Report on

"Smart and Future Agro-Farming: *Challenges for sustainability targeting SDGs'*

Dates:
The workshop was for 3 days: 17th, 22nd and 26th June 2021 from 11:00AM to 2.00PM.

Venue: CEMCA Zoom Platform

Organized by

Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh

In collaboration with

Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi, India

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I express my sincere thanks and gratitude to **Mr. Saurabh Mishra**, Programme Officer (Skills), Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi, for his constant support, guidance and encouragement in making this project successful.

Sincere thanks are also expressed to **Prof. Madhu Parhar**, Director, Commonwealth Educational Media Centre for Asia, New Delhi, for her untiring effort to make this programme successful.

I am indebted to **Mr. Dalip Kumar Tatri**, Adviser, Administration and Finance, Commonwealth Educational Media Centre for Asia, New Delhi for his active support and kind assistance.

I express my sincere gratitude to all officers and staff at Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi for their most valuable support.

I am also grateful to **Mr. Sudipta Mukhopadhyay**, Vice President, Walmart-India and **Mrs. Sumana Mukherjee**, Advisor, Tona Agro Farm, West Bengal for their kind contribution as supporting resource persons for the project.

Commonwealth Educational Media Centre for Asia (CEMCA)

In response to needs expressed by the Commonwealth countries of the Asian region for a more effective utilization of educational media resources for Distance Education, the Commonwealth of Learning (COL) established Commonwealth Educational Media Centre for Asia (CEMCA) in the year 1994. CEMCA, under a host country agreement signed between COL and Government of India (GoI) in 1998, is headquartered in New Delhi.

CEMCA works in two major sectors: Education and Skills. In both these sectors, the main focus is on the use of appropriate educational communication technologies to improve the quality of teaching and learning. CEMCA has been engaged in the promotion of low-cost open-source technologies for promoting online learning in the Asian region. While it is not a technology organization, it is engaged in experimenting with learning technologies to showcase the benefits and guide others on how to use technology for learning.

CEMCA's engagement in both the sectors of education and Skills are based on the needs of the stakeholders in the region. Though constant engagement with the Governments, stakeholders' meetings, and interaction with heads of institutions, teachers and students, CEMCA prioritizes its initiatives and activities. Most of its activities results in direct benefits to institutional development, and also provide capacity building to individuals in institutions. CEMCA's activities are grounded on the principles of Results Based Management (RBM), and therefore, focusses on outputs and outcomes. Initiatives and activities are planned in a three-year cycle, and interventions are designed to achieve measurable outputs (in a year) and outcomes (in the three year programme cycle). Most activities are implemented in partnership with local institutions, and therefore CEMCA's role is mostly catalytic in nature. In the livelihood and health sector, CEMCA uses community radio as the main medium to promote development, and therefore, it's interventions in this sector are geared towards the use of community radio. As CEMCA understand that institutional change and development of meaningful results come from long-term engagements with the stakeholders, CEMCA works closely with the grassroots level institutions to handhold them and work with them side-by-side. CEMCA provides policy advice to governments and institutions to promote the use of open, distance and online learning for development.

COL/CEMCA has identified five core strategies to achieve outcomes and impact: partnerships, capacity, materials, models and policy. In practice, most COL/CEMCA activities incorporate more than one of these strategies and, in some cases, all five.

Capacity development refers to processes that enable people and organisations to achieve their objectives more effectively. This can mean training but also networking and other processes that enable and empower people and organisations to develop appropriate policies, adopt and adapt models, and develop and use materials. In short, capacity development pervades all CEMCA activities. It focuses primarily on human resource development.

The three days programme in active consultation and engagement with Sher – e – Bangla Agricultural University, Dhaka, Bangladesh is a testimony to the CEMCA's mission to build capacity for institutions and individuals based on collaboration and shared values and goals.

Sher-e-Bangla Agricultural University, Dhaka

Sher-e-Bangla Agricultural University (SAU) is in the heart of the capital city, Dhaka with excellent public transportation facilities to reach the university. The SAU campus stands on 86.92 acres (35.19 ha) of picturesque land covered by green plantations.

The "Sher-e-Bangla Agricultural University Act 2001″ was passed in the national Parliament on 09 July 2001. The foundation stone of the University was laid by the then Honorable Prime Minister Shiekh Hasina on 15 July 2001 and inaugurated the university activities through the appointment of the first Vice-Chancellor Professor Md. Shadat Ulla. The Sher-e-Bangla Agricultural University had started its formal functions on 11 September 2001 following the issuance of a notification by the Government as per requirement of the "Sher-e-Bangla Agricultural University Act 2001″. As a public university, Sher-e-Bangla Agricultural University is a non-profit organization. All the expenditures are borne by the government grants.

The Bengal Agricultural Institute (BAI) was established on December 11, 1938 by Sher-e-Bangla A.K. Fazlul Huq, the then Chief Minister of undivided Bengal. At that time the name of this institution was "The Bengal Agricultural Institute" was renamed "East Pakistan Agricultural Institute" in 1947. After the emergence of Bangladesh as an independent country in 1971, the name of the institute was spontaneously changed to the Bangladesh Agricultural Institute (BAI). Since its inception in 1938, the BAI had been functioning as a "Faculty of Agriculture" under Dhaka University. Meanwhile, with the establishment of Bangladesh Agricultural University (BAU) at Mymensingh in 1961 its academic function was transferred to BAU in 1964 till it's up gradation to Sher-e-Bangla Agricultural University in 2001.

Nearly 5700 graduates plus 600 postgraduates have so far been produced by the Sher-e-Bangla Agricultural University. Graduates of this University have been playing a pioneer role in the development of agricultural system and agro-based economy of the country. They are involved in various national and international services ranging from civil service to UN assignments including UN peacekeeping forces. Presently, about 2500 undergraduate and postgraduate students are enrolled in this University and are taught by learned well qualified and experienced faculties.

The Sher-e-Bangla Agricultural University was established for the expansion of higher agricultural education and committed to promote research in various fields of agricultural sciences and to offer extension services. Several research projects have been undertaken by the different departments of the University.

It has made a significant progress towards commencing collaborative research programs with some foreign universities. On the eve of 100 years birth anniversary of Bangabandhu Sheikh Mujib – ur – Rehman, the programme marks significance toward sustainable development in Bangladesh.

Disclaimer

The information pertaining to Commonwealth Educational Media Centre for Asia (CEMCA) and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh has been obtained from the respective websites of the University and organization. The author of this report has not verified the details mentioned herein and the contents above merely serves to project an introduction to the respective University and organization.

Introduction

Climate-Smart Agriculture (CSA) in an integral part of the of the United Nations Sustainable Development Goals (SDGs). There is a necessity to deepen our insight and awareness of the diverse contexts and ways in which governments will have to steer and report the inevitable choices and conflicts, synergies and trade-offs that will characterize efforts to simultaneously implement these global goals. CEMCA, in association with Sher-e-Bangla Agricultural University, Dhaka aimed to develop an account of why and how agriculturally progressive countries like Bangladesh are managing the interrelationship between SDGs, particularly those associated with food production, security, value chain network and interlinkages between the farm to fork, including positive climate action and in the process transforming Bangladesh to a carbon neutral nation. Leading up to the UN Climate Change Conference (COP 23), FAO Director-General José Graziano da Silva noted the importance of addressing both agriculture's emissions as well as the worldwide impacts that climate change will have on food security and nutrition. He called for integrating climate change mitigation and adaptation across the entire food system. Regarding agriculture, da Silva said, "much more needs to be done to reduce these emissions and to simultaneously improve yields and build resilience."

