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# Implementation Framework for Sustainable Development: What Matters in the Context of Bangladesh

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***Abstract -*** *COVID 19 recovery path, economic growth path and climate resilient path have much in common to help in building back better for Bangladesh which experienced multiple hazards due to hydro-meteorological disasters during the pandemic year. Changing the framework around this intersection of sustainable developmental actions can strengthen the productive base of the economy which can create momentum for the attainment of equitable human wellbeing for people of Bangladesh. For successful implementation of actions updated methods, community involvement and data are the most important elements.*

## 1. INTRODUCTION

21st century economic growth agenda especially after COVID-19 pandemic need a better evolved framing compared to the preceding century. What should be the "changed framing" of growth agenda? Lesson learnt from COVID-19 is just not about one of its kind of a health-related disaster due to appearance and spread of an unknown virus. It reflects much deep- rooted implication of how human activities (Dutta 2020, Roy 2020a) are planned, managed, how societies are governed, how individuals, communities, businesses (Tarafder 2020), international trade, resource extraction and above all the two institutions: market and the state function, perform and are monitored through transparent accounting process or fall short of managing new challenges in the absence of a visionary approach.

Post industrial revolution society over past one century experienced unprecedented technological progress due to various scientific discoveries, understanding and innovation (Kar 2020a, 2020b). The market and the state as complementary institutions grew over time historically according to societal organizational dynamics, power structure and resource ownership to address resource allocation issues within the society (Roy 2020b). The resources which market and state manage for allocation has property right defined to either private ownership or state ownership. Despite all such technological and institutional marvels of the past century it is a reality that in this century we inherit an unequal world with wide gap in capability and opportunities and access to technologies (UN 2020). This century begins in a world with approximately seven billion human souls where approximately 50% are excluded from access to all the basic needs for a dignified living. Majority of them live in South Asia, East Asia and Africa. Also, science is now clear and can say with high confidence that it is the state of the climate system, state of the local natural assets, health of the forest, state of wild biodiversity, water, air, ocean, rivers systems, coasts are going to determine the economic outcome of this century and consequent human wellbeing. But systems are interconnected. Through the feedback loop choices of development pattern made by economic activity sectors and nations will also determine the state of all these natural resources, state of the climate system and disaster intensity, cascades and frequency (Roy, Islam and Pal, 2020). A frequently asked question for the fast-developing economies of 21st century like Bangladesh is, economic development first or climate first? Based on current scientific discourse due to interconnectedness of systems, answer is both need to happen together, and it is possible to choose a development pathway which is climate friendly and disaster resilient as well. A development path that reduces inequity and over all carbon footprint of production and consumption practices is one of such examples (Roy *et al.*, 2018). But that can happen in multiple ways through individual country level actions or through mutually beneficial global cooperation. Such actions increase economic activities, creates jobs and do not worsen climate change. Nature based solutions such as, sparing the nature to do the regulatory services (Shah *et al.*, 2020), mangrove or other forest conservation, protecting coastal salt marshes, floodplains, sea grass, investment in managing soil quality, air quality, or choosing an economic activity that prevents greenhouse gas emissions, local air polluting emissions, reduces solid and liquid wastes are all climate friendly economic activities. All these preventive activities have much higher multi-dimensional human wellbeing impact compared to building a concrete embankment for flood defense.

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## 2. IMPLEMENTATION FRAMEWORK: FOR CLIMATE FRIENDLY, DISASTER RESILIENT, SUSTAINABLE DEVELOPMENT FOR ECONOMIC GROWTH

