UNITED INTERNATIONAL UNIVERSITY

IDSS
Institute of Development Studies and Sustainability

5th ICSD

INTERNATIONAL CONFERENCE ON SUSTAINABLE DEVELOPMENT

TOWARDS RECONSTRUCT THE KNOWLEDGE-BASED SOCIETY

5th UIU-ICSD 2022

19 - 20 February, 2022

UIU, Dhaka, Bangladesh

Joint Cooperation Program Bangladesh Netherlands

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5th International Conference on
SUSTAINABLE DEVELOPMENT

19-20 February 2022
Dhaka, Bangladesh
Venue: Online

Organized by

Institute of Development Studies and Sustainability (IDSS)
United International University (UIU)

5th UIU-ICSD 2022

5th International Conference on Sustainable Development 2022

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Contents

MESSAGE FROM THE VICE CHANCELLOR

In today's world, sustainable development is crucial to meet the needs of the present without compromising the ability of future generations to meet their own needs. I understood, the 5th UIU-ICSD 2022 provided opportunities to bring scientists, policy makers, academics, development professionals, experts, activists, students together to share practical solutions towards achievement the Sustainable Development Goals.

This conference facilitates the generation of options for addressing the issues of sustainability. This conference is a part of the series of conference followed by the first 1st, 2nd, 3rd and 4th International conference on sustainable development held in February 2017, 2018, 2019 and 2020. I hope, IDSS of UIU will be organizing this conference until 2030 to observe and track the progress of the 2030 Agenda for Sustainable Development. I believed, the scientific knowledge sharing through papers presentations in the parallel sessions enriched our understanding of Sustainable Development.

This kind of platform is very important to build a bridge between people from different sectors who are individually working for sustainable development. In this conference, all the themes are related to 17 UN SDGs and we ourselves must work collaboratively to support the implementation of Agenda 2030. Recognizing that IDSS at UIU has agreed on a set of core principles to guide the support to achieve the SDGs. A strategic and sustainable approach to poverty reduction and the stratification of SDG priorities, along with sustainable, robust and quality growth must be UIU's prior target with research outputs. Solution-oriented research for sustainability, addressing environmental change and development challenges to satisfy human needs for food, water, energy, health is crucially important. Sharing this research knowledge timely with the policy-makers is highly important to bridge up the gaps of science and policy. Our university – United International University (UIU) - is dedicated to generate empirical knowledge through interdisciplinary research and disseminate this knowledge to different levels of stakeholders in several paths like teaching, publications, seminars and training. The Institute of Development Studies and Sustainability (IDSS) at United International University (UIU) is dedicated to interdisciplinary hub for research, teaching, and collaborations for narrowing down the science-policy gap towards sustainable development. The IDSS is committed to managing and expanding the interdisciplinary major in Development Studies and Sustainability by providing students with fellowships, scholarships, and study opportunities through collaborations with universities in Europe and Asian countries.

My sincere appreciations and gratefulness to the International Advisors of UIU-ICSD 2022, and the co-organizers, I congratulate the authors for their brilliant contributions and the session chairs for their kind cooperation and sincere contributions.

The Plenary session on Bangladesh Delta Plan, which facilitated debate, dialogue and discussions on long-term plan for sustainable development. Participation of universities, research organizations, implementing organizations, civil society forums, and policy people

strengthened our capacity and confident to move forward to generate new knowledge and policy briefs through collective initiatives.

I highly appreciate all the paper presenters for responding to our call actively. I, on behalf of UIU, would like to express our gratitude to the intellectuals and the co-organizers for their sincere and kind contributions in making this Conference a Success.

I congratulate the Conference Convener Prof. Dr. Hamidul Huq and his Team for their hard work in organizing this conference annually since 2017.

Professor Dr. Chowdhury Mofizur Rahman

Vice Chancellor
United International University

20 February 2022

NOTE FROM THE 5th UIU-ICSD 2022 CONVENER

On the rise of awareness of the world concern about 'Our Threatened Future', Sustainable Development is conceived as the new Form of Development. Sustainable development aims to be anchored on three pillars, which are to evolve concomitantly on sustainable factors, namely, economic, social and environmental and to be centered on the human being, implying that the process of sustainable development is necessarily inclusive and should promote unity in cultural and other forms of diversity. But it is essential, in the context of establishing this unity, that diverse cultures, interests, and wishes, particularly of the downtrodden and disadvantaged groups, are facilitated to flourish and find proper expressions in appropriate forms. Such a process conducted within a broad framework under the provision of the Constitution of the country should help all groups, the majority and the minorities, to understand each other's points of view and needs and find common grounds to work together for an all-inclusive, equitable social progress.

In the field of sustainable development, it is globally understandable that there are many major challenges must be mentioned. They require all of us to re-think our economy and our growth in favor of a society that is more economical in its use of raw materials and energy. To me, the major challenge is to ensure the sincere practice of good governance. Many argue some of the major challenges are climate change, energy consumption, waste production, threats to public health, poverty, social exclusion, management of natural resources, loss of biodiversity, and land use. In this context, sustainable development approaches are now essential obligations.

Sustainable Development Goals (SDGs) is especially relevant for South Asia countries which, despite their economic dynamism and remarkable Millennium Development Goal (MDG) achievements, account for 37% of the world's poor, nearly half of the world's malnourished children, and suffer from a number of development and infrastructure gaps. Sustainable development needs to be able to respond to the various problems generated by dominant development interventions such as agricultural modernization through heavy chemical inputs, industrialization through deforestation and water pollution, over consumptions in all respects, ugly urbanization, and generation of non-renewable energy. Other problems rose by demographic growth, the planet's limited capacity, war, and social inequality are crucially needed to address. Accelerate global warming carries risks of shortages and the disruption of certain natural cycles such as fresh water, impoverishment of agricultural soil, deforestation, and reduced biodiversity. A great concern and tension of the day is that the North/South economic divide and the unequal distribution of the consumption of the planet's natural resources between the world's populations; will the 10 billion people of our planet in 2100 be able to live as well as the 750 million people in industrialized nations do today?

Hence an interdisciplinary knowledge base is important to bridge up the gaps. International Conferences on Sustainable Development like 5th UIU-ICSD 2022 and beyond may contribute to filling up the knowledge gaps and give a new shape of next moves towards sustainable development. I strongly think that collaboration is one of the keys to unlocking sustainability. No single organization or sector has the knowledge or resources to 'go it alone'. Leaders from

all sectors of society agree that solving sustainability challenges will require unparalleled cooperation. Multi-sector partnerships must be strengthened where public-interest entities, private sector companies, and civil society organizations enter into an alliance to achieve a common practical purpose, pool core competencies and share risks, responsibilities, resources, costs, and benefits.

In this perspective, I must mention the cooperation between Bangladesh and the Netherlands goes back over half a century, have worked together on flood management, drainage, river basin management, and coastal zone management – creating safe polders and making land available for the landless. The **Bangladesh Delta Plan 2100,** the latest long term visionary plan, is an important step towards fulfilling our commitment of achieving a safe, resilient and prosperous Bangladesh. In order to face challenges and realize the potentials of the Bangladesh Delta, Bangladesh have adopted the long-term visionary techno-economic plan- "Bangladesh Delta Plan 2100 (BDP 2100)" with the cooperation of the Kingdom of the Netherlands.

I would like to take advantage to note that the South Asia countries are quite distinct in population, social &economic structures, and development challenges. This region is full of opportunities along with vulnerabilities. Sustainable Development offers a unique transformative opportunity to narrow down the development gaps and provide a life of dignity and sustainable prosperity to nearly a quarter of the global population that lives in South Asia. Looking at regional cooperation as a complement to the bilateral and multilateral relations, SAARC aimed at providing a platform for the people of South Asia to work together in a spirit of friendship, trust and understanding, at promoting the welfare, and at improving the quality of life of the people of the region through accelerated economic development, environment development, and social progress, SAARC needs to consistently promote interaction on sustainable development issues of common concerns to its members, and identify areas in which collective position could be projected at international forums. I strongly hope, the respective country needs close partnerships of government and knowledge institutions towards solid coupling of science and policy.

It is also important that an integrated framework of effective institutions is essential for sustainable development. Building this framework requires coherent integration of policies across the economic, social, and environmental spheres; significant participation of civil society in policy making and implementation; coordination between national governments and international organizations; and strong political commitment to a long-term perspective. In this respect, Bangladesh is well advanced. Bangladesh government has developed a Sustainable Development Strategy for the period of 2010-2021. The strategy is guiding the annual plan and Five Years Plan. The Bangladesh Delta Plan 2100 will guide us making the development plans, programs, and projects towards building a Sustainable Bangladesh.

The 5th UIU-ICSD 2022 is one of the initiatives of partnering with the government towards attaining the challenges of Sustainable Development and facilitating forums, e.g., ***Delta Forum*** (initiated by IDDS at UIU from its ICSD process) of collective actions in national, regional and international levels.

Hamidul Huq, PhD, WUR

Convener, 5th UIU-ICSD 2022
and
Professor and Director
Institute of Development Studies and Sustainability (IDSS)
United International University
20 February 2022

United International University: An Overview

United International University or UIU is a private university located in Dhaka, Bangladesh, The government of Bangladesh approved the establishment of United International University in 2003 under the Private University Act (PUA) 1992 (now replaced by PUA 2010). Financial support came from the United Group, a Bangladeshi business conglomerate.

Vision: To become a center of excellence in teaching and research in the South Asian region.

Mission: To produce graduates with excellent intellectual, creative, technical, moral and practical skills of the highest possible degree with undiminished human values.

Strategy: To develop a united, interactive, involving and caring relationship among teachers, students, guardians and staff.

Policies:

- To develop and implement the state-of-the-art curricula
- To recruit committed, accessible and inspiring teachers
- To select meritorious and promising students
- To provide the most attractive infrastructure and logistic support
- To maintain an environment free from smoking, drug, politics and session jam
- To pursue a never-ending quest for excellence in knowledge, learning, skill development, teaching and research.

Schools and Institutes of UIU

School of Business & Economics
School of Business & Economics offers the following programs;

- Bachelor of Business Administration (BBA)
- BBA in Accounting and Information Systems (AIS)
- Master of Business Administration (Executive)
- Master of Business Administration (Regular)
- BSS in Economics;

- Master in Economics;
- Master in International Human Resources Management

School of Science and Engineering

School of science and Engineering offers the following programs;

- Department of Electrical and Electronic Engineering (EEE)
- Department of Computer Science and Engineering (CSE)

School of Humanities and Social Sciences

School of Humanities and Social Sciences offers the following programs;

- Master in Development Studies
- Environment and Development Studies

Center and Institutes of UIU

- Center for Energy Research
- English Language Institute
- Institute of Natural Sciences
- Institute of Business & Economic Research (IBER)
- Institute of Quality Assurance Cell (IQAC)
- Institute of Development Studies and Sustainability (IDSS)
- Centre for Information Technology Service (CITS)
- Center for Engineering & Scientific Research (CESR)
- Institute of Advance Research (IAR)
- Power and Training Academy (PETA)
- Cisco Network Academy

To know more about UIU, please visit **www.uiu.ac.bd**

Institute of Development Studies and Sustainability

About IDSS

Institute of Development Studies and Sustainability (IDSS) at United International University (UIU), launched in Fall 2014, is committed to interdisciplinary hub for research, teaching, and collaborations for narrowing down the science-policy gap towards sustainable development. The IDSS promises to advance knowledge of Sustainable Development through its graduate and diploma programs, outreach programs for the broader community, and faculty research. The IDSS is committed to managing and expanding the interdisciplinary major in Development Studies and Sustainability by providing students with fellowships, scholarships, and study opportunities through collaborations with universities in Asian countries. Finally, the institute promises to contribute to UIU's vision of becoming the center of excellence in teaching, learning and research in the South Asian region.

Vision of IDSS

Knowledge based peaceful, Green and Sustainable Society.

Mission of IDSS

Interdisciplinary Education and Research towards building strengthened human capital to lead sustainable development missions through collaboration and collective actions.

Objectives of IDSS

- To study political, social, economic, humanitarian and other challenges of Sustainable Development in Bangladesh and Asia.
- To promote and undertake research on current development issues, ethnic diversities, gender, migration, sociolinguistic and cultural studies of Bangladesh and other Asian countries.
- To run collaborative empirical research to generate and share knowledge of sustainability and contribute in reducing science-policy gaps.
- To initiate and maintain international academic exchange, affiliation and coordination of research activities of Bangladeshi and Asian scholars.

- To organize national and international seminars, conferences and disseminate its research works in various publications.

Graduate Program

UIU-IDSS offers Master in Development Studies (MDS) program, which is designed in interdisciplinary. The MDS program focuses on issues of sustainable development, climate change adaptation, renewable energy, disaster management, poverty, water resources management, sustainable livelihoods, and environment. The IDSS has a plan to offer PhD program in collaboration with universities in Asia.

Diploma program

In moving China-Bangladesh relations forward, the key challenge is to increase 'understanding' China –Economy, History, Administration and Government, Business Policies and Practices, Higher Education System, Chinese People and their Culture and so on. Given Bangladesh's steady economic growth and urbanization, business partnership with China, the country, especially the business and knowledge sectors need to develop knowledge, skills, understanding and research capacity on China. Globally, China is now the second largest source of outward investment and is projected to become the biggest source by 2020. The challenge is to avail these opportunities for the interests of Bangladesh.

Grounding on this background the center offers short course of Diploma in Development Studies on China: Government, Policies, Business, Culture and Language. Center also plans to offer full range of instruction in the two major East Asian languages: Chinese and Japanese.

Research Priority of IDSS

Like others the UIU-IDSS believes that the 'world needs to do far more and do it faster'. National policymakers face the challenges of implementing the indivisible agenda for 17 SDGs and achieving progress across the economic, social and environmental dimensions of sustainable development. Therefore, there is a need to address the scope and systemic nature of the 2030 Agenda and the urgency of the challenges. This requires a wide range of tools and science-based analysis to navigate the complexities and to realize the ambitions. IDSS's research priority on SDGs 1, 6, 7& 11:

Other than the above mentioned top priority of research, the following are the priority areas of the UIU-IDSS's research:

- Study and assess the social response to development programs and its implications in terms of various policy options for sustainability;

- Examine complexities of development interventions vs local initiatives of sustainable livelihoods;
- Study climate change adaptation options and policy research and advocacy for scaling up of good practices;
- Study Gender and Development;
- Study DRR and Sustainable Livelihoods;
- Study cultural diversities.
- Bangladesh Delta Plan 2100

Approach of IDSS

Interdisciplinary Research and Education is the main approach of UIU-IDSS. IDSS understand that the challenges of policymakers are implementing the indivisible agenda for 17 SDGs and achieving progress across the economic, social and environmental dimensions of sustainable development. This requires a wide range of tools and science-based analysis to navigate the complexities and to realize the ambitions. The UIU-IDSS is committed to delivering high quality results and workable solutions to the policymakers and practitioners. IDSS would apply research-oriented, robust approaches, responding to on-the-ground realities. It would seek to enhance and foster knowledge sharing and exchange with other national and international institutions around home and the globe.

UIU-IDSS would generate knowledge through empirical research of its faculty and post graduate students as well as engaging in collaborative research projects in partnership with foreign and local universities. Teaching, publications and national and international seminars would be the main means of sharing knowledge.

Strategy:

A. Strategies for Research Work

i. Research work shall be interdisciplinary in nature and mostly empirical;

ii. Students of MDS shall be providing with scope and opportunities of getting engaged in research projects;

iii. Research projects to be carried out on regular basis with UIU Research Grant;

iv. Research projects will be carried out mobilizing external fund;

v. IDSS will join collaborative Research Projects with other universities abroad;

vi. Respective Researchers shall publish Articles in International Peer Reviewed Journals;

vii. Contributions in book chapters of quality publishers would be regular outputs;

viii. Books to be published from quality (publishing) houses;

ix. Regular activities to be organized on “Science-Policy” interface;

- Seminar
- Symposium
- Dialogue
- Public Lecture.

x. Collective initiatives for sharing knowledge, policy advocacy, and “Research with Impacts” to be mobilized through strengthened networks with knowledge institutions and development practitioners;

B. Strategy for Graduate and Post graduate programs:

i. The Institute will continue offering the Master in Development Studies (MDS) program;
ii. Staff training in home and abroad to be organized to maintain quality teaching;
iii. Making the Teaching Applied;
iv. Participatory Teaching;
v. Field Study/Study Tour;
vi. Collaborative Programs with Foreign Universities;
vii. Students exchange program with Foreign Universities;
viii. Hosting and guiding Masters and PhD foreign students for their field Research;
ix. Periodical review of course syllabus by engaging internal and external experts;
x. Innovation in Teaching Aids;
xi. Offering PhD Program in collaboration with Foreign Universities.
xii. IDSS offers all GED Social Science Courses of all disciplinary programs of UIU.

Master in Development Studies (MDS) program

The landscape of development world is changing. Development paradigm is continuously under pressure of shifting. Education for Sustainable Development has emerged as a paradigm for revising and reorienting today's education. Development world demands new knowledge and leadership with adequate capacities. Challenges of universities are to ensure offering quality higher education along with interdisciplinary research.

The United International University (UIU), established in 203, one of the leading private universities of Bangladesh, shouldering a challenge of offering quality post graduate program on Master in Development Studies (MDS). With a commitment to contribute in producing young professionals with capacity of interdisciplinary knowledge and skills to response to the growing demand of professionals in government, NGO and private sectors in Bangladesh. Going abroad for higher studies is always not possible because of time constraints, lack of scholarships, and family affairs. UIU designed its MDS program in such a way that ensures international standard and within affordability.

UIU has been offering a 39 credit hours MDS program since Spring 2009 Trimester. MDS program includes unique courses that enrich students' knowledge, skills, and abilities to analyze development and society. The courses help students in assessing needs of the society, and develop, design, monitor and evaluate development programs and projects. Emphasis is given on knowledge generation in sustainable development. Special focus is given on Interdisciplinary Education and Research.

Special features of UIU MDS program: Students have scope of engaging in collaborative research projects; present papers in International Conference on Sustainable Development held in every February at UIU; produce and publish articles jointly with UIU Faculty; build networks with development actors through participation in forums of MDS program of UIU.

Eligibility for Admission

- A Bachelor degree (Hons) in Economics with CGPA of not less than 2 or equivalent or at least a Second-Class Master degree from a recognized university with basic courses in economics and business studies.

- Two/three- years Bachelor degree (pass) holders are also eligible for admission without the benefit of course waivers.
- Must pass the university admission test.
- Applicants with at least two years' experience in a public, private or NGO sector program/project shall get priority in admission.

Tuition Fees, waiver and scholarship policy

UIU charges Tuition Fees for MDS program @Tk.3700 per Credit. But UIU offers 25% Tuition Fee Waiver for the students having GPA 3.50 on Scale of 4.00 & GPA 4.37 on Scale of 5.00 in HSC & above or equivalent level of public examinations.

The MDS students who have been working in government, semi government and NGO sector having a minimum of 5 (five) years' experience will be entitled to 40% tuition fee waiver.

Top 20% of UIU students get 25% to 100% tuition fee waiver on the basis of trimester examination results.

MDS Program Structure:

Title	Number of Courses	Number of Credits
Foundation Courses	3	9 Credits
Core Courses	6	18 Credits
Elective Courses	2	6 Credits
Thesis/Two selective courses	1/2	6 Credits
Total	12/13	39 Credits

For further information kindly contact: Prof. Dr. Hamidul Huq, Director, IDSS. Email: hamidulhuq@idss.uiu.ac.bd Cell: 01819259969.

BSS in Environment and Development Studies

Sustainable Development is a challenge of the moment. The youth are expected to lead the sustainable development movement. There is no alternative to interdisciplinary knowledge and competency in leading Sustainable Development. Besides theoretical ground, an empirical

understanding of the three main 'Pillars of Sustainable Development: Environment, Social, and Economic Development' is crucial. The UIU offered BSS (Hons.) in Environment and Development Studies nourishes you to grow as a compatible young leader to reconstruct a knowledge-based sustainable society. The graduates in Environment and Development Studies from UIU will have employment opportunities in the government organizations, banks and financial institutions, education and research institutions, non-government and private organizations, NGOs, INGOs, industries, electronic and print media, power sector organizations, and in various sectors in the national and international domain.

In a speech in 2015, Mr. Bill Gates, co-founder of the Microsoft Corporation, predicted an infectious virus and an impending pandemic, coinciding with the current global epidemic of coronavirus infection. A few months ago, he predicted another catastrophic pandemic that is 'Climate Change'. By 2060, climate change will be as deadly as Covid-19 and by 2100, it will be five times more frightening than the current one. To win over contemporary global challenges regarding climate change and sustainable development, there is no substitute for having up-to-date knowledge of environment and development. UIU's BSS in Environment and Development Studies promises to build leaders in national and international spheres in tackling climate change catastrophes, which is a barrier to sustainable development.

Key Features of EDS:

- A global standard undergraduate degree offered for the first time in Bangladesh
- Unique interdisciplinary program
- Credit Transfer facilities to foreign universities
- Research Oriented Faculty
- Interdisciplinary research work opportunities targeting SDGs achievement
- Working and networking opportunities with national and foreign academics and development practitioners
- Field visits and internship programs for hands-on learning
- Reading materials are made available online
- Opportunity to join student clubs and forums for extra-mural activities
- Direct Admission to Master in Development Studies (MDS) Program of UIU

5th International Conference on

Sustainable Development

Towards Reconstruct the Knowledge-based Society

International Advisory Board of 5th UIU-ICSD 2022

Prof. Dr. Chowdhury Mofizur Rahman

Vice Chancellor (Designate) since November 2017
and Pro-Vice Chancellor since April 2006
United International University

Prof. Dr. Chowdhury Mofizur Rahman is the Vice Chancellor (Designate) since November 2017 and Pro-Vice Chancellor United International University from April 2006. Prof. Chowdhury is a Professor of the Department of Computer Science & Engineering of UIU. He has been teaching in CSE Department of UIU since 2003. Prior to that he was a Professor, Head of Department of Computer Science & Engineering at Bangladesh University of Engineering & Technology (BUET). He was awarded Monbusho Scholarship by Japanese Ministry of Education and Culture and pursued his PhD from Tokyo Institute of Technology, Japan in1996. He obtained his M.Sc.Engg. from Department of Computer Science & Engineering, Bangladesh University of Engineering & Technology in 1992 with a CGPA of 3.75 in a scale of 4.0 and B.Sc. Engg. from Department of Electrical & Electronic Engineering, Bangladesh University of Engineering & Technology in 1989 with 1st class Honors marks.

Prof. Chowdhury obtained IEEE AI'95 best paper award at 8th Australian Joint Conference on Artificial Intelligence, Canberra, 1995. He got JSPS Short Term fellowship as a Visiting Researcher at Tokyo Institute of Technology in 2000-2001. He went to University of Bradford, UK from 17.10.2009 to 12.12.2009 under the EU sponsored eLINK project as Visiting Professor. He worked as coordinator from Bangladesh in the EU sponsored (EM ECW Ref: 149674-EM-1-2008-1-UK-ERAMUNDUS) eLINK (*e*ast west Link for *I*nnovation, *N*etworking and *K*nowledge exchange) project. Prof. Chowdhury has as many as 119 articles published in international journals.

Professor Dr. M. Rezwan Khan
Director
Institute for Advanced Research
Professor, Department of Electrical & Electronic Engineering
United International University (UIU)

Professor Dr. M. Rezwan Khan is the Professor of Department of Electrical & Electronic Engineering and the immediate past Vice Chancellor of United International University (March 2005 – November 2017). Prior to taking charge of Vice Chancellor, Prof. Rezwan Khan served UIU as the Professor and Dean of School of Science and Engineering at United International University [February 2004 – March 2005 (On leave from BUET) and also director of (Institute of Advanced Research). He started his professional journey as Lecturer of the Department of Electrical Engineering at Bangladesh University of Engineering & Technology (BUET) in April 1980 and ended up with BUET as Professor in 2005. Prof. Khan visited Clarkson University, Potsdam, New York, USA, as a visiting faculty member for the Summer Session II, July 3 – Aug. 5, 2000, and taught the summer course on Microelectronics (EE341).

Professor Rezwan Khan has been selected as Distinguished Lecturer of IEEE for his outstanding research work on DC Power system for the year of 2017-2018. IEEE is the World Largest Professional association for the Electrical and Electronic Engineers. Prof. Khan is a veteran researcher in electrical engineering and he has been contributing in the renewable energy sector of Bangladesh significantly. He has a large number of publications in international journals.

Professor Dr. Hajime Nakagawa
Professor, Disaster Prevention Research Institute, Kyoto University

Hajime Nakagawa is working as a Professor of Prevention Research Institute at Kyoto University since 1981 onwards. He obtained Bachelor, Master and Doctor Degree from Department of Civil Engineering in Kyoto University (Dissertation Title: Risk assessment of flood and debris flow). He is currently He was an Associate Professor in Sabo Section (1990), Anti-Flood Hazard Systems (1992) and Urban Flood Hazard in Bay Area (1995),under Disaster Prevention Research Institute and then Professor in Research Center for Fluvial and Coastal Disasters, DPRI, in 2001 Kyoto University. His main research topics are (1) mechanisms and prevention/mitigation schemes of flood and sediment disasters, (2) strength evaluation of river-disaster prevention facilities such as river dykes, (3) research on interdisciplinary hydraulics, and (4) echo-hydraulics, hydro science and hydraulic engineering.

Professor Dr. Md. Munsur Rahman
Professor, Institute of Water and Flood Management, BUET

Md. Munsur Rahman did his BSc in Civil Engineering from BUET. He obtained MSc and PhD from Kyoto University and joined Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology (BUET) in 1999. He was a Post-Doctoral Research Fellow during 2002-2004 in Disaster Prevention Research Institute (DPRI), Kyoto University funded by Japan Society of Promotion of Science (JSPS).He became a professor at IWFM, BUET in 2008 and has been involved in a number of national and international research projects. During his 24years professional career, Prof. Munsur focuses his research on the formation processes of large-scale sand bars in tidal and non-tidal rivers, together with the growth of char land resources and livelihoods strategy of the people living there. During 2007-2009, he executed a collaborative research with Vietnam, Cambodia and UK funded by DelPHE on the issue of river erosion bank protection and social response. Since 2012, he has started (as PI) a 4-year-long consortium grant project with UK, Indian, and Chinese partners on the theme of health, livelihood, ecosystem services and poverty alleviation in populous deltas funded by ESPA (www.espadelta.net). The results will be useful in managing the populous deltas in a sustainable manner. He is working as Bangladesh PI of the consortium project Deltas Vulnerability in Climate Change: Migration and Adaptation (DECCMA) under CARIAA program jointly funded by IDRC and DFID. Prof Munsur is working as Bangladesh PI of the 5 year long project Disaster Prevention/mitigation against Storm Surges and floods in Bangladesh under the SATREPS program jointly funded by JICA and JSTA since 2014.General research interests are grouped into River and coastal processes, morph dynamics and river and coastal management; Ecosystem services of river, coasts and floodplain system, Indigenous approach on river, coasts and floodplain management; Bridge hydraulics and related problems.

Professor Dr. Margreet Zwarteveen
Professor, Water Governance at UNESCO-IHE, Delft, The Netherlands.

Margreet Zwarteveen is Professor of Water Governance at UNESCO-IHE, Delft, the Netherlands since June 2014. Prior to that Margreet was an irrigation engineer and social scientist, working since 1998 at the Centre for Water and Climate at Wageningen University. From 2012 onwards she was an Associate Professor, and also assumed responsibilities for coordinating gender studies education at the Wageningen University. Margreet studies water allocation policies and practices, focusing on questions of equity and justice. Her research includes the study of different modalities of regulating water flows (technologies, institutions) and of ways to understand (knowledge) or legitimize these. She uses an interdisciplinary approach, seeing water allocation as the outcome of interactions between nature, technologies and society. In a project financed by the Netherlands Organization for Scientific Research, she works with a number of colleagues from Benin, France and Morocco to study how the introduction of supposedly water efficient technologies (drip irrigation) is accompanied with, and causes, changes in water tenure relations and water distributions that favor some people more than others. An interesting new project that she is coordinating similarly sets out to explore how new investments in irrigation systems along the Nile in Ethiopia, Sudan and Egypt re-allocate

water and water-related benefits, tracing what this means for different groups of people and for ecosystems. This project is part of the CGIAR Water, Land and Ecosystems Program. In her work, Margreet favors an interdisciplinary approach, seeing water allocation as the outcome of interactions between nature, technologies and society. She is also involved in several research projects funded by NWO-WOTRO, such as The Globalization of Water Struggles and Hydropower development in the context of climate change.

