

# **Diverse Perspectives on Governance in Asia**



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Edited by  
**Ahmed Shafiqul Huque**  
**Aka Firowz Ahmad**



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## **Diverse Perspectives on Governance in Asia**

**Ahmed Shafiqul Huque  
Aka Firowz Ahmad**

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*Dedicated to our teachers*



## Preface

The book ‘**Diverse Perspectives on Governance in Asia**’ is the compilation of selected research papers presented in the Insearch 2016: 3<sup>rd</sup> International Integrative Research Conference on Development, Governance and Transformation, held in Bangladesh Academy for Rural Development (BARD), Comilla on 27-28 December 2016. The conference was jointly organized by Netinsearch International -Network for Integrative Research, GAIN (Governance and Administration Innovation Network) International, Centre for Administrative Research and Innovation (CARI), University of Dhaka, Bangladesh Academy for Rural Development (BARD) and the Stamford University Bangladesh.

The term governance has various perspectives and focuses on numerous issues. Governance manages the functions and moves forward to solve the socio, economic and political issues of the society. It also recognizes the public choices and integrates them with the policies. There are substantial researches on governance issues. The research based papers included as the chapters of the book focus on political commitment, land reform, rural development, social entrepreneurship, remittance, productivity, global market, eco-tourism, forest conservation, climate change, climate change and farmers’ responses. These researches were conducted on the various issues of Asian countries including Bangladesh, Korea and Nepal. We hope this book will be an added knowledge in the governance scholarship and will tremendously help to shape the knowledge of academician, practitioners and researchers.

We remember the significant contribution of Professor Dr. M. A. Hannan Feroz, Founder of Stamford University Bangladesh. It is really very shocking for us that Professor Dr. M. A. Hannan Feroz suddenly left us forever on October 29, 2017. We pray to almighty to grant peace for his departed soul.

A group of young teachers and researchers including Khandakar Al Farid Uddin, Md. Mamunur Rashid, Md. Al-Ifran Hossain Mollah, Abdur Rahman, Md. Jahidul Islam, Md. Mansur Hossen and Mohammad Joynul Abedin who worked hard in preparing, formatting and printing the manuscript in book form. We express our gratitude to them. Thanks are due to Osder Publications for publishing, distributing and marketing this book.

Since we could not devote sufficient time for editing and proofreading, there might be some inadvertent errors as well as scope for corrections and development. We admit our responsibility and limitations, and hope to overcome the shortcomings in future editions with feedback and advice from the readers.

Editors





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## Contributors

*Niraj Acharya*, Research Scholar, Tata Institute of Social Science, Deonar, Mumbai, India. Email: nrj.acharya@gmail.com

*Lee Misook*, Assistant Professor, Park Chung Hee School of Policy and Saemaul Yeungnam, University, R.P Korea. Email: misook@yu.ac.kr

*Syed Salah Uddin Ibne*, Deputy Director, Bangladesh Academy for Rural Development (BARD) Comilla, Bangladesh. Email: syed\_bard@yahoo.com

*Iftekhhar Ul Karim*, Lecturer, University of Liberal Arts Bangladesh, Dhaka, Bangladesh. Email: iftekhar.karim@ulab.edu.bd

*Muhammad Mueen Uddin*, Research Assistant, Centre for Administrative Research and Innovation (CARI), University of Dhaka, Dhaka, Bangladesh. Email : mueendu@gamil.com

*Mohammad Joynul Abedin*, Research Assistant, Centre for Administrative Research and Innovation (CARI), University of Dhaka, Dhaka, Bangladesh. Email: joynul.edu@gmail.com

*Abdullah Al Rana Farhad*, Senior Consultant Rajesh Bheda Consulting Pvt. Ltd, Dhaka, Bangladesh. Email: ranafhrd@gmail.com

*Md. Shahadat Hosen*, Project Coordinator, Society for Health Extension and Development Cox's Bazar, Bangladesh. Email: shahadat59@gmail.com

*Abdul Mannan*, Program Officer, Arannayk Foundation, Dhaka, Bangladesh

*Zobayer Ahmed*, Faculty, Dept. of Economics & Banking, International Islamic University, Chittagong, Chittagong, Bangladesh. Email: [ecozobayer@gmail.com](mailto:ecozobayer@gmail.com)

*Muhammad Abdullah*, Assistant Postmater General, Head Post office, Comilla, Bangladesh. Email: mabdullahapmg@yahoo.com

*Utpal Kumar De*, Professor and Head, Department of Economics, North-Eastern Hill University, Shillong, 793022, Meghalaya, India. utpalkde@gmail.com

## Editors

### **Ahmed Shafiqul Huque**

Professor and Chair., Department of Political Science  
McMaster University, Canada

### **Aka Firowz Ahmad**

Professor, Department of Public Administration  
Chairman, Center for Administrative Research and Innovation (CARI)  
University of Dhaka, Bangladesh.



# 1

## **Development Strategies and Potentials in Asia**

**Ahmed Shafiqul Huque**

### **Concept and Strategies of Development**

Development has been the subject of research for over half a century, but there has been no success in defining the concept and determining strategies for attaining it. There are debates regarding the methodology for classifying countries into developed, undeveloped or developing, although the points of distinction remain unclear. As the literature is dominated by contributors from the Western world, the process of development appears to be a transition from a country's current state to that of developed countries. In other words, development is presented as the combination of efforts that will change a country into high income, industrialized, democratic and capitalist political units. This idea may not be acceptable as it implies the destruction of indigenous practices and traditions that have served communities in the developing world for centuries.

However, advancement of knowledge and understanding of the consequences of moving to a state similar to political, social and economic arrangements in the West have persuaded analysts to reconsider this approach. The creation of the human development index by the United Nations reflect acknowledgement of the fact that traditional indicators such as per capita income, gross national product, rate of literacy, favourable balance of trade and industrialization do not contribute to the ends that development is expected to facilitate. Instead, attention shifted toward human health, social security, peace and potentials for self-realization of citizens in societies free of inequality, discrimination, exploitation, and injustice instead of concentrating on an affluent lifestyle with access to all the amenities of modern society. Therefore, it is necessary to rethink about the goals of development, and the strategies that can be applied to that end.

Whether the goal involves a transition to the Western model or designing a new system to strengthen the positive indigenous lifestyle, it is important to devise a set of strategies for arriving to the desired state.

The discussion draws upon the various models of development that have had considerable impact on thinking on the topic. The origin of development can be traced back to the competition between capitalist and socialist states to persuade poor countries to join their camps by offering assistance with development. While financial and technical aid was needed by the developing countries, the ideological aspect remained prominent and fuelled much of the competition during the Cold War.

Apart from the ideological divide, the debate on strategies of development touched upon the issue of comprehensive and sectoral efforts to achieve this end. Many countries have performed remarkably well in certain sectors such as industry, agriculture, communication and particularly in economic development. However, sector based development can be criticized for concentrating efforts in designated areas while putting other important areas at risk. The Newly Industrializing Economies of Asia (Hong Kong, Republic of Korea, Singapore and Taiwan) received commendation for their remarkable performance in developing the economy at the cost of lagging behind in the sectors of political and social development (See Huque 1996).

The counter argument would be that developing countries do not have the capacity to attempt comprehensive development. It would involve massive investments in infrastructure, development and distribution of social services, advanced technological facilities and, more importantly, a stable political system with leadership to guide the transformation. Faced with the dilemma of selecting strategies for development, most countries opted for to emulate policies by imitating the political and institutional arrangements that operate in developing countries.

A brief recapitulation of the impetus to development and its interpretations will facilitate a discussion of relevant strategies and potentials for success. After the conclusion of the Second World War, the “colonial powers began to accept the need for social and economic development and even the reality of political independence in their territories, and this acceptance was partly the result the result of growing pressures for development and independence from the citizens of those countries” (Conyers and Hill 1984, 24). Thus, there was a demand among the citizens of the developing world and an intent to reciprocate from colonial powers that could have arisen from the guild of long periods of exploitation and oppression or an acceptance of the realities of the new world order.

Around that time, development was considered largely synonymous with industrialization and its ultimate goal was to raise income and give poor people access to a range of goods and services that was widespread in developed societies (Rapley 2007, 1). Apparently, it was believed that

only industrialization could lead to development, regardless of the degree of affluence a country attained through agricultural productivity. Diverse perspectives can be detected in the literature on the concept and process of development. Berger (1976) described development as a process by which poor countries become rich, and this appeared to be the key point of distinction between developed and developing countries. Esman presented a narrow view of development as "the rational process of organizing and carrying out prudently conceived and staffed programs or projects" (1966, 95), and Riggs described it in terms of "rising gross national product or increasing per capita income" (1966,230).

As the process of development progressed, other aspects of development began to be noticed. Siffin (1966) emphasized economic development that would facilitate goal-setting and allocation of resources. Diamant (1966) pointed to the need for focusing on the political aspect of development for enhancing the capacity to sustain new types of social goals. Midgley and Hall (2004) highlighted the social aspect and argued for development in terms of dynamic and change-oriented inclusive approach for promoting redistribution and wider dissemination of benefits. "Development denotes a major social transformation, a change in system states, along the continuum from peasant to pastoral to industrial organization. The assimilation and institutionalization of modern physical and social technology are critical ingredients. These qualitative changes affect values, behavior, social structure, economic organization and political process" (Esman 1966, 59). This view demonstrates the vast scope of development that continues to influence thinking on development.

Later, the United Nations Development Program (UNDP) elaborated on the objectives of development that helps understand the concept. "The basic objective of human development is to enlarge the range of people's choices to make development more democratic and participatory. These choices should include access to income and employment opportunities, education and health, and a clean and safe physical environment. Each individual should also have the opportunity to participate fully in community decisions and to enjoy human, economic and political freedoms" (UNDP 1991, 1).

Thus, a formidable section of development analysts subscribe to the idea that enhancing economic capability is an essential element of development. The chapters in this volume seek to present cases and arguments for improving economic conditions through land reform and redistribution, rural development and participation, social entrepreneurship, remittance governance, and efficient management techniques in Bangladesh, India and Nepal. They also offer ideas on

promoting eco-tourism and strategies for dealing with the challenges of climate change. The objectives are to include the landless and poor farmers in the political mainstream, encourage villagers to become self-reliant, allow opportunities to the poor to initiate social enterprises, utilize resources through remittance efficiently, enhance competitiveness of garments exporters in the global market, increase revenue from tourism, and assist farmers to cope with climate change. The following section provides an overview of the chapters and their main points.

### **Organization of the Book**

Poverty in most developing societies emanate from the inequitable ownership of land where a tiny powerful section retains control over vast tracts while the majority remains landless. Naturally, land reform has been highlighted as an essential first step for promoting development to replace the traditional pattern of distribution of this valuable resource in society. Niraj Acharya identifies landlessness of a large number of the population as one of the principal reasons for poverty in Nepal. Redistribution of land can have other beneficial effects including increased agricultural productivity and tenancy rights for farmers. The author finds linkages between land reform and politics because one influences the other. It is, therefore, not surprising that the degree of political commitment is influenced by several factors including the result of power struggle between the elites and peasants and this can be attributed to the lack of success of reform policies.

Drawing upon the history of the land tenure system in Nepal under monarchical rule, Niraj Acharya reviews the performance of several regimes and finds that political movements did help change the political structure, but commitment by the new republican regime will be critical for implementing substantial changes in the land tenure system to facilitate the process of development in Nepal. He notes that power in Nepal resides with elites who have close relationships with the palace, military and bureaucracy. Successive governments failed to implement land reform policies, mainly because incoming governments did not ensure continuation of policies initiated by previous regimes. Land reform in Nepal will be able to usher in changes in the status of the poor and power relationships. It also has the potential to eliminate the domination of one class over another. This presents a major challenge for the country and requires full political commitment from a stable and democratic government.

Some countries opted to promote development through introducing changes in the rural society where most of the population lives and supports an economy based on agriculture. Lee Misook and Syed Salah Uddin Ibne use two cases from the People's Republic of Bangladesh and



Republic of Korea to illustrate this point. The *Comilla* and *Saemaul Undong* models were introduced with the objective of transforming rural communities into modern villages through creation of infrastructure and provision of inputs for agriculture in Bangladesh and Korea respectively. Both programs were participatory in nature and intended to create the basis for development by reducing poverty initiating income generating projects to improve living conditions in the rural societies.

A comparative analysis of the two cases reveals interesting points on their institutional frameworks as well as relative success and failure. The authors find that the Comilla model has been beneficial as a learning experience and strongly influenced the rural development process in Bangladesh. A decentralized approach has helped address problems of low productivity and unemployment in the rural areas. A prominent feature of this model is the organization of villagers and their participation in development programmes. In South Korea, the Saemaul Undong has been successful in transforming villages and changing the mindset of rural inhabitants. The authors conclude that the success of the two models suggest that different strategies can succeed in promoting rural development.

Poverty is a major obstacle on the path to development, and analysts continued their search for strategies to address this problem for decades. Iftekhar Ul Karim highlights the potential of social entrepreneurship as a tool that could contribute to reducing the gap between the rich and poor by helping the latter to improve their economic standing. The author draws upon the extensive literature on social entrepreneurship and relates the classical perspectives to contemporary ventures and uses empirical research to contribute to theoretical knowledge.

The chapter contributes a typology for helping understand the core concept of social entrepreneurship through a wide variety of perspectives. They include perspectives related to knowledge-base and resource-base, social capital, social learning, planned behaviour perspective and cultural dimensions. Iftekhar Ul Karim recommends use of this typology in future research on social entrepreneurship and adopting a cross-disciplinary approach.

In recent decades, some developing countries have adopted a strategy of developing human resources for export to affluent parts of the world. This group would be able to earn valuable foreign currency to strengthen the economy. At the same time, there is concern over the utilization of the money that is remitted to the country by the large number of overseas employees. Muhammad Mueen Uddin and Mohammad Joynul Abedin acknowledge the benefits of remittance as it helps in building foreign currency reserve, stabilizing exchange rates and facilitating balance of

payments for trade. Moreover, it serves another important purpose of reducing poverty, increasing the purchasing power of families receiving remittance, and encouraging entrepreneurship among them.

Based on primary data collected from a village in Bangladesh, the authors present an analysis of the use of remittance by the families of overseas workers and note that the expenditures are made mostly for household needs and consumption. They argue that remittance income has not contributed to economic growth as expected and attribute the problem to the lack of specific policies for putting remittance to productive use. The problem is exacerbated because there is no coordination among the various agencies of the government that are responsible for streamlining the process of sending workers overseas to earn remittance and utilizing it for contributing to social and economic development.

The steady growth of the economy of Bangladesh is attributed to the readymade garment industry as one of the main drivers. Over the years, Bangladesh has emerged as the second major exporter and dominates the readymade garment markets across the globe. Abdullah Al Rana Farhad reviews the style of management in the readymade garment industry and finds substantial discrepancies between the various levels. He expresses particular concern over the lack of modern techniques and considers this weakness to be a major drawback for competing at the global level.

The chapter discusses various issues related to planning and evaluation of performance, and recommends placing emphasis on the core idea of 'productivity' instead of 'production'. The author demonstrates the distinction between the two ideas by considering the flow of work, methods of calculating production and output, and other efficiency measures. Abdullah al Rana Farhad recommends adoption of a globally practiced system and using productivity as a key performance indicator. He calls for reviewing the goals of business, ensuring effective performance evaluation and determining the capacity of factories before marketing products. These steps are expected to result in a higher volume of export and profit and eventually contribute to development of the country.

Development can also be promoted by earning revenue through programs of tourism that attracts visitors to a country. In most cases, an excessive number of tourists results in depletion of natural resources and degradation of the environment. Md. Shahadat Hosen, Abdul Mannan and Zobayer Ahmed argue that it should be possible to promote tourism in an environmentally friendly manner, and discuss the prospect of eco-tourism in the Inani natural forest in Bangladesh. They present a plan for inviting tourists to enjoy the natural splendour of the forest along with an

opportunity to experience the lifestyle of the indigenous Chakma people. Participation in local festivals, observation of the creation of local arts and crafts, and experiencing life in the hills will contribute to the development of eco-tourism in Bangladesh in an environment-friendly manner.

The authors make another important point on the potential role of eco-tourism in diverting the local population from the layered method of cultivation. The *jhum* method of agriculture has devastating impact on nature because it involves slashing and burning of the hills after a few years of cultivation. This practice affects the environment and diminishes fertility of the soil. Hosen, Mannan and Zobayer believe that promotion of eco-tourism will strengthen the local economy by opening up opportunities for the community. Increase in income will encourage the indigenous people to adopt a non-forest based alternative source of livelihood. Development will be sustainable and bio-diversity protected while providing economic benefits to the community and the country.

Climate change has affected life in many ways in the contemporary world. Bangladesh is identified as a highly vulnerable country in this regard. Muhammad Abdullah discusses the potential impact of climate change on the life of citizens in the face of severe damage to crops, flora, fauna, ground and surface water and the environment in general. Agricultural productivity declined due to salinity in the soil, and is a major threat to food security for the nation. In addition, climate change turns people into refugees as river erosion and destruction by tornadoes force people to leave their home, in addition to incidences of economic hardship as they are unable to earn a livelihood from their land.

The author makes a strong case for raising awareness among the people at risk in order to inform and prepare them to deal with this major threat. He argues that addressing the challenge of climate change entails the development of a set of infrastructure consisting of transportation facilities and cyclone shelters and also recommends for the establishment of effective warning systems and facilities for relief (cash and/or kind) for the affected people. Muhammad Abdullah recognizes that substantial financial and technological support from the international community is extremely important for dealing with climate change. He reviews the policies for adaptation to climate change and argues that this global challenge requires close attention from governments, policy makers and the international community.

Development has to proceed in spite of the challenges presented by climate change. Utpal Kumar De considers the impact of climate change and responses by farmers in Northeast India. He studies the pattern of climate change, its impact on agricultural productivity and the response of farmers towards changing climatic conditions in the state of Assam. Agriculture suffers the most from climate change as the incidence of flash

floods and draughts increase and present hindrances to agricultural activities and productivity. This underlines the importance of adaptive behaviour on the part of farmers who are affected by loss of crop with their livelihood at risk. Farming activities are impeded by too much water or draught, crop is lost and often marketing becomes untenable due to damaged infrastructure and communication facilities.

The most common pattern of adaptation is the practice of mixed farming and crop diversity. Other options, such as use of flood and draught resistant seeds and insurance for crop, are not available to the poor framers who are the worst affected by climate change consequences. The author finds that education is a useful tool for enhancing the capacity to adopt new technology and help them deal more efficiently with this challenge. He suggests that fertility of the soil can be increased by rotating and restructuring the existing sequence of crops and staggering the harvesting time. The extent of devastation of climate change can be reduced through irrigation management and improved crop varieties to prevent economic loss. Finally, Utpal Kumar De recommends state support to farmers for generating long-term and location-specific adaptation strategies and emphasizes attention to social, economic and technical dimensions to facilitate development in the face of challenges from climate change.

It is not surprising that several chapters in this book analyse issues that have the potential to contribute to the economy. The authors propose strategies for promoting development and allowing the marginal population to benefit along with the country. This is consistent with the

### **Concluding Observations**

Development was considered as economic growth, evolution of political institutions, or the mobilization of the masses for modernization. The concept of development has undergone repeated revision and redefinition and has become much more complex. It is no longer restricted to the growth of the economy and enhancement of purchasing power of the people. Instead, the focus has shifted to the process of people-building. Earlier, development was principally concerned with the construction of infrastructure which involved the allocation of public funds to particular localities and could open up scope for corruption. Eventually, it was realized that concentrating on the financial aspect of development provides an incomplete picture and human resources are the most important component in this process (Huque 1995, p. 282).

A number of other areas have also bene recognized over the decades. The literature on development has been enriched with inclusion of analyses of its relations to ethics, gender, human rights, environmental concern, migration, security and similar issues that have captured the imagination of analysts. This calls for a multidimensional approach and “development is now an aggregation of multiple goals and functions that

go beyond economic considerations” (Zafarullah and Huque 2012, p. 45). Goulet argues that “ethical judgments regarding the good life, the just society, and the quality of relations among people and with nature always serve, explicitly or implicitly, as operational criteria for development planners and researchers” (1997, p. 1161). These are important points, but governments need to establish priorities with reference to their current state of development, capacity to plan and implement programs, and perform routine tasks of governance along with promoting development. Therefore, the contributions to this volume should help identify potentials for development and formulate strategies to improve living conditions in both urban and rural areas in the countries.

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# 2

## **Political Commitment, Land Reform and Transition in Nepal**

**Niraj Acharya**

### **Introduction**

Landlessness among a large segment of the population is one of the principal reasons for poverty in most developing countries. Thus, one of the most important political-economic issue these poor countries must confront is perhaps the agrarian question (Byres, 1986) arising from the landlessness of majority of the population. In countries where technological advancement and industrial development are still at a primary stage, agricultural production helps to contribute to the nation's GDP, although unequal distribution of land lowers agricultural productivity considerably and remains far from the desired level. One strategy of reducing poverty in countries where a large number of the population is dependent on agriculture could be through substantial increase in the proportion of farm land controlled by the poor (Lipton, 2009).

There are various theoretical frameworks through which scholars have examined land reform. In the 1960s, land reform was inspired by Marxian economic analysis where it was regarded only as redistribution of land from those who have excess holding to those who have none. However, along with the development of the neo liberal economic theory in the 1980s, land reform began to be seen as not only the redistribution of land but inclusion of the approach of market or technology towards the agriculture as well. Tai (1974) defines land reform as the redistribution of land holdings, but he excluded measures such as agricultural research, extension, credit, marketing and the like. According to him, land reform should primarily be seen as the means of redistribution of asset, i.e., land from those who have large holdings to those who have none or almost nothing required for basic survival. The introduction of policies and measures for advancement in agriculture would be targeted for increasing agricultural production, but land reform should primarily focus on the redistribution of land or securing tenancy rights to address the key problems of land less people. Raup (1963), however, defined land reform as the full range of measures that may or should be taken to improve the structure or relations among men with respect to their rights in land.

Therefore, some of the major characteristics of land reform should be ensuring ownership to the cultivators and reduction of absentee landlordism, provision of secure tenancy rights, fragmentation or parceling of the large land holdings, cooperative/collective agriculture for small pockets of land, and improving land registration and documentation practices. Raup argued that land reform should be initiated as a process and while the redistribution of land to the landless is primary goal, a complementary act should include advancement of the agriculture by introducing new measures and innovations such as technology, credit facility, and cooperative farming.

### **Land Tenure in Nepal**

Agriculture has always been the backbone of the economy of Nepal. At present, agriculture contributes to 33% of GDP and over 70% of the people are employed in this sector (UNDP, 2014). However, Nepal has always lagged behind in formulating policies on agricultural reform. With strong roots in the feudal structure, agrarian reform in Nepal is being affected by ineffective implementation of policies, unstable political dynamics, complex geographical structure and lack of capital. Although more than 65% of labor force are engaged in agriculture (UNDP, 2014), Nepal is highly vulnerable to food insecurity and remains dependent on India and other donor agencies for food. Land in Nepal is a basis of survival, means of identity, source of culture and foundation of social recognition (Upreti et. al, 2008). However, the pattern of land distribution reflects its feudal nature with the major share held by the monarchy and their selected elites. Out of the total land area, only 18% is arable (Shrestha, 2008) among which 37% are owned by just 5% of population (Sharma et.al, 2014). According to an UNDP report (2004), the land ownership among dalits (so called untouchable caste in Nepalese society) is minimal. 15% of hill and 44% of Terai dalits are landless making them vulnerable to food scarcity and economic deprivation. Beside the uneven distribution of land, agriculture in Nepal is also characterized by a high level of absentee landlordism, large areas of underutilized farmland and poor economic condition of tillers (Willy et.al, 2009).

In the early days, Nepal was settled by migrants and hill tribes sharing different culture and socio economic structure. By the middle of the 18th century, it was already divided into about sixty principalities (Regmi, 2014). They were primarily Baise and Chaubise Rajya in the western part, Makwanpur in the south, Vijaypur in the east, Kathmandu principalities consisting of Kantipur, Badgao and Patan and Gorkha. Although these principalities had different tribal and cultural groups, they shared the same type of socio-economic structure and land was the major economic resource for them. They followed the similar structure of land



holding and the state was the primary owner of land in all principalities. Although it was not the primary source for accumulation of power, land was the instrument through which rulers would hold exercise control over powerful people. The land was then distributed to the close relatives of the royal family, military elite, and people who held important religious positions in the society in the form of different land grants. This pattern of land distribution resulted in the development of a certain structure of land holding in that period, and it still determines the agrarian condition of Nepal. The ownership of land was within the states or, more specifically, within the palace in all principalities before unification. In fact, the major form of land tenure that started in the 5<sup>th</sup> century was followed until the 20<sup>th</sup> century, and these tenures were practiced to retain control by the palace or the rulers.

Economic structures and relationships are strongly influenced by the political and social setting of a country. In Nepal, the economy has been structured through prolonged periods of kinship based rule, i.e., mainly through links to the palace and for a century by Ranas, and the social structure based on caste hierarchy which is highly stratified even at present. Land is generally the basis of the economy in developing countries like Nepal. It has also been the major source of power for the ruling class. Hence the ruling class have always used land to promote their own interests, and this has shaped the economy of the country which into semi-feudal, non-agrarian and non-industrialist and backward system. The land tenure structure which was formed according to the will of monarchy continued to have an impact on Nepal's agriculture until the 20th century. Only after the abolishment of Rana regime in 1950, the political commitment towards restructuring land tenure could be noticed, although several hurdles were faced in implementing the change.

### **Political Transitions and Land Reform**

Land and politics are interdependent and along with the political system, the land structure or the tenure has played a role in the history of Nepal. For example, during the monarchial rule or the Rana rule, land was treated as the property of the ruler who had the right to distribute it as they wished. After the installation of democracy in Nepal, private distribution of land was abolished and all land belonged to the state. The more radical governments in subsequent years tried to implement more radical land reform, but it was not implemented.

Since land reform is more of a political issue that has the potential to disturb the establishment, several preconditions are required for accomplishing land reform. Revolution, rural unrest, intention to deter communism, ideological commitment, mood of the international community, and pressure from the population are some factors that could

encourage or force the state to adopt revolutionary land reform (Tai, 1974). Some of these preconditions were present in Nepal during this time period. There were various revolutionary acts from time to time that had changed the establishment. In 1951, the Nepali Congress led revolution overthrew the Rana regime. In 1990, the all party coalition revolted against the autocratic rule of the King and installed a democratic system with an elected parliament. The Communist Party of Nepal under the influence of Maoist ideology conducted an insurgency for twelve years, and succeeded in overthrowing the monarchy in 2006. Although these phases of political transition did not succeed in institutionalizing the achievements by implementing effective policies, the approach towards land and its reform by democratic governments has been different and more revolutionary than that of the monarchy or Rana regime.

### **The Abolishment of Rana Regime**

Following a prolonged struggle by the Nepali Congress, King Tribhuvan initiated a move to end the Rana regime in 1951 and the three parties (Monarchy, Congress and Ranas) formed an interim government. The period 1951-64 witnessed various reforms, such as, a transition to coalition government, a Congress majority government, and the King's panchayat regime which was enforced in 1960. As Nepal had not had any kind of census or surveys, and land was occupied by the ruling elites, reforming the agriculture in which most of the population was engaged, was the priority for every government.

**Table 1.** Physical Distribution of Nepal in 1960s

	<b>Areas (%)</b>
Mountains, Hills and Barren areas	33.2
Forest	31
Roads and Rivers	7.8
Cultivable Land	28
Cultivated Land	13.1
Uncultivated or reclaimable	14.9

*Source: UNDP country report, 1972*

Table 1 shows the physical distribution of geography on Nepal in the 1960s. More than 70 percent of area is non-agricultural land and, of the remaining 28 percent, more than half was left fallow in the 1950s and 1960s. One of the main reasons for the huge portion of land left uncultivated was absentee landlordism which was a consequence of the decisions by the rulers. Nepal was ruled by the monarchy and Ranas and, as discussed above, land was distributed to those who were close to the rulers. After the abolishment of the Rana regime, the democratic government led by B. P. Koirala tried to break the complex ruler-centric agrarian structure by introducing various acts and abolishing the land

grant systems. However, these acts were short lived, mostly because of the power held by the ruling elite even under the democratic system. When King Mahendra introduced the Panchayat system through an army supported coup in 1960, the agrarian reform was again back to the agenda of monarchy which was always using the land to hold its power. Until the general elections of 1959 (2016 B.S.), the collective government included the King and Ranas and there was not much change in the policies in spite of efforts by the government led by M. P. Koirala to introduce different acts.

### **Panchayat Regime**

After King Mahendra seized power and the introduced “Panchayat” system in 1960 to legitimize the move and show the sincerity towards peasants, the royal government introduced the detailed land act in 1964. It was in some way a revolutionary step by the King as for the first time in Nepal’s lands history, a land ceiling was imposed and credit rights of tenants were recognized. The key objectives of the land act were to lawfully distribute the land, improve living standards of peasants by introducing modern techniques, increase agricultural production and transfer inactive capital from agriculture into other economic sectors (Badal, 1994). The major provisions made in the land act were to:

1. Impose a ceiling on land ownership, and acquire land in excess of ceiling for distribution to others;
2. abolish the Jimidary system;
3. Provide security to tenant farmers; and
4. Provide for agricultural credit (Zaman, 1973).

The land act of 1964 tried to address the issues of feudalism and landlessness, but the act introduced by the monarchy appeared to have intentional loopholes through which powerful people could retain their land.

**Table 2.** Land holding in 1970 (after 6 years of land act) \*

<b>Size of holding</b>	<b>Households</b>	<b>Total Area</b>	<b>Avg. size</b>	<b>Household %</b>	<b>Area %</b>
>1 ha	1651	502.17	0.30	65.12	9.66
1-3 ha	452	758.42	1.68	17.83	14.59
3-5 ha	171	581.38	3.40	6.74	11.19
5-10 ha	148	1123.81	7.59	5.83	21.63
10-15 ha	56	615.15	10.98	2.20	11.84
15-20 ha	26	432.64	16.64	1.02	8.32
20-30 ha	13	314.12	24.16	0.51	6.04
<30 ha	18	867.82	48.21	0.71	16.70
<b>Total</b>	<b>2535</b>	<b>5195.47</b>	<b>2.05</b>	<b>100</b>	<b>100</b>

*Source: Zaman, 1973*

**\*Note:** the data is self-computed on the basis of data available from Zaman, 1973. Original data was based on taking the sample size of 12 districts out of 75 districts in 1972 and was segregated into different regions such as Kathmandu, eastern Terai, western Terai, eastern hill and western hill however the above data shows the total number of land holding by combining the regions.

Even in the 1970s, 19 years after the abolishment of Kinship based rule, the landholding structure did not change much. Table 2 shows the uneven distribution of land where 0.71% held almost 16.70% of land at an average of almost 50 hectares per families. However major portion of the population which consisted of 65.12% held only 9.66% of land with an average of less than 1 hectare of land. The vast variation of unevenness in land holding structure was the result of more than 3 centuries of kinship rule which had used the land for their personal gains. When the Rana regime was overthrown and a general election was held in 1959, peasants had expectation from the “people’s government” to introduce revolutionary land reform measures to amend the uneven trend of land distribution. The expectation was short lived as in 1960, the then monarch overthrew the democratically elected government through a coup and introduced the Panchayat regime.

### **Return to Democracy, 1990**

More than 30 years after the coup by King Mahendra, Nepal’s development including the agrarian reforms remained stalled. Although there were various development priorities and the five-year plan was initiated in the 1960, the ruling monarch did not interfere much with the land holdings of the large feudal landlords as they held important positions in the palace and bureaucracy. After a civil movement in 1990, Panchayat was abolished and a new constitution was adopted to impose checks on the power of the monarch. However, it was unable to overthrow the monarchy, and the King continued to remain above the constitution which may have contributed to another coup at the beginning of the 21<sup>st</sup> century.

**Table 3.** Land Distribution by farm size in Nepal, 1991

Size of Holdings	Holdings		Total Area	
	Number	%	Hectares	%
No land	32,109	1.2	1571	0.1
<1 ha	18,77,702	68.6	791883	30.5
1-2 ha	529467	19.4	716533	27.6
2-3 ha	168449	6.2	400,227	15.4
3-5 ha	88,165	3.2	328089	12.6
>5 ha	40158	1.5	360669	13.9

*Source: CBS, 1994*

A prominent feature of agriculture in Nepal is the unequal distribution of land among the people. As seen in the above table, almost 68.6% of population owns less than 1 hectare of land and 1.5% of population own more than 5 ha of land which constituted 13.9% of total land. These lands were all the land granted by the palace and rulers and even after the democratic government came to power in 1990. Although the monarch was made a constitutional head, the government could not make meaningful changes in the landholding size. As only 1% of the population was composed of Ranas, Shahs, bureaucrats and other influential people, the people's representatives shied away from reducing their power as it could lead to loss of their positions, as was seen later.

There were several changes of governments after 1990 and some announced radical measures for land reform. However, due to rapid changes in government, these measures were not implemented. The government formed under Man Mohan Adhikary tried to address the agrarian issue and formed a commission under Keshab Badal in 1995. This commission is still regarded as the most radical, and it had proposed some measures to redistribute the land to the landless, but sudden change in government halted the implementation of this commission's report.

The period from 1990- 2006 was crucial in Nepal for various reasons. While the country was settling down in the much-awaited new democratic environment, the political parties were in confrontation with each other. For most of the time, the situation was unstable and no government could complete its five year tenure. The UML government formed in 1994 took the first major step in revolutionary land reform and formed the High Level Land Reform Commission under the chairmanship of Keshab Badal. However, immediately after the completion of report, the government was removed from power, and the incoming Congress government did not give much importance to the report. Moreover, the Agricultural Development Strategy was formulated with the help of donor agencies which designed the 20-year agricultural plan that emphasized increasing production, managing irrigation and fertilizers and similar other growth based innovations, but disregarded the landholding issue. In 1996, one section of the Communist Party submitted a 40-point demand to the government and launched a "people's war". One of the major demands in those 40-point was that "land should be owned by those who cultivate it". Over the next 12 years, Nepal faced a crisis which was mainly located in the rural areas, but the unrest halted many development projects including the land reform.

**Table 4.** Percentage of total household and holding from 1961-2001

Landholding categories	1961		1971		1981		1991		2001	
	holding	Area	holding	area	Holding	Area	Holding	Area	Holding	area
<0.1 ha							6.4	0.4	7.8	0.5
0.1 to 0.2 ha	56.2	11.9	62.7	13.8	50.3	6.6	9.8	1.5	10.4	1.9
0.2 to 0.5 ha	--	--	--	--	--	--	27	9.4	39.1	12.3
0.5 to 1 ha	18.8	12.2	14.9	12.1	16.3	10.8	26.3	19.2	27.4	24.2
1 to 2 ha	11.9	15.4	11.1	17.4	17.3	19.9	19.6	27.6	17.6	29.8
2 to 3 ha	5.2	11.7	5	13.4	7.2	15.4	6.2	15.4	4.7	14
3 to 4 ha	2.7	8.6	2.3	8.6	3.5	10.8	2.2	7.8	1.5	6.6
4 to 5 ha	1.5	6.2	1.2	5.7	1.9	7.7	1.1	4.8	0.6	3.4
5 to 10 ha	2.6	16.4	2.1	15.5	2.7	15.8	1.2	8.1	0.6	5.3
>10 ha	1	17.7	0.7	13.7	0.7	13.1	0.3	5.8	0.1	2

*Source: CBS, 2006*

In the year 1961, ten years after the abolishment of Rana Regime, 2.6% of population had occupied 16.4% of land more than 5 ha, whereas 75 % of population had less than 1 ha of land. After 40 years of abolishment of Rana regime too, the land structure has not changed much as 0.6% of population hold more 5.3% of total land with more than 5 ha holding 84.7% of population hold 38.9% of land less than 1 ha. Over thirty years of governing the panchayat regime introduced the land act, but this could not significantly improve the landholding structure due to many loopholes in the ceilings it had imposed. Similarly, the land reform commission formed post democracy had also suggested various efforts to reduce the uneven distribution of land, but the commission's report was not implemented. In this way, the quest for an appropriate answer to the agrarian question in Nepal continues to be frustrated by the political fragileness since the advent of the democratic regime.

### **Post 2006**

Nepal was paralyzed by a vibrant civil movement termed as JanaAandolan II for 19 days in April 2006. The mass movement all over the country was a demonstration against the King's direct rule, and demand to end the ten year long armed conflict as well as inclusion of the socially oppressed ethnic groups into mainstream and the economy. The result of such mass uprising was that Nepal, after more than 240 years of Shah Dynasty rule, became a republic and achieved a new constitution in 2016 which is considered to be participatory and inclusive than before, and gave overall sovereignty to the people.

Although the period after the reinstatement of the parliament in 2006 raised new hope, the political parties of Nepal were unable to institutionalize this historic achievement successfully. Over the next ten years, Nepal had two constituent assembly elections, 9 prime ministers

and several movements by the people exerting pressure on the political parties to institutionalize the change that was promised in 2006. Thus, political instability has sidelined the development issues, and most of the youth population has migrated abroad for employment making remittance one of the largest contributors to the economy.

The elections of 2008 gave the then Unified Communist Party of Nepal (Maoist) majority in the constituent assembly and the Chairman of the party Pushpa Kamal Dahal (Prachanda) became the first elected prime minister of Nepal. Following the commitment made during the insurgency, the prime minister formed the High Level Scientific Land Reform Commission under the chairmanship of Haribol Gajurel. As it was a communist government, people expected that the regime would sincerely examine the agrarian condition and implement the revolutionary land reform policies which would benefit the peasants. This commission, too, proposed a land ceiling like the Badal Commission, but again the government fell before the commission could submit the report. The new government under CPN-UML did not take into account, but formed a new commission under Ghanendra Basnet. Ironically, before the commission could submit its report, the government changed and new government shelved it.