**Economic systems** narrowly managed through market and state led regulations are unable to cover all the wider impacts of many of the current economic activities happening worldwide. Both formal and informal human activities do generate jobs and livelihood for many people. According to Report on Labor Force Survey 2010, the informal employment in Bangladesh is more than 85%. However, many informal activities might create impacts which go unregulated within current narrowly defined economic systems and can create larger social impact with cost burden on the society at large. One such example is air pollution and which is known as external effect (Dasgupta *et al.*, 2015, Dasgupta *et al.*, 2016) of private or government led economic activities within GDP framework (more discussion is there in Volume 1 of this special issue). COVID 19 can also be seen as one such external effect of wild animal trade and consumption. Wilderness is seen and mostly managed an as open access resource without exclusive property rights defined and thus have unintended tendency to get over exploited by the users. Climate change is an important example in this category and the consequent disasters are the wider negative impacts. MERS, SARS, EBOLA in the past were the precursors of current pandemic and alerts were on from scientific community. There has been discussion led by environmental economists, ecological economists for more than three decades to manage external effects of mainstream economic activities on environment and consequent feedback through implementation of broader framework of sustainable development. So, while polluting activities like coal extraction get accounted for in increasing GDP and economy's progress but adverse health impact of that or environmental impact remain unaccounted for. Pollution reducing activity, preventive health care actions do not get adequately captured by GDP but they do help in advancing human wellbeing and sustainable development. So, in post COVID 19 world what needs to change is framing the national economic progress indicators towards sustainable development.

In earlier volume 1 we presented the conceptual and operational framework. Here in this volume 2 (Figure 1) we present the components of implementation framework. For fast growing economies since majority of the energy infrastructure will be built in these next two/three decades (Mahmud and Roy, 2020) one driving force is implementing investment plans to accelerate the assessment of alternative resource potential of renewable resources using advanced scientific tools and methods. Methods of estimating costs and benefits quantitatively and qualitatively need to be advanced to be able to take into consideration the wider social and environmental costs and benefits and not just private costs and benefits. In terms of economic impact, a disaster may be considered the opposite of an investment project. The three basic parameters of an investment project are the amount of the initial investment, the lifetime of the project and the flow of costs and benefits generated by the project over its lifetime. From an economic standpoint, project viability and disaster impacts can be assessed by comparing costs to benefits but going beyond standard techno-economic elements. Disasters cause damage to assets. It can be imagined as "disinvestments" which impacts the production of goods and services adversely. Inadequate methodologies give rise to uncertainties on climate change impact related and disaster related costs estimation (Hallegatte *et al.*, 2010). What is important to make clear is how the economic system can react to shocks from changing climate and disasters. How, preventive actions can help avoid, reduce shocks, disasters and resultant costs. But, this needs better understanding of how markets and non-market institutions function outside equilibrium, and of how various actors/economic agents behave under situations of high uncertainty. Opportunity costs and externalities that affect the wellbeing of society, non-market valuation methods become important tools for assessment. The boundary of externality/wider impact can be very different depending on the nature of disaster. It can be on neighbourhood community, national and/or international. The natural and anthropogenic hazards may lead to disasters, which might cause short and long term impacts on social and economic development of the country (Rahman *et al.*, 2020). Disaster cost estimation are not only to arrive at compensation, relief or insurance purposes but also for making choice among alternative recovery projects or prior preventive actions. For designing any policy or a governance programme, the functional need has to be translated into a functional requirement, a detailed quantitative and operational statement (Pal and Bhatia, 2017). To make it happen, experiential knowledge and a deeper understanding of the domain plays an essential role in guiding our search for plausible design alternatives (Pal *et al.*, 2017).

## 3. IMPLEMENTATION FRAMEWORK: FOR NEW INSTITUTIONS, GOVERNANCE AND ROLE OF COMMUNITY

Governments can enhance preventive action which can be cost effective than costly and sometimes uncertain "cure through relief" approach which needs huge resource mobilization and quick spending. Preventive actions are mostly in Public service categories so governments have an important role to play. Vulnerability to disasters is embedded in a complex system of societal structures and processes. Resilience to disasters is driven by a combination of social, economic, environmental, institutional, and other relevant processes that interact with and influence each other (Choudhury and Haqque, 2016, Pal *et al.*, 2021). Djalante *et al.*, (2012) justify the use of the Hyogo Framework as a tool of analysis on the basis that (1) the Hyogo Framework is an internationally agreed

