

NAM

S&T Newsletter



A Quarterly of the
Centre for Science and Technology of the Non-Aligned
and Other Developing Countries (NAM S&T Centre)

VOL. 32, No. 2
JULY - SEPTEMBER 2022

FROM THE DG'S DESK

Warmest Greetings to all our Esteemed Readers!!



I am pleased to inform you that the 2nd Meeting of the Bureau of the 15th Governing Council (GC) of the NAM S&T Centre was held on 21st September 2022 (in Virtual Mode). The meeting was hosted by the Higher Council for Innovation and Excellence (HCIE), Government of the State of Palestine. The Members of the Bureau and other delegates appreciated various S&T initiatives taken by the Centre to establish international

partnerships through joint scientific programs, publications and other bilateral and multilateral projects.

During the third quarter of the year, the NAM S&T Centre, in partnership with the Center of Excellence on High Voltage Engineering, University of the Witwatersrand, Johannesburg, South Africa; Department of Science and Innovation, Pretoria, South Africa; and Energy Storage Chapter, South African Institute of Electrical Engineers (SAIEE) successfully organised an International Roundtable on “**Energy Storage Systems**” on 12 September 2022 in Virtual mode. The Roundtable provided concept-based understanding on sustainable and long-duration energy storage technologies and was attended by more than 150 experts and professionals from 25 developing and developed countries.

I am happy to announce that our book on “**Managing Extreme Natural Events: Sustainable Solutions for Developing Countries**” published by Springer Nature, Singapore has now been released and the printed Book as well as the eBook are available for purchase from the publisher.

The Centre invites applications from interested scientists and experts for the following scientific program which was announced recently: International Training Workshop on “*Emerging Trends in Materials, Design, Innovation and Intelligent Manufacturing of Footwear and Leather Products in Developing Countries*” to be organised jointly with the CSIR-Central Leather Research Institute (CLRI) in Chennai, India during 30-31 January 2023. Detailed guidelines for participation are available at Centre's official website: www.namstct.org.

As the situation is fast coming out of the Covid-19 pandemic, a number of international scientific activities on broad range of topics are lined up by the Centre in the upcoming year. We look forward to receiving nominations from concerned experts and professionals for attending these important events.

I would like to thank all the Focal Points, scientific community and scientific organizations in our Member Countries for their encouragement and enormous support to the Centre in taking forward our pursuit for the promotion of Science, Technology and Innovation for the benefit of developing countries.

Happy Reading!!

Amitava Bandopadhyay
(Amitava Bandopadhyay)
Director General

Second Meeting of the Bureau of the Fifteenth Governing Council 21 September 2022

(Hosted by Palestine in Virtual Mode)

The 2nd meeting of the Bureau of the 15th Governing Council (GC) of the Centre for Science and Technology of the Non-Aligned and other Developing Countries (NAM S&T Centre) was held on 21st September 2022 in Virtual Mode which was hosted by the Higher Council for Innovation and Excellence (HCIE), Government of the State of Palestine. 44 delegates from 12 countries including Focal Points of the NAM S&T Centre in Member Countries; representatives from the diplomatic missions of Egypt, South Africa and Sri Lanka; senior officials of HCIE; and representatives of the NAM S&T Centre Secretariat attended the meeting.

At the outset, Dr. Khaled MA. Qalalwa, Director General for International Cooperation, Higher Council for Innovation and Excellence (HCIE), Palestine welcomed the distinguished Members of the Bureau, delegates from other Member Countries and other delegates from Palestine; and the esteemed representatives from the diplomatic missions of various countries.

(Contd. on page 2)

Centre Organised

International Roundtable on Energy Storage Systems

12 September 2022 [Virtual Mode]

Marching from black energy to a world of green energy essentially requires energy storage systems that could hold sizable quantity of energy for a reasonably long time, to maximize the usage of energy produced. Most renewable sources are non-uniform in availability and thus, long-duration energy storage systems hold great potential for developing countries in which renewable energy dominates new additions and gradually may overtake the other sources of electricity.

Energy Storage Systems (ESSs) store energy in various forms such as electrochemical, kinetic, electromagnetic, chemical, thermal and others using fuel cells, batteries, capacitors, liquid and compressed air, hydrogen, etc. There is a need to accelerate advanced research on inventing new, innovative and cost-effective energy storage systems.

In view of the above backdrop, the *Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)*; New Delhi; in partnership with

(Contd. on page 4)

(Contd. from Page 1 - Bureau Meeting.....)

Mr. M. N. Ranasinghe, Secretary, Ministry of Education, Government of Sri Lanka and President of the 15th GC of the NAM S&T Centre in his remarks expressed gratitude to the Government of the State of Palestine for hosting the Bureau Meeting and welcomed the Excellencies and distinguished delegates. Mr. Ranasinghe said that Sri Lanka has been an active member of the NAM S&T Centre from its inception and is honoured to hold the positions of both Vice-President and President of the Governing Council in recent years. Mr. Ranasinghe also mentioned that the Sri Lankan government has been implementing development projects in various areas and his Government has identified another priority area on: "Expanding the field of Research and Development (R&D) and encouraging Innovation and Facilitate widespread adoption thereof" and suggested that the Members of the NAM S&T Centre should work together in many such mutually beneficial projects.

Mr. Ranasinghe appreciated the good work done by the NAM S&T Centre during the Pandemic time and also recognized the commendable contributions of the Centre towards capacity building of the scientific community of Sri Lanka as well as all other Member Countries through fellowships, joint R&D projects and training programmes in areas such as Disaster Mitigation; Technology Transfer; Science, Technology and Innovation; Energy; Food and Water, etc.

Prof. Dr. Gina Elfeky, Supervisor, Scientific & Cultural Relations Sector, Academy of Scientific Research and Technology (ASRT), Cairo, Egypt attended the meeting on behalf of Prof. Dr. Mahmoud Sakr, President, ASRT and Vice President of the 15th GC of the NAM S&T Centre - who could not be present due to some unavoidable circumstances. Prof. Gina in her remarks appreciated the crucial role the NAM S&T Centre has been playing over the years to tackle various economic, scientific and developmental issues to shape the S&T strategies of developing countries. She assured that ASRT would continue to work in partnership with the Centre for various activities on different aspects and disciplines for the welfare of the Member Countries of the Centre.

Mr. Vedanand Bhurosah, Assistant Director, Ministry of Education, Tertiary Education, Science & Technology, Mauritius attended the meeting on behalf of Mr. Youdhisteer Munbodh, Permanent Secretary of the Ministry, and Vice President of the 15th GC of the NAM S&T Centre. In his remarks, he expressed happiness that in spite of the pandemic during the last two years, the NAM S&T Centre could organise and fund a large number of international workshops, conferences and training courses in virtual mode; and many scientists from Mauritius and other Member Countries immensely benefited from the same. He further mentioned that Mauritius had hosted an international workshop virtually in collaboration with the NAM S&T Centre on '*Smart Agriculture for Developing Nations: Broader Perspectives and Special Challenges for Island States*' in August 2021 and added that a very good publication on the subject would be brought out by the Centre very soon as a follow up of the Workshop. He also commended the bold initiative of the Centre for dissemination of S&T information and knowledge by preparing Fact Files on various subjects, the first one being on '*Sustainable Agriculture*'.

Dr. Hussein A. Al-A'raj, Vice-President, Higher Council for Innovation and Excellence (HCIE), Government of the State of Palestine and Vice President of the 15th GC of the NAM S&T Centre in his remarks welcomed the delegates on behalf of HCIE, Palestine. He mentioned that the level of education in Palestine is among the highest in the globe, despite several challenges and restrictions imposed on the Palestinian people over the last 70 years, which has been possible due to self-awareness among the people and the vision of the leadership to promote science and learning as a tool for creating a more advanced and developed state.

He said that HCIE has been playing a very important role for achieving the goals of advancing Science and Technology and employing the abundant human capabilities in Palestine by setting up appropriate policies and plans. He also added that HCIE being the Focal Point of the NAM S&T Centre in Palestine has actively participated in the scientific activities and initiatives of the Centre from time to time, and sincerely followed up on the recommendations made by the Centre after the completion of its scientific programmes. Dr. Al-A'raj said that HCIE will provide the NAM S&T Centre a list of Palestinian scientific programmes with international orientations along with an invitation to Member States to participate in them.

Dr. Amitava Bandopadhyay, Director General (DG), NAM S&T Centre expressed his gratitude to His Excellency President Mahmoud Abbas, the President of the State of Palestine; and H.E. Eng. Adnan Samara, Advisor to the President of the State of Palestine on Innovation Affairs and Chairman, HCIE for their kind addresses, and welcomed the delegates from the Member Countries, senior diplomats and other dignitaries to the Bureau Meeting.

Dr. Bandopadhyay thanked Mr. M. N. Ranasinghe, President, 15th Governing Council of the NAM S&T Centre; Prof. Dr. Mahmoud M. Sakr, Vice President, NAM S&T Centre; and Mr. Youdhisteer Munbodh, Vice President, NAM S&T Centre for their continued support and guidance towards the functioning of the Centre. He warmly welcomed Prof. Dr. Gina Elfeky and Mr. Vedanand Bhurosah who represented Egypt and Mauritius respectively in the Bureau Meeting. He also thanked the Focal Points of the NAM S&T Centre in Member Countries, other dignitaries and delegates for attending the Bureau Meeting. Dr. Bandopadhyay then made a presentation on the objectives and functions of the NAM S&T Centre and its role in developing partnerships and promoting South-South and North-South cooperation in Science & Technology in the NAM and other developing countries

(Contd. on page 3)

(Contd. from Page 2 - Bureau Meeting.....)

H.E. Eng. Adnan Samara, Advisor to the President of the State of Palestine on Innovation Affairs and Chairman, HCIE, represented the Chief Guest, His Excellency President Mahmoud Abbas, the President of the State of Palestine, in the meeting. He welcomed all the delegates to the meeting, and then presented the inaugural address of the Chief Guest, Excellency the President of Palestine.

He concluded by stating that all the Members of the NAM S&T Centre should work together to attain a better world through cooperation in Science and Technology, and that Palestine is committed to continue its support to the initiatives pursued by the Centre to promote Science and Technology cooperation among the developing countries.