**Table 5** Number and Area of holding 2011

	Holdings	
	Number (HH)	Areas (ha)
Holding without land	115538	3119.3
<0.1 ha	355549	20,076.5
0.1 ha-0.2 ha	461,957	68,161.8
0.2 ha-0.5 ha	1169503	396720.9
0.5 ha-1 ha	984022	695060.1
1 ha-2 ha	548974	749810
2 ha-3 ha	129364	308568.5
3 ha-4 ha	39,507	134353.1
4 ha-5 ha	14881	65364.7
5 ha-10 ha	10744	69177.1
Above 10 ha	1054	15227.2
<b>Total</b>	<b>3831093</b>	<b>2525639.2</b>

*Source: Statistical Information on Nepalese Agriculture, 2011*

Table 5 presents the land holding structure in 2011, five years after Nepal became a federal republic. The land structure was highly affected by the long kinship based rule where only a few people close to the palace or ruler held the maximum portion of land. After abolishing the monarchy, there was an expectation that the government formed under the new republic system would introduce revolutionary land reform measures that could bring an end to the unequal distribution of land. Two successive governments formed land reform commissions in four years, but the lack

of political stability and political commitment prevented the implementation of any form of land reform policies. By 2011, 0.06% of households still owned 5% of land with an average of 4-10 ha of land each, whereas 80% of people own less than 1 ha of land or no land at all. This highly uneven distribution of land has now been further aggravated by the fragmentation of land mainly by large land holders. Therefore, the proposal by the three commissions to impose a land ceiling may not be effective anymore as these lands are now further divided into smaller landholdings, mainly because the time lag helped the large land owners to evade the limit on the amount of land that can be held.

### **Conclusion**

Land reform and politics cannot be separated as they have a major impact of one another. While political decisions influence the nature and outcome of reform to a large extent, appropriate land reform also helps to balance political power in the country. In a democracy, political influence over the electorate and state of the economy are important factors for the success of political parties. While the influence is assessed by the support from the mass, the economy or finance is powered by the support from business elites and landlords. The elites are powerful people who have retained their position through linkages with the palace, military and bureaucracy, belonging to a high caste or being religiously influential people. Hence the degree of commitment from political parties hinges on the struggle between the elites and peasants and due most of the reform policies did not succeed.

Land reform is intimately related to restructuring economic and political influence. Although it has the potential to benefit a large segment of population who support political parties to win elections or initiate, elected leaders are unwilling and unable to disregard the wishes and interest of the elite class whose financial support was critical for winning seats in the parliament. The political connections of landlords to the establishment are very strong and can easily thwart new land reform policies from implementation. Every attempt by various governments at implementing land reform policies in Nepal was frustrated, apparently because next governments did not care to continue with measures initiated by the previous government. The Badal Commission, Gajurel Commission, and the communist government tried to address the issue in successive governments, but they were out of power before implementing any of the recommendation and the reports are lost somewhere in the ministry stacks.

In an agricultural society, land is at once the principal source of wealth, the foundation of political power and the symbol of social prestige (Tai, 1974). Hence the major feature of land reform would alter the socio-economic structure that is impossible to accomplish without strong political commitment. Transferring land from landed elites to landless peasants would not only shift ownership of a factor of production, it would also result in major changes in the status, economy and power. In short, it could eliminate the domination of one class over



another. It can be said that land reform will not succeed without full commitment from the government or the political party in power. The powerful people would not give up their power, economic strength and prestige voluntarily. While other countries have made significant progress in industrialization, Nepal is still struggling to find an appropriate method to solve the agrarian question it has faced since the 5<sup>th</sup> century. Only a strong political commitment from a stable government in a genuine democratic setting can help Nepal move towards progress in this aspect.

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# 3

## Rural Development in Bangladesh and Korea

LEE Misook  
Syed Salah Uddin Ibne

### Introduction

Many countries in Asia and Africa became independent in the twentieth century after the conclusion of the Second World War. Most of these newly independent countries had a large population who lived in the rural areas and were engaged in agricultural activities without modern facilities and support. Rural development initiatives were considered necessary for the improvement of rural communities. The Republic of Korea became independent from Japanese rule and Bangladesh was liberated from Pakistani and British colonial after the end of Second World War. Both the countries are located in Asia but have different socio cultural and geographical context. The countries were also similar in terms of lack of resources with a large population groups living in the rural areas. The *Comilla* model and *Saemaul Undong* were initiated in the People's Republic of Bangladesh and the Republic of Korea respectively to transform the rural communities into modern villages by developing infrastructure and supplying modern inputs. Both the programmes were participatory in nature.

Rural development is a critical element for comprehensive development of a country. It refers to the process of improving the quality of life and economic well-being of people living in relatively isolated and sparsely populated areas (Malcolm, 2003). Rural development signifies a distinct approach to interventions by the state in the economics of underdeveloped countries, and one which is at once broader and more specific than simple agricultural development. The scope is broader because rural development entails much more than enhancement of agricultural production and is, in fact, a distinct approach to the development of economy as a whole. Rural development is more specific in the sense that it focuses (in its rhetoric and in principle) on poverty and inequality (Harris, 1982, pp.14-15). It is a process of governing, rather than a programme or agency and represents an attempt to restructure the government's relationship with its non-urban population (Tepper, 1971).

The Comilla model of rural development was initiated by the Pakistan Academy for Rural development (at present Bangladesh Academy for

Rural development) in the district of Comilla. Another model of rural development known as *Saemaul Undong* was initiated in the Republic of Korea in the early 1970s. The chief objective of both programs was to reduce poverty in the rural areas, generate income and make real changes in the life and livelihood of the rural society in Korea and Bangladesh. This chapter presents a comparative study of these two models of rural development and their features. It intends to compare the socio-economic context of the two states of Korea and Bangladesh where the models of rural development were implemented, the institutional framework and area of implementation, and highlights the extent of success and failure.

### **The Context of Rural Development**

From one point of view, the term development implies economic growth that can be measured in a quantitative manner. However, it is distinct from growth and should not be considered only in quantitative terms. Development also aims at qualitative changes in various aspects, like organization, institution, culture and society (Hayami & Buller, 1987), and it is a continuous process.

Rural development generally refers to a broad range of technical, economic, political and social change related to private and governmental effort to enhance the wellbeing of rural citizens (Stevens, 1971). The World Bank defines rural development as “A strategy designed to improve economic and social life of a special group of people. It involves extending benefits of development to the groups who seek a livelihood in the rural area” (Deb. k, 1986). The World Bank emphasizes the livelihood of the poor including marginal farmers, sharecroppers, tenants, traders and other occupational groups who live at subsistence level. It should be pointed out that comprehensive rural development entails the effort of several agencies across the government.

Rural development can be described more specifically as community development because it focuses on rural communities. In the Republic of Korea *Saemaul Undong* is widely considered as a successful community development model. It is described as a “pure Korean way of community development which was initiated by the political will of the top national leadership in order to escape from poverty” (Chang, 2005).

A study reviewed the *Saemaul Undong* in the 1970s as a rural modernization movement from a perspective of populism, and found it to be a combination of the governing strategy of the regime in power and the socioeconomic needs of villagers (Ha, 2014). It was pointed out that Park achieved it by holding several rural events and providing economic rewards by encouraging comradely connection with the people. The author added that the regime developed solidarity between the nation and rural areas by applying the cooperative traditions to the organization and

system of Saemaul Undong. The administration attained success by developing group identity through large-scale Saemaul education and eventually disseminated the governing ideology of modernization throughout the country effectively (Ha, 2014).

The first significant experiment for rural development was undertaken in the 1960s (Khan 1989). Tepper(1971) pointed that East Bengal after being renamed as East Pakistan remained domestically a quasi-colonial state. As a result, cultural development in the region fostered an anti-Pakistan sentiment. Poor performance of the Village Aid program contributed to the development of the Comilla Model of rural development to overcome its deficiencies. It was engineered by the Pakistan Academy of Rural Development (renamed subsequently as Bangladesh Academy for Rural Development (BARD). Raper(1970) pointed out that the Comilla Model piloted a methodology for stimulating agricultural and rural development based on the principle of grassroots cooperative participation by the people.

### **The Context of Korea and Bangladesh**

The Republic of South Korea is situated in East Asia at the southern part of Korean Peninsula. This area has a rich history of mostly village based human settlement from the Palaeolithic period. The Korean society is traditionally agricultural in nature. Massive exploitation under colonial rule compelled large numbers of poor tenants and farm labourers to leave their homes. The war between North and South Korea waged from 1950 to 1953. It resulted in food shortage and destruction of infrastructure.

Korea has a tradition of century old village cooperation system. In bad climate or during the harvesting period, village communities helped one another. The system of exchanging labour with other communities is known as *pumassi*. During the Song dynasty in the 15<sup>th</sup> century, another system of community driven activity took place under the influence of neo-Confucianism.

Between 1962 and 1994, the South Korean economy grew at an average of 10% annually, fuelled by annual export growth of 20%. This period is known as the Miracle on the Han River. The Korean economy experienced extraordinary success, combining economic growth with significant reduction of poverty. This happened over a period of three decades in the twentieth century. Korea has set an example in sustainable development for developing countries. It has advanced infrastructure and sophisticated policies to contribute to the improvement of the country. Eventually, Korea has transformed into a dynamic knowledge economy.

Bangladesh is situated in South Asia between 20.5N and 26.5N latitude and 88.5E and 92.5E longitude. The total land area of the country

is about 156000 square kilometre with a population of more 160 million. Hundreds of rivers flow through the country into the Bay of Bengal. The country experiences heavy rainfall during the rainy season and the season is dry in the winter.

Bangladesh has a large number of peasants and small farmers, and agriculture has been the main source of livelihood of the rural population. In 1965, more than 65 percent gross Domestic product in East Pakistan originated from agriculture. Paddy was the major crop, while jute and sugarcane were cultivated during the rainy season. Pulses, oilseeds, tobacco and vegetables were grown in the winter time.

### **The Comilla Model of Rural Development**

Two major events in East Pakistan in the 1950s and 1960s initiated a transition. A land reform law abolished the colonial Zamindari (landlord) system in 1950. At that time, Muslim tenants in the rural society were mostly marginal and small farmers. Following political uncertainties and power struggle in Pakistan, General Ayub Khan emerged as the leader of the country through a military takeover, and introduced the basic democracy system. He tried to develop a support base both in rural and urban areas through this system, and tried to accomplish this by providing support to large landowning farmers. The V-Aid Academy in Comilla was unable to address the issue of landlessness and offer direct support to the landless class in this complex political context. Therefore, it prepared a different package for the poor farmers of East Pakistan through a two-tier cooperative rural works programme, thana training and development center, and improved irrigation system.

The Academy did not adopt a radical approach that could come into conflict with the existing system. From the beginning, it developed a number of “value premises and ideological commitments”. These were:

- a. The condition of rural life is worthwhile and the living conditions in the rural areas must be improved;
- b. The solution of these problems should come from the local level;
- c. The working style in the village will be Gandhian;
- d. Labour intensive programme to utilize mass employed;
- e. Co-operative movement for peasants’ protection and production;
- f. Islam as a modernization force; and
- g. Mechanization of agriculture (Choldin, H.M. op. cit., p-675).

The Academy obtained permission from the central government to make Comilla thana as its laboratory that covered an area of 100 square miles with 300 villages. The thana was considered as social laboratory area for research and demonstration and the title of Comilla model became

recognized. The first stage of study on Comilla area was observational and analytical in nature to find about the real situation. These tasks were done by both instructors of the Academy and researchers from Michigan State University in the United States of America. Efforts on identification of problems were based a series of conferences and camps with various groups from the villages, and opinions of the villagers were meticulously recorded. The process was aimed at mere fact finding rather than research, and helped understand the social and economic structures of the villages. The Academy took the policy of “Let begin by doing small thing, and slowly it may become better; it may become more sophisticated” (Khan, 1983).

### **The Comilla Model**

The Comilla was based on six steps to fulfill its goals of developing a comprehensive and effective rural development initiative.

- |                           |                                                                                                                                            |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>First Step</b> —————→  | Make use of the existent Training- cum-research Institution. BARD.                                                                         |
| <b>Second Step</b> —————→ | Affiliation of a laboratory area i.e. Comilla Kotwali Thana.                                                                               |
| <b>Third Step</b> —————→  | Intensive study and Consultation with Community People. Understanding the problem from Below.                                              |
| <b>Forth Step</b> —————→  | Close collaboration with planning Commission with national Level.                                                                          |
| <b>Fifth Step</b> —————→  | Continuous evaluation and documentation of the pilot project. Determining the strength and Weakness ofthe project for further improvement. |
| <b>Sixth Step</b> —————→  | To assist the government agencies in the multiplication of the model.                                                                      |

*Source: MA Quddus,1993*

### **Features of the Comilla Model**

#### ***Two Tier Cooperatives***

The principles and philosophy of the Academy cooperative movement had to be introduced to the rural area. The Academy recognized the history of cooperative movements and their pitfalls in East Pakistan, and used the Raiffeisen cooperative model. The main aim was to neutralise the conflicting forces, rather than using the harmonious forces within the village.

The major objective of such cooperatives is primarily to develop villagers own capital through savings, although the impact would take a

long time. The new form of cooperative movement helped to develop trust among the villagers, enhance their capacity, build harmony among villagers, improve the capacity of planning and implementation, and provide a platform that would help them link the village with service providing institutions for activities in family planning, health, adult education, women's education and home development. Above all, it would help villagers attain self-confidence and believe in their capacities.

The village cooperatives in Comilla Sadar thana formed their federation known as Thana Central Co-operative Association (TCCA) in 1962. It assisted with the allocation of responsibilities, and the village societies were to perform specific functions and the central association was to deal with business, management, economic development, training, supervision and linking the village with other relative departments. (Hart, 1971, p. 57).

### ***Thana Training and Development Center (TTDC)***

Lack of effective administration was a major problem in the V-AID program. During the 1960s, there was a gap between the subdivision (Thana) and village levels. Although there were Union Boards situated between them, the administrative linkage between these institutions was absent. The sub division/thana was basically a police station. Therefore, nation building departments like agriculture, health, cooperative, education, etc. were there but no systematic economic development activities in villages were undertaken.

### ***Rural works Programme (RWP)***

The Academy identified major areas of weaknesses of the rural setting of Comilla in the early 1960s. Reconstruction of physical infrastructure for drainage, embankments and roads was the first priority. It was felt that the existing departments lacked the ability to perform the job of developing infrastructure in the rural area. The rural works program is a labour-intensive programme that aimed to develop infrastructure in the rural areas through local government institutions. It was observed that during dry months of the year (January-May) the landless labours remained jobless, and the rural works program provided them with support for livelihood.

### ***The Thana Irrigation Programme (TIP)***

Irrigation is an important part of crop production and is needed in the dry season. The Thana irrigation Programme (TIP) was an extended work program of the Comilla model and it was introduced to help with dry season paddy production. The Academy started experimenting with the programme in early 1962, and it was fully operational by 1965. The programme was so successful that by 1970-71 it was extended to 352



thanas of the country. The reason of success is increase in the production of HYV rice and possibility of producing rice in the flood free season.

### **Effectiveness of the Comilla Model**

The Comilla rural development model was the first comprehensive and participatory approach for rural development in Bangladesh. The potentials, viability and effectiveness of the model have been subjected to critical examination over several years. They demonstrate that the program had effectively helped to improve the livelihood of all sections of rural people including peasants, artisans, women, youth and children. The project also helped to identify the main causes of rural poverty and backwardness.

The foundations of the model of rural development (TTDC, RWP, TIP, Two-tier Cooperatives) evolved through the experiments undertaken in Comilla, and made significant contributions towards national development in Bangladesh. The experiments generated many new ideas and methods that provided a basis for formulating other national programme. For example, the family planning program was completely redesigned in the sixties following the results of a pilot experimentation by the Academy. The national program in women's development introduced by the BRDB (Bangladesh Rural Development Board) is based on the model developed through the Comilla experiment.

The Comilla model has ushered in a new era of rural development in Bangladesh by replacing the old colonial approach to "development through officers". The model has pioneered the method for replacing the three characteristics of the colonial era, namely elitism, centralism and paternalism by a system of decentralized administration and participatory rural development.

The model helped establish a wide range of innovative methods that are essential for promotion of rural development in the country. It contributed to the development of organizations for small farmers and peasants to facilitate production and protection, and the accumulation and investment of capital in rural areas. The Comilla model placed people's participation at the heart of the development process and the nurturing of leadership in the rural areas. In addition to the incorporation of a bottom-up planning process, the model demonstrated that large scale adaptations of technological innovations can take place in backward rural communities, and the rural people and government officials can work as partners in development.

### **The Saemaul Undong**

Saemaul Undong started its journey as a new village movement in 1970-71. At the beginning, the government provided some material support to

more than 3300 villages of Korea for the project. This was a primary support to encourage villagers to plan for developing the infrastructure, and more than half of the village mobilized their resources for community development. In the next stage, government support was devoted to the transformation to self-reliance villages. Inspired by the success of the experiment, the villages began to receive package of projects. These packages were much more comprehensive in nature and included larger government support with a focus on income generation. Participating villagers were receiving payments for their labour. Village cooperatives were initiated and encouragement was provided by allowing them to retain half of the income generated from Saemaul Undong. That fund could be used for joint investments for the village.

Saemaul Undong has four goals based on the need and aspiration of the community. They include increasing of production from a limited area of arable land, earning higher income, obtaining better security for community life, and looking for opportunities in off-farm activities to improve social and financial status. The goals are comprehensive and detailed. As result, there were integrated efforts by government officials, community leaders and villagers/community members to work for the success of this effort. Integrated participation was the key strategy for running the movement. Community members had the opportunity and access to plan and implementation to run the programme. The *Saemaul* spirit had to be instilled in the hearts of the people and practiced in their everyday life. Finally, all activities were to be undertaken for the interest and benefit of the community and participants, and should be directly or indirectly linked to an increase in production and income. Spiritual development is the key force for attitudinal change in the mindset of the people of Korea. Diligence, self-reliance and cooperation constituted the foundation of Saemaul values.

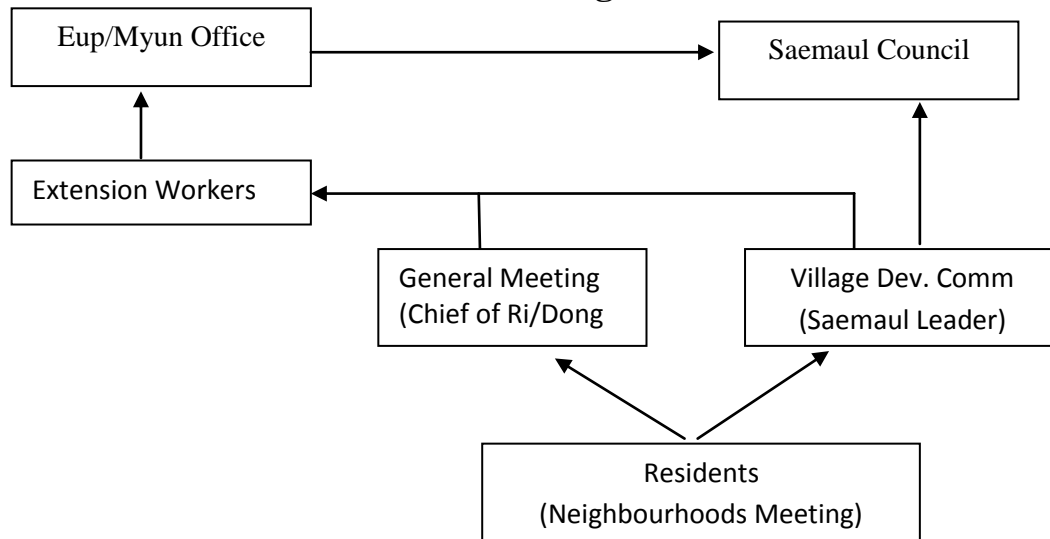
### **Features of Saemaul Undong**

The key to the success of Saemul Undong was an appropriate institutional framework and synchronization of different organization for planning and implementation of at the community level. The administrative structure represented a pyramid that comprise from the top, ministries of central government, level of lower government administration including that of province, city-county, town-myun, and at the lower level, at village-ri.

The involvement of local government bodies helps to reduce conflict among the stockholders within the community. Studies have found thana significant strategy of the Saemaul Undong was pooling of resources from the delivery organization to provide efficient services in the wide range of activities undertaken in the communities (Choe, 2005). There was a system of monitoring the activities and performance of officials of

local governments, who had to meet frequently with the community to ensure the efficiency and effectiveness of various projects.

### Government Administration Saemaul Organization



**Fig:** The Saemaul Undong Implementation at Community Level

### *Achievement of Saemaul Undong*

The Asian Development Bank pointed out that the Saemaul Undong movement improved both individual and community well-being by reducing poverty through increased household income and access to modern infrastructure and services with mechanized farming, electrification, improvement in the quality of housing and health services, and child care provided by Saemaul nurseries during the planting, cultivation, and harvesting seasons. Moreover, it empowered local communities to accumulate social capital, and revitalized the community leadership by permitting younger people to assume leadership roles traditionally held by senior members of society. Finally, it helped create a status free social context within the traditional rural village setting, and facilitated acceptance of modern roles for women in terms of overall social participation, management of household budgets, and part time employment as wage earning (ADB, 2012).

The Saemaul Undong has successfully transformed the layout of rural areas of Korea from backwardness to modern physical form. It also helped to improve the economic condition of rural mass by creating income generating activities. The projects contributed to sharp increases in the income of households in the 1970s. Saemaul Undong helped develop the will power and cooperation within the village and provided support for developing alternative income source for the villagers. The following table has shown the increasing trend of household income during the period of 1970s.

**Table 2:** Increase trend of Farming Household Income in 1970s

Year	Household Income	Agricultural Income		Non-Agricultural Income	
		Amount	Ratio (%)	Amount	Ratio (%)
1970	255,800	194,000	75.9	61,800	24.1
1973	489,700	390,300	81.2	90,400	18.8
1976	1,156,300	921,200	79.7	235,100	20.3
1979	1,531,300	1,531,000	68.7	696,200	31.3

*Source: National Council of Saemaul Undong(1999). Saemaul Undong in Korea. P. 25.*

## **A Comparison of the Comilla Model and Saemaul Undong**

### ***Common Socio-Political Context***

Saemaul Undong and the Comilla model were implemented around the same time period in two different areas of Asia. There were similarities in the economic and social situation in the two countries. The timing of implementation should be noted with reference to the political contexts as they were similar. The Comilla model was introduced in the 1960s and Saemaul Undong in the 1970s. Both countries had leaders with military backgrounds, and the rural areas were more progressive economically and politically compared to the urban areas, and the villages needed assistance to move forward. In the case of Comilla model, experimentation by the government with both strategies of development and political structure of East Pakistan facilitated the process. In Korea, Saemaul Undong contributed to the creation of a strong political support base among the rural population, and to develop a new power structure in the rural areas.

The case of the Comilla model developed in a more complex social context than Korea. The land reform in 1950 abolished the Zamindari system, but the law did not effectively help the middle and poor peasants escape the poverty trap. Seasonal flood, shortage of food several months in a year, and different sizes of land held by the farmers made the task complicated, and there was deep social stratification in the rural society. Korea faced a different problem as the entire infrastructure had broken down during the Korean War. Seasonal joblessness and food shortage were common issues, but a successful land reform helped reduce resource inequality among the farmers. At the village level, the society was not so complex and there was a positive environment for initiating a major rural development program.

### ***Diverse Implementation Need***

The Comilla model of rural development and Saemaul Undong were implemented for different causes and needs. The Comilla model was a response to failure of a much wider program of V-AID which was

implemented throughout the country. The government officials were the main mobilizers and catalysts for the program. However, due to the colonial attitude of the officials, lack of understanding of the real situation in the rural area and lack of coordination and participation of rural people, the program failed to achieve its goals and objectives.

The Rural Development Academy was established to train V-AID officials. After the V-AID Academy failed to deliver, the focus shifted to people's participation and experiment of projects on a smaller scale. Only the Kotwali Thana (Sub-district) was selected as the social laboratory area for experimenting with projects of the Academy. In this period of experimentation, problems were identified by the villagers and solutions, too, came from the village. So, the development approach was more home grown and indigenous, although professionals from the Academy helped to develop the ideas.

In the case of Saemaul Undong the need of implementation was different. Korean cities were developing rapidly in the 1960s due to industrial revolution in the country and income disparities between the urban and rural population were increasing rapidly. As a result, the social and economic conditions in the rural areas were worse than the city, and there was rapid migration from villages to the city. Thus, a massive development initiative was needed to restore the socio-economic stability in the villages.

Saemaul Undong can be translated as "new village", and it was a massive movement to modernize the rural society. As the characteristics and nature of the program were formidable, all agencies and institutions of the government related to welfare and development were involved in different phases and sections in creating the policy and its implementation. The lead was given from the top where leadership was provided by President Park Chung-Hee.

### ***Small vs Large Scale Implementation***

The Comilla model did not seek to implement the projects in large scale, and the number of projects in Comilla Kotwali thana was restricted to 500 hundred village. These projects were designated as action research. After several years of experimentation, the Academy recommended the Planning Commission to implement all over the country. For Saemaul Undong, the situation required large scale implementation of the projects. The first projects were introduced in about 33,000 villages all over the country. The extremely large scale required involvement of all government bodies from the central to local levels. The central government made the policy and decision of engaging various service giving bodies while the local government played the role of implementation.

### ***Support and Input Services***

The government provided subsidy to the projects under the Comilla model of rural development. It was not in the form of goods or inputs, and the Academy gave cooperative backup and technical support. Saemaul Undong received subsidy in the form of goods as well as services. Developing infrastructure was a major goal for both projects. In the Comilla model, the rural works programme played a vital role in developing the physical infrastructure in the village, as roads and embankments helped to deal with seasonal flooding and crop damage. The roads helped to develop linkages between urban markets and rural societies. Saemaul Undong helped to transform rural infrastructure into modern facilities that contributed to better living condition as well as a good network for marketing agriculture produce.

### ***Generating Income and Savings***

Both models have unique characteristics of generating income and accumulating savings by the villagers. Under the Comilla model, projects were taken to introduce high yielding varieties of seeds and new irrigation facilities through the farmers' cooperatives for improving agricultural production. The (*Krishak Somobay Samitis* (Farmers Cooperative Societies) had created a savings base for the rural people, and it helped to increase income as well as savings through cooperatives. In the case of Saemaul Undong, some of the projects were directly related with growth of production and diversified farm activities. The village owned society had enough income to save, and growth of income and savings helped to transform the rural society into a modern one. It is notable that there was a dramatic increase of income in the Korean model. In the Comilla model, the large and medium farmers benefitted more compared to small and landless peasants.

### **Conclusion and Recommendation**

The Comilla model experiment had established a number of learning experiences, which have been instrumental in shaping the rural development process in Bangladesh. The model offered an alternative to the top down model with the introduction of a decentralized administrative structure for organizing participatory rural development. The model has shown an effective way of tackling critical and chronic problems of low productivity, food deficit, unemployment and growing poverty in rural areas. The model also demonstrated a viable method of organizing villagers, self-mobilization of resources and ensuring participation in planning and implementation of development programmes. All these learning experience led the government to adopt the four major programmes, the TTDC (Thana Training and development Center), RWP (Rural Works Programme, TIP (Thana Irrigation

Programme), and TCCA (Thana Central Cooperative Association), for replication throughout the country.

After the independence of Bangladesh, the Comilla model has undergone transformations to suit the needs of the changing times. The two-tier cooperatives were being replicated by the BRDB (Bangladesh Rural Development Board) all over Bangladesh. The Thana Training and Development Centers (TTDC) have changed with the establishment of the upazila, one of the strongest local government units in the country. The Rural Works Program has been absorbed by the Local Government Engineering Department (LGED). The Thana Irrigation Program has been placed under the Bangladesh Agriculture Development Board. Thus, the Comilla model of rural development has provided a strong ground for initiating rural development out of the control of bureaucratic and administrative officials with an effective bottom up approach, where participation of rural people were ensured under a framework developed by academicians from home and abroad. It also identified some ground rules for dealing with development programs, opened up the scope for several development institutions from the centre to the local level.

Saemaul Undong has not only transformed the villages into a modern form, and also changed the mindset of rural people in Korea. The spirit and slogans have provided an impetus for enhancing community development. The approach was a mixture of top-down and bottom up approaches, but the learning from the projects has transformed into a new stage of development. The projects helped developed the will power and elevated the spirit of the rural people. After the initial planning and implementation processes, the movement spread to the cities and industrial as well as the private sector.

Saemaul Undong has become a model for developing countries, especially Africa and Southeast Asia. The Korean government is pleased with the results, views it as an effective tool for reducing poverty as well as changing the mindset of rural people. Lessons from the Comilla model of rural development and Saemaul Undong represent different strategies for reducing poverty, generating income and developing rural institutions for transforming rural society.

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# 4

## Contemporary Social Entrepreneurship

Iftekhhar Ul Karim

### Introduction

Social entrepreneurship is grounded in an array of theoretical perspectives and antecedents (see Santos, 2012; Jain, 2009; and Bula, 2012) that have contributed to the conception of social entrepreneurship and social innovation (Ebrashi, 2013; Abu-Saifan, 2012). Studies have examined in the concept and evolution of social entrepreneurship from different points of view (Welsh and Krueger, 2012; McDougall and Oviatt, 2000), and their findings have shaped and moulded contemporary views of social entrepreneurship (see Shaw and Carter, 2007; Spear, 2006; and Roper and Cheney, 2005).

Pless (2012) argued that the field of social entrepreneurship has grown in relation to social, economic and cultural phenomenon and not as a disjointed development. A widening gap between rich and poor in many developed countries has given rise to visionary entrepreneurs who design solutions for unmet social needs with primary intention to solely help other and thus have created different patterns in markets over the period of time (Pless, 2012). Needless to say, this has not been an unplanned initiative, and rather has been developed on a fundamental sets of conceptions and perspectives in a broader societal manner taking into account of the same elements of society, culture, and economy as put forth by Pless (2012), Welsh and Krueger (2012) and Spear (2006).

Jain (2009) investigated the origins of pro-social behaviours constructing the formation of social entrepreneurship and related it to the idea of “volunteering” or “volunteerism” by looking at a number of individual traits, and characteristics including empathy and altruistic personality. Pless (2012) elaborated ideas on similar elements of society, culture and economy that form the structure of social entrepreneurship. His study complemented Jain’s views that limit the notions of social entrepreneurship with the age-old spirits of volunteerism as a fundamental linchpin of pro-social behaviour of a social entrepreneur.

This chapter identifies the classical theoretical perspectives related to contemporary social entrepreneurship through a literature review as well as empirical research to contribute to the theoretical knowledge on the building blocks of social entrepreneurship.

## **Social Entrepreneurship Research**

Social entrepreneurship, in its network perspective, can be demonstrated with the aid of leadership theories and contributed to further development of the field. Depicting the broader instrumental approach of leadership and focusing on the influences and interactions among social entrepreneurs as leaders and their stakeholders in their dyadic relationships, Northouse (2013) developed the Leader-member exchange (LMX) theory. It relates to the context of in-group and out-group stakeholders of the organization or project that signifies the context of the social venture of the social entrepreneur (Cobb 2012). This naturally entails a higher amount of intimacy with the closer stakeholder group and lower amount of engagement with the outer stakeholder group, resulting in a challenge to social entrepreneurship. In this context, stakeholders of the in-group receive more information, influence and confidence from the social entrepreneur than the out-group stakeholders. Ensuring high quality leader-member exchanges (Northouse, 2013) will help avoid stakeholder conflicts and build effective dyads and network partnerships throughout the social entrepreneurship phases in small project life-cycles (Cobb, 2012; Tolbert and Hall, 2009). Northouse reported that studies by Graen and Uhl-Bien are quite relevant for social entrepreneurs, and suggests forging leadership in three progressive stages:

- a. The stranger phase, with lower quality LMX exchanges and self-interested actions/performances by stakeholders;
- b. The acquaintance phase, with medium quality LMX exchanges and room for more roles, responsibilities and challenges for stakeholders; and
- c. The mature partnership phase, with high quality LMX exchanges and effective dependencies with the stakeholders of the social venture in order to understand the progressive stages amongst the social entrepreneurs as well.

Likewise, the leadership factors are common to social enterprises and ventures of the social entrepreneurs and consistent with the leadership theories.

## **Organizational Factors in Social Entrepreneurship**

Social entrepreneurship in its organizational perspective can be demonstrated through theories and factors that have led to further development of the field. In this context, the case of Grameen Bank (GB) can be mentioned which started locally at a much smaller size in a small village of Bangladesh, and has grown into 43,000 villages with 22,149 employees across Bangladesh (Yunus, 2004). The monetary goal of GB is to make social profits (profits through social welfare) by offering

microcredit to poor and its non-monetary goal is to make borrowers (also shareholders) independent in a poverty free climate. In doing so, GB allocates roles to bank officials and loan collection officers under an authority system of GB's board of directors (Tolbert and Hall, 2009; Yunus, 2004).

Considering the organization structure of GB, it seems to be based on a closed system approach where size, technology and culture play a crucial role in determining the formal structure. The size of GB has expanded with the its growth and continues to be on the increase with greater specialization and complexity, the technology in terms of microfinance banking software, accounts/booths/ accounting systems for GB in large numbers in the rural communities and finally, with pooled interdependence of banking activities which is relatively independent but share pool of common banking resources such as microcredit banking systems) (Tolbert and Hall, 2009). Moreover, its closed system offers the artifacts of GB being a non-traditional bank, espoused values for community development and underlying assumptions of any microfinance project for poverty mitigation solely – all forming the internal culture of GB. Such a structure advocates for it being both a function-based organization (in a local context), and at the same time because of running organizational microfinance projects globally it also presents a global matrix together with a modern form of project-based organization (Tolbert and Hall, 2009). This structure is common in social enterprises and ventures of the social entrepreneurs.

### ***Corporate Social Responsibility***

Elements of responsibility and sustainability of social entrepreneurship can be understood through the concept of Corporate Social Responsibility (CSR) that influenced further development in this area. In this context, social entrepreneurs are community developers for whom making profits is not the main goal but only a steppingstone. This refers to the Corporate Social Responsibility (CSR) Pyramid, where being profitable and getting a fair financial return on investments is merely a basis of the whole model with a further hierarchy of goals (Werther and Chandler, 2011). This hierarchical system consists of four main cores for social entrepreneurs: economic responsibilities, legal responsibilities, ethical responsibilities and discretionary responsibilities (Werther and Chandler, 2011). As to legal responsibility, social entrepreneurs are aware of the importance of gaining social trust to act according to the legal framework established by the government for their social ventures and ethical responsibility is discharged for the society that is served by social entrepreneurs. Discretionary responsibility requires social entrepreneurs do more for the society in general whereas their vision of the society's welfare evolves

from their greater mission of combating social issues and problems (Werther and Chandler, 2011). Likewise, the CSR factors are common in social enterprises and ventures of the social entrepreneurs.

### ***Ethical Factors***

The ethical perspective of social entrepreneurship can be demonstrated by theories that led to further developments in this field. Generally, social entrepreneurs relate to a broader teleological approach comprising of three specific approaches of decision making on moral conduct: ethical egoism, utilitarianism and altruism (Northouse, 2013). Among these three, social entrepreneurs coincide most commonly with the utilitarianism approach. It justifies their social actions for the greatest good for the greatest number of social communities across the globe based on consequences with a clear indication toward the utilitarian approach with medium concern for people and medium concern for self-interest, thus ultimately justifying for maximizing the greater social benefits broadly through their social innovation. This approach of social entrepreneurs is not fully ethical egoism (high self-interest) and also not fully altruism (high generosity), and also to some extent supports the value-based ethical perspective in terms of building social/rural communities through social and rural/grassroots innovation (Northouse, 2013). Likewise, the ethical perspectives are common to social enterprises and ventures of social entrepreneurs as well with the same ethical theories.

### ***Project Management***

The project perspective of social entrepreneurship can also be found in relevant theories (Silvius et al., 2012). Engwall found that the interior processes of a project are influenced by historical and organizational contexts, similar to lessons to be learnt for social entrepreneurs from the experiences of past and previous ventures and the risks and crises faced in the past. Therefore, future projects of social entrepreneurs need to be conceptualized as interconnected with their history and future, as well as embedded in their surrounding societal and organizational contexts, and treating social enterprises in isolation poses an obvious risk (Engwall, 2003). Furthermore, Silvius et al. (2012) developed a maturity model to assess, monitor and improve the incorporation of the principles and concepts of sustainability in projects depending on the economic, environmental and social sustainability in the project management where stakeholders are placed in a separate category. The role of social entrepreneurs for ensuring the sustainability of the social venture is very important to specify the topics of consumer health, safety, and right to information.

## **Research on Social Entrepreneurship**

Discussion of social entrepreneurship from several perspectives has clarified and laid the foundation of its exploration with critical insight to identify gaps in research on the phenomenon. Bula (2012) critically analyzed the sociological aspects of entrepreneurship using ideas of classical theorists like Richard Cantillon who typifies the entrepreneur as one who equilibrates supply and demand in the economy. He also found that Jean Baptiste Say depicts the entrepreneur as a manager rather than a risk-taker, and Alfred Marshall introduced an innovative function of an entrepreneur who continuously seeks opportunities to minimize costs through perfect competition. Bula (2012) also discussed the Schumpeterian approach as a creative destroyer of equilibrium through introducing new products or new processes. These ideas help in understanding the foundations of social entrepreneurship by drawing upon classical theories.

Social entrepreneurship has been a topic of academic research for nearly twenty years with relatively little theoretical underpinning of this interesting field of study. Short et al. (2009) suggest that social entrepreneurship is informed by familiar areas of interest to management scholars like entrepreneurship, public/non profit management, and community issues, all of which symbolize productive venues for future research efforts and recommend that scholars should devise interesting themes and outline their research using recognized theories, such as contingency theory, creation theory, innovation diffusion theory, resource dependence theory, and other theoretical bases pertinent to social entrepreneurship study.

Abu-Saifan reports that while individuals may be publicly recognized as social entrepreneurs for their contributions to improve the wellbeing of communities, the concept continues to struggle to achieve scholarly legitimacy, identifying social entrepreneurship as a term in search of a good definition and devoid of a basis of theoretical foundations (2012). It is further pointed out that the current use of the term of social entrepreneurship is vague and requires clear-cut boundaries to demarcate its function and theoretical basis. The lack of a theoretical ground of social entrepreneurship hinders research and raises questions about which social activities fall within the gamut of social entrepreneurship and it lacks a theoretical framework that links it to the theory of entrepreneurship (Abu-Saifan, 2012). He goes on to argue that the study of social entrepreneurship requires theoretical direction, framework and foundation.