framework for disaster risk reduction to increase the resilience of nations and communities, and (2) the Hyogo Framework has been well received and well adopted in order to enable a comprehensive analysis on how countries implement various disaster risk reduction activities. However, that the Hyogo Framework initiated a strategic and systematic approach to building disaster resilience has rarely received critical analyses (Djalante *et al.*, 2012). Subsequently Sendai Framework for Disaster Risk Reduction (SFDRR) 2015- 2030 drive the national and subnational level risk governance and advocate the build back better for resilient communities with better adaptive capacity. Disaster impacts across the community grossly depends on their exposure, sensitivity and related vulnerability. Bottom-up approach considering community as central entity for spatial variations of the local level vulnerability as well as adaptive governance (Thanvisitthpon *et al.*, 2020).

## 4. IMPLEMENTATION FRAMEWORK: ROLE OF EVIDENCE, INFORMATION AND DATA

**Insufficient data** give rise to uncertainties on total costs and benefits of climate change, unsustainable development and disaster. National statistics are usually blind to interaction between regular incremental cycles, crises and long disaster related shocks. Data sets run parallel and independently and makes cost estimates using standard macro data sets erroneous. The role of various systems and sub-systems/critical infrastructures e.g., electric system, water distribution, transportation have very important role to play in sustainable development through the supply-chain links. Interdependence of these systems/ structures play a very crucial role in terms of cost assessment and recovery of any economy.

Disaster shock led asset loss both at private and public level impacts long term recovery and sustainability. Asset loss and uncertainty creates impact on private decisions (households and company level) because of insufficient resources. The quality of response and recovery actions are primarily dependent on availability of context specific granular evidence base on multiple key indicators that determine total impact on people and their wellbeing and sustainable development indicators. So preventive actions, role of financial institutions and regulations can reduce indirect cost.

While globally accepted methods can be used but data types and needs usually vary by national circumstances and especially at community scale. They will be varying depending on socio-technical, economic and political agency of the individuals and social groups in any local contexts. However, digitalization can help in overcoming this agency problem by appropriate evidence and governance mechanism if these are built into the digital platform in inclusive way.

Globally, statistics show with resources allocation and technology, effective prevention can be planned to reduce disaster led loss and damage. In Bangladesh which is now on fast economic growth path costs of disaster impacts will rise significantly as a result of the greater concentration and value of societal activities through asset creation. Reduction of loss and damage of people and to the nation as a whole and globally from disasters depend on quality of informed decision making for maximizing benefits from 'response and recovery actions'.

To make information easily available and accessible and trustworthy there is urgent need to create this under public sector management:

a) Maps of disasters at granular scale (neighbourhood/community scale) involving local institutional capacity. This granular database should be properly geocoded so that other relevant information could be added with it when necessary.
b) Identification of hotspots through over lay of maps of multiple disasters.
c) Maps of infrastructure and their risk levels to various disaster types.
d) Maps of varying disaster impacted/exposed locations temporally to enable dynamic baseline determination possibility to help in planning long term recovery path.
e) Map of protected coasts by type: nature based or manmade structures, embankment.
f) Map of reliable and safe public transport system/routes to reduce loss and damage due to immobility of people e.g., to enable quick movement from unsafe areas to safer locations, home to work place and back.
g) Map of agro-ecological systems based on contemporary data on soils, hydro-meteorological parameters, tidal amplitude and influence (especially for coastal resources).
h) High spatial resolution terrain models based on accurate land elevation data so that locational attributes are adequately registered.
i) High resolution demographic and health related data.
j) Provisions for data sharing among the agencies should be made so that data-driven, effective decisions could be made.
k) State of the art data, methods and techniques such as geospatial data and techniques (*i.e.* GIS, optical and radar remote sensing, LiDAR, GPS *etc.*) should be used for updating existing data and to generate new data where necessary.