Thereafter, the book titled **Climate Change Adaptations in Dryland Agriculture in Semi-Arid Areas**: Edited by Xavier Poshiwa (Zimbabwe) and G. Ravindra Chary (India) and *published by Springer Nature, Singapore in February 2022* was released by Mr. M. N. Ranasinghe, Secretary, Ministry of Education, Government of Sri Lanka and President of the 15th GC of the NAM S&T Centre. The book was brought out by the NAM S&T Centre during the intervening period after the 1st Meeting of the Bureau of the 15th GC of the NAM S&T Centre held on 20 September 2021.

At the end of the Opening Session, Dr. Hussein A. Al-A'raj, Vice-President, HCIE, and Vice President of the 15th GC of the NAM S&T Centre proposed a vote of thanks to all the esteemed delegates and participants.

The Working Level Discussion of the Bureau Meeting was attended by the delegates from Sri Lanka (President), Egypt (Vice-President), Mauritius (Vice-President), Palestine (Vice-President); Focal Points and other delegates from various Member Countries of the NAM S&T Centre; and the Director General and other officials of the Centre's Secretariat. The Meeting was presided over by Mr. M. N. Ranasinghe, President of the 15th GC of the NAM S&T Centre.

The Bureau then took up various items of Agenda for discussion:

The Members of the Bureau expressed happiness to note various initiatives of the Centre to establish international S&T partnerships with other inter-governmental organisations and agencies. In this connection, the President urged the Member Countries and agencies to come forward with relevant proposals for implementation in partnership with the Centre.

The Bureau congratulated the Centre for inducting JSS Academy of Higher Education & Research (JSS AHER), Mysuru, India as a new Network Member after the last Bureau Meeting in 2021.

The Bureau requested the delegates and participants from other Member Countries to approach various S&T organisations and agencies in the countries in their respective regions and widely disseminate the concept of the *NAM S&T-Industry Network* and its usefulness so that some of them join the Network.

The Bureau noted and approved the removal of such organisations of the NAM S&T-Industry Network which have been inactive for a very long time and also have not been making payment of their membership subscription.

The delegates congratulated the Director General, NAM S&T Centre for achieving an impressive output in spite of very limited financial resources, even during the Pandemic.

However, the Members expressed concern that less than half of the Member Countries are not paying their annual membership subscription to the Centre. The Bureau made an appeal to the non-paying Member Countries to expedite payment of their membership subscription dues to the Centre.

The Bureau, on behalf of the Governing Council of the NAM S&T Centre approved the Evaluation Format on assessment of the activities of NAM S&T Centre. The approved Evaluation Form with a questionnaire on assessment of the activities of NAM S&T Centre will now be sent to the Focal Points of the Centre for their evaluation and feedback.

Dr. Amitava Bandopadhyay, Director General thanked Mr. M. N. Ranasinghe for presiding over the Bureau Meeting in such an excellent manner with many important decisions taken, and for his guidance and support to the Centre for its efforts towards the promotion of South-South Cooperation in Science & Technology. He also thanked other Bureau Members and other Member Countries for participating in the Bureau Meeting and offering their support and guidance to the Centre. He further expressed his gratitude to the Government of the State of Palestine, and in particular, H.E. Eng. Adnan Samara, Advisor to the President of the State of Palestine on Innovation Affairs and Chairman, HCIE of Palestine; Dr. Hussein A. Al-A'raj, Vice-President, HCIE; Dr. Khaled MA. Qalalwa, Director General for International Cooperation, HCIE; and other officials of the HCIE for making excellent arrangements for hosting the Bureau Meeting in Virtual Mode.

(Contd. from Page 1 - Intl. RT on Energy Storage Systems.....)

the *Center of Excellence on High Voltage Engineering, University of the Witwatersrand, South Africa; Department of Science and Innovation, South Africa; and Energy Storage Chapter, South African Institute of Electrical Engineers (SAIEE)* organized a one-day **International Roundtable on “Energy Storage Systems”** on **12 September 2022** in **Virtual-mode**.

The event was hosted by the Center of Excellence on High Voltage Engineering, University of the Witwatersrand, South Africa and Energy Storage Chapter, SAIEE.

The Roundtable provided participants with a concept-based understanding of energy storage systems such as latest, cost-effective and efficient technological solutions for long-term energy storage, their applications and benefits and strategies to overcome several energy storage barriers as well as addressing all related challenges.

The **Inaugural Session** started with an Introduction to the Event and Energy Storage Chapter of SAIEE by Prof. Chandima Gomes, University of the Witwatersrand, Johannesburg, South Africa. He welcomed the participants and briefed about that the Energy Storage Chapter of SAIEE which was formed in the year 2020 with the intentions of promoting energy storage technologies among the researchers, entrepreneurs, investors, and the general public and supporting the relevant authorities to develop various roadmaps, policies and guidelines related to energy storage systems. Afterwards, Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre, New Delhi, welcomed the participants from various countries and outlined the role of NAM S&T Centre in promoting Science and Technology in the developing world. He mentioned that the NAM S&T Centre is an Inter-governmental Organization which was set up in 1989 in New Delhi, India in pursuance of the recommendations in various NAM Summits. It is a diplomatic entity and has 47 Member Countries from the African, Middle Eastern, Asian, Latin American and European regions. The Centre aims at promoting South-South Cooperation in Science and Technology for collective self-reliance of the developing countries, with a special focus on Sustainable Development Goals-2030. In his message, Mr. Selby Modiba, Deputy Director, Multi-lateral Collaboration, Department of Science & Innovation, South Africa indicated that Africa is currently facing acute energy crisis, and the knowledge shared through the Roundtable would help South Africa's primary electricity supplier like “Eskom” to ensure energy security in South Africa and other African countries.

The Roundtable comprised of 7 Technical Presentations followed by a Panel Discussion.

Presentation 1: “Impact of Increased Penetration of Photovoltaics on Power Systems, Challenges and Mitigation by Electrical Vehicle (EV)” was delivered by Dr. Mohammad Reza Maghami, Centre of Energy, Faculty of Mechanical Engineering, Alzharia University, Tehran, Iran. He defined Penetration as the ratio of nameplate PV power rating to the maximum load seen on the distribution feeder. Advantages of PV Penetration are: less pollution, low maintenance, minimization of transmission loss and reduced stress on the power system. Some of the PV Penetration challenges include: voltage fluctuations and voltage rise, unintentional islanding, power fluctuations in grid, effect in grid frequency, harmonics, etc. Mitigation methods include: Energy Storage Systems (ESS), Demand Side Management (DSM), Reactive Power Control (RPC), On Load Tap Changer (OLTC). Therefore, it was concluded that electric vehicles are not only cost saving and environmentally friendly in terms of operation, but also are better performer and low on maintenance than traditional non electric vehicles.

Presentation 2: “Potential of Developing Countries for Innovative Long-duration Energy Storage Technologies” was given by Mr. Peter Oldacre, Global Business Development, CellCube, Austria. He summarized that in regard to infrastructure for energy storage, the CellCube system provides a clean, reliable and sustainable option for long-term energy storage for developing countries. The CellCube system also meets the most stringent safety standards. The CellCube energy storage system uses the Vanadium redox flow technology to store large energy capacities and supplies clean and emission-free electricity within milliseconds.

Presentation 3: “The Need of Standards Governing Energy Storage Batteries for Developing Countries” was given by Prof. Mahlanyane Kenneth Mathe, University of the Johannesburg, South Africa. He emphasized that Africa needs to promote policies to enable the creation of more value as a continent, through resource-based industrialization, build productive capacities and develop intra-African exports and trade by leveraging on the African Continental Free Trade Area (AfCFTA). Also, African countries need guidance to optimize benefits from the battery and electricity vehicle chain standards. Global lesson to Africa and the developing countries is that *every nation needs codes and standards for energy storage* to ensure safety of products in the market, warranty on performance and durability and end-of-life recycling, reuse and repurpose.

Presentation 4: “Role of Nuclear Power Coupled with Energy Storage Technologies in Reducing Carbon Footprint” was given by Prof. Pat Naidoo, Nuclear Energy Chapter, SAIEE. A Cautionary Note on renewables is that they are 100% dependent on weather conditions, given the forecast of extreme weather events due to climate change, and one must expect and plan for extreme impacts and performance of renewable energy sources. He also indicated that South Africa is experiencing an avalanche of exit in nuclear skills and expertise, all are heading towards top paying global jobs. He further quoted a tweet by Hon. Boris Johnson - “Nuclear is a reliable, safe and constant source of clean energy. It's absolutely crucial to weaning us off fossil fuels, including Russian oil and gas”.

Presentation 5: “EVs for Developing Countries: Possibilities and Challenges” was given by Prof. David Dorrell, University of the Witwatersrand, South Africa. EV numbers are growing in many Western and Asian countries, from simple

(Contd. on Page 5)

(Contd. from Page 4 - Intl. RT on Energy Storage Systems.....)

electric scooters and mopeds to electric cars, SUVs, luxury vehicles and commercial vehicles. A typical example is Tesla Model 3: dual motor vehicle and YASA machine – by Mercedes-Benz. The future prospect of EVs in Africa is Hala Motors - a company planning to manufacture electric taxis in South Africa. The battery swapping EV stations are being developed in China. These batteries are not affected by load-shedding and are precharged, reduce consumer cost as they are rented not bought and time saving as battery swaps faster than charging.

Presentation 6: “Energy and South Africa” was given by Ms. Joanne Dean & Mr. Hugo Stewar, Enerj Carbon Management, South Africa. Together, they emphasized that the socio-economic and infrastructural development typical of a developing country is embedded in electricity generation, transmission and utilization. South Africa being the most developed nation and largest consumer of energy in the African continent is now in an urgent need of energy transition. The rising energy demand in South Africa has overwhelmed the existing power generating plants, placing the country in a critical supply shortage. The conventional electricity generating plants are responsible for ranking South Africa at 13th place in global list of greenhouse gas emitters. In an attempt to mitigate CO2 emissions, and to provide reliable electricity to its people, South Africa is on a fast track to develop a private renewable energy sector and to effectively deliver to green energy transition.