The three days' workshop was an attempt to explore the rich diversity in climate resilient agricultural husbandry practices in Bangladesh and aided explanations for the diversity in approaches and provide an initial assessment of what the consequences are for policy and practice. The analysis is informed by the contrasting experiences of Western Europe, North America, and the Asia Pacific, as they seek to build more "climate resilient" food and agricultural systems that are compatible with achieving the SDGs.

This workshop analyzed climate change impacts on agriculture in Bangladesh, food security and food systems and provides an overview of the main climate change adaptation and mitigation strategies in the country's agricultural practices. Equipped with proven models in India and Bangladesh, the workshop also introduced the Climate-Smart Agriculture (CSA) approach and described the process to implement it in Bangladesh.

Aim

The aim of this online capacity building program is to provide a platform to the leading academicians and undergraduate/post graduate students in agriculture to brainstorm and develop climate vulnerability proof farming models, with adequate interconnectedness and supply chain visibility, both upstream and downstream. The online CBP on "Smart and Future agro-farming: opportunities for sustainability targeting SDGs" course for Faculty Members of Sher – e – Bangla Agricultural University, Dhaka, Bangladesh is an attempt to help the ac academic fraternity,

University project personnel and students to gather the requisite skills and competence to assimilate the knowledge and accordingly extend the knowledge to frontline agricultural extension workers, field specialists and the farming community.

Governance and the role of the state	The politics of translation, domestication and the role of sub-national level actors	Policy autonomy and developmental space	Political economy of knowledge
State power and resources	**Process of domesticating global and regional commitments**	**Material base of the economy and the centrality of agriculture**	**Role of global institutions and knowledge brokers**
* Shapes ability to lead and implement visions for CSA. * Manifest in planning and priority-setting on CSA.	* Explains why global and regional initiatives on CSA look so different once refracted through domestic institutions, policymaking processes and political bargaining. * Manifest in how governments domesticate their international commitments and align them with domestic agendas.	* The high dependence of these countries on agriculture for growth explains why policy in this area is high politics. * Manifest in regional commitments such as CAADP to boost expenditure on agriculture and increase private investment.	* Control of knowledge about CSA held by actors that finance initiatives in this area confers significant agenda-setting power on those actors to shape outcomes. * Manifest in role of consultants, advisors, trainers in delivering and evaluating programmes according to their preferred indicators of success.
Ideology/history of state vs. market in agricultural development	**Level of democratization and channels for participation and consultation**	**Insertion in regional and global political economy of trade, production and finance**	**Whose expertise? Relative power of types of actors**
* Shapes expectations and roles of public and private actors in delivering on CSA. * Manifest in roles given to actors in delivering CSA projects and initiatives.	* Shapes whose voices get heard and reflects degree of central state control over policy on CSA. * Manifest in degree of participation in policy of civil society and farmers' organizations and the private sector.	* Shapes ability of state to depart from preferences of donors and private investors on CSA. * Manifest in policies which reflect donor priorities and create an enabling environment for private investors.	* Shapes what counts as CSA and gets evaluated. * Manifest in technical support, training, reporting requirements and nature of recommendations for action.
Nature of policy processes/bureaucratic politics	**Degrees of decentralization and devolution**	**Developmental space**	**What counts as "Climate Smart Agriculture?"**
* Shapes who participates in policy and which ministries and preferences prevail in CSA-related strategies. * Manifest in battles over authority to manage CSA and finance to support it.	* Shapes balance of power and authority over CSA relevant policy between central and local state (counties and local government authorities). * Manifest in struggles over resources and delegation of responsibility downwards.	* Shapes scope for pro-poor interventions on climate change and agriculture, which might depart from donor or investor preferences. * Manifest in conflicts over policy priorities and allocations of funding and high levels of representation of donors in policy fora.	* Shapes what gets funded and acted upon and what gets neglected. * Manifest in development of national CSA strategies, contests over which metrics and indices are the right ones and the active presence of key international institutions in capital cities in the region.

Table 1: A framework for understanding the governance of SDGs. (Accessed from https://www.frontiersin.org/articles/10.3389/fsufs.2019.00055/full on 03 July 2021)

Objectives

Capacity Building of the farming community is one of the most important pillars to ensure inclusive growth in agriculture as it encompasses imparting contemporary knowledge, technology, and training to the farmers to equip them to manage and overcome the ever-changing dynamics in Agriculture.

The major objectives for the three days' Workshop are as follows:

- Adoption of productivity enhancement technologies to enhance rural income by maximizing quality produce.
- Enhancement of Agritech knowhow of the farmers for judicial usage of their resources and timely intervention to reduce wastages by monitoring crop health.

- Develop understanding of market dynamics amongst the farmers to drive demand driven production.

- Demonstration/Classroom Training of rural community in preservation and food processing technologies to maximize returns.

- Imparting understanding of sustainable farm operations amongst farmers to enhance quality of farming life and promote environmental stewardship.

Participants

Around 42 participants, including the Hon'ble Vice Chancellor and senior leadership team at Sher-e-Bangla Agricultural University attended the three days programme.

Methodology

The capacity building workshop was conducted online through Zoom platform created by Mr. Saurabh Mishra, CEMCA. Google Forms was used for session feedback and conducting the assessment.

Materials for the workshop

The instructor and facilitator Dr Ranjan Chaudhuri used PowerPoint presentations, online videos and shared documents for the workshop. All materials used in the workshop are enclosed as a part of Annexure to the report.

Day 1: An Introduction to Smart and Future Agro-Farming: Opportunities for Sustainability Targeting SDGs

The three days' workshop was inaugurated by Professor Madhu Parhar, Director, CEMCA. In her opening address, Professor Parhar highlighted the impacts of climate change on food security, combined with the influence of food and agriculture over our collective ability to dramatically lower greenhouse gas emissions, has been recognized by policymakers, and a suite of policies which attempt to square increasing agricultural production with mitigating climate change, as well as becoming more resilient to its effects, have since followed. She stressed on the pivotal role played by Bangladesh in ensuring food security and safety for the millions. She reiterated that Sustainable Development Goals, agreed in 2015, explicitly recognized the "integrated and indivisible" interconnections between sustainability goals, and are novel in the extent to which they attempt to move beyond traditional agriculture to more sophisticated, climate resilient, smart and digitally precise agriculture. She welcomed the audience and wished the programme a hearty success.

Mr. Saurabh Mishra, Programme Officer (Skills), Commonwealth Educational Media Centre for Asia (CEMCA), responsible for Promoting Learning for Sustainable Development, in his inaugural address introduced the scope and sphere of activities for CEMCA. He ushered the concept of good will and friendly neighborhood policy followed by the organization and welcomed the dignitaries and participants to productively engage them in the three days workshop and help to re-write the agricultural transformation story in Bangladesh.

Professor Abul Hasnat M Solaiman, PhD

Professor Dr Abul Hasnat M Solaiman, PhD (Japan), Professor and Founder PD-Fab Lab SAU (Funded by: The World Bank Group), Sher-e-Bangla Agricultural University in his welcome address triggered the discussion on the potential and constraints of agriculture in Bangladesh and urged the audience to discuss ways and means regarding how complex local agricultural problems can be solved locally, using the platform provided by CEMCA. He also deliberated on creating agricultural entrepreneurship ecosystem in Bangladesh and how to reduce carbon credit and carbon emissions to transform Bangladesh to carbon neutral in agriculture in the next ten years. He also mentioned few smart agricultural technologies, mobile apps, water-smart, weather-smart, knowledge-smart, nutrient-smart, carbon-smart that are needed for Bangladesh perspective. He connected SDG goals with a lot of smart-technologies, prototypes that are being practiced around the world. He showed flow charts on partnering ecosystem. He highlighted the potentiality of Agriculture 4.0 with the relation to IR 4.0 (4^{th} Industrial agricultural Revolution).