Professor Rajib Shaw
Professor, Graduate School of Media and Governance
Keio University
Shonan Fujisawa Campus (SFC), Japan

Professor Dr. Rajib Shaw is the Executive Director of the International Program Office of the Integrated Research on Disaster Risk (IRDR) program hosted at the Institute of Remote Sensing and Digital Earth in Beijing. He is Professor, Graduate School of Media and Governance Keio University Shonan Fujisawa Campus (SFC), Japan. Shaw was a Professor in the Graduate School of Global Environmental Studies of Kyoto University, Japan. He has extensive experience in disaster risk reduction (DRR) research and has worked closely with local communities, NGOs, governments and international organizations in Asia. His research expertise includes community-based disaster risk management, climate change adaptation, urban risk management, and disaster and environmental education. He is the editor of a book series on disaster risk reduction, published by Springer, and is Co-chair of UN ISDR's Asia Science Technology Academic Advisory Group (ASTAAG). Shaw has published extensively in scientific journals and books. He is currently the President of Asian University Network of Environment and Disaster Management [AUEDM], and the Co-chair of UN ISDR Science Technology Academia Stakeholder Group. Professor Shaw has extensive publications in different journals, books and edited volumes.

Professor Mahbuba Nasreen
Director and Professor, Institute of Disaster Management and Vulnerability Studies, University of Dhaka

Mahbuba Nasreen is the founding Director of Institute of Disaster Management and Vulnerability Studies at University of Dhaka. Dr. Mahbuba Nasreen has been involved in research in the areas of theory, gender, disasters, environment, climate change, education, social inclusion, indigenous community and other areas of social development since late eighties. She has joined as a Lecturer in the Department of Sociology in 1988 and became Professor at the same department in 2005, University of Dhaka. After obtaining MSS in Sociology from the University of Dhaka, Dr. Nasreen received Commonwealth Scholarship for pursuing her PhD Degree in New Zealand. Her dissertation topic was "Coping with Floods: the Experiences of Rural Women in Bangladesh". She obtained PhD in1995. Prof. Nasreen is the first woman attaining the PhD research who, since the mid-90s, forcefully arguing that women are contributors to resilient rather than conventional viewing of them as mere victims of disasters. As a member of the National Disaster Management Advisory Committee, Ministry of Disaster Management and Relief (MoDMR), Government of the People's Republic of Bangladesh (GoB) Prof.

Nasreen contributed to policy making in reducing disaster risks and other relevant areas of national and international drivers.

Professor Boris Braun
Professor, Human and Economic Geography, Department of Geography, University of Cologne, Germany

Dr. Boris Braun is a professor for Human and Economic Geography, Department of Geography, at University of Cologne. He completed his Diploma (1992), PhD (1994) and Habilitation (2001) at University of Bonn. Professor Boris has over 23 years of teaching and research experience in various reputed universities in Germany. He started his journey, as a Research associate in the Department of Geography at University of Bonn since February 1992 and then became the Assistant professor of Department of Geography at University of Bonn in 1995. He joined as professor (fixed-term contract) for Economic Geography, Faculty of Economics at University of Mannheim in 2002. Then he also worked as a professor in Department of Geography in University of Bamberg.Prof. Braun started his journey as a University professor for Human and Economic Geography, Department of Geography, University of Cologne in January 2008. His research interests are environmental economic geography, environmental management, industrial and urban change; environmental and social impacts of globalization, economic and social aspects of natural hazards in South Asia (mainly India and Bangladesh), Australia, Germany and Western Europe. Prof. Braun has worked as a Scientific Adviser in “GeographischeRundschauâ• for the German Research Foundation (DFG), the German Academic Exchange Service (DAAD) and several national and international journals. He was the board member of the Association for Australian Studies (1998-2007).

Professor Mukta S. Lama (Tamang)
Professor, Central Department of Sociology/Anthropology, Tribhuvan University

Professor Mukta S. Lama (Tamang) completed his PhD from Cornell University with the dissertation entitled “Himalayan Indigeneity: Histories, Memory, and Identity among Tamang in Nepal”. Dr. Lama, an indigenous rights activist is a Professor of Sociology/Anthropology in Tribhuvan University, Nepal. He holds a PhD in anthropology from Cornel University entitled, 'Himalayan Indignity: Histories, Memory and Identity among Tamang in Nepal'. He has conducted several research studies in the areas of social inclusion, indigenous peoples and other excluded and minority groups. He has published several articles, books and contributed to journals and presented several papers in the national and international arena. His publications include Cultural Diversity and Democracy in Nepal, Himalayan Research Bulletin, (21)2, 2002, The Working of Democracy in Nepal, Seminar, April 2005, Emotional Aspects of Peer Relations among Children in Rural Nepal (with Pamela Cole and Alice Walker), in X. Chen, D.C. French, and B.H. Schneider (eds.) Peer Relationships in Cultural Context (2006), and Culture, Caste and Ethnicity in the Maoist Movement, Studies in Nepali History and Society, (11)2, 2006. He was Senior Research Fellow at Nepal School of Social Sciences and Humanities from 1March 2012 to 28 February 2013.

Professor Dr. Abdul Shaban
Professor, School of Development Studies,
Tata Institute of Social Sciences, Mumbai, India

Abdul Shaban is a professor at the School of Development Studies, in Tata Institute of Social Sciences. He has done his Masters on Geography from Jawaharlal Nehru University (JNU), New Delhi, and M.Phil. and PhD from Indian Institute of Technology (IIT), Mumbai. He has published 3 books and over 40 papers in various refereed journals and edited books. Dr. Shaban has been Visiting Professor at the Erasmus School of History, Culture and Communication, Erasmus University, The Netherlands; Department of Geography, University of Paris- 7, Paris, France, and at University of Masaryk (Brno) and Palacky University, Olomouc, Czech Republic. He has also been Fellow at the Department of Geography and Environment, LSE, London. He was Commonwealth Academic Staff Fellow at Cities Programme, London School of Economics and Political Science (LSE), London during 2011-12. He was member of Mahmoodur Rahman Committee, set up by Government of State of Maharashtra, and Post-Sachar Evaluation Committee, Ministry of Minority Affairs, Government of India. Currently he is, a Deputy Director TISS Tuljapur Campus, Osmanabad, Maharashtra, and Professor at School of Development Studies, TISS, Mumbai, a Chairperson of International Relations Office (IRO), TISS, Mumbai and aÂ member of the Commission of Inquiry to Study Socio-Economic Status of Muslims in the State of Telangana under chairmanship of Shri G. SudhirÂ (IAS).

Professor E. R. Nimal Gunawardena
Professor, Agricultural Engineering, University of Peradeniya, Sri Lanka

E. R. N. Gunawardena is a Professor of Agricultural Engineering at the University of Peradeniya, Sri Lanka. He completed his BSc in Agriculture from the same university. He obtained his MSc and PhD in Soil and Water Engineering from Cranfield University in UK. During his 30 years of career, he served as Head of the Department of Agricultural Engineering, Dean of the Faculty of Agriculture, and Deputy Vice Chancellor of the University of Peradeniya. He was a Fulbright scholar at the University of Athens, Georgia, USA and worked with the Institute of Hydrology and Oxford Forestry Institute of UK on collaborative research projects.He has published extensively in the areas of hydrological simulation, irrigation, drainage, and watershed management and was involved in formulating the protected area network of Sri Lanka and drafting the forestry sector master plan. His current research interests lie in the area of Integrated Water Resources Management. He was the first country coordinator of the CapNet, a UNDP project on capacity building in Integrated Water Resources Management (IWRM) and later became the Executive Director of SaciWATERs in Hyderabad India and the Project Director of the Crossing Boundaries Project, a regional capacity building project on IWRM, Gender and Water. As a consultant, he has undertaken various assignments in Sri Lanka for the IUCN, USAID, ADB, and FAO to translate research into practice. He also served as an international consultant to the UN/ESCAP and UNOPS.

Dr. Jeroen Warner
Associate Professor, Sociology of Development and Change Group, Wageningen University and Research Centre (WUR)

Dr. Jeroen Warner is the Associate Professor, Sociology of Development and Change Group at Wageningen University and research Centre (WUR). He did his MSc in International Relations from University of Amsterdam; PhD in Disaster Studies from Wageningen University. Dr. Warner teaches, trains and publishes on domestic and transboundary water conflict, participatory resource management, and governance issues. His main research interests are in social resilience and the disaster studies domain. He has long experience of working in Bangladesh. Dr. Warner's expertise is in Disaster Studies, Politics, Water Management, and Risk Analysis.

Professor William H. Derrenger

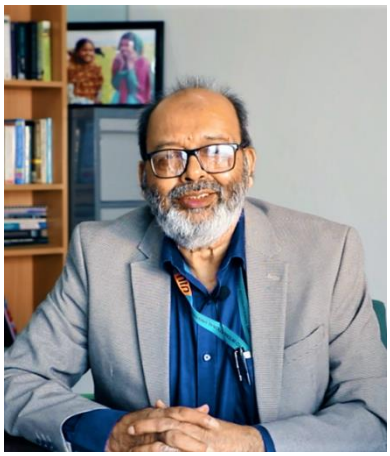
Dean, School of Business

Canadian University of Bangladesh (CUB)

Professor William H. Derrenger (Bill Derrenger) was the Founding Vice Chancellor of Canadian University of Bangladesh (CUB) and currently he is the Dean, School of Business of CUB where he is introducing practice based, education models to Bangladesh's higher education scenario and attempting to shift the higher education paradigm away from traditional academic, class based approaches to ones that give students opportunities to learn and apply fundamental concepts in the conduct of real work. Bill served ULAB as a Dean of School of Business during January, 2015 – February, 2016 where he introduced "The Business Process" across all course areas in The Business School as a paradigm shift in the delivery of UGC's mandated, University level Business School curriculum in the context of practice-based business processes. Professor Derrenger's innovative teaching and learning strategies gave USB's BBA graduates a competitive advantage in finding suitable, entry level employment due to their practical grasp of the needs of local employers. Professor Derrenger also worked as Associate Dean, Faculty of Business at Northern University, Dhaka during January, 2012 to January, 2015 where he used case studies to impart Strategic Planning, Organizational Development, Entrepreneurship and Business Communication skills to BBA/MBA candidates with academic, social and economic deficits. Bill served the American International School, Dhaka as Academic Advisor during September, 2001 to June, 2011. He is the Director, Agricultural Advisory Services (AAS), Dhaka since1991 – Present. AAS provides ongoing agricultural consulting services to a wide range of international funding agencies for purposes of promoting crop intensification and diversification projects among small and landless farmers. William H. Darrenger served different business, finance and development organizations in USA and Bangladesh for a quite long time. He has studied BA in Economics at Baylor University, Waco, Texas and MA, Educational Psychology, Strategic Planning & Human Capital Development at American International College, Springfield, Massachusetts, USA.

Dr. Megan Farrelly
Senior Lecturer in Human Geography, located within the School of Social Sciences at Monash University

Over the last decade Dr Farrelly has investigated various governance and institutional mechanism within the Australian urban water sector to advance a transformation in the functionality and livability of urban and rural environments. Her research interests span environmental governance, sustainability transitions, experimentation, learning and evaluation. Her current research focuses on the intersection of multiple infrastructure sectors (i.e. water, energy, green infrastructure), in order to understand what role this nexus plays in bringing about policy and practice change. In addition, and supported by PhD researchers, Dr. Farrelly has begun to explore the urban water governance challenges within Bangladesh and Indonesia. Dr. Farrelly has been heavily involved in the Cooperative Research Centre for Water Sensitive Cities, which seeks to inform the development of sustainable, resilient and productive cities and towns. She has led various social science research projects (i) examining how to transform storm water management practices; (ii) bridging evaluation studies, impact assessment and research adoption to inform the development of an evaluation and learning framework to support large-scale, complex research projects achieve maximum impact. Resulting from this body of research Dr Farrelly has been engaged in a number of external consultancies for Government Agencies and local governments.



Professor Dr. Hamidul Huq
Convener, 5th UIU-ICSD 2022 and
Professor and Director
Institute of Development Studies and Sustainability (IDSS)
United International University (UIU), Dhaka, Bangladesh

Dr. Hamidul Huq has specialization is in the areas of sustainable livelihoods, integrated coastal zone management, integrated water resources management, disaster management, ecosystem services, poverty alleviation, Sustainable Development, and Interdisciplinary Research and Education. Prof. Huq has a Masters with Honours in Social Welfare from University of Dhaka, and a PhD in Rural Development Sociology from Wageningen University, the Netherlands. His PhD dissertation was titled “People’s Practices: Exploring contestation, counter-development, and rural livelihoods”. Prof. Huq has been engaged in collaborative interdisciplinary education and research projects on ecosystem services, disaster management, and Integrated Water Resources Management, Solar Home Systems. Prof. Huq has 25 years of working experience in leading NGOs.

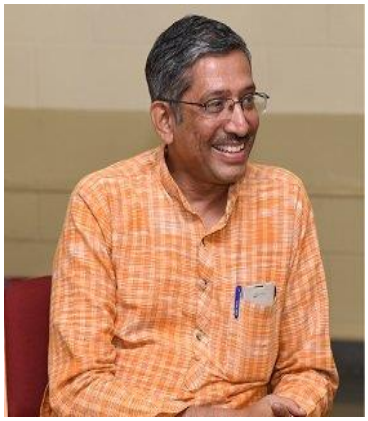
KEYNOTE SPEAKER AND CONFERENCE CLOSING SPEAKER

Keynote Speaker of Inaugural Session

Mr. Anderson Gitonga
Inclusive Development Director, CBM Global

Mr. Anderson Gitonga is a focused and dynamic community development practitioner who has successfully led multi-disciplinary teams in implementing community focused programs for the last twenty years focusing on the persons with various disabilities. Using his refined interpersonal and communication skills, he has facilitated conceptualization, design, resource mobilisation and implementation of community rooted projects focusing on promoting the rights of persons with disabilities. Currently, he is the Inclusive Development Director at CBM Global Disability. He has previously held key leadership positions as the Chief Executive Officer at the United Disabled Persons of Kenya, (National Umbrella organisation for Disabled Persons Organisation) He has held key programmatic and leadership functions at Act Change Transform, (former PACT-Kenya), Association for the Physically Disabled Persons of Kenya (APDK), Swedish Organisation of Persons with Disabilities International Aid Association (SHIA), Adventist Development and Relief Agency (ADRA), Blind and Low Vision Network (Blink), Kenya Society for the Blind and Kenya Union of the Blind.

Conference Closing Speaker



Dr. Seetharam M.R
Steering Committee Representatives - South Asia
Consultant Orthopedic Surgeon,
Vivekananda Memorial Hospital, Mysore
&
SWA CSO

Dr. M.R. Seetharam envisioned and led the implementation of various community level interventions in the sectors of Reproductive and Child health, Water and Sanitation, Community Based Rehabilitation of visually challenged. He is also the Adjunct Professor for International Programs of University of Iowa and Member of Regional Steering Committee, South Asia Region and Co-convener of National Steering Committee FANSA (Freshwater Action Network – South Asia.).

5th International Conference on
Sustainable Development
Towards Reconstruct the Knowledge-based Society

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Dhaka, Bangladesh

ABSTRACTS

THEME 1: SUSTAINABLE AGRICULTURE & FOOD SECURITY

Natural Silk as a Means of Sustainable Livelihood- A Case in Muga Silk of Assam (India)

Dr. Niranjan Das[1], Dr. Sujata Deori[2]

[1]Indian Council of Social Science Research Department of Business Administration, Tezpur University, Napaam-784028, Sonitpur-Assam (INDIA)

[2]Department of Geography, North Gauhati College, North Guwahati-784031, Kamrup-Assam (INDIA)

Abstract

The north-eastern region is a part of eastern Himalaya biodiversity hotspot in the world and hence endows with endemic flora and fauna. Muga Silk (Antheraea assamensis) has been and continues to be an integral part of Assamese life and tradition. Assam is literally a 'Silk country' and silk culture is deep-rooted in the rural life and culture of Assamese people where Muga silk is grown. There are 100 per cent of India's Muga silk production is originated in Assam and hence Assam silk occupies a unique position in the sericulture map of the world. Considering the ecological conditions, food plant distribution, presence of eco-types and species of diverse nature in co-existence, it is said that this region is home of origin of Muga. Muga cloth has 85.8 per cent absorption capacity of ultra-violet ray of sunlight. Muga, the unique golden-yellow silk of Assam was granted the Geographical Indication (GI) registration in 2007. More than 18 per cent of the rural population has been engage in muga rearing and it is one of the major sources of sustaining livelihood. The present paper will be highlighted the Muga as a means of sustainable livelihood among the rural folks of Assam.

Keywords: *Muga, Natural silk, Geo-environment, sustainable livelihood and Rural folks.*

Student Internship program as a solution towards facilitating south-south extension of agroecology knowledge: the case of Access Agriculture and University of the Philippines partnership

Dr Ahmad Salahuddin[1]

[1] Access Agriculture

Abstract

Access Agriculture is an international non-profit agency engaged in the promotion of agroecology. It does so by focusing on the creation and dissemination of farmer-to-farmer training videos through any possible advisory service provider in southern countries that promote agroecological knowledge. The concept of agroecology has increasingly been recognised by international actors and national governments as a key solution to curb the tide of climate change. For the past 5 years it has also been officially advocated by the Food and Agricultural Organization (FAO) of the United Nations. The agroecology concept cuts across the disciplines of environment, agriculture, biodiversity, food quality, local food systems, culture and many other sub-systems that contribute to supporting safe food-based livelihoods for all concerned stakeholders from production to consumers. Agroecology calls for effective collaboration between all stakeholders to be able to provide and generate adequate knowledge among the farming households, the value chain agents, the customers and the range of other important actors in this food system. There is a need to generate a huge range of knowledge products from across the world as no single country or region can satisfy the enormous demand for knowledge. Access Agriculture has successfully mobilized such knowledge at a slow but steady pace from professional groups across the continents to produce agroecology videos on many important topics. Based on demand, Access Agriculture translates the videos into local languages to make them more accessible to local farmers, so currently on its open access video platform it shares videos in ninety languages. Often Access Agriculture cannot meet the demand because of lack of resource and time constraints.

Recently, Access Agriculture has agreed to an understanding with the College of Development Communication (CDC), University of the Philippines, Los Baños, the Philippines, under which undergraduate students in their fourth year have been offered a semester of internship program to work as volunteers to translate the videos scripts into Philippines local languages. This example of collaboration between the university and Access Agriculture brings an innovation in the inter university and development agency education ecosystems to work for the promotion of agroecology approach as a win-win that can have the potential to serve millions of farmers with agroecology knowledge for free. This is an approach that any university (development, development communication, agriculture disciplines) can take as a part of its education program, as such helping farmers to access these world knowledge resources and improve their livelihoods.

Key words: *Agroecology, Access Agriculture, University of the Philippines, student internship, smallholder farmers*

A gassy gordian knot: A sustainable approach towards celebrating Eid-ul-Adha

Md Tawfic Noor[1], Antara Rizwani[2], Mohosina Hossain Nobony[3], Mehjabee Mahmud Mattra[4]

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Abstract

Globally the livestock industry is largely to blame for the greenhouse gas (GHG) emission occurring on a daily basis and, in 2010, it accounted for 18.1 gigatonnes (GT) CO2 -eq of the total global GHG emission. In regards to this emission, the beef cattle industry is especially notorious, causing the most amount of GHG emission. Bangladesh, much like the world, is also suffering as a result of its own beef cattle industry and, interestingly, 40% of all slaughters in Bangladesh occur within just three days of the year, during the observation of the holy Eid-ul-Adha. This can prove to be an issue for Bangladesh in terms of GHG emissions. However,

it can also provide the country with the unique opportunity to devise socially acceptable interventions for the celebration as a way to make it socially, economically, and environmentally sustainable. As a result, in our paper, we track and calculate the GHG emission driven by the demand for beef cattle generated during this festival. Analysis based on intensive literature review suggests a conservative number of 0.0687 GT of CO2 -eq of emission caused by the cows which have been slaughtered during Eid-ul-Adha in 2021. However, in order to provide a more accurate estimate of the actual GHG emission marking the festival, we have conducted an LCA in our paper (in compliance with ISO 14040-14044 guidelines), making use of the ReCiPe2016 model. Three main midpoint impact categories were taken into consideration – global warming, water use, and land use/transformation – and for the endpoint indicator, we are focussing on "damage to ecosystems". Through the effective implementation of the ReCiPe2016 model in our LCA, we will be able to determine an accurate amount of GHG emission at every step of the beef production and consumption process; e.g., GHG emissions due to growing feed, transporting cattle, etc. and thus estimate the total GHG emission due to the event. Finally, using the information generated, we were able to devise an intervention which we hope will be helpful in reducing the total GHG emission of the event whilst also in conserving the social and economic integrity of the event.

Organic Carbon Content and Fe-Organo Association in Soils under Rice Dominant Cropping System in Bangladesh

Puja Biswas[1], Md. Sanaul Islam[2], Abu Bakor Siddique[3], Milton Halder[4]

[1234] Soil, Water and Environment Discipline, Khulna University, Khulna

Abstract

Soil organic carbon (SOC) storage is significant for nutrient recycling and mitigation of greenhouse gasses emission from soil environment. It is investigated as to how SOC is varied and stored at iron (Fe) interface under different cropping systems. Thus, the experiment was conducted at three cropping systems consisted as Fallow-Fallow-Fallow (FL), Fallow - Fallow - Rice (OC), Fallow- Rice - Rice (TC). Soil samples were collected from the indicated cropping systems and three parameters were assessed: SOC, amorphous Fe oxides (Feo) and organically complex Fe (Fep) oxides. The results revealed that SOC content reduced significantly ($p < 0.05$) in the order of FL < OC < TC. Feo and Fep oxides also reduced significantly under OC and TC cropping systems compared to FL. A significant ($p < 0.01$) positive correlation between Feo and Fep oxides with SOC ($r = 0.93$, $r = 0.86$, respectively) was observed. The results suggest that Feo and Fep play a significant role to improve SOC storage through complex formation in soils of rice dominant cropping system.

Keywords: *Soil organic carbon, Cropping system, Organically complexed Fe oxides, Fe-organo association*

Biodegradation of poultry feather using Streptomyces sp. for nitrogen and its effect on growth and yield of okra

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Abstract

Purpose Improper management of poultry feather (PF) leads to various environmental problems. Biodegradation of PF using Streptomyces sp. was initiated to recover N because PF is rich in keratin protein which is difficult to break down. Methods PF was collected, washed, chopped, and was transferred to plastic pots (200 ml each containing 30g PF). Streptomyces sp. was cultured using selective media and transferred to plastic pot at different concentrations (0, 1, 2, 3, 4, and 5ml broth) with three replications. PF was composted under this condition for 75 days. The poultry feather compost (PFC) was used as fertilizer to grow okra in a separate experiment in pots. Different rates (0, 153, 306, 460, 613, and 766 kg ha-1) of PFC equivalent to 0, 50, 100, 150, 200, and 250 kg urea ha-1 based on N content was applied. Inorganic N was applied at the recommended dose (150 kg urea ha-1). Results Both total and available N content increased significantly in PFC with increasing concentration of Streptomyces sp. broth in composting media. Maximum N (15.31% total; 1.51% available) was found when PF was treated with 4 and 5 ml of Streptomyces sp. broth. Considering the plant's agronomic attributes and fruit yield, the application of 460 kg ha-1 PFC was found most suitable for growing okra. Conclusion Composting of PF with Streptomyces sp. is a viable technique to recover N from PF. PFC can make N rich organic amendment and reduce the use of chemical fertilizer (urea) in the agricultural field.

Keywords: *Poultry feather, Streptomyces sp., Biodegradation, Nitrogen, Soil amendment*

Suitability Assessment of Push-Pull Farming System to Combat Pest Infestation as a Nature based Solutions (NbS) of Climate Change Adaptation in Bangladesh

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Abstract

Bangladesh's economy is mostly centered on agriculture, which accounts for 18.6% of the country's GDP (gross domestic product) (BBS 2010). The adverse effects of climate change have a significant role to play in the rise in pest infestation that eventually obstructs agricultural yield. Diseases and pest incidences tend to rise in response to shifting temperatures and variable rainfall patterns (Rashid et al. 2014). According to estimates, 25% of vegetables, 20% of sugarcane, 16% of rice, 15% of jute, and 11% of wheat produced in Bangladesh are lost each year due to pest infestation (MoA 2010; Kabir and Rainis 2013a). Despite the lack of a formal record, it is thought that this loss is greater than that resulting from natural disasters such as floods, droughts, and cyclones (Kabir and Rainis 2013b). Farmers rely heavily on chemical insecticides to compensate for this massive loss. In the long run, pesticides or insecticides, which are inorganic chemicals, may be harmful for agriculture and also the environment. On top of that, these chemicals can be too expensive for the poor farmers of this country. Pesticide use grew from 2200 metric tons in 1980–1982 to 6500 metric tons in 1992–1994, while modern rice agriculture increased from 20.3 percent of total rice land to 49.0 percent (Rahman and Thapa, 1999). As an alternative to using pesticides or insecticides, a nature-based solution (NbS), such as, the push-pull farming system may be applied. It is an environment-friendly and cost-effective approach to control pest attacks. This system has been made very popular in Kenya, Africa. In this system, Napier Grasses are used around the periphery of an agricultural field which release a chemical that attracts or pulls pests towards them. In addition to this, Desmodium crops are planted within the agricultural field that release a chemical which repels or pushes pests away from them. This push and pull system in combination work together to

protect crops from harmful pests. It has also been reported that there is a rising pest infestation in the Rangpur district of Bangladesh. Moreover, Napier Grasses have reportedly been successfully grown in Rangpur since Napier grass has low water requirements and the Northwest region of Bangladesh is comparatively quite dry. This is why the push-pull farming system as an NbS may be attempted to be applied in Bangladesh as well. As a part of the National Adaptation Plan (NAP) project, Bangladesh is aiming to promote the concept of NbS. In this regard, this paper aims to popularize the push-pull farming system as an NbS initiative. In order to do this, a number of parameters, such as, soil characteristics, climate patterns, plant species characteristics etc. have been studied to ascertain if the push-pull farming system would be suitable in the context of Bangladesh. This paper has further provided recommendations for scaling up this NbS initiative and mainstream it among the general people.

Keywords: pest infestation, push-pull farming, climate change, nature-based solutions, adaptation

Nutrients Availability from Chicken Feather Waste under Composting through Peat, Forest and Agricultural Soils and Effect on Plant Growth

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[123] Soil, Water and Environment Discipline, Khulna University, Khulna

Abstract

Purpose Inappropriate supervision of chicken feather (CF) leads to various environmental problems. Management practice of CF under composting through Peat, Forest and Agricultural soils was initiated to recover nutrients because CF is rich in nutrients dominantly Nitrogen. Methods Compost of CF was prepared under aerobic and anaerobic conditions. Plastic drums (volume=8940.94cm3 , radius, r=12.75 cm and height, h=55cm) were used as decomposition vessels to bury the CF. The drums (8 drums) were washed with water. Compost was prepared mixing with 3 types of soils as the starter materials. The soil and CF was arranged layer by layer where the soil (3kg) and CF (9kg) ratio was 1:3 for both the two conditions and 9kg as a control. For anaerobic condition, the drums (4 drums) were sealed with air tight lid and plastic tape and kept them for three months. In the case of aerobic condition, the drums were opened at every 3 days interval of time and mixed thoroughly to control the temperature of feather pile buried into the soil. After 3 months composts were collected and samples were used in the laboratory for nutrients analysis and applied to tomato and beet crops. Results All the three applications resulted significantly in nutrient analysis dominantly in total nitrogen (peat-6.78%, Agriculture-5.54%, Forest- 4.93%) and the root, leaf and production of fruits both in tomato (total weight-1184gm) and beet were high (total weight-483.8kg) under aerobic peat application. Conclusion Composting of CF with Peat, Forest and Agricultural soils dominantly of peat soil is a viable technique to recover nutrients from CF. CF compost can make N and different nutrients rich organic amendment and reduce the use of chemical fertilizer (urea) in the agricultural field.