Presentation 7: “The Electric Power Research Institute - Energy Storage Resources to Meet Green Energy Goals” was delivered by Ms. Eva Gardow, EPRI, USA. She briefed about EPRI's comprehensive R&D on clean energy to meet the green energy goals. EPRI delivers industry expertise to help the energy sector identify issues, technology gaps, and broader energy needs that can be addressed through effective, collaborative research and development programs.

This was followed by a Panel Discussion moderated by Ms. Joanne Dean, Enerj Carbon Management, South Africa. During the deliberations, it was concluded that primary energy sources deployed for energy development should have low carbon emissions to minimize the environmental impact. To combat climate change, a carbon tax should be levied on the carbon emissions and to effectively align policies for a low-carbon economy. Energy storage system guidelines for compliance with safety codes and standards should be adopted and regulated. There is a need for developing economies to do high capital investment in the development of modern infrastructure and grid expansion. The lack of a robust recycling process of batteries is one of the drawbacks of energy storage systems. Therefore, best practices on the end-of-life management of batteries should be adopted in order to increase the recovery of critical minerals while ensuring that batteries are reused and recycled at a high rate.

The Roundtable was concluded with a Vote of Thanks given by Ms. Naniki Nzuzza, Energy Storage Chapter, SAIEE.

Memorandum of Understanding (MoU) between NAM S&T Centre and Indian Ocean Rim Association (IORA) Extended

A Memorandum of Understanding (MoU) for cooperation on "*Application of Science, Technology and Innovation for Sustainable Development*" was initially signed between the NAM S&T Centre and Indian Ocean Rim Association (IORA) on 7 November 2019 on the margins of the IORA Council of Ministers' Meeting in Abu Dhabi, United Arab Emirates for a period of three years.

The purpose of the partnership is to establish cooperation in the broad field of *Academic, Science & Technology* for capacity building and to take-up joint activities to achieve the Global Sustainable Development Goals (SDGs) through the application of Science, Technology & Innovation (STI) in the IORA and NAM S&T Centre's Member States for mutual benefit and on the basis of equality and reciprocity.

Although, the cooperation under the MoU was hampered owing to the Covid-19 global pandemic, both sides jointly conducted a very successful International Workshop on the 'Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals - 2030' on 24-25 May 2022.

The MoU was set to expire on 6 November 2022, and it was agreed to extend the MoU by a further period of three (3) years i.e. until 6 November 2025.

The extended MoU proposes to further strengthen cooperation between the two sides and work together for the promotion of Science, Technology & Innovation (STI) and related subjects, sharing best practices, tapping into global expertise, projecting economic opportunities and jointly promoting STI oriented programs and other such activities to benefit the Member States of both sides.

The signing ceremony for extension of the MoU was held at the NAM S&T Centre Secretariat in New Delhi on 29th September 2022. The extended MoU was signed by the Secretary General of IORA, H.E. Dr. Salman Al Farisi; and Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre in the presence of Mr. Gareth Rees, Director - IORA, IORA Delegation Members and Staff Members of the NAM S&T Centre Secretariat.

(Contd. on page 6)

(Contd. from Page 5 - Memorandum of Understanding (MoU with IORA))

H.E. Dr. Salman Al Farisi welcomed the extension as the confirmation of the NAM S&T Centre's ongoing commitment to cooperate with IORA in the realm of Science, Technology and Innovation. During the signing ceremony, H.E. Dr. Al Farisi highlighted the significance of timely engagement with the NAM S&T Centre to strengthen IORA's priority area of Academic, Science & Technology Cooperation to foster the development and implementation of plans and projects focused on achieving SDGs through the application of STI among the IORA Member States. "Through evidence based technical support, research, knowledge sharing and capacity building, this cooperation will ensure sustainable development in the Member States of IORA and NAM S&T Centre" he added.

Dr. Bandopadhyay expressed that the engagement between the NAM S&T Centre and IORA has laid down a strong basis to realize common objectives of the two inter-governmental organisations. He indicated that the renewal of the MoU with IORA would help encourage further engagements in the field of STI for capacity building and dissemination of knowledge in IORA and NAM S&T Centre Member States through collaborative programs and publications. It is a testament to the commitment and collaborative efforts of the NAM S&T Centre and IORA that the MoU has been extended further.



Signing Ceremony for Extension of MoU between the NAM S&T Centre and IORA

H.E. Dr. Salman Al Farisi (L) Dr. Amitava Bandopadhyay (R)

Special Feature

THIRD GLOBAL CONFERENCE ON STRENGTHENING SYNERGIES BETWEEN THE PARIS AGREEMENT ON CLIMATE CHANGE AND THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

- UN Conference Presses for Integrated Solutions to Scale Up Action on Climate Crisis and Sustainable Development Set-backs

UN Climate and SDG Synergies Conference was held virtually in Tokyo on **20-21 July 2022**, generated an impressive range of potential solutions and proposals for how to better integrate efforts to tackle these interlinked global crises and accelerate action to address the climate emergency and recent reversals in achieving the Sustainable Development Goals.

The Conference was co-convened by the United Nations Department of Economic and Social Affairs (UNDESA) and the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC), and it was hosted by the Ministry of the Environment of Japan, in partnership with the United Nations University (UNU) and the Institute for Global Environmental Strategies (IGES). The Conference was attended by around 2000 participants, including more than 130 speakers from over 100 countries around the world. The High-level Segment of the Conference was joined by 30 Ministers, heads of UN organizations and agencies, and other high level representatives including from business, youth, and academia. An informative Conference Background Note on advancing climate-SDG synergies was prepared and discussed at the Conference.

At the high-level segment of the Conference, Ministers, heads of UN organizations and agencies, business leaders, scientists and youth representatives emphasized the need for greater SDG and climate ambition. The need to urgently boost joint implementation and address gaps such as financing and capacity building were also recognized.

Liu Zhenmin, UN Under-Secretary-General for Economic and Social Affairs, said that “to get the Sustainable Development Goals on track and keep the goal of 1.5 degrees alive, we must dramatically increase the pace of implementation and ramp up ambition. An integrated approach between the Paris Agreement and 2030 Agenda is critical”.

Ibrahim Thiaw, Acting Executive Secretary of UN Climate Change (UNFCCC)- called for greater synergies at the national level, through cooperation across ministries, and globally, through enhanced collaboration across UN organizations.

Japan's Environment Minister Tsuyoshi Yamaguchi, highlighted his country's efforts towards deep decarbonization through innovative fuels, inter-city collaboration and economic transition bonds. The Japanese Government, which currently holds the Presidency of the G7, also announced a new target of raising USD 15 billion through the G7 for decarbonization and plans to issue “green transition” bonds.

Citing the long list of devastating global crises that have disrupted sustainable development efforts over the last few years, Amina J. Mohammed, UN Deputy Secretary-General and Chair of the UN Sustainable Development Group, said that “we must turn this perfect storm into an opportunity to transform our systems, become more climate-resilient and transition to a greener economy. We must come together to rescue the SDGs and the Paris goals before it is too late,” she stated.

The UN Secretary-General's Envoy on Youth, Jayathama Wickramanayake, urged delegates to allow youth to be part of crafting solutions. “Let youth lead the way,” she stated.

All representatives in their statements emphasized the need for greater SDG and climate ambition, and the need to urgently ramp up joint implementation. Addressing existing gaps such as in financing, data, and capacity building was also highlighted

Key messages

- 1. Ramping up action on synergistic opportunities to achieve the 2030 Agenda and the Paris Agreement is needed now more than ever.** Evidence clearly suggests that we are not on track to achieving these two critical agendas. There is also an increasing pool of evidence that suggests delivering

(Contd. from Page 7 - Special Feature.....)

win-win outcomes for climate action and the SDGs is entirely possible, but the full potential of such synergistic outcomes can only be realised if deliberate action is taken. For example, the latest IPCC report shows that if we take decisive climate action now, there is potential to not only advance the SDGs immediately but also gain tremendous development co-benefits in the long-term such as \$43 trillion in economic output by 2070.

2. **Realizing the SDGs while accelerating progress towards a climate resilient, net-zero future requires getting the whole of government and whole of society on board.** Active engagement of line ministries as well as sub-national and local authorities in integrated planning and implementation is critical. Meaningful engagement of youth, civil society, academia, the private sector, and indigenous peoples is also vital.
3. **Just transition and leaving no one behind should be at the centre of integrated policy and programme planning and implementation.** Climate action should prioritize the needs of marginalised, poor and vulnerable communities, as well as those who will be impacted the most by transformational pathways. At the same time, we should strengthen national and local development and climate strategies including NDCs, building on existing integrated approaches, such as Circulating and Ecological spheres and Decarbonization Leading Areas, aimed at advancing SDGs and climate action.
4. **Enhancing capabilities of various stakeholders to pursue synergistic implementation of climate and SDGs agendas is crucial.** This includes enhancing capacities to identify synergistic opportunities and to overcoming technical, financial, planning, organizational and behavioural barriers.

Way forward

Participants highlighted that synergistic implementation of climate action and the SDGs should be based on:

5. **Strengthening the evidence base for synergistic action.** The preparations for the Conference have greatly benefited from the guidance that was provided by the Technical Advisory Group. Building on the work of this network and in collaboration with other stakeholders, a comprehensive global analytical synthesis report on climate action and SDGs synergies may be considered to fill existing knowledge gaps and provide scientific underpinnings for accelerated synergistic action towards 2030 and beyond.
6. **Convening multi-stakeholder dialogues at all levels.** Facilitating global, regional and thematic exchanges of practice on advancing climate and SDG synergies, for example, in the context of future UNFCCC Regional Climate Weeks or other relevant events, can strengthen knowledge sharing and communities of practices tailored to local conditions and needs. Convening the next conference at UN Headquarters in New York would help contribute to fostering alignment with the High-level Political Forum and the SDG Summit.
7. **Enhancing integrated planning.** Existing instruments such as Nationally Determined Contributions (NDCs), Voluntary National Reviews (VNRs), and National Biodiversity Strategies and Action Plans (NBSAPs) offer opportunities for integrated planning and synergistic implementation on climate action and the SDGs.
8. **Partnerships for transformation.** We need all actors – national and local governments, the private sector, civil society, academia, communities and individuals – to work together to deliver on the full potential of synergistic action to achieve the 2030 Agenda and the Paris Agreement. In particular, youth must play a game-changing role in a multi-decade journey of transformation across the world. Building on the successful “Youth Day” at this Conference, providing further meaningful engagement opportunities for youth is necessary.
9. **Informing key intergovernmental processes on climate and the SDGs.** Relevant global milestones such as the SDG Summit (in 2023 and 2027), the High-level Political Forum, the United Nations Framework Convention on Climate Change Conference of the Parties, the Convention of Biological Diversity Conference of Parties, the Intergovernmental Panel on Climate Change and the on-going global stocktaking efforts under the Paris Agreement must be leveraged to mainstream and strengthen synergistic action at all levels. The output document should be fed into these processes.