Dr Ranjan Chaudhuri

Dr Ranjan Chaudhuri, Fulbright Fellow and Associate Professor at National Institute of Industrial Engineering Mumbai, India in his opening remark highlighted the importance of an integrated approach to climate-resilient agriculture and the existence of opportunities to capitalize on

synergies, between two neighbour countries, India and Bangladesh. Responding to a request received from Professor Parimal Biswas, Dean, Faculty of Agriculture, Dr Ranjan Chaudhuri addressed the question of how countries navigate such different contexts in pursuing strategies for climate resilient agriculture in line with the SDGs.

Dr Ranjan Chaudhuri discussed that there has been rapid transformation from traditional agricultural husbandry to modern agriculture. Digital agriculture is fundamental to the understanding of agricultural information systems and architecture. The strengthening of digital agriculture will greatly enhance agricultural technology revolution and a country's competitiveness in the WTO. To implement digital agriculture, the frame system of digital agriculture is required must be studied. In accordance with the theory and technology of digital earth and in combination with the agricultural reality of contemporary agricultural sciences, through discussions on state-of-the-art review articles and use cases, Dr Ranjan Chaudhuri outlined the frame system of precision and digital agriculture and its limitations and benefits.

Mrs. Sumana Mukherjee

Mrs Mukherjee primarily introduced the concepts of Smart and Future Agro Farming in the context of climate change and sustainability development goals. She talked about the impact of Climate change which is leading to rise in sea level, flash floods, cyclones and tornados, temperature rise and irregular rainfall. She discussed the case study on climate resilient rice farming in Bangladesh, which is enclosed as a part of the annexure. She specifically covered the impact of sea level rise in Bangladesh and potential of productive arable land getting submerged. She gave examples of shifting and reduced cultivation of crops due to soil degradation and salinity. Urban sprawl was also mentioned by her as a major reason for reduction in farmlands which will pose a major challenge to food security with projected increase in population.

She talked about the three pillars of climate smart agriculture and covered in the detail the agricultural practices to enhance livelihood and ecosystems and Low carbon farming linking them to the Sustainability development goals.

As a comprehensive solution she talked about integrated farming with the live example of a zero-waste concept farming being done by Biodiverse Farming in Tona Village of West Bengal, appended in annexure herewith, and suggested to draw learnings from the concept for practical application in Bangladesh.

Mr. Sudipta Kr. Mukhopadhyay

Mr. Mukhopadhyay primarily talked about the concept of Farm to Fork. He made it very clear that to plan the micro one needs to understand the macro. He started with overall agriculture and allied production scenario of Bangladesh. He talked about a large size of the population still dependent on agriculture, lower growth in farmers income, increasing indebtedness of farmers, low value addition and presence of few secondary agri industries affecting the agricultural sector. However inspite of the challenges, Bangladesh as a country has done fairly well in feeding its 16 Cr

population in the past. But challenges in the future are many and its time to start developing market led supply chains.

He touched up the concept of Agroecological Zones and how Bangladesh has done a fantastic job in dividing itself into 30 different agroecological zones. Its time the potential crops are identified from each ecological zone and efforts are made to make them compete at a world stage. Example of Washington Apples was shared on how their uniqueness in maintaining traceability, understanding of destination markets and consumers has made them become a world leader in apples from the state of Washington in USA.

Importance of ICT was explained to the audience with the example of ITC eChoupal case study and how ITC developed a world-renowned Atta Brand "Aashirwaad" by linking the farmers digitally for knowledge dissemination, input availability and market linkage.

Finally, he talked about Demand driven supply chains, importance of primary procurement infrastructure and value addition as close as possible to the origins to capture maximum value early in the supply chain. He also introduced the concepts of food safety, traceability and Blockchain.

Day-2: (22nd June, 2021)

Prof Dr Solaiman was expert of session on 22nd June 2021. The sessions were aimed to support towards online capacity building and sensitization programme on "Smart and Future agro-farming: opportunities for sustainability targeting SDGs" course for Agriculture University faculties from Bangladesh.

At the beginning, Prof Dr Solaiman described the different ways and tools of the session and described different agricultural complexes of Bangladesh that need to be addressed. He mentioned the 4 key characteristics of the agricultural problems. He mentioned the multi-level, multi-dimensional and multi-stake holders' problems and how innovation can mitigate those problems connecting different smart farming tools. He also presented the value chain system with farm to factory gate. He connected the innovation system dynamics by involving meteorological department and university to achieve the solution for the future. In 2-3 slides he described about innovative agriculture system like Technology Transfer (TT), Rapid Appraisal Innovation System (RAIS), and Farming system analysis (FRS), Agricultural knowledge and Information System (AKIS) and also the Agricultural Innovation System (AIS). Then he defined smart farming and showed different smart farming technologies including different apps that are being implemented throw out the world.

He also described the three pillars of climate-smart farming (CSA) and how it can be adopted using smart farming technologies. He mentioned uses of IoT, drones, and cloud systems etc with photos, designs and innovative prototypes. He outlined selected climate smart options to assess farmers' preferences like water-smart technologies, weather-smart, knowledge-smart, carbon-smart, nutrient-smart technologies that to be practiced in future agriculture of Bangladesh.

The challenges foreseen in Bangladesh agriculture as far as the need to double food supply by 2030 according to SDG is concerned are now putting agricultural sustainability ensuring food security. For example, As we are struggling to ensure efficiency in how we use water in our

agriculture field, ways of reducing soil erosion and ensuring minimum degradation, or even minimizing energy input, smart innovative technologies are the solution. Every farmer wishes to get efficient and sustainable yield using possible low-cost inputs gettable in Bangladesh market. However, such goals can be achieved in agriculture by smart farming technologies keeping in mind the skillness which cannot be achieved successfully through traditional approaches of farming. These issues can be solved enhancing the capacity of the stakeholders involved in agriculture system by workshops, training etc about the innovative technologies that are necessary for future farming.

In this context, Considering covid-19 pandemic 3-day virtual training programme was arranged by CEMCA, New Delhi collaboration with Sher-e-Bangla Agricultural University, Dhaka Bangladesh for enhancing capacity of the faculty members who are strongly connected with the Bangladesh Agriculture System.