Keywords: *Chicken feather, compost, Nitrogen, Soil amendment.*

Impact on Crop Production (Paddy) due to Heat Wave: A Case Study of Derai, Sunamganj

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[123]Department of Disaster and Human Security Management, Faculty of Arts and Social Sciences, Bangladesh University of Professionals, Mirpur Cantonment, Dhaka-1216, Bangladesh.

Abstract

Rice is the staple food of Bangladesh as well as 17 countries in Asia and the Pacific. But the negative impact of global warming and climate change, rice production has been severely reduced and may threaten the food security of developing countries like Bangladesh. This study is undertaken to assess the potential impact of heatwave on the Boro rice production in Bangladesh and find out the correlation between heatwave and crop production. The research is conducted on quantitative method and data were collected from secondary sources. The crop production data were collected from District Agriculture Office, Sunamganj, and the meteorological data were collected from Bangladesh Meteorological Department (BMD). We also reviewed literature, newspaper, articles, the website of the district agriculture office, the website of the Bangladesh Bureau of Statistics (BBS), the website of the Bangladesh meteorological department, etc. We utilized newspaper, articles sources that are used for finding the impact of crop production due to heatwave. Multiple linear regression and correlation were conducted to assess the heatwave-crop interrelations based on three meteorological data for the period of 2010-2020. From our study, we found that climatic variables such as maximum temperature, average rainfall, and relative humidity have had a significant impact on rice production over the period under study. This paper also reveals that maximum temperature is statistically significant and negatively affects the rice production of Bangladesh. However, relative humidity has a significant effect on the seeding and harvesting period of Boro rice. Our research paper emphasizes the importance of heat-tolerant rice varieties, strategies to fight against heatwave and develop a better early warning system to establish sustainable agriculture which may help to maintain food security and help to mitigate the adverse impact of global warming and climate change effects. Keywords: Climate change, Boro rice, heatwave, food security, global warming.

Factors Influencing of Selection and Usages of Pesticides among the Peasants: A Qualitative Study of MasukBazar in Sylhet, Bangladesh.

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[123] Department of Anthropology, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh

Abstract

The performance of the agricultural sector has an overwhelming impact on the economy of Bangladesh that creates employment generation, poverty alleviation, human resource development, and food security. Pesticides' proper selection and usage are the prime barriers to successful and sustainable agricultural production. Because peasants mainly depend on the pesticide dealers and indigenous healing system. Therefore, this study explores the influencing factors of pesticide selection and usage that negatively impact the environment and health. We adopted a qualitative study design and conducted twenty in-depth interviews with peasants who produced vegetables and sold in the market, ten key informant interviews with pesticide dealers, local pesticide sellers, school teacher, and community health worker, and observation note has taken about the practical usages of pesticides in the field. Open code list generated and clustered different sub-themes and major themes following the thematic analysis. Results

reported that peasants used pesticides to maximize production and higher profit. They selected and used the pesticides that the seller suggested. Crop producers collect vegetables for selling at the market immediately after spraying pesticides. The peasants are unaware of pesticide use and do not know about the adverse side effects on health and the environment. Policymakers should consider the everyday way of pesticide selection and usages to improve food security through sustainable agricultural production.

Keywords: *Pesticides, Peasants, Selection, Usages, Bangladesh*

Nano fertilizer influencing the endophytic symbiosis and physicochemical properties of Oryza sativa as a sustainable alternative for commercial fertilizer

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[2] Laboratory of Nano-bio and Advanced Materials Engineering (NAME), Jashore University of Science and technology, Jashore 7408, Bangladesh

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Abstract

Due to the severe impacts of the excessive use of commercial fertilizer (CF), alternate fertilizer management is crucial for plant physiology, biochemical properties and microbial activities. Thus, our study was to investigate the comparative effects of mixed nano fertilizer (MNF) as an alternative to CF on endophytic symbiosis and biochemical properties of rice. We synthesized MNF and characterized by using scanning electron microscopy (SEM). Comparative endophytic study and physicochemical analysis were conducted as per required methods. The panicles per hill, length of panicles, grain per panicles, 1000-grain weight were not significantly ($p<0.05$) different treated with MNF treatments as compared to CF indicating the MNF as a suitable alternative for CF in rice cultivation. We have also found several predominant endophytes in rice plants (mainly seed and stem associated) treated with MNF such as Penicillium spp., Aspergillus fumigatus, Rhizopus spp. and Fusarium sp. that could have significant effects on the enhancement of growth and physicochemical properties in rice grain. Contrarily, stem-associated Cercospora spp. were found in CF treated field, which is phytopathogenic fungi causing cercosporin spots on leaves, however, any sort of disease spots was not observed in blank treated filed. Moreover, the biochemical properties such as protein, fiber, carbohydrate, energy, vitamin A and minerals were significantly increased with the application of MNF. MNF could be one of the most potent alternatives to CF for preserving the beneficial plant microbes (endophytes) in the field as well as sustainable environment.

Keywords: *mixed nano fertilizer, growth, and developments, endophytes, physicochemical properties, rice.*

Effects of nano mixed fish feed on water quality, growth performance, and nutritional properties of Catla fish, Catla catla

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Abstract

The study was to investigate the effects of commercial fish feed (CFF) and nano mixed formulated fish feed (FFF) on pond water quality, growth performance, meat quality, survival rate, and antioxidant properties of Catla catla. The experiment was carried out for 120 days in which CFF and FFF were supplied daily as 3% and 0.3% of the total body weight, respectively. The growth was calculated regarding total body weight, total length, specific growth rate (SGR), feed conversion ratio (FCR), and survivability. : Results revealed that weight, length, and SGR in FFF were significantly ($p<0.05$) higher than that in the CFF. However, a significantly ($p <0.05$) lower FCR was observed in FFF. No mortality was observed in both feed treatments. The protein, fat, energy and mineral contents, were significantly increased with FFF. Meat quality was also improved with the supply of FFF indicating the addition of two essential amino acids such as glycine and alanine. The antioxidant properties were also increased with FFF treatment. This study suggests that FFF has the potential to enhance the water quality, growth performance, nutritional properties, and bioactive compounds of Catla fish and thus it could be a potential alternative to CFF for aquaculture.

Keywords: *Fish feed; nanoparticles; proximate composition; nano nutrients; antioxidant pond water quality.*

Flexible label-free electrochemical DNA biosensor for selective detection of Shigella flexneri in real food samples

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Abstract

An effective tool for early-stage selective detection of the foodborne bacterial pathogen Shigella flexneri (S. flexneri) is essential for diagnosing infectious diseases and controlling outbreaks. Here, a label-free electrochemical DNA biosensor for monitoring S. flexneri is developed. To fabricate the biosensor, detection probes (capture and reporter probe) are immobilized on the surface of poly melamine (P-Mel) and poly glutamic acid (PGA), and disuccinimidyl suberate (DSS) functionalized flexible indium tin oxide (ITO) electrode. Anthraquinone-2-sulfonic acid monohydrate sodium salt (AQMS) is used as a signal indicator for the detection of S. flexneri. The proposed DNA biosensor

exhibits a wide dynamic range with concentration of the targets ranging from 1×10^{-6} to 1×10-21 $molL^{-1}$ with a limit of detection (LOD) of 7.4×10^{-22}molL-1 in the complementary linear target of S. flexneri, and a detection range of 8×106 -8 CFUml-1 with a LOD of 1 CFUml-1 in real S. flexneri sample. The proposed flexible biosensor provides high specificity for the detection of S. flexneri compared to other target signals such as discrete base mismatches and different bacterial species. The developed biosensor displayed excellent recoveries in detecting S. flexneri in spiked food samples. The proposed biosensor can serve as a model methodology for the detection of other pathogens in a broad span of industries.

Keywords: *Flexible sensor, label free detection, Shigella flexneri, DNA biosensor, polymelamine, poly glutamic acid*

Graphitic carbon nitride and APTES based an advanced electrochemical biosensor for detection of 17β-estradiol in food samples

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Abstract

This work demonstrates a simple and inexpensive electrochemical biosensing pathway for selective and sensitive recognition of 17β-estradiol (E2) in environmental and food samples. The biosensing system was fabricated by graphitic carbon nitride (g-C3N4) and a conductive polymer 3-aminopropyltriethoxysilane (APTES). The properties of the biosensor were investigated by using cyclic voltammetry (CV), differential pulse voltammetry (DPV), electrochemical impedance spectroscopy (EIS), total attenuated reflectance Fourier transform infra ray spectroscopy (ATR-FTIR), and scanning electron microscope (SEM). Important parameters such as pH and amount of g-C3N4 used to fabricate the biosensor were optimized to achieve the best performance of the modified biosensor. The proposed biosensor shows the ability to detect E2 in attomolar levels within a wide linear logarithm concentration range of 1×10^{-6} to 1×10^{-18} molL-1 with a limit of detection (LOD) of 9.9×10-19 $molL^{-1}$. The selectivity of the developed biosensor was confirmed by conducting the DPV of similarly structured hormones and naturally occurring substances. The proposed biosensor is highly stable and applicable to detect E2 in the presence of Spiked food and environmental samples with satisfactory recoveries ranging from 96.8 to 104.8%. The proposed electrochemical biosensor might be an effective alternative tool for the detection of E2 and other endogenous substances to attain food safety.

Keyword: *Graphitic carbon nitride, APTES, 17β-estradiol, Hormones, Electrochemical biosensor*

Farming for the future: Feasibility and sustainability analysis of vertical farming in Dhaka city

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Abstract

Rapid urbanization, unreliable road networks, and loss of arable land are only a few reasons why vertical farming (VF) should be considered in a city like Dhaka. Designating vertical farms across the city with effective pricing and a shorter supply chain will enable the residents of

Dhaka to enjoy nutritious, fresh produce. However, with VF there are concerns regarding resource use and energy requirements. When considering Dhaka in this multivariable equation, it can raise questions on the feasibility of a vertical farm in a stressed Metropolitan. The objective of this study was to use Life Cycle Assessment (LCA) to see if a vertical farm in Dhaka would yield feasible results. For the study, we have considered three leafy vegetables- mainly Basil, Lettuce, and Bok Choy. The sample farm itself has been considered as the system boundary to conduct LCA. Afterwards, an inventory was developed which looked at the quantifications of each type of input given to the farm. This involved accounting for every input including distances, fuel requirement for transport, amount of water, electricity, and nutrition needed by the plants and finally looking at the output and acknowledging any forms of waste. Developing and analyzing this inventory captured the entire process of how the farm worked and how their 5-layered vertical farm in a hydroponic agricultural system was practical for a city like Dhaka. For a functional unit of 400 plants, the farm allocated 500 liters of water, as well as 2 liters of nutrition culture. Once production is over, the water, which contains little to no nutrients is then treated and disposed of before another production cycle of vegetables takes place. On top of that, there is a significant reduction of emissions that come from transport because the maximum distance traveled to send vegetables to the buyers is 15 km. For now, the only concern is the significant electrical footprint. While still in the research and development stage, this farm shows great potential for improving the nutritional value of food in the city. Since the water used in the process has the potential to be recycled, the water requirement for vertical farms won't exhaust the water reserves in the city the way existing buildings and offices do. Our analysis yielded benefits that may sound more suitable to a rural environment but show hope for metropolitans like Dhaka city. With investments in green technology and energy, vertical farms show great potential to further explore the untapped potential of closing the gap in the existing supply chain.

Roles of Small-scale Producers in Sustainable Agriculture & Future Food Security: A Case Study from Sub-urban and Rural in Northern Regions, Bangladesh

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Abstract

In Bangladesh, agriculture is one of the leading sectors for greenhouse gas (GHG) emissions. Currently from agricultural sectors, the gross domestic product (GDP) declined to 12.65% significantly from 60% since 1960s. Therefore, the objective of the paper is to scrutinize the roles of small-scale producers in agro-productions for future food security in developing sustainable agricultures, particularly from northern regions such as Bogura, Rajshahi, Rangpur, and Dinajpur. This research investigates historical practices of agricultural lands, agro-productions, utilization of fertilizers, and impacts to soil health and compares with small-scale agro-practices in rural and sub-urban regions in Bangladesh. Along with extensive reviews, the experimental methodology includes offline and online surveys and data analysis by descriptive statistics for utilizations on chemical and bio-fertilizers, small-scale agroproduction, livestock or cattle farming, source for cooking fuel and cost, and possible impacts about climate change. The conducted survey represents 600 households from sub-urban, village, coastal and capital (megacity) respectively about 64, 20, 7.7, and 4%. From the secondary data and paper reviews, Bangladesh Bureau of Statistics indicate that fallow areas reduced while cultivable waste and

unavailable lands increased respectively 80% and 50% more in 2017 than in 2012. Though agro-lands are reducing, crop production increases without strong variations from 2014 to 2015. Moreover, utilizations of chemical pesticides from 1997 to 2018 indicate an increasing trend. However, in 2009, a decrease is in the trend noted because of awareness and policy. Though bio-pesticides considered in the policy in 2010, the continued uses of chemical insecticides keep damaging soil health. The survey analysis reveals that farmers confront challenges in low-income generation, inadequate nutrition, and difficulties in cooking fuels during monsoon. The results also indicate significant roles of small-scale producers in agro-practices that house gardening reduce stresses from chemical fertilizers or pesticides (210 families) whereas mesoscale (70 families) farmers use chemical fertilizers and pesticides at mega-production. Despite of cultivations, 58.14% of families cannot meet nutrition levels in the villages. The survey found most families depending on cylinder and biomass for their cooking fuels. Most villagers (42 families) also collect biomass from surroundings while some households (69 families) pay for biomass for cooking fuels. The fuel cost analysis show that mean expenses stand as biomass, cylinder, and pipeline gas respectively 850, 940, and 985 Bangladeshi Taka (BDT). Among small-scale producers, most villagers experience difficulties in cooking during monsoon periods. Based on the above analyses, small-scale producers provide opportunities in reducing carbon footprints, chemical fertilizers, and pesticides from agricultural sectors. Finally, the research aims to apply a circular economy model among small producers for developing biogas plants as a source for clean cooking fuel and income sustainability in Bangladesh.

Keywords: *Small-scale producers, Livelihood, Circular Economy, Agro-economy, Future Sustainability, Northern Regions, Bangladesh*

THEME 2: POVERTY ALLEVIATION

Entrepreneurship Development, Employment Generation and Poverty Alleviation at WASH Sector: A study of three cities, Bangladesh

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Abstract

WASH stands for water, sanitation and hygiene the important word that has had a deep impact to human life. In Bangladesh 45% of total population have not a decent toilet and 3.79 million of them don't have access to clean water. According to the World Bank, the economic cost of poor sanitation and hygiene in Bangladesh is US $4.2billion per year or the equivalent of 6.3% of annual GDP. The paper is highlighted how to minimise the economic loss and create employment opportunities through entrepreneurship development approach at WASH sector. Hope for the Poorest (HP), a national NGO in Bangladesh, is working on WASH entrepreneurs' development at urban and rural areas. The organisation has a track record on WASH entrepreneurs' e.g. local sanitation, small scale water vending, kitchen waste management and low-cost sanitary napkin at the local level supported by Simavi, a Dutch donor organisation. Find out the opportunity of employment generation in WASH sector thirty WASH entrepreneurs are randomly selected and well-structured interviews conducted on their personal and business experiences. At Satkhira, Kolaroa (of Satkhira district) and Barguna municipality is coastal areas where safe water, improved sanitation system and kitchen waste management facilities are very low. The women and girls feel shy to say they have menstruation. In this context, WASH entrepreneurs are doing their business successfully with motivating community people. Based on their experiences and evidences, every entrepreneur on average monthly income is BDT 15,000 that is sufficient for leading a family. Peoples from low-income family are selected to be entrepreneurs and if they are not entrepreneurs they mainly depend on daily labour wages that means a person will have opportunity to earn BDT 300 that is consolidated BDT 7,800 (26 working days counted) in a month. At the consumer point of view, they are getting WASH facilities at affordable cost and reducing their expense on WASH related diseases in comparing 5 years ago the situation. In those areas there are 133 (water = 45, sanitation = 55, kitchen waste management = 25, low cost sanitary napkin = 8) WASH entrepreneurs have successful business and having 266 local peoples employment opportunities. So, 400 families are directly involved in the business and changed their better livelihoods like the families are purchasing nutritious food; providing fees of children schooling; and they have future savings. If this approach is being followed in other municipalities (330) in Bangladesh, the total 14,520 low-income peoples would be entrepreneurs and almost 29,040 peoples would have opportunity to be employees. A research finding by the World Bank, the benefits of sanitation investment are conservatively estimated as 2.3 times the investment cost. So, WASH entrepreneurship development is important constituent of poverty alleviation at low-income family that is proved. Now the time to increase and support from government, international donors, non-government organisations and private sectors for low-income people to become and stay WASH entrepreneurs for alleviating their poverty.

Key words: *WASH, Entrepreneurship, Poverty alleviation, Employment generation.*

Measuring Rural Poverty Using Multidimensional Poverty Index: A Case Study in Khulna

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Abstract

This paper has analyzed the depth of poverty through an empirical investigation of two Unions in the Dumuria Upazila, Khulna district of Bangladesh. As, the targets under the first goal of SDG: 'end of poverty in all its forms everywhere' emphasize poverty reduction at different magnitude by the year 2030, poverty alleviation has become a key area to work on. The multidimensional Poverty Index (MPI) approach can be the best measures of monitoring the target of the first goal of the SDG. From Bangladesh Bureau of Statistics, poverty estimation of Bangladesh 2016 evident high level of poverty intensity in the Khulna District with HCR of 30.8% below Upper Poverty Line where it is 33.9% (high) for the Dumuria Upazila. Climate-induced shocks (i.e., cyclones) take place here in this Upazila frequently and these events damage livelihood assets and create stress in many dimensions of daily life among the inhabitants. The Head Count Ratio (HCR) cannot explain the severity when a poor become poorer thus it creates the necessity to work with the multidimensionality of poverty which can explain the severity of the deprivation. The quantitative research approach has been adopted in this study and a total 319 number of households have been selected as the sample and household data was collected from two Unions such as Sharafpur and Shovna. To construct MPI, 19 indicators have been considered under three major dimensions such as health dimension (6 indicators), education (2 indicators), and living standard dimension (11 indicators). A household is considered multidimensionally poor when it is found to be deprived in more than or equal to one-third of total dimensions-thus, this article considers the poverty cut-off of 0.33. The result found that 57.4% of the total population is multidimensionally poor (i.e., 174 households). These poor households are experiencing 52.3% of deprivation from total weighted indicators. The adjusted MPI score we found is 0.30 which indicates these two unions are deprived of 30% of the total potential deprivation. Moreover, the poverty cut-off justifies 20% of total households are in vulnerable condition to become MPI poor (0.2<=k< 0.33) whereas 9% of total households are experiencing acute poverty (k>=0.66). This severe magnitude of poverty is caused mostly by the lack of minimum years of schooling among at least one of the members of each household, lack of school attendance for the children who are supposed to go to school under education dimension; malnutrition, food coping, food diversity, prevalence of fever or diarrhoea under health dimension; lack of accessibility to a minimum area of cultivatable land, insufficient cash saving, flooring material under living standard dimension. This paper will create a background for different actors including NGOs, communities, local government, central government organizations to make community-level poverty alleviation planning effective and make them realize the areas where resource allocation is needed. The donors or government can take MPI as poverty monitoring tool in tracking poverty reduction process in different countries.

Keywords: *Rural Poverty, SDGs, Multidimensional Poverty Index, Headcount Index, Intensity Index, Khulna*

Human Security as a Key Driver of Poverty Alleviation in Developing Countries to Attain Sustainable Development

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Abstract

The dimension and concepts of security has widely changed from the late nineties. Human Security has transformed from state centered ideas to human centric ideas. Also, at the same time MDG was incorporated. SDG with much broader outlines were introduced from 2015. Both the MDG and SDG had one goal in common which is poverty alleviation. Numerous projects were undertaken by INGOs and governments. But there always remains a disparity for which the poverty is ever-increasing. Human Security can be a key driver in the field of poverty alleviation. Individual centric human security concepts could not be incorporated still in the developing and underdeveloped countries. If we take Central African Republic as a case study, we find that, at least 14000 military and 12000 civilian UN components are working in the country. Apart from that numerous international NGOs are also working. Millions of funds of different projects are underway for poverty alleviation. But due to the absence of human security: freedom from want, freedom from fear and freedom from indignity; alleviation of poverty remained an illusion. From 2014 at least 1million are dead in the country due to protracted violence. The fear of life remains as the biggest impediment for poverty alleviation in the region. The impact of the projects is overshadowed by the absence of security. In the growing environment of insecurity around the world due to political instability, terrorism and other factors human security has become a key component to attain development goals. Human security agenda should be given more emphasis and could be given a thought to include in the SDG or the next development goals. In this context this paper will assess the role of human security as a key driver to attain the Sustainable Development Goals one: poverty alleviation. To do so the study will use the reports of UNDP on Human Security, Reports on Human Security Index, Annual Reports on SDG by UN. The study will also use the field level reports from MINUSCA field offices collected during the year 2020/2021 during my staying in Central African Republic. The study will also use the transcripts of interview of field level INGO staffs, UN staffs and local leaders of the country regarding security and poverty alleviation. The study will also use related scholarly articles on the relevant topics.

Keywords: *Human Security, Sustainable Development, Poverty Alleviation, Central African Republic, Developing Countries*

The Role of Islamic Wealth Management Practices for Poverty Alleviation; A Study on Bangladesh Perspective

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Abstract

This article examines wealth management practices for poverty alleviation in Bangladesh from the Islamic point of view. The main objectives of this paper is to identify the contribution of wealth management practices to poverty eradication by applying Islamic Wealth Management (IWM) principles, especially according to the Quran and prophetic tradition. For this study,

qualitative methods will be adopted, with secondary data as the primary source of evidence. Several statistics have shown that about 25% of Bangladesh's population are living below poverty line. This research will play a crucial role to identify the ways to reduce poverty through IWM practices in Bangladesh. In Bangladesh, only a few significant studies have been carried out on IWM practices from the Islamic perspective and have not yet been fully implemented. Based on the results of this study, all forms of economic management and organization in Bangladesh will benefit greatly and contribute immensely to poverty reduction in the country.

Keywords: *Bangladesh, Islamic Wealth Management and Poverty Alleviation*

Empowering Extreme-Poor Women through 'Graduation Approach': An Empirical Analysis from BRAC's Ultra-Poor Graduation programme in Bangladesh.

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[123] BRAC

Abstract

Across the globe, a variety of approaches have been introduced and experimented to fight poverty. BRAC's 'Graduation Approach' is one of the most impactful approaches to identify the extreme-poor population, understand their multidimensional vulnerabilities and needs as well support them holistically to break their poverty cycles with confidence and resilience. After its launch in 2002, with mostly women as the primary target, the Graduation approach with its household-centered intervention has been adopted in different contexts, such as rural, urban, climate change, refugee influx, and for targeted population, such as widow and single women, ethnic community, people with disability etc. This intervention has transformed millions of poverty-stricken people's lives, including a substantial gendered impact. In this article, we discuss BRAC's experience in dealing with poverty eradication in rural Bangladesh, and how it has contributed to extreme poor women's empowerment through Ultra-Poor Graduation programme. Through BRAC's Ultra-Poor Graduation programme's annual survey, this study manifests women's empowerment in a number of ways, with a special focus on economic and social empowerment in a rural context. This annual survey measures economic empowerment primarily in terms of expansion of productive asset and income; and social empowerment in respect of access to different services and health and nutrition relation information, social inclusion and women's empowerment.

Social Business Model for Poverty Alleviation and Application of Remote Sensing and GIS to Monitoring Tea Plantations: A Case Study at Tentulia Upazila in Bangladesh

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Abstract

The historical background of tea cultivation in Bangladesh is over 150 years of ages and it was concentrated mainly Sylhet and Chittagong district. It is very difficult to meet up the local demand, increase production and export tea and also a challenge for cultivation in new areas. In 2000 A.D tea plantation was introduced in northern part of Bangladesh specifically in panchagarh district. Small holding tea cultivation is very popular in northern part of Bangladesh Within a very short period of time. This paper mainly focuses on the north Bengal small holding tea cultivation expansion and the social business model for poverty alleviation and lifestyle changes through their self- employment. Both primary and secondary data are used in this study. A questionnaire survey, several in depth case studies, Key Informants Interviews (KIIs) and focus group discussion (FGD) are conducted in the study area. Besides these data some secondary data was also used in this study. Geographic Information System (GIS) and Remote Sensing (RS) techniques are used to analyze the changing pattern of the tea garden in tetulia upazila. The main objectives of this model are converting unproductive land to performing assets, poverty alleviation, employment generation, ensure food security, creating entrepreneurs at grass root level, economic employment, financially sustainability at least three generations and finally social and lifestyle change. In 2004 total area of tea garden only in tetulia upazila was 460 hectares, in 2011 area was 715 hectares and 2016 the total area was 963 hectares. A massive social and lifestyle change through self-employment is generated. Year after year tea cultivated area is increasing. Both man and women received entrepreneurship award in this region by cultivating tea. This model is totally unique because small holding tea estates as opposed to traditional large tea estate and farmers retain land ownership minimizing landlessness. Rate of increase annual production 25-40% opposed to 2-3%. Qualitative changes taken place in crop pattern in the northern part of Bangladesh mainly at tentulia upazila in panchagarh district.

Key Words*: Social Business Model, Tea, Small holders, Poverty alleviation, Remote sensing, GIS*

Assessing Urban Poor Resilience to Natural Disasters using AHP-Based Indexing Model: A Case Study on Khulna City

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Abstract

This study measured urban poor's resilience to natural disasters using analytical hierarchy process (AHP) based model. This study investigates the household resilience and factors affecting resilience level. Urban poor communities in Khulna City have multiple vulnerabilities while living in the slums and squatter settlements, whereas they became resilient by adopting different adaptation strategies. Considering this fact, this article intends to assess level of resilience of urban poor communities in Khulna city and factors influencing their resilience. We select six slum and squatter settlements for data collection based on some major criteria

like age of the slum, larger slums in respect of slum area and household number, and flooding risks. We collected quantitative data from these six slums by using household questionnaire survey and a total of 384 households were selected as the sample in these six slum and squatter settlements. The distribution of samples among slums is done accordingly number of the households in the slum and a systematic random sampling process was used to select households in the slums. A total of 4 major dimensions and 19 indicators under these dimensions have been selected for collecting the data. An AHP based indexing model has been used to analyze the level of resilience of the urban poor and a factor analysis has been performed to extract the dominant factor that affects the resilience level of these poor communities. The weightage for each dimension and indicator is determined by the analytical hierarchy process (AHP) based approach. The result of the indexing analysis demonstrates that the level of resilience among the urban poor is not satisfactory. The household-level analysis revealed that most of the people are between low to moderate level of resilience. The output shows that 48.2% and 51.5% of people are low and moderately resilient respectively. The percentage of high resilient people is too poor and about only 0.3%. Among the four dimensions, the people are only resilient to the social dimension and about 68.9% of the households are highly resilient in social dimensions. They face severe vulnerability in respect of economic dimension because of their low income, savings and other related factors and only 0.3% of the households are highly resilient to the economic dimension. The results revealed that there does not have any highly resilient urban poor community in Khulna city. Among the six slums, two slums are found in the low resilient category named Kaderer Bari slum and Khora slum and the remaining four are belong to the moderate group. This research also idenitifies some factors that have the highest effect on the differential resilience of the urban poor, including income, savings, social support network, microfinance membership, housing condition etc. Finlay the study extracted that any sort of climatic disaster can affect the poor people of Khulna city to a large extent and almost all the poor households do not enough capacity to deal with that disaster. The research demonstrates that some policy input is required to improve the condition of the poor people against climate vagaries. The factors and indicators that are impacting most in resilience condition should be the top priority for improvement then the overall resilience condition of poor people of Khulna city will improve.