Jain considers social entrepreneurship as a factor of risk and reward and clearly indicated that it should be a branch of entrepreneurship for

social cause, and social well-being must take priority over profit motive with due entrepreneurial significance. He proposes a model which shows the growth and direction of social organizations that do not differ from an entrepreneurship venture in a social context with commitment (Jain, 2009). This proposition of to examine social entrepreneurship through the lens of modified classical entrepreneurship paves the path for the further research in this field.

Chell (2007) notes that throughout the 20th century multiple discourses of enterprise and the entrepreneur have developed and they can be used as a backdrop to understand both social and economic entrepreneurship focusing on social enterprise. Welsh and Krueger (2012) pointed out the need for further maturation of the field of social entrepreneurship indicating suggesting more research on its theoretical ground and thus acknowledging a research gap. An exploratory citation analysis of social entrepreneurship research conducted by Kraus et al. shows that a wide range of social entrepreneurship sub-domains have been explored, and authors are in agreement that social entrepreneurship research is still at an early stage and not enough information has been gathered to construct a strong theoretical base (2014). This view points to the need for additional research on social entrepreneurship to build a data base through additional research on the motivation and creation of social enterprises and incorporation of social capital into the social entrepreneurship literature.

### **Research Methodology**

Depending on the relative context of the foundational knowledge on social entrepreneurship from different perspectives, the social constructionist standpoint in terms of both ontology (view of reality) and epistemology (view of knowledge) has been adopted in this research (6 & Bellamy, 2012). The role of theory in this research is considered inductive as it starts without a clear theory, but presented available theoretical ideas. It takes a theory building inductive approach and offers theoretical understanding in the form of a basic typology at the end. The inference of this study is descriptive as it demonstrates the theoretical understanding of social entrepreneurship by identifying and describing its relevance to classical thought in a descriptive manner. The relation of the theory to the concept is not regarded as an explanatory inference since to the focus is on relevance and not on relationship.

The data is mainly qualitative, and analysis is based on the grounded theory approach. The type of data and analysis of this study is mainly literature based and qualitative from a theoretical standpoint to arrive at concrete conclusions for further research based on the developed typology. Secondly, with an empirical research design, secondary qualitative data have been extracted from Ashoka's directory of social

entrepreneurship faculty where he identified 87 professors and researchers in 15 countries who teach courses or conduct research in the field of social entrepreneurship. The study was limited to core articles relevant to the subject matter in terms of “article title” only; therefore, many scholarly articles may have been excluded for not having a relevant title.

Adopting a systematic overview of the literature, this chapter critically examines a number of relevant papers extracted from the scientific and scholarly databases on social entrepreneurship. In the process, the systematic literature review underwent two probing phases to underpin the correct relevant literature on the topic. In the first phase of literature review, the search focused upon fundamental keywords “entrepreneurship/entrepreneur” and/or “social” in the context of “theoretical perspectives” to pinpoint the thematic setting. The search was restricted to the literature in the contemporary Social Science field only, to avoid irrelevant and outlying concepts, and also to identify the strongest relevancies and relations and looked for contents directly under article titles.

Concomitantly, research outputs of faculty members were reviewed to capture the meaning of core concepts of social entrepreneurship from Ashoka’s directory of social entrepreneurship faculty. After closely observing the robustly cited and theoretically used perspectives in the contemporary domain of “entrepreneurship/entrepreneur” and/or “social” in the context of “theoretical perspectives”, a number of key relevant theoretical perspectives were used to prioritize them, from the most palpable (e.g. “knowledge”, “resources”) to the most pioneering categories (e.g. “social capital”). Next, the second probing phase of the literature search dug deeper to identify and highlight related works of the underpinned perspectives. After an initial review of some general studies for delineation purpose irrespective of regions and keeping the search restricted to articles that appeared recently in the contemporary social science domain (i.e. 2010 onwards), the identified perspectives were then filtered out on the basis of more specific aspects such as knowledge, resource, trust, learning, behaviour and culture.

## **Perspectives on Social Entrepreneurship**

### ***Knowledge-based and Resource-based perspectives***

A knowledge-based view (KBV) of the firm underlines knowledge as its most advantageously important resource (Grant, 1996); this makes multifaceted knowledge foundations and polymathic competences across firms its sustained competitive advantage in the long run. Given the fact that, knowledge itself is too complex to imitate or reproduce, it penetrates through the organizational context and culture, firm’s identity and idealism beset with the people surrounding the organization or social

enterprise. This perspective is based on the resource-based view (RBV) of the firm primarily proposed by Penrose (1959) and later elaborated by others (Wernerfelt, 1984; Barney, 1991), and they distinguish the vital role of knowledge in and around the firm or social enterprise. On this note, RBV underlines the competitive advantage and superior long-term performance of the firm based on its accumulated or valuable resources, or even rarity in resources as far as the firm masters the art of preserving resource imitation, transfer, or substitution. Needless to say, social entrepreneurship is founded on the strong grounds of knowledge expertise along with resources to revamp the social ventures and enterprises.

### ***Social Capital Perspective***

Social capital is primarily related to the significance of social networks and institutional affiliations that link similar people and provide bridges between dissimilar people formulating how these people and entities interact with and benefit from each other. Securing payback by virtue of attachment to social networks or other social structures, social capital is considered a collective good that results in augmented sharing and solidarity among actors in the network that would be otherwise inaccessible (Gedajlovic et al., 2013). Considering the goodwill that others have toward us as a resourceful asset, social capital represents the value embedded in social relationships of individuals or collectives (Gedajlovic et al., 2013) and this is convertible into economic capital, profitable returns and win-win deals affecting economic growth and valued in the market place. After the growing delineation of social relationships underlying entrepreneurship (Estrin et al., 2013; Light and Dana, 2013; Audretsch and Aldridge, 2012), social capital could be regarded as a foundational theory of social entrepreneurship (see Gedajlovic et al. 2013). As social entrepreneurs are socially situated, social capital establishes relationships deliberately and utilizes them to produce intangible and tangible mutual benefits in short or long runs. In this context, social entrepreneurs have to be networked and interactive with several stakeholders to achieve their goals. It can be therefore theorized that a strong element of social capital underlines the major function or factor of social entrepreneurship.

### ***Social Learning Perspective***

The social capital perspective gives rise to the underlying social learning that is augmented in the course of social/entrepreneurial networking and social affiliations. Social learning is firmed by a three-way relationship between cognitive factors, environmental influences, and behaviour; and transpired through four main stages: close contact, imitation of superiors, understanding of concepts and role model behaviour (Bandura, 1968). Urban (2011) has strongly argued that people learn more from people like themselves than from other groups or experts, given the fact that they tend to learn best from those that are at the same level as themselves.



Apart from that learning about entrepreneurial networking has also become crucial in the social entrepreneurial learning process in and of itself. Collaborative learning as proposed by Dodgson (2011) in new products, production processes, organizational practices, approaches to marketing, and sources of supply can be effective for the social entrepreneurial success. On this note, it can eventually synergize the social entrepreneurship success right from the start-up phase of the social venture. It can be therefore theorized that social entrepreneurs can better learn in an environment comprised of fellow social entrepreneurs and thus can share their own learning process and disseminate their expertise in a participatory and shared approach.

### ***Planned Behaviour Perspective***

The planned behaviour perspective is intended to serve as a mediating factor that connects the antecedents of actual behaviour like attitude towards the behaviour (positive or negative feelings about performing a behaviour), subjective norm (surrounding the performance of the behaviour), and perceived behavioural control (perception of the ease with which the behaviour can be performed) with the actual behaviour (Ajzen, 1985). In short, behaviour is driven by intentions those are a function of antecedents of actual behaviour. Furthermore, Tipu and Arain (2011) termed entrepreneurial behaviour as a set of activities performed by an entrepreneur or entrepreneurial actions in brief. This portrays a social entrepreneur who exhibits opportunistic behaviour of identifying and exploiting prospective opportunities beset with the social entrepreneur's dealings with the external setting and response to existing conditions. Additionally, they set entrepreneurial behaviour as cognition stipulating how entrepreneurs think and actions underpinning what entrepreneurs in reality do. Entrepreneurs act to manage success factors and hence the thinking-doing nexus of entrepreneurship seems to underline strong entrepreneurial intentions for (Tipu and Arain 2011). Social entrepreneurs are likewise supposed to be holding these strong entrepreneurial intentions, especially in developing countries and leading toward formation of their social ventures.

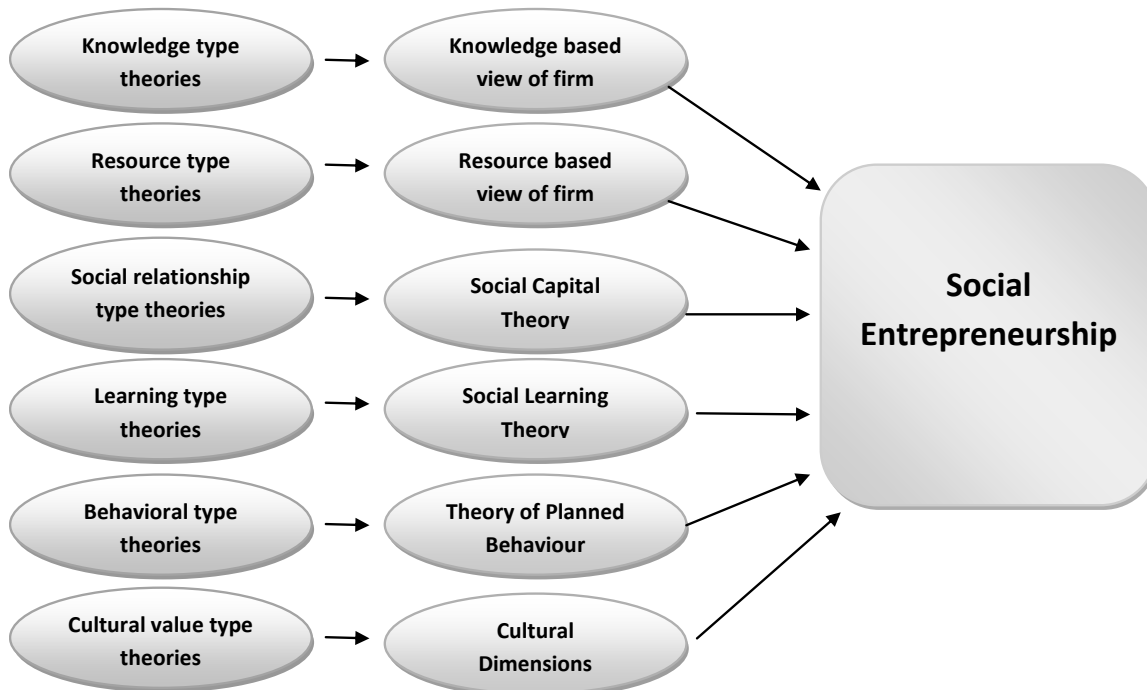
### ***Perspective on Cultural Dimensions***

Hofstede's cultural dimension theory states that the characteristics of the people of a particular region are determined by their customary value systems, and he added that we can gain insights about people's motivation and expectation by understanding these values (cited in Holt, 1997). Holt applied this idea to the domain of entrepreneurship exploring the value orientation of the entrepreneurs. He found that entrepreneurs in the East (e.g. China) behave differently than the entrepreneurs in the West (e.g. US) depending on their crucial value dimensions (Holt, 1997). Interestingly, Judge et al. argue that entrepreneurial ventures require a "leap of faith"- where the entrepreneur's faith orientation may influence

the start-up process for some entrepreneurs (2013). It is therefore interesting to identify and theorize what factors play vital roles for social entrepreneurs in their cultural contexts focusing on locally popular and traditionally/culturally/religiously inspired social ventures.

### Conclusions and Recommendations

Depending on the perspectives discussed above, the following combined typology can be presented for the theoretical understanding of the social entrepreneurship field without disassociating it from the basic field of entrepreneurship.



**Figure: 1:** Classical Theoretical Perspectives of Contemporary Social Entrepreneurship

This typology depicts the core theoretical understanding underpinning the field of social entrepreneurship comprising of the Knowledge-based and Resource-based perspectives, Social Capital perspective, Social Learning perspective, Planned Behaviour perspective and Perspective on Cultural Dimensions. On the basis of these classical theoretical perspectives of contemporary social entrepreneurship, it is recommended to compare the future publications on social entrepreneurship with the aforementioned typology to undertake research on the sub-categories of this typology and extend the domain of social entrepreneurship by conducting cross-disciplinary research in identifying the expanded elements of this typology. It is of paramount importance to establish social entrepreneurship as an extension of entrepreneurship for recognizing this theoretical transformation.

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# 5

## **Remittance and Productivity in Bangladesh**

**Muhammad Mueen Uddin  
Mohammad Joynul Abedin**

### **Introduction**

Remittance plays a significant role in strengthening the economy of developing countries. It helps to ease foreign exchange constraint, stabilize exchange rate movement and improve the balance of payments at the macro level. At the micro level, remittance has a positive impact on household consumption, alleviation of poverty and entrepreneurship. There is keen global competition for exporting manpower and the demand for skilled and educated personnel, and Bangladesh lags behind in these areas compared to some other remittance earning countries. A number of public and private agencies, Ministries, non-governmental organizations and banking institutions are engaged in the remittance process. Individually, they have plans, visions and missions but most of them do not implement or achieve them effectively. Besides, the government has no specific policy for remittance governance and there is no co-ordination among the various agencies and institutions engaged in the process. Under the circumstances, it is important to develop a planned remittance governance system for contributing to social and economic development.

As a developing nation, remittance inflow is one of the vital indicators for the economic growth in Bangladesh which exports about 0.5 million human resources to the world labour market every year. Unless this sector is efficiently governed, the rate of remittance will continue to be in negative territory. Higher remittance inflow helps increase the purchasing capacity of the households especially in the rural areas, and decrease the government expenditure for the safety net programs. Besides, the government can reduce trade deficit by exporting more skilled workers to the world labour market. Since the percentage of import is higher than that of export, there is a large deficit in the balance of foreign trade in Bangladesh. Therefore, it can be argued that an effective policy for remittance is critical for micro and macro economy of the country.

Remittance is the lifeline of the economy of Bangladesh as it is a major contributor to the foreign reserve of the country. Bangladesh is the 7th highest remittance earner country in the world (Bangladesh Economic Review 2016). Unfortunately, this earning cannot make much

contribution to productive economic growth because of mismanagement. Among the low-income countries, the Bangladeshi diaspora has the largest savings of approximately US\$9.5 billion as bank deposits in destination countries. These savings provide a strong case for issuance of diaspora bonds, that can be issued by the Bangladeshi government like other countries—India, Philippines, Sri Lanka, Kenya, Ghana, Nepal and Ethiopia (Sohel, 2015). Remittances have not contributed much to economic growth in remittance-receiving economies, and success stories are rare. It will be difficult to find any country that can truly claim to have funded significant economic development from remittance earnings (The Economist, 2014).

This chapter examines the state of remittance governance in Bangladesh. It is based on primary data collected through questionnaire surveys and interviews with fifty selected respondents from Pashapur village in Laksam upazila of Comilla district. Secondary data were gathered from journals, books, reports, public documents, relevant websites and newspapers. The chapter analyzes the issues related to remittance from Bangladeshis employed overseas and proposes a number of recommendations for the government of Bangladesh for developing a globally adaptive mechanism for increasing and sustaining the flow of remittance that will contribute to the development of the country.

### **Remittance to Bangladesh**

Remittance can be transferred through both formal and informal channels. In recent times, the remittance transfers through formal channels are higher than informal channels. A survey by the International Organization of Migration revealed that 82 percent remittance receives through banks and formal money transfer agencies and only 18 percent are sent through informal channels (BHRS, 2009). Another survey (BD Bank, 2009) reported that 54 percent was received through informal channels in 2006 and 24 percent in 2008. Thus, remittance transfer through informal channels has gradually declined. If more remittance could be sent through formal arrangements, it would benefit the financial system and accelerate the economic development. Although most of the remittances are sent through legal means, illegal channels are also active in these transactions. According to an International Labour Organization report, although the annual flow of remittance through legal routes now accounts for \$14 to \$15 billion, a huge amount worth between \$4.3 and \$5.7 billion are remitted by migrant Bangladeshis using illegal routes (Zahid, 2015).

Bangladesh experienced a decline in remittance for the first time in 2013 (Bangladesh Economic Review, 2016). Four factors can be identified for this consequence and they are a drop in the number of



Bangladeshi migrants who send money home as well as earnings per migrant worker. Moreover, there has been a decline in the capacity for saving and amount of money remitted to home. The main reason for decline in remittance is directly related to the rate of migrants. Two factors are responsible for this situation. Bangladesh failed to send more workers abroad and the state was unable to explore new markets. Only 450,000 migrants were able to find overseas jobs in 2013 where as 680,000 were recruited in 2012. Additionally, the government's diplomatic efforts were insufficient to solve problems related to the legal status of Bangladeshi migrant labours in the Middle East (Hussain, 2014).

### **Status of Remittance Inflow in Bangladesh**

Although the remittance inflow in Fiscal Year 2015-2016 was 12,225 million US dollar in Bangladesh (8% of GDP), the growth rate was negative at -1.82%. The country has experienced negative growth rate in remittance since 2013 after loss of labour market in Saudi Arabia, United Arab Emirates and Malaysia.

**Table 1: Remittance inflow to Bangladesh**

<i>Fiscal Year</i>	<i>Growth rate (%)</i>	<i>Percentage (%) rate of GDP</i>
<i>2011-2012</i>	<i>10.24</i>	<i>9.6</i>
<i>2012-2013</i>	<i>12.60</i>	<i>9.6</i>
<i>2013-2014</i>	<i>-1.61</i>	<i>8.2</i>
<i>2014-2015</i>	<i>7.70</i>	<i>7.9</i>
<i>2015-2016</i>	<i>-1.82</i>	<i>8</i>

Source: *Bangladesh Economic Review*, 2016

The prevailing perception is that remittance governance simply involves exporting human resources and receiving money from them. In reality, it is a long and complete process that begins with preparing human resources for overseas employment and ends with the proper utilization of remittance received. It covers a wide range of activities including training of workers, education and job knowledge, identification of new markets, provision of support abroad, reception of remittance, and ensuring appropriate utilization of the funds.

The present situation of remittance governance can be explained at three stages; namely- initial, intermediate and final stages where proper smooth operation of one stage is completely depends on others. The present condition of remittance governance is less congenial to bring socio-economic development of the country.

### **Problems of Remittance Governance**

#### ***Initial Stage: Exporting Human Resources***

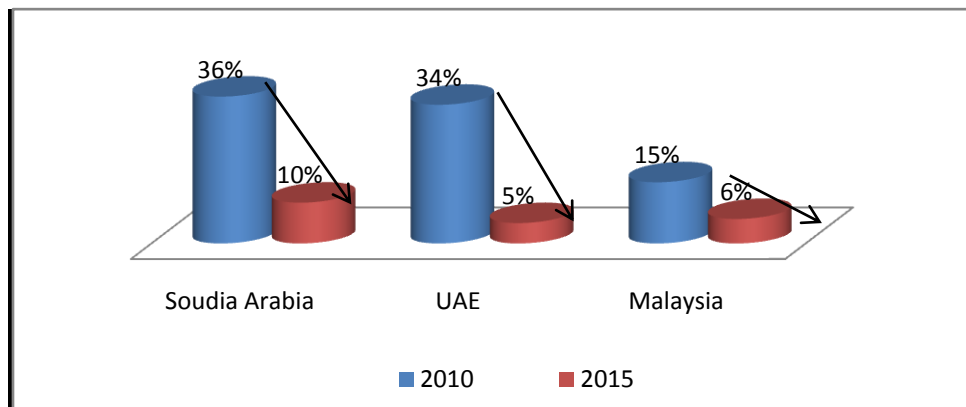
Market research is essential for determining the need of labour markets. Neither the government of Bangladesh nor private manpower exporting

agencies undertook research about the world labor market. Consequently, the agencies do not have knowledge about the world labour market and cannot determine the types of skills in demand in overseas job markets.

The potential labor force has poor knowledge about market demand and they have to maintain brokers for managing passport and visa due to complex procedures of migration. In this complex process, brokers charge a large amount of money from them and sometimes they cheat with the migrants as well. Complex and unclear procedures, rules and regulations make it difficult for the employment seekers to navigate through bureaucratic demands.

Creating and identifying new labour markets is a challenging task and requires wholehearted efforts by the government, particularly its diplomatic offices abroad. The scope for employment of Bangladeshi migrants overseas is declining due to inefficiency of diplomatic officials. The labour market in Saudi Arabia fell from 36% to 10% and Malaysia from 15% to 6% in recent years.

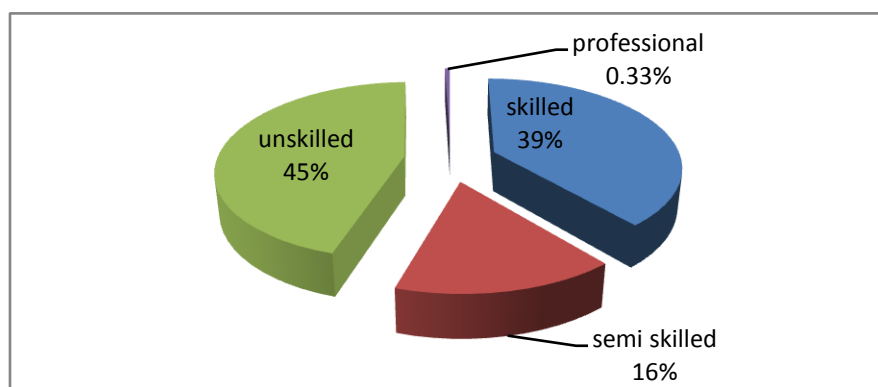
**Figure 1:** Decline in Human Export, 2010-2015



*Source : Bangladesh Economic Review 2016*

Most of the migrants from Bangladesh are unskilled workers with little education, job experience and no training. The lack of skills makes it very difficult for them to compete in the world job market.

**Figure 2:** Skilled and Unskilled Migrants from Bangladesh, 2015



*Source : Bangladesh Economic Review, 2016*

### ***Intermediate Stage: Overseas Employment and Transferring Remittance***

Migrants often go abroad after prolonged efforts and frustrating experience, and face problems at the destination. These vary from one country to another, and the migrants need support from local Bangladeshi missions. The problems are often related to Akama (work permit), visa, salary, accidents on the job and death. At times of crises, they are unable to obtain support from the foreign missions of Bangladesh. Although helping migrants is one of the main tasks of the missions, they do not serve migrants in difficult situations. Lack of support from Bangladesh missions is a major issue.

One of the reasons for the inability or disinterest of Bangladesh missions to help migrants is the absence of a labour welfare wing in the agency. This section is essential in order to assist migrants who are confronted with various problems in unknown circumstances. This facility is not available to them.

The migrants encounter several roadblocks and obstacles in remitting funds to their families in Bangladesh. This is caused by information asymmetry about the market as well as an active hundi or non-formal channel for remitting money. The problem is made complicated by low literacy rate that does not allow migrants to search and locate the best medium for remitting money. Poor infrastructure makes the transfer to rural and remote areas difficult, and private commercial banks do not have large enough network to participate in the process.

### ***Final Stage: Utilization of Remittance***

The actual benefits of remittance money will be reflected through its proper utilization at both the macro and micro economic level. In reality, remittance money seldom goes toward productive investment. Most of the income is used for household consumptions like food, clothing, and entertainment, as well as education, health and other essential needs. Although a small portion of remittance is invested, there is no organized arrangement by the government and non-governmental agencies to educate migrants on investment strategies and savings.

### **Migration and Utilization of Remittance**

A comprehensive study was conducted on fifty households of migrants' families from Pashapur, a village of Laksam upazilla in Comilla district to understand the current remittance process and its utilization. Information was collected on problems faced by migrants before going abroad, training received for overseas employment, channel for transmitting remittance, changes in income and expenditure of their families before and after migration, use of remittance at household level, help and advice offered by public and private financial institutions, changes in economic role of family members/wives due to migration, and

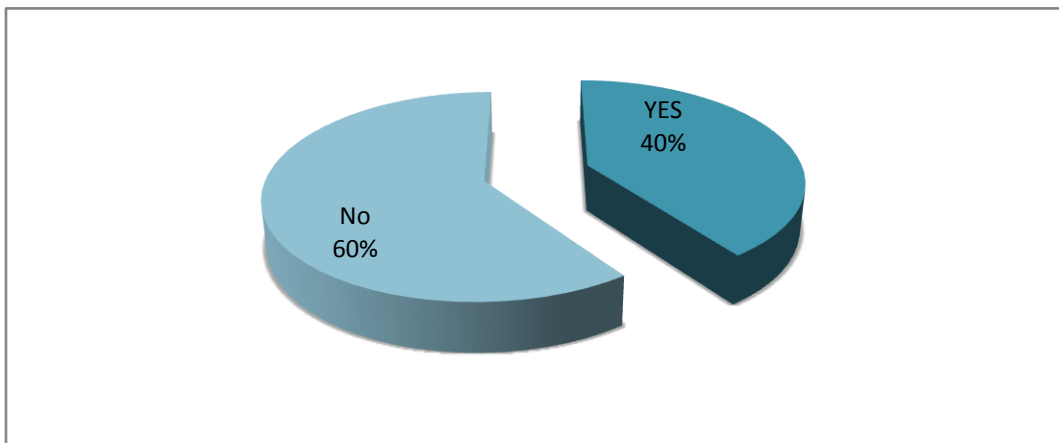
the level of concern about the future of migrants after they return to the country.

**Figure 3: Problems Faced Before Migration**



Figure 3 illustrates that about 90% migrants of Bangladesh have to use the services of agents to go abroad because they have no knowledge about the opportunities abroad as well as the process of migration. Therefore, they have to pay the agents huge sums of money to acquire passports, visa and work permits for migration, and it is estimated that about 30% of the migrants were cheated by the agents. Generally, Bangladeshi migrants are expected to arrange visa themselves, through relatives or acquaintances, and a negligible number go abroad through government agencies. About 50% of migrants, who go through the government agencies, are subject to extortion, and this eventually discourages the people from being migrated.

**Figure 4: Percentage of Trained and Untrained Workers**



Even a decade ago, generally 2% - 4% migrants would receive training programs before going abroad. At present, about 40% workers are trained to obtain skills in driving, electrical work or construction jobs, but this is not enough for them to compete with the globally competitive labour market. On the other hand, about 60% of the migrants have little knowledge, experience and skills to be used on the job. For these reasons, Bangladesh has been losing its potential labour markets over the years.

**Figure 5:** Channels of Remittance

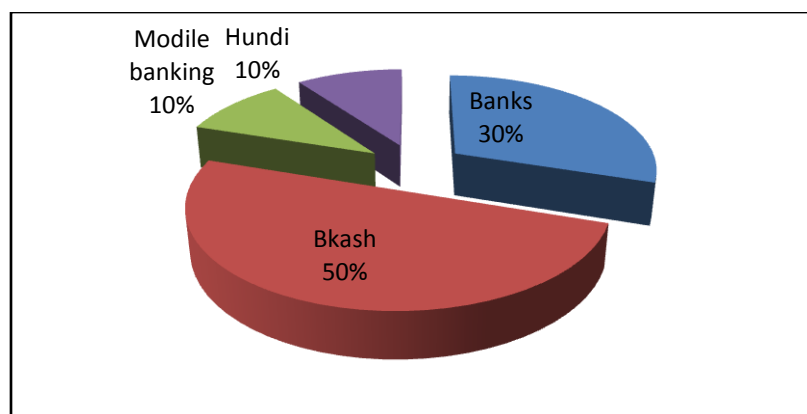
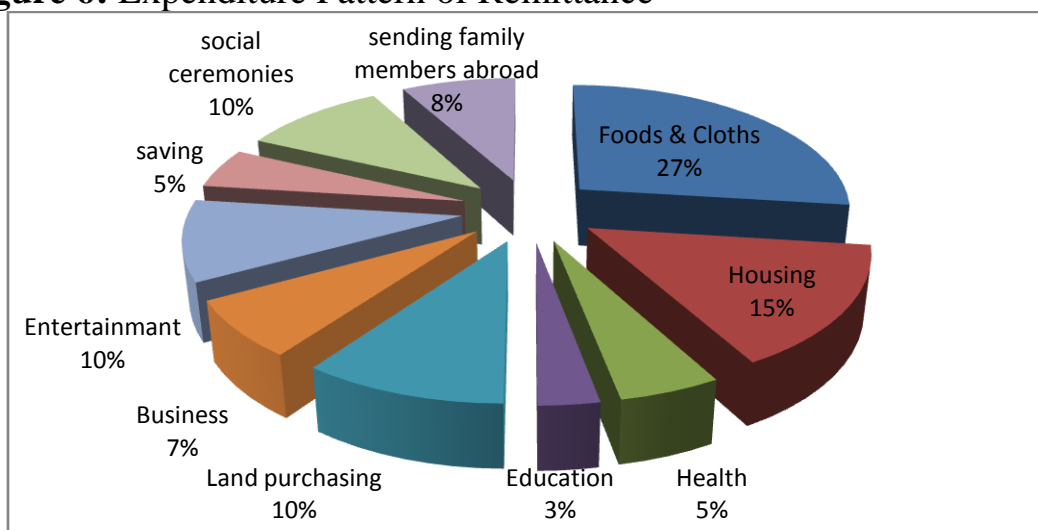


Figure 5 illustrates that at present time about 50% of remittance money is transferred through BKASH, a mobile financial service in Bangladesh operating under the authority of Bangladesh Bank as a subsidiary of BRAC Bank Limited, and it helps to send and receive money easily in a short time. Though any amount of money can be transferred through bkash, it charges about 2% as service charge and the cost is quite high. The role of banks in remitting money has been decreasing due to the lengthy process adopted by them. Hundi, an illegal channel, is still in operation because large amounts of cash can be transferred in a short period, although the government does not receive any benefit from this process.

It was found that the income of migrants’ families increased by 400-500 percent after migration, and this enhanced their purchasing capacity. At the same time, their household expenditure has increased by 200-300 percent compared to the period before migration. Thus, the living standard of the families has been elevated, although most of the households do not appear to be interested in utilizing the remittance for investment to earn high returns.

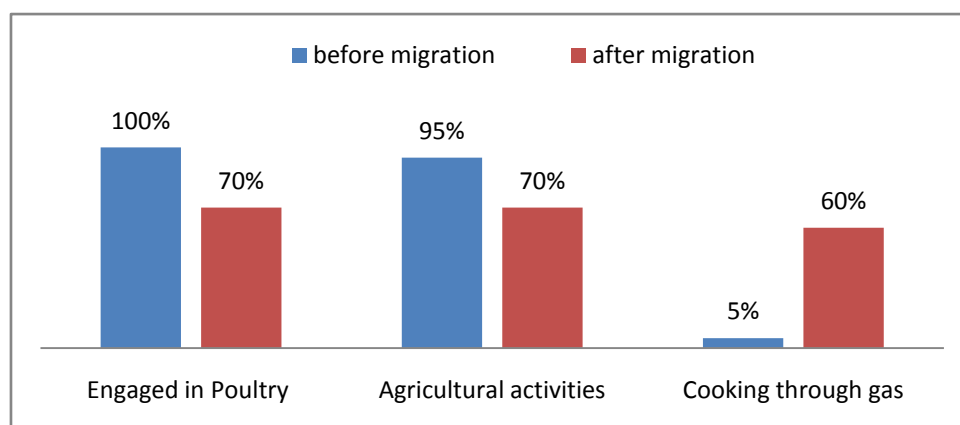
**Figure 6:** Expenditure Pattern of Remittance



After a worker migrates abroad, members of the families try to increase their social status by spending more money on food and clothing which amounts to 27 percent of the remittance. They spend 15 percent on housing, and 20 percent on entertainment and other events. Apparently, the families are not that concerned about health and education of the children who often become rebellious as the heads of the households are not around to discipline them. A small percentage of remittance is used to buy gold, lease a shop, save money in banks and purchase land.

BRAC as a private financial institution provides loan for migration to the vulnerable people to be repaid by instalments. Grameen Disa, a non-governmental organization, offers loan to poor people to be used for meeting the cost of migration. The Probashi Kayllan Bank has the mandate to provide give loan to migrants and advise them on investments, but their network is limited and unable to reach the village level. In fact, there is no designated institution for performing these important tasks.

**Figure 7:** Change in Economic Activity



Remittance money influences not only the living standard of households but also economic activities of family members who remain in the country. As the family income is increased through remittance, the family members use the benefit of this new source of income and make less contribution to the family.

Figure 7 illustrates that before a member of the family migrated, all the households were engaged in raising poultry and 95 percent in agricultural activities, but the percentage dropped to 70 percent in both areas after migration. Before migration, only 5 percent of households used natural gas for cooking and other families used firewood collected from the surroundings. After migration, the usage of natural gas as fuel increased as 60 percent of households started using it.

It appears that the family members at home enjoy the benefits of income from migrants, but are not concerned about the future. Conspicuous consumption and a lack of foresight often render the efforts

of hard-working migrants useless. There are no productive investments or savings for the migrants and it gives rise to various problems after they return to the home country.

### **Policy Issues**

Bangladesh earns a considerable amount of money through remittance from migrant workers. However, there is no clear policy and guidelines for preparing employees for working overseas or using the remittance in a productive manner for strengthening the economy. There are some superficial efforts by the government of Bangladesh through the Ministry of Expatriate Welfare and Overseas Employment, financial institutions and agencies including Probashi Kayllan Bank to govern remittance, but it is not conducted in a coordinated way. Although the Ministry and Probashi Kayllan Bank appear to have plans to develop in this area, no clear national remittance policy has been formulated. This chapter offers a number of recommendations, taking into account the practical problems discussed in this study.

Diplomatic efforts to plan and migration need to be developed and continued for helping to sustain the current overseas labour market and explore the new markets as well. Bangladesh missions overseas need to establish user-friendly labor welfare wings with the capacity to respond quickly and effectively to assist migrants in need.

The process for migration should be simplified to encourage migrants to go abroad. Smooth and secured transfer of remittance through different financial agencies should be ensured to encourage the formal channel. There should be an expansion of training and other institutional facilities for assisting potential migrants to become skilled. Continuous market research needs to be conducted for understanding market demands and bridging the gap between demand and supply human resources. Families of migrants in Bangladesh could be assisted with counselling, and advice on effective utilization of remittance.

Institutional mechanisms must be developed to reduce the cost of migrating for employment overseas and transferring remittance. This will be made easier with proper coordination among Bangladesh Overseas Employment and Services Limited (BOESL), non-governmental recruitment agencies, Bangladesh Bank, Ministry of Expatriate Welfare and Overseas Employment, foreign missions and Probashi Kayllan Bank.

### **Conclusion**

Bangladesh with a population of approximately 16 million people faces the challenge of developing and using human resources effectively. Labour migration has been identified as a potential tool for contributing to the socio-economic development of the country. Efforts to manage

migration and remittance should be strengthened, and digital technology can be introduced in order to maximize benefits from migration. In spite of being mostly automated and partially manual, the remittance process is still far from satisfactory in terms of service quality, cost structure and transaction risk. The biggest impediment is the risk and cost of the transaction of remittance. If the government intends to retain market share of the highest remittance source countries such as Saudi Arabia, United Arab Emirates, United States of America and Malaysia, the government of Bangladesh has to develop globally adaptive strategies by reviewing plans and policies of the top most remittance earning countries such as India, China, the Philippines and Mexico.

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# 6

## Global Market and Management

Abdullah Al Rana Farhad

### Introduction

The readymade garment industry has been a major economic force in post-independence Bangladesh and continues to flourish. It is the second largest player in the world export market without adopting the principles and practices of modern manufacturing systems. In the management of readymade garment industry in Bangladesh, there is a huge gap between the ground level line of management to the top level management in terms of synchronizing, understanding and adopting modern manufacturing methods. The garment industry is engaged at competing at the global level on the strength of their past experience instead of adopting management for future.

One of the basic tasks in the garment industry is costing, i.e., to plan and evaluate performance with reference to *production* instead of *productivity*. In fact, many factories appear to be unaware of the term *productivity*. Work study was introduced in this sector in the 1990s to implement time-based management. The primary initiative was to convert the base of calculation from overall performance to individual performance. The output of a worker per hour is used to evaluate the performance of different sewing line in a factory, and the daily output number was used for measuring production. Productivity was introduced as a simple tool for understanding the expense to earn ratio. Later, SMV (Standard Minute Value), efficiency and other tools were introduced for this purpose. However, even in 2016, many factories and their top and front line management are not interested in and/or aware about this management. To grow in global platform, RMG sector must adopt the globally practiced system.

In Readymade Garment (RMG) industry, the manufacturing process runs in a line according to product layout, and line wise performance evaluation is essential for assessing the performance of an industry. A sewing line starts at input area and ends at the output area and includes proper quality inspection. Therefore, it is important to evaluate each and every part of performance based on Key Performance Indicators (KPI), and productivity is one of the most important KPI. Since the inception of RMG industry in 1978, people in this sector know production as the produced garment pieces from a sewing line. It is the common practice to ask about the performance of a sewing line or an industry with the

question “How much is the production”. Although production is important, it is not a KPI. Typically, in an industry, comparison in performance in two lines is also measured by the daily output (usually called Production).

### **Production and Productivity**

Production is a process that combines inputs (both material and immaterial) to yield outputs which will be a good or service with value. In the RMG sector, the output is the garment that had passed quality test, and there are several inputs like manpower, machine, raw material (fabric, thread, buttons), power, time, and money. There are so many factories that consider the output from sewing line as production even if it had not passed the quality test.

Productivity is a KPI of a production process. It is the ratio of input and output of the process.

Productivity = Output/Input

Productivity can be measured partially or totally. Partial productivity reflects a comparison with a partial input such as only manpower or machine. Three types of partial productivity are easily applicable and viable for RMG industry.

1. Labor Productivity = Total Output/Total Number of Labor
2. Machine Productivity = Total Output/Total Number of Machine
3. Energy Productivity = Total Output/Energy Input

Total productivity is determined by calculating the total input, and capital productivity is used in this process.

Total Productivity = Total Output/Total Money Input

The monetary input includes the total direct and indirect cost. Both partial and total productivity can be calculated for a sewing line and/or for full industry. But as the RMG is a labor oriented industry, labor productivity plays a key role there.