<https://www.un.org/en/climate-sdgs-conference-2022>

STI Developments in NAM S&T Centre Member Countries

MYANMAR

OPENING CEREMONY OF “FOOD INNOVATION CENTER (FIC)”

Department of Research and Innovation (DRI), Ministry of Science and Technology is implementing the project “Study on Deep Processing of Fruits for Economic Development in Lancang - Mekong Area” under the Lancang Mekong Cooperation Special Fund (2020).

The main beneficial of this project is a foundation for promoting the fruit growing business, providing the guidelines to local fruit growers in Regional Countries. The practice and experience of this project is effective to Myanmar and also fruit farmers in the Mekong River Basin Countries. One of the key objectives of this project is to provide the existing food innovated production technology to MSME in Regional countries.

Opening Ceremony of “Food Innovation Center (FIC)” was held at the Food Innovation Center, Department of Research and Innovation (DRI) under Ministry of Science and Technology on 15 August, 2022 in Yangon. It was one of the activities of the above project. At the opening ceremony, the Ministry of Science and Technology, Union Minister Dr. Myo Thein Kyaw, Minister Counselor H.E. Dr. Zheng Zhihong of the Embassy of the People's Republic of China in Myanmar; Ministry of Foreign Affairs, Deputy Director General U Win Ze Yar Tun delivered opening remarks. The establishment of the Food Innovation Center (FIC) is one of the landmarks of the above project and the pilot scale deep drying machines are being set-up for the value-added fruit drying products.



Fig 1. Union Minister Dr. Myo Thein Kyaw, delivered opening remarks

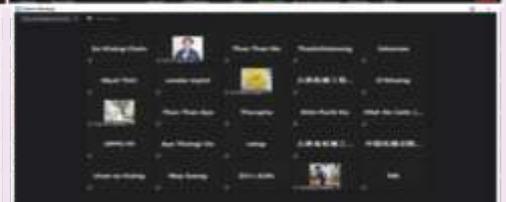


Fig 2. H.E. Dr. Zheng Zhihong of the Embassy of the PR of China in Myanmar delivered opening remarks



Fig.3 Ribbon cutting Ceremony of “Food Innovation Center (FIC)”

DRI also held Training on methods of making value-added dried fruit products from 15 to 18 August 2022 with 60 trainees by the Chinese experts and DRI researchers at the FIC. The training course had two sessions; the first one was the basic concept and application of advanced technologies and the second one was the practice of the production of value-added innovative fruit and aquatic products and how to develop the innovative agricultural products in effective ways. This training course effected the local agricultural food production MSMEs to develop the innovative value-added food products with high quality for the local distribution, regional and international export purposes. This training shared knowledge and practice among experts, researchers, local MSMEs people, private sector and public sector of Myanmar about the advanced deep processing technologies, production of value-added innovative fruit products and also enhanced the technology contribution between Research Institutes and Private Sector.



On 30 August 2022, DRI held Regional Workshop for Deep Drying Process of Fruits with the participation of professors, university's lecturers, CEO from dried fruits manufacturing companies, presidents from private associations, MSMEs people and researchers from Mekong Lancang Countries.

(Contd. on page 10)

(Contd. from Page 9 - STI developments in Member Countries....)

Ongoing Activities for Promotion of Science, Technology and Innovation (STI) Development through Education and Research Works at Yangon Technological University in Myanmar

Prof. Hla Myo Tun., Ph.D.

P. C. Ray Research Fellowship (Indian Institute of Technology (Delhi), India

Pro-Rector (Research), Yangon Technological University

E-mail: hlamyotun@ytu.edu.mm

Introduction

Myanmar is one of the developing countries with plenty of natural resources and cultural people in the world. The art of agricultural development is an essential role to implement the socioeconomics development in ASEAN region. The Government of Republic of the Union of Myanmar always tries to improve the economic development through the promotion of Science, Technology and Innovation (STI) in the nation. The human resources (HRs) development and transformational shift to outcome-based engineering education (OBEE) in Technological Universities are two main pillars in STI promotion in the nation. The main contributor for STI promotion is Yangon Technological University (YTU) which is a leading research-based university and a Centre of Excellence in Teaching and Research Outstanding. There are 12 Engineering and Architecture departments which were fully accredited by Myanmar Engineering Council (MEngC), a full member of Federation of Engineering Institutions in Asia and Pacific (FEIAP), and MEngC is now trying to promote the national level to international level which is called the full signatory of Washington Accord over and done with the Enhancement of Engineering Higher Education (EEHE) and High Quality Research in YTU.

Implementation of Outcome-Based Engineering Education at YTU

Yangon Technological University (YTU) (Formerly names of Burma Institute of Technology (BIT) or Rangoon Institute of Technology (RIT) or Yangon Institute of Technology (YIT)) was found in 1965. The activities of education and research purposes of YTU gradually increases until 2012. The participation of a lot of alumni of YTU, industrial people and the government are great opportunities to enhance the contribution of excellence teaching before 2012. The transformational shift from traditional university to Research-based University was transpired by internationalization and collaboration experience after 2012. Japanese Government mainly contributed to the Project on Enhancement of Engineering Higher Education through Research Activities in YTU intended to the development of all Technological Universities in Myanmar. The new intake of HR development programme for outstanding student recruitments under that project was launched in 2013 and the promotion of teaching and research quality for teaching staffs was implemented by achieving the master and doctoral degrees through research works at Japanese Supporting Universities (JSUs). The important contribution of JSUs are Kyoto University, Okayama University, Kanazawa University, Nagasaki University, Chiba University, Niigata University and Kumamoto University in Japan. YTU sent over fifty staff to those universities to promote their outstanding research activities through doctoral degree programme in 2014. During 2014 to 2019, the PhD graduates could contribute their experience on research-based activities and outstanding teaching to the highly qualified engineering students. Due to the efforts of all staff of YTU, a full accreditation certificate was awarded to YTU by FEIAP through MEngC in 2019. There are seven criteria under the FEIAP level such as (1) Programme Educational Objectives (PEOs), (2) Graduate Attributes (GAs), (3) Curriculum and Syllabus, (4) Academic and Supporting Staff, (5) Students, (6) Facilities, and (7) Quality Management System (QMS). The top management of YTU guided the right way to implement the OBEE system in line with the Quality Objectives and Quality Policy based on effective PEOs and GAs standard. The development of Curriculum and Syllabus for all engineering departments was led by seven JSUs. There are two formal trainings and discussion meetings called “Staff Training at YTU and MTU (called Mandalay Technological University)” in a year occurred in May and November. All staff from YTU and MTU actively participated in those trainings to promote and develop the effective design of curriculum and syllabus through model teaching of sample subjects.



Figure.1. Discussion Meeting on Curriculum and Syllabus Development at YTU by Professor of Chiba University



Figure.2. Research Knowledge Sharing Seminar at SUTD by Mr. Aung Maw

(Contd. on page 11)

(Contd. from Page 10 - STI developments in Member Countries....)

The standard model of Curriculum and Syllabus design which was substantial equivalent to those six JSUs was completely formulated in 2019. During the period of project on EEHE, the effective curriculum and syllabus designs were ready to enhance the quality of the outcomes for first and second batch of students (in 2019 and in 2020) of YTU. MEngC always assesses the quality of teaching staff and engineering students through complex problem solving skills under the OBEE schemes [1]. YTU sent many students to International Universities and Organizations to get research exposures for their educational career lives for lifelong learning through two months' internship programme.



Figure.3. Giving a Seminar after Internship at NOKIA (Telecommunication Industry)



Figure.4 Seminar after Internship at OOREDOO (Telecommunication Industry)



Figure.5. Activities of YTU at CASTIC in 2018

The outcomes after two months internship (fully funded) at Sirindhorn International Institute of Technology in Thailand of two students from YTU had been published in IEEE.



Figure.6. Receiving the IEEE Certificate for Paper Publications of YTU's Students in 2019



Figure.7. Achievement of Engineering Students in Soft-Skill Training at YTU

YTU hosted the soft-skill training including Project Management, Organizational Management, Business Communication, Financial Management, Creative Thinking and Critical Thinking for all students. Figure.7 shows the photo of achievement of YTU students in soft-skill training.

YTU always drives their students to meet the international standards of 21st century skills which will be substantial equivalent of Washington Accord.

Figure.8 illustrates the analysis model for the implementation activities at YTU towards the Outcome-based Education System with qualified engineering education. The input of that model is ten critical skills for university students, and the disturbance input is unexpected disturbance things. The feedbacks are depending on the parents, teachers, and government. The outcomes for the process of this model is intended to obtain 21st-century skills.

(Contd. on page 12)

(Contd. from Page 11 - STI developments in Member Countries....)