Objectives of the session:

1. Triggering participants for future farming and smart ideas to solve agricultural complex dynamics through innovative tools
2. To build capacity on smart and future farming to face challenges in sustainability targeting SDGs'
3. Participants will be able to think about innovations strategies to address local agriculture problems and smart solution of Bangladesh
4. Connecting participants with innovation space/maker-space/Fab Labs to understand the making and operating smart devices and other future farming devices that are necessary for Bangladesh

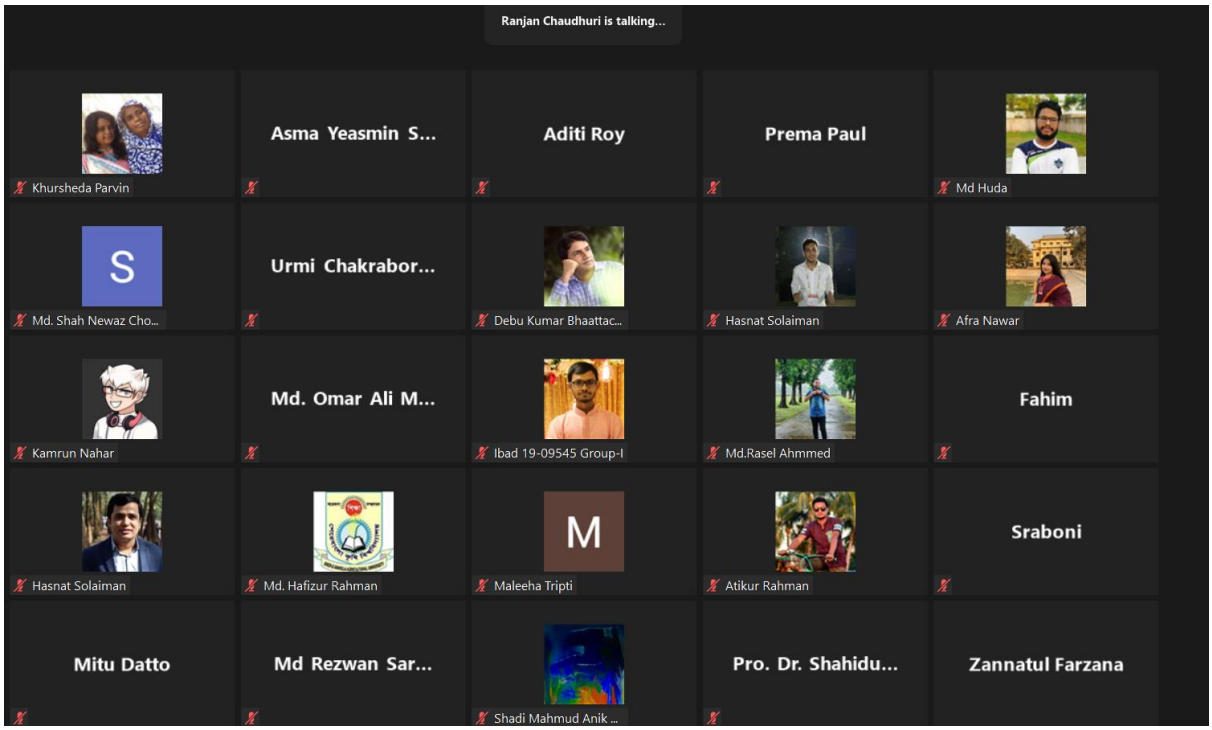
Course-Outline:

Support towards online capacity building and sensitization programme on "Smart and Future agro-farming: opportunities for sustainability targeting SDGs" course for Agriculture University faculties from Bangladesh

1. Finding out agricultural complexes: 4 key characteristics
2. Climate change and food security: problems identifications
3. Need for Agricultural innovation systems: Multi-stakeholder and multidimensional approach
4. How innovation measures-video demonstration
5. Defining agro-innovations
6. Smart agriculture-definition, making understandings to participants
7. Climate smart agriculture (CSA)- highlighting 3 pillars
8. Management concept using modern technologies

9. IoT in agricultural management
10. Selected climate smart options to assess farmers' preferences: weather smart, knowledge-smart etc
11. What we have now. In Bangladesh: Production surplus
12. Identifying problems and Sustainable & Innovative Technologies in Agriculture
13. Future agro-tools to sustainability-ways and tools
14. Trend in 2021
15. Inventions/Fabrication-Local inputs- problem specific solutions
16. Agriculture 4.0
17. Future agro-challenges to meet
18. Partnerships for sustainability
19. SDG's that need to be addressed
20. Technologies for sustainability targeting SDG's: Evidence for start now
21. Agriculture minister and PM requested for future and smart farming
22. Activities how we can work together and make sustainable partnerships

2nd Day Session:



Then Dr Solaiman mentioned the 17 goals of SDGs. Just after these, he showed different apps that are already have in Bangladesh which basically promoting modern agriculture not smart-agriculture.

He described the different gate-ways of smart farming and devices that are necessary to develop along with prototypes where necessary. He mentioned the Digital Agriculture 2021: Bringing Innovative Technology to One of the Oldest Industries with the footprint of smart farming in Bangladesh with Geopotato; GEOPOTATO alerts allow farmers to protect their crops before blight occurs, reducing their uncertainty and losses. This project goal is to scale this system to provide alerts about weather and cultivation practices to reduce farmer risk and increase inputs, yields and profits. Theoretically, the service can be expanded to other crops like tomatoes

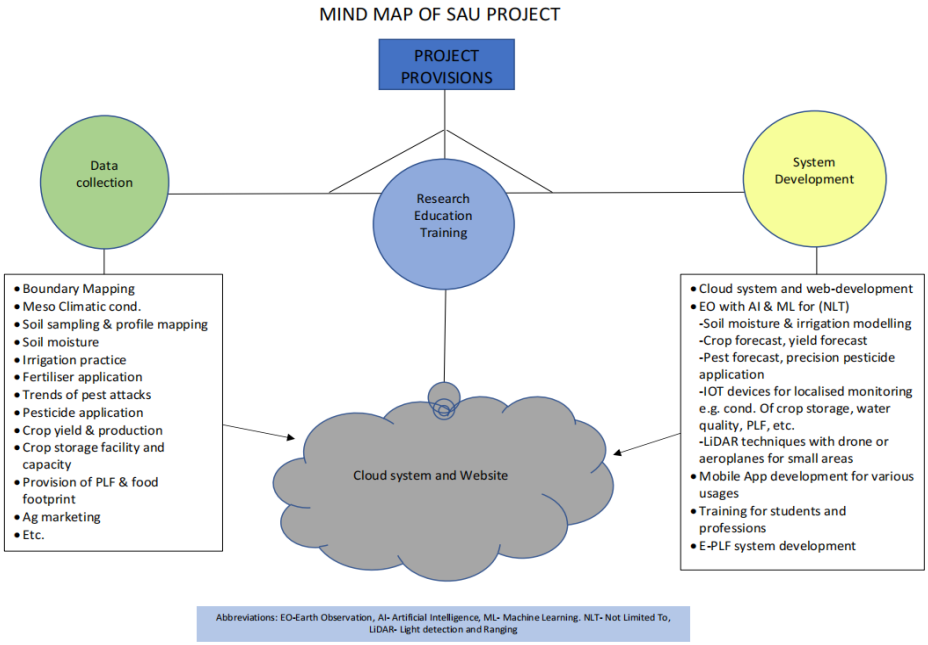
After that Prof Dr Solaiman highlighted future Agro-technologies and requested all faculty

members as follows: Following areas have been identified and project proposals may be submitted for development of Sustainable & Innovative Technologies in Agriculture in the following areas: -Development of advanced production technology; Development of rural resource management strategies; Food Processing technologies or devices; Pre-processing technologies on land management, Farm mechanization; Post harvest management, storage and processing, Technology for Agribusiness and marketing of produces, Development of Sensor based applications in agriculture/ irrigation, Technology in agriculture infrastructure, Technologies for Pesticide Management, Technologies for Prevention of lodging losses in crops, Technologies for Agri-residue Management, Technologies for reducing on-farm loss of pre Management, Technologies for Agri-Product Transport, Precision Farming Technologies, Net house cultivation etc. He focused on the Agriculture Innovation Trends In 2021 mentioning Software-as-a-service solutions for orchard management, Yield monitoring and estimation, Farm management platforms, Utilization of drones, IoTs in farming, Smart agriculture machines, Water management, Packaging, Eco-friendly plant production products based on Digital agriculture, Technological Agriculture, Industrial agriculture (4.0), Precision agriculture-GPS, GIS, GNSS, UAVs, VRT and Future Farming/Smart farming. Dr Solaiman showed how different smart apps have been using nowadays, to resolve the local problems in different countries. He mentioned in his presentation how we can meet these challenges that will require a concerted effort by governments, investors, researchers and innovative agricultural technologies.