### **Performance Comparison Based on Productivity**

Daily output is not a scientific or even proper tool for comparison, but it helps to compare the production lines producing same product. For example, two sewing lines (Line A and Line B) in an industry are running for 8 hours shift and producing 900 pieces and 950 pieces respectively. Judging by the output number, Line B is performing better. If the number of workers is 50 and 54 respectively, then the unit of labour productivity is 18 and 17.59. In this case, Line A is the better performer and the evaluation becomes scientific. However, only the daily output is considered in most of the industry. The industries have an Hourly Output Board where only hour wise outputs are recorded and labor wise hourly output reports are maintained.

### ***Standard Minute Value (SMV) the Time based Management***

Standard Minute Value (SMV) is the time required for a qualified worker working at “Standard Performance” to perform a given task. The SMV includes additional allowances for Rest and Relaxation, Machine Delay and anticipated Contingencies.

In modern business paradigm, every industry manufactures a product or service but they sell time. They are paying the employees based on time and also calculating the cost of manufacturing based on time. All the products or services are transformed into a standard time value. In RMG sector in Bangladesh, many factories calculate the SMV of their product, but few of them rely on their system.

SMV helps the organization to use time based management. Product turn-in time needs a proper match with lead time. Cost of manufacturing (for Garment Industry Cut Make Price) can be calculated based on SMV and factory capacity can be expressed in available minute so that marketing can be done more precisely.

### ***Efficiency***

Efficiency of a sewing line is generally measured by the ratio of input to output. Generally, input minutes are taken as input and produced minutes are taken as output to calculate the efficiency of a sewing line.

Input Minute = Labor worker in a sewing line \* Working Minute

Output Minute = Output Garment Quantity \* SMV

Efficiency = Output Minute / Input Minute %

Efficiency is usually calculated by comparing consumed and produced resources. Comparison can be done among any type of product manufacturing sewing line or industry.

### ***Per Minute Labor Cost***

Though SMV is necessary to calculate the efficiency, it also used to calculate the per minute labor cost in an industry. The per minute labor cost is the key for calculating the cost of manufacturing.

Per minute labor cost = (Wages and Fringe or Social Benefits + Manufacturing Overhead Expenses) of month / (Total Directly Working Minute per month including efficiency)

Wages and Fringe or Social Benefits = Average actual labor monthly wages (direct and indirect without fringe and social benefit) + Average actual monthly Overtime wages + Monthly fringe or social benefits

Manufacturing Overhead Expenses = Variable Overhead costs + Fixed Overhead costs

Total Directly Working Minute per month including efficiency = Working hours per day (expressed per direct labor employee) \* Working

days per month (expressed per direct labor employee) \* Number of Direct Labor Employees \* Average production efficiency (expressed as %)

### **Managing Daily Production**

Life of a sewing supervisor or line chief in a Bangladeshi RMG factory is full of challenges. There is severe bull whip effect in fixing the daily targets. Most of the factory marketing departments calculate the cut make price based on Man-Machine-Hourly Production, and line target is set on the forecasting data. When the product enters a sewing line, the available manpower and machine or space becomes minor issues. The prime issue is the achievement of the forecasted target. There is also a huge communication gap between the manufacturing and the marketing department. The marketing does the costing based on their forecast and then the planning department adds allowance for uncertainty in setting the target, and this becomes difficult to achieve. Then the management instructs the production department to achieve the forecasted target in any way. The process of setting targets is important for smooth production management, and every concerned employee should know the expectations from the beginning.

### ***Setting of a Target and Marketing Strategy***

A sewing line is the ultimate place where the core activities take place. Every industry should align their marketing with the sewing line. The average monthly forecasting system should be based on Total Directly Working Minute per month including efficiency.

Monthly forecast for a line = Total Directly Working Minute per month including efficiency / average SMV of the product

### ***Effect on Line Human Resource Management***

In quantity based allocation, the output target remains nearly fixed and the input factors vary. The line chief needs to increase or decrease the number of workers in sewing line to ensure the target is achieved. Budgeting of manpower becomes very difficult for him or production manager as well as the Human Resource Management department. The production manager needs to switch workers frequently from line to line, and this has two major effects:

- a. Worker Migration: Workers are usually comfortable with their assigned line supervisor or line chief and they develop a good working relationship with them. Frequent moves make the workers uncomfortable and they often leave.
- b. Effect on Production Incentive Plan: It is a common practice to implement a group incentive plan to enhance productivity. Frequent switching makes it difficult to implement group incentive plan.

### ***Effect on Compliance***

Each line has a fixed amount of space and each workstation has a specified area. When a line management needs to achieve a fixed target, they need to increase the input. The increase in input is either the worker and machine or working hours. Increase in worker or machine requires more space but it is already occupied. But space is required for the additional machines or workers. However, if the number of workers or machines cannot be changed, the working hour needs to be increased. This bears the risk of violating the working hour limit as the planning is done on the basis of maximum allowable working hour.

### ***Target of a Sewing line***

Target of a sewing line should have the below criteria should be achievable. The line management and workers should have confidence in the specific and visible targets. They should be announced early in the process and remain valid for a specific period and not be changed without advanced notice and preparation.

The number of machines and workers must remain fixed. The target may vary based on available manpower. The available working minute including efficiency has been considered in marketing.

Target of a sewing line = Number of Worker \* Working Minute \* Expected Efficiency / SMV

### ***Tracking the Daily Improvement***

The line chief or supervisor should track not only the hourly output of the sewing line, but also calculate the hourly productivity and efficiency along with it. The production management should compare the performance of the line chiefs or supervisors against these two KPIs. Achieving the daily targeted quantity is very important to meet the shipment timeline, but it is also important to know the amount of resources being consumed to achieve it. It is important to note that only the quantity is not the ultimate factor for the organization to survive.

### ***Distribution of Work in the Sewing Line***

There is no prescribed method for distributing work in a sewing line. The layout was based on the principle of one worker for one process. Later, machines, operators or helpers were added to balance the line or resolve the bottleneck. This adds value but the target was not revised in view of the added manpower. SMV based work analysis helps to distribute work based on time of the process. For example, a 20 minutes product is completed by 50 workers and thus, 0.4 minutes work is allocated for each worker. There may be a single or multiple tasks. This creates an impression in the line that every process is important to achieve an optimum output.

### *The CM price*

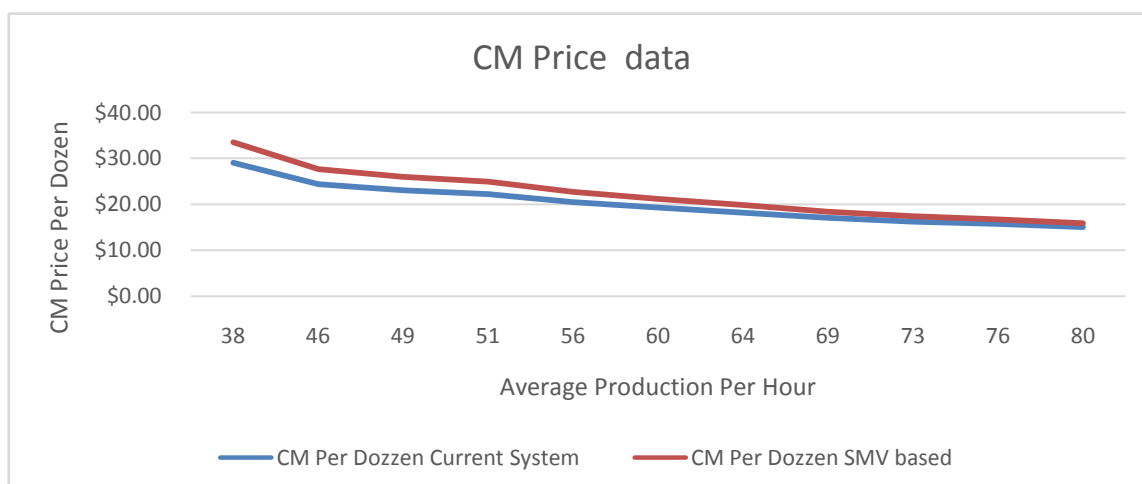
The CM price represents cut and make price. Currently, it is calculated by the ratio of man-machine-production per hour. In time based management, CM price is calculated based on SMV of the product. Table 1 shows the difference of CM price in both systems.

**Table 1.** CM Price Data Comparison

Si	Man	Machine	Production/Hour	SMV	Efficiency	Based on Man Machine and Hourly Output	Based on SMV
						CM Per Dozen	CM Per Dozen
1	65	50	38	33.5	32.64%	\$29.08	\$33.53
2	65	50	46	33.5	39.51%	\$24.44	\$27.70
3	65	50	49	33.5	42.09%	\$23.09	\$26.01
4	65	50	51	33.5	43.81%	\$22.28	\$24.96
5	65	50	56	33.5	48.10%	\$20.51	\$22.75
6	65	50	60	33.5	51.54%	\$19.30	\$21.23
7	65	50	64	33.5	54.97%	\$18.24	\$19.90
8	65	50	69	33.5	59.27%	\$17.10	\$18.45
9	65	50	73	33.5	62.71%	\$16.29	\$17.45
10	65	50	76	33.5	65.28%	\$15.74	\$16.76
11	65	50	80	33.5	68.72%	\$15.08	\$15.92

When the order quantity is lower, it decreases the rate of production per hour and efficiency. Customers are shrinking the CM price and expect higher production per hour. Production can vary by piece and the variation in one piece from the costing system will have an impact to a certain extent. But in the SMV based system, expected efficiency is the key factor. It can easily vary in decimals levels. However, as the system is directly related to the expense details of the organization, it provides the real CM price. Figure 1 shows that increasing the production per hour or efficiency makes clear the difference between the two systems.

**Graph 1:** CM Price Data Comparison



The difference is higher when the factory performs at a low level of efficiency. As a result, every garment industry is interested to have a long-term high quantity order to archive a better production rate. But the reality in the world is that fashion changes and various people prefer different types of garments, and do not wear similarly fashioned garments. RMG chains are shortening the volume per product to meet changing customer demands and offer a wide variety of styles in their products. This calculation reveals that at low volume order the costing system is not in favor for manufacturing industry.

### ***Role of Industrial Engineering***

The basic purpose of industrial engineering can be expressed as ECRS

**E= Eliminate.** Eliminate the non-value added work which increases the cost but does not add value to the core product. They can eliminate marking jobs from process by using jig, fixture, template etc. They can also eliminate unnecessary movements during performing a task by implementing proper work station layout.

**C= Combine.** Combine the related work together to reduce the in between hidden losses. When any non-value added task cannot be eliminated, it can be reduced by combining with next process.

**R= Rearrange.** Rearrangement of work can improve the work flow. By drawing the product flow diagram of a sewing line, they can easily visualize the flow of product. Any discrepancy in the flow can be easily detected.

**S= Simplify.** Leonardo daVincistated that “Simplicity is the ultimate sophistication”. The process should be simplified to perform a sophisticated task

To work according to ECRS, industrial engineers should focus on team building. As it is not possible for a person to be an expert on all jobs in a department, a cohesive team can build a system of collaboration.

### ***The Speed of Trust***

The first step in team building is developing trust among members. It is commonly seen in garments factories, mainly in Knit composite factory, that after receiving fabric from textile, the garment making unit inspects it again. Though both industries are under the same management, the fabric is inspected twice. This is a result of lack of trust and adds to the cost. If the textile unit is trustworthy, the fabric would not wait for re-inspection. There would be speed in the flow, time would be saved and process costs reduced. A similar pattern is also found in the internal supply chain. The store or cutting department counts their supply during delivery, but the sewing department also crosschecks while receiving them. Enhanced trust in the chain can eliminate such duplication of efforts.

The main challenge of an Industrial Engineer is to gain the trust of workers and line chief about the SMV. They need them understand about SMV calculation, the allowance and rating system or motion system. If

the workers and line chief have Trust in the system, implementation of productivity improvement tools and techniques becomes much easier.

**Choosing the Tool to Build Team**

Quality and production appear to be in constant conflict in the garment industry. The employees are often divided between “production team” and “quality team”. In reality, they are not team, but simply a department in the team. Similar to bowling, batting or fielding units in a cricket team, or goaltender, defense, mid fielder and striker positions in football. Smooth co-ordination of these departments is essential for winning. Industrial engineers can play a vital role to form a team within an industry by choosing the right tool.

**Pre-Production Stage: Preparation of Layout of New Product**

The line chief starts the change in layout with a new product sample in hand. Many factories focus on pre-production process to reduce the changeover time and quick ramp up in learning curve. Industrial engineers make the operation bulletin to help the line chief. But there is a huge gap in understanding between them. Due to lack of team work, differences emerge between the operation bulletin and practical layout. Industrial engineers can resolve the problem and reduce the changeover time by adjusting their workstyle. Industrial Engineering teams in some factories in Bangladesh now prepare the operation bulletin as a team with the Line Chief, Quality Supervisor and the person in charge of maintenance.

**Figure 1: A Common Format for Operation Bulletin**

Process Serial No.	Part	Operation Description	Machine Type	Machine Quantity	Operator Quantity	Helper Quantity	Iron Man Quantity	SMV	Capacity @ 100%	Capacity @ 75%

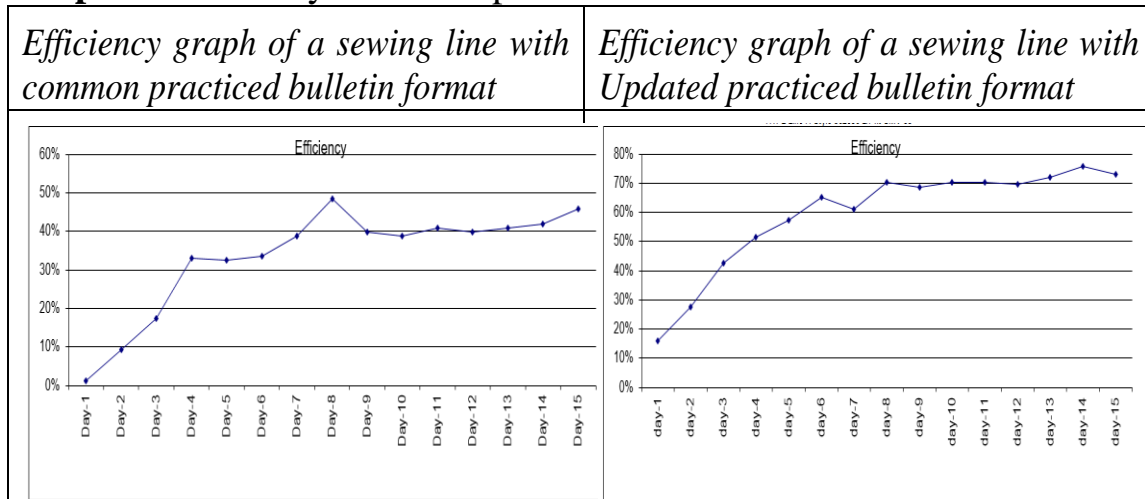
Operator's SI	Operation Description	SMV	Operator's Name	Type of Machine	RPM (Machine Speed)	Type of Presser Foot	Type of Feed Dog	Needle Plate	Needle size	Thread (s)	Method (guide/folder/attachment/feimplate)	Number of Standard Sewing Burst (From GSD Standard)	Hourly potential @ planned peak eff%	Daily Potential @ planned peak eff%	Operator's Required @ planned peak eff%	Direct issue (Pcs)	Training Required (Plan)

**Figure 2: Updated Format for Operation Bulletin**

In this session, all members related to the manufacturing of the new product will be informed earlier, and will plan the task. The line chief can select appropriate workers and can take the initiative to spare them when required. Offline or online training plans can be prepared earlier by the line chief and quality supervisor. People in charge of maintenance can take charge for arranging machine, folder, jig and other required things.



**Graph 2.** Efficiency trend comparison

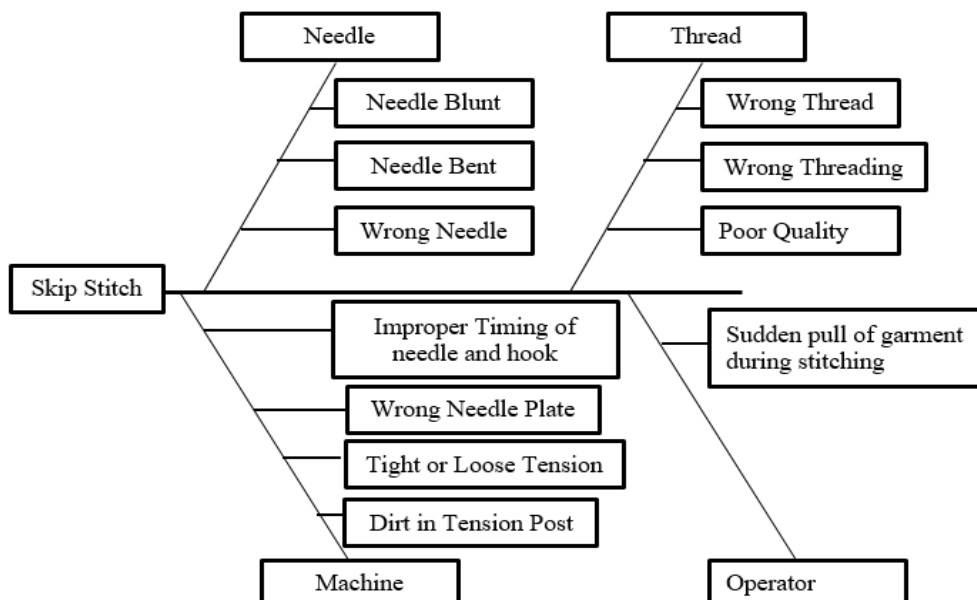


***Autonomous Maintenance as a Team Building Approach to Ensure Quality***

A system is important in which equipment operators learn to perform daily checks, lubricate equipment as needed, replace simple components, carry out minor repairs on machines and assist in problem solving. Operators become the early warning system for abnormalities detected in machines. Industrial engineers can form a team with sewing line chief, quality supervisor and maintenance person to prepare guidelines for autonomous engineering. First, they need to identify the most serious problems or defects that are damaging the factory. Then next step is to make a fishbone diagram for analyzing the problem. Eventually, they can develop a flow chart for repair, and train the operators. In this way, solving the quality issue becomes everyone’s responsibility.

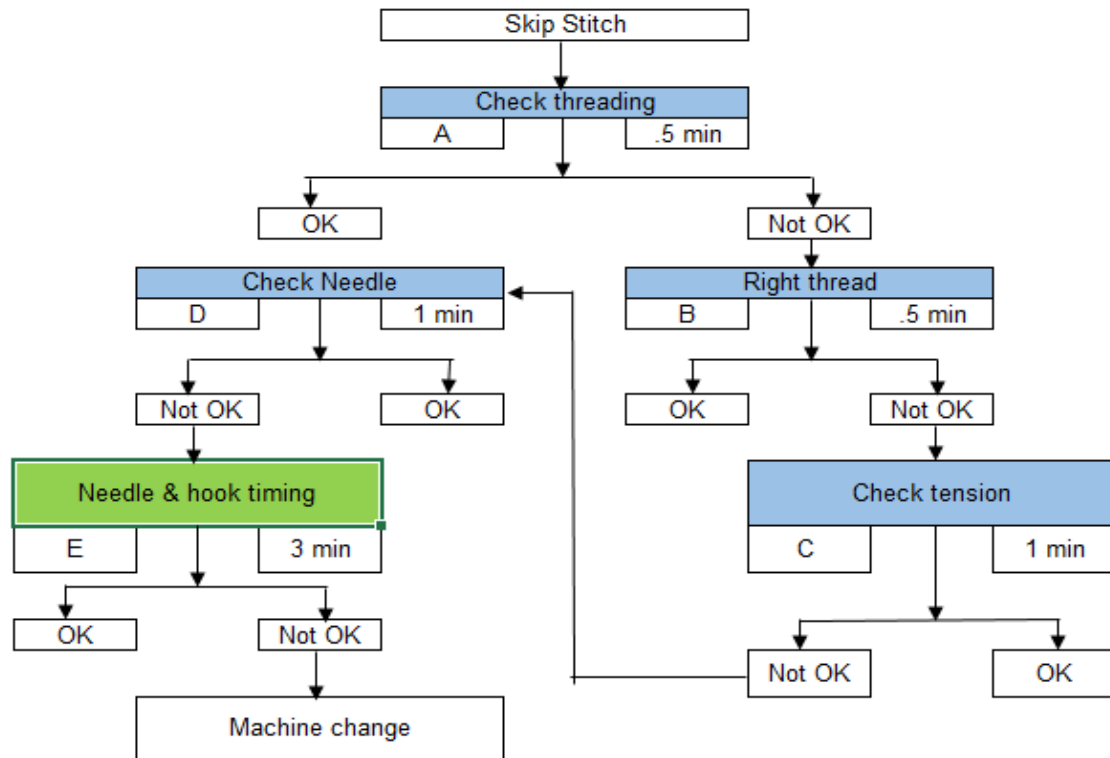
This can be illustrated with an example. Skip stitch on a sewing machine is a common problem in the garment industry. Figure 3 shows a simple fishbone diagnostic for skip stitch in a single needle lock stitch machine.

**Figure 3:** Fish Bone Diagram of Skip Stitch



Using the fish bone diagram, the autonomous maintenance plan flow chart can be developed (see below picture). Blue and green colour boxes depict the responsibility of operators and mechanics respectively.

**Figure 4:** Flow Chart for Skip Stitch Repair



This can be implemented only through collaborative team work and an effective training system.

## Conclusions

Garments industries are very familiar with the term defect which is the result of abnormality. A loose nut in a machine, vibration and sound beyond normal range, detecting stitching thread more than allowable length, excess work-in-process are common examples of abnormality. Therefore it is necessary to take steps to eliminate the abnormalities from the system. More problems can be found in repair work stations, spot removing rooms, excess cutting in overlock machines, fallen garment on aisles or floor, most of which do not add any value to the product.

It is the time to review and reset the goals of the business. Along with gradual increase in the export quantity, the objective is to enhance profit. In the process, the industry needs to consider increasing the net profit, return on investment and increasing cash flows simultaneously. The management should consider the capacity of the organization before marketing. Efforts to market products beyond the capacity of the factory will make the situation worse in terms of compliance, increasing administrative cost and obstacles to implementing modern tools and techniques. Effective performance evaluation at every stage should help reduce wastage in the system, and the manufacturing culture should be realigned to operate with long-term goals in view.

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# 7

## **Eco-Tourism and Forest Conservation in Bangladesh**

**Md. Shahadat Hosen  
Abdul Mannan  
Zobayer Ahmed**

### **Introduction**

Cox's bazar is the tourism capital of Bangladesh and the Inani natural forest area in the region attracts a large number of tourists as the lush green hills with a view of the sea are its special features. The area is also an important biodiversity hot spot of the country as some natural forests in Cox's Bazar account for about 12.27% of the country's total natural hill forest (BFD, 2016). These forests are not only important for country's biodiversity resources but also a traditional source of livelihood for millions of poor people. A report by a non-governmental organization found that about 80,000 people are dependent on Inani Reserve Forest that has an area of 10,000 hectares (SHED, 2012). This group of people include not only include local Bengalis but also some indigenous communities that migrated from Bandarban Hill district during the British ruling. A few decades ago, about 655 ethnic families (Chakma and Taunchyanga) settled in four villages (Madarboniya, Monkhali, Telkhola and Musarkhola) within Inani forest. Following the tradition of their community, they have been engaged in shifting cultivation as the prime source of livelihood. The harvest was good in the first few years, but gradually the fertility of the soil was lost and the forest became denuded (Ahmed et al., 2016). As a result, they need a non-forest based alternative livelihood as the forest has already been degraded. It is assumed that ecotourism will be an important alternative option for reducing of forest dependency of Madarboniya Chakma para.

Many forms of alternative tourism were introduced since the 1980s in order to cope with the social and environmental impacts of tourism. Ecotourism was included as one of the alternative form of tourism that seemed to be acceptable to the tourism industry. Mass tourism had been detrimental to the environment due to its unsustainable approach, but ecotourism is environment-friendly, supports local livelihood diversification and nature conservation in a sustainable way (Shamuddoha and Nasir, 2011). Ecotourism can help increase green productivity, infrastructure development in remote areas and generate

employment for the local community by considering it as a market based product (Hossen, A. et al., 2014).

In 2003, 170 nations attending the World Parks Congress in South Africa called for increasing measures to make ecotourism a more effective “vehicle” for conserving biodiversity and reducing poverty (IUCN, 2003; Stronza and Pegas, 2008). Ecotourism has been adopted in our country recently although it had evolved and was recognized internationally more than three decades ago. Despite its popularity, theorists and practitioners are yet to understand the conditions under which ecotourism works effectively as a tool for conservation (Doan, 2000; Kruger, 2005). It is one of the most important tools of tourism for sustainable development. Ecotourism also focuses on recreation with scientific investigation, education, and awareness to all kind of biological diversity (Hossen, et al., 2014). Cater (1994) suggested that ecotourism improves life expectation in communities and helps to obtain socio-economic benefits from this sector. Since ecotourism introduced new practices to the local community for assisting with their economic activities, combined efforts by the local community and eco-tourists generate positive attitude towards conserving biological and natural resources (Drake, 1991).

Moreover, revenue from proper use of natural resources can be used for conservation and sustainable development and the economy will gain from ecotourism (Hossen, et al., 2014). Most research on ecotourism to date comprises of case studies on impact on local communities and natural resources (Agrawal & Redford, 2006). The cases are generally used by local and international non-governmental organizations and private actors to promote of awareness for environmental protection, biodiversity conservation as well as rural economic development. This chapter seeks to explore the scope of government initiatives in ecotourism for indigenous community development to create alternative livelihood development options for the forest dependent rural community to assist with conserving and restoring of forest biodiversity.

The objective of the study is to assess the current state and assess the future potentials for ecotourism development in the area. In the British ruling period, some indigenous communities migrated in Inani reserve forest under the Cox’s Bazar district from the adjacent Bandarban & Rangamati Hill Tracts in search of better livelihood. Hill forest based shifting cultivation was their prime source of livelihood. But slashing and burning practices in this traditional system was responsible for the loss of biodiversity. It was identified as one of the major drivers behind forest encroachment and change in land use pattern. The study is based on reconnaissance and exploratory assessment, with socioeconomic household and external visitor surveys, focus group discussions, and coordination meetings with the local population.

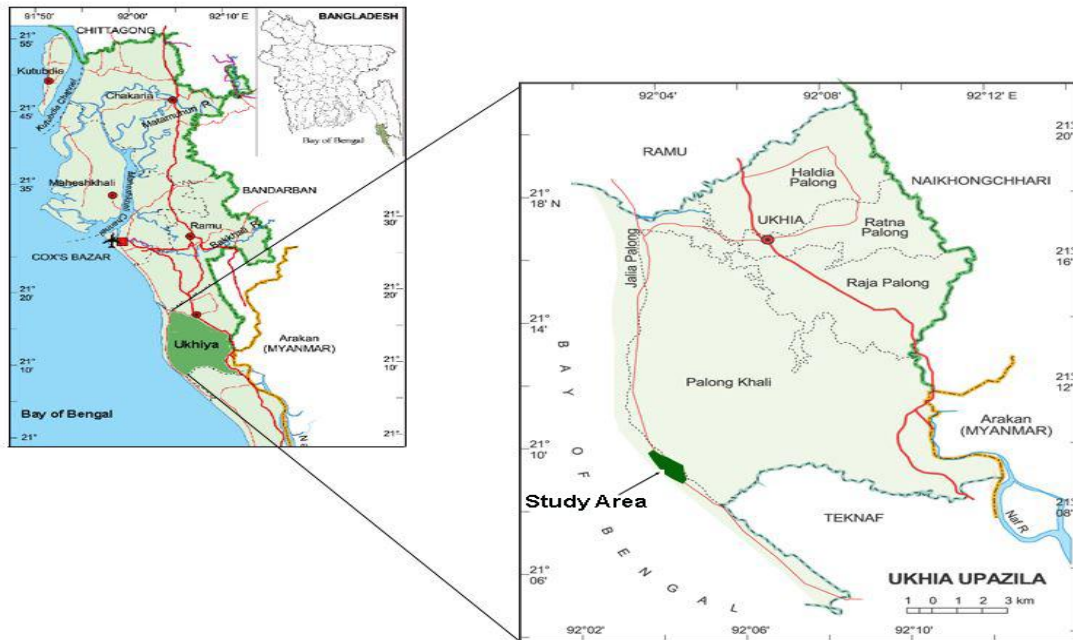
### **Research Location, Materials and Methods**

Arannayk Foundation, SHED and Bangladesh Forest Department support the community of Madarboniya Chakma para at Cox's Bazar for developing Ecotourism in their surroundings as an alternative livelihood to reduce their forest dependency. The geographic location of Madarboniya Chakma para refers 21.118165 to 21.121199 N latitude and 92.104293 to 92.106672 E longitudes. The altitude is almost 3 kilometers above sea level and the topography is undulated hilly terrain with evergreen and semi-evergreen natural forest coverage. It is one of the indigenous settlements of Ukhiya upazilla located near the Cox's Bazar–Teknaf marine drive at 15 km from Inani Sea beach point to the south. It is under the Jalia palong union and about 40 kilometers from Ukhiya upazila to the south-west. In the forest administrative circle, the Inani Forest range falls under the Cox's Bazar south forest division.

There are about 85 families with more than 600 inhabitants that belong to Chakma and Tanchangya cultural background. They migrated from Bandarban & Rangamati hill district during the British period in search of better livelihood. The community was solely dependent on shifting cultivation (*Jhum chash*) in the hill that was practiced by their ancestors (Ahmed, *et al.*, 2016).

Primary data collection has been conducted in the period of January-April and secondary data was processed between June-July 2016. A semi-structured questionnaire was used to gather information about the community livelihood pattern with reference to the existing socio-economic condition. Reconnaissance and exploratory assessments surveys were used to assess the prospect of ecotourism facilities development. Focus group discussions were been arranged with potential stakeholders and community leaders at different levels to obtain an understanding of the situation on the ground. An external visitor or tourist survey with a semi structured questionnaire was piloted in Inani Beach point to learn about their expectation about the existing facilities in Chakma para as well as changes they would like to see in the future. Relevant information was collected from various sources including published journals, periodicals, newspapers, magazines, and the internet.

A sample population of 85 respondents from 85 households was interviewed to cover entire community by using purposive and simple random sampling techniques. Most of them were heads of households or leading earning members where the male-female ratio was 5:3. They represented 100% households of the community as household heads and 14% (85) of total population (612) as individual respondents. A sample size of tourist opinion survey covered 80 travelers or approximately 2% of daily visitors in Inani Beach. They were selected randomly along with those who wished to express their opinion on the issue.



**Figure 1:** Study location and Map of the study area

## Results and Discussions

### *Socio-cultural Environment in the Village*

The socio-cultural relations and cohesion among villagers (i.e. Chakma and Tanchangya community) is very strong as they strictly abide by the customary and traditional community rules under the leadership of the village headman. The Chakma and Tanchangya people are Buddhist in religion and follow the southern form of Buddhism historically (*IndianMirror*, 2016). The Buddhist temple of the community known as Pagoda or Keyang is the Centre for all social and traditional activities. The monk who is the head of the Keyang commands significant respect in the community. He presides over all religious festivals but other social and external activities were led by the village headman. They celebrate all festivals in the Pagoda courtyard. The villagers support the Pagoda and monks in the form of offerings to Buddha as food and gifts. The most important religious and cultural festivals are Buddha Purnima, Biju, and Kothin Chibor Dan.

The traditional Chakma house is made of bamboo and the wooden structure is about 2 meters above the ground. The house is locally known as *Machang Ghor*. The Chakma men have given up their traditional dress but the women still don the traditional two-part thami at times of festivals. The women make their own cloth as they are traditionally skilled weavers. The staple food of Chakma is rice with vegetables grown in the hills by using the traditional shifting cultivation method. They are used to drinking alcohol and the home brewed liquor is consumed in the festivals and social occasions. Guests are greeted with home-made rice liquor and hukka pipe. The villagers mostly have arranged marriages



known as Chumulong performed by the monks. Parents arrange matches after taking into account the wishes of sons and daughters, and the dowry is fixed by negotiation at the family level.

Anthropologically, Chakma and Tanchangya families are headed by males but in some families the female partner has the largest earning contribution. It was found that among the 85 households there are 612 Chakma and Tanchangya people. The pagoda has a religion-oriented educational system for the community children who wish to join the monastery. The village has only two pre-primary schools. One is run by SHED (anon-governmental organization) through financial support from Arannayk Foundation and the other is Pagoda-based pre-primary school funded by the Ministry of Religious Affairs. Most of the children go to their nearest primary school and one junior high school that service the Muslim community. Only 12% of the community people are literate and 3% went to primary school and 2% attended high school. There are only 5 people who studied beyond the secondary school level and among them 2 were graduates.

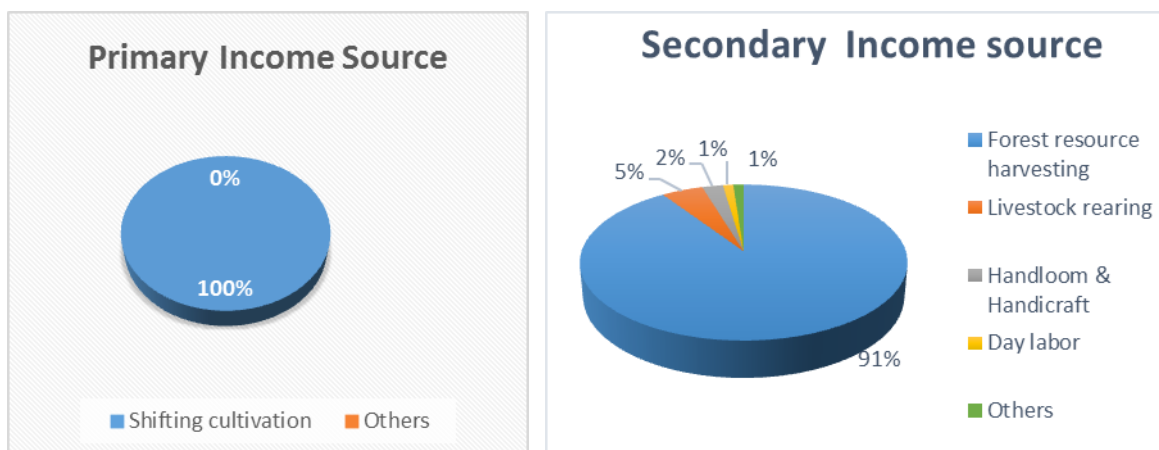
#### ***Traditional Livelihood Pattern of Villagers and Deforestation***

The villagers are mainly farmers and grow their necessary food and materials in the hills and around the forest. They have no land rights as they live in the territory of the forest department administered as reserved or protected forest land. They follow the traditional slash and burn agriculture, known as shifting cultivation or Jhum, and practiced it as their tradition, culture and even a ritual. After burning the vegetation, they plant crop in April after the first heavy rain and harvest it in October–November. They plant multiple crops at different tiers simultaneously to get multiple outputs from a single piece of land. They generally produced rice, corn, millet, mustard etc. with vegetables likes, yams, melons, cucumber, pumpkin, urinal and other leafy vegetables. The most interesting side of Jhum is that this process does not need application of any manure, insecticides/pesticides or even watering. Therefore, the Chakmas follow a practice that is different from agriculture in the plain land. They also rear livestock like pig, goat, cow, and homestead bird like chicken and duck.

Although the Chakma families are headed by males, the contribution of females in the livelihood activities is more significant. Chakma women are more productive in livelihood activities where the male partners are comparatively lazy. It was found that before 2010 they were 100% dependent on shifting cultivation for their livelihood as the primary source of income (Figure2). More than 90% of the people also used to harvest forest resource with other wild vegetables and fruits as a secondary income source (Figure2). They used to collect fuel wood from

the forest for selling in the market. It was an arduous task to collect and sell the forest resources and other harvesting crops in the market due to the long distance and lack of transportation. They learned from the forest conservation and development intervention of FD, SHED and AF that shifting cultivation as a farming system is not environment-friendly, and gradually abandoned the practice.

For many centuries, the indigenous communities managed the forests in a sustainable manner by keeping the rotation of their shifting cultivation long enough (15-20 years) (Rasul and Thapa, 2003). Population pressure, over cropping and soil erosion, indiscriminate illegal logging in forest areas and lack of suitable land, and shifting cultivators nowadays are forced to use a shortened fallow period (3-4 years) (Roy and Halim, 2002; Rahman, et al., 2007) resulting in declining yield and drastic loss of forest coverage leading to land degradation (Nath and Inoue, 2008). The same situation exists in Madarboniya Chakma para. They migrated in search of fertile forest land but found that continuous slash and burn nature of shifting cultivation significantly reduced the fertility of the soil which caused lower production. Subsequently the shifting cultivators face a shortage of production. To overcome the food shortage and feed their family they go to the forest and cut down trees illegally and sell them. When the large trees are exhausted, they encroach and convert the forest land into agricultural land and sell the converted



land to other Bengali settlers or local elites.