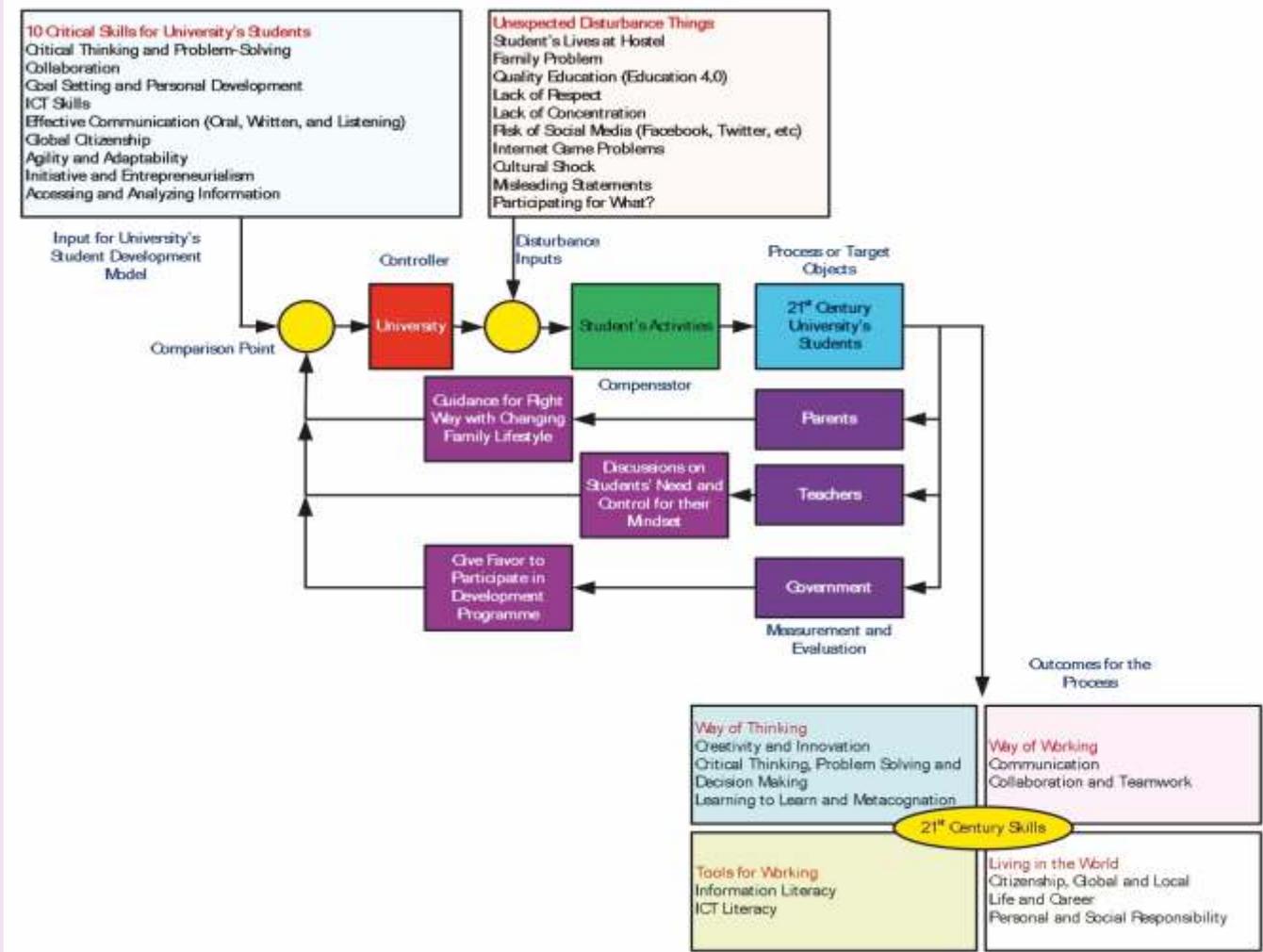


Figure.8. Analysis Model for Outcome-Based Engineering Education System

Implementation of Research Activities at YTU

YTU plays an important role in enhancing the research culture in the degree programme under the graduate departments. The schooling years in the high school level is ten, and it was the old education system. Therefore, our engineering universities offer a six-year undergraduate degree program at the technological universities in Myanmar. The first-year courses are the foundation years of YTU. From the second year to fifth year courses are the junior engineering courses and senior engineering courses. Final year courses are only for doing research works and writing the theses for their graduations. YTU formulated the research groups under each department based on the specializations and specific topics of basic research works.

The target of Research University has been followed by the activities of research groups at the university. Figure.9 offers the important activities of a research group at YTU. The research publications are one of the credits for the establishment of Research University. In this model, the first level is the final year or sixth year (B6) students, and the second level is the first year and second-year master (M1 and M2) students, the third level is the first year to third-year doctoral (D1 to D3) students, and the top-level is the teachers. At first, teachers announced their research themes and topics for creating their research groups. The different levels of research topics are provided by the respective supervisors or teaching staff at YTU. The leader is those teachers, and he/she introduced his/her research works in front of the B6, M1, M2, D1, D2, and D3 students. That teacher always creates research group seminars every week. All research group members have to present their understanding of research findings and knowledge sharing at the research group seminars. That teacher always gives valuable advice to his/her research group members. The research group members follow the suggestions of that teacher. Finally, they have got their research achievements after completing the research activities based on different levels. The teachers shall have to transform their research outcomes into research publications and teaching material. In this regard, the teachers have the dominant teaching qualifications based on the research achievements by researching with research groups at university. The consequence of research-based education is directly affected by the Outcome-

(Contd. on page 13)

(Contd. from Page 12 - STI developments in Member Countries....)

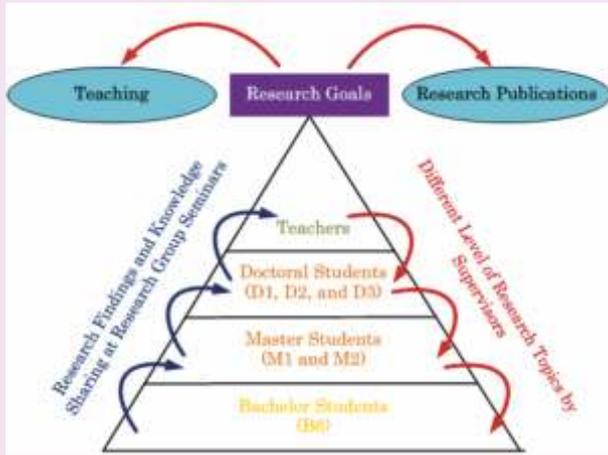


Figure.9. Formulation of Research Groups Activities at YTU

Based Education system with research university establishment.

The fulfillment of laboratory facilities in a research university plays a crucial role in enhancing the quality of engineering education for OBE implementation. The qualified teaching staff, researchers, or research teachers must establish outstanding research facilities based on their research experience and experimental studies for all students and societies.

Figure.10 illustrates the model for formulation of research laboratory. To formulate the research laboratories under YTU, all teachers or researchers shall have to find the research problems from the own idea or from the industries and the research funds from the funding agencies like government research funds, U NyiHlaNge foundation, JICA project for EEHE (Enhancement of Engineering Higher Education). They shall have to prepare the research setup for doing research work and they

shall have to

do their proposed research work. They also shall have to analyze the outcomes of their research findings. After that they shall have to prepare the teaching materials such as experimental procedures and lectures for their teaching purposes. These steps are for establishing the research-based education system. After the accomplishment of the confirmed research outcomes, they shall have to prepare the laboratory manual for their students. And then, they shall have to collect the appropriate equipment according to the permission from the budget section comply with the auditing rules and regulations. And then, they shall have to make the experimental setup for their laboratory. Finally, they shall have to establish the research laboratory for their students (target for research engineering and research scientists) by approaching the outcome-based education.

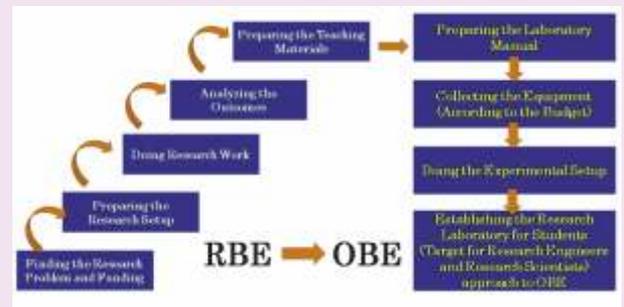


Figure.10. Model for Formulation of Research Laboratory

At first, the leader or head of the department shall have to identify the specializations of teaching staff in a specific department. For example, the facilities in a research laboratory for the Electronic Engineering program are formulated based on the different research areas or fields interested in modern technology improvement. There are five main specializations for the Electronic Engineering program and five main specializations for the Telecommunication Engineering program under the Department of Electronic Engineering of YTU.

NOKIA technology center was established for telecommunication purposes at YTU. The facilities included in this laboratory are 5G testbed for future wireless technology for Telecommunication engineering purposes which were the outcomes of internalization of YTU.

Conclusion

The article highlighted the prospects of teaching staff education, teaching staff education and technology utilization, professional development (PD), and the perspectives on teaching staff qualification in the digital age. Another demonstration is the fulfillment of qualified equipment or facilities in a research university. Encouraging teachers' competence in teaching transversal competencies and heterogeneous classes is recognized as essential in global education. High-quality researches on teaching staff qualification systems includes improving the supply and quality of teachers' continuous professional development (CPD) approaches on research activities; providing educational institutions high-quality teacher education systems that respond to the evolving needs of schools, teachers, and educational society; and facilitating the acquisition of the competencies that teachers need, such as teaching transversal competencies, teaching heterogeneous classes, and collaborating with colleagues in local and international universities and organizations. If the aforementioned discussions on two criteria under the OBE were utilized in Technological Universities in Myanmar, quality engineering education could be offered to our next generation in our societies without difficulties.

References

Hla MyoTun: "Improvement of Teaching Staff Qualification in line with Research-Based University and Outstanding Laboratory Facilities Fulfillment for Quality Engineering Education towards Outcome-Based Education System", International Conference on Engineering Education Accreditation (ICEEA) 2021, January 14-16.

Science, Technology & Innovation News

HEALTH

New Drug Candidate Developed to Treat Type 2 Diabetes

A team of researchers from Helmholtz Munich, the German Center for Diabetes Research (DZD) and Novo Nordisk have developed a new hormone combination for the future treatment of type 2 diabetes. The scientists have combined the blood sugar-reducing effects of the drugs tesaglitazar and GLP-1 (Glucagon-like peptide-1) in a new and highly effective drug. The advantage is that, by combining tesaglitazar with GLP-1, the tesaglitazar only enters tissue that contains GLP-1 receptors. This reduces the adverse effects of tesaglitazar while increasing the effects on sugar metabolism. The new drug has already been successfully tested in animal studies. The findings were published in *Nature Metabolism*.