Key words: *resilience, urban poor, slums and squatter settlements, AHP-based indexing, Khulna city.*

THEME 3: SUSTAINABLE DELTA MANAGEMENT

Agricultural and Food Security: an application of Bangladesh Metamodel

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Abstract

Definition of food security by the FAO has widely established the four dimensions of food security: availability, accessibility, utilization, and stability. Food availability indicates if there is an adequate amount of food for people's disposal and food access is achieved when all individuals of households have sufficient resources to gain good food for a healthy diet. This framework is also used in the National Food and Nutrition Security Policy of Bangladesh (NFNSP). The composite Food Security measures the Average Dietary Energy Supply Adequacy (ADESA) for the lowest income quartile of each District. The food security module calculates food availability on district level and the food access of each income quintile group per district. In this module, food availability is connected with utilization as agricultural productions and agri-food imports are converted to nutrients based on distinctive nutrition components across agri-food products; availability is connected with accessibility as relative income is introduced to judge to what extent the available nutrients are accessible to a certain group of people; and stability mean have enough shocks.

THEME 4: WATER GOVERNANCE

Problems and Remedies in Socio-Water Governance in the face of Climate Change: A Study of Rajasthan, India

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Abstract

Water governance is widely recognised as an important factor for the socioenvironmental sustainability of water resources and services. However, when we discuss the socio-water governance system in our societal space in terms of climate change, it is a more critical area to improve sustainability. Extreme challenges for socio-water resource governance are posed by climate change/variabilities. Climate change, along with an increase in extreme events and social inequality in rural areas, has revealed vulnerabilities in socio-water resource governance regimes. In addition, it has an impact on people's lives and livelihoods. This has provided additional evidence for the need to develop flexible and adaptive governance approaches, as well as innovative approaches to dealing with risk and uncertainty, in order to implement and ensure the long-term sustainability of water management. The specific problems of socio-water governance include the inequitable distribution of water resources and services among various social and economic groups, uneven distribution in time and space, and bias in social class and caste consumption, among others. Based on this specific situation, this study seeks to assess the current socio-water governance situations, problems, and potential solutions in rural Rajasthan in case of climate change. This study identified current socio-water governance situations, problems, and potential solutions by critically reviewing existing research and conducting a ground-based field study. And various statistical techniques and quantitative methods from the general social sciences were used. The main finding indicates that Climate-related water security issues, as well as unequal distribution of water across societal groups based on social class and caste, were present. In rural Rajasthan's socio-water governance, a sustainable framework for managing socio-environmental sustainability is developed. We all know that Water governance is the key to tackling climate change. So, 'If we want to solve climate change, water governance is our blueprint.'

Keywords: *Climate Change; Water Governance; Social Bias; Right to Social Space; Sustainable Development*

A novel activated carbon-based nanocatalyst for sustainable removal of bisphenol-A from water via catalytic ozonation: efficacy and mechanisms

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Abstract

The rising number and quantity of contaminants in the water resources is a matter of concern. Technologies for the removal of these Contaminants of Emerging Concern (CECs) are imperative for a sustainable future. Advanced oxidation processes (AOPs) such as non-catalytic ozonation and catalytic ozonation have shown promise in removing CECs in water and wastewater. Hence, in our study, we used a novel nano-composite bimetallic catalyst (AC/Bi2O3/V2O5) for the removal of 5 mg/L of Bisphenol-A (BPA) from water. Characterizations using yield, BET Surface Area, XRD, FESEM, Raman spectra, and DLS studies showed optimal binding of the bimetallic catalyst to the activated carbon surface with no impurities. FTIR studies confirm the degradation and the robustness of the catalyst structure. Degradation studies with different variables found pH 8, 500 µg/L catalyst dosage, and 60 minutes treatment time optimal for maximum BPA removal (97%) and TOC removal (68%). TOC analysis further found catalytic ozonation with the novel catalyst to be 32% more efficient than non-catalytic ozonation. The degradation pathway of BPA was discerned using LC-MS/LC-Q-TOF studies.

Keywords: *Water, Catalytic Ozonation, Bisphenol-A, Nano-bimetallic catalysts, Degradation, Byproducts.*

Detection of Contaminants of Emerging Concern in the water Environment

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Abstract

Contaminants of Emerging Concern (CEC) are a relatively recent matter of concern across th e world. Chemicals such as perfluoroalkyl and polyfluoroalkyl replacements (PFAS) should b e given more attention because they are employed in the production of many everyday consu mer items. They are long lasting in the environment because to the strong bonding energy of PEAS carbon and fluorine; they are also resistant to water and oil and can withstand high temperatures. Studies have shown that per-fluoro compounds, even in minimal concentrations, can cause significant problems for living and non-living organisms. India has conducted a limited number of scientific studies on this topic. As a result, it is critical that the Indian people, who are becoming increasingly reliant on natural resources for water, determine whether PFAS are present in their drinking water. The CEC is challenging to analyse due to their low concentration and complexity in water matrices. Solid-phase cartridges were used to produce samples to get around these problems. To circumvent these difficulties, solid-phase cartridges were used to prepare samples. Perfluorooctanoic acid was used to conduct the target analysis. The fundamental objective of this research is to use advanced chromatographic technologies, such as LC-MS / MS analysis to identify the emerging contaminants in water. According to this study, the presence of CEC in water is down to lack of awareness about the

chemicals involved in emerging pollutants and their impact, direct expulsion of contaminants into the water bodies and environment, and the lack of availability of effective management technologies.

Keywords: *Contaminants of Emerging Concern; Water Pollution; Per-and Polyfluoroalkyl Substances; Solid-Phase Extraction; LC-MS / MS*

Exploring the options for best practices and possible incentive mechanism for valuing water in Bangladesh

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Abstract

Water is a unique resource unlike other natural resources in terms of availability and uses. Nature itself needs water to maintain a balance in biophysical and ecological system. Diversified and conflicting uses of water make its management very critical and complex. Human interventions and Climate Change put enormous pressure on the water system. Sustainable water governance needs informed policy and planning with regulatory interventions. Bangladesh aims at water secured development ensuring industrial and economic growth, needs to sensitize the value of water and mainstreaming the water security in the heart of the planning process. Still having troubled with the flood in the heavy monsoon season, the dry period puts pressures on water resources. On the other hand the coastal reason faces salinity and North-West region faces drought. Water demand is increasing with the economic advances. Still the sense of mass people is that water is priceless. Efficient allocation of resources is indicated by the absence of both overuse and misuse and for this, we need to know the value of such a resource. Since water is not priced through the market and is accessible for use by various users free either of charge or at a minimum nominal price (like water supplies in cities), it is likely that the resource is over-used and consequently over-exploited and so may face depletion which unless checked and regulated may be severe. As such, there is a need to understand such over-use and misuse and how actual prices paid for water differ from its values in such cases. In this study, detail policy review, Sectoral Consultation, Focus Group Discussion (FGD), Key Informant Interview are done extensively to explore the stakeholder perception and opinion on water uses, water security and mechanism for valuing water in different key sectors mainly Industry and agriculture. More detail study and mass sensitization on valuing water and raising awareness on best uses of water is prerequisite. In agriculture sector, water use efficiency can be improved using Alternate Wet and Dry (AWD) method. However, it is not widely used due to the system of Irrigation which is based on Area Cultivated. Managed Aquifer Resurge System (MAR), Rainwater Harvesting, Circular use of Water, Integrated water resources management, Volumetric water allocation are the some of the best practices that have impact on water use efficiency and thus value water. In case of incentivize the sustainable approach, Payment for ecosystem services is an incentive-based instrument that seeks to monetize the external, non-market values of environmental services – such as removal of pollutants and regulation of precipitation events as well as green production – that can be used as financial incentives for local actors to provide such services. Rebate programs are commonly used to encourage customers to make investments in water conservation and efficiency improvements.

Appropriate valuing water and thus adopting the best practices to ensure the judicious uses are fundamental to fulfil the future demand of the scarce water resources.

Reducing childhood malnutrition through Healthy Village Approach in rural Bangladesh: A large community-led Nutri-WASH integrated approach

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Abstract

Globally in 2020, 149 million children under 5 were estimated to be stunted, 45 million were wasted, and 38.9 million were overweight or obese. In Bangladesh, there is a sharp decline in chronic malnutrition as measured by stunting, from 42% in 2013 to 28% in 2019; the prevalence is still high compared to middle-income countries. This study was undertaken to explore whether a community led Healthy Village approach can reduce childhood undernutrition in rural Bangladesh. This was a community led intervention study through the Healthy Village approach. Max Foundation, Bangladesh (MFB) had been running an integrated intervention (Nutri-WASH) in 62 Unions (the lowest tier of the local government of Bangladesh) from 2016 to 2021 through the community lead Healthy Village approach. The program was built-up with four major components, firstly WASH to protect enteric infections, secondly the nutrition promotion to boost immunity and healthy growth, third local level food production and product supply by community entrepreneurs and finally the local government and health institutions engagement for better health and nutrition services. The program provided knowledge through courtyard meetings, adolescent and male group sessions on consumption balanced diet, and further focus on early initiation and exclusive breastfeeding, complementary feeding, and consumption micronutrients. Anthropometric measurements of the children in those 62 Unions have been measured at baseline and 3 years later in 2021 (end line). After excluding the loss of follow-up, a total of 36,671 children were measured at the end line in 2021. Overall severe and moderate stunting at baseline was 18.9% and 22.5%, which came down to 17.1% and 13.2% at the end line. Severe and moderate wasting were 9.3% and 8.7%, respectively, during baseline and fell to 4.2% and 6.4% at the end line. Severe and moderate underweight were 10.2% and 16.9% at baseline, which reduced to 7.0% and 10.3%, respectively, at the end line. There was a 13.9% reduction of stunting (45.9% vs. 32.0%) in the Healthy Village, whereas it reduced 10.4% in the non-Healthy Village (40.1% vs. 29.7%). A major reduction of stunting was observed among the children of Healthy Village, aged between 2 to 5 years, which is 16.7%. Our study concluded that the nutrition intervention through the community-based Healthy Village approach could reduce a significant percentage of stunting, wasting, and underweight. A substantial reduction of stunting was possible between 2 to 5 years. We recommend nationwide scaling up this type of program through government settings.

Surface-Ground Water Study in South-west Coastal Areas

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Abstract

World Vision Bangladesh initiated the study under Nobo Jatra USAID funded Project with a view to identify surface and groundwater sources (shallow and deep aquifer) with appropriate water options of the project area considering its water quality parameters.

The objective of this study was to identify surface and groundwater sources (shallow and deep aquifer) with appropriate water options of the project area considering its water quality parameters aquifer, stratigraphy, water source, ground water flow direction etc.

Specific Objectives:

- To prepare a list of water technologies both surface and ground water with proper analysis of beneficiary coverage, installation cost, maintenance cost, operational challenges, sustainability, longevity, water tariff existing etc.
- To identify the area-specific multiple water options for providing safe drinking water to the beneficiaries.
- Identify potential surface water sources/technologies with recommendations as appropriate options for treating the contaminated water.
- To identify and assess potential shallow and deep aquifer water sources by conducting Electrical Resistivity Survey employing Vertical Electrical Sounding (VES).
- Prepare GIS map on both groundwater and surface water of proposed project area.

Mixed method was considered to conduct this study and the technologies were selected by random sampling method. The participatory techniques used in the study process includes, review of available documents and secondary data and information, series of field visits, questionnaire survey, Focus Group Discussions (FGD), Key Informant Interview (KII), test boring, Vertical Electrical Sounding (VES), water quality test result analysis, transect walks and observation of all types of existing water technologies.

- Deep Tube Well (DTW) is the most preferable water option where suitable deep aquifer with low-salinity water is available at Kaliganj, Koyra and Shyamnagar.
- Pond Sand Filter (PSF) is a promising option for community water supply where suitable pond is available.
- For existing PSFs; It is needed to pond re-excavation, cleaning, lime mixing on each edge side for protection of saline water intrusion.
- Rain Water Harvesting (RWH) system appears to be a suitable option at household and community level. RWHS is effective in Dacope area due to shallow aquifer is contaminated by salinity and iron. PSF, Rain water harvesting, desalination plant is good option for drinking water supply system.

Surface and ground water sources are being contaminated with high levels of salinity and iron; cyclones and tidal surges affect water supply and sanitation services in the coastal areas of Bangladesh. Since surface and ground water sources are contaminated by salinity so the coastal community has to heavily depend on rain water for 6-8 months of the year; sometimes they also use river, canal and pond water for drinking and domestic uses. For about 4-5 months, particularly in the dry seasons, they suffer from severe water crisis. Existing water technologies are being used i.e., Rain Water Harvesting Systems, pond sand filter, and some communities in remote locations also used pond, canal and river water during facing crisis.

Slaughterhouse Wastewater Treatment and Energy Harvesting in Microbial Fuel Cells

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Abstract

Energy crisis serves as one of the world's major problems these days, and the Microbial Fuel Cell (MFC) has been developed as a promising technique for sustainable energy production and simultaneously coupled with the remediation of pollutants from wastewater. Raw slaughtering wastewater effluent put to use as a substrate for electricity generation in MFC, and the effectiveness in treatment, including pollutant reduction using MFC, are the focus of the study. The fuel cell was connected to the external circuit using a multimeter to measure the voltage and current readings, and the MFCs were periodically filled with the inoculants and glucose as a substrate until the constant output voltage was obtained. After about 33 days of continuous running at room temperature, the fuel cell, which has a graphite sheet as an electrode, produced a maximum voltage of 0.89 mV that derived a maximum current density of 335.25 mA/m^2 and power density of 291.66 mW/m^2 without any pre-treatment of the effluent, removal efficiency of Chemical Oxygen Demand (COD) was 64%. It seems to be effective than the conventional treatment techniques. The MFC treatment also assisted in removing Nitrate 33%, Phosphate 89%, Sulphate 20%. This study shows that the treatment of slaughterhouse effluent is effective with the MFC technique and electricity production.

Keywords: *Chemical oxygen demand; Electricity demand; Electric current; Green energy; Microbial Fuel Cell; Renewable energy; Wastewater treatment*

Exploring Violence against Women & Girls (VAWG) in Relation to Water Sanitation & Hygiene (WASH) Resources: Evidence for Sustainable Development Goal 3, 5, 5 & 10

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Abstract

Violence against women and girls in the context of inadequate water, sanitation and hygiene services and facilities has recently garnered attention in media and academic research. Inadequate WASH services in themselves already constitute a gendered burden, because women have more biological needs, and due to social or cultural norms they traditionally have the responsibility for the household, including water acquisition and management (IASC, 2015). Worldwide, around 8 of 10 households, women and girls are responsible for collecting water. Collectively women and girls spend an estimated 200 million hours daily to fetch water (WHO, UNICEF), and fetching water exposes women and girls to attacks from evil men.

To explore on the connection and identify gaps on VAWG in relation to WASH resources, Simavi conducted research in three countries Uganda (IPV: 50%) and Bangladesh (IPV: 54,2%) and lower in Nepal (IPV 25%). The main objective of this research is to find the

connection between certain forms of VAWG and GBV related to access to and control over WASH resources. The research sought answers to four specific questions: i) how are the decisions about access to and control over WASH resources made, in the community and at the household level, ii) do women and girls experience violence/problems in the use of and access to WASH? iii) what kind of violence and how is it related to harmful social and cultural norms, iv) what are the consequences for women/girls of the violence they experience in relation to the availability and accessibility of WASH?

The abstract elaborates objectives, methodology, key findings, and recommendations for Bangladesh. In Bangladesh, the research has been conducted in Barguna and Satkhira districts including 8 urban and 8 rural areas. The method includes transect walk to map out challenging paths and places to use and access of WASH, FGD within workshop with community people and KIIs with relevant stakeholders. The research shares preliminary findings such as violence in the form of verbal harassment, infrastructural barrier, social gender norms and climate change effect are some major reasons behind VAGW in relation to access to WASH. Exclusion of women with poor socio-economic status are worst sufferers. Fear of losing respect, dignity, and difficult process are reasons for less police case. Women have to collect water during pregnancy which poses serious health threats. Besides, broken slab rings, lack of lighting and fragile infrastructure create fear, shame and discomfort among women nan girls while using toilets as men sometimes peep through the holes. Capturing unconsented photos while fetching water and taking bath in the pond are another form of harassment found in research areas. Females have little to no decision-making power while installing water point or latrine and are not friendly for person with disability (PWD) and pregnant women. The result brought some key recommendations; for instance, mass awareness at all level regarding VAWG in while accessing WASH resources. Provision of streetlights, providing subsidies for resilient WASH facilities supported by Local Government Institutions (LGIs). Continue advocacy for the increased safety, privacy and space for women and girls to enjoy their right to access clean water and adequate sanitation facilities at all level.

Keywords: *WASH, VAWG, GBV, Human Right to Water and Sanitation (HRWS), Dignity, Bodily Integrity*

Spatial and Temporal Variability of Rainfall over Bangladesh during 1981-2020

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Abstract

Rainfall is a very important climatic parameter of Bangladesh for evaluating the drainage network design, flood control work, soil, and water conservation planning, watershed management, etc. The main objective of this study is to analyze the spatial and temporal variability of rainfall in Bangladesh using the satellite daily rainfall data from 1981 to 2020. Twelve weather stations of Bangladesh are divided into three zones: eastern (Sylhet, Srimangal, Cox's Bazar, Teknaf), central (Dhaka, Mymensingh, Barisal, Patuakhali), and western (Rajshahi, Rangpur, Jessore, Khulna) were selected to represent the country. The spatial and temporal rainfall characteristics were determined by Precipitation Concentration

Index (PCI), Rainfall Anomaly Index (RAI), and Standardized Precipitation Index (SPI) using R programming. The mean arrival and withdrawal dates of the rainy season and duration of the rainy season and seasonal rainfall were determined and also rainfall trends were determined by using the Mann-Kendall trend test then predicting the data by geostatistical interpolation method Kriging and IDW and represents through maps in ArcGIS 10.5. The results showed that PCI values were higher in the eastern region and have strong seasonal influences, whereas lower PCI values were mostly observed in the central region of Bangladesh. Among all the stations' RAI showed that the year 1992 was the driest period and 1998 was the wettest period in Bangladesh. SPI at a 12-month time scale drought severity showed a significant increasing trend, mainly the wettest region in the eastern zone and the driest region found in the western region. The Mann-Kendall trend test reveals that the significance of monotonic annual rainfall trends increase in Sylhet, Cox's Bazar, Teknaf, Patuakhali, and Rangpur regions and decrease in Srimangal, Dhaka, Mymensingh, Barisal, Rajshahi, Jessore, and Khulna. The overall seasonal highest rainfall occurs in monsoon > pre-monsoon > post-monsoon > winter and a seasonal rainfall trend increase in the eastern zone then gradually decrease in central and lastly in western zone in Bangladesh. These seasonal changes may have a deleterious effect on rain-fed agriculture in Bangladesh. Furthermore, PCI, RAI, and SPI can serve as warning tools for disaster control and water resource management.

Keyword: *precipitation concentration index, rainfall anomaly index, standardized precipitation index, rainfall trend analysis, geostatistical interpolation, Bangladesh.*

WASH Budget Tracking: A Tool to Improve Water Governance in Rural and Urban Areas of Bangladesh.

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Abstract

DORP has introduced WASH Budget Monitoring Tool which is Inclusive and Gender Responsive and that has implemented with the Local Government Institutions i.e. Union Parishad and Municipality. This Tool is a vehicle to reach different Government WASH service providers to know Inclusive & Gender Responsive budget related information particularly allocation and expenditure. It helps to increase relationship with respective department and ensure to establish evidence-based advocacy to improve water and sanitation situation both in rural and urban areas. This also helps to track Budget quarterly with its allocated from ministry and departments.

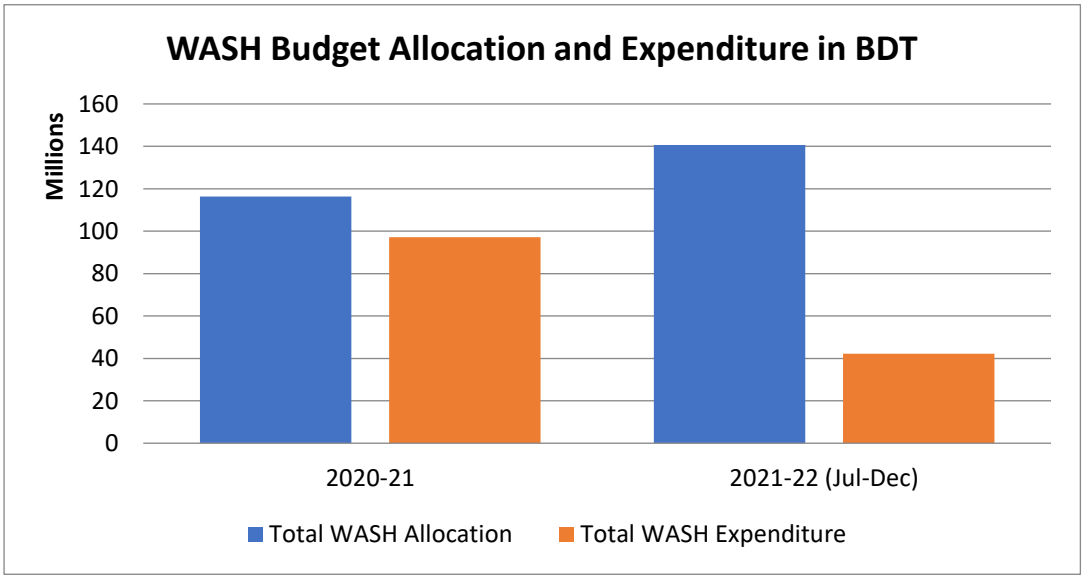
This tool is being filled up quarterly to review WASH budget allocation and expenditure of the Government service providers (i.e. LGED, DPHE, and EED) and LGIs. The Civil Society Organization (CSO) and DORP staffs collect data through filling up this tool on WASH Budget allocation and expenditure. They discuss jointly with LGIs and government WASH service providers and asked them to share what is their WASH budget allocation and how much fund is allocated for women, poor and socially excluded people. During this, they also collect WASH budget expenditure status. This budget monitoring tool help the LGIs and Government service providers to track their budget and expenditure. This tool also helps to identify gap of budget allocation and expenditure. From beginning the CSO WASH committee members are

actively involved in this process. CSO committee members pursue with the LGIs and Government Service providers to increase WASH allocation for Women, poor and socially excluded people. This progress of GESI budget monitoring findings also discussed in the coordination committees at LGIs level.

This tool works as creating an accountability mechanism and contribute to ensure expenditure happened according to allocation to sustainable service for those who need it the most (women and excluded community). It works to incorporation of specific gender and social inclusion indicator in Monitoring Tool is necessary to control that no one left behind. This tool is being used for evidence on the real allocation and utilization of budget to excluded group. It helps to identify the segregated budget which is supposed to be at Upazila and Union level. For example, in fiscal 2019-2020 Union and Municipality WASH budget allocation for women and socially excluded persons wash nil and introducing this tool budget allocation in fiscal year 2020-2021 was 17017700 BDT which has increased 46160000 BDT in 2021-2022. However, expenditure was 84% in 2020-21 in WASH and 30% in first half of 2021-22.

The LGI has pivotal role in implementing this tool. The LGIs fill up the tools quarterly and check what the gaps are and how to address those. They also have to keep record of disaggregated data as per the allocation. By monitoring their expenditure, they can get update and progress of implementation and follow up the planned activities.
Abu Hena Mostofa Kamal Titu, Chairman of Dhalua Union Parishad, Sadar Upazila, Barguna said this “Inclusive and Gender Responsive WASH Budget Monitoring Tool” is quite helpful to look how much budget is spending for women, poor and socially excluded people. This tool helps to ensure accountability and enhance people’s confidence on Union Parishad.

WASH allocation and expenditure is calculated by using WASH budget monitoring tool in 23 Unions and Municipalities.



Lack of clarity and overlap of roles and responsibilities of different service providers is a major obstacle for communities to demand their WASH rights to the right person. The stakeholders most of the times

are busy which took some time or days to complete the tool and also some information are missing or they do not keep the record.

Empower CSO to hold the government accountable to provide or facilitate provision of WASH services can lead to increased access to WASH facilities. Use of social accountability tools such as gender responsive public WASH budget monitoring tool can facilitate demand-based allocation of the public resources.

Assessing Contribution of Haor Ecosystem in Flood Regulating Services through 2-Dimensional Numerical Modeling using SOBEK 2D

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Abstract

Haors are depressed and marshy areas that are round in shape and are predominantly found in Bangladesh's north-eastern region, occupying about 25% of the country's total territory and containing a population of about 19.37 million people. Haors are utilized for agricultural (Boro) production during the dry season, and for freshwater fishing during the rainy season. Haors are quite important in terms of its diverse and reach biodiversity. Approximately, 8000 migratory wild birds pass through the area each year. Some Haors have been designated as Ramsar sites like Tanguar haor. Haor are situated at the foothill of the Meghalaya, which is the highest annual rainfall receiving region of the world. Further, north-eastern region of Bangladesh receives highest annual and monsoon rainfall as well than any other parts of the country. Haor thus faces frequent flash flood events, inundate and damage crops, erode infrastructures and often result loss of lives and property in low-lying deeply flooded regions. Ideally these losses and damages would be catastrophic if such vast network of bowl-shaped depressions were not existed. Connected network of large number of Haors together act as huge freshwater reservoirs during a sudden flood event storing a significant volume of water until reaching its tipping point. Consequently, it delays the peak of flood saving life and properties downstream areas like Brahmanbaria, Dhaka and Cumilla, providing enormous intangible benefits. This study thus aims at developing a numerical 2D model based on SOBEK hydrodynamic modeling suite for the haor areas and investigating the contribution of haor ecosystem for retention of flood as regulatory services. Simulation of the developed model have been done for Business as Usual (BAU) and without existence of haor scenarios. Flood storage capacity in BAU scenarios and additional flooded area in without haor scenarios are taken into consideration for estimating the monetary benefits of flood regulation and protection of life and livelihoods. From simulation, an additional 26% area in the downstream are found flooded for damaging settlements, life and properties if haors were not present. Monetary benefits of the damage protection have been estimated using damage avoided or replacement cost method and found significantly higher to give utmost importance on the conservation of this very important haor ecosystem of Bangladesh.

Keywords: *Regulating Services, Haor Ecosystem, Flood Regulation, Flash Floods, Water Modeling*

THEME 5: GREEN ENERGY

Review on seasonal variation of air pollutants at selected locations of Bangladesh over the period.

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Abstract

Comprehensive study of air pollutants plays an important role in realizing how the weather change influences the functions of air pollutants. Correlation coefficient value of two variables indicates the relationship between those two variables. That can be helpful for further researches, for establishing an environmental design etc. For this comprehensive study we collect data about CO (in ppm), NOX (in ppb), O3(in ppb), PM2.5(in µg/m3), PM10(in µg/m3), Temperature (° c), RH (%), Rain(mm) from DOE (Department of Environment) Bangladesh for a certain time period (01-11-12 to 31-10-18). After that, we decided to find out the correlation between air pollutants and humidity for a certain time period. We select these data for two different locations of Bangladesh. One was CAMS-3 and the other was CAMS-7. We also find out mean and median value of pollutants for above selected locations. For the comprehensive study a corelation coefficient value® is taken as standardizing parameters according to Evans (1996) suggestion. There are three possible results of this co-relational study: a positive co-relation, a negative co relation and no co-relation. This study finds co-relation between two variables which is a prediction type co-relation. We make a prediction about one (ex.: humidity) from another (ex.: CO, NOX, O3). Moisture content (i.e., humidity) is negatively related with concentration of CO, NOX and O3 in the atmosphere. We try to figure out six types of scatter graphs. By plotting the graphs, it was found that humidity was negatively co-related with the air pollutants for the time period we choose to study. As we predicted that one variable is independent and others are dependent so the interrelation becomes almost predicted. We come with several assumption for this study result. Seasonal variation should be a reason. Because in our study period there are seasonal variation which may be a reason for the data variation. Input of data can be a reason. As Pearson correlation coefficient formula are only be used for finding correlation between two variables so it can be said that input of missing data may be given a negative value. There might be a reason of reaction between the variables which gives a negative outcome of the result. Also, location of sampler can be an important issue. We conclude that Emitted gases can contribute in acid formation in urban areas and those acids can accumulate on vegetation and infrastructure. That may be a reason of quick degradation of urban infrastructure. But for a statistical study, reliability of data is important. Sometimes monitoring network may not be functional due to routine corrective maintenance.