**Figure 2:** Traditional Livelihood Pattern of Villagers before Adopting AIGA, 2010

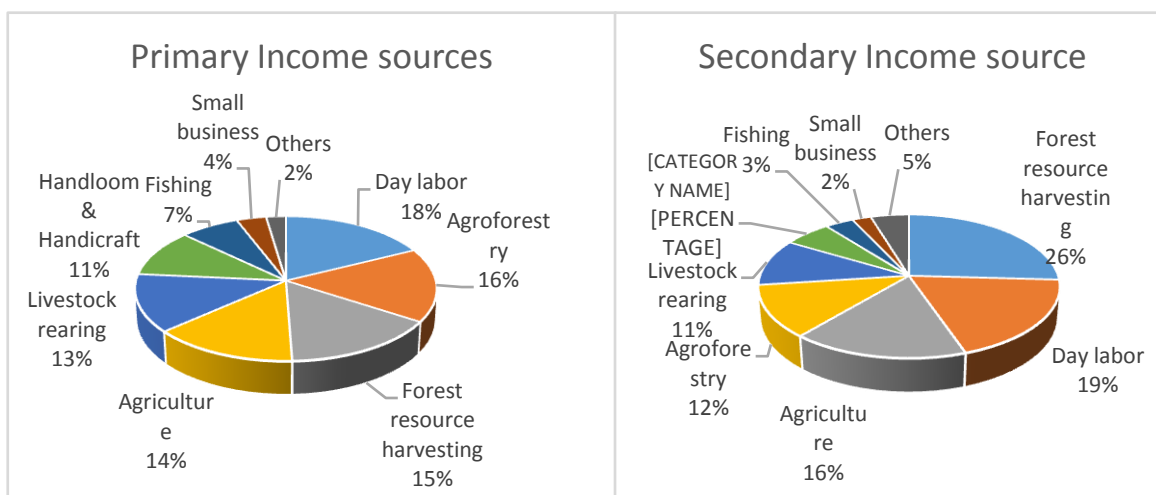
The Chakma community is involved in poaching wild animals for their own consumption and selling to the nearby market. Some local people are associated with wildlife poaching although it has reduced drastically since 2010 due to constant patrolling by community groups. They normally kill Barking Deer, Wild Boars and Jungle Fowls (Ahmed *et al.*, 2016). These are the main reasons for the destruction of forest, biodiversity loss and land use changes of land in Inani Reserve forest

area. These circumstances call for an alternative livelihood adoption to reduce dependency on the forest and abolish shifting cultivation. Ecotourism appears to be a potential and effective solution for achieving sustainability and efficient use of the available tangible and intangible resources.

### *Non-forest based Alternative Livelihood Options*

Shifting cultivation as the traditional source of livelihood failed to fulfill the needs of the households for food and cash. A number of interventions have been carried out to develop non forest based livelihood options for forest dependent households of the village since 2009.

**Figure 3:** Status of Livelihood Activities of Chakma People, 2016



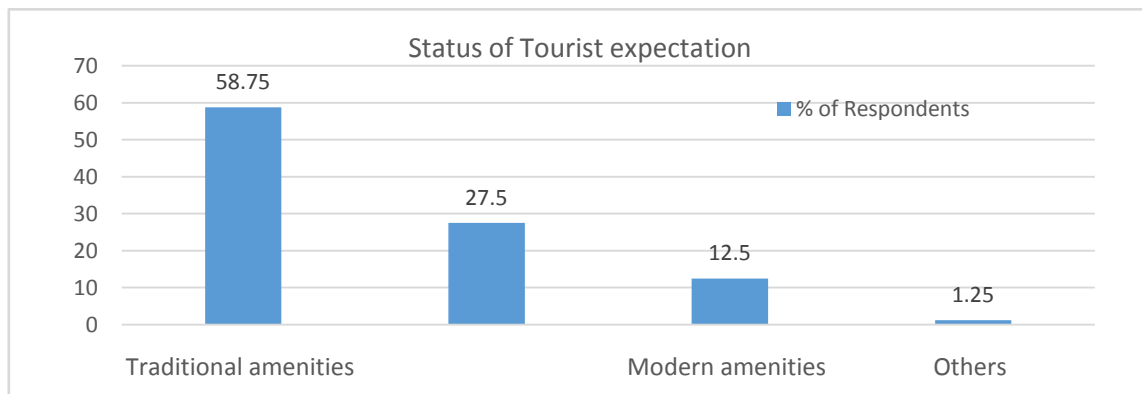
It was assumed that, if livelihood can be secured from non-forest based options, the indigenous people would not destroy the biodiversity in the forest. We found that agro forestry practice was the second highest primary source of livelihood for about 16% of the respondents, followed by day laborers 18% (Figure 3). Approximately 11% of the people still earn their primary livelihood from the traditional handloom and handicraft industry. A significant factor is that about 15% of the people earn their primary livelihood and 26% their secondary livelihood from forest resource harvesting. This indicates that forest resource harvesting is still a significant source of local livelihood (Figure 3). The consequences of high population growth create pressure for defragmentation of agricultural land, so they were not able to cultivate these lands with solo agricultural crops. Therefore, they were mostly engaged in agro forestry practice with other common occupations (Ali, 2010).

### *Ecotourism Potentiality in the Village*

The Chakma community is enriched with colorful cultural and traditional events which may be a major attracting feature for ecotourism development in the area. Their religious, social and family festivals and traditional food, housing, clothing and lifestyle can attract tourists.

Moreover, the location between the sea and the hill provides an excellent opportunity to enjoy unspoiled natural beauty. Major Chakma festivals include Buddha Purnima, Kothin Chibor Dan, and Biju/Bishu. Buddha Purnima is a three day long event celebrated during the full moon in Boishakh (usually in May). They go out in traditional dresses on the occasion, visit the Pagoda, and offer flowers to Buddha, light candles, and listen to holy sermon. The offerings to Buddha are distributed among the poor and feasts are held to honor the priests. Another important festival is Biju, a traditional New Year celebration which falls around the Bangla New Year in 1<sup>st</sup> Boisakh (usually in April). The day is celebrated with colorful events, special respect to elders to get their blessings, houses are festooned with flowers and traditional dishes are prepared for the guests. These events can contribute to the promotion of potential ecotourism in the area.

A survey was conducted among tourists and external visitors in Inani beach to find out about amenities available or required in the village. The survey revealed that 12% of the respondents demand modern luxurious amenities and 28% expect modern facilities in traditional style. But 59% of the tourists wish the night stay in the village at traditional wooden-bamboo made *Machang Ghor* (Chakma house) with traditional amenities and a candle light dinner with local food would be a memorable experience. About 63% of the respondents wish to visit the place at the time of a Chakma festival.



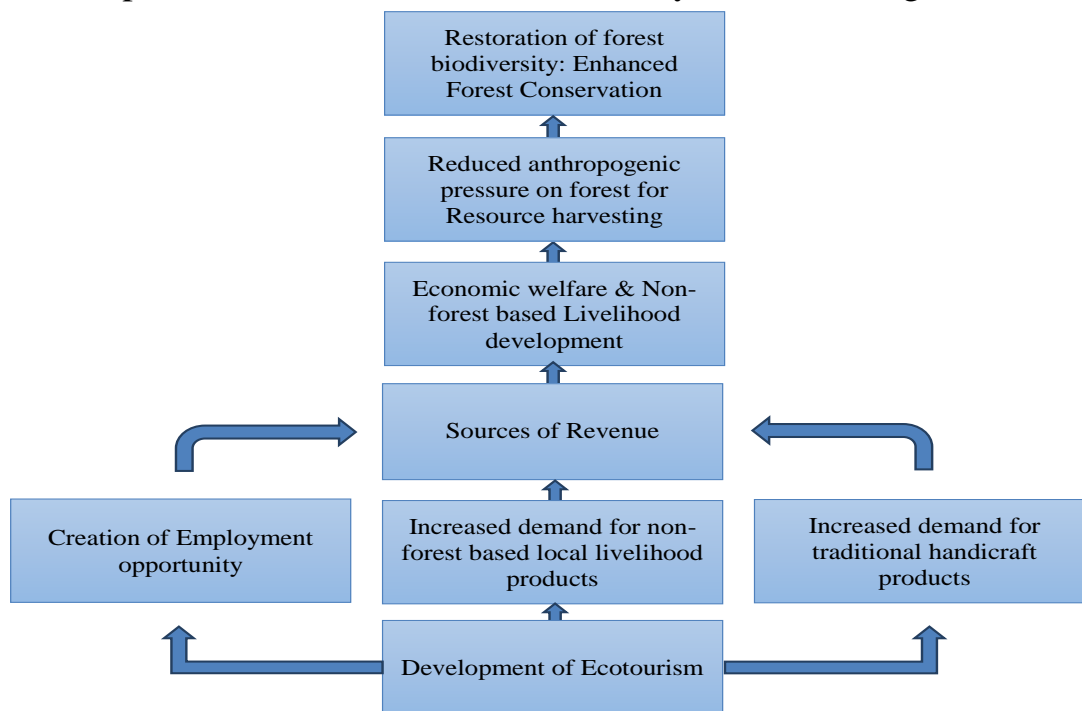
**Figure 4:** Tourist Expectation for amenities

### ***Ecotourism and Forest Conservation***

The community was 100% dependent on forest for livelihood by shifting cultivation, wildlife hunting and poaching and forest resource harvesting (Figure2). These were the major causes of forest and environmental degradation in the area (Ahmed *et al.*, 2016). This suggested that they need a viable alternative livelihood option to change the traditional practice and ecotourism can be a practical alternative livelihood option for the community. This is a nature-based tourism that intentionally seeks to deliver net positive contributions to environmental conservation and sustainable development for local communities (Cater and Lowman, 1994; Wallace and Pierce, 1996; Wearing and Neil, 1999). Revenue

earned from ecotourism will help fulfill their financial need and the return is expected to be higher than that from their traditional livelihood activities. This will help to conserve forest and biodiversity for attracting tourists.

Ecotourism will also help communities to develop non forest based income generating activities to fulfill the demand of tourists. They can showcase the art of making bamboo made handicraft production and handloom making, native chicken and livestock rearing, vegetable cultivation, and fruit gardening. These non-forest based livelihood options will be much more profitable than the collection of forest resources. As a result, nearby forest will face less anthropogenic pressure and help conserve forest and its biodiversity resources (Figure5).



**Figure 5:** Linkage between Ecotourism & Forest conservation

### Conclusion and Recommendations

A large number of tourists visit Cox's Bazaar every year from all over the world. Most commonly they visit the world's largest continuous sandy sea beach of Cox's Bazaar and the rocky sea beach of Inani. After visiting these places they have nothing else to see or do. Therefore, the development of ecotourism facilities in Madarboniya Chakma para could add a huge value to their trip with opportunities to enjoy the traditional culture and food of indigenous community as well as nature-based ecotourism in Chakma para.

Ecotourism is one of the best options for redistributing wealth from the rich to poor which results from the financial income and job creation. It is a key source of income and employment for local communities, which in turn provides direct benefit for conservation of nature. Sustainable tourism preserves land for nature, offering alternative

livelihood options to those who may otherwise resort to less sustainable land use (UNWTO, 2011).

The study found that ecotourism can be an effective vehicle for conserving forests and biodiversity resources. It can also be a major source of livelihood for forest dependent communities as it creates demand for non-forest based products that help reduce their dependency on the forest for livelihood. The culture, religious festivals, traditional food, accommodation and lifestyle have the potentials to be prime attractions for tourists. As adjacent forests and their biodiversity resources are the main components of nature based ecotourism, the communities can be easily motivated to conserve their adjacent forests for promoting ecotourism in their village. Earning revenue will encourage the local community to conserve forests and biodiversity as integrated component of ecotourism and abandon shifting cultivation and wild life hunting. The commoditization of traditional heritage, indigenous culture and better amenities are essential for making eco-tourism successful in Bangladesh.

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# 8

## **Climate Change and Stakeholders Adaptation in Bangladesh**

**Muhammad Abdullah**

### **Introduction**

Climate change is a serious long-term threat to Bangladesh in the way of achieving overall sustainable development goals. Currently it is one of the worst affected countries in the world due to its vulnerability to climate change, and it has affected several aspects of life including critical areas such as agriculture, livestock, fisheries, biodiversity, environment, water resources and ground water (Karim, 2011). In order to deal with these consequences, Bangladesh has developed a number of policies to respond to the effects of climate change. This chapter aims to understand the impact of climate change on the government and stakeholders as well as the role of policy makers in formulating and implementing climate change policy for adaptation process. The study adopts a qualitative approach based on secondary data collected from published and unpublished documents, relevant research articles and books.

The geographical location and climate pattern has always rendered Bangladesh vulnerable to natural disasters. Moreover the capacity of the country to adapt to the ever-changing effects of climate change is very poor (Karim, 2011). The country is regularly hit by natural disasters like cyclones, inundation, tropical surges and storms and they disrupt the progress of food cultivation and production as well as development projects (Ali, 1999).

Climate change is a big threat for Bangladesh and may obstruct the progress achieved in the increasing of purchase capacity of the common people and reduction of poverty (Masum & Hasan, 2009). Bangladesh needs to urgently mitigate the effects of climate change and has invested more than US\$10 billion for this purpose (World Bank, 2010). The proposed measures include increasing awareness among the people, strengthening the infrastructural capacity and other practical issues such as repairing roads and highways, creating cyclone shelter centers for disaster stricken people and early warning systems, providing relief for the affected people as a post effect method. This has been done with the support of many development partners across the globe (World Bank, 2010).

Climate change is a global issue and it is impossible for a developing country like Bangladesh to overcome the effects of the climate change without substantial support from the international community. It is acknowledged Bangladesh has developed some policies to deal with the effects of climate change, but mere formulation of policy is not adequate as mitigating the effects of climate change require exceptionally huge amounts of finance and state of the art technology (Mia, n.d.).

## Impact of Climate Change in Bangladesh

### *Floods*

Floods have become a regular feature in Bangladesh and almost 25% of the total land of the country gets inundated (Displacement solution, 2012), and in some extraordinary cases as much as 70% of the entire land area goes under water (Mirza, 2002).

**Table 1.** Floods in Bangladesh, 1984-2007

Year of Flood	Flooded area	Effect
1984	Total area flooded 50,000 sq. km.	Projected damage US\$378 million
1987	Total area flooded 50,000 sq. km.	Projected damage US\$1 billion, and 2,055 deaths
1988	Total area flooded 90,000 sq. km.	Projected damage US\$1.2 billion; deaths 2,000 to 6,500 deaths; over 45 million homeless
1998	Total area flooded approximately 100,000 sq. km.	30 million people homeless; projected damage 500,000 homes; 1,100 deaths and heavy damage to infrastructure projected at US\$2.8 billion
2004	Total area flooded 56,000 sq. km.	Projected damage US\$6.6 billion; 700 deaths and 3.8 million people affected.
2007	Total area flooded 32,000 sq. km.	Projected damage over US\$1 billion; 6490 deaths; 1.2 million acres of crops destroyed or partially damaged.

**Source:** Government of Bangladesh (2005) National Adaptation Programme of Action, Ministry of Environment and Forests, Dhaka and Government of Bangladesh (2007) 'Consolidated Damage and loss Assessment, Lessons Learnt from the Flood 2007 and Future Action Plan', Disaster Management Bureau, Dhaka. (Cited: MOEF, 2009).

### *Droughts*

Drought is one of the worst forms of climate change that affects agricultural production as well as farmworkers seriously and they lose their source of subsistence. The northwestern part of the country is most seriously affected by droughts (MOEF, 2009).



**Figure 1:** Severe drought condition

**Source:** MOEF, 2009.

### ***Sea Level Rise***

The sea level will continue to rise due to continuous global warming (Displacement solution, 2012). Mohal and Hossain (2007, cited in Pender, 2008) anticipate that the land mass of Bangladesh could be affected by sea level rise and it might happen within 2050. 10 cm of sea level may rise within 2020 and it may affect 2% of the total land mass of Bangladesh and within 2050 sea level may rise up to 25 cm which may also affect another 4% of the total land mass of Bangladesh, according to the Bangladesh Strategic Program for Climate Resilience (SPCR).

### ***Land Erosion***

Land erosion is a common problem in the coastal zone of Bangladesh because of climate change. According to government statistics, river erosion is taking away land and making many people landless and homeless. It is happening quite frequently every year in the country (Displacement solution, 2012).



**Figure 2:** River bank erosion

**Source:** MOEF, 2009.

### ***Temperature Trend***

World temperature may increase by 0.2<sup>o</sup>Centigrade annually over the next twenty years and by the year 2100 global temperature may increase by 4<sup>o</sup>c (Alley *et al*, cited in Pender, 2008). Effect of climate change becomes visible if we see the current trend of temperature in summer and winter. The temperature in summer continues to get higher and drops more than usual in the winter, with some variations. Temperature in Bangladesh has increased 1°C in May and 0.5°C in November respectively and in the future this trend may continue (Huq and Ayers, 2008).

### ***Salinity Intrusion and Reduced Fresh Water Availability***

The southern region of Bangladesh is seriously affected by soil salinity intrusion and it is a big threat for the region and the coastal area in particular. The intrusion is seasonal in nature. The effect of saline water intrusion is very high in the dry season. It rises from 10 to 40% in the dry season in comparison with monsoon (DOE, 2003).

### **Impact of Climate change in Bangladesh**

#### ***Impact on Health***

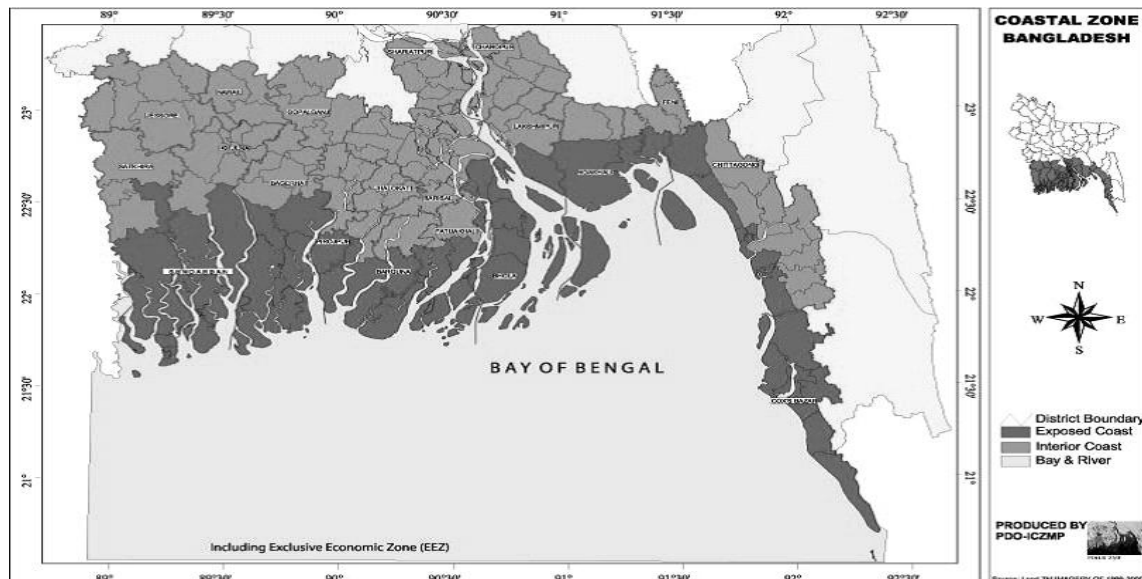
Climate change negatively affects the health of the people directly or indirectly in Bangladesh. The most important factors responsible for health risks are increasing temperature, precipitation, and sea level rise, changes in the quality of air, water, food, the ecosystem and agriculture. The results of these risks are death, disability and suffering (Rahman, 2008).

#### ***Impact on Bio-diversity***

Climate change and its impact will also affect the ecosystem and many species will face extinction which will ultimately affect the biodiversity of the nature (Reid, n.d.). Bangladesh is popularly known as a land of rivers, lakes, haors and ponds which play an effective role in enhancing natural beauty and foster biodiversity. There are over 400 species but many of these have to struggle to survive due to salinity intrusion and severe drought which are the results of climate change (Pender, 2008).

#### ***Impact on Coastal Zone***

Bangladesh faces increased risk of natural disasters that emanate from the effects of climate change and the coastal areas are more vulnerable. Out of sixty four districts of the country, the coastal zone includes 19 and out of over 500 thanas it includes 153. The coastal area of Bangladesh covers 32% of the total land mass of Bangladesh (about 47,201 square kilometer, see Figure: 3) (Islam, 2004, as cited in Islam, n.d.).



**Figure 3:** The coastal zone of Bangladesh

*Source: Pre-and post-tsunami coastal planning and land-use policies and issues in Bangladesh, Rafiqul Islam, (n.d.).*

### ***Impact on Water Resources***

Climate change can have a catastrophic effect on the surface and groundwater resources. The problems of sea level rise and the impact of water resources will have negative impact on the coastal area as well as on entire Bangladesh which is a land of rivers. This will cause inundation in the wet season as most of the rivers in the country are silted up and cause drought in the winter (Alam, 2004).

### ***Impact on Agriculture***

Bangladesh is an agricultural country and most of the people depend on agricultural activities for their existence. The impact of climate change will affect the agriculture of the country. Increasing temperature, drought, reduced rainfall and salinity will contribute to reduce the crop harvest in the country. The sign is already visible in many parts of Bangladesh and arable land is on the decline and the economy of the country is affected (Huq and Ayers, 2008).

Climate change will also affect the fisheries industry along with agriculture sector of Bangladesh. This will affect both the food security as well as intake of protein that come from fish. Due to extinction of many types of fish the country will suffer from scarcity of fish (MOEF, 2005).

## **Future Climate Change Impact**

### ***Global Warming***

Climate hazard is crucial for Bangladesh because of its geographical location, rapid population growth and excessive dependence on natural

resources. Potential future impacts are outlined in the following paragraphs.

### ***Changing Temperature***

Bangladesh experiences marked inconsistency in temperature trend. It is predicted that average temperature of Bangladesh will increase to 1.0<sup>0</sup>C by 2030, 1.4<sup>0</sup>C by 2050 and 2.4<sup>0</sup>C by the year 2100. According to temperature trend, the average rainfall of Bangladesh will also change. It is assumed that in the summer season, the average rainfall of Bangladesh will increase 8% by 2050 and 12% by 2100. On the other hand the average rainfall in the winter season will decrease -2% by 2050 and -3% by 2100 (Tanner, Hassan, Islam, Conway, Mechler, Ahmed, and Alam, 2007).

### ***Excessive Flooding***

Due to global warming, glaciers of the Himalayas are melting rapidly are contributing to increases in the sea level. If this process continues and global temperature increases by 3 to 4<sup>0</sup>C, it is predicted that more than 70 million people of Bangladesh will be permanently affected and displaced by flooding (Human Development Report, 2008).

### ***Increasing Salinity Interference***

The southern parts of Bangladesh (districts of Bagerhat, Khulna and Sathkhira) near the coastal regions have faced salinity erosion for some time. At present, 13% of the land area in this part has been affected by salinity and it is expected to increase to 16% by the year 2050 and 18% by the year 2100 (Mostofa, 2009).

### ***Increasing Cyclone and Rainstorm***

The annual incidences of cyclones and storm surges are gradually increasing in Bangladesh. Approximately three to seven cyclones hit the coastal zone every ten years. The coastal areas of Bangladesh with high risk of cyclones will increase 35% by 2020 and 40% by 2050 (Tanner, 2007).

### ***Effects on Agriculture and Bio-diversity***

Most of the people of Bangladesh depend, in one way or another, on agricultural production which is badly affected by climate change. This threatens the food security of the country (Huq and Ayers, 2008). If the temperature increases by 4<sup>0</sup>C, rice production in Bangladesh will decrease by 30% and wheat production by 50% (Lezlie, Moriniere, Taylor, Hamza, and Downing, 2009).

Drawing upon the discussion above, the impact of climate change in the short and long run can be summarized. In the short run, increasing temperature trend will cause health risks, particularly for the children and

elderly. Excessive climate hazards such as cyclone, storm surges, riverbank erosion and extensive flooding will have negative impact on human settlement as well as socio economic condition. Shrinkage of arable land will force people to migrate from rural to urban areas in search of work. Rising sea level may inundate the coastal areas with increased possibility for tidal waves. Agricultural production will be affected by both excessive and inadequate rainfall and erosion of land will diminish availability of cultivable land.

In the long run, prolonged flooding may make the inundation permanent. The fish population will be reduced or become extinct along with various species of animals and birds. Agricultural production will be decreased and food security will be threatened. This will have an impact of social relationships and the process of development will be hindered.

### **Government Policies on Climate Change**

#### ***National Adaptation Program of Action (NAPA), 2005***

The National Adaptation Program of Action (NAPA) is one of the main programs of the government of Bangladesh to adapt to the effects of climate change. It was drafted on the principles of the LDC Expert Group and the Ministry of Environment and Forest that sought to implement the decision of the Seventh Conference of parties of UNFCCC (COP7). NAPA was prepared in 2005 with the participation of all stakeholders related to the issues of the environment and management of resources. It ensured a bargaining option in the field of resource use, allocation and disbursement. NAPA covered a wide range of areas and required all stakeholders to observe impact, vulnerability and adaptation measures. Its coverage areas were water, coastal areas, natural disaster, health, agriculture, fisheries and livestock. The program also covered biodiversity, forestry, land use, industries, infrastructure, food security, livelihood, gender and local governance (Tanner et al., 2007).

Later, NAPA put forward a number of suggestions in relation to climate change strategy in Bangladesh (MOEF, 2005). The recommendations covered the following areas.

- The hazards of the effects of climate change must be minimized and for that purpose the coastal afforestation approach and the participation of the community should receive prominence.
- The coastal communities have to be supplied pure and safe drinking water.
- There should be opportunities for the integration of climate change planning, infrastructure design, conflict management and water management institutions.

- The vulnerable community should be provided with early information to create awareness among them so that they can take preparation for going safer places before disasters strike. In this way, they would be able to mitigate the fall out of climate change.
- Sector wise policies and programs should be adopted for disaster management.
- Climate change issues have to be included in the curriculum of secondary and tertiary educational institutions.
- Capacity of urban infrastructure and industries need to be developed to contain effects of climate change.
- Rigorous research would have to be conducted on drought, flood, and salinity.
- Efforts should be made to make coastal crops salinity proof.
- Appropriate practices that are helpful for fisheries of northeast and central region and coastal areas of Bangladesh should be introduced.
- A system of crop insurance should be introduced to minimize the effect of climate change.

### ***Bangladesh Climate Change Strategy Action Plan, 2008***

The 2008 action plan was formulated as part of the preparation of a UK-Bangladesh conference and the government came up with the Bangladesh Climate Change Strategy and Action Plan (MOEF, 2008). It is widely known as action Plan 2008, and included the following six main points.

- 1 All programs will be planned with the intention to ensure food security, social security and health security so that the effects of climate change will have light impact on the most vulnerable and the poorest in the society. Their employment will also be prioritized.
- 2 A comprehensive disaster management approach will be adopted to cope with various systems of disaster management and also focus on the capacity to face the effects of climate change effectively and efficiently.
- 3 There should be massive improvement and renovation of the infrastructure.
- 4 Continuous research and updated knowledge management should be undertaken to mitigate impacts of climate change on the economy and other sectors.
- 5 Ensuring Mitigation and low carbon development and implementation should be ensured so that the effects of climate change on the poor and vulnerable gradually diminishes in the upcoming decades.
- 6 Efforts should be directed towards capacity building, institutional strengthening, ensuring the participation of various sectors of the government and the members of the civil society, non-governmental organizations and other players of the private sector to formulate



timely policy to develop skills of the ministries of the government to deal with the challenges of climate change.

### ***Bangladesh Climate Change Strategy Action Plan, 2009***

The climate change strategy action plan, 2009 is a long term action plan for responding to the challenges of climate change. It is a complete package of the government and will be implemented over a period of ten years. The action plan consists of six pillars with each is of special and distinctive features, and they are summarized below.

#### *Food security, social protection and health*

There is no denying the fact that climate change will affect the poorest and most vulnerable of the society very badly. Under this pillar government will take every required step to protect the poor and vulnerable. In order to ensure this, the government will have to undertake many tasks such as increasing the resilience capacity of the affected people including children and women, developing community based adaptation programs, introducing climate change resilient cropping, fisheries and livestock systems to ensure food security, ensuring health security of the people through effective health policy, supplying safe and pure drinking water among the affected and arranging proper sanitation system for them.

#### *Comprehensive disaster management*

It is not possible for the government on its own to ensure a comprehensive disaster management system because it is a massive task. This pillar focuses on developing and increasing the capacity of the various ministries and agencies of the government to ensure participation of all stakeholders in the society.

#### *Infrastructure*

It is not possible to deal with the effects of climate change without strong infrastructure. Taking this into consideration government has to focus on constructing new infrastructure and repairing the existing facilities. Building strong infrastructure and maintaining them is critical for effective response to climate change.

#### *Research and knowledge management*

This pillar of the action plan 2009 is very important because research is essential for acquiring the knowledge required to face the challenges of climate change. Its importance is underlined by the fact that climate change is an ever changing issue. This body of research will focus on studying global climate change model and applying the findings in Bangladesh to mitigate the effects of climate change, and modeling the hydrological impacts.

### *Mitigation and low carbon development*

Bangladesh does not have massive industrialization and programs that could contribute to greenhouse gas emission. Nevertheless, the government moves very cautiously in this regard, and would like to emphasize on the development of a strategic plan, expansion of social forestry program across the country on government and community land, and careful consumption and utilization of energy.

### *Capacity building and institutional strengthening*

This pillar focuses on strengthening the capacity of the government ministries, agencies, civil society and the private sector of the country. The activities will include review and/or revision of sector wise policies relating to climate change and focus on key ministries and agencies for adaptation purpose.

## **Conclusion and Policy Recommendation**

### ***Conclusion***

Climate change is no longer a domestic or regional issue; rather it is a global and ever changing challenge. Developing countries will fall victims to the severe effects of climate change although it may be for no fault of their own. In reality, they are in this situation due to the overambitious programs of the developed countries and emerging economies which are contributing to the problem with excessive and rapid industrialization. The impacts of climate change on Bangladesh have been very costly. Food production has declined as agriculture in the coastal zones is gravely affected due to salinity of soil, contributing to food insecurity for the entire nation. The agricultural sector makes a substantial contribution to gross domestic product of Bangladesh which depends excessively on agriculture to feed the nation. This underlines the need for a pragmatic approach for increasing food production in the country.

Another sector that faces a major threat is water resources. People in the coastal areas will suffer from lack of pure drinking water. The poor and marginalized groups will suffer from various diseases, and the biodiversity and ecosystems of the country are affected by climate change. Bangladesh has developed policy outlines for dealing with the challenges, but does not have the financial strength and technological knowledge to implement the policies and programs on time. This will require full cooperation of developed countries and the United Nations for effectively formulating and implementing climate change adaptation policy and programs.

### **Policy Recommendations**

In order to mitigate the intensity of the effects of climate change, this chapter proposes a number of recommendations. More research is needed

to increase food production, develop an appropriate agricultural system for the coastal areas and upgrade knowledge of relevant personnel to formulate, review and monitor climate change adaptation policy to keep pace with the changing pattern of climate change.

Crop insurance should be introduced to mitigate the financial loss of farmers that emanate from climate change. Strengthening the infrastructure ought to receive top priority because it will help the government achieve more institutional capability to mitigate repercussions of climate change.

Competence must be achieved by the diplomats, the government of Bangladesh and other non-governmental players including the civil society to globally project the problem of climate change and its impact on Bangladesh to work towards achieving adequate financial allocation and updated technological support from the global community required for implementing climate adaptation policy. Public awareness should be developed across the country with the help of press and electronic media to inform the citizens of the risks and effects of climate change.

The policies should be formulated on a sector-wise basis. Cooperation and co-ordination among the concerned ministries and agencies that are responsible for implementing climate change adaptation policy is strongly recommended. Climate change issues should be included in the curriculum of secondary and higher secondary education so that the future leadership of the country becomes aware of the effects of climate change right from the early stage of their lives. The bio-diversity and ecosystem of the country will be greatly affected by the effects of climate change. Therefore, special measures from the part of the government should be undertaken to ensure the equilibrium of the nature. Therefore, more local, national, regional and global commitment is critical indispensable for preparing climate change adaptation policies of the developing countries like Bangladesh for mitigating the consequences of climate change.

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# 9

## Climate Change and Farmers' Response in North-East India

Utpal Kumar De

### Introduction

Changing climate and extreme climatic behaviour like sudden floods and draughts have extensive impacts on the agricultural activities and its productivity which compel rural farmers to shift their existing cropping pattern to reduce risk (Auffhammer *et al.*, 2012; De & Chattopadhyay, 2010). Agricultural performance is vulnerable to the variability in local climate across different locations rather than global climate patterns that raise risk and uncertainty (IPCC, 2007b; Ye *et al.*, 2013). Under increasing uncertainty, maintenance of agricultural productivity depends on the adaptability of the farmers with the changing weather pattern over the years. Farmers in developing countries, especially in rural areas are hit the hardest by extreme climatic events such as floods and draughts that reduces crop yields in most tropical and sub-tropical regions that also happens due to changes in water availability (Adger *et al.*, 2003; IPCC, 2007a; Tanner *et al.*, 2008). The rural poor normally have limited adaptation choices including very limited options to diversify cultivation of crops. At the same time, they are more vulnerable than the rich farmers to agricultural disruptions and they lack access to improved technologies such as flood and draught resistant varieties of seeds or crop insurance etc. However, most of the farmers are aware of the fact that greater crop diversity and mixed farming (crops and livestock) offers considerable protection against farming risk, including climate-related risk (FAO, 2011). Continuous adaptation is a useful tool for dealing with climate change risk or climate extremes. Crop diversity is the best way of adaptation and the foundation for future efforts to feed the world (Kyte, 2014). It is therefore, important to analyse farmers' perception and awareness about crop diversification as their adaptation actions followed the climate change scenario in the region. Although there are several studies on the process of diversification of crops along with the other resources to deal with the changing weather pattern, agro-technology, and infrastructure are critical for sustainable agricultural growth (Krishnan, Vasisht and Sharma, 1991; Bastine and Palaniswami, 1994; Dale, 1997; Hazra, 2003; De, 2003; and Mehta, 2009). However, analyses of adaptation measures of farmers in response to changing weather pattern,

different agro-technologies, risk and uncertainty on account of the climate extremes are rare.

Changes in climate, agricultural productivity and crop diversity over time is examined by using secondary data, while farmers' adaptation is understood by collecting primary data across two different zones of extremely opposite weather conditions. The role of various factors in adaptation and crop diversification has been analysed by using regression analyses. Extent of diversification of crops has been measured by the Herfindahl Index (HI) of diversity. Also an adaptation index (AI) is constructed by using the formula  $AI = (\sum P_i * X_i) / n$ , where  $P_i$  is the weight of  $i^{th}$  adaptation;  $X_i$ .  $P_i$  is computed as the proportion of  $i^{th}$  strategy in the gross number of adaptations followed by all the farmers in the area. Effects of different factors on the level of crop diversification by individual farmers and on the adaptability with the changing agro-climatic conditions is tested by multiple regression technique. The results reveal significant changes in weather pattern during the last six decades with slow crop diversity across zones. It is however observed that education of the respondent farmers, farm size, area of holdings and share of family income from agricultural activities have significantly positive impacts on the crop diversification as well as adaptation to moderate the adverse climate impact or avoid climate related disaster. Education improves technology adoption capacity and thus helps farmers adapt better to the changing climatic conditions.

Climate change has important consequences on agricultural practices and productivity in the North-Eastern part of India. This chapter explores changes in agricultural productivity and its regional pattern using a composite productivity index. It examines the pattern of climate change, changing agricultural productivity and farmers' response towards changing climatic conditions or extreme climatic events in Assam. Additionally, the impact of various factors including changing technological support, age, education and training, farming experience, area under cultivation, income and access to capital for crop diversification or other adoption mechanisms are examined by using a cross section data collected from sample villages of Kokrajhar and Dhemaji. Finally, the farmers' response to changing climate has been observed through the crop diversity pattern and adaptability of farmers with varying climatic conditions.

### **Agricultural Productivity and Climate Change**

Agricultural productivity, pattern of crop diversity across regions have been subject to the changing agro-climatic conditions of respective regions (IPCC, 1995; Peng, et al., 2004; Aufhammer, Ramanathan, and Vincent, 2006, 2011; Kar et al. 2004; Wejnert, 2002; Deschenes and



Greenstone 2007; Feng, Krueger and Oppenheimer, 2010; De and Bodosa, 2014). As changing production condition leads to variation in productivity of crops, it also affects farmer's option for diversification of land use in an optimum manner. Moreover, uncertainty on account of market information gap disallows farmers to adopt appropriate crop diversification (Ellis, 1989; Anderson, 2003) and adopt new technology (Rasul et al., 2004; Knowler and Bradshaw, 2007; Teklewold et al., 2006). However, productivity growth and crop diversity are closely linked with agricultural prosperity and, by turn, agro-economic development of a country (Kasem and Thapa 2010, Hutagaol 2006, Pingali 2004, FAO/RAP 2000, Rahman 2009 and Van den Berg et al. 2007). Under changing climatic conditions, agricultural sustainability of any region depends on farmers' capability to adapt to the changing climatic conditions and moderate its adverse impacts on the agricultural performances of that region.

Adaptation to climate change refers to adjustments in practices, processes and systems to minimise current and/or future adverse effects of climate change and take advantage of available opportunities to maximise benefits (Eriksen *et al.*, 2011; Pouliotte *et al.*, 2009). Adaptation and mitigation in agriculture require local responses. Selection of crop variety and diversification, date of planting, harvesting, tillage and fertilisation are some possible adaptation strategies to the changing climatic pattern. However, farmers' adaptability to the changing climate and choice of suitable cropping pattern depends largely upon their awareness and skill to anticipate the expected situation that is highly dependent on their level of education, availability of information, training, extension services by outside agencies regarding climate change and assets, access to appropriate agro-technology and agro-infrastructure (IPCC, 2007a; Anselm and Taofeeq, 2010; Onyeneke & Madukwe, 2010; Adensina, *et al.*, 1995; and Krishnamurthy, 2012). Moreover, innovative agricultural practices and technologies can play an important role in climate mitigation and adaptation. This adaptation and mitigation potential is most pronounced in developing areas like North-East India where agricultural productivity remains low, and poverty, vulnerability and food insecurity remain high; and the direct effects of climate change are expected to be especially harsh (Lybbert & Sumner, 2010).

Assam is the largest agrarian state in North-East India dominated by small landholdings (average 1.2 hectare; GoA, 2012-13) with high weather dependence and substantial agricultural diversity. Climate of Assam region recorded gradual changes over time as reflected in inconsistent variations in rainfall, rising temperature and erratic humidity level. In recent years, the highest level of precipitation was observed in Assam (De and Bodosa, 2014) either in pre-normal monsoon months of

March-May or during post monsoon months of August–October, resulting in untimely devastating floods. Flood is a common phenomenon in Assam and Dhemaji, Lakhimpur, Nagaon and some other districts are highly prone. Moreover, both maximum and minimum temperatures were observed to increase consistently and the winter months recorded faster growth across different parts of the state. Needless to say that rising uncertainty in monsoon rainfall and temperature seriously affect pattern of agricultural activities undertaken by the farmers and their livelihood conditions as well. It thus necessitates appropriate preparedness and continuous adaptation in the crop and non-crop activities for the reduction in risk and best possible livelihood practice in the region.