The drug tesaglitazar improves glucose and fat metabolism in patients with type 2 diabetes. It acts on two receptors within the cell nucleus to increase insulin sensitivity. This was proven in phase 3 clinical trials. However, tesaglitazar also caused unwanted effects, such as signs of kidney damage. Nevertheless, in order to use the drug therapeutically, the researchers used a trick: they biochemically combined tesaglitazar with the gastrointestinal hormone GLP-1, which since several years successfully used to treat type 2 diabetes. This allows the combined drug to only act on cells and tissue that contain GLP-1 receptors.

"This trick enabled us to combine the blood sugar-reducing effects of GLP-1 and tesaglitazar into a single highly effective molecule, while keeping tesaglitazar away from tissues that it could damage," explains PD Dr. Timo Müller, corresponding author, director of the Institute of Diabetes and Obesity, and scientist at DZD.

The new drug has already been successfully tested in animal studies: "The sugar metabolism of obese and diabetic male mice improved to a far greater extent compared with treatment using only the GLP-1 hormone or tesaglitazar alone and with no damaging adverse effects to the liver or kidney," says Prof. Kerstin Stemmer, one of the lead authors of the study.

<https://medicalxpress.com/>; August 26, 2022

WHO and Partners Launch A New Online Resource to Advance STI Vaccine Development

The first online portal on vaccine development for sexually transmitted infections (STIs) was launched at the 23rd IUSTI World Congress. The portal, STI Watch contains technically sound and updated information on the most common STIs and the vaccine development status for each.

Despite decades of global efforts to control STIs, which have a major impact on sexual and reproductive health, by promoting healthier sexual behaviours, including increasing condom use, treating people with STI symptoms, and improving access to testing and treatment, global STI rates remain stubbornly high. Innovations are needed in the fight against STIs. The development of safe and effective STI vaccines has the potential to revolutionize the approach to STI prevention.

STI Watch is a collaborative effort between WHO, US National Institute of Allergy and Infectious Diseases (NIAID) and AIDS Vaccine Advocacy Coalition (AVAC). WHO and NIAID along with other key stakeholders have developed a roadmap for STI vaccine development and introduction. The roadmap lays out next steps for accelerating STI vaccine development, including: assessing the public health need and value of new vaccines; defining their preferred product characteristics; and outlining the pathway to developing, evaluating and licensing the vaccines.

This collaboration was extended to AVAC to create a web-based clearinghouse for STI vaccines in order to raise their profile globally. Most STIs go untreated, often because they cause no symptoms. If left untreated, STIs are easily transmitted to others, and can cause severe health consequences, including increased risk for HIV, infertility, adverse pregnancy outcomes and cancer. Vaccines currently exist for only 2 common STIs – human papilloma virus (HPV) and hepatitis B virus. Where they have been implemented widely, these vaccines have led to significant decreases in cervical cancer and in acute and chronic hepatitis.

Currently, research to develop vaccines against herpes simplex virus (HSV) and HIV is advancing but not complete. Vaccine development for gonorrhoea has become increasingly promising. Randomized controlled trials using licensed vaccines against a related pathogen, serogroup B *Neisseria meningitidis* (MenB), are underway to assess whether these vaccines also prevent gonorrhoea. A vaccine candidate for chlamydia has entered early clinical trials, and research studies into vaccines for syphilis and trichomoniasis are in earlier stages of development.

<https://www.who.int/>; September 5, 2022

BIOENGINEERING

Better Photosynthesis Increases Yields in Food Crops

Scientists have transgenically altered soybean plants to increase the efficiency of photosynthesis, resulting in greater yields without loss of quality.

For the first time, RIPE (Realizing Increased Photosynthetic Efficiency) researchers have proven that multigene bioengineering of photosynthesis increases the yield of a major food crop in field trials. After more than a decade of working toward this goal, a collaborative team led by the University of Illinois has transgenically altered soybean plants to increase the efficiency of photosynthesis, resulting in greater yields without loss of quality.

The most recent UN report, The State of Food Security and Nutrition in the World 2022, found that in 2021 nearly 10% of the

(Contd. on Page 15)

(Contd. from Page 14 - STI News)

world population was hungry, a situation that has been steadily worsening over the last few years and eclipsing all other threats to global health in scale. According to UNICEF, by 2030, more than 660 million people are expected to face food scarcity and malnutrition. Two of the major causes of this are inefficient food supply chains (access to food) and harsher growing conditions for crops due to climate change. Improving access to food and improving the sustainability of food crops in impoverished areas are the key goals of this study and the RIPE project.

Realizing Increased Photosynthetic Efficiency, or RIPE, is an international research project that aims to increase global food production by improving photosynthetic efficiency in food crops for smallholder farmers in Sub-Saharan Africa with support from the Bill & Melinda Gates Foundation, Foundation for Food & Agriculture Research, and U.K. Foreign, Commonwealth & Development Office. Amanda De Souza, RIPE project research scientist, and lead author said, "Our research shows an effective way to contribute to food security for the people who need it most while avoiding more land being put into production. Improving photosynthesis is a major opportunity to gain the needed jump in yield potential."

Photosynthesis, the natural process all plants use to convert sunlight into energy and yield, is a surprisingly inefficient 100+ step process that RIPE researchers have been working to improve for more than a decade. In this first-of-its-kind work, recently published in *Science*, the group improved the VPZ construct within the soybean plant to improve photosynthesis and then conducted field trials to see if yield would be improved as a result.

The VPZ construct contains three genes that code for proteins of the xanthophyll cycle, which is a pigment cycle that helps in the photoprotection of the plants. Once in full sunlight, this cycle is activated in the leaves to protect them from damage, allowing leaves to dissipate the excess energy. However, when the leaves are shaded (by other leaves, clouds, or the sun moving in the sky) this photoprotection needs to switch off so the leaves can continue the photosynthesis process with a reserve of sunlight. It takes several minutes for the plant to switch off the protective mechanism, costing plants valuable time that could have been used for photosynthesis.

"Having now shown very substantial yield increases in both tobacco and soybean, two very different crops, suggests this has universal applicability," said Long. "Our study shows that realizing yield improvements is strongly affected by the environment. It is critical to determine the repeatability of this result across environments and further improvements to ensure the environmental stability of the gain."

"The major impact of this work is to open the roads for showing that we can bioengineer photosynthesis and improve yields to increase food production in major crops," said De Souza. "It is the beginning of the confirmation that the ideas ingrained by the RIPE project are a successful means to improve yield in major food crops."

<https://www.sciencedaily.com>; August 18, 2022

ENERGY

Floating 'Artificial Leaves' Ride the Wave of Clean Fuel Production

Researchers have developed floating 'artificial leaves' that generate clean fuels from sunlight and water, and could eventually operate on a large scale at sea. The researchers, from the University of Cambridge, designed ultra-thin, flexible devices, which take their inspiration from photosynthesis, the process by which plants convert sunlight into food. Since the low-cost, autonomous devices are light enough to float, they could be used to generate a sustainable alternative to petrol without taking up space on land.

Outdoor tests of the lightweight leaves on the River Cam near iconic Cambridge sites including the Bridge of Sighs, the Wren Library and King's College Chapel showed that they can convert sunlight into fuels as efficiently as plant leaves.

This is the first time that clean fuel has been generated on water, and if scaled up, the artificial leaves could be used on polluted waterways, in ports or even at sea, and could help reduce the global shipping industry's reliance on fossil fuels. The results are reported in the journal *Nature*.

For several years, Professor Erwin Reisner's research group in Cambridge has been working to address this problem by developing sustainable solutions to petrol which are based on the principles of photosynthesis. In 2019, they developed an artificial leaf, which makes syngas, a key intermediate in the production of many chemicals and pharmaceuticals from sunlight, carbon dioxide and water.

The challenge for the Cambridge researchers was how to deposit light absorbers onto lightweight substrates and protect them against water infiltration. To overcome these challenges, the team thin-film metal oxides and materials known as perovskites, which can be coated onto flexible plastic and metal foils. The devices were covered with micrometre thin, water-repellent carbon-based layers that prevented moisture degradation. They ended up with a device that not only works, but also looks like a real leaf.

"This study demonstrates that artificial leaves are compatible with modern fabrication techniques, representing an early step towards the automation and up-scaling of solar fuel production," said Andrei. "These leaves combine the advantages of most solar fuel technologies, as they achieve the low weight of powder suspensions and the high performance of wired systems." Tests of the new artificial leaves showed that they can split water into hydrogen and oxygen, or reduce CO₂ to syngas.

"Many renewable energy technologies, including solar fuel technologies, can take up large amounts of space on land, so moving production to open water would mean that clean energy and land use aren't competing with one another," said Reisner. "In theory, you could roll up these devices and put them almost anywhere, in almost any country, which would also help with energy security."

<https://www.sciencedaily.com>; August 17, 2022

(Contd. on Page 16)

(Contd. from Page 15 - STI News)

Battery Charges in Under a Minute

A fast charging and fire resistant battery made from aluminium and sulphur could be used in electric cars, avoiding the fire hazards linked to lithium-ion batteries.

Donald Sadoway at Massachusetts Institute of Technology and his colleagues developed the battery, which can charge to full capacity in less than a minute, store energy at similar densities to lithium-ion batteries and isn't prone to catching fire. 'This is a totally new battery chemistry', says Sadoway.

Although the battery operates at the comparatively high temperature of 110 C (230 F) , it is resistant to fire because it uses an inorganic salt that can't burn as its electrolyte, the material that allows charge to flow inside a battery.

New Scientist pg. 22; September 3, 2022

Lithium-Sulfur Batteries: The New Kid on the Block

A team of researchers from Monash University's Faculty of Engineering, led by Professor Matthew Hill, Dr Mahdokht Shaibani and Professor Mainak Majumber, are behind the breakthrough in lithium battery development which centres around a new lithium-sulfur battery interlayer that promotes exceptionally fast lithium transfer, as well as improving the performance and lifetime of the batteries.

