labor-intensive farming method also provides jobs for villagers.^[5]

4.2 Improve the Level of Mechanization

To improve the level of agricultural mechanization, the Bangladesh Ministry of Agriculture has implemented a number of projects, such as the ongoing National Agricultural Mechanization Project, which provides 70% subsidies for the use of agricultural machinery equipment in remote and coastal areas, 50% subsidies for other areas.^[9] The government also plans to reduce import tariffs on parts of agricultural machinery and equipment to create favorable environment for the establishment of agricultural machinery production and assembly plants in Bangladesh.

Chapter 5 Recommended Solutions

Climate change is a global challenge that will exist in the long term. The negative effects on agricultural production, threats to food security and people's livelihood are particularly prominent in some regions. Bangladesh and other developing countries with weak economic base and national economy that depend on agriculture have to take effective measures. They need to strengthen macroeconomic control, and realize mechanization and agriculture intelligence, in the interest of improving productivity and offset the loss caused by climate change.

5.1 Improve Non-structural Strategic Projects

In low-income countries like Bangladesh, non-structural strategic choices are equally important compared with structural actions. This requires emphasis in the vulnerability in both structure and society, and pay attention to the both disaster reduction and improving people's daily life.^[6] Such measures could consist of strengthening the construction of meteorological forecasting system, improving the supervision system at all levels, carrying out all-round monitoring of dangerous situations and timely alarm, making rational use of land, encouraging the cultivation of flood-resistant crops, preventing deforestation and reducing groundwater runoff, etc. These non-structural governance strategies need less investment and can give quick results, which is conducive to mobilizing more people to participate in disaster prevention and mitigation.

5.2 Improve Infrastructure

To adapt to threats from frequent flooding rainfall, Bangladesh may need to develop rainwater storage,

turn to build water-permeable pavements. Through the application of pervious material, the water-permeable pavement can play the role of flood water management. The main structural layers of water-permeable pavement may include permeable surface layer, permeable base layer, cushion layer and soil foundation. Rainwater enters into pervious base through the holes of pervious surface layer, and then slowly penetrates into the cushion layer. As a drainage base, the permeable pavement is likely to release the floodwater into the soil foundation and then to the municipal water storage system.

The use of household rain barrels may also storage surplus rainwater for dry seasons and other use. To promote a wide use within ordinary families, the government needs to set up an incentive system to encourage the appliance of the new devices. For example, the government can subsidize the families that are willing to use rain barrels. It can also cooperate with relevant companies and manufacturers which can support community organizations to propagandize the advantage and necessity of this new devise.

Rural area is in extremely urgent need of infrastructure improvement. Traffic and roads need dredging so that large agricultural machineries can have access to the cultivated farmland and thus, achieve large-scale mechanized operations to improve efficiency. The government may also need to take stronger steps for the provision of approximate and timely irrigation facilities to farmers, which may include subsidized tube-wells, building of dikes and dams, and ground water management.

5.3 Accelerate the Agrarian Reform

Facing a shrinking farm size, land and/or tenurial reforms measures aimed at land consolidation as well as smooth functioning of the land rental market will increase agricultural production and efficiency. Simultaneously, efforts for enhancing efficiency particularly at the small farm holdings, through approximate technologies and improved multi-dimensional market linkages should be prioritized, as land reform initiatives take time and may not be adopted at all levels.

5.4 Cereals Diversification

Confronting insufficient domestic supply of cereals cause by the negative impact of climate change, Bangladesh needs to increase the cultivation of high-yield crops. For example, wheat and maize have both experienced explosive growth over the past few decades compared to Boro rice ^[2]. However, rice is the most widely-grown cereal in Bangladesh, indicating that the country needs to grow more maize and wheat to get higher output. More excitingly, production efficiency of maize and wheat at the farm-level is significantly higher than rice, which means that this policy might be accepted by local peasants easily. Non-cereals also contribute to the production, and the Government of Bangladesh is eager to diversify the agricultural sector by

replacing rice with other nutritional crops.

References [1]Md. Shakhawat Hossain. Economic impact of climate change on agriculture in Bangladesh 气候变化对孟加拉国农业经济的影响, P467;F335.4 [2]Sanzidur Rahman, Asif Reza Anik. Productivity and efficiency impact of climate change and agroecology on Bangladesh agriculture, Land Use Policy 94 (2020) 104507 [3]Mohammad Shakhawat Hossain, Muhammad Arshad, Lu Qian, Minjuan Zhao, Yasir Mehmood, Harald Kächele. Economic impact of climate change on crop farming in Bangladesh: An application of Ricardian method, Ecological Economics 164 (2019) 106354 [4]吴雨伦. 水上学校:孟加拉国学生的“诺亚方舟”, 2015年9月1日《文汇报》 [5]赵月琴 孙奎法 卢剑波. 孟加拉国的无土农业技术,世界农业 2005.8(总 316) [6]雷鸣. 孟加拉国的气候灾害及其治理, South Asian Studies Quarterly No.4 2012 [7]Hulme, Mike. "Concept of Climate Change, in: The International Encyclopedia of Geography". *The International Encyclopedia of Geography*. Wiley-Blackwell/Association of American Geographers (AAG). Retrieved 16 May 2016. [8]Riches, Charle. "Enhancing Rural Livelihoods Need Not Cost the Earth". *Pettra-irri.org*. Archived from the original on 28 September 2007. [9]Economic and Commercial Office of the Embassy of the People's Republic of China in the People's Republic of Bangladesh, 孟加拉农业现状及其发展前景 from: <http://bd.mofcom.gov.cn/article/ztdy/201705/20170502583321.shtml>