Clean electricity and stable polity for green growth in sub-Saharan Africa

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Abstract

This paper examines the impact of clean electricity and political stability on green growth in sub-Saharan Africa. The Generalized Method of Moments (GMM) was used as the estimation method and 45 sub-Saharan countries were considered from 2008 to 2017. The interactive result reveals a positive and significant effect of clean electricity on green growth. Political stability also shows a positive and significant impact on green growth. However, the non-interactive result suggests an insignificant effect of clean electricity on green growth. In general, clean electricity has a positive impact on green growth in sub-Saharan Africa. The implication of this for policymakers is that for clean electricity to have the desired impact on green growth, a stable political environment cannot be overemphasized. Moreover, clean electricity development can instantaneously encourage the development of smart cities and job creation in the region.

Keywords: *Energy, governance, sustainable growth, Africa*

CO2 Management and Clean Transport Policies for Bangladesh

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Abstract

This paper introduces DTReMB (Dynamic TRansport emission Model for Bangladesh) that is imitative from the DTReM-LV (Dynamic TRansport emission Model for Latvia) to calculate CO2 emission in the transport sector of Bangladesh. The general structure of the model brought the scenarios of passenger and freight transport systems based on the population GDP and fuel economy in producing CO2 and contributing to environmental degradation. After that, this model has calculated the energy demand and quantity of CO2 by considering the types of vehicles, fuels, emission factors in four categories of vehicles: cars, trucks, trailers and buses. The findings of the research state that conventional vehicles in the road transport sector that operating currently are the major source of CO2 emissions and taking the maximum spaces against the capacity of said vehicle. The road transport sector is the main source of CO2 and contributor to environmental degradation where a modal split is essential. It is highly required to divert the carrying load from road to river mode that is underutilized also to rail mode by increasing its capacity and modernizing the rail transportation system. Overall, the DTReMB model will give a summary for better understanding the source of CO2 that is produced in the transport sector and quantification of CO2 will help to design clean transport policies for Bangladesh.

Keywords: *CO2 Management, Dynamic Transport Emission, Population GDP, Fuel Economy, Road Transport Sector, Environmental Degradation.*

Spatial Distribution of Air Quality in Chattogram Metropolitan, Bangladesh: A Winter Time Observation

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Abstract

Chattogram, the port city and the financial center of southern Bangladesh, is experiencing extreme air pollution last few decades. The objective of this study is to monitor the Particulate Matters (PM1, PM2.5 and PM10) and Carbon Monoxide (CO) concentration based on different land use in Chattogram metropolitan area. This study was conducted in 64 locations of Chattogram metropolitan area, by using portable Air Quality Monitor (Model: B07SCM4YN3) and portable CO Meter (Model: AS8700A). It is found that average concentrations of PM1, PM2.5 and PM10 of 64 places in Chattogram metropolitan area were 100.23, 165.28 and 213.46 µg/m3 respectively. The average concentration of PM2.5 and PM10 were found 2.54 and 1.42 times higher than NAAQS level. It is estimated that the average PM2.5/PM10 was 77.99%, PM1/PM2.5 was 60.74%. Further found that average concentration was 2.79 times higher than standard level. Average concentration of PMs which follows as sensitive area > industrial area > mixed area > commercial area > village area > residential area > road intersection area.

Keywords: *Air Pollution, Particulate Matter, Concentration, Chattogram Metropolitan area, Distribution*

Spatial Distribution of Air Quality in Noakhali District Town, Bangladesh: A Winter Time Observation

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Abstract

Air pollution is a crucial environmental issue due to its tremendous impact on human health for developing countries like Bangladesh. Air pollution is one of the major problems in most of the urban areas of Bangladesh. The objective of this study is to monitor the Particulate Matters (PM1, PM2.5 and PM10) based on different land use in Noakhali district town. This study was conducted in 62 locations of Noakhali district town, by using portable Air Quality Monitor (Model: B07SCM4YN3). It is found that average concentrations of PM1, PM2.5 and PM10 in Noakhali district town were 96.60, 158.93 and 205.06 µg/m3 respectively. It is estimated that the average PM2.5/PM10 was 77.99%, PM1/PM2.5 was 60.74%. It is further found that, the changes in the concentration of all the selected parameters within land uses were insignificant except PM2.5. Average concentration of PMs which follows as mixed area > road intersection area > commercial area > sensitive area > residential > industrial area > village area.

Keywords*: Air Pollution, Particulate Matter, Concentration, Noakhali District Town, Distribution.*

Status of Air and Noise Quality in Coastal Area of Bangladesh: A study in Cox's Bazar Area

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ABSTRACT

The objective of this study is to monitor the Particulate Matters (PM1, PM2.5 and PM10) and Carbon Monoxide (CO) concentration and to assess the status of noise pollution based on different land use in Cox's Bazar district town. This study was conducted in 52 locations of Cox's Bazar district town, by using portable Air Quality Monitor (Model: B07SCM4YN3), portable CO Meter (Model: AS8700A) and (Model: SD4023). It is found that average concentrations of PM1, PM2.5 and PM10 of 52 places in Cox's Bazar district town were 130.10, 183.42 and 275.19 µg/m3 respectively. It is estimated that the average PM2.5/PM10 was 75.38% and PM1/PM2.5 was 66.17%. The average concentration of PM2.5 and PM10 of different land-use were found higher which 2.82 and 1.84 times higher than the standard level. The average concentration of CO found in the most polluted place was 2.64 times higher than NAAQS level. Further found that the changes in the concentration of all the selected parameters within land uses were significant. Average concentration of PM2.5 which follows as commercial area > residential area > road intersection area > industrial area > sensitive area > village area. It has affirmed that the maximum noise level was found in Boilla Para (129.10 dBA) and minimum noise level found both at Silent area which is South Khurushkul Govt. Primary School area (61.09 dBA). However, we observed that the noise level had exceeded the National Standard Level in all the locations from this study.

Keywords: *Air Pollution, Noise Level, Particulate Matter, CO, Cox's Bazar District Town.*

Microbial Analysis of Atmospheric Environment with the Comparison of Indoor and Outdoor Air and its impact on public health in the case of Dhaka City

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Abstract

Atmospheric Environment is very important for Humans and other organisms. But the Microbes in Air have severe health effect on human health. The objectives of the study to identify the presence of microbes in indoor and outdoor air and to assess the co-relationship between particulate matter and microbial concentration. Study have collected 34 samples from five areas of Dhaka city, and the sampling location divided into air conditioning room, natural ventilation room, outdoor area and slum. This study found that the Fungal and Bacterial colonies both were highest in Bashabo and the lowest in Mirpur DOHS among the chosen areas. Besides that, Bashabo Slum found highest fungal colonies about 80 CFU and highest bacterial colonies about 756 CFU in the day time and night time respectively. It also found that Yeast, Penicillin, Aspergillus, Rizopus species, Candida etc. fungal pathogens has been found in the Air of those areas. Also, Staphylococcus aureus, Bacillus sp., Shigella dysenteriae, Pseudomonas sp, Bacillus licheniformis, Bacillus altitudinis, Klebsiella pneumoniae, Micrococcus luteus, Micrococcus flavus and Aerococcus viridans strains of bacteria found from the samples. Besides that, PMs found highest in Bashabo area both day and night time. PM and Microbial concentration found highest in Bashabo area which means the area is very polluted by Air pollution and microbial air pollution.

Keywords: *Microbial air pollution, Particulate Matter, Concentration, Dhaka City, Bangladesh*

Meteorological Influence on Air Quality Index (AQI) in Dhaka City

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Abstract

Dhaka, being the core of all economic, political, and cultural activities, has been on the path of urbanization, modernization, and development race with the rest of the world. Increase in unplanned urbanization, and industrialization development, and additional anthropogenic activities, increased the amount of air pollutants. Air pollution has become a massive issue to deal with since it not only risks human health but also the surroundings. This study aims to investigate the temporal variation of AQI of PM2.5 in Dhaka city from the year 2016 to 2020, and the relationship between AQI of PM2.5 and meteorological characteristics of Dhaka city from the year 2016 to 2020. AQI of PM2.5, from the year 2016 to 2020, was collected from World's Air Pollution: Real-time Air Quality Index Project. For temperature, and precipitation data was collected from National Oceanic and Atmospheric Administration (NOAA), and for relative humidity and windspeed, from Power Data Access Viewer. The overall result of the study suggested that AQI was highest during the dry winter season, that is, in months like December and January. Moreover, meteorological parameters have negative relationship with AQI, and tend to be more effective with seasonal influence. Out of the selected years (2016-2020), 2018 had the highest annual average AQI. During 2016 to 2020 the AQI category was mostly either "Unhealthy for sensitive group" or "Unhealthy", which means air quality is not recovering and this needs serious attention by not only the government but also the common man.

Keywords: *Air pollution, PM2.5, AQI, Dhaka, Meteorological parameter, Seasonal variation.*

A Winter Time Observation of Particulate Matters in Dhaka Metropolitan

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ABSTRACT

Air pollution is increasing in Dhaka city from last few years, this study objective of this study is to explore the concentration of suspended particulate matters (PM1, PM2.5 and PM10) in the ambient air at varied land use entities in Dhaka Metropolitan area conducted at 70 stations using a portable Air Quality Monitor (Model: B07SCM4YN3). The average concentrations of PM1, PM2.5 and PM10 was 153.28, 252.96 and 326.93 µg/m3 respectively and estimated that the average PM2.5/PM10 was 75.45%, PM1/PM2.5 was 62.74%. Again, the average concentration of PM2.5 and PM10 of all land use found 3.89 and 2.18 times higher than NAAQS level. It also found that Suvastu Arcade, Elephant road was most polluted place with the PMs concentrations of 287.25, 300.00 and 605.33 µg/m3 respectively which is 4.61 and 4.03 times higher than Bangladesh National Ambient Air Quality Standards (NAAQS). The

concentration of PMs in ambient air with respect to land use decreases as follows: commercial area > residential area > mixed area > industrial area > sensitive area.

Keywords: *Air Pollution, Particulate Matter, Dhaka Metropolitan, Bangladesh*

Spatiotemporal Variation and Trends of Air Quality Index (AQI) in Bangladesh during 2014-2019

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Abstract

The object of the study to show the proportion of six classes AQI of four different seasons, identify the monthly mean of AQI in six different district and find the relationship between AQI and PM2.5 from 2014-2019. For research purpose AQI data was collected from six stations of CAMS, DOE. Analysis done by suing IBM SPSS V27 and MS Excel 2020. Study found that in this six stations winter was in most polluted category followed by the Monsoon season. It has been revealed that the air quality status of the area has been declining from 2014 to 2019. It explains Winter season had worst air quality for all station and Pre-monsoon had second worst air quality. Among 4 seasons, Monsoon had better air quality for all station and Post-monsoon had moderate air quality. Among 6 District (9 stations) Extremely Unhealthy air observed in Narayanganj (77%). Considering Good AQI rankings of the six cities Sylhet has highest number of Good AQI days (554). Their most of the proportion of AQI found to be unhealthy and extremely unhealthy. It shows strong co-relationship between PM2.5 and AQI. However, in all the cities the AQI was increasing with the increasing concentration of PM2.5. Monthly mean AQI was found to be higher in the month of January, February, march, November and December and lower in the May, June and July. In the study we has been applied Statistical and Duncan's multiple range test to the result one-way analysis of ANOVA based on different AQI and stations. Where one-way analysis of variance test shows the F-values varies between 57.447 to 110.162 based on seasons and stations respectively which is found to be significant ($P < 0.05$).

Keywords: *Air Quality Index (AQI), Particulate Matter (PM2.5), Sessional Variation, ANOVA, Co-relation.*

THEME 6: GREEN CITIES AND HUMAN SETTLEMENT

3:3:2 - A Sustainable Urban Development Model: Transforming Dhaka into a Sustainable Mega-City

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Abstract

The ever-bustling Dhaka city that stands as one of the most densely populated mega-cities reveals itself as the capital city of Bangladesh to the world. Dhaka is an extremely polluted city that struggles to grasp sustainability as a working concept in the grand scheme of moving forward. However, if sustainability is kept outside the equation, this city will fall flat on its growth due to socio-economic instability, health hazards, impending natural disasters, and climate change. Hence, even though it is challenging to implement sustainability, it should be promoted to the framework of the administration. However, there is an acute shortage of sustainable urban development models regarding Dhaka city, which concurrently explores the social, environmental, and economic aspects, the three core components of sustainability. This paper proposes a novel sustainable urban development model for Dhaka city named "3:3:2". In this model, we have identified three core pillars along with three sub pillars under each core pillar. Moreover, those three sub-pillars are further classified into two categories which, in entirety, correspond to the 3:3:2 model. The core pillars here are redefined as "Social Egalitarianism," "Environmental Stability," and "Economic Well-Being." This paper has further scrutinized and integrated sustainability implementations of proper infrastructure, modern waste management, cleaning of rivers, and gradual shifting to cleaner fuels, greener alternatives, and affordable and sustainable housing. Moreover, quality education, improving human rights, planned expansion, and incentives to green development are the topics that have further been integrated into the model. In essence, the model is formulated by combining the core concepts from numerous noteworthy literatures in a comprehensive form that paves a more straightforward path for our upcoming challenges regarding sustainability. The challenge is approachable only if skillful and efficient involvement of all relevant parties is ensured.

Keywords: *Sustainability, Urban Development, Environmental Stability, Social Egalitarianism, Economic Well-Being.*

Participatory Urban Planning: A Framework for the Dhaka Metropolitan Development Plan

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Abstract

Dhaka, the capital city of Bangladesh, has been remained as one of the most polluted, congested, and unsafe megacities on earth. An environmentally sustainable and socially equitable yet implementable urban development plan is very vital for a livable Dhaka. This article reviews the participatory approach to urban planning and provides a framework on how

to integrate participation into the Dhaka Metropolitan Development Planning (DMDP) process. Engaging public at an early stage of plan and throughout the planning process is essential for better planning outcomes (i.e., sustainable development solutions); and effective public participation is needed not only to identify the planning problems but also to solve them. The level of participation (power given to citizen in decision making) supported by the institutional/regulatory/legal mandate as well as agency policy and capability to conduct such participations also influence the outcomes of public participation. Based on the discussion made above and a literature review, this article focuses first on defining the public from a broader perspective (i.e., Individuals, government agencies, private sectors/NGOs, civil society organizations, elected officials etc) and then, suggesting the suitable techniques/tools that may be employed for public participation purpose at various stages of the DMDP planning process. The objectives of participation at various stages of plan formulation are also discussed.

Key Words: *Public participation, Dhaka Metropolitan Development Plan, Participation tools*

Sustainable Solid Waste Management System for the Ichamati Riverside Area of Pabna City

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Abstract

Ichamoti river, originating from Padma River, flows in the Pabna city area with indiscriminate occupancy and lack of proper maintenance adjacent to the river in the Pabna city and has been turned into a narrow canal since the last three decades. Ichamoti river segment in the Pabna city area has no water flows during most of the period of the year except the monsoon. Presently, the river is mostly occupied by the dumped wastes and these wastes have clogged the river by blocking the possibility of water flow. There needs excavation for removing the wastes from the river but also most importantly needs a sustainable solid waste management system for the proper management of Ichamoti River to have a very robust river environment in the future. The objective of the study is to assess the present Solid Waste Management system and prepare and formulate a Sustainable Solid Waste Management Plan for the riverside community area with an appropriate summation of information of the solid waste generation, collection and disposal system to adopt the free flow of Ichamoti River.

Participatory Rural Appraisal (PRA) tools have been used for conducting the study including a four-day long field survey with Questionnaire Survey, Focus Group Discussion (FGD), and Key Informant Interview (KII). Secondary data on solid waste volume and collection system was collected from the city corporation. Primary data on waste generation, dumping and people's preference and comfort on waste management was gathered from the field survey.

The main problems found are the deficiency in the collection and disposal of wastes regarding the waste management system by the Pabna municipality. Also, people's disinterest in the municipal waste management system and lack of knowledge about waste management leads to dumping wastes in the Ichamoti Riverbank. The manpower of Pabna municipality in the solid waste collection needs to be significantly increased and need to visit the houses twice a day to collect all the generated wastes properly. This study found this low-cost regular waste

collection system by the Pabna municipality from door to door can motivate the people not to throw their wastes here and there. Also relocating the local dumping station from the Ichamoti riverbank to the city can make the river safe from being the dumping choice and also the people throwing wastes in the river can be identified easily. The landfill is suggested to relocate outside of the city area so that the Ichamoti River is saved from the harmful effect of wastes. Thus by a combined interdisciplinary approach from the both government and the local people can make the solid waste management system of the Ichamoti riverside area of Pabna city sustainable.

Keywords: Ichamati River, *Pabna City, Solid Waste Dumping, Solid Waste Management, PRA tools.*

Addressing the Problems of Fire Hazards in Shopping Centres of Dhaka City: A Case Study on Some Selected Shopping Centres in Mirpur Area

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Abstract

Dhaka city has been experiencing a lot of fire mishap. In maximum occurrences institutional incapacity, inadequate equipment support along with inaccurate precautionary measures and absence of pupil awareness are making the situation worse. Fire at different shopping malls is a very common phenomenon nowadays. If any fire incidences occur in shopping centers it can causes human losses and damage properties. The modern shopping is use decorative materials which are highly combustible which increases fire vulnerability. This study tries to examine the fire safety management condition of the shopping centers. In this study, 4 high rise shopping centers of Mirpur area in Dhaka city have been taken for survey to investigate about fire safety. In this research, a checklist method was developed to identify the fire safety level of the shopping centers. Different types of factors regarding fire safety management are weighted by different fire expert of Bangladesh Fire Service and Civil Defense directorate for assessing the fire safety level of the shopping centers. Study showed that most of the shopping centers are high rise and mixed use in nature which aggravates the fire vulnerability hence fire risk as well. Most of the surveyed shopping centers are located along the main roads so the roads are sufficiently wide for the fire vehicles but the problem is most of the times the roads remain occupied. Among the surveyed shopping centers only Mirpur Shopping Center has emergency exit, some of the necessary fire sign and symbol and the other three (Shah Ali Plaza, Muktobangla Shopping Complex and Shah Ali Shopping Complex) have no designated emergency exit, sign and symbol at all which makes the shopping centers more vulnerable to fire and deceases their safety level as well. All the shopping centers are highly surrounded with different types of electric poles and transformers. The fire safety score of Shah Ali Plaza is 33.55 (average), Mirpur Shopping Center is 56.57 (excellent), Shah Ali Complex and Muktobangla is 25.44 and 26.75 (poor). The Fire hazard vulnerability score of Shah Ali Plaza is 26 (moderate vulnerable), Mirpur Shopping Center is 11 (less vulnerable), Muktobangla Shopping Complex is 31 (high vulnerable) and Shah Ali Shopping Complex is 35 (highly vulnerable). Lack of proper equipment and latest training methods in our country of the fire Brigade as well as inadequate monitoring of safety precautions is also now being discussed at many quarters.

Keywords: *Fire hazard, Shopping center, Vulnerability, Risk, Safety management.*

Urban green-space availability and recommended plantation area in Dhaka South City Corporation (DSCC) using RS-GIS

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Abstract

Urban green-spaces (e.g., a park, surrounding a monument, public playground, riverside footpath, or lakeside) are well-managed regions of a city that acts as purifier against the polluted environment. From the environmental and health perspective, experts suggest having 15 to 20% green space area in a city to cover up the pollution created from daily activities and provide a healthy environment to citizens. This study was aimed to evaluate the amount and distribution of urban green-spaces (both sparse and dense) in the Dhaka South City Corporation (DSCC) and recommend available places to create new green-spaces on-demand. Administratively, DSCC has been divided into ten zones consisting of seventy-five wards. In this study, zones were divided into four geographical sectors, i.e., North-West (zone 1 and 2), North-East (zone 6 and 7), South-West (zone 3, 4, and 5), and South-East (zone 8,9, and 10). Satellite imagery of Sentinel-2B was used with the "minimum-distance" algorithm in the QGIS 3.18.3 to classify the land use of DSCC where the accuracy was measured and tested by error matrix and kappa value. For land-use classification the area was divided into five categories; water-body, sparse-vegetation, dense-vegetation, built-up-area, and bare-soil. Google-Satellite-Images and Open-street-map were used to find out available areas to recommend the place for creating new green-spaces. The study demonstrated that about 39.19% of DSCC is covered with vegetation. Among them, 31.20% are sparse vegetation (e.g., scattered trees, shrubs, herbs that cover 10-50% of its surface area). Only 7.99% dense green-space area was available in the whole DSCC. In the sectoral view, the sparse vegetation cover in the North-west, West-south, South-east, and East-north are 28.66%, 16%, 36.45%, 42.62% and dense vegetation are 5.05%, 0.74%, 6.59%, and 19.90%. In the zone scenario, the arrangement of zones according to the dense green-space area is 3<4<5<2<10<9<1<8<6<7. The study showed that West-south, North-west, and South-east sectors of DSCC had a very low amount of dense green area, more specifically all the zones of DSCC except zone 6 and 7 had a green area of less than 10% which is below standard. To overcome this situation, places like water-bodies, roadsides, riverbanks, lake-sides, graveyards, local and public parks should need to put under the plan of creating new green-spaces. The sparse vegetation area should need to be turned into dense vegetation, and where the space was very tough to manage, roof-top gardening could be a nice way to approach focusing wards by wards of DSCC. Around 14.87 Km2 area had been pointed out in the recommendation all around the DSCC, where 2.55 Km2 in the West-south, 6.58 Km2 in the South-east, 4.14 Km2 in the North-west, and 1.59 Km2 in the East-north sectors that were available to make the dense green zone. Although few zones had greenery, small administrated unit (ward) wise plantation planning is required as the distribution of the remaining green zones is not in a balanced state.

Evaluation of Subjective Quality of Urban Life amid Covid-19: Case Study of Chattogram

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Abstract

Measuring the quality of urban life (QOUL) is an essential indicator for creating better living conditions. This is a multidimensional concept that represents people's perception of their condition and position in life with the given objective condition. This study focuses on the subjective dimension, targeting to raise awareness of the importance of QOUL and to set forth recommendations that could potentially guide policymakers to focus on the aspects of the residents of Chattogram are most dissatisfied with. This quantitative research was conducted through the online platform with 291 being selected through the convenience sampling technique. Selected predictors of QOUL were estimated and analyzed using PLS-SEM. To measure the perception of QOUL dimensions are used such as Economic Environment (EE), Physical Environment (PE), Social Environment (SE) amid COVID-19 Environment (CE). All the dimensions are significant but PE has the most influential role in explaining the QOUL amid COVID-19, followed by EE. This study will help policy makers to design urban development as per the perception of the residents of Chattogram and bridge the gap of the current state and fulfill the need of the residents with this bottom-up participatory study.
Keywords: *Quality of Urban Life (QOUL), Chattogram, Perception, Subjective Indicators, Covid-19.*

Foot Overbridges in Dhaka: Sustainability, Inclusivity, and Reformations

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Abstract

As Dhaka, the capital of Bangladesh is undergoing a development phase, sustainability and inclusivity for all must be integral to policymaking and implementation on all fronts. The ongoing burning discussions on the safety of pedestrians has highlighted the integral role that footover bridges play in ensuring safer commute. In a densely populated city, with 23,234 people living per square kilometer, a well designed action plan that caters to all is of absolute importance. Footover bridges become a priority in this context given citizens regularly cross roads with inadequate knowledge of how to do it in a safe manner. This disregard for safety measures stem from lack of understanding of traffic operations, effective education, and suitable enforcement while crossing roadways. The city corporation is divided twofold into Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC). In terms of sustainability among the two divisions, a disproportionate amount of infrastructure remains, with 31 at DSCC and 43 at DNCC. There are some evident issues with these footover bridges which includes a lack of hygiene, proper lighting, broken and wobbly stairs etc. Most footover bridges are also difficult for certain sects of people to use like the specially abled, pregnant women and senior citizens which poses obvious questions regarding how inclusive these projects were set out to be. This paper will attempt to highlight the shortcomings of the existing model of footover bridges, locate the various rooms left for improvement and suggest some concrete solutions. The reformation matrix includes embracing elevated pedestrian crossings in places of heavy pedestrian traffic, a globally embraced solution that is cost-effective and non-discriminatory. Furthermore, if overpasses are still required, they should be designed with elevators and pitches that allow individuals with wheelchairs to move. It'll be a step forward in building inclusive public spaces that are habitable for all.

Study on Thermal Performance of Concrete Hollow Block Building Envelop as a Sustainable Alternative of Clay Burnt Bricks in Bangladesh

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Abstract

Buildings are responsible for a paramount consumption of energy worldwide. In Bangladesh due to rapid urbanization, energy consumption in building is increasing tremendously every year. Conventional clay burnt bricks are widely used building material in Bangladesh which causes massive pollution and declination of fertile agricultural topsoil along with huge energy consumption in production. Sustainable building material like concrete hollow blocks can have great impact on reducing energy consumption of Bangladesh. As a part of the research and development of Alternative Building Technology at Housing and Building Research Institute (HBRI), extensive research has been done on several buildings made by concrete hollow blocks in Dhaka City. The combined effect of air temperature and relative humidity in overheated period has been investigated and comparative analysis has been done with conventional clay brick buildings. This study provides analysis of thermal performance of Concrete Hollow Block and recommendations of sustainable building materials ensuring thermal comfort in Bangladesh.

Keywords: *Building Environment, Thermal Performance, Concrete Hollow Block, Sustainability, Building Materials.*

Sustainable PET bottle recycling Industry: A case study of Bangladesh Petrochemical Company Limited

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Abstract

In Bangladesh, about 3,000 tons of plastic waste is generated every day (The Business Standard, 2019). According to the carbon footprint analysis of Polyethylene Terephthalate (PET) bottles, it is estimated that one 500-milliliter plastic bottle of water has a total carbon footprint equal to 82.8 grams of CO2 (Sciencing, 2018). Bangladesh Petrochemical Company Limited (BPCL) is the first post-consumer PET recycling bottle plant in Bangladesh, established in 2012 (Dhaka Tribune, 2018). BPCL works on 'recover and recycle' business model in which plastic waste is being revived for new use. This case study shows how BPCL can reduce CO2 by recycling PET bottles and at the same time, generate sustainable

livelihood. The objectives of this case study are to describe BPCL's: a) PET bottle collection and recycling procedure, b) PET bottle recycling amount and potential reduction of CO2 and c) the women employability within this industry. This study demonstrates that a plastic recycling plant can attain sustainable development goals 2030 like SDG 5: Gender Equality, SDG 8: Decent work and economic growth, and SDG 13: Climate action. The study was conducted at BPCL, Narayanganj (23° 47' 14" N and 90° 32' 8" E). Seven members of Auritry Foundation visited BPCL on 1st January 2022. Auritry works towards reduced plastic pollution by raising awareness among public and by trying to find ways to reduce and recycle plastics (Saikat, 2022). Auritry members collected data based on the field visit of recycling process, presentation on BPCL, questionnaires to the company's Chief Executive Officer (CEO) and drawing evidences from existing literature on the topic. BPCL is producing 6500 tons of PET resin annually, using three Extrusion lines. The products of BPCL are PET flakes, rPET Resin, PET Sheet, and PET forming products. BPCL has one washing line for producing PET flakes with an annual production capacity of 10,000 tons, one line for producing PET sheet with production capacity of 1500 tons, and three forming lines to produce about 500 tons of PET forming products. Annually, BPCL's service is currently saving 93,000 cubic metres of landfill space and preventing 15,000 PET bottles from entering the landfill (Dhaka Tribune, 2018). By employing this process, BPCL PET bottle recycling industry is potentially reducing 26,910 tons of CO2 emission. One chemical Effluent Treatment Plant (ETP) is there to treat its washing water to prevent environmental pollution. BPCL is certified by Food and Drug Administration (FDA), European Food Safety Authority (EFSA), and Global Recycle Standard (GRS). We also found that approximately three hundred staff work at BPCL, with a potential of increasing further women employment. Bangladesh spends $225 million a year on the import of more than 140,000 tons of PET resin. BPCL supplies about 10,500 tons recycled PET resin, saving Bangladesh $10 million in imports (Dhaka Tribune, 2018). BPCL PET bottle recycle plant follows an eco-friendly, sustainable model that requires scalability to fight plastic pollution.