The lithium-sulfur battery development, which was funded by the Australian Research Council and Monash University, is cheaper, greener, and enables the charge and discharge of batteries and discharge of energy at a much faster rate than previously offered, with the capacity to be manufactured in Australia.

As the world increasingly swaps fossil fuel power for emissions-free electrification, lithium batteries are becoming a vital storage tool to facilitate the energy transition. They are the go-to choice to power everything from household devices like mobile phones, laptops and electric vehicles to major industries such as aviation and marine technology. Lithium-sulfur batteries offer higher energy density and reduced costs compared to the previous generation of lithium-ion batteries, and they can store two-to-five times as much energy by weight as the current generation of lithium-ion batteries. This means a car with one of these batteries might only need to be charged once a week.

"These batteries are not dependent on minerals that are going to lack supply as the electrification revolution proceeds, so this is another step towards cheaper, cleaner and higher-performing batteries that could be made within Australia," Professor Hill said.

"A lithium battery interlayer sits in the middle of the battery and keeps the electrodes apart. It helps lithium get from one side of the battery to the other faster. The new interlayer overcomes the slower charge and discharge rates of previous generation lithium-sulfur batteries," Professor Hill said.

All this is possible because we made a material that we call SPAF-1, which has tiny holes inside that are the perfect size to allow lithium through and encourage them to move fast.

Professor Hill said that several active ingredients are mixed to improve the battery performance, but, in order to optimise efficiency, an understanding of the mechanism's operation is needed to reach peak performance.

Time will tell how we see the technology utilised in the broader industry, but for Professor Hill and his colleagues, the future of the lithium-sulfur battery is bright.

<https://www.energymagazine.com.au>; August 26, 2022

IoT TECHNOLOGY

IoT Drives Rapid Growth in UK Digital Healthcare

The National Health Service (UK) is suffering with a huge backlog of elective procedures due to the pandemic. This means that the share of individuals who are satisfied with the quality of NHS care has fallen to around 71%, and only 53% are satisfied with how the healthcare service runs today. The good news is that the government is focused on investing more in **healthcare services** and **healthcare technology**, in particular, is being prioritised. **IoT is enabling healthcare professionals to be more proactive.**

From a technology perspective, IoT is enabling better healthcare solutions and services. Today, IoT enables healthcare professionals to be more watchful and connect with patients proactively. Data collected from wearable IoT devices can help physicians identify the best treatment process for patients and achieve better outcomes. In hospitals, IoT devices tagged with sensors are used for tracking the real-time location of medical equipment like wheelchairs, defibrillators, nebulisers, oxygen pumps and other monitoring equipment. With hospital visits limited, remote patient monitoring (RPM) and telecare services increased during the pandemic and, rather than revert to in-person appointments for monitoring or support, the use of RPM and telecare is expected to continue on that trajectory.

Conventional monitoring is resource-intensive and costly-Conventional long-term monitoring can put a significant burden on healthcare providers and be restrictive and inconvenient for patients, which is why RPM and telecare are the way forward. They enable patients to be monitored and support delivered, even in hard-to-reach locations, delivering data back to medical teams to review and act on where necessary.

Digital switch over in 2025-Another healthcare trend that is driving cellular connectivity in telecare is the switch from analogue alarm systems to digital. A social telecare alarm device, installed in an individual's home, makes it possible for individuals to call for assistance. These calls are answered by an operator in an Alarm Receiving Centre (ARC) who supports the individual to resolve the issue over the phone or they call for additional on-site assistance. Traditional analogue social alarm equipment relies

(Contd. on page 17)

(Contd. from Page 16 - STI News)

on sending and receiving audible tones to communicate with the ARC enabling them to understand the type of alarm received and prioritise accordingly.

These social alarms have been in operation for around 50 years and have relied on analogue landlines for connectivity. However, new legislation means that social healthcare commissioners must move quickly to adopt new digital systems as the analogue network will be switched off by 2025.

Improved support performance and customer experience-Cellular connectivity is a superior connectivity solution compared to Wi-Fi because it offers network redundancy. If one network is down, a SIM can switch to another so there is no loss in connectivity. From a user perspective, it is incredibly simple: the telecare solution has a SIM embedded that connects and works straight out of the box, as opposed to Wi-Fi, which requires passwords and more.

In summary, global healthcare spending could reach over \$10 trillion by 2022. RPM and telecare are key growth areas but have historically witnessed issues with accuracy in the field. Now, enabled by the latest innovations in cellular IoT connectivity, these solutions will help pave the way for better, more reliable future healthcare provision.

<https://www.iotechnews.com>; July 12, 2022

NANOMATERIALS

Compost to Computer: Bio-based Materials Used to Salvage Rare Earth Elements

After soaking the materials in water, Penn State researchers chemically reacted shredded wood pulp, cotton paper and ground corncob and tomato peels to convert them into microproducts, nanoparticles and solubilized biopolymers. Adding these microproducts or nanoparticles to solutions containing the rare earth element neodymium triggered the separation process, allowing for capture of the neodymium. (Credit: Sheikhi Research Group).

Penn State researchers used micro- and nanoparticles created from the organic materials (corncoobs and tomato peels) to capture rare earth elements from aqueous solutions. Their findings, will be published in the November issue of the *Chemical Engineering Journal*.

Waste products like corncoobs, wood pulp, cotton and tomato peels were transformed into micro- or nanoscale particles capable of extracting rare earth elements from electronic waste. "Rare earth metals are used to manufacture strong magnets used in motors for electric and hybrid cars, loudspeakers, headphones, computers, wind turbines, TV screens and more. However, mining these metals proves challenging and environmentally costly.

Sheikhi plans to extend his separation mechanism into real-world scenarios and partner with interested industries to further test the process. "We also hope to tune the selectivity of the materials toward other rare earth elements and precious metals, like gold and silver, to be able to separate those from waste products as well"-Sheikhi said.

<https://phys.org>; August 19, 2022

ENVIRONMENT

Nature-Friendly Farming does not Reduce Productivity

Putting farmland aside for nature does not have a negative effect on food security, a study has found. A 10-year project by the UK Centre for Ecology and Hydrology revealed that nature-friendly farming methods boost biodiversity without reducing average yields.

Scientists spent a decade intensively monitoring the impacts of a large government-funded experiment at Hillesden, a 1,000-hectare commercial arable farm in Buckinghamshire. Beginning in 2005, this involved creating several wildlife habitats, including seed-bearing plants for birds, wildflowers for pollinators and tussocky grass margins to support a range of birds, insects and small mammals.

In the longest-running study of its kind, researchers succeeded in boosting numbers of wildlife essential for agricultural production such as pollinators and predators of crop pests. Numbers of some butterfly species including the gatekeeper and green-veined white doubled, and birds that usually feed on insects benefited from the shelter provided by hedges and grass margins, including the great tit, up 88%, and blue tit, up 73%.

They also found that overall yields at Hillesden were maintained – and enhanced for some crops – despite the loss of agricultural land for habitat creation. The areas taken out of production were difficult and unproductive to farm, and the other areas benefited from boosted pollinator numbers and pest-eating birds and insects.

This runs contrary to claims made by many politicians that new post-Brexit agri-environment schemes would be “paying farmers to produce less food” and would damage food security. Rishi Sunak, the former chancellor currently running to be prime minister, recently said he would “protect” farmers from rewilding their land for nature.

Jake Fiennes, the head of conservation at the Holkham estate in Norfolk and author of nature-friendly farming book *Land Healer*, said he was unsurprised by the results of the report.

He told the Guardian: “Historic policies in England tried to get us to produce food everywhere. But now we are realising that we can increase our average yield by stopping growing food in areas of land that aren't productive, and in these areas we can make space for nature. We know there are benefits from having more nature in the farm, we know we can improve farm biodiversity without affecting yields.

Fiennes said: “Take a field. If on the southern edge of that field you have woodland, invariably the first 15 to 20 metres of that edge

(Contd. on page 18)

(Contd. from Page 17 - STI News)

won't produce the average yield, it'll produce anything up to 50% of average. But when you have all the species that would benefit from that edge of woodland, it's a no-brainer to give it to nature. This is the poorest land for food production, and when you are not focusing on that area you increase your average yield in the rest of the field”.

“We know we have a biodiversity crisis, we know we have a climate crisis, we know the two are linked, and this is an opportunity to increase our yields as well as providing for nature.”

Dr. John Redhead of the UK Centre for Ecology & Hydrology and lead author of the research published in the Journal of Applied Ecology, said: “Investigating changes in populations over a significant period of time, and comparing these with other sites, means we can be confident that agri-environment options can bring long-term term benefits for bird and butterfly populations”.

“Hillesden is a typical, large arable farm with conventional agricultural practices, in an ordinary landscape with no large patches of natural habitat. Therefore, it is likely that the results of our long-term study indicate what can be achieved on other commercial farms with good planning, implementation and management of agri-environment measures.”

<https://www.theguardian.com>; August 03, 2022

POLLUTION

Scientist Discover Bacteria that can Clean Plastic Pollution from Lakes

An innovative way of removing plastic waste from freshwater lakes has been discovered by researchers from the University of Cambridge.

Naturally-occurring lake bacteria that grow faster and more efficiently on the remains of plastic bags have been discovered by the scientists. These bacteria break down the plastic compounds present in water and consume it for their growth.

Research has suggested that enriching water bodies with these could be a way to remove plastic pollution. The study was carried out on 29 lakes across Scandinavia. It showed that bacteria in lakes favoured plastic-derived carbon compounds over natural ones like wood or leaves.

Carbon compounds from plastics are easier to break down and use as food. Thus, if a lake has a lot of plastic but low bacterial diversity, its ecosystem will be more vulnerable.

The presence of plastic waste and microplastics in water bodies is common across the globe. Such scientific and innovative methods could provide an alternative for cleaning lakes, rivers and oceans.

<https://www.downtoearth.org.in>; August 29, 2022

INFORMATION SCIENCE

Five-Year Campaign Breaks Science's Citation Paywall

Reference lists for more than 60 million journal studies in Crossref are now free to view and reuse.