Government of Bangladesh has an initial institutional arrangement to get information and estimate disaster loss and damage for different sectors. In this vertically connected governance structure through bottom up process, local government representatives and government officials use a prescribed form ('D' form and 'SOS' form) to collect information related to financial loss, number of affected households, challenges faced by different communities *etc.* In addition, other agencies like Bangladesh Bureau of Statistics (BBS) has taken initiatives to gather climate change induced disaster impacts data by undertaking a project titled 'Generation of Disaster Related Statistics 2020: Climate Change and Natural Disaster

Perspectives'. Data are going to be generated from different disaster hot-spots every year by using mobile phone enabled smart data collection tool. BBS is also going to prepare four disaster and climate change focused reports under the framework of Bangladesh Environmental Statistics Framework (BESF 2016-2030). The major reports will be Report No. 3: Climate Change and Disaster Related Statistics (what is currently underway), Report No. 10: Disaster Risk Reduction Expenditure Accounts, Report No. 11: Climate Change and Natural Disaster Impacts Vulnerability Index and Report No. 13: Climate and Natural Disaster Induced Survey. In 2015, BBS conducted 'Impact of Climate Change on Human Life (ICCHL) Survey' and produced national level data on disaster impacts for the first time in Bangladesh. This data generation needs active involvement of local communities and stakeholders in a variety of ways to make the process inclusive.

Planning Commission conducted background studies (Report No. 11a and 11b) on disaster and climate change impacts to better understand the risks and vulnerabilities of the communities, which finally gave directives to formulate related targets for Seventh Five Year Plan (SFYP). The Eighth Five Year Plan (that is currently under preparation) has incorporated a number of DRR indicators in the scope of actions. The CPEIR (Climate Public Expenditure and Institutions Review) study undertaken by Planning Commission, CFF (Climate Fiscal Framework) published by Ministry of Finance are significant documents that provide valuable insights in understanding local level disaster risks and vulnerabilities. In parallel many other activities in allied fields were performed by different agencies, such as forest (*e.g.* REDD+, coastal afforestation project), water resources (*e.g.* Blue Gold Project by BWDB and DAE, The Bangladesh Delta Plan 2100), and education (*e.g.* production of report on Climate Change Education for Sustainable Development, by the Ministry of Education through BANBEIS). These study reports are useful sources of information and conceptual construct to better understand disaster vulnerabilities and action plans in the context of Bangladesh. However, it is important to note that the existing set of data are not adequate to fulfil national need for policy implementation as mentioned in the sustainable development framework (Figure 1) and at the same time maintain international commitments on data reporting. For example, Bangladesh is currently absent in the UNDRR (United Nations Office for Disaster Risk Reduction) disaster impact database 'DesInventar' that does not go with longstanding good posture of Bangladesh in disaster management. Similarly Bangladesh is not fully ready for submitting information as per the guidelines provided by UN-FDES and SEEA, ESSAT *etc.*

This is the second volume of the **Bangabandhu Chair Special issue of *International Journal of Energy***. The first volume published in October 2020 aimed to present how the intellectuals and experts from within the country, region and from outside the region situate sustainable energy transition of Bangladesh in the context of national economic growth aspiration, responses to climate risk, disaster risk and dynamics of regional cooperation and global common good goal. In this special Volume 2 our aim is to carry forward the intellectual discourse and expert view which is very much relevant for the post COVID recovery phase of Bangladesh.