For future agriculture, agriculture 4.0 will play the vital role in the world. He mentioned Agriculture 4.0 will no longer depend on applying water, fertilizers, and pesticides uniformly across entire fields, instead farmers will use the minimum quantities required and target very specific areas.

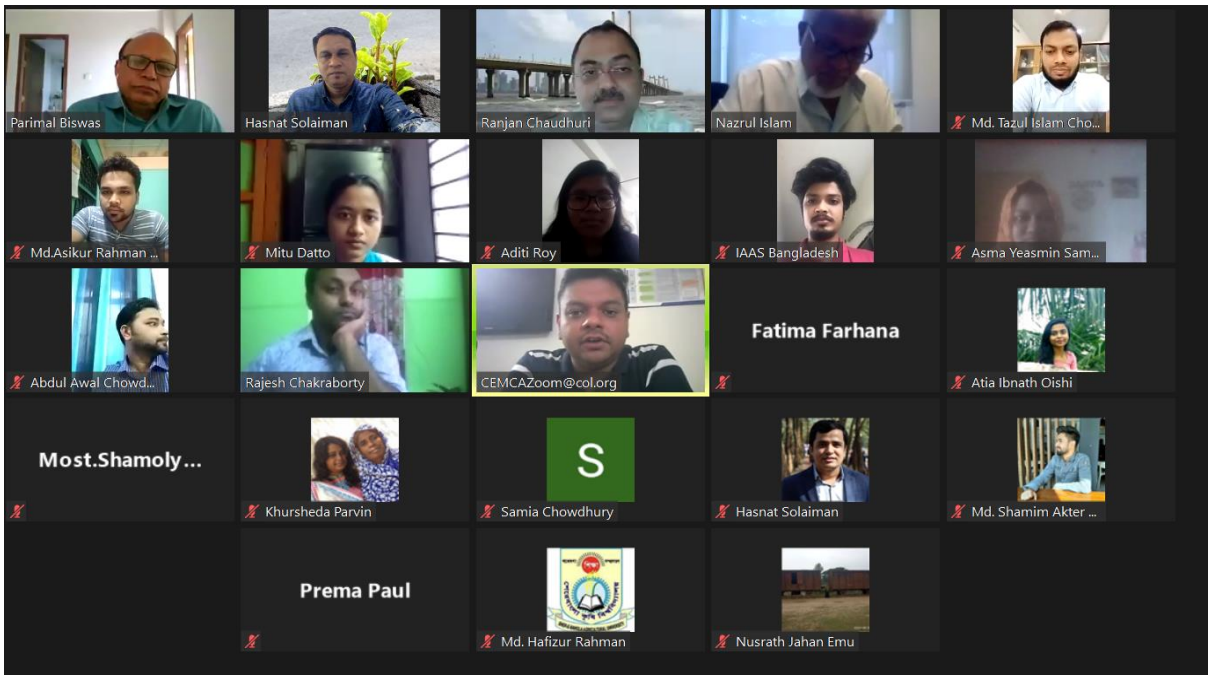
Farms and agricultural operations will have to be run very differently, primarily due to advancements in technology such as sensors, devices, machines, and information technology. Future agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be more profitable, efficient, safe, and environmentally friendly.

For describing agriculture 4.0 Dr Solaiman mentioned about a mind map that can be adopted for achieving SDGs disrupting the present farming system with doable smart-farming ecosystem.

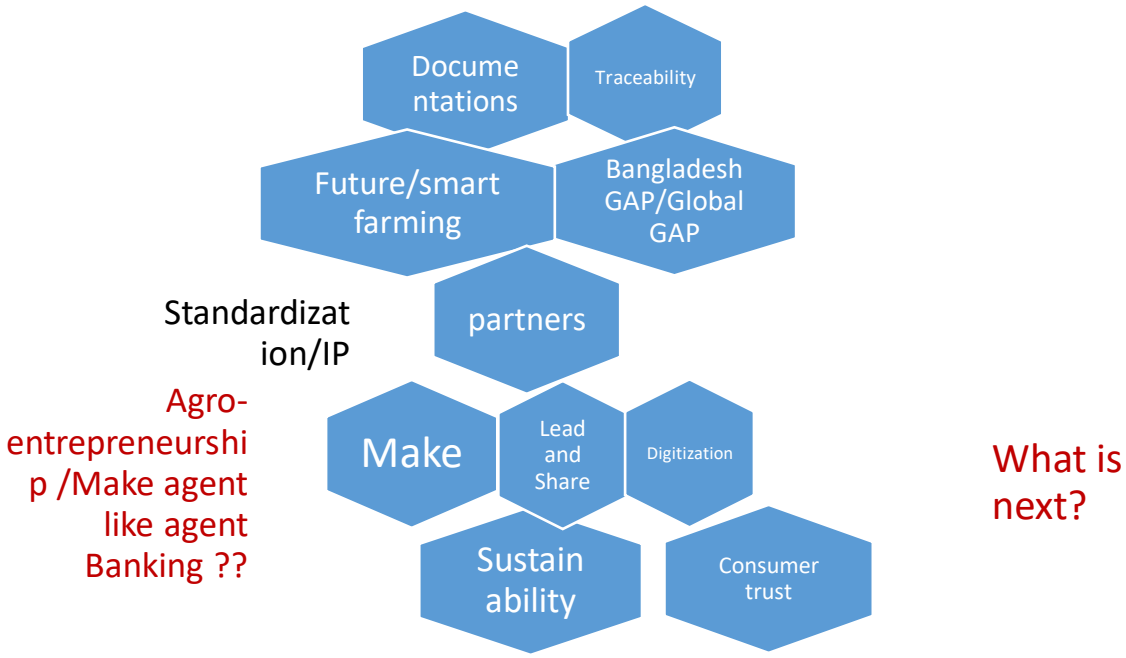


Technology-cross-industry partnership model was shown to the participants and answered; what are the new technologies and solutions in the agriculture 4.0 that can give hope to the food scarcity problem? He told We see 3 general trends where technology is disrupting industry that we will address: showing specific examples of solutions with high potential to disrupt the system like, Produce differently using new technologies, Use new technologies to bring food production to consumers, increasing efficiencies in the food chain and Incorporate cross-industry technologies and applications

Besides, he showed few prototypes, that have been developed in FabLab SAU, a makerspace that can make a lot things to support the future agriculture of Bangladesh.