Most articles in scientific journals are indexed by Crossref. The more than 60 million scientific-journal papers indexed by Crossref - the database that registers DOIs, or digital object identifiers, for many of the world's academic publications, now contain reference lists that are free to access and reuse.

The milestone, announced on Twitter on 18 August, is the result of an effort by the Initiative for Open Citations (I4OC), launched in 2017. Open-science advocates have for years campaigned to make papers' citation data accessible under liberal copyright licences so that they can be studied, and those analyses shared. Free access to citations enables researchers to identify research trends, lets them conduct studies on which areas of research need funding, and helps them to spot when scientists are manipulating citation counts.

“This is fantastic,” says Jodi Schneider, an information scientist at University of Illinois at Urbana Champaign, who has used citation data to examine whether studies that cite retracted papers mention that the papers have been pulled. “Citation data is the bedrock of science.”

At its launch, I4OC partnered with 29 scholarly publishers to open up references in 14 million papers. Five years on, that number has risen to more than 60 million, covering all the journal papers indexed on Crossref, a non-profit collaboration that promotes sharing of scholarly information. The citing papers and those being cited might still be behind a paywall, but their reference lists are not. (Crossref indexes about 134 million records in total, including articles that do not have reference lists.)

The move means that bibliometricians, scientometricians and information scientists will be able to reuse citation data in any way they please under the most liberal copyright licence, called CC0. This, in turn, allows other researchers to build on their work. Before I4OC, researchers generally had to obtain permission to access data from major scholarly databases such as Web of Science and Scopus, and weren't able to share the samples.

However, the opening up of Crossref articles' citations doesn't mean that all the world's scholarly content now has open references. Although most major international academic publishers, including Elsevier, Springer Nature (which publishes Nature) and Taylor & Francis, index their papers on Crossref, some do not. These often include regional and non-English-language publications.

I4OC co-founder Dario Taraborelli, who is science programme officer at the Chan Zuckerberg Initiative and based in San Francisco, California, says that the next challenge will be to encourage publishers who don't already deposit reference data in Crossref to do so.

<https://www.nature.com>; September 13, 2022

Meetings and Visits of Director General, NAM S&T Centre

MEETING WITH VICE CHANCELLOR, NEPAL ACADEMY OF SCIENCE & TECHNOLOGY (NAST)

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre met Dr. Sunil Babu Shrestha, Vice Chancellor, Nepal Academy of Science and Technology (NAST), Kathmandu, Nepal in his office in the NAST Campus on 12th July 2022 to discuss proposals on collaboration between the NAST and the NAM S&T

Centre in the near future. During the discussion, Dr. Mahesh Kumar Adhikary, Secretary, NAST and other senior officials from the Academy were also present.

Dr. Bandopadhyay thanked Dr. Shrestha for his kind support towards various scientific events organized by the NAM S&T Centre, especially for successfully organizing the joint International Workshop on “**Development of Food Green Cities for Urban Sustainability**” during April 26-27, 2022 which was hosted by NAST.

During the meeting, Dr. Shrestha expressed his willingness to organize an International Workshop jointly by the NAST and the NAM S&T Centre on a theme related to “**Food, Energy and Water**”. The Workshop is proposed to be hosted by NAST in physical mode sometime during 2023. The exact dates and topic will be finalized through mutual consultation.



During the discussion, Dr. Bandopadhyay also agreed to the suggestion proposed by Dr. Shrestha to undertake a joint Monograph Publication Project tentatively on “**Mountain Green Economy**” in the near future. The scope of the proposed Monograph will be discussed further between the two sides.

MEETING WITH FACULTY MEMBERS FROM TRIBHUVAN UNIVERSITY, KATHMANDU

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre met Prof. Shriram Sharma, Professor, Department of Physics and Principal Investigator, Atmospheric and Materials Science Research Centre, Amrit Campus, Tribhuvan University, Kathmandu on 11th July 2022 to explore possibilities of collaboration between the two sides on various S&T oriented activities in the near future. During the discussion, Prof. Leela Pradhan Joshi, Head (Department of Physics), Prof. Rajendra Parajuli, Dr. Prem Raj Dhungel and Prof. Chatramani Sharma were also present.

Detailed discussions were held in regard to organizing an International Conference on “**Lightning Electromagnetics and Application of Semiconductor Materials**” jointly by the NAM S&T Centre and Tribhuvan University in physical mode during October 4-6, 2023 which is proposed to be hosted by the University. Further discussion will be held for preparation of a detailed plan and Prof. Sharma will explore possibilities of inducting other partners from Nepal and other countries. Prof. Chandima Gomes from the University of Witwatersrand, Johannesburg, South Africa will be actively engaged in planning of the event.

In addition, considering the importance of the perceived role of aerosols in triggering frequent natural calamities in the Himalayan Region, it was agreed to take up a joint Monograph Project on “**Aerosols: Roles and Implications on Changing Climate Over Himalayan Region**” with Prof. Shriram Sharma as its Corresponding Editor along with Dr. Lok Lamsol, Senior Scientist, Earth Sciences, NASA Goddard Space Flight Centre, Maryland, USA and Dr. Madhu, Gyawali, Professor of Physics, San Jacinto College – South Campus, Houston, USA, as the Co-Editors of this project.

Centre Announces

INTERNATIONAL WORKSHOP ON LEVERAGING INNOVATIONS FOR INFRASTRUCTURE DEVELOPMENT AND SUSTAINABLE INDUSTRIALIZATION

17-18 November, 2022, ZIMBABWE
[Hybrid-Mode]

There is a need for developing countries to transform their economies and create jobs, enhance income and achieve sustainable development. Sustainable industrialization is integral for leaders from the developing world to achieve these objectives, with infrastructure development as a necessary enabler. The United Nations Sustainable Development Goal-9 (SDG 9) as well as the Africa's Agenda 2063 asserts the role of infrastructure and industrialization in economic transformation, job creation, increased productivity and achieving sustainable development.

However, realizing SDG-9 by 2030 will require overcoming resource constraints, building and strengthening developing countries' capacities, and exploring innovative ways of facilitating infrastructure development and harnessing sustainable industrialization.

In order to deliberate on the above issues, the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India in partnership with the Government of Zimbabwe through the Ministry of Higher and Tertiary Education, Innovation Science and Technology Development (MHTEISTD); and the National University of Science & Technology, Bulawayo, Zimbabwe is organizing an International Workshop on "**Leveraging Innovations for Infrastructure Development and Sustainable Industrialization**" to be held during **17-18 November 2022 in Hybrid-mode**.

The Workshop seeks to discuss and develop strategies and recommendations across all sectors to address issues related to sustainable infrastructure, innovation and industrialization for the country's faster economic growth and poverty reduction.

The Workshop will be hosted by MHTEISTD at the National University of Science and Technology (NUST) Innovation Hub, Zimbabwe in **Hybrid-Mode**.

More details about the Workshop is available in Centre's official **website: www.namstct.org**

INTERNATIONAL TRAINING WORKSHOP ON EMERGING TRENDS IN MATERIALS, DESIGN, INNOVATION AND INTELLIGENT MANUFACTURING OF FOOTWEAR AND LEATHER PRODUCTS IN DEVELOPING COUNTRIES

30-31 January, 2023, Chennai (Tamil Nadu), INDIA

The leather goods industry has a history with very distinct shifts in end uses and materials from the use of leather products for specific functional purposes to the current market of luxury goods. Raw materials used in the leather goods industry are as diverse as the products. Leather remains important, but the use of materials such as nylon, textiles, artificial (faux) leather and even polypropylene is growing. The leather clothing market is one of the most volatile because the demand for such products depends largely on consumers' disposable income and, in many markets, on fashion trends. Historically, leather garments have been less of a luxury and more of necessity as other materials were not available as protection against cold. But rising wealth and the emergence of excellent synthetic fabrics for waterproof and insulating garments at affordable cost have steadily weakened the position of leather in the traditional outerwear market in most countries.

Significant changes have occurred in the industries that supply machinery, components, software, and chemicals to the footwear and other leather product industries. The growing demand for leather footwear, as well as the fact that this demand competes for raw material with other products, appears to be a significant business opportunity for developing countries including the African continent. The footwear industry is a valuable source of employment for developing countries. Despite the value of the industry in improving the living standards of people in the developing world, there is little consolidated information on the industry as a whole available, particularly in the developing countries.

In view of the aforementioned global dynamic factors that control the leather footwear and products market and manufacturing industries, the Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India jointly with the CSIR-Central Leather Research Institute (CLRI), Chennai, India announces the organization of an **International Training Workshop on "Emerging Trends in Materials, Design, Innovation and Intelligent Manufacturing of Footwear and Leather Products in Developing Countries"** in **Chennai, India during 30-31 January 2023**.

The Workshop programme has been primarily designed for scientists, technologists, researchers, academicians, industry people and policy makers working in the relevant areas of footwear, footwear components, leather and leather products.

Experts and scientists desirous of participating in the Workshop, except those from India, are required to submit their application **electronically** directly to the **NAM S&T Centre** as early as possible, but latest by **Monday, 12 December 2022**.

Applicants from India should, however, submit their applications to the CSIR-Central Leather Research Institute, Chennai (Tamil Nadu), India.

For further details, please contact the NAM S&T Centre
(Email: namstcentre@gmail.com) or visit our Website: www.namstct.org

EDITOR: Dr. Kavita Mehra ❖ **ASSOCIATE EDITOR:** Ms. Jasmeet Kaur Baweja

CONTRIBUTORS: Ms. Abhirami Ramdas and Ms. Nidhi Utreja ❖ **COMPILATION & DESIGN:** Mr. Pankaj Buttan

PUBLISHED BY: Dr. Amitava Bandopadhyay, Director General, Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), Core 6A, 2nd Floor, India Habitat Centre, Lodhi Road, New Delhi-110003 (India)

PHONE: +91-11-24645134, 24644974 ❖ **E-MAIL:** namstcentre@gmail.com ❖ **WEBSITE:** <http://www.namstct.org>

Lovely Printers, New Delhi, E-mail: lovelyprintersindia@gmail.com; Ph: 9811086866.