Slum gardening - An opportunity for Dhaka to become a green city: A study on Bhashantek Slum

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Abstract

Rapid urbanization is a great problem in modern time. For urbanization, plants are being destroyed, global warming is increasing and oxygen being decreased. The only way to overcome this situation is to plant more and more trees, which can be done through urban gardening. This study examines, how slums can be used for gardening, what kind of trees or vegetables to be planted by slum dwellers, reasons behind planting, benefits of planting in slums. From 1,2,3 and 4 number lanes of Bhashantek slum, total 100 samples purposively selected from 3 and 4 number lane for this study. Using semi structured questionnaire, this study followed interview and observation for data analysis. The major findings are 1) Slums large area, soil, roof of house is perfect for gardening 2) Most of the slum dwellers come from village that's why they have huge gardening knowledge and hobby 3) Slum dwellers need support and training from expert for urban gardening 4) Slum gardening can meet slum dwellers nutrition and food demand. A large part of the Dhaka city is slum area. Which is considered as a problem of the city. But now is the time to turn this problem into an opportunity.

By slum gardening, we can reduce the massive risk of climate change, produce oxygen and keep the environment cool. So, slum gardening is an opportunity for Dhaka to become a green city.

Exploring Neighborhood Bonding for Sustainable Communities: A Case Study of Migrants Women Living in the Slums of Khulna City.

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Abstract

As the number of people migrating to the slums of cities continues to increase, it is useful to identify their social capital and use it to support sustainable development. Within last one decade poverty and disasters, especially cyclone Sidr and Aila the two largest cyclones in the southwestern coastal area of Bangladesh have caused huge displacement of the rural poor. Slums in Khulna city are the main place of living of many of these migrants. After more than 12 years of their displacement, how these poor, especially women have developed their community bonding and trust are not known yet. However, Sustainable Development Goal number 11 urges for sustainable cities and communities, where social capital, community tie and interaction in the community are critical issues. In a community, especially in slum areas, conflict and interactions are part of their daily life. Women play key role in all sorts of tie and interaction in slums. Women of slums are generally engaged in income earning activities to support their families. After their works these women pass long time with neighbors, interact with each other in different ways. After migration how poor women live with their neighbor; what type of social capital (conflict, interaction and trust) they build; how is their level of conflict, trust and interaction are needed to know to build a sustainable community. Therefore, this study aims to explore the social capital of migrated poor women in the slums of Khulna city. It is expected that the outcomes of this study will contribute to build a sustainable community by enhancing social capital among the migrated urban poor women.

THEME 7: SUSTAINABLE LIVELIHOODS

Employee Satisfaction and Retention in the Context of Sustainable Human Resource Management

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Abstract

This study presents a new approach to assessing employee satisfaction that quantifies total satisfaction and identifies job features and economic indicators that influence employee retention as a critical concern for sustainable human resource management. Employee satisfaction is, on average, according to the results of 300 survey questionnaires completed by Quasem Industries employees. Employees' financial rewards and the employer's lack of interest in their opinions and attitudes were the sources of the most dissatisfaction. The use of regression and correlation analysis revealed that employee retention is influenced by their satisfaction and the state of the labor market in the region, the age of the employee, the job position, and the length of employment. This study was the first to investigate a gap in the literature regarding sustainable human resource management and management behaviours that positively influence increased employee satisfaction. This topic is important to both leadership practice and research.

Keywords: *sustainability; sustainable human resource management; employee satisfaction; employee retention.*

Living on the Margin: Impact of the COVID-19 Pandemic on the Transgender Communities in Rural and Urban Sectors of Bogura, Bangladesh

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Abstract

This study examines the livelihood challenges that the rural and urban transgender individuals have to face for the COVID-19 pandemic in Bogura, Bangladesh. The transgender communities are one of the minor communities whose livelihood is hit hard by the pandemic. In the sustainable livelihood approach, it is well argued that a livelihood can be sustainable when one can provide for own needs and for meeting these needs, one needs different types of resources and assets and access to these assets are affected by the vulnerability context. Moreover, Satterthwaite (2000) has argued that rural and urban livelihood varies from each other due to socio cultural context. The main objective of this study is to identify the impact of Covid-19 pandemic on the livelihood of the rural and urban transgender communities who are likely to get excluded in the mainstream development. To fulfill this aim, the following facts are being focused- the perception towards rural and urban transgender communities during the COVID-19 pandemic, the socio-economic challenges

faced by the rural and urban transgender communities during the COVID-19 pandemic and its impact on their livelihood and their coping mechanisms and make a comparative analysis between the livelihood of the rural and urban transgender communities. The approach of this study is based on feminist standpoint theory. This study is based on qualitative approach. The sampling process that is used while conducting this study was quite a challenging one. First of all, reaching the target group was difficult in this COVID-19 pandemic. Field work was carried out for a period of 2 and half months and 30 income-earner lower class transgender individuals with age group 18-50 were targeted for interview. Purposive sampling method had been used here to select 15 income-earner transgender respondents from the Shahjahanpur thana, Bogura (Rural) and 15 income-earner transgender respondents from the Bogura Sadar Thana, Bogura (Urban) for the interview. Among 30 respondents, 10 in-depth interviews had been conducted (rural-5 and urban-5). About 5 interviews were conducted for pilot study. The term 'income-earner' had been used instead of profession since selecting limited transgender individuals with particular profession would be a challenging one. The findings of this study show that even though all people are affected by the pandemic, the transgender communities have become more vulnerable due to their pre-existing stigmatized identity. Furthermore, the study shows that the COVID-19 pandemic has generated heterogeneous crisis in the livelihood of rural and urban transgender individuals. It inspects how the intersection of gender with geographical location, class, culture and occupation outlines the experiences of rural transgender differently from the urban transgender. This study reveals how the convergent experiences fabricate multifaceted forms of inequalities for the transgender community and made their livelihood more vulnerable.

Keywords: *Transgender, Livelihood in rural and urban sectors, Intersectionality, COVID-19*

Food Safety and Environmental Awareness of Street Food Vending: A Case Study on Savar Municipality

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Abstract

In urban areas of Bangladesh, the sale of food along streets is a highly contentious topic at present. In Bangladesh, about 2.5 million people eat street food every day according to FAO. Street foods are prepared and stored in an unhygienic way. Experts speak up unhygienic street food can become a source for disease outbreaks. Major sources contributing to food contamination are utensils for cooking and serving, place of preparation, time and temperature abuse of cooked foods and the vendors personal hygiene. In many developing countries, the street food industry meeting the food demand of the urban dwellers and has an important role in cities and towns. This study mainly focuses on the socio-economic conditions and determination of the hygienic and sanitary practices of street food vendors in Savar municipality. A sample size of 40 street food vendors selling commonly consumed foods was selected. Data for the study were collected through informal questionnaire survey. Simple statistical techniques such as graphs, tables and more complex analytical techniques such as correlation were used to examine the safe and unsafe food practices are linked with knowledge, attitude and behavior of the street food vendors. Information reveals that 55% street food vendors are illiterate and have no formal education even they cannot write their name. As street food business requires

low investment, most of the vendors (52.5%) were found to own the business. They reportedly work for 12-14 hours a day. Permanent in nature vending shop was 33% when mobile and semi-mobile vending shop was 58%. Most of the vendors processed (cooked) their food at shops (53%) and few of them processed at home (27%). Almost 82% venders used color in food and 45% provided stored water to the customers. Most of the vending shops (70%) were located on the footpath and 30% vending carts were placed near the drain and 20% near the sewerage and almost 58% vendors dump their waste in roadside. This study reveals that poor level of awareness, lack of appropriate policy and law, negligence of authorities are responsible for the improper management system of the street food vending business. This study opines that new strategy should be introduced to change the existing condition of the street food vending in the study area.

Keywords: *Street food, Vending, Sanitary practice, Food safety, Hygienic-unhygienic.*

Motivating Factors of the People living in River Erosion prone area: A study in Faridpur, Bangladesh

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Abstract

River-bank erosions have become common phenomena in Bangladesh. It affects the core of the society destroying the cultivable lands and residential areas. It has adverse impacts on the lives and livelihoods of the people. The people of riverbank areas or 'Charlands' are the worst affected by the riverbank erosions. However, they do not leave the erosion prone areas; instead, they migrate from one 'Charland' to another when erosions occur. The study aims to explore the motivating factors of living in the 'Charland' despite all the difficulties and challenges of nature. It is observed that they are in the 'Charlands' from generation to generation because of the easiest livelihood options for survival. The study explored that people have certainty of the livelihood options in the charland whereas they are uncertain in the mainstream areas because a charland can be sure at least for 15 years. If people relocate to the mainstream land, it will increase their livelihood expenditures which would be difficult/challenging for them to manage/sustain. The data has been collected using the qualitative methods with In-depth Interviews (IDIs), Case Study and Focus Group Discussion (FGD) from two Charland of Jhaokanda Union of Faridpur District.

Keywords: *motivating factors, livelihood options, river erosions, riverbank erosion*

Sustainable Livelihood Options for Poor and Marginal Poor

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Abstract

The study was to identify potential sub-sectors for marginal poor and livelihood options for the ultra-poor community along with explore the key market system dynamics to focus through sustainable livelihood program. Marginal people were considered those earning just

near or over USD 1.9/per day/per person or BDT 2000/month/person. Extreme poor people were considered those earning below USD 1.9/per day/per person or BDT 2000/month/person.

The study aims

- To explore current livelihood practices of target groups (income sources, expenditure, saving practices, assets, food/non-food demand condition, living standards, impact of Covid-19 and their coping mechanism etc.);
- To explore and examine market dynamics, structure, distribution channels, value chain and business enabling & non-enabling environments of the shortlisted markets;
- To assess gendered nature of the resources/skillsets, vulnerabilities and experience of shock for each target group, and to assess the gendered barriers to markets;
- To identify systematic constraints within the market system and limitations of value chain for market accessibility of target group (extreme-poor, marginal poor, men and women);
- To assess market systems resilience to climatic/non-climatic shocks, identify public and private sector actors as potential partners and map power dynamics in the relationships between the actors; and
- To recommend 'Inclusive Market System Development' strategies aimed at marginal & ultra-poor graduation, economic empowerment of women and climatic and non-climatic risk mitigation.

The study adopted mixed method approach to find out the prospective livelihood options and recommend 'Market System Development (MSD)' strategies and interventions to be aligned with livelihood technical program. Both qualitative and quantitative primary data were collected through Workshop, FGD, KII, Questionnaire Survey and observation. This study comprises five consecutive segments, namely, literature review, household assessment, identification of prospective sub-sectors and livelihood options, assessment of prospective sub-Sectors, and recommendations.

It was found that

- Promising sub-sector for target groups- Vegetables, dairy, cattle fattening and poultry;
- Low quality produce due to traditional practice;
- Droughts and flood badly hamper the production process;
- Cattle fattening is preferred due to quick win potential;
- Storage problem;
- Small business, sheep breeding, and duck rearing sub-sectors are suitable for cultivable landless people;
- Poor transportation system hindering marketing;
- Rice cultivation, poultry, maize cultivation, and mixed fish farming have been identified as promising for the marginal poor;
- Since handicraft, vegetables, country chicken, duck rearing, goat rearing, small business, and sheep rearing operations can be run for women;

- Vermi Compost has been suggested as a potential sub-sector in a few locations as it will generate income as well as low-cost organic fertilizer for local marginal and ultra-poor farmers;

Since majority of respondents did not own any cultivable land for this reason livestock rearing and non-farm activities on a small scale will be most effective in improving the livelihood of both the marginal and ultra-poor. Promoting and facilitating the small farmers inclusion into different cooperative societies or producer groups formulated by market leaders to access necessary services from private sector will be key livelihood strategy for the marginal poor. Contact farming agreement with market leaders has been recommended to improve producers/farmers' access to quality inputs, improved technical services, stable price etc. for agri-based sub-sector.

Leveraging the dimensions of social challenges, social justice besides employment resolution techniques of indigenous Marma people

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Abstract

The aims of this article are to explore the essential elements and the value of traditional storytelling for culturally appropriate indigenous research; to develop a model of a collaborative community and university research alliance, looking at how to address community concerns along with their employment and gather data that will inform decision-making and help the community prepare for the future; to build up and strengthen research capacity among indigenous communities in collaboration with indigenous elders and Knowledge-holders; and to discuss how to more fully engage Marma indigenous people in the research process. In this article, one of the Marma indigenous people living in the Hill-tracts have been focused, where researchers have used the content analysis besides, traditional story telling approach and qualitative method of data collection, analysis and validation procedures. Five participants have been interviewed in-depth manner with semi-structured questionnaire, where coding, thematic analysis and cross-case analysis have been applied to identify the themes and final components to understand the rhetoric of the indigenous Marma people. The article ends with a discussion of the implications of using traditional storytelling in empowering both research participants and researcher.

Transformation Trends of Agricultural Land and its Impact on the Livelihood, Food Security and other Developments in Bangladesh

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Abstract

Land is one of the most important resources in a highly populous and land-scarce country like Bangladesh. Due to high growth of population, their life and livelihood related demands are increasing rapidly. To meet this gradual demand, unplanned and excessive use of land has been taking place. The causes of land transformation are mostly associated with proximate and underlying factors. These include eco-environmental and geo-biophysical factors (soil characteristics and quality, flood, river erosion); climate change and increased climatic events; infrastructure development; agricultural intensification; farmland extraction (usage for official, industrial and infrastructure development) as proximate causes. The underlying causes include socio-demographic; economic (market growth, opportunities of non-farm activities, urbanization and industrialization); technological changes; policy and institutional (agricultural, settlement development); and cultural factors. All these drivers are leading to loss 1% of agricultural land annually (Source: BBS data and also backed by independent data, Cited in Dhaka Tribune, June 17th, 2016) that would badly affect the food security of this agrarian country and result into decrease of per-capita agricultural land in future. The land loss in Bangladesh has gone through a five-fold increase since 2000 (SRDI 2016). The study is based on the review of secondary literature, data and information that focuses on assessing the trend of agricultural land transformation since 1961 to 2018. The aagricultural land in 2018 was 9.2 m.ha (WB 2021, FAO 2018) in Bangladesh (70.69% of its total land area), while the arable land was over 7.7m.ha in 2018 (59.71% of total land area (WB 2018). In 2018, the per-capita cultivable land was 11.86 decimals (WB 2021). The per-capita arable land in 1961 was 0.174 ha/person in Bangladesh, which has reduced to only 0.048 ha in 2018 (WB 2021). Based on the decreasing trends, agricultural lands are projected to be 8.967732 (m.ha) in 2030 and 8.682995 (m.ha) in 2050 with a per-capita of 0.04977 (ha) in 2030 and 0.04327 (ha) in 2050, while the arable lands are projected to be 2.154515 (m.ha) in 2030 and 1.845433 (m.ha) in 2050 with a per-capita arable land of 8.6237 decimals in 2030 and 6.3308 decimals in 2050 showing a drastic decrease of agricultural land with potential negative impacts on food security, employment, economy, etc. The study concluded with formulation of planned and effective land use/ zoning policy and their strict implementation by their categories. Government with this view has been working with a national digital land zoning project along with a number of associated projects to strengthening effective and optimum use of land by their categories.

Factor affecting workers' migration from the Handloom industries to the other profession: A case study of Sirajganj District in Bangladesh

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Abstract

Sirajganj District ranks fifth in Bangladesh with 8.42 percent of handloom units, according to the Handloom Census-2018. In this district, there are two categories of weavers: family workers and contract workers. However, these workers are seen migrating from their traditional profession to other sorts of jobs. The study aims to identify the contributing factors that influence people to migrate from their traditional profession. This empirical study examines the factors associated with the professional migration of the handloom weaver as worker. Qualitative data collection techniques have been used to collect primary data with a stratified sampling method.

Keywords: *Handloom, Workers, Migration, Sirajganj, Industry, Empirical Research*

Socioeconomic Vulnerability of City Dwellers during COVID-19 Shock: A Study in Southwestern Coastal Bangladesh

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Abstract

COVID-19, a pandemic, pushed the world to face different challenges at a time, especially in the urban areas. It has become a double hit for a country of coastal cities like Bangladesh, who is battered by natural hazards every year. The assessment of socioeconomic vulnerability of city dwellers in terms of geographical variation and depicting it through a comparative analysis among different statistical tools has added a new aroma in the flavor of research. This study aimed to assess the socioeconomic vulnerability of two coastal cities of southwestern Bangladesh. This study used several tools like the Lorenz curve, Gini coefficient, t-test, and vulnerability index. Using a structured questionnaire, we collected 160 households' data from Khulna and Satkhira cities deploying multi-stage sampling technique. Our results suggested that income is mainly affected during COVID-19 lockdown. The pattern of occupational return and the level of education of the household heads are the main reasons behind the change in income stability. Households with per day income and lower educational level of household heads significantly pulled down the incomes at that time. Despite that fall, the level of income inequality is relatively low as the majority of households faced a negative impact. Apart from this, the socioeconomic vulnerability index showed that both Khulna and Satkhira cities are moderately vulnerable, but Khulna is significantly more vulnerable than the latter. Among the seven dimensions, excluding cross-cutting, all the other dimensions (i.e., demographic, financial, health, social, socio-political and psychological) demonstrated that the vulnerability index of Khulna city is higher than Satkhira city. Both cities are almost equally exposed to be vulnerable. However, Khulna city is more sensitive with poor adaptive capacity compared to Satkhira city. Hence, to squeeze the magnitude of socioeconomic vulnerability, the creation of employment opportunity in the long run and social safety net program in the short run can minimize the adversity if the implementation is efficient prioritizing the more vulnerable regions.

Key Words: *Vulnerability, Determinants, Households, COVID-19, Socioeconomic*

THEME 8: DRR: INCLUSIVE RESILIENCE

A Study on the Potentiality of Earth-Bag Shelter as an Immediate Disaster Response and Humanitarian Crisis in Bangladesh

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Abstract

Bangladesh ranked as the 5th country most at disaster risk with regard to both its exposure to natural hazards and the vulnerability of its people, according to the 2016 World Risk Report. As Bangladesh faces natural disasters like cyclone or flood almost every year, assistance in providing disaster shelter is one of the major concerns of the government. A large number of Government and Non-Government Agencies have been working hand in hand in providing immediate disaster assistance which includes materials for temporary shelter. Most of the cases these temporary shelters have been made using bamboo and wood collected locally which in turn affect the environment adversely. As a part of the research and development of the Resilient Building, Housing and Building Research Institute has been working on potential emergency shelters which can be efficient in terms of construction time and sustainability of materials. The purpose of this study is to analyze the potentiality of Earth-Bag Shelter as an immediate shelter response to the disaster-prone area of Bangladesh. From the assessment of the Pilot Project constructed by Earth-Bag at HBRI, this study will outline a guideline for sustainable construction of emergency shelter and reduction of disaster impact in Bangladesh.

Keywords: *Emergency Shelter, Disaster Response, Earth-Bag, Sustainability*.

Enhance resilience capabilities through innovative approaches for disaster vulnerable communities.

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[1] Good Neighbors Bangladesh (GNB)

Abstract

Bangladesh is considered especially vulnerable to climate change, with one-third of the population displacement-risk because of different natural and manmade calamities. The increasing frequency, severity and uneven occurrence of floods, cyclones and drought have been causing loss of human life, damage to houses, property and infrastructure, disruption of agriculture and other livelihoods and contributing to increasing risks of food insecurity to the affected populations. Most of at risks are poor vulnerable households and small farmers, who are more exposed and at a greater risk because of a lack of access to very limited risk management tools.

Good Neighbors Bangladesh (GNB) has experiences of implementing projects to enhance resilience for disasters vulnerable communities with partnership and supports of donors. Its core objective is to enhance resilience and improve food security of the most vulnerable people along with strengthen national capacity to response emergency and risk reduction by the flood

vulnerable people. The study adopted qualitative approach mainly for risks assessment and data collection

Three new integrated risks management approaches- Forecast based Financing (FbF), Seasonal livelihood programming (SLP) and Climate risk insurance (CRI) have been implemented for resilience building of flood vulnerable populations. FbF is an anticipatory action that support preparedness, response and risk reduction of an anticipated flood. It uses weather forecast, deliver the emergency cash to at-risk populations in advance to improve the timeliness and effectiveness of flood response for reducing the losses, shocks and strengthening the resilience of the vulnerable communities. SLP enhances understanding of the relationship between seasonality and household economics by promoting alternative livelihood supports and facilitates prudent risk taking and increase savings of the flood affected people. CRI helps vulnerable households and small farmers in addressing loss and damages to wages, crops, livestock, and other productive assets from the risks of climatic shocks and stresses by adopting a climate risk insurance product to transfer the risks associated to climatic disaster risks and maintain their livelihoods.

The project has created innovativeness, community engagement and sustainability with integrated approaches of resilience building; minimizing the losses and maximizing the resilience with anticipatory actions; transferring cash by electronic mechanism (bKash); disseminating EW (early warning) messages with community volunteers and accordingly, providing risks transfer solution for the disaster affected people. The project has some lessons learnt and findings to scale-up the interventions likes-anticipatory action prior to the disaster; enhancing alternative livelihoods with effective solution of risk transfer for financial losses; and community volunteers' engagement that increases efficacy and sustainability of livelihoods of the flood affected people.

Community Resilience to the Risks of River Erosion and its Impacts on the Livelihoods and Other Resources along with Policy Implications in the Central Floodplains of Bangladesh

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Abstract

The people of Bangladesh have been living with frequent disasters since hundreds of years though adequate policy and preparedness measures were not adopted up till the eighties other than relief and rehabilitation activity. The riverine flood is a frequent phenomenon in the central floodplains (Boyra UP, Harirampur, Manikganj), where river bank erosion was simultaneously observed as a major disaster and often accompanied with floods and sometimes without floods with severe negative impacts on the livelihoods, agricultural lands and other resources of the study area. The objective of the research was to assess the resilience and coping capacity of the flood affected people of the central floodplains in Bangladesh including the implications of the disaster management policies in building capacity and resilience of the affected people and local government institutions mandated for disaster preparedness and management at the grassroots levels. The current feature focused on the river erosion, its damages and peoples' resilience to its risks to protect resources. The research adopted qualitative approach mainly (participant observation, in-depth interviews of key informants, case study, FGDs and limited

survey for household profile related data collection only). The research found that the flood affected people developed significant resilience to the risks of flood in reducing damages on their houses/homestead, household assets, sanitation and drinking water options, etc. except the field crops. However, they were totally helpless to the risks of river bank erosion as there was no river training project/activity or embankment. The flood, at least, left some resources that they had been able to manage through relief and rehabilitation supports along with their indigenous practices despite frequent disasters. But river erosion washed away all wellbeing making the affected people homeless, assetless and left them into severe economic hardship/poverty and often in social trauma. They did not even get minimum time to shift their houses/homestead and other properties in safe places as often it caused suddenly. Over (80%) households were affected by river erosion 2-7 times in their lifetime. Many were forced to migrate in other places leaving their fore-fathers homestead; relatives, kith and kin destructing their social and family life, gosthi, dignity and power structure; cultural aspects i.e. marriages, food habit, festivals, etc. The local government councils; Union/Upazila disaster management committees lacked disaster management plan, action plan, finance and accordingly, implementation of any preparedness activity except the conventional relief and rehabilitation. They were totally inactive and unaware of their roles and responsibilities. The research concluded with planned river training program/activity to coping the risks of the river bank erosion, preparedness measures and alternative livelihoods options.

Key Words: *River erosion, disaster, flood, risks, coping, capacity, resilience, policy.*

THEME 9: DISABILITY AND DEVELOPMENT

Journey towards independent living – A pilot study on adults with Down syndrome in Bangladesh

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[1]AMDA Bangladesh & Down Syndrome Society of Bangladesh

Abstract

Adults with Down syndrome have many latent capacities or potentials which we don't able to explore or recognize. They have the ability to live independently which parents/support persons/caregivers fail to explore in most cases. Scientific studies prove that these adults can lead their life as independent human beings if their abilities can be enhanced. The study aims at exploring these dormant potentials of adults with Down syndrome especially the Self - advocates group of Down Syndrome Society of Bangladesh. The present study is the part of a pilot study conducted by Down Syndrome Society of Bangladesh, an Organization of Persons with Disability (OPD) and a partner of ADD International Bangladesh in implementing Inclusion Works Project. The broader goal of the study is to bring into light the propensity of the adults with Down syndrome to live independently in the society. Under the study, 15 adults with Down syndrome will be monitored, interviewed, observed for six months to assess their capacities. Finally, the study will recommend the possible ways to ensure independent living for persons with Down syndrome in the context of Bangladesh.

Keywords: *Down syndrome, independent living, OPD, Self-advocates, Capacities*

Overcoming health inequalities: considerable areas to ensure access to eye health care for persons with disabilities.

Syeda Asma Rashida[1]

[1]Sightsavers

Abstract

The challenges for people living with disabilities are profound. Disability exacerbates poverty for the whole family due to increased expenses, lack of income for caring responsibilities and reduced opportunities for social exclusion. This is particularly acute for women and girls with disabilities as they face additional challenges due to gender inequality. High levels of discrimination and social exclusion affect individuals, and entire families. This can be mitigated through appropriately targeted health services and the development of approaches, which include women and men with disabilities. Sightsavers has implemented an inclusive eye health programme to test approaches to delivering services in a barrier-free environment, providing evidence on the actual cost of delivering the promise of the SDGs to universal health care. The objective of the project is to provide "improved, inclusive, sustainable and high-quality services to the women and men with and without disabilities in target districts of Bangladesh". The project was a collaborative one with Organisations of Persons with Disabilities (OPDs) and NGOs with persons of disabilities including other marginalized people in the community with access to eye health services. Significant multidisciplinary approaches were applied such as targeted outreach camp, training need assessment; providing training,

conducting accessibility audit and addressing the recommendations, post accessibility audit, advocacy with Government stakeholders in different levels. –Sightsavers found Accessibility in the hospital as the core component to access to health services for the persons with disabilities and the marginalized people in the community. Physical accessibility and positive attitude of medical professionals is necessary to avail the quality services. Targeted outreach camp contributed to reach the most marginalized people in the community including persons with disabilities to receive quality eye care services. Affordability of the service and availability of information played a vital role for the persons with disabilities to access eye health services. This has also encouraged family members to come forward to avail the service. The program concluded that the eye health services intervention needs to develop and design from both demand and supply perspectives and barrier-free to ensuring people with disabilities equitably to enjoy their rights of eye health services. This approach can be replicated more widely that has the best impact for marginalised groups with the resources available. This may result in a higher cost per direct beneficiary, when compared to non-inclusive programme, but with particular focus on equity, alongside economy, efficiency and effectiveness, Sightsavers help advance learning on how we can meet the SDGs pledge to 'Leave no one behind'.

Improving mental health for children and young people through bridging the gaps between community needs and support systems at the grassroot level of Bangladesh, an ADD approach.

Abdullah Al Harun[1]

[1] ADD International Bangladesh

Abstract

Mental health and psychosocial problems in Bangladesh and around the world have become a growing health and social problem. The deteriorating and increasing risk of mental health is hindering the achievement of the results of the entire health system and SDG 3, especially targets 3.4 and 3.5, as well as other related goals (4, 8, 10, and 11) as disabilities. Mental health conditions are contributing to premature deaths, suicides, and financial losses. In low- and middle-income countries, more than 75% of people with mental health problems do not receive any treatment. According to the mental health study supported by WHO in Bangladesh (2018–19), 18.7% of the adult population and 12.6% of children in the country are suffering from mental health disorders. The survey also found that 14% of children (7–17) suffer from mental health problems, and of these, 95% didn't have any psychiatric consultation.

There are several social barriers related to mental health that are not directly related to the medical model, but they are also closely related to the lack of access to mental health care in our communities. According to a need assessment study conducted by ADD International Bangladesh in 2021, stigma, prejudice, wrong perceptions, and negative stereotyping towards mental health are prevalent in our communities. Problems are commonly believed to be a curse from the almighty in response to a person's sinful misdeeds or their parents' misdeeds. Therefore, persons with MH problems are victims of numerous discriminatory behaviours, such as abuse, loss of property, and social exclusion. Stigma and negative stereotyping towards mental health is a historical challenge and has been identified by WHO as a major cause of discrimination and exclusion.