At last, Dr. Solaiman suggested a model for achieving the target of smart farming initiatives as follows:



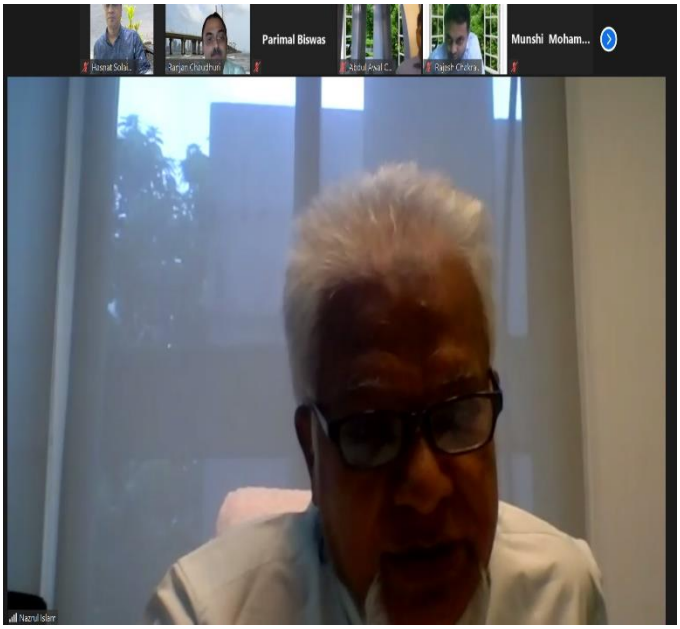
Two eminent persons were present as discussant. We had Professor Dr. Parimal Kanti Biswas, Dept of Agronomy and Ex-Dean, Post-Graduate Studies, SAU, Dhaka was present as a Discussant in that session. In addition we had with us Md. Nazrul Islam, EX-Director, Agricultural Information Services (AIS), Ministry of Agriculture, Bangladesh and Chief-Election Commissioner, Krishibid Institution Dhaka Bangladesh, (KIB)-A professional Organization for Agriculturists. They discussed about the necessity of smart and future farming in Bangladesh.

They thanked CEMCA to arrange such important training which will enhance the capacity of faculty members and agriculture students about future agriculture system of Bangladesh. They proposed to arrange few more training session on different topics related to agriculture where they will request high officials and agriculture minister to present.

At last with the vote of Thanks Dr Ranjan Chaudhury and Professor Dr Abul Hasnat Solaiman closed the session.

Panelist-1:

Professor Dr. Parimal Kanti Biswas, Dept of Agronomy and Ex-Dean, Post-Graduate Studies, SAU, Dhaka was present as a Discussant in that session.



Panelist-2:

Md. Nazrul Islam, EX-Director, Agricultural Information Services (AIS), Ministry of Agriculture, Bangladesh and Chief-Election Commissioner, Krishibid Institution Dhaka Bangladesh, (KIB)-A professional Organization for Agriculturists.

Dr Ranjan Chaudhury was the moderator for that session

Smart and Future Agro-Farming:

CHALLENGES FOR SUSTAINABILITY TARGETING SDGS'

Innovation matters

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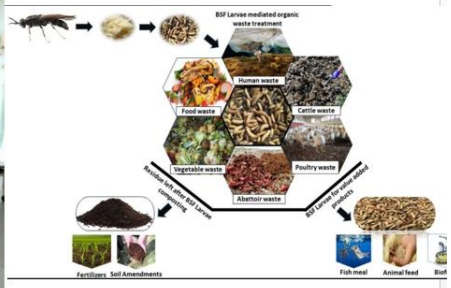
Cycle Feed

Insect-based feed for West African tilapia farmers

Prof Dr Shakhawat, Entomology

SDG 9 INNOVATION AND INFRASTRUCTURE

SDG 12 RESPONSIBLE CONSUMPTION



BSF

Solar Powered BSF Production Box, Handed Over to renowned entomologist Prof Dr Shakhawat Hossain. It will help in Kitchen waste management with BSF and Maggot will be used as feed for Fish and Poultry. First Prototype made. Another two types will be made soon. Made in Fab lab SAU. MS student-Sunonda will start her research

2nd Day Session PPT slides

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Panelist-1:

Professor Dr. Parimal Kanti Biswas, Dept of Agronomy and Ex-Dean, Post-Graduate Studies, SAU, Dhaka was present as a Discussant in that session.

Panelist-2:

Md. Nazrul Islam, EX-Director, Agricultural Information Services (AIS), Ministry of Agriculture, Bangladesh and Chief-Election Commissioner, Krishibid Institution Dhaka Bangladesh, (KIB)-A professional Organization for Agricultursits' Bangladesh.

Case Study:

A video was shown about safe farming and arranged a discussion session with faculty members to resolve the problems came out from the field.

Problem Identification from the field:

Farmers are producing safe vegetable following Good Agricultural practices (GAP). The problem they are facing to sell in the market as the chemically treated vegetables and safe vegetables have been sold in the same place or market. They were requesting for separate center or market place for selling safe commodities with a better price as they were using safe inputs. Six farmers (Three from Singair Upazilla, Manikgonj and 3 from Dhamrai Upazilla, Dhaka districts) were interviewed and almost everybody (Only one farmer selling safe vegetables/fruits to chain shops) was urges for separate market and requesting for ID-cards as safe farmer as they are following safe farming technologies.

	
Farmer Mizan- Singair, Manikgonj Dhaka	Entaz Ali, Anwar Hossain and Mosharof Hossain, Dhamrai, Dhaka

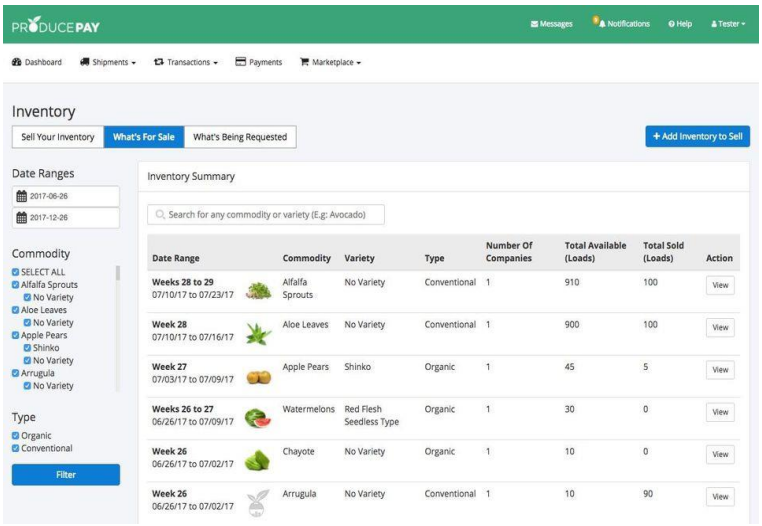
Suggestions came out in the discussion:

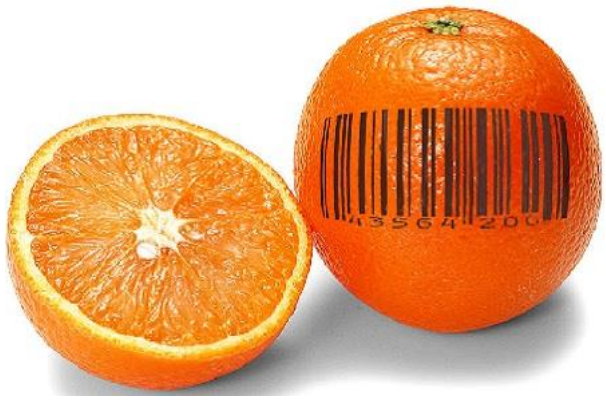
The audience and the discussant were suggesting the following ways or tools to sustainable the safe farming

1. Validation, certification of safe farming following Bangladesh GAP (Guideline for produce safe crops)
2. Scalability of inputs stores for safe farming around the country with mobile apps and

websites including social media promotion.