### Materials and Methods

The analysis is based on primary as well as secondary data. Information on maximum and minimum temperature, morning and evening humidity and rainfall for the last six decades was collected from the India Meteorological Department (IMD). Data on area under various crops since 1951 to 2011 were collected from issues of the *Statistical Hand Book* of Assam, *Economic Survey of Assam* and Reports from the Directorate of Economics and Statistics and Directorate of Agriculture, Government of Assam. Temporal changes in climatic variables are examined by comparing both the 11 and 31 years averages of month-wise variation at different periods. The trend in month-wise and region-wise variation is plotted against over time change in average figures in order to determine the seasonal and spatial variation over time.

Productivities of different crops are non-comparable in quantitative terms due to heterogeneity and without converting them in value terms for non-availability of price figures. However an overall agricultural productivity as a composite unit can be constructed based on yields of different crops as well as allocation of land towards cultivation of various crops. The index is constituted to describe the overall productivity of the districts vis-a-vis the state average. *Composite Productivity Index* (CPI) for the district  $j$  can be written as  $CPI_j = \sum_i (Y_{ij}/Y_{i0}) \cdot (A_{ij}/A_{i0}) * 100$  where  $A_{i0} = \sum A_{ij}$  and  $A_{ij}/A_{i0}$  = proportion of area under  $i^{\text{th}}$  crop to total cropped area in  $j^{\text{th}}$  district ( $j = 1, 2, \dots, 10$ ) and  $(Y_{ij}/Y_{i0})$  is the *yield relative* for  $i^{\text{th}}$  crop in district  $j$  with  $Y_{ij}$  is the average yield of  $i^{\text{th}}$  crop in the  $j^{\text{th}}$  district and  $Y_{i0}$  the average yield of  $i^{\text{th}}$  crop in the state. *Composite productivity index* is constituted for each district separately to have an inter-district comparison with varied agro-climatic conditions. Here the weight of proportion of area under different crops for the yield relative would indicate the effect of cropping pattern changes on the overall agricultural productivity and that in a way reflects the farmers move towards cultivation of crops. Inter-district disparity in CPI has been examined by coefficient of variation.

The above analysis is done for the 10 composite districts of Assam, which were in existence before 1990. Since at several points of time the erstwhile districts were divided to create smaller districts, data on all aspects are not available for all the present 27 districts of the state. Data were regrouped and computed for those erstwhile 10 districts of the state.

There are several methods of examining convergence of the series. *Beta* ( $\beta$ ) and *Sigma* ( $\sigma$ ) convergence have been popular with researchers (Barro and Sala-iMartin, 1992; Mankiw, Romer and Weil, 1992). *Beta*-convergence comes from Baumol's (1986) work on real convergence between economies. It is basically a conventional approach that examines whether the initial values across the zones are correlated with the rate of growth during the period of study. For this purpose, the following equation can be used:  $(1/T) \ln (Y_{iT}/Y_{i0}) = \alpha + \beta \ln Y_{i0} + \varepsilon_i$

Here  $T$  is the end of time period,  $Y_{iT}$  is the value of the variable (CPI) in  $i^{\text{th}}$  zone at the end of the period of study,  $Y_{i0}$  is the value of the same variable at the beginning of the period and  $\varepsilon$  is statistical error term.

The sign of slope coefficient,  $\beta$  indicates the pattern of convergence. If the sign is positive and significant, it means that the regions are experiencing divergence in the growth of the variable  $Y$ . Conversely, a negative sign of  $\beta$  is an indication of the convergence of the regions in terms of growth of  $Y$ . The problem of this measure is that it depends only on the two end values and ignores the pattern of changes in all other intervening years. Focusing on the extreme values at the end of the period can be misleading. Quah (1993), Bernard and Durlauf (1996), Evans (1997), Sala-i-Martin's (1994, 1995) criticized this method on the ground of methodological flaw and lack of reliability and suggested the time series method of unit root and co-integration techniques for examining convergence in case of the time series data (Quah 1992, Bernard and Durlauf 1995, Li and Papell 1999). Moreover, panel unit root test is suggested by Levin and Lin (1992, 1993), Quah (1994), Im *et al.* (1997), Taylor and Sarno (1998), Choi and Ahn (1999). Im *et al.* (1997) proposed a Lagrange multiplier (LM) statistic to test for the presence of unit roots in the panel framework.

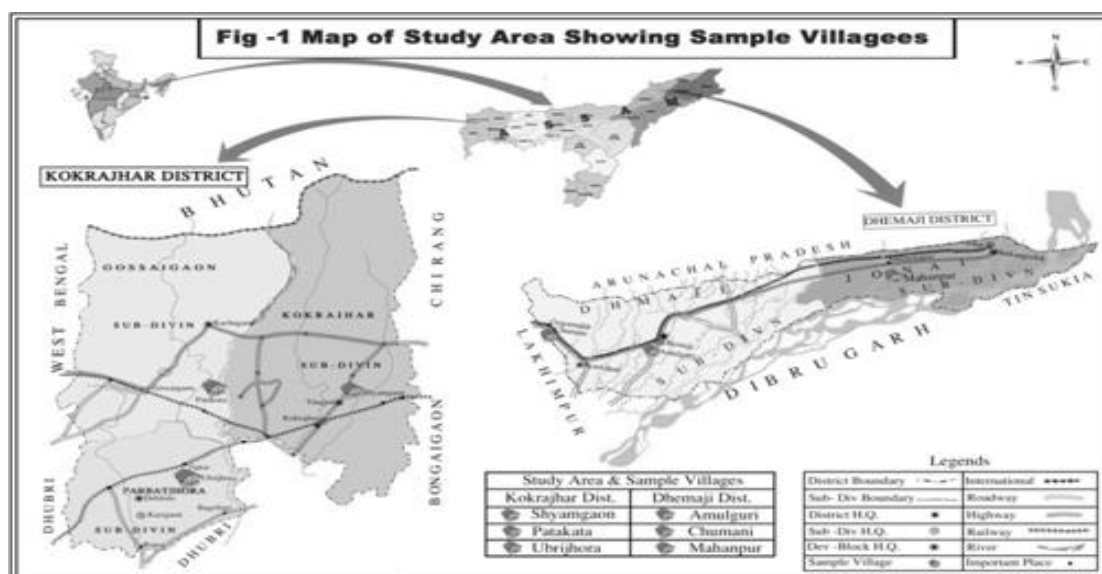
In this respect sigma-convergence can reveal a much better picture of the inter-zonal variations over the years. Thus, the convergence of growth is examined by using  $\sigma$ -convergence. The concept of  $\sigma$ -convergence is based on the neoclassical growth theory. It is defined as decline of variance (in logarithm) of composite productivity across the districts with time (Dalgaard and Vastrup, 2001; Lucke, 2008; Miller and Upadhyay, 2002; De, 2014). Sigma convergence is then described as the catching up effect. The same is also applied in case of Modified Diversity index (MDI).

Also, convergence is examined by unit root test of coefficient of variation and by estimating the following regression equation (Dickey and Fuller 1979).

$$\Delta Y_{it} = \alpha_i + \beta_i \cdot t + \gamma_{i0} Y_{i,t-1} + \sum_{j=1}^{p_i} \delta_{i,j} \Delta Y_{i,t-j} + \varepsilon_{it} \text{ where } t = 1 \dots T$$

Here,  $Y_{it}$  is the value of  $i^{\text{th}}$  variable at time  $t$ . The inference is based on the usual Dickey-Fuller  $\tau$ -statistic of  $\gamma_{i0}$ , which has a non-standard distribution. If the value of the coefficient  $\gamma_{i0}$  is found to be negative and statistically significant, the series is stationary. The Akaike information criterion has been used to determine the lag length parameter  $p_i$ .

In order to analyse the farmers' response to climate change and the impact of various factors on the farmers' adaptation to moderate climate change impact a primary survey was conducted. Multi-stage purposive sampling procedure has been followed to select the village. First of all, two districts Kokrajhar and Dhemaji have been selected purposively from the 27 districts of Assam. It may be noted that the district of Kokrajhar seldom faces extreme climate effect (except occasional draught), while devastating flood is a regular phenomenon of the Dhemaji district. In Kokrajhar three blocks namely Kokrajhar, Kachugaon and Debitola have been selected from its three sub-divisions. Dhemaji, Bordoloni and Murkongseleck blocks have been chosen from two sub-divisions (Dhemaji and Jonai) of Dhemaji district. Three blocks - one advanced, one moderately developed and another backward respectively – were selected in terms of their socio-economic characteristics. Thereafter, three villages have been chosen from each district (one from each of the selected development blocks).



Considering the socio-economic characteristics (Table 1) like transport and communication, presence of academic and administrative institutions, irrigation facilities, literacy rate, and available banking facilities in mind,

we selected one advanced, one moderate and one backward village from Kokrajhar and Dhemaji districts as sample villages. These are Shyamgaon, Patakata, and Ubrijhora from Kokrajhar and Amulguri, Chumoni and Mahanpur from Dhemaji District (Figure 1). From each of the selected villages, 50 sample households (a total of 300 sample farm households who have been practising agriculture) have been chosen as final sample units by simple random sampling without replacement. Data have been collected by direct interview using a pre-tested schedule, which includes questions pertaining to the socio-economic and demographic status of the families, utilisation of family and hired labourer, uses of fertiliser, various agro-implements, availability of irrigation facilities, topology of plots, crops damaged due to floods or other weather aberrations, perception about the diversification pattern, area allocated to various crops and outputs of crops, measures adopted for saving crops from extreme weather (mitigation measures) or changes in cultivation practices to avoid extreme weather effects (abatement measures). Information was also collected on educational achievement, experience, availability of family labour, farm size, proportion of income earned from agriculture, total family income, training, access to capital, and technology. These are some potential factors responsible for bringing changes in the existing cropping pattern and also influencing the adaptability of farmers. Descriptive statistics are used to understand farmers' socio-economic profiles, their perceptions on the impact of climate change, diversity of crops and the technologies used by them along with various adaptation measures to moderate the impacts of changing climate. Percentage of farmers who cited cropping pattern changes as a response to climate change is used to indicate the extent to which changing pattern of cultivation has been perceived as an adaptation strategy.

On the basis of primary data, effects of different factors on the level of diversification of crops by the individual farmers and on the adaptability with the changing agro-climatic conditions, is examined by *multiple regression* of the form  $Y = \beta X + D + U_i$ . Here, Y represents either farm level *Herfindahl Index of Diversity* In (it can be written as:  $HI = 1 - \sum_i^n (p_i)^2$ , where, n is the number of crops grown and  $p_i$  represents proportion of area under  $i^{th}$  crop to gross area under cultivation by the families) or *Adaptation Index*; X is the vector of explanatory variables and  $\beta$  the vector of coefficients. D is a dummy variable included in the regression that takes value zero in case of Kokrajhar (since the region hardly faces any flood incidence) and one in case of Dhemaji (that observes frequent devastating flood almost every year). Extent of diversification of crops has been measured by using *Herfindahl Index* (HI) of diversity at the farm as well as village level.

**Table 1:** Basic Characteristics of the Sample Villages

District		Kokrajhar			Dhemaji		
Sample Village		Shyamgaon	Patakata	Ubrijhora	Amulgur	Chumon	Mahanpur
Total Number of HHs		98	85	64	96	70	88
Literacy Rate (%)	Male	95	88	71	95	89	69
	Female	86	78	66	90	81	64
	Total	90.5	83	68.5	92.5	85	66.5
Distance from Village to Important Places (Km)	District H.Q.	5	35	40	8	30	56
	Sub-Davison H.Q.	5	13	15	8	30	45
	Devt. Block H.Q	2	15	20	8	15	45
	Market	2	2	7	3	4	8
	National Highway	13	9	20	0.5	4	8
	Bus Stand	2	9	7	0.5	5	8
	Railway Station	5	13	7	3.5	6	9
	Bank	3	7	8	8	5	8
Facilities available in the Village	Electrification	Yes	Yes	No	Yes	Yes	No
	Faire Price shop	Yes	Yes	No	Yes	Yes	No
	Irrigation	Yes	Yes	No	Yes	No	No
	Mobile	Yes	Yes	Yes	Yes	Yes	Yes
	Land Line/WLL	Yes	No	No	Yes	No	No
	Internet/Wi-Fi	Yes	No	No	Yes	No	No
	Road Type	Pacca	Gravel	Kacha	Pacca	Gravel	Kacha
Educational Institutions	LP	Yes	Yes	Yes	Yes	Yes	Yes
	ME/MV	No	Yes	No	No	Yes	No
	HE/HSS/College	No	No	No	No	No	No
<i>Classification of Village as per Development characteristics</i>		<i>Advanced Village</i>	<i>Moderate Village</i>	<i>Backward Village</i>	<i>Advanced Village</i>	<i>Moderate Village</i>	<i>Backward Village</i>

**Source:** Field Survey, 2013-14.

**Notes:** HHs= Households, LP = Lower Primary, ME/MV = Middle English/ Middle Vernacular.

Here, the adaptation index is constituted by using the formula  $AI = (\sum P_i * X_i) / n$ . Here, n is the number of possible adaptation measures, which are adopted by the farmers in the area differently according to their needs and capacity,  $P_i$  is the weight of  $i^{th}$  adaptation  $X_i$  and  $P_i$  is computed as the proportion of  $i^{th}$  strategy in the gross number of adaptations followed by all the farmers in the area. It is made to make the possible measures equally likely for all the individuals as observed in the overall sample and the value of AI lies between 0 and 1. In the same way technology index and infrastructure index is computed.

## Observations and Analysis

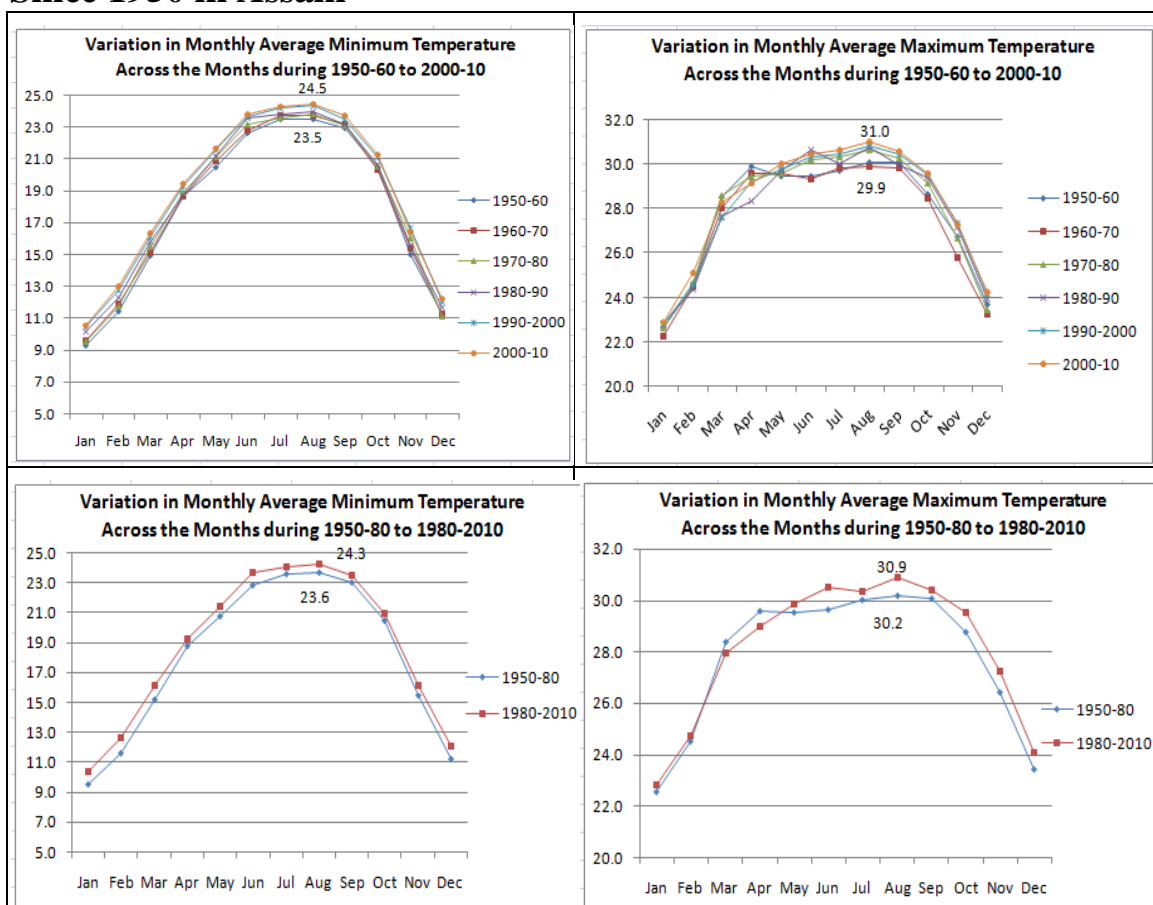
### *Changes in Agro-Climatic Condition of Assam*

Assam is well known for its diverse sub-Himalayan agro-climatic conditions which is suitable for the growth of varieties of crops across the districts. The climatic conditions in the state also changed significantly

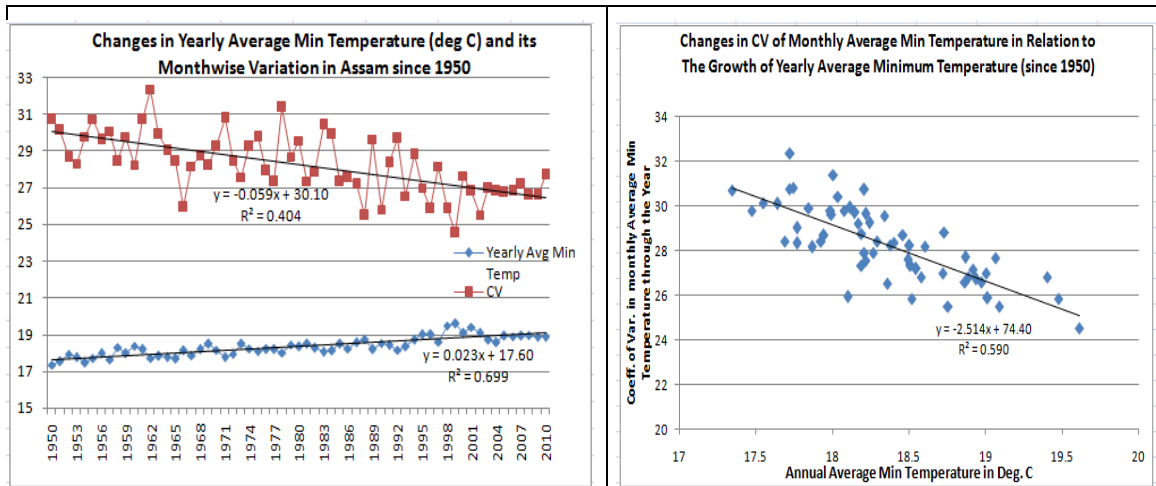
over the years and that to some extent led to the variation in crop cultivation but not observed to be in line with the growth process as expected from a progressive agricultural economy. Here, temporal variation in three major components of weather like rainfall and max-min temperature over six decades of time is observed.

11 and 31 years average figures of monthly average minimum and maximum temperature show a rise in minimum temperature in the range of  $1.1^{\circ}\text{C}$  to  $1.3^{\circ}\text{C}$ , while a rise of maximum temperature from  $0.7^{\circ}\text{C}$  to  $1.8^{\circ}\text{C}$  (Fig.-1). Also, variation in average minimum temperature across the months of the year is found to decline at a significant rate along with the rising yearly average minimum temperature over the years. Thus, an inverse relation is revealed between the yearly average temperature and the seasonal variation in minimum temperature. This is an indication of gradual convergence of seasonal temperature with global warming in the state (Fig.2). However, there is insignificant change in month-wise variation in maximum temperature with rising trend, which is subject to significant volatility in the prime monsoon months, which starts earlier than the normal monsoon season of Indian plains (Fig.3).

**Figure: 1: Changing Min & Max Temperature (Monthly Average) Since 1950 in Assam**

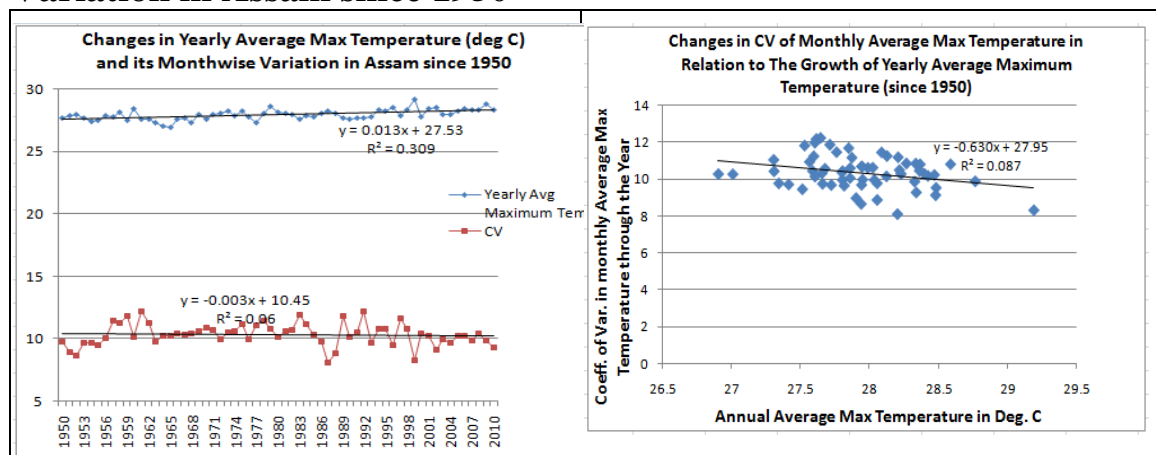


**Figure: 2: Trend of Min Temp. and Its Monthwise Variation in Assam since 1950**

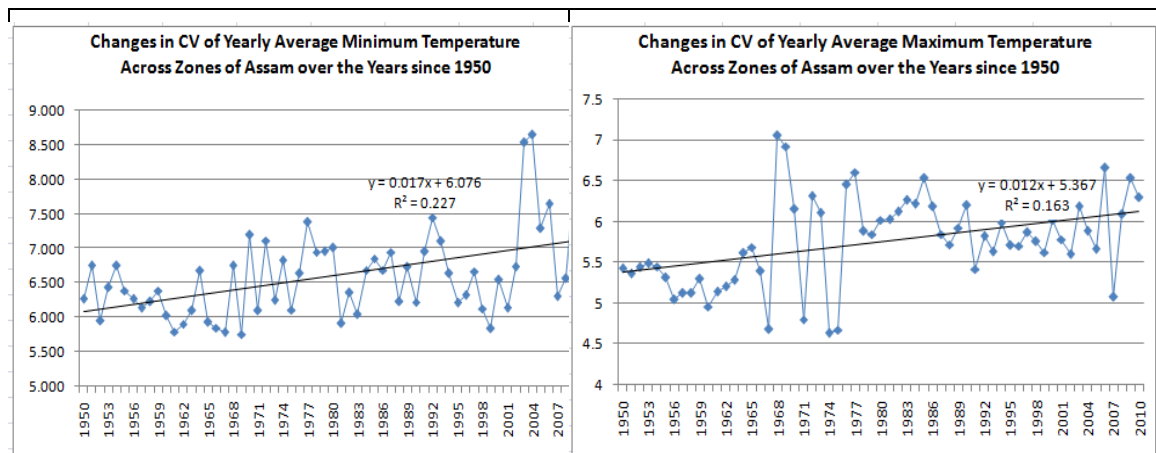


Zone-wise variation in minimum temperature has also been rising at a faster rate than the maximum temperature. This growing regional variation is also associated with increasing volatility (Fig.4).

**Figure: 3: Trend of Maximum Temperature and Monthwise Variation in Assam since 1950**

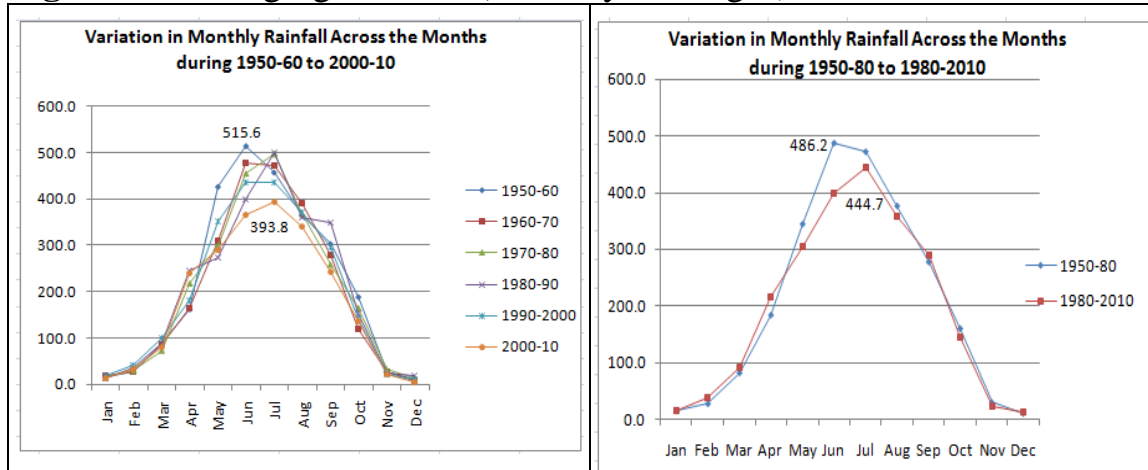


**Figure: 4: Changing Zone-wise Minimum and Maximum Temperature in Assam since 1950**



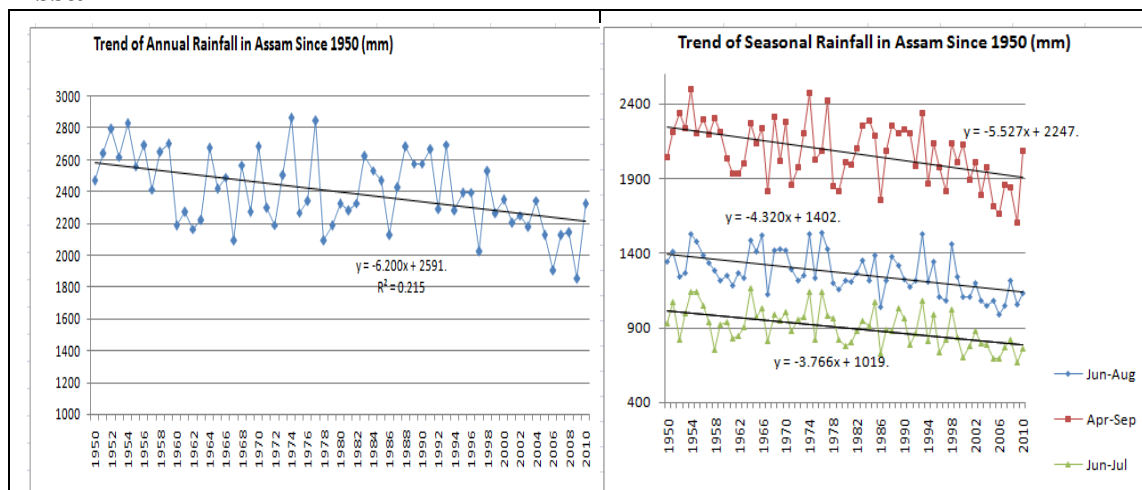


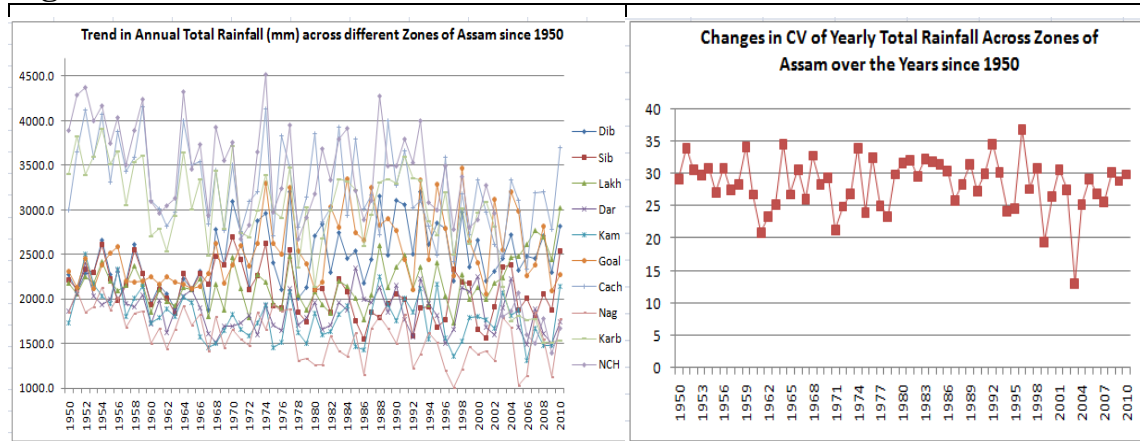
**Figure 5: Changing Rainfall (Monthly Averages) Since 1950 in Assam**



Yearly rainfall also declined during the last six decades. In addition, its seasonal pattern has changed and the monthly rainfall reaches its peak alternately in June, July or August. The 31 years average shows that the rainfall in the peak month declined from 486.2 mm during 1950-80 to 444.7 mm during 1980-2010. Despite the fall in total annual rainfall, occurrence of flood became erratic as concentration of heavy rainfall is recorded in a few days when maximum portion of rainfall of the month occurs (Fig.5). Fig.6 also shows significant decline in annual rainfall and that the share of the annual rainfall occurred during the peak monsoon months declined over time. However, the overall trend in low rainfall zones though not significant, it declined significantly in the relatively high rainfall zones and rising zonal variability is also clear from Fig.7.

**Figure 6: Trend in Annual Rainfall and Share of Various Seasons in Assam**



**Figure 7:** Trend in Annual Rainfall of Various Zones of Assam and its CV

Quinquennial average annual rainfall in Assam has been found to be increasingly erratic and on an average declined from over 2576.3 mm during 1951-56 to 2358.5 mm in 1971-76 and further to 2040 mm during 2005-10. Among the districts, Cachar area recorded the highest average annual rainfall since 1951-56 but registered decreasing trend along with other zones except in Lakhimpur where monsoon rainfall increased over time. On the other hand, Nagaon area recorded the lowest annual rainfall among all the zones and that too declined over time. Annual average rainfall in Cachar was about 3777.4 mm during 1951-56 and increased to 2833.6 mm during 2005-10, while in Nagaon it decreased drastically from around 1980.3 mm in 1951-56 to 1335.3 mm during 2005-10. In hilly Karbi Anglang and N.C. Hills however annual rainfall continuously declined from 3910.9 mm in 1951-56 to 1663.4 mm during 2005-10. Not only having inter-zonal skewed distribution of rainfall, the month-wise variation in rainfall increased significantly in the high rainfall areas, while that of low rainfall area declined (Appendix-1). In Lakhimpur, Dhemaji zone monsoon rainfall has increased continuously over the years during Kharif season and thus incidence of flood and its severity also increased with more damaging impact on the late summer and autumn crops. In Karbi Anglong and N.C. Hills, rainfall over the years shows more erratic pattern and thus farmers avoided settled paddy cultivation even in low lying areas in order to avoid uncertainty and the diversity pattern shows people's preference for more tea, horticulture and sericulture on the basis of wildy grown host plant, castor. Gradually, farmers in other areas also tried to switch over to the short period, more resistant crop varieties to reduce the risk of cultivation due to changing frequency, intensity and timing of occurrence of rain and flood emanating from the long term changes in climatic condition, which has been closely associated with the changing relative humidity and temperature variation across the months and regions over the years. Relative humidity has also been found to increase gradually in the rising rainfall areas and declined

in the falling rainfall areas of Assam. The record of maximum and minimum temperature also shows that average level of maximum and minimum temperature has increased since 1970 across the places but it has associated with rising extremeness (max-min gap) especially in the high rainfall areas (Appendix2).

### ***Spatio-Temporal Variation in Composite Agricultural Productivity***

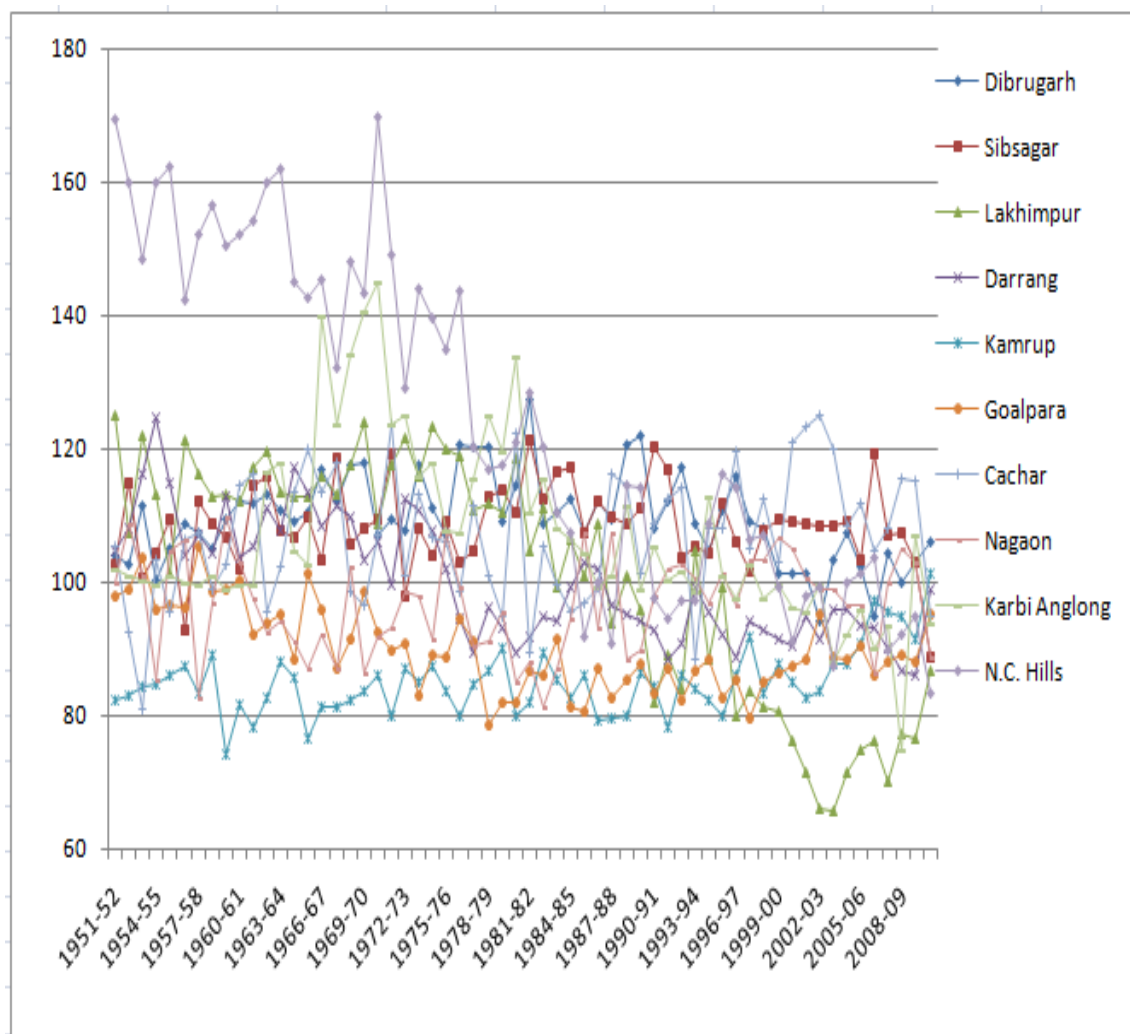
The *Composite Productivity Index* (CPI) calculated for different districts are displayed in Table1. It can be noticed that the range of variation in index in percentage term for all crops when taken together was 82.22 to 124.96, in 1951-52, 79.79 to 148.87 in 1971-72, 87.0 to 116.93 in 1991-92 and 83.38 to 106.0 in 2010-11 respectively. The range of index first increased from 1951-52 to 1971-72 and thereafter it declined and stabilized.

Table 1 also shows that Lakhimpur, Karbi Anglang and N.C. Hills were at the top three positions in respect of CPI during 1951-52, to 1981.82. Kamrup was at the bottom position in the relative ranking. Remarkable achievement in composite productivity index has been found in case of Cachar, which has jumped over many other districts in respect of CPI during 2001-02. Kamrup, too, has made significant progress. Lakhimpur and N.C. Hills lagged behind in their relative ranking in this case. Fig.8 shows the stable inter-district variation in CPI except an increase in variability in the middle of the period.