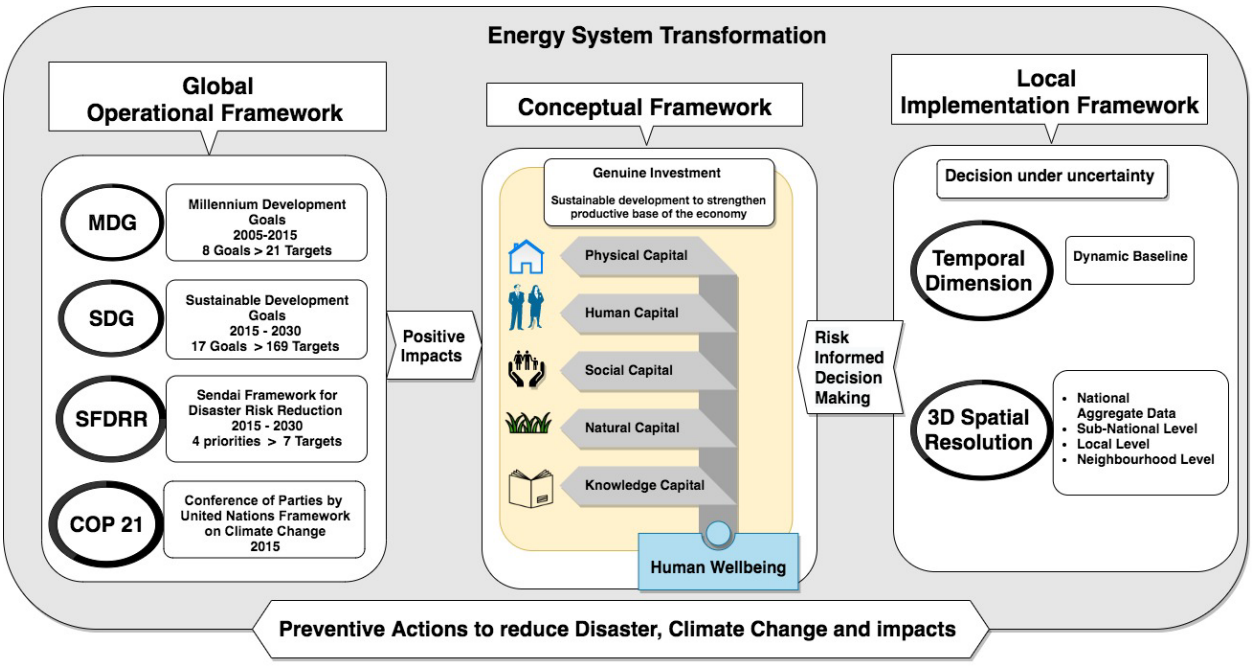


**Fig. 1. Essential elements in contextualization for implementation of conceptual framework at various levels.**

## 5. OUTLINE OF THE SPECIAL ISSUE: VOLUME 2

This Volume 2 examines the hypothesis that for contextualizing the conceptual and operational framework presented in volume 1 for successful implementation, methodological advancement in scientific assessment and analysis, data at various scales macro, meso and micro level are indispensable along with new institutional arrangements. Decision under uncertainty should be driven by appropriate methods, risk informed decision making process and this cannot happen improve unless data base is temporally maintained to help tracking progress and monitoring. Any decision over time need to depend on dynamic baseline as situations changes and a country progresses. So, in our 21st century conceptual framework in which core is sustainable development for human wellbeing with fairness/equity/justice we take a deeper look into the (1) various methodological advancements that help in modelling the resource potential better to diversify energy resource base going beyond traditional sources (2) find various means and capacities to collect and manage data base systematically with continuous updates and reviews by engaging national institutions and experts more closely both to reduce transaction cost and make use of internally sourced human and local knowledge capital (3) climate response strategy and sustainable development paths need to evolve covering mitigation and adaptation needs and very localized needs and especially in post pandemic period recovery path focusing especially on marginalized communities who are vulnerable. The articles compiled in this journal volume 2, through double blind peer review process addresses the following broad research questions:

- How can in post COVID recovery period Bangladesh economy expand its clean energy sources with application methodological advancement and by including people to share costs along with benefits?
- What is the scope of new major technological and social, economic innovations that can reduce carbon footprint and enhance adaptive capacity of various economic activities and social actors?
- How data generation and for a natural disaster exposed nation like Bangladesh how people, community and institutions interact to build resilience organically and which needs to be strengthened by scientific approaches?
- How is Bangladesh community at the margin coping with increasing disasters?

The original inspiration for this volume 2 comes from overwhelming response from researchers expressed through large number of submissions to our call for papers for a special issue. Idea of special issue germinated under the umbrella of Bangabandhu Chair endowment at AIT, Thailand by the Government of Bangladesh, Ministry of Foreign Affairs. The call for papers kept the basic thematic area under the endowment "Energy Sector Development in Bangladesh" and this journal's core focus area of Energy.