Bangladesh's government ratified the UNCRPD in 2007 and committed to ensuring the rights of all people with disabilities. Bangladesh passed the National Rights and Protection of Persons

with Disabilities Act (2013) in parliament. Bangladesh also approved the National Mental Health Act 2018 and a Policy in 2019 and a Strategic Plan 2020–2030. According to the act, mental illness-related disabilities are one of the 11 types. Thus, persons with mental illness have an equal right to enjoy basic human rights. However, the mental health support system in Bangladesh is inadequate due to the limited initiatives for implementation. Of the overall annual health budget in Bangladesh, 0.5% is designated for mental health, of which 60% is dedicated to psychiatric hospitals

ADD International Bangladesh has been working with its unique approach to strengthen the mental health support system, especially for children, young women, at the grassroots level. First, it addresses key gaps in minimum healthcare services. Second, improve access to mental health support and services, addressing social and economic rights. Third, reducing stigma, negative stereotyping, and discrimination. The project is working to bring mental health support systems to the remote areas through a quadrilateral approach.

Collaboration with the ICT Ministry for Sustainable Livelihood of Persons with Disabilities

Iftekhar Ahmed[1]

[1]Centre for Services and Information on Disability (CSID)

Abstract

To include persons with disabilities into mainstream ICT services Centre for Services and Information on Disability (CSID) started work at that time when the situation was worse for the persons with disabilities. Lack of IT skills the persons with disabilities were excluded from the mainstream education and employment facilities. Most of the computer training Centre were inaccessible for the persons with disabilities and persons with disabilities thought there was no hope to build their IT capacity. In this situation in 2010 CSID and ICT Ministry has signed an agreement to ensure mainstream ICT services for persons with disabilities and ensure ICT based employment. After signing the agreement CSID worked with ICT Ministry to make the ICT policy disability Inclusive.

Considering the needs and vast potential opportunities for persons with disabilities to learn ICT skill and be employed into ICT industries together CSID and ICT Ministry has designed and implementing a project named “Empowerment of Persons with Disabilities including NDD through ICT” where persons with disabilities will be trained in the domain of ICT by leveraging state of art technologies and therefore, they will be catered as skilled workforce in different industries. There are seven components of the project; 1.E-Learning Platform, 2. Job Portal, 3. Database, 4. Mobile App, 5. Specialized Accessible Audio &Video Contents for ICT Training, 6. Productions of specialized tutorials/Contents for visually impaired, 7. Training materials for capacity building of Key Service Providers (Community Disability Expert (CDE), Primary Healthcare practitioners and teachers. The intention of the proposed system is to develop an e-learning portal and also a mobile (Android) app for the persons with disabilities to empower them with industry standard training to produce qualified resources for the ICT industry.

The envisioned system can be considered as a complete lifecycle of building a resource and deploying them to contribute for their country to generate revenue and also to prove themselves as a qualified professional. Considering its user base, the e-learning portal and its contents will be specially designed to train the persons with disability including Neurodevelopmental Disorder (NDD) to get the online video-based training. In short, the application (both web &

mobile app) will follow the web accessibility standards to make its features user friendly, easy to access and handy for all type of users.

Employment of Persons with Disabilities: Prospect and Challenges

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Abstract

In Bangladesh persons with disabilities are less likely to be involved in any economic activity than people without a disability. Although person with disability constitute a large proportion of our population, very little information is available about their characteristics, the constraints they face in their daily lives and workplace. When people with disabilities do find work, they commonly face bullying, harassment and misbehaviors at work and tend to get paid less than others, particularly in manual or field-based jobs. Which very much against the principle of SDGs 'Leave no one behind'. Job quotas for persons with disabilities are not working. Most workplaces continue to be inaccessible to persons with disabilities. In addition, people with disabilities are not given the opportunity to qualify for employment through formal education at higher levels. The general objective of the study is to assess the situation of person with disabilities and explore the possibilities of how they could access into employment, to see the challenges and Prospects. The specific objectives of the study included to know the barriers and challenges as well as the potentials. I have been covering to review the attitudes and perception of employers towards person with disabilities about their lives and livelihood, to map and assess the scope of current situation and initiatives in the private sectors, which the person with disabilities can ensure access to employment to comply the SDG 08. Data to meet the objective has been collected at different points during the thesis period using quantitative survey and qualitative study. Questionnaire survey helped us to find out quantitative number and qualitative findings helps us to understand and the qualitative issues. This mix method made this thesis robust. All qualitative data collected from persons with disabilities and employers who employed disabled people in their workforce as appropriate by me. All interviews and group discussions and events has been audio-recorded and transcribed. Handwritten observation notes have been taken alongside audio-recordings. Based on the findings by the study, it is needed to create awareness among the family and the community members; so that the PWDs can have access to education and other socialization process to build themselves as capable workforce in line with contemporary needs. General education and technical education curriculum and teaching methods should be inclusive. Studies have shown that persons with disabilities are at a greater disadvantage, experiencing significant difficulties in securing governmental and non-governmental jobs compared to those without disabilities. Persons with disabilities also encounter difficulties to access the 10 per cent jobs earmarked for them in the public sector and 1 per cent for the first and second grade jobs. There is no obligation or a mandate for securing guaranteed employment in the private sector for the disabled persons. This study found that over 90% of jobseekers with disability do not get support from co-workers in the workplace and the organizational policies also does not support any reasonable accommodation and enabling environment. Over 90 percent persons with disabilities think the accessibility in the transportation is one of the major barriers for PWDs to sustain in their job. Along with this the attitudinal matters of co-workers and negative perception of the employers is one of the major barriers.

Disability inclusive climate change adaptation

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[12] CBM

Abstract

Bangladesh, being one of the most vulnerable countries globally to climate change impacts due to geographical location and high dependence on climate sensitive sectors, suffers from frequent cyclones, heat waves, salinity, water logging, storm surges, and floods in recent years. CBM Bangladesh Country Office, as part of its development interventions on disability inclusive disaster risk reduction and climate change adaptation, commissioned a research to identify the climate change-related vulnerabilities and the impacts of climate change on the coastal community people including persons with disabilities in Southkhali Union. The research followed mixed method, which includes review of national and international documents, analysis of both qualitative and quantitative methods, Completion of 670 household survey through Random Sampling Method, 17 FGDs, 30 KIIs and Direct observation. The study revealed that during climate-induced disasters, persons with disabilities are far less able to cope with changes. The existing adaptation strategies found to be largely inadequate for protecting the livelihoods of persons with disabilities. The study also explored the gaps in inclusion of persons with disabilities in adaptation measures and the scope and opportunities for inclusion of persons with disabilities in adaptation measures to Climate Change. Based on the research findings, CBM proposes that knowledge and perception of persons with disabilities on adverse impact of climate change should be enhanced, policy measures & support mechanism for resilient and climate smart agriculture and aquaculture system should be adopted for sustainable income of persons with disabilities, engagement of persons with disabilities, OPDs and CBOs in development of Local Adaptation Plan, National Adaptation Plan and international climate change policy should be ensured, and comprehensive data management system should be developed by collecting disaggregated data by type of disabilities, gender, and age and climate vulnerability at local level.

Key words: *People with disabilities, Climate change adaptation, climate resilient livelihoods*

THEME 10: COASTAL ZONE MANAGEMENT CHAIRPERSON

Willingness to Pay for Quality Water Supply Service in Coastal Urban Settings: Evidence from Khulna, Bangladesh

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Abstract

The stress on the water is getting acute day by day, especially in the southern and coastal parts of the world. The securement of clean water and sanitation has been one of the challenging goals of SDG for many developing countries like Bangladesh. The south-western cities of the country confront the scarcity of fresh and quality water for drinking and sanitation. The study aims to investigate the demand for quality water service for the city dwellers by elucidating their willingness to pay (WTP) and its determinants. The study surveyed 100 households in Khulna city, the most populated and only City Corporation in the south-western region, administering a simple random sampling method and in-person interview. The Contingent Valuation (CVM) technique and single-bonded dichotomous choice (SBDC) model have been applied to elicit the WTP of the city inhabitants and the factors associated with the demand for quality water service. The Probit and SBDC model results reveal that years of schooling, household income, and excessive time of collecting water positively determine the WTP for quality water service. On the other hand, household size, availability of private sources of water, the poor water quality of KWASA are negatively associated with the WTP for quality water service. The SBDC model also suggests that the households are willing to pay BDT 433 per month on average for having a quality water service, which exceeds their average monthly cost of water consumption. The finding recommends that the city corporation authority and WASA should understand this potential and manage quality water service by gaining the consumer surplus and demand of the city households. Therefore, this study gives a policy suggestion for government to ensure clean water and sanitation to thrive in SDG goal No. 6 by governing water sustainably in the City Corporation and populated urban area in Bangladesh.

Key Words: *Quality Water, Water and Sanitation; Willingness to Pay, City Corporation, Bangladesh*

Water Sources and Supply Process in Climate Resilient Coastal Communities: Experience from Khulna and Bagerhat Districts

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Abstract

Bangladesh has a history of natural disasters along its shoreline. The severity of coastal floods, tidal surges, river-bank erosion, saltwater intrusion into water and soil, tropical cyclones, and other natural disasters has skyrocketed in Bangladesh's coastal region as a result of climate-induced sea level rise. Because of their proximity to the Bay of Bengal and the Sundarbans, Khulna and Bagerhat are more susceptible to climate change than any of the other districts in the region. With the help of HELVETAS, the Panii Jibon (Water is Life) initiative addressed the water-related hazards and vulnerabilities of an already poor population in Bangladesh's

disaster-prone coastal districts. The study's aim was to evaluate the impact of climate change on coastal communities' water supplies and distribution systems. The research methodology used a variety of quantitative and qualitative techniques and methodologies to accomplish the study's goals. Household questionnaires, Focus Group Discussions (FGDs), in-depth interviews (IDIs), and Key Informant interviews (KIIs) were used to collect both qualitative and quantitative data from the research areas. The study reveals that Rainwater Harvesting System (RWHS) and deep tube well are the dominant source of drinking water accounting for 45% and 25% of the households respectively. Other source that come next is Pond Sand Filter (PSF), being used by 12% of the household's Pond/ditch/wetlands is used by 8% and Jar water used by 7% of the households. RWHS is also the most widely used source of domestic water as mentioned by 41% of the respondents followed by pond/ditch/wetlands being used by 28% of the households. Tube well is not suitable in all areas due to salinity and ground water level. Some cases, tube-well installation cost is high. During rainy season, communities can use rainwater directly. Beyond the rainy season, water tank do not provide enough water for rest of the months and also it becomes polluted. PSF gets submerged during the rainy season specially when flood and storm surges occur. Using PSF ground water extraction can be reduced and it can be utilized for multipurpose. PSF (Pond Sand Filter) is the most effective technique in coastal areas since it relies on surface water. The amount of ground water extracted by PSF may be lowered, and the water can be put to several uses using this technology as well. Providing climate-vulnerable coastal residents with clean drinking water is made possible by the use of PSF. As a result, its efficacy diminishes significantly during the pre-monsoon summer months. To assure a year-round supply of clean water via PSF, the pond's water retention capacity should be raised. The establishment of a PSF system in a government-owned pond and enhanced pond management are both urgently required in order to provide a year-round supply of clean water on a community scale. Rainwater conservation may be achieved at the home level by installing the right number and size of water tanks.

Keywords: *Climate Change, Climate Resilient, Water Sources, Coastal Districts*

Promoting Alternative Income Generating Activities (AIGAs) for Enhanced Sustainability and Resilience of Coastal Afforestation in Bangladesh

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Abstract

Coastal forests in Bangladesh have been protecting from natural disasters like cyclones and tidal/storm surges for a long time. Considering the function of the Sunderbans as a greenbelt, the Bangladesh Forest Department (BFD) has been conducting mangrove afforestation in the coastal newly accreted charlands since 1966. As climate change is increasing the frequency and intensity of cyclones, the Government is emphasizing more on creating a continuous greenbelt along the coastline of the country to protect the communities and ecosystems from disaster risks. However, experiences from previous coastal afforestation projects show that the sustainability of the new plantations often is at risk due to high dependency on forest land and forest products. The new mangrove plantation sites should be protected from human interventions that can cause damage to the seedlings. As the communities living adjacent to the mangrove forests are mainly poor and depend on natural resources for their livelihoods, it is important to ensure Alternative Income Generating Activities (AIGAs) for them to keep them

diverted from the forest. In this context, a study has been conducted with the support of the Bangladesh Forest Department (BFD) in five coastal districts of Bangladesh namely Barguna, Bhola, Noakhali Chattogram and Cox's Bazar to identity the existing forest department livelihoods and their impacts on mangrove afforestation. Also, the study focused on identifying suitable AIGAs of the local people that are non-forest dependent, environment-friendly, economically viable, and socially acceptable. The study design included secondary literature review, field investigation, Field Group Discussion (FGD) with communities, Key Informant Interviews (KII) with community and experts, and national level workshops. Based on the findings, the major two threats identified for mangrove afforestation are cattle grazing and fishing. Also, the collection of fish and shrimp fries causes damage to young mangrove seedlings. Furthermore, in fully grown forests human interventions for collecting wood, honey and other forest products cause damage to the natural ecosystem. The recommendations from the study highlight AIGAs for different areas based on socioeconomic structure and gender dynamics. This study can support the BFD and policymakers to further plan and manage coastal plantations in a sustainable manner considering the livelihood security of forest department communities.

Keywords: *Coastal, Mangrove, Afforestation, Livelihood, Climate Change*

A Comprehensive Overview of the Impacts of Natural and Anthropogenic Activities on Biodiversity and Ecosystem Restoration of Sundarban

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Abstract

The environmental condition of Sundarbans is deteriorating as a result of both natural and anthropogenic influences. Currently, it is having a significant impact on the biodiversity of the Sundarbans, which is the world's biggest mangrove forest. This research is concerned with the variability of the biodiversity and ecological state of Sundarban because of the immense change in Bangladesh's climatic pattern. This study endeavors by the review of current literature, interviews with experts and forest authorities, and focus group discussions with a variety of stakeholders as well as the dwellers of the surrounding coastal area. The Sundarbans is facing a number of difficulties as a consequence of climate change. Islands are dwindling due to rising sea levels, and the growing salinity of the water and soil has posed a serious threat to the health of mangrove forests, as well as the quality of soil and crops in the region. In the systematic review, it was observed that the Sundarbans' ecosystems are threatened by a wide range of natural and physical constraints, including overharvesting of natural vegetation, alteration in coastal resource usages, pollution from agricultural and industrial sources, chemical spills, surface water flow decline, enhanced salt concentrations threshold, spread of diseases, forest fire, environmental degradation, rising sea levels, extreme weather events, an insufficient knowledge about sustainable forest management, unregulated tourism, inadequate implementation and evaluation, and an expansion in human–animal interactions are all factors to consider. The suggested holistic strategy takes into account the present practices while also incorporating up-to-date knowledge obtained from further scientific research and excursions to mangrove forests. Appropriate design of the action adaptable schemes, such as embedding all parties involved to safeguard the forest, creating capacity building, mitigating ambient dwellers reliance on the forest, reinforcing surveillance, wildlife conservation, adopting

statutory duty, emergency response, and undertaking equitable planning and research, could be beneficial for the protection and restoration of the Sundarbans and parallel mangrove forests around the globe.

Keywords: *biodiversity, ecological restoration, sustainable forest management, ecosystems.*

THEME 11: CLIMATE CHANGE

A Web-Based Geospatial Information Services: Supporting Climate Change Analysis, Disaster Management and Environment

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Abstract

The countries that are adversely affected due to extreme climate change events, Bangladesh is one of them as strong evidence of the occurrences. The geographical location, land characteristics, several crisscrossed rivers and the monsoon climate- altogether accompany the climatic events and cause countless damage and loss of human lives, property, infrastructures etc. Inspite of that, she is counted as one of the most resilient countries, and moving steadily but surely ahead toward the attainment of sustainable development goals (SDGs). The "Environment, Climate Change & Disaster Statistics (ECDS) Cell" under Bangladesh Bureau of Statistics (BBS), a standalone national organization under the Government of Bangladesh (GoB) aims to generate environmental, natural resources, biodiversity, climate change, and disaster-related statistics and disseminate data from the web application for the institutionalization of environmental statistics in Bangladesh. In line with that, the purpose of this project is to publish geospatial data and information on environment, climate change, natural disaster etc. within a web-based information interface. This interface can be considered as a knowledge data hub which offers a number of advantages such as allowing access to the latest geospatial data and information at one-stop, empowerment of the knowledge clients, swift data visualization and data query etc. The methodology of this project consists of two components- geospatial data preparation and web application development. The process involves the collection of available geospatial data and information, thematic area preparation, database development, system design and deployment. The major themes are administrative, environment and natural resources, climate and climate change, hazard and natural disaster, ecosystem and biodiversity, demographic and socio-economic which accommodate all types of data layers under relevant theme. The web platform is developed by ASP. NET Core for front end design, MySQL for database management and Leaflet JS for map representation. Theme-based data synchronization facilitates the end-users for data query, and the platform provides security, publicly accessible open-source code, high performance and flexibility for the users. The package introduces a smart phone application in both iOS and Android version which performs similar to the native application. Indeed, the web application publishes updated theme-wise data collected from respective agencies and has potential to be explored commonly by the knowledge seekers such as policy makers, academicians, potential researchers and others.

Keywords: *BBS, SDG, ECDS, Open-Source Platform, web application, smart phone application*

Drivers of Socio-Physical Disaster-Based Change and SocioEcological Transformation in the Indian Sundarbans in the Face of Climate Change

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Abstract

Climate Change and Socio-ecological Transformation are major concerns in today's developing countries such as India. Socio-ecological systems, in general, are systems that deal with bio geophysical nature and surroundings in specific ecosystems, as well as context problems, in a complex and adaptive manner, and they are integrated with societal and ecological institutions. However, climate change and variability in the modern era exacerbate the changes and dynamics between societal and ecological systems. There are various types of climate change drivers that have triggered and sustained the magnitude of socio-ecological transformation in the Indian Sundarbans. The study field's specific problems are socioenvironmental hazards and disasters related to climate change extreme events. Based on this context, we intend to assess the climate change drivers and socio-ecological transformations in a qualitative manner using recently published research. The key result demonstrates the main two types of drivers change that are involved in the socioecological transformation. Natural drivers identified include cyclones, flooding, erosion, sealevel rise, and salinization, while anthropogenic drivers include settlement expansion, agriculture, shrimp aquaculture, land-use changes, deforestation, loss of traditional values, global warming, loss of mangroves, and unplanned tourism, among others. Another finding is that variables in a regime shift that also contribute to drivers of change identified are hydrological and disaster-based, and comparatively longer time change variables are sea-level rise, erosion, and social changes. As a result, there is a need to manage and develop the potential for recovery, adaptive capacity, and resilience power.

Keywords: *Socio-ecological Transformation; Sundarban; Climate Change; Drivers of Change; Disaster Study*

The Role of Co-management in Climate Change, Disaster and Pandemic Nexus

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Abstract

The recent COVID-19 pandemic has affected the world and due to climate change impacts, such as extreme weather events (excessive heat, droughts, flooding, cyclones, storms and heavy rainfall) the effects would be twice during a pandemic. While calls are being made to deal with the linkages between climate change, disaster and pandemic it is time to deal with an integrated policy, co-management which would be the potential to build the resilience of the community by addressing regulations, participation, partnership, knowledge and learning resources. The purpose of this paper is to develop an integrative framework of the interaction between climate

change, disaster and pandemic by addressing the role of co-management strategies during a catastrophe. The study integrates insights from climate change adaptation, disaster risk reduction and pandemic studies to provide a fresh perspective on needs and priorities in co-management strategies. This research contributes to the growing literature examining how co-management is the best fit for reducing climate change impacts and disaster risks while pursuing dual goals of social well-being, economic and environmental sustainability. This research covers a gap in the cross-cultural evidence existing in the literature and proposes the integration of the concepts of climate change adaptation, disaster risk reduction, public health, pandemic and co-management towards sustainable livelihood and community resilience.

Keywords – *climate change adaptation, disaster risk reduction, resilience, pandemic, COVID-19*

Monitoring, Reporting, Verification (MRV) for National Adaptation Plan Process in Bangladesh

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Abstract

The United Nations Framework Convention on Climate Change (UNFCCC) recognized adaptation monitoring and evaluation as an important step in the process of adapting to climate change, as it facilitates Parties to better understand climate risks, improve the effectiveness of adaptation measures, and increase accountability under the UNFCCC. MRV aids in determining whether and how adaptation programs are reducing vulnerability and strengthening countries' capacity to anticipate for and respond to climate change impacts at all levels and sectors. This study primarily focuses on the key role, principles, resources, indicative output, framework, management and Institutional arrangements, challenges revision, updating and reporting process of monitoring and evaluation in relation to the implementation of the National Adaptation Plan (NAP) by using available secondary sources on MRV in NAP process. This study also reviews the existing monitoring and evaluation system in Bangladesh and proposes some indicative measures to develop a robust MRV system for NAP implementation process in Bangladesh by following the guidelines provided by Least Developed Countries Expert Group (LEG) and integrating the climate objectives mentioned in the BCCSAP, NAPA, the Five-Year Plan, Perspective Plan, Bangladesh Delta Plan and ccGAP. The recent NAP documents recognize the importance of the M&E system for tracking the outcomes and impact of each strategic outcome together with the associated actions and indicators under each strategic outcome to improve current and future management of activities, outcomes, and impact as well as to increase the visibility of the NAP throughout the implementation period. The most of adaption monitoring and evaluation systems are focused on one or both of two motives: learning and accountability. The former refers to incorporating new knowledge and lessons learned into the adaptation process to improve its effectiveness and efficiency, whilst latter relates to demonstrating that actions have taken place and led in a result. Many monitoring and evaluation systems of Parties under UNFCCC rely on a set of indicators that give data on climatic risks, climate change impacts, exposure, and adaptive capacity, as well as adaptation processes and outcomes. While adaptation processes are the most regularly observed, adaptation outcome indicators are among the least commonly utilized and most complex to create, despite the fact that they are critical in assessing adaptation efficacy over time. Few national adaptation monitoring and evaluation systems have been using

a coordinated strategy to derive information from sub-national scales, but adopting such ways could be critical, especially for nations with large and/or diversified territories. The current manual and DPP/TAPP formats of major ministries, divisions, departments and entities of Bangladesh are not aligned with BCCSAP and other strategic documents to identify, monitor and evaluate the climate vulnerabilities and finance. To survive and reduce potential impacts of climate change with accountability, the Bangladesh Government should develop effective and robust adaptation monitoring and evaluation system in relation to the implementation of the National Adaptation Plan. This paper devises strategies to develop an effective and transformative monitoring, reporting and verification (MRV) framework to facilitate the National Adaptation Plan (NAP) process in Bangladesh.

Keywords: *MRV, National Adaptation Plan, UNFCCC, Transparency, Climate Change, Bangladesh*

Climate change mitigation and adaptation strategies in the garment and textile industries of Bangladesh

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Abstract

The global vision of achieving climate neutrality by 2050 is shaping the climate change mitigation and adaptation strategies among various sectors and industries, irrespective of geographical location. Textile and garment industries are not an exception as it is the second largest polluter in the world and stands next to the oil industry. This sector is also responsible for about 10% of global carbon emission annually, according to the World Bank. To address the environmental footprint of this industry, the UN Fashion Industry Charter for Climate Action launched in 2018 at the United Nations Climate Change Conference (COF24). Aim of this charter is to achieve net-zero GHG (Greenhouse Gas) emissions no later than 2050 and targeted 30% GHG reduction by 2030 that will be generated by the global fashion industry. If we review the global value chain (GVC) of the apparel industry then the role of Bangladesh's garment and textile industries will be very clear. Bangladesh is the second largest hotspot of global fashion sourcing. This country adds significant value to the intermediate goods network, production network and export network of fashion GVC. Majority of the climate footprint of the apparel industry lies in the manufacturing stage and in the form of direct emission plus emission from purchase of energy (Scope 1 & 2 of GHG Protocol). The garment and textile industries of Bangladesh belong to this stage of emitting. This country is the home of the highest of number of LEED (Leadership in Energy and Environmental Design) certified green garment factories in the World. This achievement deserves unanimous appreciation, but compared to the industry scenario those certified factories account for less than 2% of the respective fleet. Global fashion brands routinely push the apparel manufacturers and exporters on different sorts of compliance issues including environment. But they are not willing to compensate/remunerate them for such actions. Even the sourcing price from a LEED-certified factory and non-certified factory are generally identical for the same sort of garments that discourage the suppliers to adopt the climate initiates (e.g. transforming into LEED-certified factory) on the production processes. Achieving climate goals demands proper policy incentive as well as substantial investment. Therefore it's high time to reconfigure the strategies for climate change mitigation and adaptation, which will ultimately lead toward the sustainable transformation of garment and textile industries. To do so this study adopted a mixed method

research approach and found that apparel trade policy might play a crucial role to formulate and execute robust strategies for climate change mitigation and adaptation by the garment and textile industries of Bangladesh.

Flood Risk Assessment of Grounded Solar Power Plant (100 MWAC) in Sonagazi, Feni and Formulation of Mitigation Measures

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Abstract

The Government of Bangladesh has prioritized the development of the country's power industry and is committed to providing energy to all inhabitants by 2021. The 8th Five Year Plan's renewable energy ambitions include a target of 10% clean energy generation by 2021. The study mainly focuses on determining the flood risk considering climate change for the site of a planned 100 MWAC Grounded Solar Power Plant and propose relevant mitigation measures. A Two-Dimensional hydrodynamic model has been developed using Delft3D FM to assess the flood hazard both for base and future climate change scenarios. The model has been simulated considering normal tide, sea level rise and combination of sea level rise and storm surge. An equivalent storm surge of 1991 cyclone was considered as it is 20 years return period cyclone. For a 5-year return period flood 45% of the total area gets inundated whereas 59% and 90% area get inundated for 0.2m and 0.4m SLR respectively. The whole area goes under water for combined effect of sea level rise and storm surge where surge height becomes 6.25m and 6.50m for 0.2m SLR and 0.4m SLR. Surge height increases to 6.90m and 7.13m for 0.2m SLR and 0.4m SLR respectively if the 1991 alike storm surge makes landfall during spring tide. If 1.5 m land formation as intertidal area in the downstream of the area due to sedimentation is considered surge height, then increases further to 7.30m and 7.50m for 0.2m SLR and 0.4m SLR respectively. As a part of structural measures, a sea-dyke at southern side of the study area has been proposed to get protection against the storm surge. The design crest level has been proposed as 9.5 mPWD (considering 1.5m freeboard and 0.5 m for certain percentage of shrinkage and settling) considering 7.5mPWD surge height. Marginal dikes have been proposed at east, west and northern side with a design height of 8.8 mPWD, 8.8 mPWD and 8 mPWD respectively. There are two major canals inside the study area for which increase in width and re-alignment has been suggested. To ensure the smooth passage of upstream rainfall run-off and Tidal Inflow from Bay of Bengal two open culverts (having 3 vents and 5 vents) at major khals have been proposed. The re-excavation volume for the canals has been found to be 3,45,180 m3. A 200m X 200m internal water reservoir with a depth of around 3.5m and two regulators consisting of 3 vents (1.5m X 2m) and 5 vents (1.5m X 2m) have been proposed at the downstream of the major khals. Land formation level has been suggested to increase up to 6.5 mPWD for extra safety during the normal flooding condition. Hydrodynamic model outcome- considering suggested mitigation measures brings fully flood free condition inside the study site. But if the land level is not raised up to 6.5mPWD, 6% of the available land area would be significantly flooded with more than 80% inundation are found in the range of high flood depth which are 0.9m-1.8m and 1.8m-3.6m. This depicts the necessity of raising the formation level of the whole study area at least up to 6.5 m PWD. The suggested mitigation measures will help to battle future flood risks due to climate change. The strategies if

implemented will help to overcome the flood risks and will help in implementing better flood management in the study area.