**Table:1:** Growth of Composite Productivity Index of Various Districts of Assam during 1951-52 to 2010-11

Year	Dibrugarh	Sibsagar	Lakhimpur	Darrang	Kamrup	Goalpara	Cachar	Nagaon	Karbi Anglong	N.C. Hills
1951-52	NA	102.79	124.96	104.53	82.22	97.85	105.38	99.91	101.89	NA
1952-53	NA	114.97	107.47	108.12	82.85	98.82	92.32	108.70	100.97	NA
1953-54	NA	100.43	121.86	116.07	84.39	103.75	80.93	101.02	100.18	NA
1954-55	NA	104.24	113.02	124.69	84.80	95.85	103.22	85.29	99.42	NA
1955-56	NA	109.56	101.10	114.81	85.88	96.48	95.43	104.59	100.91	NA
1956-57	NA	92.96	121.27	104.10	87.37	96.04	106.51	106.18	99.88	NA
1957-58	NA	112.07	116.29	107.10	83.17	105.48	107.38	82.52	99.56	NA
1958-59	NA	108.84	112.70	104.17	88.98	98.38	98.96	96.86	100.87	NA
1959-60	NA	106.69	113.05	112.71	74.27	98.98	102.73	109.82	98.89	NA
1960-61	NA	102.04	112.19	103.68	81.58	100.22	114.36	102.99	99.45	NA
1961-62	NA	114.44	117.06	105.49	78.11	91.99	116.12	97.60	99.59	NA
1962-63	NA	115.94	119.52	111.07	82.60	93.89	95.66	92.55	116.46	NA
1963-64	NA	107.58	113.40	107.58	88.01	95.01	102.26	94.06	117.96	NA
1964-65	NA	106.76	112.93	117.04	85.70	88.44	113.60	90.99	104.52	NA
1965-66	NA	109.67	112.90	113.52	76.42	101.35	119.78	86.95	102.73	NA
1966-67	NA	103.45	115.69	108.35	81.30	95.76	113.39	92.06	139.73	NA
1967-68	NA	118.60	113.19	111.43	81.25	86.93	117.88	86.98	123.67	NA
1968-69	NA	105.51	117.41	109.90	82.45	91.43	98.68	102.36	134.02	NA
1969-70	NA	107.91	124.06	103.44	83.68	98.64	96.63	86.42	140.51	NA
1970-71	NA	109.33	108.55	105.91	86.11	92.52	106.93	91.65	144.80	169.86
1971-72	109.34	119.12	117.51	99.54	79.79	89.63	123.77	92.99	123.63	148.87
1972-73	107.62	97.98	121.55	112.44	86.91	90.62	101.04	98.46	124.97	129.10
1973-74	117.52	107.88	115.71	110.92	84.96	82.82	113.28	97.94	115.85	144.03
1974-75	111.22	103.82	123.32	107.69	87.34	89.06	106.61	91.32	117.95	139.59
1975-76	107.06	109.14	120.00	101.92	83.80	88.75	105.85	107.29	107.69	134.70
1976-77	120.47	102.95	118.87	94.52	80.06	94.59	98.71	99.27	107.30	143.46
1977-78	120.12	104.71	110.61	89.29	84.69	91.14	111.32	90.47	115.54	120.34
1978-79	120.15	112.75	111.61	96.24	86.86	78.63	100.80	91.26	125.07	116.91
1979-80	109.15	113.78	110.46	93.25	90.16	81.85	94.70	95.55	119.68	117.42
1980-81	114.37	110.25	118.42	89.49	80.06	82.11	122.13	85.14	133.66	120.85

Year	Dibrugarh	Sibsagar	Lakhimpur	Darrang	Kamrup	Goalpara	Cachar	Nagaon	Karbi Anglong	N.C. Hills
1981-82	127.20	121.27	104.53	91.66	81.96	86.74	89.57	88.16	110.39	128.20
1982-83	108.76	112.32	111.01	94.84	89.43	86.11	105.36	81.24	115.62	120.30
1983-84	110.26	116.51	99.15	94.20	85.46	91.35	99.72	87.18	108.04	110.56
1984-85	112.61	117.30	106.21	99.31	82.69	81.23	95.39	94.63	106.50	107.50
1985-86	107.34	107.23	100.76	102.81	86.18	80.66	96.85	107.43	104.48	91.93
1986-87	112.27	112.15	108.59	102.01	79.30	86.89	99.39	93.29	99.17	99.92
1987-88	109.23	109.77	93.93	96.69	79.70	82.52	116.13	107.24	101.07	90.62
1988-89	120.44	108.83	101.07	95.12	79.95	85.39	114.38	88.38	111.46	114.35
1989-90	122.07	111.02	95.69	94.01	86.31	87.69	101.28	89.65	98.79	113.97
1990-91	107.93	120.29	81.92	92.91	84.38	83.14	108.86	97.85	105.33	97.56
1991-92	112.08	116.93	89.17	88.32	78.16	87.00	112.30	102.05	100.25	94.44
1992-93	117.16	103.50	83.90	90.79	85.87	82.33	114.07	102.56	101.45	97.17
1993-94	108.55	105.18	104.79	99.40	84.07	86.83	88.38	100.53	98.67	97.05
1994-95	104.62	104.20	88.55	95.55	82.36	88.43	108.02	96.98	112.77	108.78
1995-96	110.65	111.86	99.16	91.96	79.85	82.60	108.10	101.13	101.03	116.19
1996-97	115.86	106.05	80.08	88.70	86.16	85.22	119.68	96.37	97.56	114.13
1997-98	109.10	101.50	83.56	94.19	91.71	79.62	104.89	103.35	102.63	106.35
1998-99	108.05	107.67	81.33	92.90	83.21	84.86	112.35	103.21	97.67	107.16
1999-00	101.24	109.33	80.69	91.50	87.82	86.47	103.04	106.74	99.65	99.07
2000-01	101.38	109.17	76.04	90.29	85.10	87.37	120.94	105.04	96.34	90.97
2001-02	101.34	108.74	71.60	94.91	82.68	88.24	123.26	100.72	95.58	97.71
2002-03	94.23	108.54	66.11	91.60	83.48	95.18	124.82	98.78	99.50	99.34
2003-04	103.18	108.35	65.54	95.77	87.82	88.73	119.89	98.77	87.88	87.34
2004-05	107.31	109.11	71.56	95.88	87.66	88.45	108.31	96.56	92.18	99.77
2005-06	102.39	103.15	74.74	93.33	90.71	90.55	111.88	96.58	95.78	101.23
2006-07	94.84	119.12	76.17	93.29	97.08	86.09	104.81	86.34	90.09	103.70
2007-08	104.34	106.89	70.03	89.93	95.61	88.11	108.00	99.84	93.31	89.89
2008-09	99.88	107.42	77.22	86.85	94.67	89.15	115.49	105.05	74.99	91.98
2009-10	103.03	102.87	76.37	86.18	91.32	88.04	115.19	102.89	106.87	94.92
2010-11	106.00	88.61	86.68	98.75	101.19	95.25	94.80	88.63	93.84	83.38

**Figure: 8:** Over Time Variation in Composite Productivity Index

The district level convergence of CPI is estimated through Sigma convergence and presented in Table 2. As the variation is noticed (from Fig. 8) to be fluctuating, it is examined for two sub-periods (1951-52 to 1976-77 and 1977-78 to 2010-11). During the first sub-periods from 1951-52 to 1976-77 there was significant convergence of CPI across the districts (significant negative slope), while during 1977-78 to 2010-11 insignificant negative trend of CV is observed.

**Table: 2:** Estimated Value of Sigma Convergence of CPI in Assam

<i>Period</i>	<i>Intercept</i>	<i>t-value</i>	<i>Slope Coef.</i>	<i>t-value</i>	<i>AdjR<sup>2</sup>, F</i>
1951-52 to 1976-77	2.966***	63.40	-0.0075**	-2.48	0.171, 6.148**
1977-78 to 2010-11	2.598***	39.95	-0.0049	-1.497	0.040, 2.24**

\*\*\* & \*\* indicate the coefficient is significant at 1% & 5% level respectively

The unit root test of district level CV of CPI and MDI is presented in Table 3. The result shows an overall convergence for CPI during 1951-52 to 2010-11. But the coefficient of MDI is found to be insignificant. It means there is virtually no convergence of MDI during the whole period.

**Table: 3:** Unit Root Test of CV of CPI in Assam by ADF Test for the whole Period

	<i>Coef.</i>	<i>t-value</i>	<i>Mackinnon P</i>	<i>Trend</i>	<i>t-value</i>	<i>AdjR<sup>2</sup>, F</i>
Without Trend	-0.2772**	-2.99	0.036			0.12, 8.94***
With Trend	-0.6119***	-4.94	0.0009	-.0877***	-3.67	0.28, 12.19***

\*\*\* & \*\* indicate the coefficient is significant at 1% & 5% level respectively.

### *Land Use Pattern and Area of Operational Holdings in the Sample Village*

One of the important characteristics of the surveyed villages is that the chosen farm families are mostly small (more than one hectare but less than four hectares) and marginal (below one hectare) farmers. Also, there is non-uniform distribution of cultivated area among farming households in all the villages. About 66 percent and 65 percent of the respondent farmers in Kokrajhar and Dhemaji districts respectively are small holders. However, more than 25 percent of farmers have land holdings between 30.0 to 75.0 bighas in Dhemaji district, while about 7 percent of the farmers in Kokrajhar belong to that group. It also indicates the presence of common land leasing practice in all the villages. The land holdings are not only small in size but also fragmented into many parcels due to subdivisions on account of breakdown of the joint family system and law of inheritance (Table 4). The lease-out and lease-in phenomena are found to be more prominent among the marginal and small farmers (Table5). Total operational holdings of the sample farmers in Kokrajhar district is 2115.5 bighas (about 283.62 hectares), of which 11.70 and 3.45 per cent are leased-in land and leased-out land respectively. On the other hand, among the sample farms of Dhemaji district the total holding is 3048 bigha (about 408.63 hectares) of which about 2 and 1 percent are leased-in and leased-out respectively. Leased on short term contracts and substantial fraction of croplands would lead to fewer incentives for investments in soil conservation by the operators. However, owner farmers have more capacity to adopt new technologies frequently than owner-cum-tenant and tenants farmers (Habiba *et al.*, 2012). Moreover, it is widely believed that land ownership encourages adaptation of technologies like irrigation and application of fertiliser. Farmers adapt their choice of farm type and irrigation to their local climate that treats the choice of crops, livestock, and irrigation as endogenous factors (Mendelsohn and Seo, 2007c).

**Table: 4: Distribution of Respondents according to the Size of Operational Holdings (in Bigha)**

Category/Size of operational holdings	Number of Respondent Farmers								
	Kokrajhar				Dhemaji				Overall Total
	Shyamgaon	Patakata	Ubrihora	<i>Sub-Total</i>	Amulguri	Chumoni	Mahanpur	<i>Sub-Total</i>	
<b>Marginal</b> (Below 7.5)	23 (46)	1 (2)	16 (32)	<b>40</b> (26.7)	2 (4)	2 (4)	10 (20)	<b>14</b> (9.3)	54 (18)
<b>Small</b> (7.5 to 30.0)	26 (52)	43 (86)	30 (60)	<b>99</b> (66)	36 (72)	28 (56)	34 (68)	<b>98</b> (65.3)	197 (66)
<b>Medium</b> (30.0 to 75.0)	1 (2)	6 (12)	4 (8)	<b>11</b> (7.33)	12 (24)	20 (40)	6 (12)	<b>38</b> (25.3)	49 (16)
<b>Large</b> (75.0 & above)	Nil				Nil				
<b>Total</b>	<b>50</b> (100)	<b>50</b> (100)	<b>50</b> (100)	<b>150</b> (100)	<b>50</b> (100)	<b>50</b> (100)	<b>50</b> (100)	<b>150</b> (100)	<b>300</b> (100)

*Source:* Field Survey, 2013-14.

*Note:* Figure in the parentheses represents percentage of the respondent farmer.

### ***Cropping Pattern in the Sample Villages***

Various types of crops are cultivated by the respondent farmers in different seasons. Generally, paddy, oilseeds, sugarcane and potato are grown abundantly in the study area and cultivation of areca nut, bamboo and banana was also observed almost in all the villages. Although different food and non-food crops are grown by them, over 82 percent of the area is found to be allocated for food grain (Table 6) in the two consecutive preceding years i.e. in 2011-12 and 2012-13. It is also observed that the farmers in Dhemaji district are cultivating proportionately more food grain crops than Kokrajhar.

Rice occupies the predominant place in all the six villages (similar to the state) comprising over 80 per cent of the total cropped area (Table 6). Mustard is the second most important crop in the sample villages. Share of non-food gains is still very low (merely 18 percent of gross cultivated area or GCA). This is an indication of very poor level of diversification and that towards inferior crops, which happens only when there is a lack of basic inputs like irrigation, access to capital and other technology. Other than food grains, farmers of the Shyamgaon village allocate relatively more proportion of GCA for the cultivation of potato (2.62 per cent), roots (1.84 per cent), chilly (1.41 per cent) and mustard (1.36 per cent) than that of other villages.



**Table 5:** Farm Operation under Tenancy Land of the Sample Farmers (Area in Bigha)

District	<i>Kokrajhar</i>															
Sample Village	Shyamgaon				Patakata				Ubrijhora				Sub-Total			
<i>Size/Class (Area in Bigha)</i>	<i>Cultivable land area</i>	<i>Own land cultivated</i>	<i>Leased-out to other farmer</i>	<i>Leased-in from other farmer</i>	<i>Cultivable land area</i>	<i>Own land cultivated</i>	<i>Leased-out to other farmer</i>	<i>Leased-in from other farmer</i>	<i>Cultivable land area</i>	<i>Own land cultivated</i>	<i>Leased-out to other farmer</i>	<i>Leased-in from other farmer</i>	<i>Cultivable land area</i>	<i>Own land cultivated</i>	<i>Leased-out to other farmer</i>	<i>Leased-in from other farmer</i>
Marginal (Below 7.5)	103	103	5	18	7	19	18	102	78.5	101	19	32	188.5	223	42	152
Small (7.5 to 30.0)	336.5	313.5	Nil	Nil	772	700	21	58	403.5	312.5	10	37.5	1512	1326	31	95.5
Medium (30.0 to 75.0)	36	36	Nil	Nil	199	60	Nil	Nil	180	150	Nil	Nil	415	246	Nil	Nil
Large (75.0 & above)	Nil				Nil				Nil				Nil			
<b>Total</b>	<b>475.5</b>	<b>452.5</b>	<b>5</b>	<b>18</b>	<b>978</b>	<b>779</b>	<b>39</b>	<b>160</b>	<b>662</b>	<b>563.5</b>	<b>29</b>	<b>69.5</b>	<b>2115.5</b>	<b>1795</b>	<b>73</b>	<b>247.5</b>
	<b>(100)</b>	<b>(95.16)</b>	<b>(1.05)</b>	<b>(3.79)</b>	<b>(100)</b>	<b>(79.65)</b>	<b>(3.98)</b>	<b>(16.36)</b>	<b>(100)</b>	<b>(85.12)</b>	<b>(4.38)</b>	<b>(10.50)</b>	<b>(100)</b>	<b>(84.85)</b>	<b>(3.45)</b>	<b>(11.70)</b>
District	<i>Dhemaji</i>															
Sample Village	Amulguri				Chumoni				Mahanpur				Sub-Total			
Marginal (Below 7.5 )	13	13	29	24	12	12		5	42	40	2	32	67	65	31	61
Small (7.5 to 30.0)	642	703	Nil	Nil	451	446	Nil	Nil	516	484	Nil	Nil	1609	1633	Nil	Nil
Medium (30.0 to 75.0)	408	294	Nil	Nil	714	714		Nil	250	250	Nil	Nil	1372	1258	Nil	Nil
Large (75.0 & above)	Nil				Nil				Nil				Nil			
<b>Total</b>	<b>1063</b>	<b>1010</b>	<b>29</b>	<b>24</b>	<b>1177</b>	<b>1172</b>	<b>Nil</b>	<b>5</b>	<b>808</b>	<b>774</b>	<b>2</b>	<b>32</b>	<b>3048</b>	<b>2956</b>	<b>31</b>	<b>61</b>
	<b>(100)</b>	<b>(95.01)</b>	<b>(2.73)</b>	<b>(2.26)</b>	<b>(100)</b>	<b>(99.57)</b>	<b>Nil</b>	<b>(0.42)</b>	<b>(100)</b>	<b>(95.79)</b>	<b>(0.25)</b>	<b>(3.96)</b>	<b>(100)</b>	<b>(96.98)</b>	<b>(1.02)</b>	<b>(2.00)</b>

**Source:** Field Survey, 2013-14. **Note:** Figure in the parentheses represent percentage of the area to total cultivable area of respective sample village.

**Table 6:** Area under Different Crops and their Percentage Share to Total Cropped Area in the Sample Villages during 2012-13 (Area in Bigha)

<i>District</i>	<i>Kokrajhar</i>			<i>Dhemaji</i>		
Crop/Sample Village	Shyamgaon	Patakata	Ubrijhora	Amulguri	Chumoni	Mahanpur
Autumn Rice	29 (5.63)	198 (18.60)	101 (19.20)	157 (15.14)	175 (14.38)	187 (19.06)
Winter Rice	405 (78.64)	647 (60.79)	330.5 (62.83)	819 (78.98)	810 (66.56)	683 (69.62)
Summer Rice	8 (1.55)	48 (4.51)	6 (1.14)	0 (0.00)	0 (0.00)	0 (0.00)
<b><i>Paddy</i></b>	<b>442 (85.83)</b>	<b>893 (83.91)</b>	<b>437.5 (83.17)</b>	<b>976 (94.12)</b>	<b>985 (80.94)</b>	<b>870 (88.69)</b>
Wheat	2 (0.39)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Gram	3 (0.58)	15.5 (1.46)	0.5 (0.00)	2 (0.19)	4 (0.33)	7 (0.71)
Tur	2 (0.39)	0 (0.00)	1 (0.19)	1 (0.10)	8 (0.66)	0 (0.00)
Pulses	1.5 (0.29)	0 (0.00)	0 (0.00)	1 (0.10)	2 (0.16)	1 (0.10)
<b><i>Food Crops</i></b>	<b>450.5 (87.48)</b>	<b>908.5 (85.37)</b>	<b>439 (83.46)</b>	<b>980 (94.5)</b>	<b>999 (82.09)</b>	<b>878 (89.50)</b>
Rapes & Mustard	7 (1.36)	56.5 (5.31)	4 (0.76)	6 (0.58)	62.5 (5.14)	31 (3.16)
Sesamum	2.5 (0.49)	0 (0.00)	12 (2.28)	0 (0.00)	2 (0.16)	3 (0.31)
Linseed	4 (0.78)	5 (0.47)	0 (0.00)	0 (0.00)	9 (0.74)	0 (0.00)
Jute	3.5 (0.68)	26.5 (2.49)	19.5 (3.71)	0 (0.00)	2 (0.16)	0 (0.00)
Tea	0 (0.00)	0 (0.00)	10 (1.90)	0 (0.00)	37 (3.04)	0 (0.00)
Sugarcane	2 (0.39)	3 (0.28)	0 (0.00)	5 (0.48)	25 (2.05)	8 (0.82)
Arecanut	4.75 (0.92)	20.5 (1.93)	18 (3.42)	26.5 (2.56)	32 (2.63)	24.25 (2.47)
Potato	13.5 (2.62)	16.5 (1.55)	2 (0.38)	3.5 (0.34)	7 (0.58)	4 (0.41)
Chilly	7.25 (1.41)	4.75 (0.45)	3 (0.57)	0.5 (0.05)	2.25 (0.18)	0.25 (0.03)
Turmeric	1 (0.19)	3.5 (0.33)	1 (0.19)	0 (0.00)	0 (0.00)	0 (0.00)
Banana	0 (0.00)	0.5 (0.05)	1 (0.19)	3 (0.29)	2.25 (0.18)	2.5 (0.25)
Bamboo	0 (0.00)	10.5 (0.99)	6 (1.14)	11.5 (1.11)	37 (3.04)	27 (2.75)

<i>District</i>	<i>Kokrajhar</i>			<i>Dhemaji</i>		
<i>Crop/Sample Village</i>	<i>Shyamgaon</i>	<i>Patakata</i>	<i>Ubrijhora</i>	<i>Amulguri</i>	<i>Chumoni</i>	<i>Mahanpur</i>
Onion	3 (0.58)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Brinjal	2.5 (0.49)	1.25 (0.12)	0.5 (0.10)	0.75 (0.07)	0 (0.00)	1 (0.10)
Cabbage/ Cauliflower	1 (0.19)	5.75 (0.54)	0 (0.00)	0.25 (0.02)	0 (0.00)	2 (0.20)
Roots	9.5 (1.84)	1.5 (0.14)	9.5 (1.81)	0 (0.00)	0 (0.00)	0 (0.00)
Radish	3 (0.58)	0 (0.00)	0.5 (0.10)	0 (0.00)	0 (0.00)	0 (0.00)
<b><i>Non-Food Crops</i></b>	<b>64.5</b> <b>(12.52)</b>	<b>155.75</b> <b>(14.63)</b>	<b>87</b> <b>(16.54)</b>	<b>57</b> <b>(5.50)</b>	<b>218</b> <b>(17.91)</b>	<b>103</b> <b>(10.50)</b>
<b>Total</b>	<b>515</b> <b>(100)</b>	<b>1064.25</b> <b>(100)</b>	<b>526</b> <b>(100)</b>	<b>1037</b> <b>(100)</b>	<b>1217</b> <b>(100)</b>	<b>981</b> <b>(100)</b>
<b><i>No. of Crops Cultivated</i></b>	<b>21</b> <b>(87.5)</b>	<b>17</b> <b>(70.83)</b>	<b>17</b> <b>(70.83)</b>	<b>14</b> <b>(58.33)</b>	<b>16</b> <b>(66.67)</b>	<b>14</b> <b>(58.33)</b>

**Source:** Field Survey, 2013-14.

**Note:** Figure in the parentheses indicate percentage of area to GCA and percentage of crop to total cultivated crops.

Farmers of the Patakata village cultivate relatively more mustard (5.31 percent) and jute (2.49 percent). On the other hand, farmers of Ubrijhora village allocate more towards jute (3.71 percent), areca nut (3.42 percent) and sesamum (2.28 percent). Whereas, farmers in Amulguri allocate land for other than food-grain crops, towards areca nut and bamboo as cash crops with 2.56 and 1.11 percent of total cropped area respectively. Cultivation of mustard (5.14 percent of GCA) is significant in Chumoni along with tea (3.04 percent), bamboo (3.04 percent) and areca nut (2.63 percent). Similarly, farmers of Mahanpur village under Murkongselek block cultivate mustard (on 3.16 percent of GCA), Bamboo (2.75 percent), and areca nut (2.47 percent). Most of the farmers in Dhemaji district utilise a part of their cultivable land for mustard, bamboo and areca nut. This may be due to the occurrence of floods in rainy seasons that force the poor farmers to cultivate early some winter crops but less capital intensive and cultivate bamboo that can sustain in flood and protect homelands from the flood. However, for non-food grain crops, irrigation is important, as many of these crops are highly water-intensive. Potato and chilly are grown mostly for home consumption like other vegetable crops by the farmers in the study area. All these facts reflect the non-arrival of the Green Revolution technology at desired level and the rural farmers have not yet fully adapted to the modern methods of cultivation.

Another important feature of the surveyed area is that most of the farmers follow single cropping system. The low incidence of double cropping is due to the prevalence of traditional and subsistence farming depending primarily on rainfall with very limited irrigation facility, use of chemical fertiliser, flood and pesticides control arrangements. However, out of 24 varieties of crops cultivated in these two sample areas, most of the farmers (62 percent) in Dhemaji district are found to be less diverse in cropping pattern. Whereas, Kokrajhar district is more diverse compared to Dhemaji and grows relatively higher more number of crops (over 70 percent). The Herfindahl index also shows a very low diversity during study year across the sample villages of Dhemaji. Moreover, there is great variation in the pattern of diversification across the villages. For instance, Shyamgaon in Kokrajhar and Amulguri in Dhemaji are less diversified and Patakata in Kokrajhar and Chumoni in Dhemaji are more diversified in terms of the Herfindahl index (Table 7). This variation is in line with the disparity in the share of income generated from crop raising activities. However, some varieties of rice are found to be grown by the sample farms.

**Table 7:** Herfindahl Index of Diversity of Area under Crops in the Sample Villages

<i>District</i>	<i>Sample Village</i>	<i>2011-12</i>	<i>2012-13</i>
Kokrajhar	Shyamgaon	0.37	0.38
	Patakata	<b>0.61</b>	<b>0.59</b>
	Ubrijhora	0.57	0.56
	<b><i>Sub-Total</i></b>	<b>0.55</b>	<b>0.51</b>
Dhemaji	Amulguri	0.33	0.35
	Chumoni	<b>0.53</b>	<b>0.53</b>
	Mahanpur	0.47	0.48
	<b><i>Sub-Total</i></b>	<b>0.45</b>	<b>0.42</b>
<b>All Villages</b>		<b>0.49</b>	<b>0.49</b>

*Source:* Field Survey, 2013-14.

**Table 8:** Distribution of Farmers according to the High and Low Herfindahl Index of Diversity

<b>District</b>	<b>Village</b>	<b>High Diversified (0.50&gt;)</b>	<b>Less Diversified (&lt;0.50)</b>
Kokrajhar	Shyamgaon	6 (12)	44 (88)
	Patakata	32 (64)	18 (36)
	Ubrijhora	17 (34)	33 (66)
	<b><i>Sub-Total</i></b>	<b>55 (37)</b>	<b>95 (63)</b>

District	Village	High Diversified (0.50>)	Less Diversified (<0.50)
Dhemaji	Amulguri	2 (4)	48 (96)
	Chumoni	21 (42)	29 (58)
	Mahanpur Pt-I	16 (32)	34 (68)
	<b>Sub-Total</b>	<b>39 (26)</b>	<b>111 (74)</b>
	<b>All Villages</b>	<b>94 (31)</b>	<b>206 (69)</b>

*Source:* Primary Data. *Note:* Figures in the parentheses indicate percentage to total.

From Table 8, it is also found that around 69 percent of the total sample farmers are agriculturally less diversified. Only 26 percent of the sample farmers in Dhemaji district are high diversified while in Kokrajhar district it is 37 percent. It may be due to the impact of extreme climate hazards (especially regular flood) in the area. Another reason is the availability of farm land or farm size that constrained many farmers from diversifying towards many crops equitably. The low diversified 206 sample farm families have an average farm size of only 14.54 bigha, while only 94 high diversified farm families have an average farm size of 24.95 bigha. Per capita income of those high diversified families is much more than that of the low diversified families.

The regression result of Table 9 shows that both the index of diversity and total area under cultivation has significant positive impacts on the earning from agriculture. Significantly positive coefficient of dummy indicates that farmers in the flood prone area of Dhemaji earn comparatively more from agriculture. Also, number of agricultural labourer available from the family has inverse effect on the agricultural earnings of the families.

**Table: 9: Results of Regression of Per Capita Income from Agriculture on Relevant Explanatory Variables**

<i>Explanatory Variable</i>	<i>Coefficients</i>	<i>t-stat</i>	<i>Significance</i>
Constant	6155.647	6.252	0.0000
Total Cultivated Area	495.165	16.889	0.0000
Diversity Index (HI)	4960.207	2.972	0.0032
Family Size	-81.859	-0.686	0.493
D	1906.446	3.233	0.001
No. of Family Labour in Agriculture	-1586.006	-7.997	0.0000

$R^2 = 0.658$ ,  $Adj. R^2 = 0.652$ ,  $F = 113.06$  (P-value: 0.0000)

*Source:* Field Survey, 2013-14.

### **Measures Adopted to Mitigate Climate Risk in the Study Area**

This section focuses on farmers' perceptions and adaptations strategy in the study area. The analysis provides information on the farmers' response to climate change and possible factors that influence their adaptation of strategies to moderate extreme climate impacts. Diversification of crops is one of the important adaptation measures where, with changing climatic conditions, farmers can choose suitable cropping pattern over periods of time to adjust with the changing climate and simultaneously maximise returns from agriculture in the respective region. However, geographical locations and socio-economic conditions have important influence on the farmers' adaptability with changing technology and climatic conditions in diversifying their crops. Sources of acquiring new knowledge or information about agricultural technologies and their cost effectiveness are important factors that also affect technology adoption. However, most of the farmers in the sample villages, particularly the tribal farmers, are unaware of many programs sponsored by the government to promote adaptation of new technology. This may be due to the lack of dissemination of information or knowledge regarding agricultural techniques. These farmers being more traditional and conservative are found to be less responsive towards the adoption of new agricultural technology. However, some farmers are ready to adopt new agricultural technology (as observed from foregoing discussions) but are not in a position to adopt it on a full scale due to certain socio-economic constraints faced in their daily life. Nevertheless, sample farmers reported that they have used some sort of modern implements on hiring basis with their limited capacity. Usually, the farmers also use both the modern varieties and traditional varieties of crops simultaneously depending upon the availability of seed and capital.

Experience from the last five years by the respondents reveals that the entire Kokrajhar district has never been affected by floods, and rarely do they face draught (Table 10). Thus, no damage of crops due to extreme climatic hazards is reported by the farmers in the district as a whole. However, draught like situation damaged some crops in southern parts of the district (Ubrihora area) and damage of some crops of a few farmers due to pests and insects were reported for the last five years. On the other hand, farmers of Dhemaji district reported damage of their crops due to regular floods. Thus, farmers of Kokrajhar district did not follow any adaptation measure to save their crops from floods and draughts in last five years as the farmers were not affected by these climatic hazards severely in the past. On the other hand, farmers of Dhemaji district reported several adaptation measures to save their crops particularly from floods that occur frequently every year and at different times. Most of the respondents adopt early cultivation method and cultivate short period crops to save them from floods and harvest early. They argued that early land preparation and plantation is associated with increased chances of

survival of the crops (mainly winter paddy) from floods. Over 76 percent of the respondents preserve seedlings for sowing again if the crop is damaged due to flood during the peak monsoon time (Table 10).

**Table: 10:** Distribution of Respondent Farmers according to the Adoption of various Measures to Tackle the Incidence of Flood

<i>District</i>	<i>Kokrajhar</i>				<i>Dhemaji</i>			
	<i>Shya.</i>	<i>Pata.</i>	<i>Ubri.</i>	<i>Sub-Total</i>	<i>Amul.</i>	<i>Chum.</i>	<i>Maha.</i>	<i>Sub-Total</i>
Cultivated short period crops	Nil				12	20	18	50
					(24)	(40)	(36)	(33.3)
Cultivated early					29	12	25	66
					(58)	(24)	(50)	(44)
Cultivated flood resistant crops					3	9	3	15
					(6)	(18)	(6)	(10)
Changed next crops					9	2	1	12
	(18)	(4)	(2)	(8)				
Diversified to other crops	2	Nil	Nil	2				
	(4)			(1.3)				
Preserve seedling for sowing after floods	45	38	41	124				
	(90)	(76)	(82)	(82.7)				
<b>Total</b>	<b>Nil</b>				<b>100</b>	<b>81</b>	<b>88</b>	<b>269</b>
					<b>(67)</b>	<b>(59)</b>	<b>(58)</b>	<b>(89.7)</b>

*Source:* Field Survey, 2013-14.

*Notes:* Figure in the parentheses indicates percentage of respondent farmer, (ii) Shya. = Shyamgaon, Pata. = Patatkata, Ubri. = Ubrihora, Amul. = Amulguri, Chum. = Chimoni and Maha. = Mahanpur.

**Table: 11:** Percentage of Respondent Farmers that Changes their Crop Cultivation for Different Reasons from 1990 to 2013

<i>District</i>	<i>Village</i>	<i>Reasons of changing to newer crops</i>					<i>Total</i>
		<i>Availability of HYV seeds</i>	<i>Reduction of Risk</i>	<i>Earning Profits</i>	<i>Lower Cost</i>	<i>Weather Resistance</i>	
Kokrajhar	Shyamgaon	Nil	Nil	46	4	Nil	50
				(92)	(8)		(100)
	Patakata	9	1	32	8		50
		(18)	(2)	(64)	(16)		(100)
	Ubrihora	Nil	1	47	2	50	
			(2)	(94)	(4)	(100)	
	<b>Sub-Total</b>	<b>9</b>	<b>2</b>	<b>125</b>	<b>14</b>	<b>150</b>	
		<b>(6)</b>	<b>(1.33)</b>	<b>(83)</b>	<b>(9)</b>	<b>(100)</b>	
Dhemaji	Amulguri	Nil	7	27	11	5	50
			(14)	(54)	(22)	(10)	(100)
	Chumoni		4	20	26	Nil	49
			(8)	(40)	(52)		(98)
	Mahanpur	18	22	9	1	50	
		(36)	(44)	(18)	(2)	(100)	
	<b>Sub-Total</b>	<b>29</b>	<b>69</b>	<b>46</b>	<b>6</b>	<b>149</b>	
		<b>(19.33)</b>	<b>(46)</b>	<b>(31)</b>	<b>(4)</b>	<b>(99)</b>	

*Source:* Field Survey, 2013-14.

*Note:* Figures in the parentheses indicate percentage to total.

Farmers reported that they had to change their cultivation of crops (whatever possible) in the last two decades (i.e. 1990-91 to 2012-13) for various reasons (Table 11). Some farmers (18 per cent) of Patakata village of Kokrajhar district have changed from traditional varieties to newer crops due to availability of HYV seeds, and 83 percent of the respondents of the same district changed cropping pattern to earn more profit. Some of them cited lower cost of cultivation for changing cropping pattern. No weather resistant crop varieties have been chosen by the farmers of Kokrajhar district. On the other hand, risk factors (19.33 percent), earning profits (46percent), lower cost of cultivation (31 percent) and weather resistance (4 percent) are cited to be the main reasons for adopting newer varieties of crops during last 20 years by the farmers in the sample villages of Dhemaji district.

The above discussion and analysis of data clearly indicates that despite a number of constraints faced by the farmers in the study area; there is enormous scope to diversify their crops and adaptability varies across the space with changing technology and environment. Adaptation and disaster mitigation requires adequate knowledge, access to suitable technology, capital and appropriate policy measures. A failure in adaptation with the changing climatic uncertainty may lead to socio-economic disaster and jeopardise the livelihood security of the people particularly those who are dependent more on natural weather for agricultural activities.

### **Adaptability of Farmers in Response to Climate Change**

Agricultural adaptation to climate risk is a relatively new field of inquiry with reference to North-Eastern India. On the basis of the farmers' response to climate change and other relevant variables, their perceptions and adaptation strategy is examined for the study area. The regression results are presented in Table 12 which shows that knowledge of the respondent farmers; farm size and area of holdings and share of family income from agricultural activities are significantly important factors behind the diversification (here Herfindahl Index). The coefficients of training to the farmers, and irrigation intensity are, however, not significant and that implies that crop diversity is hardly influenced by the training facilities and irrigation in the surveyed area. This may be due to the fact that training on cultivation of particular crops makes the farmers proficient on some specific crops and not on diversification needs. Additionally slowly growing irrigation facilities helped the small and marginal farmers to cultivate staple food-crops for food security and agriculture is still at the subsistence stage.



**Table 12:** Results of Regression of Diversity Index (HI) on Relevant Explanatory Variables

<i>Explanatory Variable</i>	<i>Coefficients</i>	<i>Std. error</i>	<i>t-stat</i>	<i>Significance</i>
(Constant)	0.097	0.051	1.926	0.055
Education of head	0.020*	0.008	2.354	0.019
Family agricultural labour	0.028	0.007	0.210	0.800
Cultivation experience	0.001	0.001	1.049	0.295
Training	-0.023	0.046	-0.489	0.625
Total cropped area	0.008**	0.001	6.601	0.000
Agricultural share in Income	0.001**	0.00403	3.060	0.002
Irrigation intensity	-0.00037	0.000299	-1.231	0.219
Dummy variable	-0.131**	0.023	-5.762	0.0000

**$R^2 = 0.354$ , Adj.  $R^2 = 0.336$ ,  $F = 19.944$  (P-value: 0.00)**

*Source:* Field Survey, 2013-14. *Note:* \*\*and \* indicate that the coefficient is significant at 1 and 5 per cent level of significance by two tailed test.

The regression results of adaptation index on various explanatory variables are depicted in Table13. The table reveals that the level of education of the heads of households has significantly positive impact on adaptation. Education generally increases knowledge and helps farmers to gain adaptive capacity to the changing climatic conditions and use of appropriate agro-technologies. The size of operational holding of the farmer (total cropped area), and years of cultivation experience also have significantly positive impacts on adaptation. The implication is that adaptive capacity of farmers increases with the larger size of the land holdings and cultivation experience. Interestingly, training of farmers is found to have no impact on adaptation. It may be noted that most of the training conducted by the concerned departments are basically related to raising crop productivity through the use of modern technology rather than on adaptation and awareness strategy towards climate change in Assam. In addition, share of income from agricultural sources and irrigation intensity reflected insignificant effects on climate change adaptation. It appears that farmers are more comfortable with the traditional way of cultivation under rain-fed conditions in Assam.

**Table 13:** Results of Regression of Adaptation Index (AI) on Relevant Explanatory Variables

<i>Explanatory Variable</i>	<i>Coefficients</i>	<i>Std. Error</i>	<i>t-stat</i>	<i>Significance</i>
(Constant)	-0.043**	0.008	-5.248	0.000
Education of head	0.005**	0.001	3.368	0.001
Family agricultural labour	0.003*	0.001	2.189	0.029
Cultivation experience	0.000454**	0.000167	2.724	0.007
Training	-0.005	0.008	-0.722	0.471
Total cropped area	0.001**	0.000194	2.839	0.005
Income from agricultural share	7.770e-005	0.00066	1.183	0.238
Irrigation intensity	6.727e-005	0.00049	1.337	0.169
Dummy variable	0.090**	0.004	24.347	0.000

**$R^2 = 0.774$ , Adj.  $R^2 = 0.767$ ,  $F = 124.265$  (P-value: 0.00)**

*Source:* Field Survey, 2013-14. *Notes:* \*\*, \* indicate that the coefficient is significant at 1 and 5 per cent level of significance by two tailed test.

It is clear from the aforementioned results that size of holdings and education level of the farmers are important factors for the extent of diversification and adaptation of crops with the climate change in different districts of Assam. This is in conformity with the results obtained by some other researchers not only in India, but in some other countries as well (Pingali *et al.*, 1997; Mendelssohn and Seo, 2007c; De and Chattopadhyay, 2010; Anselm and Taofeeq, 2010; Onyeneke and Madukwe, 2010, Sahu and Mishra, 2013). Moreover, the other agro-infrastructural variables like irrigation, training to the farmers, and share of agricultural income are also important for agricultural diversification and adaptation. But the nature and extent of variations of these variables for different crops and climatic conditions in different regions do not contribute in the same way or to the same extent.

This discussion reveals that in spite of many problems and limitations, the rural farmers of Assam manage to raise varieties of crops under rain-fed weather condition depending upon their availability of resources. One of the major factors hindering the proper utilisation of new farm technology is the dominance of scattered tiny plots (marginal and small in size) in the state.

It is needless to mention that training of farmers on available modern technology can go a long way in accelerating agricultural production and productivity. But the respondents reported that they are not aware of the new knowledge and farm practices due to lack of adequate exposure from the agricultural extension centres. Besides, farmers of the sample areas generally cultivate mustard, sesamum potato, gram and vegetable crops for home consumption with no interest in commercialization. Hence, adequate attention has not been paid on irrigation for better and efficient cultivation.

Most of the farmers are found to be risk averters and are sceptical in trying new varieties. It is also observed that farmers are not aware of the concept of crop planning and the effort of the agriculture department to train them is inadequate. As expected in the traditional cropping system, crop diversification is limited as the farmers do not have suitable facilities and agro-infrastructure for support. Lack of climatic change perception of the farmers in Kokrajhar is due to limited climate change effects in the area. Nature of adaptation with the changing technology and climatic conditions by some sample farmers of Dhemaji however proves that farmers are eager to adopt newer technology in their cropping activities to save their crops and moderate climate change impacts.