3. Traceability can be introduced to gain consumer trust for safe commodities where RFID bar coding can confirm the traceability as future and smart farming tools.
4. Government has established one market (Krishoker Bazar, Manik Mia Avenue, Farmgate Dhaka) only for safe commodities. Six directorate under Agricultural Ministry allotted two-cool van (Cool-supply chain) to collect safe vegetables/fruits/commodities from the field and this truck went to the field early in the morning, load vegetables and bring those to the "Krishoker Bazar" where farmers himself or herself (two-female farmers) sale their products here. Need more markets like that around the country.
5. To enhance confidence among the farmers who grow commodities in safe manner, separate card or sign can be supplied to them which can encourage other farmers not to use chemicals.
6. A common platform (Mobile apps) for grower, consumer and traders can be created like produce pay that is running well in Canada.





Suggestive prototype-Produce-pay-

Barcoding for traceability (Prototype)

Solution:

1. RFID barcoding for traceability
2. Mobile applications for everyone (Consumer-growers-traders)

Day 3 (26/06/21): Project on Climate Smart Agriculture

Dr Ranjan Chaudhuri initiated the discussion for the day with a brief overview on Digital Agriculture and advances in Climate Smart Agriculture. In his opening remarks, Dr Chaudhuri elaborated on the development of international agriculture, which has experienced several main stages: primitive agriculture stage, traditional agriculture stage and modern agriculture stage. Undertaking some easy work by stoneware is one of the main characters of primitive agriculture. During the traditional agriculture stage, humans invented ironware and began to produce using tools made of iron and wood. The productivity was improved significantly. While during modern agriculture stage, advanced agricultural machines were used, and agricultural economy made great progress. The character of current agriculture depends on information processing by the digitalization of information. The concept of Digital Agriculture is a turning point to normalize and boost the development of international agriculture. The Digital Agriculture is featured by digitization of agricultural activity driven by digits. It aims to build an integrated agricultural system, which combines data collection, data transmission, data processing and digital control of machinery together to realize the digitization, networking and automatic operation of agricultural activity.

Framework of Digital Agriculture

The framework of Digital Agriculture is composed of the following parts:

• Basic information databases of agriculture to provide basic information about farmlands, soil resources, climate conditions, social economy background to secure agricultural activities closely related with the whole society.

• Real-time information collecting system for monitoring of agricultural activities and update of databases made up of digitized information collectors responsible for the collection of meteorology, vegetation and soil information on ground, airborne or satellite-based sensors.

• Digital network transmission system to accept the collection of information and the distribution of commands.

• Central processing system (CPS) based on GIS, agricultural models and expert systems to analyze the collected information to makes feasible decisions, and then to send out control commands to direct the work of digitized agricultural machinery.

• Digitized agricultural machinery (DAM) include digitized sowing device, digitized water and fertilizer control devices, digitized harvesting device based on data driven control systems to support digital networks, GPS and GIS, digitized agricultural machinery to implement the commands of CPS, and return processing results directly or through the real-time information collecting system.

Digital agricultural system determines the planting plan of a year according to the basic information databases monitors the growth dynamism of crops and provides soil structure, water content, disease, meteorology and other important information by information collecting system. CPS analyzes all kinds of information and makes reasonable decisions. Under the direction of CPS real-time data driven control mechanism to operate agricultural machinery to finish series of work, such as sowing, water or fertilizer controlling, harvesting, and return the results to CPS. CPS makes the overall analysis report. Digital Agriculture adheres to the integrative development of each part. Only when all the parts tie closely and develop cooperatively, only then Digital Agriculture is constructed. Any part or several parts developing separately cannot be called Digital Agriculture.

Recent advances in sensing, information, automation, and control technologies are providing researchers with means to explore previously unanswerable questions regarding plant physiological requirements. The ability to provide specialized environments, together with emerging diagnostic techniques for cellular differentiation, segmentation, and elongation, as well as whole-plant imaging, open further avenues of research.

The fruits promised by this research include improved basic understanding of physiological processes and enhancements of our ability to apply this knowledge in efficient production control systems. Domain knowledge from research results must be coupled with technological implementation to ensure fast utilization; the demands for shortening product life cycles need to be addressed. Although no one can claim that intelligent control is a final answer for every conceivable control problem in agriculture, it must be seriously considered in future developments. The objective here is to make use of the tolerance for imprecision and uncertainty that are standards of computational intelligence techniques while incorporating characteristics of the agricultural environment under a requirement for rapid implementation. Given the power of soft computing and the wide acceptance of conventional manufacturing and control approaches, the question arises as to how to best benefit from both worlds. At the level of management, many production operations are event based, and the need for conflict management and efficient scheduling has become apparent. Manufacturing technologies such as discrete-event systems and the game theory must move around to field production and supply chain management operations. Can we develop solutions using hybrid systems to realize new control accomplishments for the benefit of society? Can the hierarchical approach, based on synergistic/competing intelligent agents using layered subsystems of intelligent supervisors providing command level directives for conventional controllers, yield solutions to some of the pressing problems in the field? We believe that such hybrid systems, which can make best use of existing as well as new knowledge about the process, will open up new horizons and lead to even further developments. Our challenge is to find practical solutions to the complex problems faced by society in the control of agriculture and the environment.

In this direction, it becomes imperative for the attendees of the workshop to develop a perspective of building climate resilient, robust, high precision, technology – mediated farming models that could address the future problems of food safety and security of feeding close to nine billion global population.

The following two projects were assigned to the participants.

Project 1: Prepare an integrated farming model encompassing the concepts of Climate Smart Agriculture in the context of Bangladesh.

Project 2: Suggest an approach towards market driven production and market linkages using concepts of ICT and Agritech

The project discussion identified key areas of intervention and outlined how the CSA approach can support Bangladesh to build the country's resilience to the impacts of climate change while increasing the sustainability and productivity of agricultural systems.

Dr Ranjan Chaudhuri summarized the key action areas to transform Bangladesh to CSA conformity.

Setting	Setting up of a web - based portal on climate change information and knowledge management (CCIKM) network at Sub-Division Level;
Enhancing	Enhancing institutional capacity of Ministry of Agriculture and relevant agencies with respect to information and knowledge management (IKM) on climate change adaptation (CCA); and
Commissioning	Commissioning prioritized research to fill the current knowledge gaps on CCA

Table 2: Key Action Areas for Bangladesh

In his concluding remarks, Dr Ranjan Chaudhuri reiterated that the world is in transition to one in which there will be more people, greater consumption of materials and resources, more global interdependence, and a need to reduce poverty without destroying the environment.

Over the past two decades, Sustainable Development has become a principal concept in integrating technological, economic, social, and political issues to decide environmental protection and economic development. The future depends on harnessing the power of modern technologies, consistent with the interests of the poor and hungry, and with respect for the environment. Agriculture, as a source for food, natural raw materials for bio-industries, and energy, will increasingly be a major driver of this transition. Sustainable

Development is a “process” of redirection, reorientation, and reallocation—an evolving process rather than a static definition. It depends on a fundamental redesign of technological, economic, and sociological processes to effect changes. To get beyond the various images of Sustainable Development, there is a need to develop a “science” of sustainability and systems of

implementation. This leads to suggest that the process of transition to a sustainable world will include:

• Streamlining processes and reusing materials with a goal of zero waste.

• Embracing new technologies of information science, biotechnology (genomics and integrative molecular biology),

• and advanced materials to reduce environmental problems while increasing economic productivity.