Therefore, of all the articles that have been chosen and included in this volume bias is more towards energy. It is complemented by articles on climate change and disasters as they pose valid threats to sustainable development directly or indirectly. Content diversity has been managed in such a way that policy makers in Bangladesh can get useful tools and information to decide on a course of action with sustainability goal. Researchers on Bangladesh economy can get a status review of a broader interconnected branch of knowledge and identify the research gaps that can add value through future knowledge gap filling studies.

What basic areas Bangladesh need to critically examine in Post COVID-19 period under energy, climate change and disaster to continue on its sustainable development path are covered in this volume.

*Ahmed, Amin et al.* provide recommendations for post COVID-19 sustainable energy options for power generation in Bangladesh by revisiting the national policies in already in place. Methodology applied to do the analysis is state of the art Dynamic General Equilibrium (DGE) model for Bangladesh economy to capture the long-run consequences of the COVID-19 towards energy sector and economy. Such methods help in analysis of the sectoral changes within an economy caused by sudden shocks like the COVID 19. One major conclusion is that in the context of Bangladesh stimulus packages can build enough incentives to accelerate the private sectors and societal investment in renewable energy sector expansion.

The article by *Iqbal and Rahaman* take an approach where they consider 'soft energy' from a whole portfolio of renewable resources for rural households in Bangladesh like many other countries can come from biomass resources e.g., animal manure, crop residues, and kitchen and green wastes, solar radiation, water and wind and at the same time create jobs, meet modern energy demand, enhance wellbeing. They apply contingent valuation method and estimate truncated mean willingness-to-pay (WTP) to derive economic value that households in Bangladesh place so call soft energy as alternative sources.

Article by *Karim* presents how using a handmade small windmill local expert can investigate the voltage generation, current generation and power generation with respect to the wind speed in Bangladesh. According to the experimental results from small windmill and the survey reports on wind speed especially in coastal areas of the country suggest that the wind energy can be an alternative power source for Bangladesh.

Article by *Jati, Manik et al.,* makes an assessment and discusses about the importance of micro-hydro power plant (MHPP) as a viable solution to the electricity crisis in rural areas in Bangladesh. There is lack of implementation in the absence of enough information and the constraints for location review. The paper proposes and explains the process to determine the ideal location of micro-hydel power. The ideal source is field observations. Analytical hierarchy process (AHP) and geographical information systems (GIS) have been

used to determine the locations of micro-hydel power especially in the rural areas.

Article by *Mamtiyev, Aliyeva et al.,* present advancement in knowledge in methods for assessing optimum management of gas wells, especially relevant for Bangladesh. Resource conservation and efficiency in operation not only reduces cost of production and increase affordability but is a necessary condition for sustainable development.

Article by *Das and Roy* suggest a method to conduct thermodynamic analysis of biomass gasification for major crop producing Asian countries including Bangladesh. Biomass gasification is a very complex chemical process. They present a model with new kind of nonlinear stoichiometric coefficient for reaction rate constant, with no propagation of error to the next level of calculation. Such studies help in design and development of appropriate technologies to reduce environmental impacts from waste generated in agriculture and livestock sectors as well as provide affordable energy security through diversification of sources.

*Karmaker, Hosan and Saha* in their paper discussed about the effect of biomass energy consumption on the economy, environment and human development. It also talks about the reliance of large number of people on biomass energy usages in South Asia. The study also investigates whether biomass energy is contributing positively to human development or not. The study suggests that the usage of biomass energy has an adverse effect on human development in South Asian countries.

The article by *Meenual and Usapein* investigates rural electricity transition for Bangladesh and Thailand. Publicly accessible data related to microgrid policies in Bangladesh and Thailand have been collected and synthesized. The research represents comparative case study to offer a range of possible synergies across different dimensions and sectors to help transform energy sector in developing countries. The transition of rural electricity driven by microgrid policy in both the countries can be achieved by adopting new electricity market structure and regulation.

Article by *Towoju* emphasizes the importance of electric vehicles to provide increasing but clean mobility demand in developing countries following the growing global trend. But also demonstrates by estimating carbon footprint of electricity sector in various country contexts how single minded focus on electric vehicle cannot be a solution unless electricity generation sectors in many countries are made carbon free through renewable energy penetration.