### **Concluding Remarks**

The above discussion clearly indicates significant changes in climatic variables like minimum and maximum temperature that is associated with

high degree of seasonal and regional variations over time. Share of peak rainfall season has also declined with rising fluctuations and reduction in overall annual rainfall. There is slow growth of overall agricultural productivity and it is associated with significant regional convergence. With uncertain weather conditions, diversification as a measure of moderating climate change effect is found to be far from common. Despite a number of constraints faced by the farmers in the study area, there is enormous scope for diversifying their crops and adaptability options with the changing variables of technology and environment.

Cultivation of a large number of crops indicates the suitability of agro-climatic environment in the state of Assam. Majority of the farmers are small landholders and their income from crop and non-crop activities is not enough to meet their subsistence and they produce only a few specialised crops which are risk prone. Due to fluctuations in price and climatic conditions; diversification of crops becomes important as a well-diversified agricultural economy opens up many opportunities. Soil fertility can be increased by way of crop rotation. It adds value in the agriculture by increasing the total productivity and at the same time stabilises the farm income by minimising the risk associated with producing only one crop.

Moreover, there is an urgent need for restructuring the existing sequence of crops so as to make suitable adjustments to changing climatic condition in flood prone districts of Assam. Hence, emphasis should shift towards growing more *rabi* crops with assured irrigation support. There is ample opportunity for increasing the production of summer rice and short duration paddy in the sample area in particular and Assam in general. For introduction and popularisation of new crop varieties, adoptive and result oriented field demonstration may be encouraged. In the flood prone areas short duration variety of paddy may be cultivated and harvested early to avoid flood damages. Adaptation options such as irrigation management and promotion of improved crop varieties are only viable if there is external support. However, there is a need to focus not only on technical aspects but also social dimensions such as perceptions of smallholder farmers. Government and policy makers should support farmers to generate long-term and location-specific adaptation strategies and therefore, emphasis should be placed on the development of irrigation, easy availability of modern agro-inputs, provision of location specific and need based solutions to support crop diversification in any type of land e.g. plain land, lowland and upland, while management of irrigation, cheap and simple technologies, innovative micro-insurance schemes can be another tool to help small-holder farmers to cope with climate variability and change (Pattet *al.* 2010).

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**Appendix: 1: Season-Wise & Agro-Climatic Zone-wise Monthly Rainfall Pattern in Assam since 1951-2010 (Millimeter)**

Zone	Season District/Dist. Group	KHARIF SEASON								RABI SEASON*							
		Months	1951-55	1961-65	1971-75	1981-85	1991-95	2001-05	2005-09	Months	1951-2 to 1955-6*	1961-2 to 1965-6*	1971-2 to 1975-6*	1981-2 to 1985-6*	1991-2 to 1995-6*	2001-2 to 2005-6*	2005-6 to 2009-10*
Lower Brahmaputra Valley Zone(LBVZ)	Kamrup Kamrup(M) Barpeta Nalbari Baksa	Apr.	216.2	208.6	143.3	170.1	124.8	293.8	168.3	Oct.	243.6	139.2	82.8	61.1	114.3	176.3	131.8
		May	557.6	443.5	251.9	216.8	287.8	218.7	184.5	Nov.	27.8	19.2	32.2	20.1	10.3	18.9	12.7
		Jun.	191.1	242.7	329.3	322.4	376.8	318.4	197.9	Dec.	8.3	2.1	7.5	14.4	6.4	2.9	4.0
		Jul.	205.0	214.9	377.6	339.9	342.7	287.2	273.7	Jan.*	12.1	7.0	10.3	8.7	25.2	9.6	7.1
		Aug.	140.0	178.6	215.4	223.5	355.5	291.8	332.6	Feb.*	11.2	16.8	20.5	22.4	33.8	15.1	22.1
		Sep.	428.0	328.6	168.4	238.5	201.1	129.3	152.9	Mar.*	131.8	74.2	36.7	34.6	60.3	77.2	53.1
		Total	1737.9	1616.9	1485.9	1511.2	1688.8	1539.1	1309.9	Total	434.7	258.5	190.0	161.3	250.3	300.0	230.9
		<b>Mtly Avg.</b>	<b>289.6</b>	<b>269.5</b>	<b>247.6</b>	<b>251.9</b>	<b>281.5</b>	<b>256.5</b>	<b>218.3</b>	<b>Mtly Avg.</b>	<b>72.5</b>	<b>43.1</b>	<b>31.7</b>	<b>26.9</b>	<b>41.7</b>	<b>50.0</b>	<b>38.5</b>
	Goalpara Dhubri Kokrajhar Bongaigaon Chirang	Apr.	84.0	88.7	183.2	172.7	198.3	349.9	290.0	Oct.	109.5	132.1	203.8	104.4	127.8	308.7	189.8
		May	212.9	318.9	386.9	423.3	439.4	363.3	326.5	Nov.	9.3	9.3	29.8	0.3	23.6	10.9	3.3
		Jun.	578.8	471.4	549.1	463.1	627.5	653.5	416.6	Dec.	2.6	1.0	2.4	16.4	5.3	9.5	1.2
		Jul.	586.9	479.4	527.4	678.2	560.7	568.0	459.7	Jan.*	12.9	5.4	11.3	4.7	19.0	6.0	10.7
		Aug.	418.5	407.0	301.4	341.8	327.6	243.4	461.1	Feb.*	2.7	5.9	13.9	13.7	27.8	6.9	16.8
		Sep.	271.8	227.4	461.9	545.5	324.1	205.9	250.5	Mar.*	29.9	43.9	26.6	41.6	43.2	53.0	68.3
Total		2152.9	1992.7	2409.9	2624.6	2477.6	2383.9	2204.5	Total	166.8	197.6	287.7	101.2	246.5	204.0	200.1	
<b>Mtly Avg.</b>		<b>358.8</b>	<b>332.1</b>	<b>401.6</b>	<b>437.4</b>	<b>412.9</b>	<b>397.3</b>	<b>367.4</b>	<b>Mtly Avg.</b>	<b>27.8</b>	<b>32.9</b>	<b>48.0</b>	<b>30.2</b>	<b>41.1</b>	<b>65.8</b>	<b>48.3</b>	
Upper Brahmaputra Valley Zone(UBVZ)	Dibrugarh Tinsukia	Apr.	148.3	161.7	281.9	245.8	175.1	228.3	230.3	Oct.	167.1	118.8	160.4	86.5	157.3	140.4	104.0
		May	301.5	201.1	302.9	247.7	344.1	336.5	282.6	Nov.	26.2	42.9	24.7	23.7	15.8	18.1	26.1
		Jun.	432.9	359.8	417.7	415.3	499.3	304.8	456.6	Dec.	26.9	18.0	12.6	37.0	18.1	7.5	6.5
		Jul.	452.3	419.2	508.3	577.3	480.8	546.1	500.5	Jan.*	25.2	18.0	29.1	20.7	38.5	33.5	23.9
		Aug.	322.0	356.2	446.1	418.8	428.1	382.9	385.0	Feb.*	41.0	43.2	45.1	42.1	88.1	76.8	70.4

Appendix-1: continued



Season		KHARIF SEASON								RABI SEASON*							
Zone	District/Dist. Group	Months	1951-55	1961-65	1971-75	1981-85	1991-95	2001-05	2005-09	Months	1951-2 to 1955-6*	1961-2 to 1965-6*	1971-2 to 1975-6*	1981-2 to 1985-6*	1991-2 to 1995-6*	2001-2 to 2005-6*	2005-6 to 2009-10*
North Brahmaputra Plain Zone(NBPZ)	Sibsagar Jorhat Golaghat	Sep.	273.8	266.1	331.0	354.3	454.2	220.7	233.9	Mar.*	121.4	57.2	91.3	84.9	175.5	126.2	100.8
		Total	1930.9	1764.1	2287.9	2259.1	2381.7	2019.3	2089.0	Total	407.9	298.1	363.2	294.9	493.4	402.5	331.8
		<b>Mtly Avg.</b>	<b>321.8</b>	<b>294.0</b>	<b>381.3</b>	<b>376.5</b>	<b>396.9</b>	<b>336.5</b>	<b>348.2</b>	<b>Mtly Avg.</b>	<b>68.0</b>	<b>49.7</b>	<b>60.5</b>	<b>49.2</b>	<b>82.2</b>	<b>67.1</b>	<b>55.3</b>
		Apr.	146.5	156.0	230.4	202.0	144.8	207.3	198.1	Oct.	175.3	142.6	134.5	83.5	169.1	124.1	120.9
		May	296.0	191.8	249.3	237.5	204.0	239.1	166.1	Nov.	27.9	41.9	29.5	22.9	20.4	24.8	24.6
		Jun.	449.2	374.5	403.0	337.2	307.0	231.4	338.4	Dec.	22.3	16.5	18.1	37.6	17.1	3.2	5.0
		Jul.	457.0	399.9	501.5	402.9	272.7	413.9	318.0	Jan.*	21.6	16.8	21.0	14.3	18.6	22.9	7.3
		Aug.	317.4	355.3	315.6	308.3	326.6	362.9	400.9	Feb.*	34.7	38.6	29.5	32.7	47.8	76.7	48.9
		Sep.	273.2	259.2	260.9	241.5	223.7	223.3	200.1	Mar.*	116.1	49.1	72.3	62.1	74.1	103.1	63.5
	Total	1939.2	1736.6	1960.6	1729.3	1478.9	1677.9	1621.5	Total	397.9	305.5	304.8	253.2	347.0	354.8	270.2	
	<b>Mtly Avg.</b>	<b>323.2</b>	<b>289.4</b>	<b>326.8</b>	<b>288.2</b>	<b>246.5</b>	<b>279.6</b>	<b>270.2</b>	<b>Mtly Avg.</b>	<b>66.3</b>	<b>50.9</b>	<b>50.8</b>	Appendix-1: continued.0				
	Darrang Sonitpur Udalguri	Apr.	188.9	192.0	146.4	189.9	136.3	223.6	186.0	Oct.	183.0	111.0	160.9	122.7	117.9	156.1	95.6
		May	398.5	363.0	279.4	212.4	299.0	264.3	256.4	Nov.	18.2	18.7	13.2	4.5	25.2	26.3	15.7
		Jun.	289.3	313.1	234.3	282.5	399.2	238.0	253.9	Dec.	10.6	3.4	12.8	34.2	11.4	3.9	13.0
		Jul.	314.1	294.7	354.9	371.4	272.8	275.0	258.4	Jan.*	13.3	8.6	13.0	11.4	24.7	8.3	6.8
		Aug.	224.6	251.0	290.2	316.5	306.2	356.5	308.4	Feb.*	9.9	18.8	15.2	14.4	37.0	22.9	27.1
		Sep.	341.1	274.1	206.3	301.6	197.3	180.2	148.8	Mar.*	118.2	60.3	26.2	34.1	44.4	69.8	60.8
		<b>Total</b>	<b>1756.5</b>	<b>1687.8</b>	<b>1511.4</b>	<b>1674.3</b>	<b>1610.9</b>	<b>1537.7</b>	<b>1412.0</b>	<b>Total</b>	<b>353.4</b>	<b>220.8</b>	<b>241.5</b>	<b>221.4</b>	<b>260.6</b>	<b>287.3</b>	<b>218.9</b>
<b>Mtly Avg.</b>		<b>292.7</b>	<b>281.3</b>	<b>251.9</b>	<b>279.1</b>	<b>268.5</b>	<b>256.3</b>	<b>235.3</b>	<b>Avg.</b>	<b>58.9</b>	<b>36.8</b>	<b>40.2</b>	<b>36.9</b>	<b>43.4</b>	<b>47.9</b>	<b>36.5</b>	
Lakhimpur Dhemaji		Apr.	145.6	159.3	192.8	183.5	135.3	210.8	204.9	Oct.	151.4	102.2	111.6	75.5	150.8	167.6	131.6
	May	301.8	223.4	253.9	247.7	319.2	322.5	334.6	Nov.	20.3	30.7	26.9	18.9	15.1	27.7	34.3	
	Jun.	415.9	378.3	383.4	348.5	443.0	356.4	503.8	Dec.	22.9	12.7	17.2	35.3	14.5	2.6	12.7	

Season		KHARIF SEASON								RABI SEASON*							
Zone	District/Dist. Group	Months	1951-55	1961-65	1971-75	1981-85	1991-95	2001-05	2005-09	Months	1951-2 to 1955-6*	1961-2 to 1965-6*	1971-2 to 1975-6*	1981-2 to 1985-6*	1991-2 to 1995-6*	2001-2 to 2005-6*	2005-6 to 2009-10*
		Jul.	445.3	422.7	425.1	450.8	362.8	439.4	489.6	Jan.*	20.3	14.7	20.1	12.2	25.0	29.2	21.0
		Aug.	325.8	351.8	328.8	310.2	372.7	265.2	427.5	Feb.*	26.3	33.4	33.1	26.4	52.5	77.3	54.9
		Sep.	257.3	252.2	232.1	248.9	300.0	268.5	271.2	Mar.*	106.8	49.2	53.5	51.3	90.2	127.4	63.5
		<b>Total</b>	<b>1891.7</b>	<b>1787.7</b>	<b>1816.1</b>	<b>1789.6</b>	<b>1933.0</b>	<b>1862.8</b>	<b>2231.6</b>	<b>Total</b>	<b>348.0</b>	<b>243.0</b>	<b>262.4</b>	<b>211.0</b>	<b>212.1</b>	<b>171.0</b>	<b>212.0</b>
		<b>Avg.</b>	<b>315.3</b>	<b>298.0</b>	<b>302.7</b>	<b>298.3</b>	<b>322.2</b>	<b>310.5</b>	<b>371.9</b>	<b>Avg.</b>	<b>58.0</b>	<b>40.5</b>	<b>43.7</b>	<b>36.6</b>	<b>58.0</b>	<b>72.0</b>	<b>53.0</b>
Central Brahmaputra Zone (CBZ)	Nagaon Morigaon	Apr.	109.1	115.5	145.9	114.9	84.9	181.4	88.0	Oct.	139.5	79.6	109.6	72.1	90.2	148.3	96.2
		May	278.9	180.3	159.7	121.3	160.2	156.3	133.2	Nov.	20.8	16.5	35.3	8.6	29.3	13.7	10.2
		Jun.	413.6	416.2	351.2	226.4	326.2	185.4	208.7	Dec.	5.9	2.7	13.2	14.2	6.6	2.8	7.9
		Jul.	424.8	369.4	352.9	275.0	279.4	268.7	241.6	Jan.*	7.3	4.4	8.4	7.6	20.2	20.4	6.7
		Aug.	267.2	264.6	291.0	292.2	237.6	245.6	231.1	Feb.*	10.2	13.1	12.4	10.3	37.8	19.2	25.8
		Sep.	221.6	166.3	192.5	238.5	200.2	164.6	247.6	Mar.*	81.4	37.7	28.5	37.2	44.0	41.5	38.3
		<b>Total</b>	<b>1715.1</b>	<b>1512.4</b>	<b>1493.2</b>	<b>1268.3</b>	<b>1288.5</b>	<b>1202.0</b>	<b>1150.1</b>	<b>Total</b>	<b>265.2</b>	<b>154.0</b>	<b>207.4</b>	<b>149.9</b>	<b>228.0</b>	<b>246.0</b>	<b>185.2</b>
		<b>Avg.</b>	<b>285.9</b>	<b>252.1</b>	<b>248.9</b>	<b>211.4</b>	<b>214.8</b>	<b>200.3</b>	<b>191.7</b>	<b>Avg.</b>	<b>44.2</b>	<b>25.7</b>	<b>34.6</b>	<b>25.0</b>	<b>38.0</b>	<b>41.0</b>	<b>30.9</b>

Appendix-I: continued

**Appendix:1:** concluded

Zone	Season District /Dist. Group	KHARIF SEASON								RABI SEASON							
		Months	1951-55	1961-65	1971-75	1981-85	1991-95	2001-05	2005-09	Months	1951-2 to 1955-6*	1961-2 to 1965-6*	1971-2 to 1975-6*	1981-2 to 1985-6*	1991-2 to 1995-6*	2001-2 to 2005-6*	2005-6 to 2009-10*
Barak Valley Zone (BVZ)	Cachar Karimganj Hailakandi	Apr.	297.7	241.2	356.0	445.5	229.3	379.0	228.9	Oct.	307.3	158.7	211.0	154.4	191.6	169.9	180.1
		May	472.1	303.9	356.8	433.1	507.0	430.2	393.3	Nov.	66.0	42.1	69.9	28.0	35.3	23.0	31.5
		Jun.	823.4	824.5	675.4	510.5	597.8	490.2	511.2	Dec.	5.1	9.7	19.7	36.1	25.9	24.0	2.8
		Jul.	619.1	663.0	595.7	570.8	360.7	547.4	510.0	Jan.*	13.3	15.0	4.0	7.6	12.4	4.2	7.4
		Aug.	499.1	555.7	459.0	437.1	429.7	352.3	495.5	Feb.*	26.5	40.6	49.6	46.0	105.7	41.7	34.5
		Sep.	479.7	322.4	290.9	429.6	352.5	274.7	320.6	Mar.*	168.1	81.2	141.2	188.8	265.5	148.4	117.8
		<b>Total</b>	<b>3191.0</b>	<b>2910.6</b>	<b>2733.8</b>	<b>2826.7</b>	<b>2476.9</b>	<b>2473.8</b>	<b>2459.6</b>	<b>Total</b>	<b>586.4</b>	<b>347.3</b>	<b>495.4</b>	<b>460.9</b>	<b>636.4</b>	<b>411.3</b>	<b>374.0</b>
		<b>Avg.</b>	<b>531.8</b>	<b>485.1</b>	<b>455.6</b>	<b>471.1</b>	<b>412.8</b>	<b>412.3</b>	<b>409.9</b>	<b>Avg.</b>	<b>97.7</b>	<b>57.9</b>	<b>82.6</b>	<b>76.8</b>	<b>106.1</b>	<b>68.5</b>	<b>62.3</b>
Hill Zone (HZ)	Mikir Hills (KarbiAnglong ) N.C. Hills	Apr.	256.9	228.8	301.6	319.7	174.7	256.1	162.5	Oct.	288.6	180.4	258.6	115.3	200.4	169.8	94.0
		May	513.3	317.8	361.8	425.4	481.4	318.5	202.3	Nov.	56.3	42.1	62.9	17.7	41.7	26.8	20.9
		Jun.	856.9	764.6	637.8	633.6	668.6	443.8	307.2	Dec.	8.4	7.3	10.2	28.1	14.4	5.8	3.8
		Jul.	768.9	637.7	629.9	696.8	613.4	438.1	363.6	Jan.*	15.0	13.9	10.4	10.3	23.4	19.9	7.2
		Aug.	498.2	501.3	443.1	497.4	545.3	334.2	229.4	Feb.*	27.4	37.9	41.2	30.8	59.7	17.0	29.0
		Sep.	434.7	327.9	315.5	414.6	371.3	249.9	184.3	Mar.*	186.4	109.9	102.9	127.3	167.5	86.4	59.1
		<b>Total</b>	<b>3328.8</b>	<b>2778.2</b>	<b>2689.6</b>	<b>2987.5</b>	<b>2854.7</b>	<b>2040.7</b>	<b>1449.4</b>	<b>Total</b>	<b>582.1</b>	<b>391.5</b>	<b>486.2</b>	<b>329.5</b>	<b>507.0</b>	<b>325.7</b>	<b>214.0</b>
		<b>Avg.</b>	<b>554.8</b>	<b>463.0</b>	<b>448.3</b>	<b>497.9</b>	<b>475.8</b>	<b>340.1</b>	<b>241.6</b>	<b>Avg.</b>	<b>97.0</b>	<b>65.2</b>	<b>81.0</b>	<b>54.9</b>	<b>84.5</b>	<b>54.3</b>	<b>35.7</b>
ASSAM		Apr.	177.0	172.4	220.1	227.1	155.9	258.9	195.2	Oct.	196.1	129.4	159.2	97.3	146.6	173.5	127.1
		May	370.3	282.6	289.2	285.0	338.0	294.4	253.3	Nov.	30.3	29.3	36.0	16.1	24.1	21.1	19.9
		Jun.	494.6	460.6	442.4	393.3	471.7	358.0	354.9	Dec.	12.5	8.1	12.6	28.1	13.3	6.9	6.3
		Jul.	474.8	433.4	474.8	484.8	394.0	420.4	379.5	Jan.*	15.7	11.6	14.2	10.8	23.0	17.1	10.9
		Aug.	334.8	357.9	343.4	349.5	369.9	315.0	363.5	Feb.*	21.1	27.6	28.9	26.5	54.4	39.3	36.6
		Sep.	331.2	269.3	273.3	334.8	291.6	213.0	223.3	Mar.*	117.8	62.5	64.4	73.5	107.2	92.6	69.5
		<b>Total</b>	<b>2182.7</b>	<b>1976.3</b>	<b>2043.1</b>	<b>2074.5</b>	<b>2021.2</b>	<b>1859.7</b>	<b>1769.7</b>	<b>Total</b>	<b>393.6</b>	<b>268.5</b>	<b>315.4</b>	<b>252.4</b>	<b>368.6</b>	<b>350.5</b>	<b>270.3</b>
		<b>Avg.</b>	<b>363.8</b>	<b>329.4</b>	<b>340.5</b>	<b>345.8</b>	<b>336.9</b>	<b>310.0</b>	<b>295.0</b>	<b>Avg.</b>	<b>65.6</b>	<b>44.7</b>	<b>52.6</b>	<b>42.1</b>	<b>61.4</b>	<b>58.4</b>	<b>45.1</b>

**Source:** Computed from data published by the IMD, Regional Meteorological Centre, Guwahati.

**Note:** \* indicates that in the Rabi season, the months January, February and March fall in the immediate next year.

**Appendix: 2:** Season-Wise & Agro-Climatic Zonewise Monthly Mean Minimum-Maximum Temperature in Assam since 1951-2010 (Deg. Celsius)

Zone	District Dist. Group	Months	KHARIF SEASON														RABI SEASON																					
			1951-55		1961-65		1971-75		1981-85		1991-95		2001-05		2005-09		1951-2 to 1955-6*		1961-2 to 1965-6*		1971-2 to 1975-6*		1981-2 to 1985-6*		1991-2 to 1995-6*		2001-2 to 2005-6*		2005-6 to 2009-10*									
			Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.						
Lower Brahmaputra Vally Zone (LBVZ)	Kamrup Kamrup(M) Barpeta Nalbari Baksa	Apr.	18	28	19	29	20	31	20	31	20	31	21	29	21	31	Oct.	20	28	20	27	22	30	22	31	21	30	22	29	23	30							
		May	19	28	20	28	22	31	22	30	22	31	23	31	24	32	Nov.	15	25	15	24	16	27	15	28	16	28	18	27	18	27							
		Jun.	21	28	22	28	24	31	24	32	24	32	25	31	25	32	Dec.	11	22	11	22	10	24	11	24	11	24	14	24	14	24							
		Jul.	22	28	23	29	25	31	25	31	25	32	26	31	26	32	Jan.*	8	21	9	21	9	24	10	23	12	23	11	22	12	23							
		Aug.	23	29	23	29	25	32	25	32	26	33	26	32	26	33	Feb.*	11	24	11	24	11	26	11	26	12	26	15	27	14	26							
		Sep.	22	28	23	29	24	31	24	31	24	32	25	32	26	32	Mar.*	15	28	15	28	15	32	16	30	16	29	18	30	18	31							
		<b>Avg.</b>	<b>21</b>	<b>28</b>	<b>22</b>	<b>28</b>	<b>23</b>	<b>31</b>	<b>24</b>	<b>31</b>	<b>23</b>	<b>32</b>	<b>24</b>	<b>31</b>	<b>25</b>	<b>32</b>	<b>Avg.</b>	<b>13</b>	<b>25</b>	<b>13</b>	<b>24</b>	<b>14</b>	<b>27</b>	<b>14</b>	<b>27</b>	<b>15</b>	<b>27</b>	<b>16</b>	<b>26</b>	<b>17</b>	<b>27</b>							
	Goalpara Dhubri Kokrajhar Bongaigaon Chirang	Apr.	21	34	21	33	21	33	21	32	21	33	21	33	21	34	Oct.	23	31	23	31	23	31	23	31	23	31	22	30	23	31							
		May	23	32	23	32	23	32	23	32	23	32	23	32	23	33	Nov.	17	29	17	28	17	28	17	28	18	28	18	28	17	28							
		Jun.	25	31	25	32	25	31	25	32	25	32	25	32	25	31	Dec.	13	25	12	25	12	25	13	25	13	25	14	26	13	25							
		Jul.	25	31	26	32	25	31	26	31	26	31	26	31	26	31	Jan.*	10	24	10	24	11	24	11	24	11	24	11	24	10	24							
		Aug.	26	32	26	32	26	32	26	32	26	32	26	32	26	32	Feb.*	12	28	13	28	13	27	13	26	13	26	14	28	13	27							
		Sep.	25	32	25	32	25	31	25	31	25	31	25	31	25	32	Mar.*	17	32	17	32	17	31	17	32	17	31	17	32	17	32							
		<b>Avg.</b>	<b>24</b>	<b>32</b>	<b>25</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>25</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>Avg.</b>	<b>15</b>	<b>28</b>	<b>15</b>	<b>28</b>	<b>16</b>	<b>28</b>	<b>16</b>	<b>28</b>	<b>2</b>	Appendix-2: continued											

Zone	District Dist. Group	Season		KHARIF SEASON														RABI SEASON													
		Months	1951-55		1961-65		1971-75		1981-85		1991-95		2001-05		2005-09		Months	1951-2 to 1955-6*		1961-2 to 1965-6*		1971-2 to 1975-6*		1981-2 to 1985-6*		1991-2 to 1995-6*		2001-2 to 2005-6*		2005-6 to 2009-10*	
			Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.		Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.	Min.	Mx.
Upper Brahmaputra Valley Zone (UBVZ)	Dibrugarh Tinsukia	Apr.	18	29	18	28	19	28	19	27	19	28	20	27	20	27	Oct.	20	29	20	29	21	30	21	30	21	30	21	30	22	31
		May	20	30	21	29	22	30	22	30	22	29	22	30	23	31	Nov.	15	28	15	25	14	27	14	27	15	28	16	28	16	28
		Jun.	23	31	23	31	24	31	24	31	24	31	25	31	25	31	Dec.	11	24	11	23	9	23	10	23	10	24	11	25	12	25
		Jul.	23	31	24	31	24	31	25	30	25	31	25	31	25	31	Jan.*	9	23	9	22	9	23	9	23	10	23	10	23	11	24
		Aug.	24	31	24	30	25	32	25	32	25	32	25	32	25	31	Feb.*	12	25	12	24	12	24	12	24	13	24	14	25	13	25
		Sep.	23	31	23	31	23	30	24	30	24	31	25	31	25	32	Mar.*	15	28	14	27	16	27	16	26	16	25	17	26	17	27
		<b>Avg.</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>24</b>	<b>30</b>	<b>24</b>	<b>31</b>	<b>Avg.</b>	<b>14</b>	<b>26</b>	<b>13</b>	<b>25</b>	<b>14</b>	<b>26</b>	<b>14</b>	<b>26</b>	<b>14</b>	<b>25</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>27</b>
	Sibsagar Jorhat Golaghat	Apr.	17	28	18	28	18	28	18	27	18	28	18	29	18	28	Oct.	20	29	20	28	20	29	20	29	20	29	20	29	20	28
		May	20	29	20	29	21	29	21	29	20	29	20	29	20	29	Nov.	14	27	14	25	15	26	15	25	16	26	15	27	15	26
		Jun.	22	30	22	30	23	30	23	30	23	30	23	31	23	30	Dec.	11	24	10	22	10	22	11	23	11	23	11	23	10	23
		Jul.	23	30	23	30	23	30	23	30	23	30	23	30	23	30	Jan.*	9	22	9	22	10	22	9	22	10	22	9	22	9	22
		Aug.	23	30	23	30	23	30	24	31	24	31	24	31	23	30	Feb.*	12	25	11	23	12	23	12	23	12	23	12	24	11	24
		Sep.	22	30	23	30	22	30	22	30	23	30	23	30	22	30	Mar.*	14	27	14	27	15	27	15	27	15	26	14	27	14	27
		<b>Avg.</b>	<b>21</b>	<b>30</b>	<b>22</b>	<b>29</b>	<b>22</b>	<b>29</b>	<b>22</b>	<b>29</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>Avg.</b>	<b>13</b>	<b>26</b>	<b>13</b>	<b>24</b>	<b>13</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>13</b>	<b>25</b>

Appendix-2: continued

Zone	District Dist. Group	Months	KHARIF SEASON														RABI SEASON														
			1951-55		1961-65		1971-75		1981-85		1991-95		2001-05		2005-09		Months	1951-2 to 1955-6*		1961-2 to 1965-6*		1971-2 to 1975-6*		1981-2 to 1985-6*		1991-2 to 1995-6*		2001-2 to 2005-6*		2005-6 to 2009-10*	
			Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.		Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.
North Brahmaputra Plain Zone (NBPZ)	Darrang Sonitpur Udalguri	Apr.	18	29	19	30	19	30	19	28	19	29	20	28	19	29	Oct.	21	29	21	29	22	31	21	31	21	30	21	30	21	32
		May	20	29	20	29	21	31	22	30	22	29	22	31	22	32	Nov.	15	27	15	25	16	29	15	28	16	28	16	28	15	29
		Jun.	23	29	23	30	24	32	25	32	24	31	25	32	24	32	Dec.	11	23	11	23	11	22	12	24	11	24	12	25	11	26
		Jul.	24	29	24	30	22	32	25	31	25	32	23	31	25	32	Jan.*	8	22	9	22	8	23	10	23	10	23	11	23	10	25
		Aug.	24	30	24	30	24	33	25	32	25	32	25	32	25	32	Feb.*	11	25	12	25	12	25	13	25	13	24	14	26	13	26
		Sep.	23	30	24	30	24	31	24	30	24	31	25	32	24	33	Mar.*	15	29	15	29	14	30	17	28	17	27	17	28	16	29
		<b>Avg.</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>32</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>32</b>	<b>Avg.</b>	<b>13</b>	<b>26</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>27</b>	<b>15</b>	<b>27</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>27</b>	<b>14</b>	<b>28</b>
	Lakhimpur Dhemaji	Apr.	19	30	19	30	19	30	19	29	20	30	20	31	19	30	Oct.	21	30	21	30	22	30	21	31	21	30	21	30	21	30
		May	21	31	22	30	22	30	22	30	22	31	22	30	21	31	Nov.	16	29	16	26	16	27	16	27	17	28	17	29	15	29
		Jun.	24	31	24	31	24	32	24	32	24	32	25	33	24	32	Dec.	12	25	12	24	12	23	12	24	12	24	13	25	12	25
		Jul.	24	31	25	32	24	32	24	31	25	32	25	32	25	32	Jan.*	10	24	10	23	11	23	11	23	11	23	12	24	11	23
		Aug.	24	32	25	31	25	32	25	32	25	32	25	32	25	32	Feb.*	13	27	13	25	14	25	13	24	14	25	14	25	14	26
		Sep.	24	32	24	32	24	31	23	31	24	32	25	32	24	32	Mar.*	16	30	16	29	17	29	16	29	16	29	16	30	16	29
		<b>Avg.</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>24</b>	<b>32</b>	<b>23</b>	<b>31</b>	<b>Avg.</b>	<b>15</b>	<b>27</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>27</b>	<b>15</b>	<b>27</b>	<b>15</b>	<b>27</b>	<b>15</b>	<b>27</b>
Central Brahmaputra Zone (CBZ)	Nagaon Morigaon	Apr.	16	26	17	26	17	29	16	25	17	26	17	27	17	26	Oct.	18	26	18	26	19	28	18	27	18	26	19	26	19	27
		May	18	27	18	26	19	30	18	26	18	26	18	27	19	26	Nov.	13	24	14	23	15	26	14	24	14	24	15	24	14	24
		Jun.	20	26	20	27	20	30	21	27	20	27	21	27	21	27	Dec.	10	21	10	21	10	21	10	21	10	21	11	21	11	21
		Jul.	21	26	21	27	21	29	21	27	21	27	22	27	22	27	Jan.*	7	20	8	20	8	8	8	19	9	20	9	20	9	20
		Aug.	21	27	21	27	21	29	21	28	21	28	21	28	21	28	Feb.*	10	23	10	22	11	11	10	21	10	21	10	21	11	21
		Sep.	21	27	21	28	20	29	20	27	21	28	21	28	21	27	Mar.*	14	25	13	26	14	14	14	25	14	25	14	25	15	25
		<b>Avg.</b>	<b>19</b>	<b>27</b>	<b>20</b>	<b>27</b>	<b>20</b>	<b>29</b>	<b>20</b>	<b>27</b>	<b>20</b>	<b>27</b>	<b>20</b>	<b>27</b>	<b>20</b>	<b>27</b>	<b>Avg.</b>	<b>12</b>	<b>23</b>	<b>12</b>	<b>23</b>	<b>13</b>	<b>18</b>	<b>12</b>	<b>23</b>	<b>13</b>	<b>23</b>	<b>13</b>	<b>23</b>	<b>13</b>	<b>23</b>

## Appendix-2: concluded

Zone	Season District Dist. Group	KHARIF SEASON														RABI SEASON															
		Months	1951-55		1961-65		1971-75		1981-85		1991-95		2001-05		2005-09		Months	1951-2 to 1955-6*		1961-2 to 1965-6*		1971-2 to 1975-6*		1981-2 to 1985-6*		1991-2 to 1995-6*		2001-2 to 2005-6*		2005-6 to 2009-10*	
			Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.		Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.	Mn.	Mx.
Barak Valley Zone (BVZ)	Cachar Karimganj Hailakandi	Apr.	21	32	20	32	21	31	20	31	21	32	21	31	21	32	Oct.	22	30	22	30	22	31	22	32	22	31	23	31	22	32
		May	22	31	22	31	23	31	22	31	23	31	23	31	23	32	Nov	16	28	16	28	17	28	16	30	18	29	18	29	18	29
		Jun.	24	30	24	30	24	31	25	32	25	31	25	32	25	32	Dec.	12	26	12	25	11	25	13	26	13	26	14	27	13	27
		Jul.	24	30	24	30	24	31	24	31	25	32	25	32	25	32	Jan.*	9	25	9	24	10	25	11	26	11	25	12	25	12	26
		Aug.	24	31	24	30	24	31	25	32	25	32	26	33	25	32	Feb.*	12	28	12	27	13	27	13	27	13	26	14	28	14	28
		Sep.	24	31	24	31	24	31	24	32	25	32	25	32	25	32	Mar.*	17	31	16	31	17	31	18	31	18	30	19	31	18	32
		<b>Avg.</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>31</b>	<b>23</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>24</b>	<b>32</b>	<b>Avg.</b>	<b>15</b>	<b>28</b>	<b>14</b>	<b>28</b>	<b>15</b>	<b>28</b>	<b>15</b>	<b>29</b>	<b>16</b>	<b>28</b>	<b>17</b>	<b>29</b>	<b>16</b>	<b>29</b>
Hill Zone (HZ)	Mikir Hills (KarbiAnglong) N.C. Hills	Apr.	18	29	18	28	18	27	18	27	18	28	18	28	19	29	Oct.	20	28	20	28	20	27	20	29	20	28	20	28	21	29
		May	20	28	20	28	20	27	20	28	20	28	20	29	21	29	Nov.	15	26	15	25	15	25	15	26	16	26	16	26	16	27
		Jun.	21	28	22	28	22	28	22	28	22	28	22	28	22	29	Dec.	11	23	11	22	11	21	11	23	11	23	12	23	12	24
		Jul.	22	28	23	29	22	28	22	28	23	28	23	29	23	29	Jan.*	9	22	9	22	9	21	10	22	10	22	10	22	10	23
		Aug.	22	29	22	28	22	28	23	29	23	29	23	29	23	29	Feb.*	11	25	11	24	11	23	12	23	11	23	12	24	13	25
		Sep.	22	29	22	29	21	28	22	29	22	29	23	29	23	29	Mar.*	15	28	15	28	15	26	16	27	16	27	16	27	16	28
		<b>Avg.</b>	<b>21</b>	<b>28</b>	<b>21</b>	<b>28</b>	<b>21</b>	<b>28</b>	<b>21</b>	<b>28</b>	<b>21</b>	<b>29</b>	<b>22</b>	<b>29</b>	<b>22</b>	<b>29</b>	<b>Avg.</b>	<b>13</b>	<b>25</b>	<b>13</b>	<b>25</b>	<b>14</b>	<b>24</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>
ASSAM		Apr.	19	29	19	29	19	30	19	29	19	29	20	29	20	30	Oct.	20	29	21	29	21	30	21	30	21	29	21	29	21	30
		May	20	30	21	29	21	30	21	30	21	30	22	30	22	30	Nov.	15	27	15	25	16	27	15	27	16	27	16	27	16	27
		Jun.	22	29	23	30	23	31	24	31	24	30	24	31	24	31	Dec.	11	24	11	23	11	23	11	24	11	24	12	24	12	24
		Jul.	23	29	24	30	23	31	24	30	24	31	24	31	24	31	Jan.*	8.9	23	9.1	22	9.5	21	9.9	23	10	23	11	23	10	23
		Aug.	24	30	24	30	24	31	24	31	24	31	25	31	24	31	Feb.*	12	26	12	25	12	24	12	24	12	24	13	25	13	25
		Sep.	23	30	23	30	23	30	23	30	23	31	24	31	24	31	Mar.*	15	29	15	29	16	27	16	28	16	28	17	28	16	29
		<b>Avg.</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>22</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>30</b>	<b>23</b>	<b>31</b>	<b>Avg.</b>	<b>14</b>	<b>26</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>25</b>	<b>14</b>	<b>26</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>26</b>	<b>15</b>	<b>26</b>

Source: Computed from data published by the IMD, Regional Meteorological Centre, Guwahati.

Note: (i) Mn and Mx. indicate minimum and maximum temperature respectively, (ii) \* indicates that in the Rabi season, the months January, February and March fall in the immediate next year.