• Utilizing renewable resources for energy to reduce or eliminate our dependence on fossil fuels.

• Developing sustainable communities based on the efficient use of space, increased conservation of materials and energy resources, and reduced transportation.

• Improving community livability and developing more efficient administrative and planning processes to demonstrate ecological living that is economically and socially desirable.

• Developing sustainable agriculture as a principal component of sustainable communities where use of fossil fuels, insecticides, herbicides, and inorganic fertilizers is minimized or eliminated.

• Focusing on newer and innovative sustainable enterprises such as bio-based industrial products.

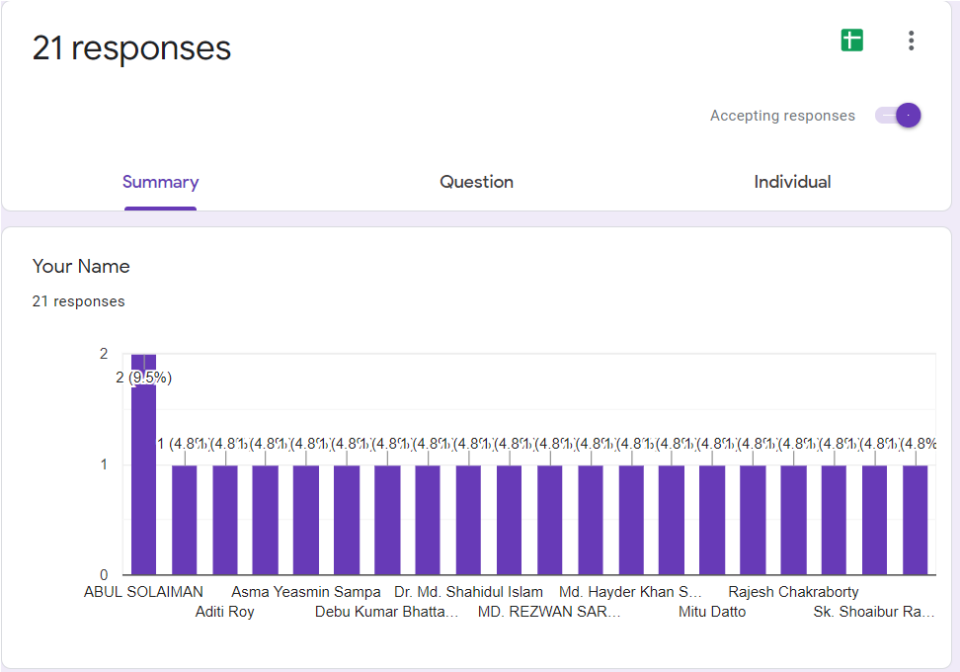
The challenge is to rethink how the material needs of society can be met by using agriculturally based systems. This rethinking involves an integration of science and engineering with an emphasis on ecological processes and socioeconomic phenomena. Technologies such as biotechnologies, information systems, and control and management systems will play a key role in inventing new processes and ensuring their effective and efficient execution at the highest possible quality and lowest cost.
Communications networking of production units has become an important feature of agricultural production processes and can be expected to continue to grow. Farm operations can communicate with weather services, traders, contractors, suppliers, biological services, consultants, and many other organizations. In these applications, the Internet already plays a key role. For on-farm communication, which is mainly used for online or inline applications on or among tractors and implements, a specific communication system, the agricultural bus system has been developed. This consistent communication system serves as the strength for precision agriculture, as demonstrated by the examples in the summary of the projects presented by the attendees in the three days' workshop.

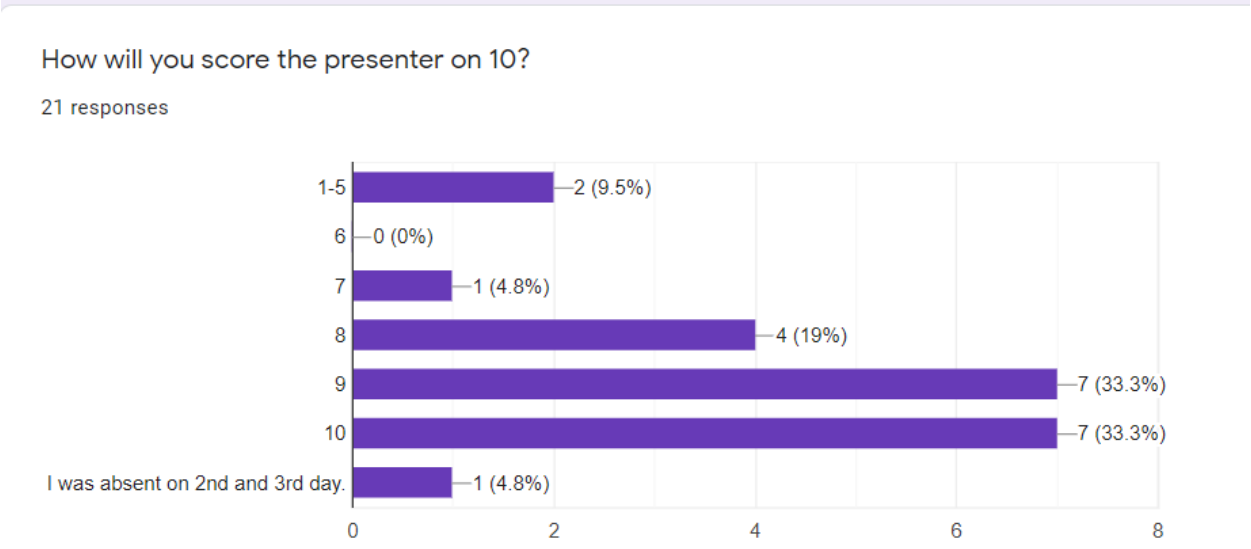
Evaluation

An online quiz was administered to the participants of the Workshop. A template for the Quiz is attached as a part of the annexure.

Evaluation of the feedback

56% trainees attended in the survey and answered questions that are necessary for the future event. Few new training title proposed by the trainees.





Participant's Feed Back:

The participants expressed their satisfaction with the overall conduct of the 3-Day Faculty Development Program. They stated that they found the content useful and also could relate to the topics discussed and examples cited in the context of their professional experience in their university. The participants proposed Offline face to face sessions in future to enhance their participation and engagement during the training once the pandemic gets over. Experience was shared by the Trainers and Participants on dealing with quiet, noisy, lazy, inactive and disruptive students in the Online Class Rooms.

Individual Feedbacks of Participants

- It was an amazing session and got to know Countless new technologies and new smart farming methods and techniques.
- If the slides are given, it would be very helpful to recall the session.
- Thank you to all respected sir for sharing your knowledge and helping us to improve our knowledge
- Thanks for this initiative.
- Good day
- Super
- Really was a wonderful workshop and presentation was absolutely mind-blowing. I wish I got the presentation slide that instructor presented to cultivate more ideas which will make my learning more long-lasting from this training. Again thanks!
- It is very helpful training.
- No
- good
- It is very informative, time demanding and agro technology based training program. I am really impressed.
- Thank you very much for giving undergraduate students this opportunity.
- That was a very insightful session. Hope we will get access to your slide. Thank you sir.
- It was an outstanding and informative session, I have done during this pandemic situation.
- Please continue such kind of meeting.
- This presentation gave me new information on some very time- demanding aspects in agriculture.
- No need
- Presentation materials should be in specific from the next activates.
- Thanks for organizing such an informative program.

Participant List

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