The article by *Udmale, Pal et al.,* provide an insight on how in deciding on development pattern trade and domestic production can be thought of in an integrated way. An integrated management of water, energy, and low carbon can be one of the strategies to increase the cereal crop production and reduce GHG emissions from agriculture in Bangladesh. Energy use in agriculture, mainly for mechanization and irrigation purposes and there is potential to reduce GHG emissions from agriculture through various alternative actions and also to meet INDCs. The methodology used for the study is virtual land and water flows through international cereal imports in Bangladesh.

The discussion by *Alam, Hridoy and Naim* addresses how fishing community on the ground perceive changes and their expectations concerning adaption action. Field level first hand source of information provide rich evidence base. Exploratory factor analysis and a binary logistic regression are used to derive results from empirical study. Despite lack of formal and institutional responses some of the impacted community adopt various coping mechanisms to continue fishing in the future.

*Ghosh and Chakraborty* show the intensity and frequency of natural disasters are increasing in Bangladesh. These are inducing challenges in energy sector in terms of availability, options, access with increased burden on women, especially in the rural Bangladesh. Participatory action research tools helped in bringing the gender perspectives of energy, disaster management and climate. The study concludes in favour of adaptive actions that address gender equity from very design of the projects.

Finally, as we mentioned in volume 1, an interesting aspect of this volume, from a sustainable development perspective, is that all of its lead authors, as well as a large majority of its other contributing authors, are from the region and from the country. While this author mix outcome has been mostly incidental, as it is outcome of an open call for papers widely circulated. It does demonstrate that there is a pool of highly qualified researchers and thinkers all around the world ready to commit time and effort to influence academic and policy discourses at the highest levels in the field of sustainable energy transformations, climate change and disaster risks in the context of Bangladesh. Unfortunately, despite the efforts of the editors it was not possible to keep all the submissions as 30% had to be rejected after double blind peer review process either due to divergence of the objectives from the thematic goal of this special issue or because they did not satisfy the scientific rigour and standard of the Journal.

Guest Editors and Bangabandhu chair researcher at AIT, synthesize the recommendations that emerge from the research studies and presents at the end in the form of a white paper which will be useful for decision makers in Bangladesh. Guest editors acknowledge with thanks cooperation from a large number of experts from various continents and institutions for their full cooperation, sometimes very tight timeline for review, taking the burden of reviewing more than one article, and sometime to review twice/thrice after resubmission in response to review comments. We acknowledge with thanks the voluntary time commitment of reviewers. Our sincere thanks to all the experts Professors/Dr/Ms/Mr. Abdul Salam, Amir Safari, Alak Pal, Anamika Barua, Anjal Prakash, Anupa Ghosh, B.B. Saha, Bikram Raha, Biswajit Thakur, Biswanath Roy, Byomkesh Talukdar, Chioma Onyige, Debalina Chakravarty, G.P. Ganapathy, Homam Nikpey Somehsaraei, Indrila Guha, J.G. Singh, Jonathan Rigg, Mani Nepal, Maria Figueroa, Md. Anwarul Abedin, Md. Rafiqul Islam, Md. Younus Mia,

Mohsen Assadi, Mofazzal Hossain, Oleg Lugovoy, Parimita Mohanty, Rajib Shaw, Ranjan Ganguli, Ranjana Chowdhury, S. Kumar, Sabuj Mandal, Sajjad Zohir, Sakib Bin Amin, Samir K. Saha, Sarmistha Das, Sasi Kottayil, Sebak K. Jana, Shyamasree Dasgupta, Soumyendra Kisore Datta, Souran Chatterjee, Suyash Jolly, Swarnendu Sen, Tejal Kanitkar, Tuhin Ghosh, V.R. Singh, Weerakorn Ongsakul, Yonariza, who helped us in the double blind review process. Also, we are extremely obliged to Editors of this Journal Prof. Kumar and Prof. Salam and the IEJ editorial support staff led by Kathrina for their excellent systematic, efficient, meticulous and prompt actions. Remaining errors are the responsibilities of the Guest Editors.

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