Keywords: *flood risk assessment, climate change, solar power plant, feasibility*

Climate Induced Migration: Case Studies from Different Hotspots in Bangladesh

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Abstract

Migration and mobility are traditional adaptation strategies in all regions of the world where environmental change and natural disasters have significant adverse impacts. However, when these attacks become frequent people often tend to migrate for short term, seasonal or even permanently. According to the United Nations High Commissioner for Refugees (UNHCR) the effects of climate change, such as natural disasters or environmental degradation have the potential to forcibly displace persons. There are several reasons for migration but recently a strong correlation has been seen between climate change and migration in many of the Asian and African countries, mainly because most of Asian and African nation are heavily dependent of agricultural activities which make them dependent on nature. Vulnerability of climate change impacts is causing migration of individuals and communities in Bangladesh. This is due to both sudden onset events such as cyclones, floods, riverbank erosion and slow onset event such as sea level rise, salinity intrusion, coastal erosion, changing rainfall pattern and drought. This type of migration might create problem for a densely populated country like Bangladesh. Despite all the prediction on climate change induced migration, there is still lack of enough evidence-based studies on climate induced migration and its adverse impacts in Bangladesh. In this context, this research has been conducted to identify the most affected locations in Bangladesh where people are influenced to migrate due to extreme climactic shocks. Also, the study identified possible causes behind migration and drivers that intensify the migration trend in different regions. The field investigation was conducted in four districts- Khulna, Sirajganj, Shunamganj, Barguna which are highly vulnerable to climate change induced hazards. The study included a total of 400 household surveys where the respondents were migrants, 28 Key Informant Interview (KII) and 8 local level consultations in the selected areas. According to the study, the most preferred destination for migration were Dhaka, Khulna, Chattogram, Sylhet, Barishal, Cumilla, Gazipur, Gopalganj, Faridpur, Jamalpur, Mymensingh, Pirojpur, Tangail, Borgura, Borguna, and Jessore. Evidences showed that a significant percentage of people were forced to migrate due to frequent climatic shocks like cyclone, flood, flash flood, salinity intrusion, riverbank erosion and erratic rainfall. Either they have lost their attests or the area suffered from environmental damage that limited their scope for agriculture or fishing. The research concluded much about the social position of migrants in their desired destinations and aims to create certain changes in behavior towards migrants. However, more detailed research with wider geographical areas (with a larger sample size) on the relationship and significance between migration, environment and climate change are extremely important for effective facilitation and management of such migration. In this regard, a comprehensive database can be developed on climate induced migrants to help the policymakers, concerned authorities.

Keywords: *Migration, Climate Change, Adaption Strategies, Natural Disasters, Displacement.*

STEAM education and innovation learning towards tackling climate change in Bangladesh

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Abstract

A greater focus on the development of a variety of educational and training programs on climate change and disaster risk reduction is critical to fulfilling the needs of adaptive competence and technology enhanced learning (TEL) of future graduates in tertiary education in times of climate crisis. The combination of STEAM education and innovation learning are likely to create an ecosystem for green jobs and sustainable development in times of climate change. In this 4th industrial revolution (4RI) era, Bangladesh, an emerging economy with the challenge of climate change, requires skilled workforces for inventive solutions. This study explores in what ways STEAM education and innovation learning can raise awareness of climate change and build the resilience of the youth towards tackling climate change. The education system needs to develop human capital to find better solutions to climate change in limited resources. This qualitative study is based on readily available datasets, policy documents, journals and reports analysis. Also, this study explores the need for innovative learning to survive in climate change challenges to create green enterprises for sustainable growth. The research finding can reveal that STEAM education and innovation learning can help tackle climate change in Bangladesh or other developing countries.

Keywords: *STEAM (science, technology, engineering, art, and mathematics), Technology-enhanced learning (TEL), Climate change, Green jobs, Human capital, Sustainable development*

Effect of Climate Change on Water Resources

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Abstract

Climate change has its significant negative impacts on water resources sector of Bangladesh. Bangladesh has a huge supply of water and sediment through its three major rivers (Brahmaputra, Ganges and Meghna). Water related hazards, floods, drought, riverbank erosion, cyclonic events and storm surge, are common in Bangladesh but increase in frequency and intensity of these hazards due to climate change have been affecting hydrological regime, agriculture, fisheries, forestry and inland navigation sectors. Several national climate change initiatives have included integrated developmental issues to reduce the negative impacts of climate change on natural environment and social lives and livelihoods ensuring sustainable development. Integrated Water Resource Management (IWRM) ensuring public participation, transboundary water management through joint basin management concept were suggested for

better planning and preparedness under the possible risks and vulnerabilities of climate change on water resources.

Keywords: *Climate Change, Water Resources*

Impact of Covid-19 on Mental Stress of Climate Migrant Older Women in Dhaka City slum

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Abstract

In Bangladesh, older people are one of the most vulnerable members of society to COVID-19. Despite the fact that mental health is an essential component of overall health and well-being, little is known regarding the impact of the COVID-19 epidemic on the mental health of vulnerable populations such as slum dwellers. This research explores the state of the Impact of Covid-19 on mental stress of migrant older women in the urban slum of Dhaka city. This Research conducted both qualitative and quantitative study to investigate the livelihood of older women slum dwellers after climate migration concerning the impact of COVID-19. All of the older women who participated in this study were over the age of 60. The study followed the convenience sampling, 30 respondents were interviewed for in-depth interview for qualitative information and 60 respondents were selected for quantitative data. Researcher used Dhaka Stress Scale-Adult (DSS-A) to measure the status of climate migrant older women in Dhaka city slum. Physical well-being is linked to mental well-being. This study provides vital information for building better mental health care and prevention initiatives for older climate migrant women in slums of Dhaka and elsewhere throughout the world.

THEME 12: CLIMATE ACTIONS AND INNOVATIONS

Green Banking as a strategic action to face the climate change in Bangladesh

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The concept of green Banking was relatively new in Bangladesh and yet to progressing, but in the developing countries it reached a mature stage. Green banking denotes the development of inclusive banking strategies which will ensure substantial economic development and promotion of environmental-friendly practices as well. It is a new way of conducting the banking business through considering the hygienic environmental issue and corporate social responsibility vice-versa. Nowadays, it is inevitable to practice green banking by banks because of globalization and to face the competition. This research is mainly base on secondary data and it a qualitative investigation to find out the current situation. In 2021, banks and non-bank financial institutions (NBFIs) in the country gave out Tk 11,893 crore in green loans, up from 7.11 per cent a year ago, according to data from the central bank. This paper focuses on the Green Banking activities of the commercial banks of Bangladesh like: Standard Chartered Bank, Eastern Bank Limited, Dutch Bangla Bank Limited, etc. and how they are related to climate change adaptation. At the conclusion of the study is, Banking sector of Bangladesh is already showing a magnificent performance to set up environmentally-friendly industries but as this country is a climate vulnerable area, green banking should be more emphasized.

Keywords: *Green-Banking, Climate, Sustainability, Environment, Bangladesh.*

Time Series Analysis of Atmospheric Nitrogen Dioxide (NO2) Associated with Climate Variables in Bangladesh

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Abstract

The present study aims to assess the time series analysis of atmospheric nitrogen dioxide (NO2) with climate variables in Bangladesh within three major cities (Dhaka, Chittagong, Khulna) from 2015–2020. The Dutch-Finnish Ozone Monitoring Instrument (OMI) provided satellite-based daily Toposhperic columnar NO2 values gathered for this study. Ground based NO2 concentration data were retrieved from publicly available air quality data provided by the ministry of Environment, Forests, and climate change and meterologial data collected from National Oceanic and atmospheric Administration (NOAA). The study observed the increasing trend of tropospheric columnar NO2 in selected cities from 2015-2020. The NO2 concentration rate was higher in 2020 almost in three cities. The Higher seasonal NO2 concentration level is observed- winter>Post Monsoon> Pre -Monsoon>Monsoon and highest concentration level of NO2 in three cities-Dhaka>Khulna>Chittagong. Positively strong and significant relations was

found between satellite and ground base NO2 concentration. Eventually, the seasonal variation was also significant with climate variables in both cities.

Keywords: *Time Series; NO2, Climate; Relationship; Bangladesh*

Youth and Their Mental Health in Digital Era

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Abstract

In recent years, we are understanding the importance of our mental health alongside our physical health. We can also see that our mental health is relatively worse compared to our ancestors. The effect is more apparent on the newer generation of youths. We need to properly understand the reasons and improve our youth's mental health by combating these problems. Studies are happening on how social media and the internet are linked to poorer mental health among the youth. In this paper we are exploring and summarizing the possible reasons why youths of the digital era have worse mental health compared to youths from a few decades ago and some possible solutions to them. We gather our information from already existing papers and most importantly from youth of age 13 - 19. We inquire from them about their lifestyle, relationships with their friends and family and their level of joy, depression, sadness and loneliness. We also take the same information from elderly people aged 40+ about their youth and compare this knowledge. We found out that people are more depressed, face more anxiety, have less confident and are less hard working. All of these are mainly due to their life being more online based and them being used to everything being over convenient. People are less willing to work hard for something and are less patient about it. They also do not like to give the effort required to make meaningful relationships with people whom they can rely on. In this super connected world, people are becoming more and more isolated. The main reason these problems are happening is because of the sudden shift of technology. Our technological improvements have a lot of adverse effects that we are unaware of. We need to enlighten the younger and also the older generation of these problems so that we can combat the high level of depression and other mental disorders that the youth are facing due to the sudden shift of the digital age. Youth should be relying less on social media and the internet and relying more on their friends and family.

Healthcare Services in Public Hospitals in Bangladesh during the COVID-19 Outbreak

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Abstract

The healthcare system of Bangladesh is heavily dependent on public hospitals. However, inadequate preparation of the government to combat the COVID-19 pandemic has posed a great challenge to these hospitals. Our study aims to identify the current problems and describes the prospects of healthcare services in public hospitals in Khulna district during COVID-19 outbreak. We employed qualitative techniques including in-depth interviews (IDIs) and focus

group discussions (FGDs) to collect the data. 20 purposively selected respondents who either sought healthcare services or were engaged in services at public hospitals participated in this study. The IDIs/FGDs were audio-tapped, transcribed and coded for thematic analysis afterwards. Our participants reported of a range of issues including lack of logistic supports (corona testing kits, safety kits, medicines, hospital beds and ICUs), higher cost of treatment, corruption, mismanagement, unhygienic environment, and shortage/unwillingness of healthcare professionals in treating patients in the public hospitals during the COVID-19 outbreak. Participants also shared their experiences of excessive pressure of both COVID-19 and non-COVID-19 patients, insufficient maintenance of social distancing as well. We suggest the government to provide the public hospitals with adequate resources, plan and monitor the situation, and take strict measures to sustain a quality service during this public health emergency.

Keywords: *Public hospitals, Patients, Healthcare services, Challenges, COVID-19 outbreak*

Challenges and Opportunities of Population Aging towards Achieving Sustainable Development Goals (SDGs) of Bangladesh

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Abstract

Recent population pyramid has drawn the attention of policy makers of both national and global arenas about the high increment of ageing adults. Older people most often are remaining out of development process though global population is ageing rapidly. The ongoing global goal for development is the Sustainable Development Goals (SDGs) have the potential to change this and improve the lives of all ages. Undoubtedly the SDGs are a landmark agreement following on from the Millennium Development Goals (MDGs) and this universal agenda sets ambitious new standards to mitigate extreme poverty, minimizing inequality and adapting climate change etc., and will guide governments and development actors in their work from 2016-2030. At the end of this period in 1930 there are projected to be 1.3 billion older people, making up 16 percent of the total population, with most living in developing countries. Bangladesh as the top densely populated country around the world and not exception and currently the country has around 8% aged adults out of whole. Population projections from different national sources showed that in 2050 this figure will reach in 20%. Consequently, the inclusion of older adults and their communities are highly important in existing and upcoming development policy, planning and programs. Keeping above mentioned considerations, this paper highlighted the challenges resulted from population aging and its opportunities towards the meaningful achievement of SDGs and to become the middle income country in the perspective of Bangladesh. The paper utilized the available information from secondary sources and presented them in a thematic discussion.

Keywords: *Population Aging, Sustainable Development Goals, Older Adults in Bangladesh*

An Artificial Intelligence-based Framework to Achieve the Sustainable Development Goals in the Context of Bangladesh

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Abstract

Sustainable development is a framework for achieving human development goals. It provides natural systems' ability to deliver natural resources and ecosystem services. Sustainable development is crucial for the economy and society. Artificial intelligence (AI) has attracted increasing attention in recent years, with the potential to have a positive influence across many domains. AI is a commonly employed component in the quest for long-term sustainability. In this study, we explore the impact of AI on three pillars of sustainable development: society, environment, and economy, as well as numerous case studies from which we may deduce the impact of AI in a variety of areas, i.e., agriculture, classifying waste, smart water management, and Heating, Ventilation, and Air Conditioning (HVAC) systems. Furthermore, we present AI-based strategies for achieving sustainable development goals which are effective for developing countries like Bangladesh. The framework that we propose may reduce the negative impact of AI and promote the proactiveness of this technology.

Keywords: *artificial intelligence, sustainable development, SDGs, framework, environment, society, economy*

Cyber Crime: What an Engineer Can Do

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Abstract

In this day of globalization, cybercrime is a prevalent occurrence. Cybercrime has become a significantly sensitive issue in a wide range of fields during the last two decades. It is undeniable that with the internet's fast expansion, the necessity of digital security has increased remarkably among the people. The term "cybercrime" refers to crimes performed using a computer, as either a tool or as a victim on the internet. As a result of people abusing the internet, cybercrime has become the fastest-growing form of criminal activity in the world today. It has caused enormous harm to businesses as well as to the individuals who have fallen victim to its machinations. As a result of the general public's lack of understanding of cyber security issues, they are regarded as the weakest link in cyber-attacks, as they are readily misled by attackers. From the perspective of an engineer, this paper discussed many forms of cybercrime activities as well as critical topics concerning cybercrime security, prevention, and detection. Furthermore, this paper has investigated current governance in cyber-security ethics by providing an overview of some of the ethical challenges that cybersecurity researchers are confronted with as well as identified gaps in governance practice now in place. Concerns about academic research are divided into two categories: those that influence the academic research community and those that affect the (business) practitioner community. We've also discussed about the latest cyber-community tactics for human and computer-based semantic and syntactic social engineering attacks. In addition, we looked into the growing patterns of high-tech crime

as well as the projected future direction of cyber-crime in terms of social engineering in the years to come, as well as the potential consequences of these patterns. Finally, we discussed the benefits of bounty programmes for small firms in the battle against cybercrime.

Factors influencing tobacco Smoking among University students during COVID 19: A case study of Chattogram, Bangladesh

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Abstract

Smoking is a demerit good that harms the smoker and the society. This study aims to determine the factors influencing the smoking habits of university students. This research also contributes to determining the level of smoking awareness and consciousness among university students in the current Covid-19 situation. A self-directed survey is used from 229 students to investigate the determinants of tobacco smoking and their relationships with it. Our data revealed that about 21.4% of students smoked, with the male ratio being the highest, most likely due to cultural and social barriers preventing females from smoking. Stress and the influence of friends were the key drivers of tobacco smoking initiation, with family members of tobacco smokers playing a significant but indirect role in it. Awareness generating tolls such as anti-smoking commercials, LED TV billboards, and adverts or pop-ups on social media should alleviate this global concern.

Keywords: *Smoking, Chattogram determinant, COVID- 19, awareness.*

Precautionary and Mercantilist Approach to Demand for International Reserve: An Empirical Investigation

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Abstract

The study aims to analyze the determinants of the continuous accumulation of international reserves in Bangladesh like other emerging and developing countries. This paper empirically investigates the precautionary and mercantilist motive for hoarding international reserves using monthly data from 2010:06 to 2019:12. The ARDL approach to cointegration is used to estimate to establish the long-run relationship between reserves and their determinants. The result shows that precautionary motive was a significant factor behind the massive accumulation of reserves. The sterilization index results show the no sterilization of the central bank to devaluate the exchange rate and the deviation of the real effective exchange rate, which captures the mercantilist motive, remains insignificant in the long run. Keywords: International reserves, Precautionary and mercantilist motive, Real effective exchange rate, ARDL

An Assessment into the Development of Ecotourism in Protected Areas: A Case Study of Lawachara National Park in Bangladesh.

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All national parks in Bangladesh are regarded as lungs, producing oxygen necessary for the existence of all living things. Bangladesh now has about fifty ecologically protected areas, which is a substantial number. Many of them are in dilapidated condition and pose a threat to the environment due to improper tourism practices. Lawachara National Park is among the most prominent reserved areas in the Moulvibazar district, and it is also included in the Northeast Bangladesh region that is privileged with the stunning features of the rainforest as well as an affluent span of biodiversity. While this research emphasized on the prevailing ecotourism practices in the Lawachara National Park, it also encouraged ecotourism management measures that were more feasible. This was attained through the use of numerous planning and decision-making techniques, which include consultation with the local people living in the area, tourists, and park employees conducted with the assistance of a questionnaire survey and secondary data obtained from the various conference papers, journals, and publications. It has been discovered that unregulated anthropogenic sources are a significant threat to the protection and restoration of this national park's ecosystems and wildlife. In addition, it has been discovered that the number of plant and animal species is diminishing day by day. In order to adequately preserve protected areas and to decrease the ongoing loss of biodiversity in Bangladesh, it is critical to develop efficient action to minimize these vulnerabilities, including holistic coordination and stakeholder participation. Additionally, the sustainability of the park's tourist industry in the near future will be influenced entirely by the facilities and services provided, which will put emphasis on the management practices of the tourism business.

Keywords: *assessment, ecotourism, conservation, restoration, biodiversity, sustainable management.*

Gender, Climate change adaptation, and Cultural Sustainability: Insights from Bangladesh

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Abstract

This paper mainly investigates climate change adaption and the application of a cultural sustainability approach in the study of gender dimension of lives, livelihoods, and survival of the people living in the coastal region of Bangladesh. The physical geography of the southwest coast of Bangladesh is one of the most vulnerable regions in South Asia due to the significant impacts of climate change. The long-term effects of climate change in this region are exacerbated by increasing salinity in farmlands, heatwaves, and sea-level rise. However, this region is also a classic example of ‘good practice’ as well as the centre for learning, implementing, and communicating climate change adaptation actions in practice. This has been made possible due to the collective action of adaptation activities carried out by the Ministry of Environment, Forest and Climate Change of the Government of Bangladesh, as well as several national and international development and non-government organizations (NGOs).

Using a systematic review of literature, and field-based case studies, we examined how gender and cultural issues (such as the adaptive capacity of men and women, and the transformation of gendered power relations) have been addressed to successfully implement climate change adaptation initiatives in the context of southwest coastal Bangladesh. This study results revealed that both male and female participants were strategic and capable of dealing with climate change impacts, although the adaptive capacity of the former group was comparatively sturdier than the later. The extent of cultural sustainability was found to be weaker in the study region compared to many other coastal communities in the country. The efforts made by NGOs in collaboration with the governmental body of Bangladesh were contributory in providing knowledge of climate change, as well as techniques to adapt to its consequences, to the people of the coastal region. Similarly, NGOs were influential in helping the government to support people in adapting to climate change, from gendered and cultural sustainability perspectives. Study findings contribute to the field of climate change impacts in understanding the complexities of rural development.

Keywords: *Gender, Climate change, Adaptive capacity, Sustainability, Bangladesh.*

Emphasis on Environmental Sustainability in Bhutan's Philosophy of Gross National Happiness (GNH) And Relevance of It in Bangladesh.

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Abstract

Environmental sustainability, as a development paradigm, has evolved with significant magnitude in the development discourse since 1980s and especially with the introduction of 'Brundtland Report' in 1987 that suggests to promote economic growth keeping natural resources well protected for the future. Termed as 'sustainable development' the 'Brundtland Report' becomes the base of development globally and as the time progresses strong consensus has remarkably been developed among the development thinkers worldwide that the indiscriminate pillage of environment has to be stopped anyhow and that the countries worldwide have to make the constrained use of natural resources in their pursuits of promoting economic advancement. A small country like Bhutan has been conducting almost the same strategy over the years and successfully promoting economic growth slowly but constantly and preserving ecological balance simultaneously through its development policy of Gross National Happiness (here after GNH) even before the introduction of 'Brundtland Report'. Basically, comparative in nature, this study keeps its main focus on how the issue of environmental preservation has so firmly been prioritized in Bhutan in undertaking any development initiative and how the issue of environment at present is highly ignored in Bangladesh for keeping its sole focus on economic growth and its negative consequences in the lives of people in Bangladesh. Developed mainly based on secondary data, this review article is qualitative in nature that argues that Bangladesh needs to keep focus more on preserving its natural resources and take the insights of Bhutan's philosophy of GNH in setting its development strategy. And the study findings can contribute to the policy makers of

Bangladesh to a significant extent that the pace of economic growth can be fostered keeping natural resources well protected that Bhutan has successfully doing over the years.

Keywords: *Bangladesh, Bhutan, Brundtland Report, Economic Growth, Environment, GNH.*

Co-organizers of the 5th UIU-ICSD 2022

Max Foundation

Max Foundation (MF), a Dutch-based international organization, has been working in Bangladesh since 2005. It envisions a world where easily preventable diseases are no longer a cause for child mortality. Max Foundation aims to fight child mortality by providing a healthy start of life for as many children as possible in the most effective and sustainable way. For that purpose, it has adopted an integrated WASH-nutrition interventions like Healthy Village approach, and for profitable entrepreneurship models to support this. It has successfully piloted Healthy Village Campaign Program (HVCP) in 2021 in Max Nutri-WASH Program areas in 62 Unions of five districts — Patuakhali, Barguna, Khulna, Jessore, and Satkhira — on water supply, sanitation, hygiene, nutrition, Adolescent and Women Reproductive Health (AWRH), Sexual and Reproductive Health and Rights (SRHR), and stunting growth prevention. After the successful piloting, the Healthy Village concept is now being implemented in other areas of the country, and abroad aiming to strengthen the community-led process. It focuses a lot on creating demand and changing behaviour and works on getting households and communities themselves to invest in improving their lives, because it is more cost-effective with longer-lasting impact. Under the leadership of local government institutions (LGIs) Max Foundation works with the communities and stakeholders in the south coastal areas of Bangladesh to accelerate Bangladesh's achievement of Sustainable Development Goals — 2, 3, 4, 5, 6, 8, 13, and 16.

ADD International Bangladesh

Action on Disability and Development (ADD) International is a UK-based international organization, founded in 1985, that has been working to promote the human rights of persons with disabilities in the countries of Asia and Africa. For over 30 years, ADD International has been supporting organizations of disability activists to fight discrimination and ensure every person with disabilities gets a fighting chance at living their best life.

The vision of ADD International is a world where all people with disabilities are free from discrimination and have equal opportunities within an inclusive society. Globally, ADD International is working for supporting activists, building movements and influencing for change. ADD believes in Independence, opportunity and equality for disabled people living in poverty.

In Bangladesh, ADD International has been working since 1995. ADD programs are currently operating in the north, south, coastal, and central geographical locations targeting marginalized people preferably persons with disabilities. It works with OPDs to strengthen their individual and organizational capacities to participate more fully in the disability movement and ensure their institutional sustainability. The major programmatic areas of ADD in Bangladesh are climate resilience and livelihood, vocational skills and employment, inclusive education and community-based mental health services with a focus on social, political, and civic rights of persons with disabilities, gender and disability-inclusive disaster risk reduction.

DORP

"Development Organisation of the Rural Poor" -DORP is a Dutch word which means 'village' in English. This is a national Non-Governmental Organisation (NGO) as well as known as Civil Society Organization (CSO) at international level. DORP is a member of various networks and steering committee member of Sanitation and Water for All (SWA) in CSO constituency from South Asia region. It has been working in the resettlement, livelihood, water, sanitation and hygiene, education and climate change including other development sector for more than 3 decades in Bangladesh. DORP in its Strategic Plan 2021-25 has targeted to reach 450,000 marginalized people through various program and projects.

The pioneer and founder of the organisation is the first generation development activist in the country, along-with his companions who have also long experience in different areas of development. At present DORP is working in 30 districts across Bangladesh under 17 programs. DORP has partnership with various international non-government organizations and government of Bangladesh as well. In DORP's evolution process, it has experimented out various approaches and undertaken action-oriented research to identify direction of its programs with active participation of people specially the poor, women and excluded groups. "Connecting the Disconnects" is its slogan.

CBM Global Disability Inclusion: Bangladesh Country Programme

"The deed of love is the sermon everyone understands." – Ernst Christoffel

Who we are:
CBM Global Disability Inclusion works alongside people with disabilities in the world's poorest places to fight poverty and exclusion and transform lives. Drawing on over 100 years' experience and driven by Christian values, we work with the most marginalised in society to:

- break the cycle of poverty and disability;
- treat and prevent conditions that lead to disability; and
- build inclusive communities where everyone can enjoy their human rights and achieve their full potential.

We work in over 20 countries, investing in long-term, authentic partnerships with the Disability Movement and multiplying our impact by delivering a combination of inclusive community-based programmes, advocacy for national and global policy change and inclusion advice to other organisations.
CBM started its journey in Bangladesh in 1972. Since then, CBM has been working in partnership with government, local non-governmental and disabled people's organizations for the promotion, protection and full enjoyment of all human rights and fundamental freedom of people with disabilities in Bangladesh.
Aligning with the change in CBM International Federation in 2019, Bangladesh Country programme has started its journey as Country Programme of new entity CBM Global Disability Inclusion from 1 February 2022. Six CBM Member Associations constitute this new federation namely – Australia, Ireland, Kenya, New Zealand, Switzerland, and United Kingdom.
Our Vision:

An inclusive world in which all people with disabilities enjoy their human rights and achieve their full potential.
Our Mission:
Fighting to end the cycle of poverty and disability.
Our Values:
CBM Global's values reflect the teachings and example of Jesus Christ, as demonstrated by love for God and love for one's neighbour. Jesus modelled and promoted inclusion and sought justice and dignity for those marginalized and excluded by society. CBM Global affirms that all people are created equally in the image of God; we follow Jesus' example of love, inclusion, justice and impartiality and we work with all people irrespective of race, gender or spiritual beliefs. This all underpins our determination to end the cycle of poverty and disability.

- We champion inclusion
- We strive for justice
- We embrace partnership
- We pursue excellence
- We live with integrity

At CBM Global we live out our values, which underpin our determination to end the cycle of poverty and disability.

Our core areas of work

- Disability Inclusive Community Development:

Promoting inclusive community development to improve access to inclusive education, employment and healthcare and improve quality of life for people with disabilities and their families.

- Inclusive Eye Health:

Improving access to inclusive and comprehensive eye health services for all, strengthening national eye health systems, making services affordable and accessible to the poorest and most marginalised people and helping eliminate Neglected Tropical Diseases.

- Community Mental Health:

Promoting good mental health, challenging the exclusion of people with psychosocial disabilities, and strengthening mental health systems.

- Humanitarian Action:

Delivering inclusive humanitarian assistance, promoting the participation of people with disabilities in reducing the risk of disasters and preparing and responding to humanitarian crises.

The Joint Cooperation Programme Bangladesh – The Netherlands (JCP)

The Joint Cooperation Programme Bangladesh – The Netherlands (JCP) is a four-year project, which started in November 2018, funded by the Embassy of the Kingdom of The Netherlands (EKN) in Dhaka, Bangladesh. The objective of the programme is to increase the knowledge base of all the institutes involved and to strengthen the capacity in Bangladesh to plan, develop and manages their (marine and fresh) water resources systems. The JCP was formulated on the initiative of four partners from The Netherlands and Bangladesh: the Center for Geographical Information Services (CEGIS), the Institute of Water Modeling (IWM), both from Bangladesh, Wageningen University & Research (WUR) and Deltares

from The Netherlands. During the inception phase, the JCP identified knowledge client's needs and matched these with their joint capacities.

Objective:

The overall JCP objective is: "To carry out a long-term knowledge sharing and capacity building program between Bangladesh and Netherlands institutes in the water sector."

Sub projects and its Activities:

To support the JCP objective, two pillars have been defined, which have further been divided into work packages. The pillars and the work packages are as follows:

Pillar 1: Knowledge Cooperation

- WP1: Management (led by Deltares, Netherlands)
- WP2: Communication and Outreach (led by Wageningen University, Netherlands)
- WP3: Knowledge Cooperation and Development (led by CEGIS, Bangladesh)
- WP4: Training and transfer of tools (led by IWM, Bangladesh)

Pillar 2: Metamodeling for Delta Planning

- WP1: Model development, testing and validation
- WP2: Training and model application

The JCP knowledge projects are related to the:

- natural flow of rivers and sediment,
- urban water quality management,
- local delta management at polder level,
- application based information services for the BDP knowledge portal, and
- the water demand of agriculture in the future under climate change and other developments have been conceptualized.

Additionally, a few new sub projects have been initiated named as Incubator Projects with seed money with the possibilities of scale-up in future. These are as follows:

- Managed Aquifer Recharge (MAR)
- Land Use Change Knowledge (LUCK)
- Char Suitability Assessment for Mangrove Afforestation (CHAR)

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Session

UNITED INTERNATIONAL UNIVERSITY

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